CAUSES OF SAME DAY ADMIT SAME DAY DISCHARGE OPERATING ROOM CANCELLATIONS IN A TERTIARY CARE TEACHING HOSPITAL

Cristina Hurtado, ACNP, John Bradley, MD

Department of Anaesthesia, The Toronto Hospital, 200 Elizabeth Street, Toronto, Ontario M5G 2C4

INTRODUCTION
The structuring of the health system has compelled all care providers to maximize their resources. Operating Room bookings, assessments, and laboratory testing are coordinated to be cost effective, reduce length-of-stay and facilitate timely surgery scheduling. This study aimed to identify reasons for Operating Room cancellations, characteristics of patients, evaluate causes, and identify remedial actions.

METHODS
During a one year period data was collected and institutional approval was obtained. A database was created considering the following variables: patient demographics, surgical procedures, surgeon identification, reason for cancellation, schedules dates and caregiver participation. Reasons for cancellation were divided into five categories: anaesthesia, medical, surgical, scheduling and "no show". Descriptive methods were used to analyze the results.

RESULTS
During the study period, 9,287 patients were booked for surgery as "Same Day Discharge or Same Day Admission" (SDA/SDD). Of these patients 483 were cancelled. The overall cancellation rate for patients arriving for surgery was 3.0%. The main factor in cancellation, (201 cases or 42%)was patients not showing for surgery. Scheduling problems accounted for 30% of cancellations. Anaesthesia, surgical and medical reasons accounted for 13%, 8% and 7% respectively. Total patient causes for cancellations were 44.5% ("no show" plus not following preoperative instructions).

DISCUSSION
This study demonstrates that patients are accountable for 44.5% of all SDA/SDD Operating Room cancellations. Analysis shows that 14 cancellations were originated by the patient, (patient ate 8, patient did not stop Coumadin 2, patient did not understand consent 1, patient preferred general anaesthetic 3). This study identified the importance of: the patient education program, and the surgical scheduling process. Consideration of historical data concerning the procedure , surgeon and scheduled time would lead to less cancellations in the future due to over-booking.

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RETROSPECTIVE STUDY OF ELECTIVE SAME DAY ADMIT AND SAME DAY DISCHARGE PATIENTS CANCELLED DUE TO RESPIRATORY TRACT INFECTIONS OVER A TWELVE MONTH PERIOD.

Andrew R. Burns BSc, John Bradley MD, Cristina Hurtado ACNP.
Department of Anaesthesia, The Toronto Hospital, General Division, 200 Elizabeth Street, Toronto, Ontario, M5G 2C4

INTRODUCTION
The cancellation of elective surgery is a major inconvenience to patients and medical professionals, and poses financial consequences to hospitals. Recent data from our institution show that 7.9% of same day admit (SDA) and same day discharge (SDD) elective surgery cases cancelled were due to patient respiratory tract infections (RTIs). The purpose of this study was to review these cancellations

METHODS
All SDA and SDD elective surgery cancellations documented as due to RTIs were reviewed, for a 12 month period. Surgeons or patients were contacted to clarify confusing information. The data were reviewed and qualitative statistical methods applied.

RESULTS
Between June 1st 1996 and May 31st 1997 there were 279 true SDA/SDD operating room (OR) cancellations. Of these, 22 were documented as secondary to a RTI. Upon chart review it was found that 77.2% were truly due to a RTI, the remainder having been erroneously documented. All patients had been phoned the day before surgery by nursing staff, although 41.2% were not cancelled until reaching the holding area adjacent to the OR. All surgeries were eventually rebooked and performed without incident, save one. General anaesthesia (GA) was chosen in 95.2% of the rescheduled cases. The majority (52.9%) were rebooked for 4 weeks or more after their initial date. Findings included one patient falsely claiming a RTI, to avoid surgery, and another who was cancelled due to an incorrect interpretation of a chest x-ray. Finally, 22.7% of patients reviewed were taking antibiotics for their RTI at, or subsequent to, their cancelled surgery.

DISCUSSION
Results were difficult to find and occasionally incorrect, as our method of documenting OR cancellation needed improvement. Although RTIs were picked up in the SDA area, far too many were not cancelled until reaching the holding area. The vast majority were rescheduled under GA without incident. Many of these cancellations could have been avoided if the symptoms were conveyed to the nurse responsible for phoning patients the day prior to surgery.

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PROSPECTIVE STUDY OF PATIENT SATISFACTION IN A TEACHING HOSPITAL PREADMISSION UNIT.

Andrew R. Burns BSc, John Bradley MD, Keyvan Karkouti MD.
Department of Anaesthesia, The Toronto Hospital, General Division, 200 Elizabeth Street, Toronto, Ontario,

INTRODUCTION

With the current climate in today's hospitals of restructuring, cost control, and downsizing, the need for more efficient and effective use of hospital resources has become imperative. To this end hospitals have shifted services to an outpatient basis; hence the surgical pre-admission unit (PAU) was born. Currently, at our tertiary care teaching hospital, more than 80% of all surgical patients are assessed in our PAU. Despite our volume and acuity of patients the effectiveness of this unit has been demonstrated by a cancellation rate below the projected standard (3.0%). As a further assessment of quality assurance we designed this study to measure patient satisfaction with our PAU program.

METHODS

To do so, standardized pre- and post-operative questionnaires were developed, and patients living in the greater metropolitan area were randomly selected, within the unit, over a 10 week period. All patients were interviewed by a single investigator. To analyze the data descriptive statistical methods were used.

RESULTS

Sixty-nine patients completed the pre-operative questionnaire with 51 of those completing the post-operative questionnaire. Overall, 80% of patients were satisfied. Our waiting time was less than expected by patients and over 80% felt that the pre-operative teaching offered was adequate. Pre-operative anxiety was low, and remained unchanged after their PAU visit. Suggestions to improve our unit came from 47% of patients, ranging from hospital organization to pre-operative teaching (*e.g.* pain control and anaesthesia related side effects).

DISCUSSION

Overall, patient satisfaction with our unit was acceptable. Pre-operative teaching was shown to be adequate, and, although we did not remove patient's anxiety regarding their experience, we found they had little to begin with. Despite the positive outlook patients had on our unit many still offered suggestions, confirming for us there are still ways we can improve.

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EFFECTS OF PREOPERATIVE ORAL FLUID INTAKE ON PERIOPERATIVE SODIUM BALANCE

Authors: Rob Anderson BSc, Simon D. Abrahamson MBChB, C. David Mazer MD FRCPC

Affiliation: Dept. of Anaesthesia, St. Michael's Hospital, University of Toronto, Toronto, Ont. M5B 1W8

Introduction: Acute symptomatic postoperative hyponatremia is a rare but potentially lethal condition which affects otherwise healthy patients undergoing elective surgery. Recent changes to preoperative fasting guidelines allow patients to drink clear fluids ad lib up to 3 hours preop. The ingestion of hypotonic fluids could affect perioperative sodium levels, predisposing patients to acute symptomatic hyponatremia. The purpose of this study was to determine the effect of preoperative drinking on perioperative serum sodium levels in acute postoperative patients.

Methods: With IRB approval and patient consent, 28 female patients undergoing gynecologic surgery by laparotomy were randomly assigned to a control group (NPO after midnight) or a liberal group (clear fluids ad lib up to 3 hours preop). An intravenous was started immediately preoperatively, with normal saline being the only intravenous fluid administered perioperatively. Venous blood samples were obtained immediately preoperatively (Pre), in the recovery room (RR), and the day after surgery (Postop). Urine samples were collected preoperatively, in the recovery room, and every 4 hours postoperatively. Data was analyzed using ANOVA or student t-test with $P<0.05$ being considered significant.

Results: The average age of the patients was 42 ± 2 years in the NPO group (n=17) and 45 ± 4 years in the liberal group (n=11). The volume of fluid taken preoperatively was 435 cc (range 200-750 cc) in the liberal fluid group. There was no difference between groups in perioperative sodium concentrations. Despite only receiving normal saline, serum sodium concentration fell in all patients and all patients excreted hypertonic urine for approximately 15 hours in the postoperative period.

	Serum Sodium (meq/L)			Serum Osmolality (mosm/L)		
	Pre	RR	Postop	Pre	RR	Postop
NPO	142±1	141±1	138±1*	291±1	293±2	286±2*
Liberal	142±1	141±1	139±1*	289±1	291±1	282±1*

* different from Pre and RR intervals, $P<0.05$

Discussion: Our data confirm that serum sodium concentration commonly falls postoperatively despite intake of isotonic or slightly hypertonic intravenous fluids, and is likely related to generation of electrolyte free water by the kidneys. Our data also suggest that patients allowed to drink clear fluids up to 3 hours preoperatively do not appear to be at greater risk of developing severe postoperative hyponatremia than patients kept NPO for at least 8 hours preoperatively.

INCIDENCE OF INTRA-OPERATIVE CESSATION OF INTRAVENOUS (iv) FLUID ADMINISTRATION

OR Hung, MD, L Comeau MD
Department of Anaesthesia, Dalhousie University, Halifax, Canada B3H 2Y9

INTRODUCTION: Intra-operative cessation of iv fluid administration is frequently undetected by the anaesthetist. The goal of this report is to determine the frequency of this interruption of fluid administration in a tertiary care centre.

METHODS: This quality assurance study was approved by the institution. To avoid bias, self reporting from anaesthetists was not employed. This study recruited respiratory therapy students who were scheduled to do a 4 week anaesthesia rotation. They were instructed to record intra-operative fluid administration without the knowledge of the anaesthetist. The number of bags of iv fluid administered to each patient, the number of bags of iv fluid ran dry unnoticed, the estimated time elapsed from the cessation of the fluid flow to the time of detection, and complications were recorded.

RESULTS: Three respiratory therapy students were recruited over a 12 week period. A total of 303 patients were recorded with a total of 718 bags of iv fluid administered. The average (±sd) number of bags of iv fluid administered to each patient was 2.4 ± 1.9. 79 patients received only a single bag of iv fluid. The remaining 638 bags of fluid were administered to patients requiring 2 or more bags of iv fluid. 114 out of 638 bags (17.8%) ran dry undetected with 26 bags (4.1%) estimated to have been dry for longer than 5 minutes. More iv fluid bags appeared to run empty in patients receiving a larger volume of iv fluid (Table). Seven of the interruptions of iv fluid administration required flushing of the iv to restore patency.

DISCUSSION: Our data showed that intra-operative cessation of iv fluid administration was frequently (17.8%) undetected. This can be attributed to intra-operative distractions or lack of vigilance. Although this is generally a benign problem, several potential complications can occur: (1) the iv catheter may become occluded, necessitating an iv cannulation; (2) if the iv fluid is used as a vehicle to deliver iv anaesthetics, cessation of iv fluid flow will stop the administration of anaesthesia. If this is not detected promptly, awareness can occur. This is particularly true for ultra-short acting drugs, such as remifentanil; (3) when the iv fluid is administered rapidly under a pressurized device, the air present in the iv fluid bag can be forced into the circulation if the termination of fluid flow is not detected promptly. This can potentially lead to fatal venous air embolism. The findings of this study suggest that cessation of intra-operative fluid administration occurs frequently and that increase in vigilance to monitor intra-operative fluid administration is necessary to avoid potential complications.

# of bags of iv fluid given to each patient	2	3	4	5	6	7	>7
total # of bags of iv fluid given	290	132	48	25	36	21	87
# of iv fluid bags ran dry undetected	39	24	10	6	9	6	23
% of iv fluid bags ran dry	13.4	18.2	20.8	24	25	28.6	23.0

A

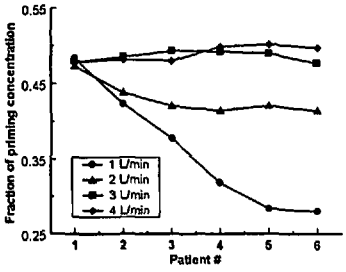
RECYLING ANESTHETIC VAPOURS FOR USE IN CONSECUTIVE PATIENTS

Joseph A. Fisher MD, Janet Tessler, Joshua Rucker BSc
Department of Anaesthesia, The Toronto Hospital, 585 University Ave., Toronto Canada M5G 2C4

Introduction: Micropore gas filters have allowed the re-use of an anaesthetic breathing circuit for consecutive patients; however, during emergence from anaeshesia, the anaesthetic vapour it contains is often purged from the circuit to provide the maximum gradient for its elimination from the lungs. Turning off the fresh gas flow prior to initiating emergence would conserve the anaesthetic vapour in the circuit and allow it to be inhaled by the following patient. A second vapour-free circuit can then be used to recover each patient from anaesthesia. For this purpose we have used a self-inflating bag with the oxygen flow equal to the minute ventilation and the expired gas directed to the gas scavenger. We examined the efficiency obtainable by re-priming a circuit already partially filled with anaesthetic vapour from a previous case.

Method: A North American Drager circle circuit was primed with 6 L of 2% halothane while occluding the patient port of the Y piece. It was then attached to a lung model (FRC 2.5 L) which "breathed" through the circuit until an equilibrium gas concentration was achieved. The circuit was repeatedly primed with either 1,2,3 or 4 L of the original vapour concentration and the equilibrium concentration re-determined with the lung model.

Results: The figure presents the equilibrium concentrations (expressed as a fraction of the priming concentration) in the circuit for consecutive "patients".



Discussion: Volume of fresh gas required to re-prime the circuit is difficult to predict at the bedside. Our model predicts that 2 to 3 L of gas are required to re-prime the circuit and maintain a consistent equilibrium vapour concentration between patients. Clinically, further adjustments can be made according to feedback from the anaesthetic gas monitor.

B

ASSESSMENT OF THE APPROPRIATENESS OF THE STATISTICAL ANALYSES IN ABSTRACTS SELECTED FOR WIDER PUBLICITY AT THE ASA AND IARS MEETINGS?

Alix Mathieu, MD, Sara Murray-Foster, MD,
Dept of Anesthesia, Univ of Cincinnati College of Medicine Cincinnati, Ohio 45267-0531

INTRODUCTION: A recent report[1] assessed the methodological and informational quality of abstracts selected by reporters at the ASA and IARS meetings for wider dissemination prior to their publication in peer-reviewed journals. A great number of those abstracts did not provide the minimal information required for their critical analysis. We are further reporting on the type and appropriateness of test statistics used in these reports.
METHODS: Abstracts selected by science writers at the ASA (October 1993) and IARS (March 1994) meetings for wider publicity via Anesthesiology News Magazine, were identified and reviewed independently by the two authors. Eighty abstracts published in the supplement issue of Anesthesiology and seventeen from Anesthesia and Analgesia met our selection criteria. In a first step the study design of each report was determined and the content of each abstract was evaluated thereafter against a check list of 10 items previously reported[2] that addressed both their methodological quality and informative content. A score for each abstract as well an overall score per journal were further determined. In a second step the type of statistic used to describe and/or analyze the data as well as the appropriateness of statistical choice with respect to the design type were further assessed.
RESULTS: The various designs of selected reports are shown in the figure. Overall, 75 % and 65% of the ASA and IARS reports respectively used appropriate statistical analysis. Statistical analysis of all ASA and IARS abstracts with a RCT design was appropriate (100%). Correct statistics was used for only 25% (NRCT), 75% (cohort) and 60% (cross-sectional) of the ASA reports; 50% (NRCT) and 45% (cohort) of the IARS abstracts.
DISCUSSION: Publicity attending our national meetings can at times focus attention on reports that may or may not be scientifically sound. Of note, 37% of ASA reports and 25% of IARS abstracts selected by Anesthesiology News did not provide sufficient information for their evaluation. Furthermore, the percentage of NRCTs selected (30% & 53%) as well as the higher prevalence of inappropriate statistical analysis in those reports suggest that science writers need to apply stricter selection criteria as to the quality and great caution as to the validity of conclusions and/or claims of statistical significance of such reports. It also suggests that in the abstract selection process for those meetings attention to such methodological issues is warranted.
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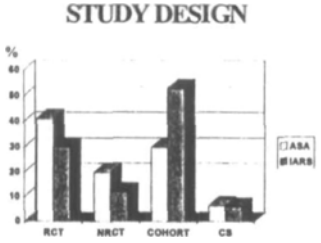
NRCT= non randomized controlled trial, CS= Cross-Sectional



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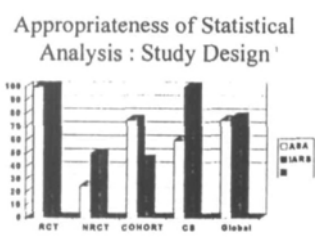

B

THE INHIBITORY EFFECT OF DANTROLENE ON PLATELET AGGREGATION AND THROMBOXANE A_2 FORMATION

Tz-Chong. Chou PhD, Chi-Yuan. Li MD
Graduate Institute Medical Sciences and Department of Anesthesiology, Tri-Service General Hospital, National Defense Medical Center, Taipei, Taiwan, R.O.C.

INTRODUCTIION

Intracellular free calcium concentration plays a central role in the medication of platelet aggregation and regulation of blood pressure. Dantrolene is an agent reducing free cytosolic Ca^{2+} level via inhibition of calcium release from the sacroplasmic reticulum. In the study, the antiplatelet effect of dantrolene was evaluated.

METHODS

Rabbit platelet suspension was prepared from EDTA-anticoagulated platelet-rich plasma according to the washing procedures described previously. Platelet aggregation was measured by the turbidimetric method. The release of ATP from platelets was simultaneously measured by Lumi-aggregometer. The thromboxane B_2 (TXB_2) level was determined by EIA kit.The intracellular calcium of platelets was measured by Jasco CAF-100 Ca^{2+} analyzer.

RESULTS

Preincubation of washed platelets with dantrolene (10~100 μM) dose-dependently inhibited the platelet aggregation and ATP release induced by arachidonic acid (AA) (100 μM), collagen (10 μg/ml) or U46619 (1 μM). The TXB_2 formation and intracellular calcium increase induced by collagen , AA or thrombin were significantly suppressed by dantrolene (100, 50 μM).

DISCUSSION

The present study suggest that the antiplatelet mechanisms of dantrolene is mainly inhibition of mobilization of intracellular free calcium and lead to diminution of TXA_2 formation.

ENDOSCOPIC TRANSTHORACIC SYMPATHECTOMY FOR PALMAR HYPERHIDROSIS

Takako Tsuda PhD MD, Akihiko Tabuchi MD, Hiroshi Sasano MD, Masanobu Kiriyama PhD MD[1], Akinori Okada MD[2], Junichiro Hayano PhD MD[2], Akinori Takeuchi PhD MD[3], Hirotada Katsuya PhD MD

Department of Anesthesiology & Resuscitology, [1]2nd Dept. of Surgery, [2] 3rd Dept. of Internal Medicine, Nagoya City University Medical School, 1 Kawasumi, Mizuho-cho, Mizuho-ku, Nagoya 467, Japan. [3] Department of Anaesthesia, The Toronto Hospital

INTRODUCTION

Hyperhidrosis which is characterized by excessive sweating of the hands, axillae and feet, is caused by an unexplained overactivity of the sympathetic fibers which pass through the upper dorsal sympathetic ganglia D2 and D3. Endoscopic transthoracic sympathectomy (ETS) provides the only permanent cure for hyperhidrosis (1). The objective of this study was to evaluate the effects of ETS on palmar hyperhidrosis and the subsequent sympathovagal balance.

METHODS

Seventeen patients, 7 women and 10 men, with severe palmar hyperhidrosis underwent ETS in our institution between 1995 and 1997.Their ages ranged from 14 to 33, with an average of 24 ± 6 at the time of treatment. Informed consent was obtained in all cases. This study was approved by the University Ethical Committee. General anesthesia with separate-lung ventilation was performed during the ETS procedure, with thermocauterectomy of the sympathetic chain above the T2 ganglion and below the T3 ganglion carried out on both sides. The effects of ETS on sweating in all patients and autonomic cardiovascular regulation in 7 patients before and 8 days after the procedure were examined. For evaluation of autonomic cardiovascular regulation, power spectral analysis of heart rate and arterial blood pressure variability in a supine position and with a 70 degree head-up tilt was performed. The effects of tilt on R-R interval, BP, and the amplitudes of spectral components as well as on the LF-to-HF ratio were assessed by repeated-measures analysis of variance with Helmet transformation by using the SAS General Linear Model (SAS institute, NC, USA).

RESULTS

All of the patients were relieved of excessive palmar sweating immediately after bilateral ETS, and none of them have suffered recurrence up to the present. Various degrees of compensatory sweating on the trunk, abdomen and thighs, and gustatory sweating were observed in 13 patients, but this was not a major source of embarrassment for all but 2 of the cases. No other serious complications were observed. Although ETS caused decrease of cardiac sympathetic activity and upper limb vasomoter sympathetic activity in response to head-up tilt, overall sympathetic activity did not change after ETS.

DISCUSSION

In Japan, ETS has become a popular approach for control of hyperhidrosis in many hospitals, because it is a simple, fast, and safe procedure for sympathetic denervation of the hand, arm, and heart (2). Thoracoscopic D2-D3 sympathicolysis corrects the over functioning of the sympathetic system in hyperhidrosis. In general, compensatory and gustatory sweating are not very embarrassing for the patients, although in two of our series the former became somewhat of a problem. Further understanding of compensatory and gustatory sweating and its incorporation into the informed consent process are indispensable to assure patient satisfaction. In conclusion, our results confirm that ETS is a useful for treatment for palmar hyperhidrosis patients.

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LEFT VENTRICULAR END DIASTOLIC AREA AS A PREDICTOR OF RESPONSE TO VOLUME LOADING IN CRITICALLY ILL PATIENTS

Claude P Tousignant MD FRCPC*, C David Mazer MD FRCPC. Department of Anaesthesia, St Michael's Hospital, 30 Bond Street, Toronto ON, M5B 1W8; University of Toronto.

Introduction: Predicting patients who will benefit from volume administration is difficult in the intensive care unit (ICU). The pulmonary capillary wedge pressure (PCWP) may not accurately reflect left ventricular volume. Transesophageal echocardiography (TEE) provides information on heart size and function which may be superior. We evaluated which parameter was best predictive of a 20% improvement in cardiac output following volume infusion.

Methods: After IRB approval and informed consent, 20 ICU patients deemed hypovolemic by the attending physician were studied. Control measurements included: left ventricular (LV) end diastolic area (EDA) and end systolic area (ESA), PCWP, thermodilution cardiac output (CO), pulmonary vein S and D wave peak velocities, mitral valve E wave deceleration time (DT) and the fractional area of contraction (FAC). An infusion of 500 ml of Pentastarch was then given over 10 minutes and measurements were repeated. The patients were divided into 2 groups: responders, who demonstrated an increase in CO of 20% and non-responders. Pre-bolus variables were compared using Student's t test. In each of the responder and non responder groups, pre and post EDA and ESA were compared using Student's t test. Linear regression was used to assess the relationship between LVEDA and PCWP.

Results: There were 9 male and 11 female patients aged 58±20 years. The average APACHE2 score was 20±8 with a range of 10 to 37. The pre-bolus LVEDA in responders was significantly lower (14.8±6.3cm^2) than in the non-responders (20.3±4.5cm^2)($p<0.05$). The PCWP was not significantly different in both groups. Pulmonary vein S/D and mitral valve DT were not significantly different between both groups. There was no relationship between the LVEDA and the PCWP ($r^2=0.02$). The % change in EDA following volume infusion was significantly higher in responders than in non responder (24%vs-0.2%,$p<0.05$). There was no significant change in ESA following volume infusion.

Pre bolus values	Responders (n=8)	Non-responders (n=12)	p value
EDA (cm^2)	14.8 ±6.3	20.3 ± 4.5	< 0.05
ESA (cm^2)	7.8 ± 5.0	12.5 ± 5.9	0.08
PCWP (mmHg)	14.4 ± 2.9	16.1 ± 3.1	0.23
S/D	1.64 ± 0.61	1.53 ± 0.96	0.99
DT (msec)	177 ± 71	130 ± 46	0.15
FAC (%)	49.9 ± 13.1	39.9 ± 21.2	0.28

Conclusion: In critically ill patients, the hemodynamic disturbances can be varied and profound. In this patient population, the LVEDA is more predictive of a positive response to volume administration than the PCWP or the Doppler measurements of the pulmonary vein (S/D) or the mitral valve (DT).

References: Anesth Analg 1996;83:1149-53
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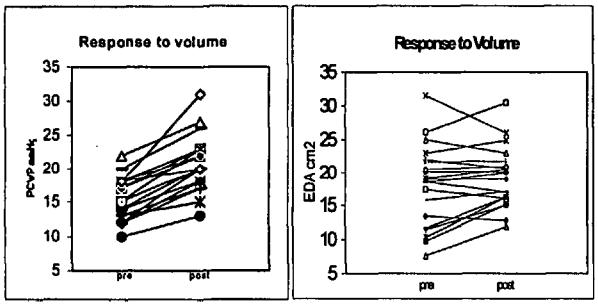
TRANSESOPHAGEAL DOPPLER TRANSMITRAL FLOW AND PULMONARY VEIN FLOW DO NOT CORRELATE WITH PCWP IN CRITICALLY ILL PATIENTS.

Claude P Tousignant MD FRCPC*, C David Mazer MD FRCPC.
Department of Anaesthesia, St Michael's Hospital, 30 Bond Street, Toronto, ON, M5B 1W8; University of Toronto.

Introduction: Left ventricular (LV) pressures have been estimated using Doppler flow velocities in the pulmonary vein (PV) and the mitral valve (MV). In critically ill patients, the pulmonary capillary wedge pressure (PCWP) is often used to reflect LV filling pressures. We evaluated the relationship between transesophageal (TEE) Doppler indices of PV and MV flow as well as LV size and PCWP in a critically ill population. We also assessed the response of Doppler variables to volume administration.

Methods: After IRB approval and informed consent, 38 ICU patients were enrolled. Measurements included pulmonary vein peak S/D velocities, MV deceleration time (DT), the transgastric short axis midpapillary LV end diastolic area (EDA) and the PCWP. The same measurements were repeated before and after 500 ml of pentastarch in 20 patients who were thought by the attending physician to benefit from volume administration. Linear regression was used to assess the degree of correlation between the TEE variables and the PCWP. Student's t test was used to compare pre and post fluid values.

Results: There were 17 males and 18 female patients. The mean age was 60±18yrs (19 to 85) and the average APACHE score was 20±7 (10 to 37). Three patients were excluded due to inability to obtain adequate measurements. There was no correlation between the PCWP and the PV S/D (p=NS), PCWP and MV DT (r^2=0.14) and PCWP and EDA (r^2=0.04). Infusion of pentastarch, significantly elevated PCWP, but did not significantly change S/D (p=0.25), DT (p=0.22) or EDA (p=0.12). However, patients with EDA ≤ 15cm^2 had a significant rise in EDA with volume administration (p=0.004, n=7/20).



Discussion: In critically ill patients, PV and MV Doppler indices do not reflect PCWP. Furthermore, these parameters do not uniformaly change following volume administration. Ventricular size does not correlate with PCWP. This lack of correlation is likely the result of the profound hemodynamic disturbances which can be seen in critically ill patients.

References: Anesth Analg 1997;84:491-6
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**Supported by the Zeneca Pharma Inc. Canadian Research Award in Anaesthesia.*

A SYSTEMATIC OVERVIEW OF THE EVIDENCE SUPPORTING THE USE OF CEREBROSPINAL FLUID DRAINAGE IN THORACOABDOMINAL ANEURYSM SURGERY FOR PREVENTION OF PARAPLEGIA

Elizabeth Ling* MD and Ramiro Arellano§ MD. *Dept. of Anaesthesia, McMaster University, Hamilton Health Sciences Corporation, 237 Barton St East, Hamilton, Ontario, L8L 2X2. §Dept. of Anaesthesia, University of Toronto, The Toronto Hospital, 200 Elizabeth St., Toronto, Ontario, M5G 2C4.

INTRODUCTION

Paraplegia remains the most devastating complication following surgery of the descending thoracic and thoracoabdominal aorta. Cerebrospinal fluid drainage (CSFD) may reduce the risk of neurological complications in these patients. Many advocate use of CSFD with or without adjuvant therapy, but the relative risk reduction of paraplegia using CSFD remains to be ascertained.

OBJECTIVE

To systematically review the English-language literature to estimate the benefits of CSFD in preventing paraplegia in humans undergoing thoracic/thoracoabdominal aneurysm surgery.

DATA SOURCES

Data sources included online searching of MEDLINE from 1966 to June 1996 and the Science Citation Index from January 1989 to June 1996, relevant citations from The Yearbook in Vascular Surgery series from 1992 - 1995, the citation lists from all relevant articles, and personal contact with four experts in the field.

STUDY SELECTION

Ten of 18 studies assessed by two independent observers met the inclusion criteria (kappa=0.68). Methodological quality was assessed independently. Disputes were resolved by consensus, and were due to oversight in all cases.

DATA EXTRACTION

Two independent observers extracted data, blinded to authors, institution, year and journal type, and the source of funding.

DATA SYNTHESIS

Due to the heterogeneity of study designs (1 RCT, 2 non-randomized observational cohort studies, 3 historical controls, 4 case series), a qualitative systematic overview is presented. A discussion of related methodological issues follows.

DISCUSSION

The benefit of CSFD in thoracic and thoracoabdominal aneurysm surgery for reducing the postoperative paraplegia remains unanswered due to inadequate evidence and methodological deficiencies in the trials performed to date. In order to determine the clinical utility of CSFD, a large, prospective, multi-center randomized trial with blinded assessment is recommended.

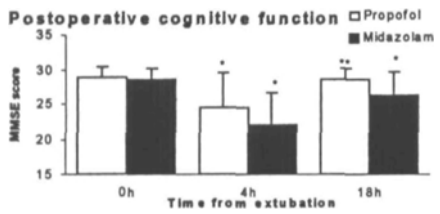
MORBIDITY AND RESOURCE UTILIZATION AFTER CABG SURGERY IN ELDERLY PATIENTS: A PROSPECTIVE RANDOMIZED CONTROLLED STUDY

N Dowd FFARCSI, J Karski FRCPC, D Cheng FRCPC, J Carroll-Munro RN.
Department of Anaesthesia, Division of Cardiac Anaesthesia & Intensive Care, The Toronto Hospital, University of Toronto, Ontario.

Introduction: Fast track cardiac anaesthesia is becoming the standard of care for the cardiac surgical patient.[1,2] However its efficacy in the elderly (>65 y) patient is not fully evaluated. This prospective, randomized controlled study investigated morbidity and resource utilization in elderly patients undergoing CABG with propofol (Group P) or midazolam (Group M) for anaesthesia and postoperative sedation.
Methods: After Human Ethics Committee approval, 33 patients (65-79 y) undergoing first time CABG with grades 1-3 left ventricular (LV) function were randomized. Premedication was given with IM morphine 0.15 mg/kg (P) or lorazepam 1-2 mg SL (M). Anaesthesia was induced with fentanyl 10-15 µg/kg, and thiopentone 50-100 mg. Anaesthesia was maintained prior to cardiopulmonary bypass (CPB) with isoflurane (P) or isoflurane plus midazolam 0.1 mg/kg (M); and during CPB with a propofol infusion at 2-6 mg/kg/h (P) or isoflurane (M). After separation from CPB the propofol infusion was reduced to 2 mg/kg/h (P) or a continuous infusion of midazolam at 1-3 mg/h (M) was started. Both infusions were adjusted in the ICU to maintain a Ramsay sedation score of 3-4. Patients were sedated for 3 h prior to awakening for extubation. Hourly assessments were made to determine when patients reached ICU discharge criteria. Data is expressed as mean ± SD. P value < 0.05 was significant
Results: Demographic data (age, sex, LV function, graft number, CPB and cross clamp (XC) time), pain scores and perioperative haemodynamic parameters were not significantly different between group P and M.

	Age (y)	Ext Time (h)	ICU LOS (h)
Group P (n=17)	72.1 ± 3.4	5.0 ± 1.0	8.0 ± 4.8 *
Group M (n=16)	70.4 ± 4.0	5.6 ± 2.2	19.5 ± 19.5

Cognitive function (Mini Mental State Exam, Trail Making Test) was reduced in both groups 4 h after extubation compared to baseline and persisted for 18 h only i n the M group ($p<0.01$,* Figure). Cognitive function was significantly better ($p<0.05$,** Figure) in the P group compared to the M group at 18 h after extubation.
Conclusion: In geriatric patients undergoing CABG surgery, fast track cardiac anaesthesia with propofol allows significantly earlier recovery of postoperative cognitive function and ICU discharge, when compared to midazolam.



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Supported in part by Zeneca Pharma Inc.

A

IMMEDIATE EXTUBATION AFTER CORONARY BYPASS SURGERY

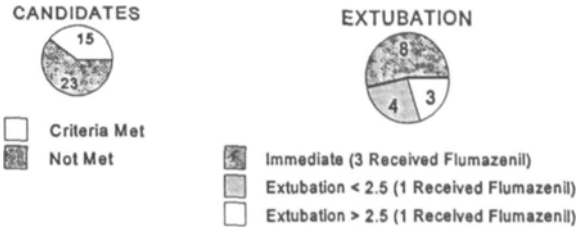
Michael I Buss MD

Department of Anaesthesia. Atlantic Health Sciences Corporation, P.O. Box 5200, Saint John, New Brunswick. E2L 4L4

INTRODUCTION
Concerns that immediate extubation after cardiac surgery might exacerbate early postoperative complications such as hemodynamic instability, hypermetabolism, shivering, and mediastinal bleeding have delayed widespread acceptance. The duration of this risk period is not defined although extubations have become earlier without compromising safety (1). Patients extubated early have reduced demands for nursing and ICU resources(2).

METHODS
As part of a pilot study into the feasibility of instituting a "fast tracking" program in our institution 38 consecutive patients having coronary bypass surgery were considered for immediate extubation. Exclusion criteria were: age over 70; ejection fraction <55%; significant valvular disease; a history of TIA, stroke, renal insufficiency, symptomatic pulmonary disease, or other disabling systemic disease. Current anaesthetic technique was modified to permit immediate extubation. Patients were premedicated with diazepam 10 mg p.o.. Coinduction was with midazolam and propofol and sufentanil restricted to 5-8 mcg/kg. Isoflurane and propofol were used for maintenance. Neuromuscular blockers were reversed. If necessary flumazenil was used at the end of surgery.

RESULTS
15/38 patients met the criteria for immediate extubation. 8/15 were extubated in the operating room. 4/15 patients were too sedated to be extubated in the operating room but were extubated within 2.5 hours. The remaining 3/15 patients were extubated beyond four hours. One remained sedated despite flumazenil and was extubated 5 hours postoperative. Two patients had excessive chest tube drainage at the time of skin closure and therefore were kept ventilated with positive end expiratory pressure. Their bleeding stopped with conservative therapy and they were extubated within 6 hours. All patients were hemodynamically stable, had satisfactory gas exchange, and recovered uneventfully.



DISCUSSION
In our institution immediate extubation is feasible in some 40% of low risk coronary bypass patients. Prospective randomised study of immediate extubation vs less aggressive early extubation protocols is warranted.

REFERENCES
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B

CHANGE IN ANAESTHETIC PRACTICE - COSTS AND SAVINGS FOR OPEN HEART SURGERY

DK Rose, CD Mazer, MM Cohen, D Wigglesworth

The Departments of Anaesthesia, St. Michael's Hospital and the University of Toronto, Toronto, Ontario

Introduction: Changes in anaesthesia practice for patients who have open heart surgery have been suggested to reduce cost and improve outcome. However, studies of changes in actual practice and the effect on costs are limited. Therefore, over time (7 years) the cost of drugs used in the operating room for open heart surgery was calculated and outcome documented.

Methods: Following Ethics approval, costs of all OR drugs (1997 Canadian dollars) for each patient who had open heart surgery were determined from individual anaesthetic records and mean costs per patient calculated. Three periods were reported (January - September 1991, 1994, and 1997). Outcome indicators for the same periods included ICU length of stay, return to OR for bleeding, and red cell transfusion. No active interventions other than passive educational initiatives occurred between study periods. Cost and outcomes were compared for each of the three periods using unpaired t tests and the chi squared statistic ($P<0.01$). The results were not adjusted for changes in case mix. Incremental spending and savings were also determined. ICU savings were theoretical and based on savings associated with an increase in patients discharged from ICU on the day following surgery, i.e. day 1 (ICU day costed at $1,430).

Results: For each of the three periods 1991, 1994, and 1997, there were 534, 586, and 739 patients. Case mix changed: shorter operative time ('91 - 5.1 ± 1.4 hr, '97 - 4.1 ± 1.0 hr), fewer valve procedures ('91 - 26%, '97 - 18%), but patients were older ('91 - 21% >70 yr, '97 - 33% >70 yr). For some OR drugs both utilization and cost changed (Table 1). Outcome improved (Table 2). The cost benefit ratio over time was favourable (Table 3).

Table 1: % Use & Mean Cost ($)/Patient - OR Drugs

	1991		1994		1997	
	(%)	Cost($)	(%)	Cost($)	(%)	Cost($)
Propofol	(0)	0	(1*)	0	(84*)	58
Tranexamic Acid	(0)	0	(15*)	39	(82*)	62
Fentanyl	(95)	35	(99*)	37	(90*)	9*
Inhal. Agents	(54)	7	(57)	7	(85*)	11*
All drugs - cost	$195±67		$224±119*		$273±113*	

*P<0.01 different from 1991

Table 2: Outcome

	1991	1994	1997
ICU LOS (days)	3.2±5.4	2.9±5.8	2.7±6.0
%≤1 day ICU	51%	61%*	72%*
OR return - bleeding	5.8%	3.8%	2.3%*
Units rbc (hosp)	4.9	4.4	2.0*

*P<0.01 different from 1991 rbc = red blood cells

Table 3: Incremental Spending and Savings

	1994	1997
OR drugs ($)/patient	29	78
ICU savings ($)/patient	131	292

Conclusion: Over a 7-year period a significant change in practice occurred without active educational interventions. Despite substantial increases in the cost of OR drugs for patients undergoing open heart surgery, the overall benefits outweighed the increase in OR drug costs.

STERNAL ACCELERATION BALLISTOCARDIOGRAPHY IN AORTIC STENOSIS

William PS McKay MD, Robert J Teskey MD, Julio Militzer PhD, Guy Kember PhD, Travis Blanchet PEng, Peter H Gregson PhD.
Dept of Anaesthesia, Division of Cardiology and Faculty of Engineering , Dalhousie University; PO box 9000, Halifax NS, B3K 6A3, CANADA.

INTRODUCTION

Sternal acceleration ballistocardiography (SAB) measures, in 3 dimensions, accelerations imparted to the chest by the cardiovascular system. SAB waves normal to the sternum (equivalent to the *Y*-axis SAB) have been correlated with events in the cardiac cycle[1]. We hypothesized that SAB waves would differ in patients with aortic stenosis (AS) compared to normals (N).

METHODS

SAB was recorded in 10 patients with aortic stenosis undergoing catheterisation and 8 patients with normal cardiovascular examinations, ECGs, and catheterisation studies. Amplitudes of SAB waveforms and time intervals of waves from the ECG R wave were measured.

RESULTS

SAB time intervals did not significantly differ between AS and N groups. SAB amplitudes were significantly different for wave forms associated with aortic opening and aortic closure:

SAB Wave	AS	N	P*
Mitral Closure	0.070 ± 0.060	0.039 ± 0.031	NS
Isovolumic Motion	-0.092 ± 0.103	-0.054 ± 0.045	NS
Aortic Opening	0.264 ± 0.100	0.171 ± 0.077	0.04
Isotonic Contraction	-0.167 ± 0.091	-0.111 ± 0.068	NS
Rapid Ejection	0.132 ± 0.109	0.124 ± 0.046	NS
Aortic Closure	0.115 ± 0.058	0.046 ± 0.052	0.02
Mitral Opening	-0.068 ± 0.056	-0.096 ± 0.062	NS
Rapid Filling	0.122 ± 0.062	0.105 ± 0.055	NS
Atrial Systole	0.098 ± 0.051	0.061 ± 0.037	NS

* probability of difference between AS and N due to chance

Receiver Operating Characteristic plots showed an excellent area under the curve for both the Aortic Opening wave amplitude (0.80 ± 0.11) and the Aortic Closure wave amplitude (0.89 ± 0.08).

CONCLUSIONS

The SAB is abnormal in patients with significant aortic stenosis. The SAB may be a useful rapid noninvasive diagnostic tool.

REFERENCES

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TRANEXAMIC ACID DOES NOT REDUCE BLOOD LOSS OR TRANSFUSION IN PRIMARY CARDIAC SURGERY

Steven R. Howells, M.D., James A. Robblee, M.D.

Department of Anaesthesia, University of Ottawa Heart Institute, Ottawa Civic Hospital, 1053 Carling Avenue, Ottawa, Ontario, K1Y 4E9

INTRODUCTION: Tranexamic acid (TA) is a synthetic antifibrinolytic agent which inhibits plasmin. This prevents the breakdown of fibrin and contributes to platelet preservation during CPB. TA is effective at reducing blood loss and transfusions following repeat coronary bypass grafting (CABG) and repeat valve surgery[1,2]. Similar effect has been demonstrated in patients undergoing primary CABG[3]. This retrospective case controlled study was undertaken to assess the effect of TA in patients undergoing primary CABG.

METHODS: The protocol for a case controlled study was approved by the hospital ethics committee. Thirty-six patients undergoing primary CABG who received TA were analyzed retrospectively for blood loss and red blood cell (RBC) utilization. 36 patients who did not receive TA were matched for age, body surface area (BSA), and preCPB hematocrit (Hct). This group served as a control. Lowest and predischarge Hct, length of CPB, auto-transfusion system (ATS) levels on arrival to recovery, and 24 hour chest tube (CT) drainage were recorded. Variables and RBC utilization were compared between groups using unpaired T-test and Chi square analysis.

RESULTS: The no TA group was matched to age 62.5 (±11) years, BSA 1.91 (±0.2) m^2 and preCPB Hct 39.1 (±6.14) in the TA group. CPB times were equivalent (TA 84.2±35.1 vs no TA 82.7±25.6 min). The average TA does was 1703 mg (±1135) with a range of 1000 to 8000 mg. Both groups had equal lowest and discharge Hct. There was no difference in ATS levels (TA 227±166, non TA 251±156) and 24 hour CT loss (TA 1003±646, no TA 1115±629) between the two groups. There was also no difference in blood utilization (TA 1.36±3.86 vs no TA 0.81±1.47 RBC units/pt) or number of patients in each group receiving blood (TA 12, no TA 12).

DISCUSSION: TA has been shown to decrease blood loss and transfusion in all types of cardiac surgery including primary CABG. In this study, the beneficial effects of TA were not demonstrated. Blood loss and transfusion were equal in TA and no TA groups. The significance of these preliminary findings is limited by the small sample size and we are currently extending this study to include 200 patients in each group.

(1) Anesth Analg 83:18-26, 1996
(2) Can J of Anesth 44(9):934-941, 1997
(3) Anesth Analg 85:963-70, 1997

OBSTETRIC ANAESTHESIA SURVEY 1997: OPERATIVE ANAESTHESIA

Terrance W. Breen MD, Laura Dierenfield, Tacie McNeil R.N.
Dept. of Anaesthesia, Foothills Medical Centre and the University of Calgary, Calgary, Alberta Canada
This study was supported by the Obstetric Section of the Canadian Anaesthetists Society

INTRODUCTION: The practice of obstetric anaesthesia in Canada is not known. Therefore, a survey of obstetric anaesthesia was undertaken to determine current practice.[1,2]

METHODS: In February 1997, a questionnaire was mailed to all 1539 specialist anaesthetist members of the Canadian Anaesthetists' Society residing in Canada. Three months later, a second questionnaire was sent to all non-responders. University based anaesthetists (UBA) and community based anaesthetists (CBA) who practice obstetric anaesthesia were compared using the chi-squared test.

RESULTS: There were 818 completed questionnaires (53%) and 496 of these anaesthetists practice obstetric anaesthesia (60.6%). Of these, 181 were UBA and 292 CBA. 79% of anaesthetists in both groups were male. Anaesthetists in university centres were younger (43.7±10.4 yr. vs. 48.3±10.6 yr., $p<0.001$) and were in practice for shorter periods of time (13.1±8.8 vs. 18.3±11.0 yr., $p<0.001$). Only 36.6% of UBA practiced obstetric anaesthesia compared to 69.3% of CBA ($p<0.001$). Spinal anaesthesia was the most common anaesthetic for elective cesarean section used by 87.7% of UBA and 81.3% of CBA ($p<0.001$). Hyperbaric bupivacaine was used by 95.9% of UBA but only by 73.5% of CBA; hyperbaric lidocaine was used in the other patients ($p<0.001$). In the event of a failed epidural anaesthetic for a cesarean section, 55.6% of UBA used a decreased dose of local anaesthetic compared to 40.9% of CBA ($p=0.004$).

Data below refers to women without epidural catheters.

Scenario	UBA (n=181)			CBA (n=292)			p
	SA	EA	GA	SA	EA	GA	
Urgent C/S (%)	90.0	1.7	7.2	78.0	4.5	17.5	<0.01
STAT C/S (%)	17.2		82.3	7.6		92.4	<0.01
Urgent C/S, Chorio (%)	60.3	29.1	8.9	50.7	8.6	40.0	0.085
PPTL (%)	42.7	5.5	50.6	17.4	1.5	80.8	<0.01

SA = Spinal Anaesthesia, EA = Epidural Anaesthesia, GA = General Anaesthesia, Chorio = Chorioamnionitis, PPTL = Post Partum Tubal Ligation

Postcesarean section analgesia was provided using neuraxial narcotics in 77.8% of UBA patients and 57.7% of CBA patients ($p=0.001$)

CONCLUSION: The practice of obstetric anaesthesia is different in community and university hospitals. Reasons for these differences and their impact on patient outcomes should be sought.

REFERENCES:

1. Reg Anesthesia 1996; 21: 49-60 2. Anesth Analg 1996; 83: 735-41

OBSTETRIC ANAESTHESIA SURVEY 1997: LABOUR ANALGESIA

Terrance W. Breen MD, Tacie McNeil R.N., Laura Dierenfield
Dept. of Anaesthesia, Foothills Medical Centre and the University of Calgary, Calgary, Alberta Canada
This study was supported by the Obstetric Section of the Canadian Anaesthetists Society

INTRODUCTION: The practice of obstetric anaesthesia in Canada is not known. Therefore, a survey of obstetric anaesthesia was undertaken to determine current practice.[1,2]

METHODS: In February 1997, a questionnaire was mailed to all 1539 specialist anaesthetist members of the Canadian Anaesthetists' Society residing in Canada. Three months later, a second questionnaire was sent to all non-responders. University based anaesthetists (UBA) and community based anaesthetists (CBA) who practice obstetric anaesthesia were compared using the chi-squared test.

RESULTS: There were 818 completed questionnaires (53%) and 496 of these anaesthetists practice obstetric anaesthesia (60.6%). Of these, 181 were UBA and 292 CBA. Data below describes some aspects of labour analgesia provision by these anaesthetists.

		UBA (n=181)	CBA (n-292)	p
Teach pain relief classes (%)		53.7	23.0	<0.001
Provide information pamphlets (%)		79.5	58.9	<0.001
Do *not* warn patients of:	Paralysis (%)	28.8	26.4	0.64
	Dural Puncture (%)	5.6	6.4	0.76
	Nerve Injury (%)	29.0	29.0	0.999
Minimum lab tests for providing epidural	None	66.3	57.8	0.19
	CBC	33.1	39.1	
Minimum platelet count before providing epidural analgesia	≤ 50,000	17.0	16.0	0.66
	60-75,000	15.2	15.7	
	80-95,000	40.9	34.8	
	≥ 100,000	26.9	32.4	
Will provide epidural analgesia if (cervical dilation)	< 3 cm dilation	64.6	54.0	0.037
	3-7 cm dilation	98.9	96.9	0.27
	> 7 cm dilation	95.5	91.5	0.47
Pull epidural catheter 1-2 cm through needle	Uncommon	38.0	33.0	0.37
	Common	35.2	32.6	
Pull epidural catheter ≥ 3 cm through needle	Uncommon	24.7	19.6	0.23
	Common	6.2	3.4	
Experienced sheared epidural catheter (%)		5.6	5.2	0.84
Use CSE (%)		43.5	18.4	<0.001
Use PCEA		19.0	8.1	0.08
Never use IV PCA		64.6	89.7	<0.001
Simultaneously cover OR and L&D		67.4	94.5	<0.001

CONCLUSION: The practice of obstetric anaesthesia is different in community and university hospitals. Reasons for these differences and their impact on patient outcomes should be sought.

REFERENCES:

1. Reg Anesthesia 1996; 21: 49-60 2. Anesth Analg 1996; 83: 735-41

A

POST-OPERATIVE PULMONARY FUNCTION IN CABG PATIENTS UNDERGOING EARLY TRACHEAL EXTUBATION: A COMPARISON BETWEEN SHORT TERM MECHANICAL VENTILATION AND IMMEDIATE EXTUBATION.

Donna J. Nicholson, MD, Stephen E. Kowalski, FRCPC, G. Andrew Hamilton, FRCSC, Michael P. Meyers, FRCPC, Carl Serrette, MSc, Peter C. Duke, FRCPC.

University of Manitoba, Department of Anesthesia, Health Sciences Centre, 820 Sherbrook Street, Winnipeg, Manitoba, R3A 1R9.

INTRODUCTION

Early extubation after CABG surgery has been shown to be safe and to decrease post-op LOS and hospital costs.[1,2] We hypothesize improved pulmonary function from a short period of post-op ventilation compared to immediate extubation.

METHODS

Institutional and ethics approval was obtained. The study population consisted of patients scheduled for elective CABG surgery. Patients with significant valvular disease, previous cardiac surgery, EF ≤ 30%, FEV_1/FVC ≤ 60%, renal insufficiency, or an abnormal CXR were excluded. Informed consent was obtained. Twenty patients were prospectively enrolled and randomized to 1 of 2 groups. Patients in Group I were extubated as soon as possible after surgery (n=10). Patients in Group II were sedated and ventilated for 3 hrs after surgery (n=10). Both groups were extubated only after achieving predetermined extubation criteria. All patients received a standard anesthetic. Serial PFTs were performed (pre-op and post-op Day 1 and Day 3) using the helium dilution technique. Serial ABGs (pre and post-op) and serial CXRs (pre-op, 4 hrs after extubation, and post-op Day 1 and Day 2) were obtained. CXRs were evaluated for degree of atelectasis. Both the radiologist and respiratory therapist were blinded to the study group.

RESULTS

Demographic data were comparable between groups (Table I). The mean time to extubation in Group I was 43 min ± 26 min vs 206 min ± 18 min in Group II. There was a significant decline in post-op PFTs in both groups, but there was no difference between groups at either 24 or 72 hrs post-op (Table II). There were no differences in post-op ABGs after 2 hrs or atelectasis scores (data not shown).

Table I

	Age	Wt (kg)	Risk Score	CPB (min)	X-Clamp (min)
Group I	60.2±11.4	87.5±11.8	1.2±1.2	72.2±22.1	41.8±13.9
Group II	56.8±5.0	88.8±11.5	1.0±0.7	60.7±13.6	43.4±20.8

Table II

	Preoperative		24 Hours		72 Hours	
	Group I	Group II	Group I	Group II	Group I	Group II
FEV_1	2.8±1.0	3.0±0.7	1.4±0.4	1.3±0.4	1.6±0.7	1.5±0.5
FVC	3.8±1.0	3.8±0.7	1.7±0.5	1.6±0.5	2.1±0.9	2.1±0.7
TLC	6.6±0.9	6.3±0.9	3.1±0.9	2.9±1.0	3.6±1.1	3.3±0.9
FRC	3.4±0.6	3.3±0.5	1.8±0.7	1.6±0.5	2.1±0.7	1.7±0.6

DISCUSSION

Our preliminary data indicates that short term mechanical ventilation does not improve post-op pulmonary function. Patients can be safely extubated shortly after CABG surgery without added pulmonary dysfunction.

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B

PAIN ON INJECTION OF ROCURONIUM : METHODS OF ALLEVIATION.

Ingrid Custeau MD, René Martin MD, Sonia Larabée MD, Martine Pirlet MD, Madeleine Pilote RN, Jean-Pierre Tétrault MD
Department of Anaesthesia, University of Sherbrooke, 3001, 12th Avenue North, Fleurimont, Quebec, J1H 5N4

INTRODUCTION

Rocuronium is a good pretreatment to prevents succinylcholine fasciculations[1]. However, the pretreatment with rocuronium produces pain if a vein on the dorsum of the hand is used. The aim of our study was to determine a technique which would prevent that pain.

METHODS

With institution's ethical committee approval, 80 patients scheduled to undergo elective surgery were randomly assigned in this prospective and double blind study to one of four groups. Patients in group 1 (n = 20) received 2 ml of normal saline followed by rocuronium 0.06 mg/kg^{-1}. Those in group 2 (n = 20) had 2 ml of normal saline followed by rocuronium 0.06 mg/kg^{-1} mixed in a 1/1 ratio with normal saline. Patients in group 3 (n = 20) had 2 ml of normal saline followed by rocuronium 0.06 mg/kg^{-1} mixed in a 1/1 ratio with 2% lidocaine. Patients in group 4 (n = 20) had 2 ml of 2% lidocaine followed by rocuronium 0.06 mg/kg^{-1}. The patients were instructed to report the presence of pain, and its intensity on a 0-10 scale. When present, the duration of pain was measured. Anova, Fisher's PLSD and chi-square tests were used for statistics. Means ± SD are reported.

RESULTS

Age, sex and weight did not differ significantly amongst groups. Twenty three of the 80 patients had pain : 10/20, 7/20, 4/20 and 2/20 in groups 1, 2, 3, and 4 respectively ($p < 0.05$: G1 and G2 vs G3 and G4). When present the intensity of pain varied between 1 and 8/10 (3.9 ± 1.9) and lasted between 1 and 20 sec. (4.3 ± 4.3).

DISCUSSION AND CONCLUSION

Fifty per cent of the patients in Group 1 (control) presented pain on the dorsum of the hand after rocuronium 0.06 mg/kg^{-1} used as pretreatment to prevent succinylcholine fasciculations. Amongst the three techniques tested to prevent the pain, the injection of 2 ml of 2% lidocaine before rocuronium (G4) is the best one with only 2/20 patients presenting pain; mixture of 2% lidocaine in a 1/1 ratio with rocuronium (G3) is also effective, but to a lesser degree.

REFERENCE

Can J Anaesth 1997; 44 : A-24.

CONFIRMATION OF EPIDURAL CATHETER PLACEMENT USING NERVE STIMULATION: A PILOT STUDY IN POSTOPERATIVE PATIENTS.

Ban C.H. Tsui, MSc MD,Sunil Gupta, MD, and Brendan Finucane, MBBCh

Department of Anaesthesia,University of Alberta Hospitals, Edmonton, Alberta T6G 2B7

INTRODUCTION

Spinal cord stimulation using specialized catheters in the epidural space has been used to treat chronic pain for many years[1]. The objective of this study was to evaluate the reliability of low current electrical stimulation to confirm proper epidural catheter placement.

METHODS

Following ethics approval and written informed consent, 40 patients, with epidural catheters (19G Arrow Flextip plus) already in place for post-operative pain management were studied. An adapter (Arrow-Johans ECG Adapter) was attached to the snap-lock connector of the epidural catheter (Figure 1). The epidural catheter and adapter were filled with sterile normal saline. The negative lead of the nerve stimulator was attached to the metal hub of the adapter. Catheter placement was judged to be correct or incorrect, depending upon the presence or absence of truncal or limb motor movement to 1 Hz stimulation within a range of 1 to 10 mA. A standard test dose consisting of 3ml of 1.5% lidocaine with 1:200,000 epinephrine was then injected. The efficacy of the epidural morphine was assessed independently by anaesthetists from the acute pain service as either satisfactory or unsatisfactory.

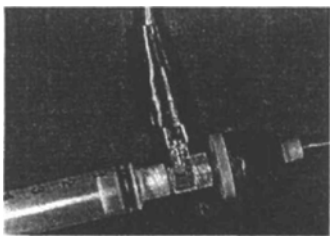

Figure 1. Setup for monopolar stimulation on existing epidural catheter. *Black arrow* shows an Arrow-Johans ECG Adapter connected to snap-lock connector of the epidural catheter.

RESULTS

The sensitivity and specificity of the test was 100% and 91.6% compared with the standard test dose. The positive and negative predictive value was 96% and 100%. When this new test was compared with the efficacy of epidural morphine, the sensitivity and specificity was 96.1% and 76.9%. The positive and negative predictive value was 89% and 90%.

DISCUSSION

These data show that this new test reliably confirms epidural catheter location in the postoperative period, in the vast majority of cases. The only false positive result may be due to patient reporting problems rather than the accuracy of the test, as occurred in one elderly patient.

CONCLUSION

This study establishes this new test as a simple, rapid and reliable technique for confirmation of epidural catheter placement.

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INTRAVENOUS REGIONAL ANAESTHESIA WITH ROPIVACAINE

Mitchell J. Weisbrod MD, Vincent W. S. Chan MD,
Z. Kaszas MD, C. Dragomir MD
Department of Anaesthesia, University of Toronto,
The Toronto Hospital, Western Division, 399 Bathurst St.,
Toronto, Ontario, Canada M5T 2S8

INTRODUCTION Ropivacaine, a new local anaesthetic, is less toxic than bupivacaine. This volunteer study evaluated the efficacy and safety of intravenous regional anaesthesia (IVRA) with ropivacaine when compared with standard lidocaine.

METHODS Following IRB approval and informed consent, 13 ASA I volunteers (8 male: 5 female, 26 - 40 y.o., 57 - 82 kg, 161 - 188 cm) were double-blindly randomized into 3 groups: Group R1.8 (ropivacaine 1.8mg/kg), Group R1.2 (ropivacaine 1.2mg/kg), and Group L3 (lidocaine 3mg/kg). The volunteers received IVRA in a standardized manner. After tourniquet inflation, a 40-ml IV bolus of local anaesthetic was injected over 2 minutes. The tourniquet was kept inflated for 30 minutes then deflated over 2 cycles. Motor and sensory functions were assessed at baseline and every 5 minutes until recovery in the distributions of the median, radial, ulnar and musculo-cutaneous nerves. Sensory testing included touch, cold, pinprick, pinch, and transcutaneous electrical stimulation (TCS) using 60mA, 100Hz for 5 seconds. Motor testing included hand grip strength (ability to squeeze an IV bag attached to a pressure transducer) and muscle power. Also, the presence of local anaesthetic toxic symptoms, tourniquet pain and local anaesthetic blood levels (arterial and venous) were recorded. Data are expressed as mean ± SD and analyzed using ANOVA where appropriate. $P<0.05$ is significant.

RESULTS The onset of sensory and motor anaesthesia was equally rapid in all three groups. After tourniquet deflation, residual anesthesia and analgesia were significantly prolonged in Group R1.8 when compared with the other groups (see table). Five volunteers experienced transient dizziness and tinnitus (4 Gp. R1.8 vs. 1 Gp. L3, $p = 0.04$). Six subjects experienced tourniquet pain (n.s.). Results of Local anaesthetic blood levels are pending.

Time to complete recovery of:	Group R1.8 n=4 (min.)	Group R1.2 n=5 (min.)	Group L3 n=4 (min.)
Touch	38.8 ± 30.9	23.0 ± 17.5	6.2 ± 2.5
Cold	106.2 ± 31.7*	68.0 ± 42.8Ψ	8.8 ± 2.5
Pinprick	155.0 ± 38.7*†	54.0 ± 46.4	17.5 ± 13.2
Pinch	55.0 ± 37.2	43.0 ± 39.0	6.2 ± 2.5
TCS	115.0 ± 22.9*	54.0 ± 40.8	15.0 ± 11.5
Muscle power	168.8 ± 68.6*†	56.0 ± 44.8Ψ	8.8 ± 2.5
Grip strength	100.0 ± 22.7*	47.5 ± 31.2Ψ	6.2 ± 2.5

* $p<0.05$; Gp. R1.8 vs Gp. L3 † $p<0.05$; Gp. R1.8 vs Gp. R1.2
Ψ $p<0.05$; Gp. R1.2 vs Gp. L3

DISCUSSION Our data suggest that ropivacaine 1.8mg/kg produces similar onset of IVRA, prolonged residual anaesthesia and analgesia and fewer minor toxic symptoms when compared with the standard dose of lidocaine.

A

Isoflurane Preserves Cardiac Function in Hearts Following Prolonged Cold Cardioplegic Storage

MR Cohen[1] MD, M Gandhi[2] PhD, AS Clanachan[1,2] PhD, BA Finegan[1] FRCPC
Dept. of Anaesthesia[1] and Pharmacology[2], University of Alberta, Edmonton AB

Introduction: Donor hearts deteriorate with time limiting availability of organs for transplantation. Isoflurane (ISO) is an effective protective agent in hearts subject to brief ischemia[1]. We hypothesized that ISO would also be protective in hearts subject to cardioplegic arrest and prolonged storage.

Methods: Institutional animal ethics approval was obtained. Hearts from pentobarbital-anaesthetized rats were perfused in Langendorff mode for 10 min, arrested and stored in St. Thomas' II cardioplegia at 4°C for 8 hr. Hearts were reperfused in Langendorff mode for 10 min, then paced at 300 bpm in working mode for 60 min with Kreb's solution containing 2.5 mM Ca^{2+}, 11 mM glucose and 1.2 mM palmitate. ISO was delivered via a calibrated vaporizer and equilibrated with Kreb's or cardioplegic solution for 10 min. Delivered concentration of ISO was monitored via infrared analyzer. Four groups were studied. A Stored Untreated control group (SU, n=11) was arrested, stored and reperfused without ISO. An ISO Reperfusion group (I/R, n=6) was exposed to 1.5% ISO during Langendorff reperfusion. An ISO Storage and Reperfusion group (I/SR, n=12) was treated with 1.5% ISO during both Langendorff periods and stored in cardioplegic solution saturated with ISO. In a fourth Non-Stored group (NS, n=11), hearts were perfused in Langendorff mode for 10 min and then immediately switched to working mode.

Results: ISO treatment in the I/SR group increased coronary flow (mL/min) compared with SU group in Langendorff mode both pre-storage (14.8 ± 0.6 vs 11.6 ± 0.4, $p<0.001$) and post-storage (14.1 ± 0.5 vs 10.2 ± 0.5, $p< 0.0001$). I/R group did not exhibit this effect. While there was no difference between spontaneous heart rates (bpm) in initial Langendorff perfusion, at reperfusion both I/SR (164 ± 36) and I/R (200 ± 93) showed better rates than SU (10 ± 10, $p< 0.05$). ISO treatment I/SR improved the recovery of LV work during working reperfusion (Fig. 1) compared with SU, but did not completely recover to non-stored (NS) function ($p<0.05$). I/R did not significantly improve recovery.

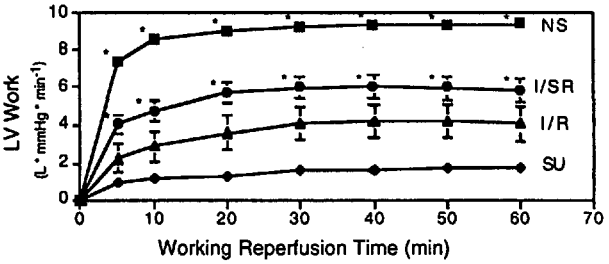

Fig.1 : LV Work vs. Time (* = $p<0.05$ vs SU)

Discussion: ISO is protective when present only during storage and non-working reperfusion. While the mechanism of this effect remains under investigation, these preliminary findings offer the exciting possibility of a safe and clinically feasible intervention to enhance the protection and prolong the ischemic storage interval of donor hearts.

Reference: Anesthesiology 69 : 552-565

B

PHARMACOECONOMICS OF NEUROMUSCULAR BLOCKING AGENTS: PERIOPERATIVE COST MINIMIZATION STRATEGY IN CHILDREN

Lisa Isaac, MD, William M. Splinter, MD, L. A. Hall, MD, H. M. Gould, MD, E. J. Rhine, MD
Department of Anaesthesia, Children's Hospital of Eastern Ontario and The University of Ottawa

INTRODUCTION

Fiscal policy has impacted dramatically on anaesthetic practice. Anaesthetic drugs costs are a small portion of the hospital budget[1], but neuromuscular blocking agents represent ~25-30% of anaesthetic drug costs[2]. We compared the costs associated with the use of several intermediate-acting neuromuscular blocking agents in children during the perioperative period.

METHODS

With ethics committee approval, a double-blind, randomized trial was completed on 92 healthy (ASA status I-II) children 2 - 10 yrs, undergoing elective dental restorations. Patients received 0.5mg/kg midazolam p.o. 20-30 min preoperatively. After induction by inhalation with N_2O/halothane, patients were randomized to receive a bolus of the study drug [mivacurium 0.2mg/kg, rocuronium 0.6 mg/kg, vecuronium 0.1 mg/kg, atracurium 0.4 mg/kg or cisatracurium 0.08 mg/kg (2 x ED95)]. Anaesthesia was maintained with N_2O 70% & halothane 1.0% (expired). Infusion of the study drug began when the T1 of the train of four reached 10% of baseline twitch height. Infusion rate of the study drug was changed every 2 min if indicated, to maintain T1 height of 5-15% of baseline, until 10 min before the end of surgery. Neuromuscular blockade was assessed with the TOF-GUARD™acceleration transducer. Residual neuromuscular blockade was reversed with 0.015 mg/kg atropine and 0.5 mg/kg edrophonium at the end of surgery if the train of four ratio was less than 70%. Results were compared using the one-way ANOVA.

RESULTS

The groups had similar demographic data by age and weight. At our institution, cisatracurium was the least expensive drug for induction and infusion for procedures 30, 45, 60, 75 and 90 min duration. Mivacurium was the most expensive drug.

COST PER KG OF PATIENT OF STUDY DRUG

Drug	30 min	45 min	60 min	75 min	90 min
ATRAC	$0.145	$0.170	$0.204	$0.240	$0.306
CISATRA	$0.073	$0.095	$0.115	$0.131	$0.158
MIV	$0.212	$0.292	$0.378	$0.436	$0.430
ROC	$0.166	$0.200	$0.228	$0.267	$0.292
VEC	$0.182	$0.218	$0.251	$0.301	$0.392

DISCUSSION

At our current prices, cistatracurium is the least expensive intermediate-acting neuromuscular blocking agent in children.

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SPINAL PROCAINE WITH AND WITHOUT EPINEPHRINE: A NEW LOOK.

Lyne Bergeron MD, Michel Girard MD MHPE FRCPC, Pierre Drolet MD FRCPC, Hong Hanh Le Truong MD, Carl Boucher MD.
Department of Anaesthesia, Hôpital Maisonneuve-Rosemont and Université de Montréal, 5415 l'Assomption Blvd., Montréal, Québec, H1T 2M4

INTRODUCTION

There is no data about the precise characteristics of spinal procaine with and without epinephrine in recent literature (1). Given the current expansion of regional anaesthesia for ambulatory surgery, it is time to update our knowledge of this medication.

METHODS

Sixty patients scheduled for a surgery of less than one hour under spinal anaesthesia were enrolled in a double blind randomized study. Each group (n=30) received procaine 100 mg; group I: + 0.3 ml NaCl 0.9% and group II: + 0.3 mg epinephrine. Sensory level, motor blockade and arterial pressure were noted every 1 minute for 10 minutes, every 3 minutes for 35 minutes and every 5 minutes until the sensory level receded to L4 .

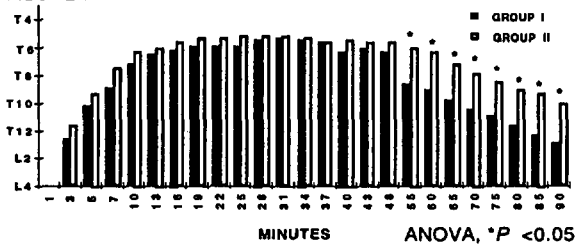
RESULTS

There was no difference between groups with regard to demographics and blood pressure during surgery. Maximum sensory level and time to obtain this level showed no difference between groups (TABLE). Sensory levels for both were similar until 48 minutes after injection. From 55 minutes on, sensory levels in group I were lower than in group II (FIG. 1). Duration of motor blockade was shorter in group I than in group II (FIG. 2).

TABLE	Group I	Group II	P
Time to max sensory level (min)	18.5±8.4	15.7±6.8	N.S.
Number of levels blocked from L4	11.8±1.9	12.4±2.2	N.S.

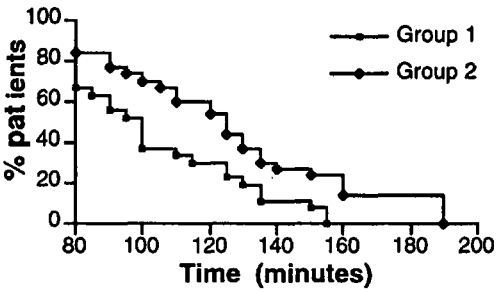
Data are presented in mean ± SD, T test, unpaired

FIGURE 1



ANOVA, *P <0.05

FIGURE 2



Kaplan Meier survival curve and log-rank test for trend, $P < 0.05$

DISCUSSION

In our study, the spinal block obtained with procaine was appropriate for short duration surgery. The addition of epinephrine prolongs the duration of spinal anaesthesia with procaine, without modifying onset time or maximum sensory level reached.

REFERENCE
1. Southern Medical Journal 1950; 43: 771-3

CLINICAL EVALUATION OF DAR BARRIERBAC S® BREATHING FILTERS FOR BACTERIAL FILTRATION EFFICIENCY

Daniel Vézina MD, Martin R. Lessard MD FRCPC,
Marie Gourdeau MD FRCPC, Claude A. Trépanier MD FRCPC,
Departments of Anaesthesia and Microbiology, Centre Hospitalier Affilié Universitaire de Québec (Pavillon Enfant-Jésus),
1401, 18e Rue, Québec (Québec), G1J 1Z4.

INTRODUCTION

Contaminated anaesthesia breathing circuits (BC) have been implicated as the cause of postoperative pulmonary infections. To minimize the risk of cross-infection, it is currently recommended that the BC be either single used , sterilized, or subjected to high degree disinfection between each patient.[1] In order to reuse the same BC for more than one patient and thereby decreasing costs, it has been proposed to add a breathing filter (BF) at the patient's end of the BC. However, because of the lack of scientific proof of the safety of this practice, neither the CDC or the ASA has yet recommended it. In-vitro studies of different types of BF have demonstrated a filtration efficacy > 99.99% for bacteria and virus-size bacteria.[2,3] However, because of the paucity of clinical investigations, the in-vivo efficacy of BF has not been demonstrated yet. The purpose of this study was to evaluate the in-vivo bacterial filtration efficiency of a BF (DAR Barrierbac S®) in a usual clinical anaesthesia setting.

METHODS

All the daytime cases under general anaesthesia were included in the study. Before induction of anaesthesia, a sterile BF was inserted at the Y-piece of a sterile single use BC. Then, anaesthesia proceeded as usual. At the end of anaesthesia, the inside of the BC connector of the BF (circuit side) and the inside of the endotracheal tube connector (patient side) were swabbed separately. Swabs were soaked in transport media and plated on growth media (Mc Conkey, Chocolate and Blood agars) less than three hours after sampling. Cultures were evaluated at 24 and 48 hours and if they showed bacterial growth, bacterial identification was done.

RESULTS

Over a 26 week period, 2001 BF were studied in a usual clinical anaesthesia setting. Mean duration of anaesthesia was 96.9 ± 65.3 min. Of the 2001 BF evaluated, 1842 BF had negative bacterial cultures on both sides of the BF. One hundred and four (104) BF had a positive culture on the patient side. On 2 of those 104 BF, the circuit side grew the same bacteria as the patient side. Thus, despite the presence of a BF, the same bacteria was found on both sides of the BF in 2 out of 2001 cases, representing an incidence of bacterial contamination of a BC protected by a BF of 0.1% ($CI_{95\%}$ = 0.017 - 0.4). Finally, when the patient side of the BF was contaminated (n=104), the filtration efficacy of the BF was 98.08% ($CI_{95\%}$= 92.54 - 99.67).

DISCUSSION

The anaesthesia breathing filter studied did not completely prevent bacterial contamination. Using the upper limit of the confidence interval, a BC would become contaminated once every 250 cases (0.4%). Besides, BF were evaluated only for their bacterial filtration efficiency and these results cannot be applied to virus or mycobacteria. We conclude that the in-vivo bacterial filtration efficacy of the BF is less than the one reported in-vitro and that the BF does not completely protect the BC from bacterial contamination.

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2. Acta Anesthesia Italica 1992; 43 (suppl 1): 93-7.
3. Anesth Analg 1991; 72 : 651-5.

A COMPARISON OF 0.1 MG VERSUS 0.25 MG INTRATHECAL MORPHINE FOR ANALGESIA FOLLOWING CESAREAN SECTION

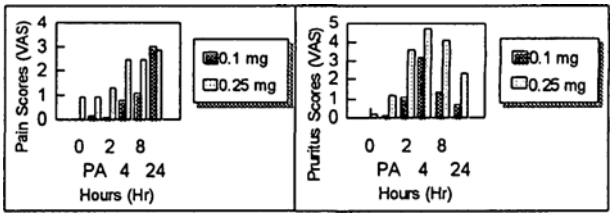
Theresa Yang, MD, Terrance W. Breen, MD, FRCPC, Alison Macarthur, MD, FRCPC.

Department of Anaesthesia, Foothills Hospital, University of Calgary, 1403 - 29th St. N.W., Calgary, AB, Canada, T2N 2T9

INTRODUCTION: Intrathecal morphine has been the standard analgesic employed following cesarean section in the last decade. Recent studies have suggested that smaller doses might be as effective as the larger doses [1-3]. Adding NSAIDS to the postoperative analgesia routine may decrease the dose of intrathecal morphine required but still provide satisfactory analgesia with fewer side effects, particularly pruritus.

METHODS: Following Medical Research Ethics Board approval and written informed consent, women scheduled for elective cesarean section under spinal anaesthesia were enrolled. They were all ASA I/II with normal term pregnancies. These women were randomized to receive either 0.1 mg or 0.25 mg of intrathecal morphine, in addition to 0.75% hyperbaric bupivacaine and 20 µg of fentanyl. All patients were given a 100 mg indomethacin suppository at the end of surgery and started on naproxen 500 mg p.o. bid the same evening after surgery, and remained on this dose until discharge. A blinded researcher recorded the pain and pruritus scores using a visual analogue scale (VAS), and nausea scores using a 5-point ordinal scale, at entry, in the post-anaesthetic recovery room (PARR), 2h, 4h, 8h, and 24h. Satisfaction with the anaesthetic was also assessed with a VAS. Pain and pruritus scores were analysed with ANOVA, while parametric and nonparametric data were compared using the unpaired t-test and Mann Whitney U test respectively.

RESULTS: 20 patients have been currently enrolled out of a planned sample size of 60. There were no significant differences between the 0.1 mg vs. the 0.25 mg group with respect to demographic data. The 0.1 mg group had significantly lower pruritus scores at 2 and 8 hours, as well as a lower pain score at 4 hours. There were no significant differences between the two groups with respect to satisfaction with the anaesthetic technique.



DISCUSSION: The use of a smaller dose of intrathecal morphine (0.1 mg), in conjunction with NSAIDS, provided similar pain control as a larger dose (0.25 mg) after cesarean section. More importantly, 0.1 mg of intrathecal morphine produced less pruritus and gave similar satisfaction than with 0.25 mg.

REFERENCES

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3. Anesth Analg 1988; 67: 137-43.

Abstracts

Monday, June 15 (a.m.)

PREEMPTIVE ANALGESIC EFFECT OF KETAMINE AFTER MAJOR ABDOMINAL SURGERY

P Chouinard MD, F Fugère MD, FRCPC , M Ruel RN.
Department of Anesthesia, Centre Hospitalier de l'Université de Montréal, Pavillon Notre-Dame,University of Montreal, 1560 Sherbrooke Street East, Montreal, Canada.

Introduction: Ketamine is a NMDA receptor antagonist which has been used to decrease postoperative hyperalgesia after nephrectomy[1] and postoperative pain after laparoscopy[2]. However, no study has ever measured the efficacy of preemptive treatment with continuous infusion of ketamine. The purpose of this study was to assess if preoperative institution of an intravenous ketamine infusion is a more effective means of controlling postoperative pain than postoperative institution of that same ketamine infusion.
Method: After institutional approval and written informed consent, the first 40 patients ASA 1 and 2 aged 18-70 years scheduled for abdominal hysterectomy were prospectively randomized to receive a bolus and a ketamine infusion instituted either before skin incision or after skin closure. A standard general anesthetic technique using fentanyl up to 10 µg/kg (none in the last hour), thiopental induction, succinylcholine, isoflurane, N2O, vecuronium, neostigmine and glycopyrolate was used. In group 1 (preemptive group), a bolus of ketamine 0.3 mg/kg followed by a continuous infusion of 0.12 mg/kg/hour for 24 hours was administered intravenously before skin incision. In group 2 (control), the bolus as well as the 24 hour continuous infusion of ketamine was began after the surgery. Postoperatively, patients received morphine 3 mg IV q 5 min prn in PACU until comfortable and then PCA morphine in a dose of 1 mg with a 5 minute lockout time and no basal infusion on the ward. Pain scores at rest and on movement using a visual analog scale (VAS: 0 = no pain to 10 = worst pain possible), morphine consumption, incidence and severity of side effects were recorded for 48 hours. Assessments were done by the same person blinded to the technique used. Data were analyzed by ANOVA or chi-square and $p<0.05$ was considered statistically significant.
Results: Demographic data did not differ between the study groups. There was no significant difference in pain scores as well as analgesic requirements for the first 48 postoperative hours (Table). Finally, both groups of patients complained of equivalent somnolence and fatigue during the first 24 hours that resolved with the termination of ketamine infusion. No patient experienced delirium or hallucination.

	Group 1	Group 2	*p*
V.A.S. at rest (for the first day)	1,6 ± 1.7	1,1 ± 0.9	0,3
V.A.S. at rest (for the second day)	0,8 ± 0.9	0,8 ± 1.0	0,9
V.A.S. at cough (for the first day)	4,5 ± 2.0	4,5 ± 1.8	0,9
V.A.S. at cough (for the second day)	3.0 ± 1.7	3,6 ± 1.8	0,15
morphine consumption after 48 hours (mg)	74,2 ± 33.8	102,9 ± 50.5	0,06

V.A.S. are expressed as mean ± SD
Discussion: We conclude that for an abdominal hysterectomy the institution of a ketamine infusion before surgical incision does not provide better postoperative analgesia and does not reduce postoperative analgesic requirements when compared to a ketamine infusion started at the end of the surgery.
1- Proceedings of the 8th World Congress in Pain. 1996; 3.
2- Proceedings of the 8th World Congress in Pain.1996; 47-8.

A

EFFICACY AND SIDE EFFECTS OF TRAMADOL AND OXYCODONE AFTER MAXILLOFACIAL SURGERY

Pekka Tarkkila MD PhD, Marja Silvasti MD, Marjatta Tuominen MD PhD, Nils Svartling MD PhD, Per H Rosenberg MD PhD
Ear Hospital and Department of Anaesthesia, Helsinki University Central Hospital, Haartmaninkatu 29 E, FIN-00290 Helsinki, Finland

INTRODUCTION
Respiratory depression still remains one of the most undesirable side effects of opioids. Tramadol is a centrally acting opioid with a low affinity for the µ-opioid receptor and therefore does not depress respiration [1,2]. Patient controlled analgesia (PCA) enables comparison of potency, efficacy and side effects of the opioids in analgesia after surgery. In this prospective, double-blind and randomized study we examined relative potency and side effects of tramadol and oxycodone after maxillofacial surgery.

METHODS
Fifty-four ASA I or II patients gave informed consent to participate in the study approved by the Ethics Committee of the hospital. After standardized anaesthesia, the patients were allocated randomly to receive tramadol or oxycodone by PCA (lockout 5 min, tramadol 0.3mg/kg bolus, oxycodone 0.03mg/kg bolus). During the immediate recovery period, opioid was administered i.v. in a double-blind fashion in either 10mg (tramadol) or 1mg (oxycodone) increments in the recovery room until the pain control was judged to be satisfactory by the patient. PCA was then commenced. A 50cm visual analogue scale (VAS) was used in order to score pain at rest and movement (mouth opening) at 2h after commencing the PCA, as well as 9p.m. and 9a.m. the following morning. Side effects were recorded at the same observation points. The opioid consumption was recorded by the PCA-device. Data were analyzed by Student's *t*-test, Mann-Whitney *U* test and Chi-square test, as appropriate.

RESULTS
The groups were comparable with regard to age, height, weight, duration of operation and alfentanyl consumption during the surgery. One patient in the oxycodone group was withdrawn because of intractable pruritus. The mean postoperative opioid consumption was 202mg in the tramadol group and 26mg in the oxycodone group (ratio 7.8:1). There were no significant differences between the groups in the VAS scores for pain (between 3 and 10cm at rest and between 8 and 15cm at movement, in both groups) or in the incidence of side effects. Nausea was the most common side effect and occurred with 7 patients (26%) in each group.

DISCUSSION
No significant differences were found between tramadol and oxycodone PCA in pain and side effects after maxillofacial surgery. Tramadol : oxycodone potency ratio of 7.8 : 1 was found in the present study. According to previous studies, tramadol is a safer opioid with respect to respiratory depression than classic opioids [1,2]. Tramadol was found to be a good alternative for analgesia after maxillofacial surgery.

REFERENCES
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2. *J Clin Anesth* 1997; 9: 582-585

B

LIDOCAINE IN BONE CEMENT - A DEPOT ANALGESIC SYSTEM?

David M. Bond MB FRCPC*, John F Rudan MD FRCSC†, Michael A Adams PhD¶
Departments of Anaesthesia*, Surgery† and Pharmacology¶, Queen's University, Kingston, Ontario K7L 3N6

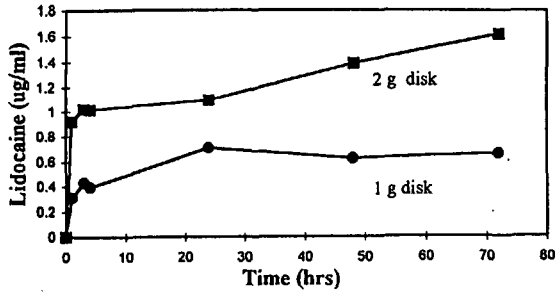
INTRODUCTION

Current analgesic modalities following prosthetic joint replacement are imperfect and carry morbidity. We postulated that delivery of lidocaine directly to the cut bone surface might provide effective analgesia. Our objective was to determine whether lidocaine elutes from a lidocaine/bone cement mixture.

METHODS

Howmedica Simplex® bone cement (40g) was mixed with 1g and 2g lidocaine base powder. Discs (50mm x 1mm) were prepared and placed in a stirred solution (100ml) containing 0.2N saline at 37°C. HPLC with electrochemical detection analysis of lidocaine levels was performed on samples (100µl) taken at 1,2,3,4,6,24,48 and 72h.

RESULTS



DISCUSSION

The major finding was that lidocaine elutes from the mixture. The time course of lidocaine concentrations indicates that release probably occurs only from the surface of the cement. This release is proportional to the amount of added lidocaine and occurs mainly within the first 24h which corresponds to the period of the most severe postoperative pain. This modality may be an effective depot analgesic system with less morbidity than systemic analgesic administration. Chemotherapeutic agents[1] and antibiotics[2] have been delivered using this technique. Further dose response studies and mechanical testing with different anaesthetics are being performed.

REFERENCES

1. J Bone Joint Surg 70A:1551-1557
2. Bull Hop Jt Dis 53: 68-74

BLINDED FORMULATION OF LIQUID METHADONE FOR CHRONIC NONMALIGNANT PAIN.

Brian K. Tsang, MD, and Wanda Keahey, Pharm D*
Dept of Anesthesiology, School of Medicine, *Dept of Pharmacy Services and School of Pharmacy, University of Mississippi Medical Center, Jackson, MS, USA

Introduction: Clinicians often hesitate to prescribe long-term opioid analgesics to patients with an unclear diagnosis of pain or a history of drug abuse/misuse (1). The authors have established a protocol for the use of oral methadone in a flavored liquid, with the drug concentration blinded (unknown) to patients. The clinicians can adjust the dosage according to the patient's pain and functional level without the patient's knowledge. Oral methadone provides steady plasma levels, and thus minimizes euphoria. Euphoria is thought to contribute to the development of addiction.

Methods: In a retrospective review, over the last two years, seven patients were identified as candidates and received the blinded methadone formulation in our outpatient pain clinic. Each patient was evaluated every two to four weeks for assessment of pain, sedation, ability to concentrate, satisfaction, and functional level. The clinician utilized evaluation of these parameters to adjust the dosage. The written prescriptions were sealed in an envelope. The patients were notified that opening the envelope would invalidate the prescription inside. The compounding pharmacist prepared the oral solution with powdered or liquid methadone in a flavored syrup. The label attached to the bottle had directions for use, total volume prepared, expiration date, but not the concentration or amount of methadone.

Results: One patient received the blinded formulation once and did not return for followup. The remaining six patients, at an average age of 47.5, included two with low back pain, and one each with painful diabetic neuropathy, cerebral palsy pain, rheumatoid arthritis, and abdominal pain. Reduction of the initial methadone dose was achieved in all six patients. The average dose decrease was 32.1% over an average time of 8.2 months. One patient dropped out due to the higher cost of the compounded formulation ($60-70/month vs. about $20/month for the tablets). The other five patients achieved better or the same pain control and/or functional level at the reduced methadone dosage.

Conclusion: The blinded methadone formulation allows adequate pain relief and functional level at a lower opioid analgesic dosage, and elimates the sometimes confrontational discussion between clinician and patient about dosage reduction. The patients who dropped out might or might not have genuine needs for long-term opioid therapy. This formulation can be recommended as an alternative to maintaining a high dose of opioids with an open label for chronic pain patients.

Reference: 1. J Pain Symptom Manage 1993; 8:297-305

AGE DIFFERENCES IN POSTOPERATIVE PAIN LEVELS AND PCA OPIOID CONSUMPTION

Lucia Gagliese BSc, Marla Jackson MHSc, Paul Ritvo PhD, Adarose Wowk BScN, Alan N. Sandler MB FRCPC, Joel Katz PhD
Departments of Psychology and Anaesthesia, The Toronto Hospital, General Division, 200 Elizabeth Street, Toronto, Ontario, M5G 2C4

INTRODUCTION

There is some debate over the relationship between age and post-operative opioid consumption. Increasing age has been associated with decreased postoperative analgesic consumption using patient-controlled analgesia (PCA)[1] although this relationship has not been replicated in other studies[2]. These results are based on only the first 24 hours after surgery, and since post-operative stay is usually much longer following major surgery, a more detailed analysis is required. The present study assesses age differences in analgesic consumption, pain levels and satisfaction with pain control in the first three days after major surgery.

METHODS

All patients received instruction in the use of the PCA pump prior to surgery. Upon arrival in the recovery room, patients received a loading dose of either demerol or morphine and were immediately placed on a PCA pump. Pain was measured daily using a 10 cm visual analog scale of pain intensity at rest (VAS-R) and in response to a standard mobilization exercise (VAS-M). Daily opioid intake (in morphine equivalents) and VAS ratings of satisfaction with pain control in general (VAS-PC) were recorded. The total number of days patients required PCA was also recorded. This study was approved by the Toronto Hospital Committee for Research on Human Subjects.

RESULTS

Three age groups were formed: young (mean age = 30.9 ± 5.7 years, n= 22), middle-aged (mean age = 48.1 ± 5.9 years, n= 29), and elderly (mean age = 69.0 ± 7.0 years, n = 38). Age differences were assessed using repeated measures (post-operative day (POD)) ANCOVA with weight as a covariate. There was a significant effect for both age group ($p \leq 0.0001$) and POD ($p \leq 0.0001$) on daily PCA opioid consumption. In all three age groups, the amount of opioid self-administered decreased over time. Mean daily opioid consumption was significantly lower in the elderly group (26.2 ± 12.6 mg) than the middle-aged (42.1 ± 22.9 mg).and young (54.2 ± 36.3 mg) groups. There were significant effects of both age group ($p \leq 0.006$) and POD ($p \leq 0.0001$) on VAS-R. VAS-R decreased over time. The older groups had significantly lower VAS-R scores than the young group (3.2 ± 1.8). The elderly (1.7 ± 1.4) and middle-aged (2.1 ± 1.3) groups did not differ from each other. There were no significant age group or POD effects on VAS-M. There were no significant age group or POD effects on VAS-PC (young: 7.4 ± 1.9; middle-aged: 8.0 ± 2.3; elderly: 8.7 ± 1.0). The interaction of age group and POD was not significant for any variable. Age did not influence the number of days on PCA.

DISCUSSION

These results suggest that older patients self-administer less opioid in the first three days following surgery. However, older patients also report lower pain at rest than younger patients. It is not clear whether the elderly self-administer less analgesic because they have less intense post-operative pain at rest, because they were more sensitive to the drug or both. Despite the age differences in pain and opioid consumption, there were no differences in the level of satisfaction with the analgesic regimen. Future studies are needed to clarify these relationships.

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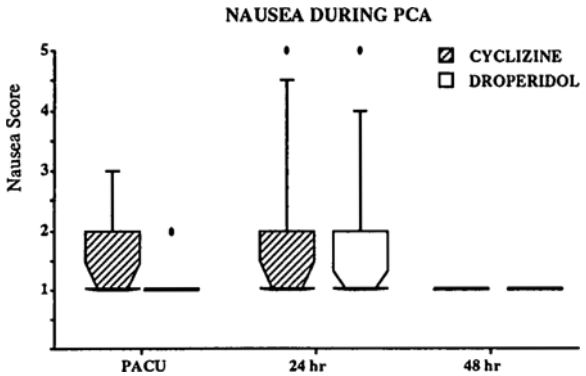
A

CYCLIZINE AND DROPERIDOL HAVE COMPARABLE ANTIEMETIC EFFICACY AND SIDE EFFECT PROFILE DURING PATIENT CONTROLLED ANALGESIA

J.G. Laffey MB FFARCSI, J.F. Boylan MB FRCPC

Department of Anaesthesia, St. Vincent's Hospital/SEDDA, Dublin, Ireland

Introduction: Postoperative nausea and vomiting (PONV) is a common problem following abdominal surgery [1]. Patient controlled analgesia (PCA) is frequently complicated by nausea, and the optimum method of prophylaxis is unknown. Cyclizine and droperidol are superior to placebo in PONV prophylaxis, but their relative efficacy and side effect potential have not been compared. We assessed emetic sequelae, pain and sedation in patients receiving PCA following gynaecologic surgery in a double-blind, randomized trial.
Methods: After IRB approval and written consent, 25 women undergoing abdominal hysterectomy entered the study. Patients received a standardized anaesthesia technique and underwent surgery via a transverse incision. Each was assigned to receive either cyclizine (group C) or droperidol (group D) perioperatively. Intravenous morphine sulfate 0.15 mg/kg was administered prior to skin incision. Patients received cyclizine 0.7 mg/kg or droperidol 0.04 mg/kg intravenously 15 minutes before abdominal closure, followed by PCA containing morphine sulfate (1 mg bolus) with cyclizine 2 mg or droperidol 0.05 mg per demand. Blinded observers scored nausea, sedation (Trieger test) and pain (visual analogue scores, PCA use) for 48 hr. Nausea was scored using a five point ordinal scale. Data were analyzed by unpaired *t* tests and the Mann-Whitney U test.
Results: Demographics, pain scores and PCA usage were comparable in both groups. Two patients in each group developed refractory PONV. Median (Q1, Q3) nausea scores (Figure) were similar. Sedation was similar in PACU (4 (3, 4) vs 3.5 (3, 4)), at 24 hr (2.5 (2, 3) vs 2 (1, 2)) and 48 hr (1 (1, 2.25) vs 1 (1, 1.5)) in groups C and D, respectively.
Discussion: Cyclizine and droperidol are equally effective in antiemetic prophylaxis during PCA, with similar side effect profiles. A significant minority of patients continue to have refractory PONV despite prophylaxis and treatment.



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B

PATIENT ATTITUDES REGARDING PCA SIDE EFFECTS AND THEIR TREATMENT

Neal H Badner MD, Wendy E Komar RN

Department of Anaesthesia, London Health Sciences Centre, University Campus, London, Ontario N6A 5A5

Introduction: Our acute pain service maintains a quality assurance (QA) program to evaluate our care through the use of patient questionnaires. We previously determined our patients' knowledge and attitudes towards PCA costs to be very positive but noted a problem with side effects and their treatment.[1] We subsequently modified our preprinted order sheets to include medications commonly used for the treatment of nausea, vomiting and pruritus. We recently repeated our questionnaire to determine if these changes resulted in any improvement.

Methods: Patients receiving PCA at our institution have orders written by their attending anaesthetist and treatment initiated in the PACU. PCA therapy usually consists of morphine 1-2 mg, and occasionally fentanyl 10-20 μg or demerol 10-20 mg with lockout intervals of 5-10 minutes. Basal infusions are not routinely utilized. These specifications are indicated on preprinted medication order sheets. Following our previous review the order sheets were modified to include dimenhydrinate and metoclopromide for nausea and vomiting, and diphenhydramine to be available for pruritus. Patients are followed twice daily by the acute pain service where changes to the original orders can be made.

QA questionnaires were distributed to all patients receiving PCA narcotics for more than 12 hours. Patients were asked to note the presence [yes/no(y/n)], or the amount [none, a little or a lot] of the various side effects (nausea/vomiting, pruritus, urinary retention), to indicate if they were satisfied with regards to their PCA pain relief, and whether they would request PCA in the future [strongly agree(STA), somewhat agree (SWA), somewhat disagree (SWD), strongly disagree (STD)], and to indicate if the treatment of their side effects was excellent (E), very good (VG), good (G), fair (F) or poor (P). They were also asked to note the form of previous pain relief and their satisfaction with it. Following IRB approval we reviewed the results obtained over a recent two month period. Chi-square analysis was used to compare responses from this review with those obtained previously.

Results: 132 QA questionnaires were distributed and 101 (77%) were returned. The incidence of side effects and the degree of satisfaction is shown in the Table.

	1997	1995	p value
nausea/vomiting			
yes/no	52/48	48/54	0.48
little/lot	44/18	41/7	0.91
pruritus			
yes/no	49/52	43/59	0.36
little/lot	39/10	33/8	0.92
side effect treatment E/VG/G/F/P	23/26/16/5/2	24/34/11/1/3	0.41
PCA satisfaction STA/SWA/SWD/STD	84/7/3/1	90/9/1/0	0.51
PCA future request STA/SWA/SWD/STD	79/14/4/0	81/12/1/5	0.09

Discussion: The addition of medications for the treatment of side effects to the PCA preprinted order sheets did not improve the side effect profile nor patients' satisfaction with side effect treatment. In spite of this, patients remain highly satisfied with current PCA therapy.

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A

PRE-ANAESTHETIC ASSESSMENT CLINICS IN ONTARIO

David M Bond MB FRCPC
Department of Anaesthesia, Queen's University, Kingston General Hospital, 76 Stuart Street, Kingston, ON K7L 2V7

INTRODUCTION

To survey the provision of pre-anaesthetic assessment clinics in hospitals in Ontario during the spring of 1997.

METHODS

Mail survey questionnaire of all hospitals in Ontario.

RESULTS

Questionnaires were mailed to 300 hospitals and replies received from 260 (87%). Of these, 131 hospitals (86% community/14% teaching) provide anaesthesia. The mean number of OR cases/year is 5457 (SD 5779) of which 21% are inpatients, 64% outpatients and 15% same day admission. 70% of responding hospitals hold regular clinics, most commonly daily (52%). 73% are held in the outpatient department and 77% of departments issue written guidelines detailing which patients should be referred. The attending surgeon is the most common source of referral (64%). Referred patients are most commonly seen by a nurse (52%) who decides on onward referral to an anaesthetist. Services generating the most referrals are general surgery (83%), orthopaedics (64%) and obstetrics/gynaecology (49%). 47% of hospitals see 10-50 patients/month who travel most commonly up to 100 km. The average percentage of patients scheduled for surgery seen in the clinic is 52%.The average no show rate is 6.2%. Only 36% of departments assess patients the same day as seen by the surgeon. On attending the clinic, 51% can see an internist the same day in contrast to 30% being able to see a cardiologist. Pre-admission testing is available to 97% on the same day. Direct funding is available for the nurse (87%), physician (1%) and secretarial help (43%). Remuneration of the anaesthetist is fee for service (99%) and sessional (1%). Of the 8 departments providing cardiac anaesthesia, 7 see these patients in the clinic and admit them on the day of surgery.

DISCUSSION

Pre-anaesthetic assessment clinics are relatively common in Ontario. More development is required to enable patients to receive all aspects of their preoperative assessment during one visit.

Future research must examine the cost/benefit ratio of these clinics and follow outcome indicators such as unexpected cancellation and admission.

B

A SURVEY OF PATIENT ANXIETY, KNOWLEDGE AND EXPERIENCE IN THE ANAESTHETIC PREADMISSION CLINIC

R.A. Cherry MD, S.M. Spadafora FRCPC, R.J. Butler FRCPC *

Department of Anaesthesia, St. Joseph's Health Centre
268 Grosvenor Street, London, Ontario, N6A 4V2
and * London Health Sciences Centre

INTRODUCTION: A visit to the pre-admission clinic (PAC) is a common component of operative preparation for many patients. Recent publications have studied the benefit of video presentations in the PAC[1] and patient attitudes toward preparation for anaesthesia.[2] PAC proponents cite reduced O.R. cancellations and delays through improved preparation and patient education. Deficiencies in the understanding of the anaesthetist's role and status persist[2,3]. In our PAC, we wished to survey aspects of i) patient anxiety ii) patient satisfaction with their PAC visit and iii) pertinent factual knowledge.

METHODS: IRB approval was obtained. Between July 1 and September 31, 1997 266 patients completed surveys immediately following their PAC visit. The survey consisted of 14 questions of multiple choice, agree/neutral/disagree or true/false format. Questions included: number of previous anaesthetics, patient reported anxiety pre- and post- visit, clinic experience (including video and anaesthetic consult), knowledge of peri-operative NPO and arrival time guidelines, and perceived benefit of the visit. Errors of reporting were noted on the survey (e.g. patient incorrectly reports being assessed by an anaesthetist). Statistical analysis used chi-square, Fisher's exact test and Wilcoxan rank-sum test where appropriate. Response comparisons were made over the domains of age, sex, number of prior anaesthetics, video viewing and anaesthesia consult. Statistical significance was set at $p<.01$.

RESULTS: The mean respondent age was 59.1 years. Forty-six percent were male and 54% female. Greater than 93% felt the PAC visit helped their understanding of the surgical procedure, anaesthetic and recovery, and post operative pain management. Increased age was associated with reported anxiety reduction after PAC visit ($Z=3.27$ $p<.01$). Females reported more pre-visit anxiety concerning anesthesia ($p<.01$). Number of prior anaesthetics did not influence responses. Seventy-one percent of patients saw the PAC video and 96.8% rated the video as "helpful". Viewing the video improved patient reported knowledge of perioperative medication use ($p<.01$). Personal anaesthesia consultation (17.3% of those surveyed) was not associated with a difference in responses. Nineteen patients(7.5%) incorrectly indicated a personal anesthesia assessment. Sixty-eight percent of patients surveyed correctly identified their anaesthetist as a physician. Upon review of O.R. records, none of the surveyed patients had their surgery canceled.

DISCUSSION: The vast majority of patients perceive benefit from a PAC visit. Viewing the PAC video improved patient knowledge regarding perioperative medications. Other factual knowledge appeared to be conveyed equally well with or without the video. Other studies support the significant association between female patients and reported pre-op anxiety as well as a decreased anxiety in the elderly.[2] Patients may not truly know who is assessing them during a busy clinic visit as evidenced by those who mistakenly claimed to have seen an anaesthetist. Some patients remain unclear of the anaesthetist's physician status. This study will be used as a baseline for ongoing evaluation of PAC content and effectiveness.

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2. Anesth Analg 1996;83:1314-21
3. Anaesthesia 1194;49:165-66

A

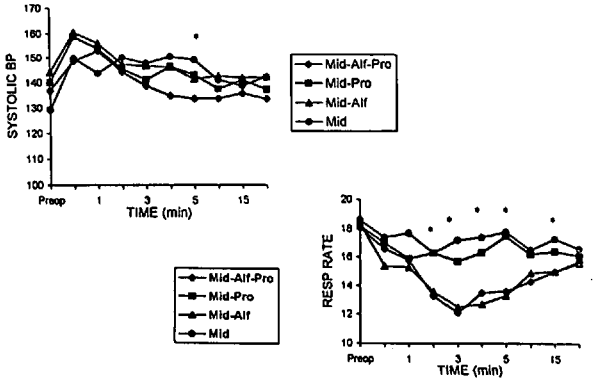
A COMPARISON OF MIDAZOLAM, ALFENTANIL AND PROPOFOL IN OUTPATIENT INTRAOCULAR SURGERY

Fiona McHardy FRCA, Joanne Fortier FRCPC, Frances Chung FRCPC, Scott Marshall FRCA, Ananthan Krishnathas MBBS
Department of Anaesthesia, Toronto Hospital, Western Division, University of Toronto, Toronto, Ontario, Canada

INTRODUCTION This study investigates the effect of adding alfentanil and/or propofol to midazolam for sedation in patients (pts) undergoing ophthalmic surgery and to determine the optimal regimen for intraop haemodynamic variables, respiratory rate (RR), pain, anxiety and sedation scores and postop recovery.

METHODS After institutional approval and informed consent, 83 pts, ASA I-III, 50-85 yrs, undergoing intraocular surgery under retrobulbar (RB) or peribulbar (PB) block were randomized to either: Group 1: midazolam (mid) 0.015 mg/kg + alfentanil (alf) 5 μg/kg + propofol (P) 0.15 mg/kg; Group 2: mid 0.015 mg/kg + placebo +P 0.15 mg/kg; Group 3: mid 0.015 mg/kg + alf 5 μg/kg + placebo; Group 4: mid 0.015 mg/kg + placebo + placebo. Prior to surgery, baseline pain, anxiety and sedation scores and psychomotor testing (Trieger Dot and Digit Substitution) were done. Syringes containing mid 1 mg/ml, alf 500 μg/ml or an equivalent volume of 0.9% saline, and P 10 mg/ml or an equivalent volume of intralipid were prepared by pharmacy and were administered slowly in the OR at 30 sec. intervals, in the order mid, alf/placebo, P/placebo. The PB/RB block was done 30 sec. later. BP, HR and RR were recorded every min for the 1st 5 min and then every 5 min during surgery. Pain, anxiety and sedation scores were done after administration of the three drugs, after the PB/RB block and then every 20 min. On arrival in the PACU, BP, HR, RR, pain, sedation, anxiety scores and psychomotor testing were recorded every 30 min. A 24 hr phone interview was conducted to determine pt satisfaction.

RESULTS Data was analyzed using ANOVA. Demographic data were similar in the 4 groups. Pts receiving alf had significantly lower systolic BP (6.0%) at 5 min. Mean time at which PB/RB block was performed was 3.4 min. These pts also had significantly lower RR during the 1st 15 min intraop although O_2 saturation was not affected, and their pain scores were significantly lower during the 1st h postop. There was no difference in anxiety and sedation scores, psychomotor testing, time to discharge or pt satisfaction.



DISCUSSION The addition of alfentanil to midazolam significantly attenuates the haemodynamic response to the insertion of peribulbar or retrobulbar block. Pain scores of pts who were given alfentanil were also significantly reduced in the postop period. The addition of propofol to midazolam was not found to have these effects.

B

SHOULD MORPHINE BE GIVEN INTRAOP OR POSTOP IN PAINFUL AMBULATORY SURGERY?

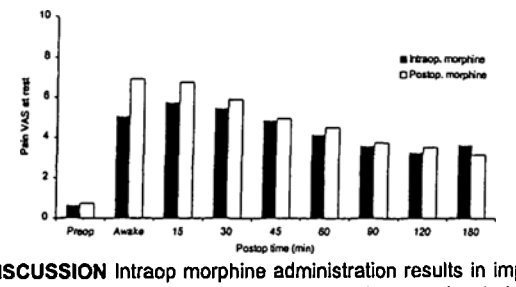
Jean Wong MD, Frances Chung MD, Ewan Ritchie MB ChB, Fiona McHardy MB ChB, Scott Marshall, MB ChB, Joanne Fortier MD
Department of Anesthesia, Toronto Hospital, Western Division, University of Toronto, Toronto, Ontario, Canada

INTRODUCTION Certain types of ambulatory surgical procedures are associated with significant postop pain. Parenteral morphine is often needed for adequate analgesia. However, one of the common side effects of morphine is nausea and vomiting (N&V). The ideal timing of morphine administration is not known, but previous studies suggest that the incidence of N&V may be increased by the administration of morphine intraop rather than postop. This study determined the ideal timing of administration of morphine to reduce pain, prevent N&V, reduce recovery time, and prevent delayed discharge from hospital.

METHODS Approval from the institutional ethical committee and informed consent was obtained for this randomized, double blind, placebo controlled study. 67 ASA I-II patients scheduled for painful ambulatory orthopaedic procedures were studied. Two syringes; one containing 0.1 mg/kg morphine, and the second containing an equivalent volume of 0.9% saline, were prepared and supplied by pharmacy. Group 1 (n=33) received the morphine intraop, 5 min following skin incision and the normal saline after arrival in PACU. Group 2 (n=34) received saline intraop, and morphine in PACU. In PACU, patients were given PCA morphine and two Tylenol #3 1 h postop. Gravol 25-50 mg was given for nausea. Ondansetron 4 mg was administered for nausea refractory to Gravol. Data were compared using the t test, or χ^2 analysis where appropriate.

RESULTS The demographic data were similar in the two groups. There was no statistical difference between the groups in postop nausea scores or incidence of N&V at any time. Patients who received intraop morphine had lower postop pain VAS scores upon awakening both at rest and with movement. However, this difference did not persist beyond the immediate period following awakening (Fig.). The total number of PCA attempts and total postop morphine requirements were similar in both groups. The patients who received postop morphine were able to drink sooner (90±34 min vs 111±38 min, P<0.05). All other recovery milestones (time to; Aldrete score ≥9, PADS ≥9, eat, sit up, walk, void) were similar between the two groups.

Figure. Mean pain VAS scores at rest (Overall test p=0.09)



DISCUSSION Intraop morphine administration results in improved analgesia for painful ambulatory procedures only during the immediate (<15 min) postop period. There was no difference in analgesic requirements, N&V, and discharge time between the two groups. Thus, there may be a small advantage in giving morphine intraop versus postop.

A

DOES PRE-DISCHARGE ANTIEMETIC PROPHYLAXIS REDUCE POST-DISCHARGE NAUSEA AND VOMITING AFTER OUT-PATIENT LAPAROSCOPIC SURGERY?

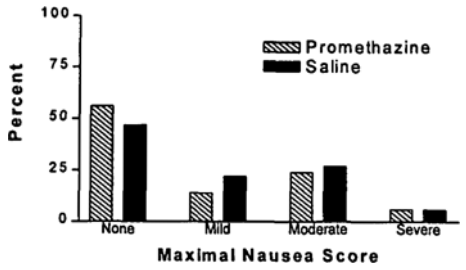
Andrew Meikle MD, Nicole Avery BA, Janet van Vlymen FRCPC, Joel L. Parlow MD FRCPC
Department of Anaesthesia, Queen's University, Kingston General Hospital, Kingston, Ontario K7L 2S6.

INTRODUCTION: Patients undergoing laparoscopic surgical procedures experience significant postoperative nausea and vomiting(1). Following out-patient surgery, this problem often occurs after discharge from hospital when access to treatment is limited. This study was designed to determine a) the incidence of post-discharge nausea and vomiting following out-patient laparoscopic surgical procedures and b) whether prophylactic administration of promethazine prior to discharge reduces the incidence of post-discharge nausea and vomiting.

METHODS: After institutional ethics approval, 100 patients scheduled to undergo day surgery laparoscopic gynecologic procedures or cholecystectomy signed informed consent. Patients received balanced general anaesthesia (propofol, vecuronium, fentanyl, nitrous oxide, isoflurane). Induction was preceded by droperidol 0.5 mg. In all patients. Patients were randomized to receive either promethazine 0.6 mg/kg or saline in a double-blinded fashion just prior to discharge from the recovery room. Incidence of vomiting and need for rescue antiemetics, and scores for nausea, pain and sedation were documented by patient diary for 24 hours after surgery. Proportionate data were analyzed using Chi-square, and parametric data using unpaired t tests, with $P<0.05$ as significant.

RESULTS: The groups were similar with respect to demographic data, length and type of procedure and pain scores. Post-discharge nausea occurred in 44% of promethazine and 54% of placebo patients (ns), and was considered more than "mild" in 39% of cholecystectomy and 26% of gynecologic patients with no difference between groups. Vomiting occurred in 18% of promethazine and 12% of placebo patients (ns) and rescue antiemetics were needed in 30% of promethazine and 20% of promethazine patients (ns). Sedation scores were significantly higher in the promethazine group for the remainder of the day of surgery.

DISCUSSION: Post-discharge nausea and vomiting was a significant problem following out-patient laparoscopic surgery. The prophylactic administration of promethazine prior to discharge increased sedation without any beneficial effect on nausea and vomiting.



REFERENCES: (1) Anesth Analg 1995; 80:903-9

B

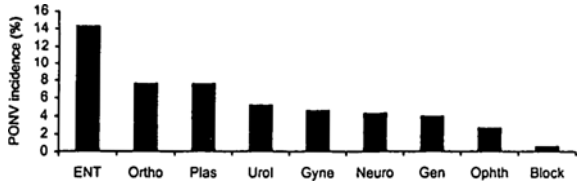
RELATION OF POSTOPERATIVE NAUSEA AND VOMITING TO THE SURGICAL PROCEDURE

David Sinclair MD, Frances Chung FRCPC, Gabor Mezei MD
Department of Anaesthesia, Toronto Hospital, Western Division, University of Toronto, Toronto, Ontario, Canada

INTRODUCTION Postop Nausea and Vomiting (PONV) remains one of the most common and distressing complications following ambulatory surgery, resulting in delayed discharge and unanticipated admission. The purpose of this study was to determine which types of surgery were associated with PONV.

METHODS After institutional ethical approval, 17,638 consecutive ambulatory surgical patients (pts) were prospectively studied. Data on demographics, medical, anaesthesia, and surgery were collected. Data on PONV were collected in post-anaesthesia care unit (PACU) and ambulatory surgery unit (ASU) by nurses using an adverse event check-off form. PONV was defined as any volunteered complaint of nausea and observed active retching or vomiting. The percentage of PONV for each type of surgery was determined. Student's t-test and chi-square were used when appropriate. $P<0.05$ was considered statistically significant.

RESULTS The incidence of PONV in the PACU was 2.2%; in the ASU 3.0%. Women had a higher rate of PONV compared to men (5.3% vs 3.3%). Higher rates of PONV were observed among ASA I, 5.3%, and II pts, 4.1%, than ASA III, 2.5%. A five-fold increase was seen among pts receiving general anaesthesia compared to other types of anaesthesia. ENT/dental, orthopedic and plastic surgery had the highest incidence of PONV, while urology, gynecology, neurosurgery, general surgery, ophthalmology, and chronic pain block had lower incidence. In plastic surgery, breast augmentation had 41.5% PONV. In orthopedic pts, those undergoing shoulder surgery experienced 16.6% PONV. In ophthalmology, strabismus surgery had 22% PONV and in dental pts, 25%. With laparoscopic sterilization, the incidence was 17.5%. Pts with PONV stayed 23 min longer in PACU and 62 min longer in ASU.



DISCUSSION A high incidence of PONV is associated with certain surgical procedures. ENT/dental surgery and orthopedic surgery involve bone injury and damage to the periosteum, resulting in significant postop pain which may be a cause of PONV. The etiology of PONV in pts undergoing breast augmentation may be multifactorial, such as early ambulation and oral analgesia in this population. Prophylactic antiemetics should be used in specific ambulatory surgical procedures with high PONV.

A

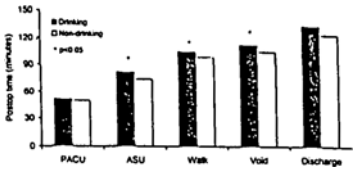
SHOULD ADULT PATIENTS DRINK BEFORE DISCHARGE FROM THE AMBULATORY SURGERY UNIT?

Fengling Jin MD, Frances Chung FRCPC, Andrew Norris FRCA, Tharini Ganeshram MD
Department of Anaesthesia, The Toronto Hospital, Western Division, University of Toronto, 399 Bathurst Street, Toronto, Ontario, M5T 2S8 Canada

INTRODUCTION A previous study demonstrated that postoperative nausea and vomiting (PONV) may be reduced in paediatric patients by restriction of oral fluids before discharge[1]. This study was designed to determine if withholding oral fluids before discharge from ambulatory adult surgical patients (pts) could decrease the incidence of PONV and shorten the duration of stay in ambulatory surgery unit (ASU).

METHODS Following hospital ethical committee approval, 726 consenting adult general surgical pts were randomized to drinking and non-drinking groups. Both groups received a standardized anaesthetic, fluid replacement and analgesic regimen. Induction of anaesthesia was intravenous fentanyl 1.5 μg/kg, propofol 2-3 mg/kg and maintenance with 33% O_2 in 66% N_2O and isoflurane 0.5-1% titrated to requirement. For pts requiring endotracheal intubation, muscle relaxation was achieved with mivacurium 0.2 mg/kg. On arrival in ASU, pts in drinking group were given oral fluids. Prophylactic antiemetics were not given to any pts. Nausea and pain were assessed by visual analog score (VAS) every 15, 30, 60, 90, 120, 150 and 180 minutes. The time to drink, sit, void, ambulate, and discharge were recorded. At 24h postop, pts were interviewed with a standardized questionnaire. Unpaired t-test and chi-square test was performed; $p<0.05$ was considered significant.

RESULTS 597 pts completed the study; 527 pts were interviewed at 24h by phone. There was no difference in the demographics, anaesthetic and postop medications. The pts drank 146±54 ml liquid in the drinking group. The cumulative proportion of patients with PONV did not significantly differ between the two groups. The mean VAS pain was significantly different at 90, 105, and 120 min postop. The duration of stay in ASU, the time to ambulate and void were significantly shorter in the non-drinking group than the drinking group (fig.).



Time to normal drinking at home was shorter in the drinking group than the non-drinking group ($p<0.05$). Time to normal eating at home and satisfaction (99.2% vs 99.2%) were similar in both groups.

CONCLUSIONS Withholding early postop oral fluids in adults does not decrease the incidence of PONV. However, it may shorten the duration of stay in ambulatory facilities. Pts should have the option to assess whether they want to drink or not postop before discharge.

REFERENCES 1. Anesthesiology 1992;76:528-33.

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B

COMPARISON OF THE COST OF SEVOFLURANE TO ISOFLURANE ANAESTHESIA

Bernard A. MacLeod MD, Aliréza Azmudéh BSc,
Luigi G. Franciosi MSc, Craig R. Ries MD PhD,
Stephan K.W. Schwarz MD
Clinical Pharmacology Research Organization (CPRO)
Depts. of Anaesthesia and Pharmacology & Therapeutics
The University of British Columbia
2176 Health Sciences Mall, Vancouver BC, Canada V6T 1Z3

Introduction: Sevoflurane has recently been introduced in Canada as an inhalational anaesthetic agent which may reduce postoperative recovery time, but at unknown additional costs.[1] As part of a cost-benefit analysis, we compared the perioperative cost of general anaesthesia for a short ambulatory procedure (< 1 h) using either Sevoflurane or Isoflurane as the volatile agent. We also compared the incidences of nausea and vomiting and the time to readiness for discharge from the postanaesthetic recovery room (PAR).

Methods: After approval of the institutional human research committee, we studied 40 patients undergoing arthroscopic menisectomy in a prospective randomized trial. Following written informed consent, the patients were assigned to receive either Sevoflurane (group S; *n* = 20) or Isoflurane (group I; *n* = 20) as part of a balanced anaesthetic (i.v. induction). The fresh gas flow (FGF) rate was standardized to 3 l/min. Dedicated vaporizers were used. Patients, nursing staff and data analyst were blinded to group designation. For safety considerations, anaesthetists were unblinded. The total amount of volatile anaesthetic was measured for each group. The fraction of volatile anaesthetic received by each patient was determined by integrating the product of inspired concentration and FGF over time. All gas concentrations and vital signs were continuously recorded to disk. In PAR, recovery was assessed at 15 minute intervals using the Aldrete Scale. The incidences of nausea and vomiting as well as the cost of all adjuvant drugs used in the perioperative period were recorded and compared. For statistical analysis, the *t*-test, chi-square-test, and ANOVA were used where appropriate.

Results: Satisfactory anaesthesia was obtained for all patients. There was no statistical difference in patient demographics between groups. The major outcomes are presented in the following table.

	Group S	Group I	*P* value
Total drug cost*	37 ± 10	22 ± 6	< 0.001
Volatile agent*	19.40 ± 8.80	4.50 ± 1.90	< 0.001
PAR drug cost*	0.36 ± 0.58	0.14 ± 0.30	0.13

* costs are given per patient in Canadian $ as mean ± SD; *n* = 20

All patients were deemed ready for discharge from PAR (score ≥ 9 out of 10 on the Aldrete Scale) by 15 minutes after surgery. One patient in each group experienced mild postoperative nausea without vomiting. Antiemetics were not required in either group.

Conclusion: In this study, we found the perioperative cost of balanced general anaesthesia for a short ambulatory procedure (< 1h) to be significantly higher with sevoflurane than with isoflurane.

References: 1) Anaesthesist 45 Suppl 1:S63-70, 1996

RESTING MUSCLE SOUNDS IN ANAESTHETISED PATIENTS

William PS McKay MD, Peter H Gregson PhD, Benjamin WS McKay Msc, Travis Blanchet PEng.
Dept of Anaesthesia, Dalhousie University, Queen Elizabeth Health Sciences Centre, PO Box 9000, Halifax, Canada B3K 6A3; Department of Engineering, Technical University of Nova Scotia, Halifax; Duke University Department of Mathematics, Durham, NC, USA.

INTRODUCTION

Contracting muscle makes low frequency sound vibrations[1]. Smaller vibrations of uncertain origin are found over resting muscle. Hypothesis: these are likely of muscle origin if they significantly diminish with agents expected to decrease muscle activity. Thiopental, propofol, and muscle relaxants have such properties.

METHODS

Subjects slated for elective surgery in the supine position for which they would be anaesthetised and paralysed gave informed consent. A small accelerometer was taped upon their supine mid-biceps (9 subjects), or volar mid-forearm (12 subjects). Recordings were made in 4 phases: i) lifting a 2kg weight just off the sponge armrest on which their outstretched arm lay; ii) relaxing the arm in the awake state; iii) after induction with intravenous thiopental (n = 11) or propofol (n = 10); and iv) after paralysis. Recordings were digitised at 172Hz and 6s segments fast Fourier transformed (FFT).

RESULTS

Total signal power (area under the power spectrum) was significantly different ($p < 0.05$) in all phases for the biceps and in all but phases iii from iv in the forearm.

Phase	Power*			p**
	Median	25% -ile	75% -ile	
i lifting	0.274	0.213	0.369	
ii resting	0.167	0.144	0.286	<.05
iii asleep	0.135	0.112	0.151	<.05
iv paralysed	0.097	0.084	0.120	<.05

* mean acceleration in $m.s^{-2}$; biceps experiment
**probability of power difference from preceding phase due to chance alone; Friedman Repeated Measures One-way ANOVA on Ranks. Post hoc Student-Newman-Keuls method.

DISCUSSION

Induction of anaesthesia with thiopental or propofol decreased vibration over resting muscle. Paralysis with vecuronium or succinylcholine decreased it more. Thus the small vibrations were likely due to muscle activity, and may be of interest in anaesthetic monitoring.

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40-HZ AUDITORY STEADY-STATE RESPONSE AND BISPECTRAL INDEX AS MONITORS OF THE LEVEL OF CONSCIOUSNESS DURING ANESTHESIA WITH PROPOFOL.

Pascal Meuret MD, Vincent Bonhomme MD, Gilles Plourde MD MSc, Pierre Fiset MD, Steven B. Backman MD PhD.
Anaesthesia, Royal Victoria Hospital and McGill Univ., 687 Pine Ave. West, Montreal, QC, H3A 1A1.

INTRODUCTION

The 40-Hz auditory steady-state response (40-Hz ASSR) is an auditory evoked potential that provides a sensitive measure of anaesthetic effect. It probably reflects the capability of the brain to sustain endogenous gamma oscillations which are a prerequisite for the emergence of consciousness.[1] The "Bispectral Index™" (BIS) combines spectral and bispectral analysis of the electroencephalogram to obtain a multivariate index that correlates with drug concentration or responsiveness.[2] Both measures have been proposed to monitor the level of consciousness.[1,2] The present study compared the predictive value of the 40-Hz ASSR and the BIS to evaluate the level of consciousness during propofol anesthesia. Consciousness was defined as responsiveness to verbal commands.

METHODS

Eight healthy volunteers (Ethic Committee approval, informed consent, 18-31 yrs) received propofol by a computer controlled infusion pump.[3] The target concentrations were 1 (PRO-1), 2 (PRO-2), and 3 or 4 μg/ml as required to cause unconsciousness (UNC). The ASSR was recorded from Cz and BIS from C3 with M2 as common reference. Recordings were obtained before propofol (BASE) and at each concentration. The concentration of propofol in arterial blood was determined by HPLC. Significant differences between conditions were assessed with ANOVAs for related samples and Tuckey's HSD tests. The predictive value for consciousness was assessed using Pk, a rank order correlation test. A value of 1 indicates perfect concordance; a value of 0.5 indicates chance level.[4]

RESULTS

The measured plasma concentration of propofol (μg/ml) was [mean(SD)] 1.1 (0.2), 2.2 (0.5) and 3.5 (0.9) for PRO-1, PRO-2 and UNC. The amplitude of the 40-Hz ASSR (measured by FFT, μV) was [mean(SD)] 0.33 (0.24) during BASE, 0.37 (0.32) for PRO-1, 0.24 (0.23) for PRO-2 and 0.06 (0.04) for UNC. Significant differences ($p < 0.05$) were UNC < BASE and PRO-1. BIS was 93 (2) during BASE, 88 (5.) for PRO-1, 73 (7) for PRO-2 and 51 (6) for UNC. Significant differences were UNC < BASE, PRO-1 and PRO-2 ; PRO-2 < BASE, PRO-1. All subjects were unconscious when the ASSR was below 0.08 μV or BIS below 60. The Pk value of 40-Hz ASSR and BIS for consciousness was 0.94 (SE 0.03) and 0.99 (SE 0.01), respectively (difference not significant).

CONCLUSIONS

The concentration range of propofol producing loss of consciousness and profound attenuation of the 40-Hz ASSR and BIS is the same.

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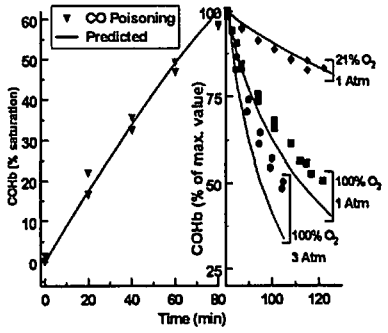
A

PREDICTION OF CARBON MONOXIDE UPTAKE AND ELIMINATION IN DOGS USING A NEW COMPUTER MODEL

Alex Vesely, Akinori Takeuchi MD, Leeor Sommer BSc, Joshua Rucker BSc, Joel Greenwald, Elana Lavine, Steve Iscoe PhD, George Volgyesi PEng, Ludwik Fedorko MD, Joseph Fisher MD
Department of Anaesthesia, The Toronto Hospital, 585 University Avenue, Toronto, Ontario, M5G 2C4

Introduction: To improve therapeutic decisions in CO poisoned patients, it is important to know the patient's prior maximal blood carboxyhaemoglobin concentration ([COHb]). The CFK equation[1] predicts [COHb] from known initial conditions accurately, except when the fraction of inspired O_2 (FIO_2) is 1.0 at 1 Atm or higher[2], as occurs during treatment. We developed a computer model to predict [COHb] based on parameters similar to those used by the CFK equation. However, our model allows the examination of each parameter individually, and updates all calculated terms after each breath. In this study, we compared our model's predicted [COHb] to those obtained in CO-poisoned dogs breathing air, and 100% O_2 at 1 and 3 Atm.

Methods: Our model uses a spreadsheet program (Excel) to calculate the volume of CO transferred between blood and alveoli during a given breath. This value is then used to calculate the change in [COHb], and the gradient determining the CO transfer on the next breath. Other factors determining CO transfer such as tidal volume, frequency, FIO_2, FICO, and barometric pressure, are assigned on a breath-by-breath basis. The model was used to make predictions for four pentobarbital-anaesthetized ventilated dogs. The dogs were exposed to 0.3% CO for 80 min and then ventilated with air followed by 100% O_2 at either 1 or 3 Atm for 1 h. Normocarbia was maintained throughout the protocol. Predicted and actual values were then compared.



Results: The Figure shows the predicted (solid lines) and measured [COHb]; in the right panel, [COHb] was normalized to % of initial value.

Discussion: As with the CFK and other equations[2], our model's predictions agree with the data for ventilation with air, and overestimate the rate of CO elimination when breathing 100% O_2. Analysis with our model suggests that either the CO/O_2 affinity for Hb or lung diffusivity for CO or both, may not be constant, as assumed.

1. J. Appl. Physiol. (1975) 39(4):633-638. 2. J. Theor. Biol. (1993) 162:321-336.

B

CEREBRAL MICROEMBOLISM DURING TOURNIQUET RELEASE AFTER TOTAL KNEE ARTHROPLASTY

Emilio B. Lobato MD, Cheri A. Sulek MD, Laurie K. Davies MD, Peter F. Gearen MD
Departments of Anesthesiology and Orthopedic Surgery, University of Florida College of Medicine, Box 100254 JHMHSC, Gainesville, FL 32610-0254, U.S.A.

INTRODUCTION

Tourniquet release after total knee arthroplasty (TKA) is commonly associated with release of emboli into the pulmonary circulation.(1,2) Paradoxical macroembolism has been reported.(3,4) We evaluated the presence of cerebral microemboli after tourniquet release with transcranial Doppler (TCD) and correlated these with the presence of echogenic material in the left atrium (LA).

METHODS

After IRB approval and informed consent, 22 adult patients (9 male,12 female) were studied. All subjects underwent TKA under general anesthesia. Bilateral TCDs were applied to monitor velocity of middle cerebral arteries (Vmca) and adjusted to obtain optimal signals. A transesophageal (TEE) omniplane probe was placed to monitor the 4-chamber view. TCD and TEE data were recorded after anesthesia induction, tourniquet inflation, and during tourniquet release. TCD emboli counts were performed manually off-line. The presence of echogenic material in the LA was qualitatively assessed. Data were analyzed by ANOVA of repeated measures with SNK test. P values <0.05 were considered significant.

RESULTS

15 subjects underwent unilateral TKA (8 left, 7 right) and 7 had bilateral sequential TKA (BKA). 2 patients had a positive bubble test. Cerebral emboli were present during tourniquet deflation in 9/15 patients (60%) with unilateral TKA and in 4/7 patients (57%) with bilateral TKA. Emboli counts in patients with BKA were significantly higher compared to right TKA (87 ± 20 vs 31 ± 23; $p<0.05$) but not left TKA (87 ± 20 vs 56 ± 44 NS). Echogenic material in the LA was detected in 7/13 patients (55%) with cerebral emboli.

DISCUSSION

The results of this preliminary study suggest that tourniquet release is associated with cerebral microembolism diagnosed by TCD. These are more likely as a result of transpulmonary passage to the left cardiac chambers. All patients with echogenic material in the LA also developed cerebral microemboli manifested by TCD.

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A

THE RELATION OF PHONOMYOGRAPHY TO FORCE PRODUCTION IN THE EVALUATION OF MYORELAXANTS.

François Bellemare PhD, François Donati MD, and Jacques Couture MD. Département d'Anesthésie-réanimation, Centre Hospitalier de l'Université de Montréal, Université de Montréal, 3840 rue St-Urbain, Montréal, Québec, H2W 1T8
(Supported by Respiratory Health Network of Centers of Excellence of Canada)

INTRODUCTION: Skeletal muscles vibrate laterally during the build-up of longitudinal forces producing sound waves which can be picked by microphones fixed to the skin over the muscle. Such recordings are called phonomyograms (PMGs). Their amplitude has been shown to be proportional to force output during evoked twitch contractions of the diaphragm [1] and adductor pollicis muscle (APm) [2]. This method may thus be useful in the evaluation of myorelaxants. The purpose of this study was to determine the relationship between PMG and force output from APm during the onset of, and recovery from, neuromuscular blockade in surgical patients under general anesthesia.

METHODS: Following institutional approval, and written informed consent, 9 ASA I-II patients undergoing orthopedic surgery recieved a standardized anesthesia. For paralysis, Rocuronium (0.6 mg/kg IV) was given as bolus. To monitor the time course of paralysis and its reversal, the left hand was immobilized in a special orthosis equiped with a strain gauge that recorded the adduction force exerted by the thumb (F_{add}) and measured from baseline to peak. The PMG of APm was recorded simultaneously with a small electret microphone, 5 mm in diameter, fixed on the palmar surface of the hand over APm and measured as peak-to-peak. The ulnar nerve was stimulated transcutaneously at the wrist at a rate of 0.1Hz with 0.2 ms square wave pulses and an intensity of 60 mA. The PMGs and F_{add} signals were amplified, digitized at a rate of 1000Hz and stored on computer. For each subject, between 50 and 574 such contractions were analysed (mean = 266). F_{add} and PMG were each expressed in percent of the maximum value in each subject.

RESULTS: In all patients, the relationships between PMGs and F_{add} were adequately described by linear functions of the form $PMG = F_{add} * B + A$, with regression coefficients (r^2) between 0.82 and 0.96 (mean = 0.91 $\pm$ 0.05 SD). For the group, B did not differ significantly from unity (mean = 1.00 $\pm$ 0.13) and A did not differ significantly from zero (mean = -2.33 $\pm$ 9.07%) (paired t-test: $P > 0.5$).

CONCLUSION: We conclude that PMG is a reliable indicator of the degree of muscular paralysis produced by myorelaxants. This is a simple method which can be extended to other muscles and which may prove to be useful clinically.

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B

OPTIMAL METHOD FOR USING THE INTUBATING LARYNGEAL MASK AIRWAY- COMPARISON OF INTUBATIONS USING DIRECT LARYNGOSCOPY, FASTRACH WITH FIBEROPTIC GUIDANCE AND FASTRACH WITHOUT FIBEROPTIC GUIDANCE

Hwan S Joo MD, FRCPC, D K Rose MD, FRCPC
Department of Anaesthesia, St. Michael's Hospital, 30 Bond St. Toronto, Ontario, M5B 1W8; University of Toronto

INTRODUCTION: The Laryngeal Mask Airway-Fastrach™ (fastrach) is a new modification of the original Laryngeal Mask Airway™ specifically designed to facilitate tracheal intubations. To determine the optimal method of use, we compared three methods of tracheal intubations following inhalational induction with Sevoflurane on spontaneously breathing patients in a randomized control study. The three groups were 1) direct laryngoscopy (control), 2) fastrach with fiberoptic guidance (FOB) and 3) fastrach without fiberoptic guidance (blind).

METHODS: After institutional ethics approval and informed consent, 46 healthy ASA I-II females with normal preoperative airway assessment scheduled for laparoscopy or laparotomy were enrolled in the study. After correction of fluid deficit, patients were induced with 1mg/kg of propofol, 50% N_2O and 8% Sevoflurane. At 3 minutes the airway was topicalized with 100 mg of lidocaine to decrease coughing with tracheal intubation. An oropharyngeal airway was inserted in group 1 and a fastrach was inserted in groups 2 and 3. Following 5 more minutes of inhalational induction, tracheal intubation using a 7mm PVC ETT was accomplished with either direct laryngoscopy, fastrach with FOB or fastrach without FOB. Data was collected regarding success rates for tracheal intubation, times to airway insertion and tracheal intubation. Patients were interviewed the day after surgery regarding sore throat (VAS 0-10). One way ANOVA on ranks with Dunn's method was used to analyze data. ($P<0.05$ significant)

RESULTS:	Laryngoscopy Control n=14	Fastrach FOB n=16	Fastrach Blind n=16
Successful intubation	14 (100%)	15 (93.8%)	16 (100%)
One attempt	13 (92.9%)	14 (87.5%)	14 (87.5%)
Two attempts	1 (7.1%)	1 (6.2%)	2 (12.5%)
Time to airway insertion -median (range)	oral airway 15.0s (12-22s)	fastrach 32.0s * (20-250s)	fastrach 25.0s * (16-38s)
Time to intubation -median (range)	32.5s (25.0-110s)	48.0s ** (32.0-210s)	24.0s (16-130s)
Induction to intubation time -median (range)	9min (8-12min)	10min *** (8-18min)	9min (8-11min)
Sore throat score median (range) VAS (0-10) 0 best	0.0 (0-6.0) P=0.780	1.0 (0-6.0)	1.0 (0-6.0)

-p<0.05 compared to group 1* *-p<0.05 compared to group 3*
****-p<0.05 compared to groups 1 and 3*

DISCUSSION: All groups had comparable success rates for tracheal intubation and sore throat scores. Although time from induction to intubation was longer in group 2 it was not clinically significant. Using FOB with the fastrach has the theoretical advantages of increasing success rates and avoiding trauma associated with blind tracheal intubations but we have not found a significant advantage when compared to fastrach tracheal intubations without FOB.

A

EVALUATION OF CORD CARE, A NEW ENDOTRACHEAL TUBE INTRODUCER.

Sunil Kapoor MD, Shahriar Shayan MD, Keyvan Karkouti MD, FRCP

Department of Anesthesia, University of Toronto, The Toronto Hospital, General Division, Toronto, Ontario, Canada.

Introduction: Limited neck extension is a cause of difficult laryngeal visualization and results in greater frequency of difficult tracheal intubation. Cord Care® is an endotracheal guide that may aid in intubation where the laryngeal view is poor. It fits outside of a regular endotracheal tube, (ETT), is tapered to a blunt point at its distal end, and is designed to direct the ETT towards the glottic aperture. To use it, direct laryngoscopy is performed with the ETT inserted in Cord Care® and the tip of Cord Care® is placed past the epiglottis. The laryngoscope is then removed, and the ETT advanced through Cord Care®. We endeavored to evaluate the success of Cord Care® in cases of limited neck extension as compared to a styletted ETT.

Methods: Following institutional approval twenty-four ASA class I and II patients undergoing elective surgery requiring tracheal intubation were enrolled in this study. Patients were randomized to be intubated with either Cord Care® or styletted ETT. Difficult intubation conditions were simulated by positioning patients heads in the neutral position and providing in-line stabilization. Patients were induced with fentanyl and propofol and were paralyzed with rocuronium. Once paralyzed, they were intubated by a single anesthetist. If the first attempt was unsuccessful then the alternative device was chosen to intubate the patient. Application of external laryngeal pressure to facilitate the best view was not permitted. If both attempts failed then the airway was secured with conventional laryngoscopy in the sniffing position.

Results: In the neutral position, 18 patients (75%) were found to have grade II views, 5 grade III views (21%), and 1 with a grade I view (4%). Views were noted to be identical on first and second attempts.

Attempt:	First:		Second:		Combined:	
Method	Success	Fail	Success	Fail	Success	Fail
Cord Care®	5	7	0	2	5	9
Stylet	10	2	6	1	16	3

Fisher's Exact Test was used to compare the success rates of the techniques. P values were calculated at 0.089 for the first attempt p=0.083 for the second attempt, and p=0.001 for the combined attempts.

Discussion: Cord Care® is no better than ETT with stylet in patients where the laryngoscopy view is poor due to in-line stabilization. ETT with a stylet had a high success rate, which may have been higher with the application of external laryngeal pressure. These results support its use in patients with limited cervical spine mobility.

B

SEVOFLURANE BY NASAL MASK COMPARED TO INTRAVENOUS MIDAZOLAM FOR SEDATION IN PATIENTS UNDERGOING SURGERY WITH LOCAL ANESTHESIA.

Kenneth M. LeDez FRCPC, Jim Au RRT, John H.Tucker FRCPC, Edwin B. Redmond FRCPC, V.Gadag PhD, Catherine Penney PhD
Dept. of Anesthesia, Memorial University of Newfoundland, 300 Prince Philip Drive, St. John's, Nfld., A1B 3V6

INTRODUCTION: Sevoflurane (SEVO) has the potential advantage of more rapid and predictable onset and offset of sedation compared to midazolam (MIDAZ).
METHODS: After Human Investigation Committee approval and written informed consent fasting ASA 1 - 3 patients scheduled for surgery under local anesthesia in the operating room were randomized to receive either SEVO or MIDAZ for sedation. Patients > 150% ideal weight, creatinine > 200, or with difficult airways or reflux were excluded. The Digit Symbol Substitution Test (DSST) and Trieger Dot Test (TD) were administered pre-op and at 5, 10, 20, 30, 45, & 60 minutes after arrival in recovery room. All patients breathed oxygen from a nasal mask connected to the circle breathing system. Exhaled CO_2, SEVO and vital signs were recorded. Alfentanil (ALF) 100-200 μg was administered as required for pain. Sedation was titrated to and maintained at a score of 3 using a modified OAAS[1] scale as judged by the blinded research nurse until the last suture or adhesive tape was in place. Coughing and other complications were recorded. Statistical analysis was by repeated measures ANOVA and independent T-test with Bonferoni correction as appropriate.
RESULTS: SEVO patients (9 male, 9 female) had mean (±SD) age and weight of 39.7(14.4) years and 78.8(11.5) kg; for MIDAZ (6 female, 10 male) these were 36.1(14.3) years and 82.1(14.8) kg. Total ALF dose was 716.6 (503) μg for SEVO and 1025 (678) μg for MIDAZ patients. None of the preceding was significant. Mean (±SD) MIDAZ dose was 12.7(4.9) mg. All patients preferred the nasal mask to the oxygen mask worn in recovery, and to have the same anesthetic in future. DSST and TD data are in table 1.

Table 1

		Time (minutes) after arrival in recovery room						
		pre-op	5	10	20	30	45	60
DSST	SEVO	47.5(11.9)	43.8(14.8)	48.2(14.7)	47.5(13.9)	48.0(14.8)	50.7(13.4)	51.6(12.1)
	MIDAZ	44.6(10.2)	21.8(11.2)	24.8(12.1)	28.6(11.7)	31.5(11.5)	37.0(12.7)	39.2(10.2)
	P-value	0.457	0.000	0.000	0.000	0.001	0.005	0.004
TD	SEVO	3.3(3.9)	2.8(2.4)	1.9(2.5)	1.5(2.0)	1.7(2.1)	1.5(2.9)	1.4(2.1)
	MIDAZ	3.6(4.1)	19.6(7.2)	13.8(6.6)	13.0(6.5)	9.1(6.5)	6.1(6.5)	5.5(5.3)
	P-value	0.821	0.000	0.000	0.000	0.000	0.017	0.012

Mean (± SD) DSST score and no. of dots missed on TD.

DISCUSSION: SEVO inhaled by nasal mask is a clinically useful method of sedation in the operating room and results in significantly better recovery as judged by the DSST and TD compared to midazolam at all times measured.
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Acknowledgments: This study was financially supported by a grant from Abbott Laboratories.

Abstracts

Monday, June 15 (p.m.)

Poster Discussion Session IV/Cardiovascular

Poster Discussion Session V/Regional

Poster Discussion Session VI/Neuroanaesthesia

MEDIAL SMOOTH MUSCLE APOPTOSIS IS INITIATED AFTER TRANSIENT ALLOGENEIC EXPOSURE IN RAT AORTIC ALLOGRAFTS.

Gregory M.T. Hare M.D Ph.D., Timothy D.G. Lee Ph.D., Gregory M. Hirsch M.D.
Departments of Anaesthesia and Surgery. Dalhousie University, Halifax, N.S.

INTRODUCTION: Chronic rejection of vascularized allografts is manifested by medial smooth muscle cell (SMC) loss and diffuse concentric intimal proliferation, termed allograft arteriosclerosis (AAS). AAS is the leading cause of late transplant failure. We have recently demonstrated that cytotoxic cell-mediated apoptotic SMC death is an early key step in the development AAS (1). This study utilised the finding that AAS does not develop if aortic allografts are reimplanted back into isogeneic animals within 3 days, but does develop if the grafts remain in the allogeneic recipient for more than 5 days (2). We utilised this model to assess a causal role for apoptosis in the development of AAS.

METHODS: Brown Norway to Lewis rat (BN-L) abdominal aortic allografts were implanted orthotopically. Grafts were then retransplanted back into BN recipients after 2 or 10 days (BN-L-BN)(n=7). As a control, BN grafts were retransplanted into Lewis recipients after 2 days (BN-L-L) (n=5). Isograft controls were L-L-L (n=6). Grafts were harvested after 20 days for histologic assessment. Apoptosis was detected utilising *in situ* terminal deoxynucleotidyl transferase (TdT) mediated dUTP nick end labeling.

RESULTS: All grafts developed a variable amount of intimal hyperplasia. Aortic isografts exhibited healthy medial smooth muscle and minimal adventitial inflammatory cells (1+). Allografts retransplanted back into isogeneic hosts after 2 days resembled isografts but had a more pronounced adventitial inflammatory cell infiltrate (2+). Allografts retransplanted after 10 days exhibited medial smooth muscle cell drop-out (20%) and significant adventitial inflammatory cell infiltrate (3+). Allografts maintained in an allogeneic environment had a slightly more pronounced medial cell drop out (30%) and a more prolific adventitial cell infiltrate (4+). At day 20 post-transplantation, apoptotic cells were identified after 10 days of allogeneic exposure.

DISCUSSION: The histologic features of allograft rejection were proportional to the duration of allogeneic exposure prior to retransplatation into isogeneic hosts. Allogeneic exposure sufficient to cause irreversible AAS (10 days) was associated with marked medial SMC loss and apoptosis. Brief allogeneic exposure (2 days), which is insufficient to result in AAS, was not associated with medial SMC loss or apoptosis. These data support an association between apoptotic SMC cell loss and the subsequent development of AAS.

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A

TEMPORAL PRODUCTION OF NOx IN HEART AND PLASMA INDUCED BY LPS AND CORRELATION WITH BLOOD PRESSURE EVOLUTION IN RATS

Fan Yang MD, Eric Troncy MS DVM, Gilbert Blaise MD.

Laboratory of Anesthesia, Department of Anesthesia; Centre Hospitalier de l'Université de Montréal - Pavillon Notre-Dame; 1560 Sherbrooke St East, Montréal, Québec, H2L 4M1.

INTRODUCTION

Septic shock is characterized by hypotension, vascular hyporeactivity, depressed myocardial contractility, and generalized tissue damage, as well as cardiovascular and biochemical derangements that are largely caused by bacterial endotoxin e.g. lipopolysaccharide (LPS). Accumulating evidence indicates that induction of inducible nitric oxide (NO) synthase expression and excessive formation of NO mediate the hypotension, depressed myocardial contractility, and cardiovascular hypotension. The aims of this investigation were to conduct a detailed time course study of LPS-induced NO formation, which was determined by NO_2^- plus NO_3^- (NOx), the end-products of NO in heart tissue, plasma as well as a correlation of the time-course profile of the NOx formation with the blood pressure evolution during septic shock.

METHODS

This study was approved by the Research and Ethics Committee of Centre Hospitalier de l'Université de Montréal. Either LPS (O26:B6) at a dose of 5 mg/kg or 0.9% saline solution was injected intraperitoneally (i.p.) to conscious Sprague-Dawley rats (250-350 g) killed at 0, 3, 6, 12, 24 hours (n=10/group). Heart and plasma samples were collected. In a separate set experiments, rats (n=7) were anesthetized with i.p. pentobarbital (45 mg/kg plus infusion 2-5 mg/kg/h). Arterial blood pressure was recorded during 24 hours with computer connected to HP 54S through a pressure transducer via cannula to the right carotid artery, in anesthetized control group, LPS 5 mg/kg and 10 mg/kg. Fluid (0.9% saline) and anesthetics were infused i.p. with pump as required. NOx in samples were determined by Sievers 270B chemiluminescence analyzer. The data were analyzed by GLM procedure using SAS program.

RESULTS

-Mean blood pressure was not statistically significant changed in control group and 5 mg/kg LPS group during 24 hours, but it was in LPS 10 mg/kg group from 9 to 12 hours after LPS injected ($P < 0.01$).
-The NOx production in heart tissue and plasma was increased following injection of LPS in rats in both 5 and 10 mg/kg from 3 to 12 hours.
-NOx levels in heart and plasma were paralleled during 24 hours time course.

DISCUSSION

To our knowledge, it is the first time that the blood pressure is monitored for 24 hours in anesthetized rats and time course of NOx production in heart tissue after LPS injected in rats. The results clearly showed that NOx production in heart and plasma were increased after injection of LPS but mean blood pressure was only statistically significant changed between 9 to 12 hours and only at a LPS i.p. dosage of 10 mg/kg. Variations in myocardial contractility may be associated with NOx alteration in heart tissue, which also may come from plasma NO, since it paralleled the alteration of NOx in plasma.

B

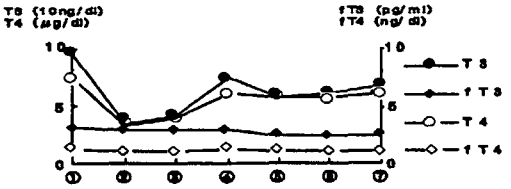
CHANGES OF PLASMA THYROID HORMONES AND THEIR BINDING PROTEINS DURING AND AFTER CARDIOPULMONARY BYPASS

Yoshiyuki Naito MD PhD, Shoji Arisawa MD, Masahiro Ide MD, Susumu Nakano MD, Kazuo Yamazaki MD
Department of Anesthesia, Kobe City General Hospital, Minatojima Nakamachi 4-6, Cuo-ku, Kobe 650, Japan

Introduction: The inotropic and vasodilating effects of triiodothyronine (T3) are well documented under certain clinical conditions.[1,2] Based on these results, several trials of administration of exogenous T3 were performed in anticipation of improved cardiac performance in patients undergoing coronary artery bypass grafting (CABG).[3-5] But the effects of exogenous T3 were less explicit in CABG, and the efficacy of perioperative T3 administration is controversial. To explain the apparent discrepancy in these observations, we investigated perioperative changes of free and total thyroid hormone levels, together with their binding protein levels, in euthyroid patients undergoing CABG.

Methods: After receiving IRB approval and informed consent, plasma T3, thyroxine (T4), free T3 (fT3), fT4, thyroid-stimulating hormone (TSH), thyroxine-binding globuline (TBG), and albumine (Alb) levels were determined in ten ASA II patients who underwent CABG. Anesthesia was induced using fentanyl (5 μg/kg) and propofol (1mg/kg), and endotracheal intubation was facilitated using vecuronium (0.25mg/kg). Anesthesia was maintained with continuous administration of fentanyl (2.5 μg/kg/h) and propofol (1-5mg/kg/h). Nitroglycerin (0.5 μg/kg/min) and diltiazem (1 μg/kg/min) were infused continuously during and after surgery. Inotropic agents were used according to the patients' hemodynamics after cardiopulmonary bypass (CPB). Plasma samples were collected ①before induction of anesthesia (9:00 a.m.), ②just after the institution of CPB, ③at the end of CPB, ④at the end of the surgery, and at 9:00 a.m. on ⑤ the first, ⑥second, and ⑦third postoperative day. Levels of plasma T3, T4, fT3 , fT4, and TBG were determined using RIA, and plasma TSH levels were determined using IRMA. Statistical analysis was performed using ANOVA followed by the Bonferroni method.

Results: During CPB, plasma T3 and T4 levels decreased significantly. Although plasma T4 levels returned to the preoperative level promptly after CPB, plasma T3 levels remained slightly suppressed during the sampling period. In contrast, plasma fT3 and fT4 levels did not change significantly. Plasma TBG levels decreased significantly during CPB, and recovered promptly after CPB. Plasma Alb levels changed similarly, but to lesser degrees.



Discussion: These results demonstrated that plasma levels of free thyroid hormones remained within the physiological ranges during and after CPB. The changes in TBG and Alb levels may contribute to the apparent discrepancy observed in the plasma levels of total and free thyroid hormones.

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A

PROSTAGLANDIN E1 REDUCES MYOCARDIAL REPERFUSION INJURY BY INHIBITING PROINFLAMMATORY CYTOKINES PRODUCTION DURING CARDIAC SURGERY

Takae KAWAMURA, Noriko NARA, Reiji WAKUSAWA,Katsuya INADA
Department of Anesthesiology, Iwate Medical University, School of Medicine, 1-2-1 Chuodori, Morioka-shi, Iwate 020 Japan

Background and Objectives:
Cardiac surgery induces systemic inflammatory responses that have been implicated in postoperative organ dysfunction including myocardial reperfusion injury. Recently, the concept of cytokine balance has emerged whereby the balance of pro-and anti-inflammatory cytokines may determine clinical outcome. The purpose of this study is to examine the influence of prostaglandin E1 (PGE1) on the cytokine balance and organ protection during cardiac surgery.

Method:
Patients who underwent cardiac surgery were studied. According to randomized sequence, the patients were divided into 2 groups; the patients who received PGE1 (0.03~0.05 μ g/kg/min) from after induction of anesthesia to the end of surgery (PGE1 group n=7) and the patients without PGE1 (control group n=10) . Cardiac surgery was performed under general anesthesia with moderate systemic hypothermia and cold-blood potassium cardioplegia solution. Blood samples were drawn after inducing anesthesia, before starting CPB, 60 min aortic occlusion, and 60 , 120, 180 min after declamping of aorta. In each sample, serum interleukin 6 (IL-6), IL-8, IL-10, CK-MB and troponin, granulocyte elastase (GEL) were measured.

Results:
Serum IL-6 and IL-8 concentration in both group increased significantly at 60 min after declamping of the aorta compared to preoperative value ($P<0.01$, respectively). However, the increases were greater in control group than those in PGE1 group. Serum IL-10 concentration increased significantly 60 min after declamping of the aorta compared to preoperative value in two groups. There were no difference between two groups. Serum troponin T and CK-MB concentration increased significantly from 60 min after declamping of the aorta in two groups ($P<0.01$, respectively), but these increases were greater in control than those in PGE1 group ($P<0.01$).
Plasma GEL concentration increased from 60 min after declamping of the aorta compared to preoperative value in both group ($P<0.01$, respectively) but the increases were greater in control than those of PGE1 group($P<0.01$).

Conclusions:
PGE1 suppressed the production of IL-6 and IL-8 but not IL-10. As a result, myocardial reperfusion injury was reduced. This changes in the balance between pro-and anti-inflammatory cytokines may be one of the most important mechanism of cytoprotection of PGE1

B

THE PHARMACOKINETICS OF FENTANYL IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFTING

Robert J. Hudson MD, Karanbir Singh MD, Gary A. Harding BSc, Blair T. Henderson BSc Ind Eng, Ian R. Thomson MD

Department of Anaesthesia, University of Manitoba, St. Boniface General Hospital, 409 Taché Avenue, Winnipeg, Manitoba, R2H 2A6

INTRODUCTION: Current practice in cardiac anaesthesia uses lower opioid doses, combined with other anaesthetic agents, to facilitate earlier tracheal extubation, while still providing adequate postoperative analgesia. Accurate pharmacokinetic data are needed to design dose regimens that achieve these goals, ideally using inexpensive generic drugs. Therefore, we determined the pharmacokinetics of fentanyl prior to cardiopulmonary bypass in patients without severe left ventricular dysfunction undergoing elective coronary artery bypass surgery.
METHODS: Institutional ethical approval and informed consent were obtained. Antianginal medications were continued on the morning of surgery. Premedication was lorazepam 60 µg/kg PO. Fentanyl was administered with a computer-driven syringe pump controlled by the program STANPUMP. Four different fentanyl regimens were used, intended to maintain target effect-site concentrations of 5 (n=7), 8.1 (n=9), 10 (n=7), or 15 ng•ml^{-1} (n=6). Isoflurane and/or vasoactive drugs were used as needed. Fentanyl concentrations were measured by radioimmunoassay in arterial blood samples drawn at intubation, skin incision, sternotomy, sternal lifting, sternal spreading, aortic dissection, and placement of the first aortic stitch. Population pharmacokinetic modelling (Naive Pooled Data and Mixed Effects Modelling) was used to derive pharmacokinetic parameters for 2 (NPD2 & MEM2) and 3-compartment (NPD3 & MEM3) models. The optimal model was identified by comparison of log likelihood estimates and analysis of the median prediction error [MPE=(Measured-Predicted) /Predicted)] and its median absolute value (MAPE). MPE and MAPE of the derived models were compared with published fentanyl pharmacokinetics.[1]
RESULTS: Patient demographics were (mean ± SD): 6 female, 23 male; age 65.2 ± 9.5 y; weight 84.5 ± 12.1 kg. The total doses of fentanyl ranged from 18.8 ± 2.5 µg•kg^{-1} to 50.4 ± 3.0 µg•kg^{-1}. A total of 208 samples were available for modelling. Addition of a third compartment did *not* significantly decrease log likelihood ($p<0.05$) for either NPD or MEM. Both NPD2 and MEM2 had significantly lower ($p<0.05$, Kruskal Wallis test) MPE and MAPE than previously published pharmacokinetic parameters for fentanyl: *MEM2* MPE -3.5%, MAPE 14.2%; *NPD2* MPE -3.2%, MAPE 14.1%; *Scott et al*[1] MPE +26.4%, MAPE 26.9%. The model parameters for NPD2 and MEM2 are:

	V_1 (l)	V_2 (l)	*Elimination clearance (l/min)*	*Distribution clearance (l/min)*
NPD2	19.4	71.8	1.3	4.9
MEM2	39.5	92.4	0.9	2.7

DISCUSSION: The virtually identical MPE and MAPE of our models indicates similar predictive performance. The median PE for both our models of about -3.3% indicates minimal systematic bias of measured *vs* predicted concentrations, and is >7-fold less in magnitude than that obtained using previously published fentanyl pharmacokinetics.[1] APE measures the variability of the measured concentrations around the predicted values (precision). Median APE for both our models was much less than the generally accepted limit of 30%,[2] and almost 2-fold better than the APE derived from published fentanyl kinetics. In this patient population, prior to cardiopulmonary bypass, dose regimens based on either NPD2 or MEM3 should produce median fentanyl concentrations that are within 3.5% of the target, with a very acceptable degree of variability. When appropriate target fentanyl concentrations are defined, these pharmacokinetic models can be used to design scientifically based dose regimens.
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A

FENTANYL VS SUFENTANIL IN CABG SURGERY: HAEMODYNAMIC CONTROL AND COST

Gary A. Harding BSc, Robert J. Hudson MD, Ian R. Thomson MD

Department of Anaesthesia, University of Manitoba, St. Boniface General Hospital, 409 Taché Avenue, Winnipeg, Manitoba, R2H 2A6

INTRODUCTION
Fentanyl and sufentanil are often used during coronary artery bypass grafting (CABG), but conclusive comparisons have not been performed. Definitive comparison requires maintenance of equipotent effect-site opioid concentrations. The relative EEG suppressing potency of the opioids is 12:1 (sufentanil vs fentanyl).[1] We used computer-assisted continuous infusion (CACI) to target equipotent opioid concentrations prior to bypass. The dose of isoflurane needed to maintain haemodynamic stability, and opioid cost, were our indices of opioid efficacy.

METHODS
Institutional approval and informed consent were obtained. 21 patients without severe LV dysfunction, undergoing elective CABG, participated in this double-blind study. After premedication with lorazepam 60 µg/kg, anaesthesia was induced with the opioid plus propofol 1 mg/kg. Succinyl choline 1 mg/kg was used for intubation. Opioids were administered by CACI. The target effect site concentration was the IC_{50} for EEG suppression: fentanyl 8.1 ng/ml (n=10) or sufentanil 0.68 ng/ml (n=11).[1] Isoflurane was used to maintain MAP as close to ward baseline as possible. Haemodynamics and end-tidal isoflurane (ET-ISO) were acquired every 15-30 sec by computer. Arterial blood for serum opioid concentration was drawn at intervals, and measured by radioimmunoassay. $P < 0.05$ was considered significant.

RESULTS
There were no intergroup differences in demographics. Intraoperative opioid concentrations were constant and slightly below target. The ratio [fentanyl]:[sufentanil] was 11:1. There were no intergroup differences in mean prebypass haemodynamics, ET-ISO, or cost.

	Fentanyl	Sufentanil
Dose (µg/ml)	20.3 ± 1.8	1.6 ± 0.4
Concentration (ng/ml)	6.45 ± 1.17	0.59 ± 0.13
Cost ($CDN)	11.50 ± 2.06	10.37 ± 3.50
MAP (mmHg)	83 ± 5	84 ± 6
HR (beats/min)	50 ± 6	51 ± 8
ET-ISO (%)	0.46 ± .021	0.56 ± 0.24

DISCUSSION
When administered at constant, equipotent effect site concentrations, fentanyl and sufentanil do not differ with respect to cost or suppression of haemodynamic responsiveness. The choice of opioid should then be based on pharmacokinetic considerations. These favour sufentanil.[2] The IC_{50} for EEG suppression is an effective prebypass target opioid concentration for patients undergoing CABG.

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B

THE DOSE-RESPONSE TO FENTANYL IN PATIENTS UNDERGOING CORONARY ARTERY BYPASS GRAFTING

Ian R. Thomson MD, Karanbir Singh MD, Robert J. Hudson MD

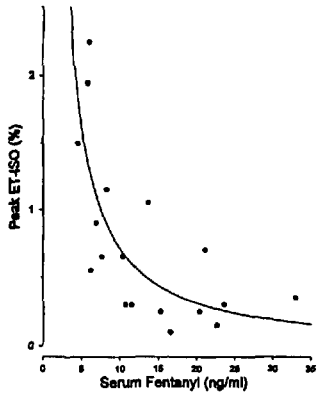
Department of Anaesthesia, University of Manitoba, St. Boniface General Hospital, 409 Tache Avenue, Winnipeg, Manitoba, R2H 2A6

INTRODUCTION

Fentanyl is frequently used in patients undergoing coronary artery bypass grafting (CABG), but the optimal dose is unclear. The MAC-reducing properties of fentanyl have been described.[1,2] However, in CABG surgery the usual clinical goal is haemodynamic control in 100% of patients, rather than prevention of movement in 50%.

METHODS

Institutional approval and informed consent were obtained. Twenty patients without severe LV dysfunction undergoing elective CABG participated in this double-blind study. They were randomly assigned to target effect site fentanyl concentrations of either 5 ng/ml (Group L, n=7), 10 ng/ml (Group M, n=7), or 15 ng/ml (Group H, n=6). After premedication with lorazepam 60 µg/kg, anaesthesia was induced with fentanyl plus propofol 1 mg/kg. Succinyl choline 1 mg/kg was used for intubation. Fentanyl was administered to the preselected target concentration by computer-assisted continuous infusion throughout the prebypass period. Isoflurane was used to maintain mean arterial pressure as close to ward baseline as possible. Haemodynamics and end-tidal isoflurane (ET-ISO) were acquired every 15-30 sec by computer. Arterial blood for serum fentanyl concentration ([fentanyl]) was drawn at intervals, and measured by radioimmunoassay.



RESULTS

The prebypass fentanyl dose was 18.8 ± 2.5, 33.9 ± 2.9, and 50.4 ± 3.0 µg/kg for Groups L, M, and H respectively. Intraoperative [fentanyl] was constant at 7.3 ± 1.1, 13.2 ± 2.2, and 24.4 ± 5.8 ng/ml in Groups L, M, and H respectively. The mean prebypass ET-ISO was 0.50 ± 0.15, 0.20 ± 0.08, and 0.25 ± 0.14 % (p = 0.0009, ANOVA) for Groups L, M, and H, respectively. Nonlinear regression defined correlations between ET-ISO and [fentanyl] at most study intervals (e.g. peak ET-ISO = 10.96 x [fentanyl]$^{-1.19}$, p = 0.0003, r^2 = 0.566, following sternal lift, Figure). There were no intergroup differences in haemodynamics, and no awareness.

DISCUSSION

The mean Group L [fentanyl] of 7.3 ± 1.1 ng/ml lies on the steep portion of the dose-response curve, whereas concentrations of 13.2 ± 2.2 and 24.4 ± 2.2 ng/ml lie on the plateau. This relationship is similar to that obtained with arterial blood sampling in dogs,[1] but to the right of that obtained with venous blood sampling in humans.[2] Using a [fentanyl] exceeding 7.3 ± 1.1 ng/ml, does not improve prebypass haemodynamic stability. The latter is a suitable prebypass target concentration in patients without severe LV dysfunction undergoing CABG with fentanyl-isoflurane anaesthesia.

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A

REGIONAL HEPARINIZATION DOES NOT REDUCE THE INCIDENCE OF EMBOLIC PHENOMENA DURING TOTAL KNEE ARTHROPLASTY

Christopher G. Wherrett, MD, Donald R. Miller, MD, Alan A. Giachino, MD, Michelle A. Turek, MD, Kelly Rody, BScN.
Departments of Anaesthesia, Surgery, and Medicine, Ottawa General Hospital, University of Ottawa, 501 Smyth Rd, Ottawa, ON, K1S 4Z3

INTRODUCTION

Deep vein thrombosis (DVT) may occur intraoperatively during total knee arthroplasty (TKA)[1]. Embolization of material following release of the thigh tourniquet may serve as a marker for DVT[2]. A clinical trial was undertaken to determine whether heparinization prior to TKA decreases the incidence or severity of embolization following release of the thigh tourniquet, as assessed by transesophageal echocardiography (TEE).

METHODS

Sixty-six ASA Class I-II patients, scheduled to undergo elective TKA under general anaesthesia, entered this trial after giving written informed consent to the institutionally-approved protocol. Patients were prospectively randomized, in a double-blind manner, to receive either placebo (Group PLAC) or heparin (Group HEP) in a dose of 100 $\bar{u}\cdot kg^{-1}$ following induction of general anaesthesia. The systemic heparin was reversed with protamine after inflation of the thigh tourniquet and anaesthesia was controlled using sufentanil, isoflurane and N2O in a standardized protocol. A 5.0 MHz multiplane TEE (using a 5.0 MHZ multiplane ultrasonic transducer, Hewlett Packard) was used in the 0° transverse plane to evaluate echogenic material reaching the heart following deflation of the tourniquet during surgery. Blood samples were drawn from the ipsilateral femoral vein in 29 patients to analyze for fat and thrombi. Statistical significance was assumed when $p<0.05$.

RESULTS

Return of echogenic material to the heart resulted in either complete or incomplete opacification of the right atrium and ventricle in all patients. The incidences of complete and incomplete opacification were similar in both the HEP and PLAC groups (Table). The incidence of detectable fat was also similar in both groups. There were no differences between groups with respect to transient changes in heart rate, systolic blood pressure, oxygen saturation, end-tidal CO_2, or cardiac output. One patient in the HEP group experienced a DVT without pulmonary embolism.

Table: Rates of Embolization and Content of Emboli

Group	Complete Opacification	Incomplete Opacification	Fat Present	Fat Absent	P-Value
Control (n=33)	45%	36%	46%	43%	NS
Heparin (n=33)	55%	64%	54%	57%	NS

DISCUSSION

Administration of heparin prior to tourniquet inflation does not influence the incidence of embolization or the composition of embolic material following tourniquet deflation during TKA. As well, it does not modify the hemodynamic and respiratory changes associated with tourniquet deflation.

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B

ROPIVACAINE 7.5 mg/ml VERSUS BUPIVACAINE 5 mg/ml FOR BRACHIAL PLEXUS BLOCK: A MULTICENTRE TRIAL

H. Vaghadia FRCPC, V. Chan FRCPC, S. Ganapathy FRCPC, A. Lui FRCPC, J. McKenna FRCPC, K. Zimmer MSc
Department of Anaesthesia, Vancouver Hospital and Health Sciences Centre; Room 3200 - 910 West 10th Avenue, Vancouver B.C. Canada

INTRODUCTION: Ropivacaine is a new long-acting local anaesthetic with less CNS and cardiotoxicity than bupivacaine. In previous studies, ropivacaine 5 mg/ml was more effective than the 2.5 mg/ml solution for axillary blocks. This double blind multicentre clinical trial evaluated the efficacy of ropivacaine 7.5 mg/ml with bupivacaine 5 mg/ml for subclavian perivascular brachial plexus anaesthesia.

METHODS: After IRB approval and informed consent 98 ASA I-III adults scheduled for upper limb surgery were enrolled in the study at 5 centers across Canada. Patients were randomised to receive 30 ml of either ropivacaine 7.5 mg/ml or bupivacaine 5 mg/ml for the subclavian perivascular block. Onset and duration of motor and sensory block, quality of analgesia and muscle relaxation, incidence of tourniquet pain and adverse events were documented. Data were analysed using confidence intervals, log-rank test and survival functions.

RESULTS: Patients were comparable with respect to demographics (age, height and weight). The 95% confidence intervals were similar between groups with regards to the onset and duration of sensory analgesia and anaesthesia and, onset and duration of partial and complete motor block for axillary, median, musculocutaneous, radial and ulnar nerves. The proportion of patients with a complete sensory and motor block in all 5 nerves did not reach statistical significance inspite of a trend in favour of ropivacaine (see Table).

	Ropivacaine	Bupivacaine
Sensory analgesia	0.73	0.69
Sensory anesthesia	0.26	0.14
Motor block	0.34	0.26

One patient in the bupivacaine group developed a grand mal seizure suggestive of intravascular injection. There were no adverse events attributable to ropivacaine.

DISCUSSION: Thirty mls of ropivacaine 7.5 mg/ml or bupivacaine 5mg/ml produce comparable results when administered for subclavian perivascular brachial plexus anaesthesia. Unlike bupivacaine, ropivacaine was not associated with serious adverse events.

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FEMORAL 3-IN-1 BLOCK FOR POST-OPERATIVE PAIN RELIEF IN ARTHROSCOPIC CRUCIATE LIGAMENT REPAIR

Stephan K. W. Schwarz MD,* Bernard A. MacLeod MD,* Craig R. Ries MD PhD,* Luigi G. Franciosi MSc,* William D. Regan MD,† Ross G. Davidson MB ChB,† Krista Nevin HBSc,‡ Sergio Escobedo‡
*Clinical Pharmacology Research Organization (CPRO), Depts. of Anaesthesia and Pharmacology & Therapeutics, †Dept. of Orthopaedics, The University of British Columbia, Vancouver, B. C., Canada, and ‡Clinical Research Department, Astra Pharma Inc., Mississauga, Ontario, Canada

INTRODUCTION

Arthroscopic cruciate ligament repair (ACLR) is commonly associated with severe postoperative pain. When managed with opioids,[1] pain relief is often unsatisfactory,[2] and untoward effects including nausea, vomiting and urinary retention delay recovery and prolong in-hospital stay. A femoral 3-in-1 block as adjunct to general anaesthesia (GA) may improve postoperative pain relief in ACLR.[3]

METHODS

With approval of the institutional human research committee, we conducted a prospective, randomized, placebo-controlled, double-blind trial. After obtaining written informed consent, 44 ASA 1 patients scheduled for ACLR were assigned to one of two parallel groups. Following induction of a standardized GA, the treatment group received a femoral 3-in-1 block with 40 ml of ropivacaine 2 mg/ml, augmented by local periincisional infiltrations with 20 ml of ropivacaine 2 mg/ml at the end of surgery. The control group received injections with saline instead of ropivacaine. All patients received 30 ml of ropivacaine 2 mg/ml intraarticularly at the end of surgery. When postoperative pain was ≤ 50 mm on a 100 mm visual analog scale (VAS), acetaminophen with codeine was given. At VAS scores > 50 mm, morphine was administered via PCA. The primary efficacy variable was PCA morphine consumption standardized by weight over 24 h.

RESULTS

22 patients were enrolled in each group. The male to female ratio was 17:5 in the treatment group and 13:9 in the control group. Other patient demographics were statistically similar in both groups. There was no significant difference between the groups in the doses of drugs used for GA, including fentanyl as the opioid analgesic. No signs of local anaesthetic toxicity were observed and no incidents of persistent neuropraxia occured. The PCA morphine consumption over 24 h standardized by weight (mean ± SD) was 0.45 ± 0.44 mg/kg in the control group and 0.37 ± 0.50 mg/kg in the treatment group ($P = 0.55$). The absolute values for PCA morphine consumption over 24 h for both groups were 31.0 ± 28.7 mg and 27.7 ± 38.7 mg, respectively ($P = 0.75$). There were more patients in the treatment group ($n = 10$) that did not receive postoperative morphine than in the control group ($n = 6$); the difference was however not statistically significant ($P = 0.35$).

CONCLUSIONS

In this randomized, placebo-controlled, double-blind trial, we found no significant effect on postoperative morphine consumption of a femoral 3-in-1 block combined with local periincisional infiltrations with ropivacaine 2 mg/ml, compared to intraarticular instillation with ropivacaine alone, in patients undergoing ACLR under GA.

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INCIDENCE OF TRANSIENT RADICULAR IRRITATION FOLLOWING SPINAL ANAESTHESIA

E. Mitmaker, MJ Tessler, K Kardash, SJ Kleiman, M Rossignol
From the Departments of Anaesthesia and Epidemiology, SMBD-Jewish General Hospital and McGill University, Montreal, Quebec

INTRODUCTION: Spinal lidocaine has been associated with transient radicular irritation (TRI). We sought to determine the incidence at our hospital of this controversial syndrome.
METHODS: All spinal anaesthetics administered during daytime operating room hours from May 5, 1997 until July 26, 1997 were eligible. Patients who could not understand English or French were excluded. The local anaesthetic and concentration administered were recorded. On postoperative days 1 and 3 every patient was interviewed by the same investigator who asked about the presence, site, and severity of leg pain. A standardized questionnaire was used which included a 1-10 verbal pain scale, with 1 representing no pain and 10 representing the worst pain imaginable. Any patient who still had pain in the legs on postoperative day three was contacted until the pain went away. Descriptive statistics, chi-square, and multiple linear regression analysis were performed.
RESULTS: Four hundred and sixty-four spinal anaesthetics were analyzed. There was a 11.4% and 4.4% incidence of radiculopathy in the groups for lidocaine and bupivacaine respectively ($p<0.05$). There was no statistical difference in the incidence of radicular pain within each local anaesthetic group dependent upon the concentration (See Table).
DISCUSSION: Transient radicular irritation occurs following spinal anaesthesia with both lidocaine and bupivacaine. The incidence of TRI is higher with lidocaine than bupivacaine. We were unable to demonstrate a statistically significant difference based on concentration for each drug. In our study TRI always disappeared in less than five days. Further study is needed to better define this clinical condition.

	L 5% D7.5% N=249	L 2% N=32	B.75% D 8.3% N=105	B.5% N=78
Incidence of leg pain Postoperative Day 1	12.1%	6.3%	6.7%	1.3%
Frequency of pain score ≥6 Postoperative Day 1*	43.3%	50.0%	28.6%	100.0%
Frequency of pain score ≥6 Postoperative Day 3*	6.7%	0.0%	14.3%	0.0%

*Frequency among those patients who complained of leg pain
L=Lidocaine, B=Bupivacaine, D=Dextrose

A

A PROSPECTIVE RANDOMISED TRIAL COMPARING THORACIC AND LUMBAR EPIDURAL TECHNIQUES FOR POST-THORACOABDOMINAL ESOPHAGECTOMY ANALGESIA.

L. Kahn MB ChB, F. Baxter MD, A. Dauphin MD, C. Goldsmith ** PhD, P. Jackson MD, J. McChesney MB ChB, J. Miller * MD, L. Takeuchi MD, E. Young * MD.
Dept. of Anaesthesia and Thoracic Surgery*, St. Joseph's Hospital, Hamilton, Ontario. Dept. of Clinical Epidemiology and Biostatistics**, McMaster University, Hamilton. Ontario, Canada.

INTRODUCTION: The purpose of this study was to compare Thoracic Epidural Opioid-Local Anaesthetic Analgesia (TEOLAA) and Lumbar Epidural Morphine Analgesia (LEMA) with respect to the duration of post-operative ventilation and the quality of post-operative analgesia in patients having a thoracoabdominal esophagectomy
METHODS: Approval from the Research and Ethics Committee was obtained. Twenty two patients scheduled for an elective thoracoabdominal esophagectomy were enrolled into a randomized controlled, observer blinded study. They were randomized to a TEOLAA or a LEMA group. The TEOLAA group had a T6-T8 and the LEMA group had a L2-L4 epidural catheter inserted prior to induction of general anesthesia. The TEOLAA group received a combined epidural-general anesthetic. Both groups were limited to a maximum fentanyl dose of 5 $mcg.kg^{-1}.h^{-1}$. All criteria for tracheal extubation (VC > 10 $ml.kg^{-1}$; MIP < -30 cm H_2O; respiratory rate > 6 and < 20 b.p.m.; oxygen saturation > 95% on FiO_2 1.0 ; temperature > 34.5°C and eye opening on command) had to be fulfilled, and were assessed by a blinded observer. Postoperatively, the TEOLAA group received PCEA 0.125% bupivicaine and fentanyl $5mcg.ml^{-1}$, with a continuous infusion at $10ml.h^{-1}$, and a bolus of 9 ml q 30 min to a maximum of 3 boluses in 6 hours. The LEMA group received PCEA morphine $0.2mg.ml^{-1}$, with a continuous infusion of 0.6 $mg.h^{-1}$, and bolus of 1.8 mg q 30 min to a maximum of 3 boluses in 6 hours. Early extubation was defined as tracheal extubation within 4 hours postoperatively. Visual analogue pain scores (VAPS) at rest (static VAPS, SVAPS) and with movement (Dynamic VAPS, DVAPS) were recorded at 1 h, 6 h, 12 h, 18 h and 24 h post-extubation. Failure of the epidural protocol (FEP) was defined as a request by the patient for additional analgesia.
RESULTS: There were no significant demographic differences between the groups. Time to extubation (Fig. 1) was significantly less in the TEOLAA group (logrank test p=0.01). However, at 4 hours postoperatively, all the TEOLAA and 70% of LEMA were extubated. (p=0.09). The rate of FEP (Fig. 2) was significantly higher in the LEMA group (p=0.01), with a 50% FEP at 6 hours post-extubation. There were no FEP in the TEOLAA group. SVAPS and DVAPS (Fig. 3) were significantly better in the TEOLAA group ($p < 0.01$). The difference between SVAPS and DVAPS in the TEOLAA group was statistically significant ($p = 0.03$), but clinically unimportant. However, the differences in the LEMA group were both statistically ($p < 0.01$) and clinically important.
DISCUSSION: Earlier time to extubation and superior pain control was demonstrated in the TEOLAA group.

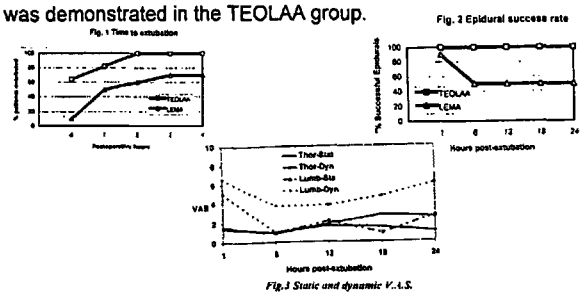

Fig.3 Static and dynamic V.A.S.

B

EPIDURAL ANAESTHESIA AND SURGICAL OUTCOME: HAVE WE BEEN MISLED BY UNRELIABLE RESEARCH METHODOLOGY?

Kristine Klubien MBChB, Edith Bandi MD, Franco Carli MD, MPhil.
Department of Anesthesia, McGill University, Royal Victoria Hospital, 687 Pine Ave West, Room F9.16, Montreal, Quebec, Canada. H3A 1A1.

INTRODUCTION

That epidural anaesthesia modifies the perioperative stress response has led to publication of many studies addressing its influence on surgical outcome [1]. As complete deafferentation of the injured area is required throughout the perioperative period to attenuate the metabolic activity associated with surgical insult, it is essential to document the segmental limits of sensory blockade following establishment of the epidural block, at the end of surgery and during the period of postoperative analgesia [2]. Without confirmation of effective deafferentation invalid conclusions could be drawn from the study results. This review examines how investigators tested the adequacy of neural blockade in epidural outcome studies.

METHODS

A Medline search was conducted from 1970 to 1997 to identify manuscripts looking at the influence of epidural local anaesthetics on outcome and the epidural technique and its documentation were scrutinised. The effect of the epidural blockade on outcome from surgery was also noted.

RESULTS

89 manuscripts from 22 journals were examined. The spinal level of insertion of the epidural was stated in 85% (76) of the studies. The epidural was inserted in the unanaesthetised patient in 80% (71), 13% (12) following anaesthesia, and remained unstated in 7% (6). In only 69% (61) of the studies was the extent of segmental sensory block documented prior to surgery. In the postoperative period only 63% (56) of the studies used local anaesthetic for analgesia, for a period varying from 1 to 8 days. Of these 56 studies only 39% (22) performed a daily assessment of the analgesic block (dermatomal level/VAS score). Overall only 27% (15) of these 56 studies documented satisfactory attention to epidural technique, that is an epidural inserted and the sensory level verified prior to the induction of general anaesthesia, and a daily check of the sensory level in the postoperative period. Of the 89 published studies, 82% (73) concluded that the epidural was beneficial to surgical outcome. In the 15 studies which documented appropriate attention to the epidural technique 87% (13) demonstrated a beneficial outcome.

DISCUSSION

Rigorous testing and verification of the adequacy of the procedure under investigation is essential if reliable conclusions are to be drawn about its therapeutic effects. The presented findings suggest that this has been lacking in the majority of studies investigating epidural anaesthesia and surgical outcome.

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A

GENERAL VS. REGIONAL ANAESTHESIA ON CARDIAC OUTCOMES IN CARDIAC PATIENTS UNDERGOING NON-CARDIAC SURGERY. A META-ANALYSIS

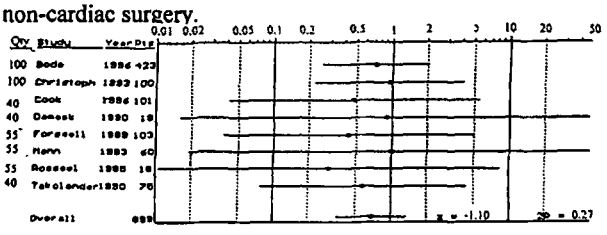
Kathleen Dattilo MD, Doris Tong FRCPC, Mohit Bhandari MD
Department of Anesthesia, Toronto Hospital, University of Toronto, M5T 2S8

Introduction: Regional anaesthesia (RA) has never been shown to improve cardiac outcomes vs. General anaesthesia (GA). We systematically review the literature in order to summarize the best evidence to date.

Methods: Search was done on the following databases from the earliest available date: Medline, PreMedline, Healthstar, Dissertation abstracts, EMBASE, HSRPROJ, Conference paper index, Cochrane database, Biomedical Collection. Sixteen textwords/MESH headings were used. All languages were searched. Manual search was done on Current Contents, all major anaesthesia journals, meeting supplements and proceedings (90-). Citations from major articles were reviewed and SCISEARCH was used to locate relevant citing articles. Unpublished data were sought. Study selection was done in triplicate (DT/KD/MB) independently and blinded to the results. Defined criteria were used in study selection. Validity of RCT was assessed using component approach and Detsky's scoring system. Data extraction was done using a standard form. Agreement was tested at each stage. Before data examination, *A-priori* hypotheses were identified for sensitivity analysis with regard to cardiac outcomes as primary/ secondary outcomes; published/unpublished data; English/foreign languages. Studies were considered combinable if population, intervention and outcome were similar. Population characteristics within and across studies were examined for clinical and statistical heterogeneity. With a negative test of homogeneity, the raw data were entered into Meta-Analyst 0.988 with random effect model.

Results: The search yielded 198 articles. After study selection, 23 articles were retained, including 4 foreign language and 2 abstracts. We discarded 8 articles after validity assessment. The authors of 1 article and the abstracts were contacted for further data. The foreign articles were being translated. Thus, data were extracted from 8 RCT on vascular patients. The Kappa agreement ranged from 0.71-1.00. The test of Homogeneity was non-significant (Q=0.77). The summary odds ratio=0.69, relative risk=0.70, risk difference=-0.014 and number needed to treat was 69.

Discussion: There was no significant difference between GA vs. RA in cardiac outcomes in cardiac patients undergoing non-cardiac surgery.



B

THE IMPACT OF EPIDURAL LOCAL ANESTHETICS AND I.V. DEXTROSE ON PROTEIN KINETICS IN HEALTHY VOLUNTEERS

Franco Carli, MD, MPhil, Kristine Klubien, MD, Louise Mazza, BSc, *Linda Wykes, PhD. Department of Anesthesia and *School of Dietetics and Human Nutrition, McGill University, Royal Victoria Hospital, 687 Pine Ave West, Montreal, Quebec H3A 1A1.

INTRODUCTION

The maintenance of nitrogen balance depends on both protein and energy intake (1). Epidural blockade using local anesthetics has been shown to inhibit the postoperative hepatic glycogenolytic response and protein breakdown (2). The objective of this study is to elucidate the effect of a well defined sensory blockade in the fasted and fed (i.v. dextrose) states on proteolysis and aminoacid oxidation without surgical stress.

METHODS

The project was approved by the Ethics Committee. Six healthy volunteers (mean age 26 ± 6 years, body weight 62 ± 11 kg, height 173 ± 10 cm) were studied on two occasions following an overnight fast. Each volunteer was assigned to undergo in a random order a fasted/fed study for a total of 6 h without (control group) or with epidural block (epidural group). In the latter group sensory block (T7-S1) was achieved and maintained with bupivacaine 0.25%. A primed continuous infusion of ^{13}C leucine was delivered using calibrated a syringe pump. After 3 h of fasted state, dextrose was infused I.V. at a rate of 4 mg kg^{-1} min^{-1}. Blood and expired air samples were collected during the last 30 min of both fasted and fed states (at isotopic steady state) to measure the rate of protein flux or protein breakdown and amino acid oxidation, and circulating plasma glucose, insulin and glucagon.

RESULTS

Administration of i.v. dextrose was associated with a non significant decrease (4-8%) in protein breakdown and amino acid oxidation in both control and epidural groups. There was a significant increase in circulating plasma glucose and insulin ($P<0.01$). In contrast, plasma glucagon decreased ($P<0.05$). No difference was found between the two groups during either the fasted or the fed state.

DISCUSSION

Administration of I.V. dextrose, at a rate which inhibits gluconeogenesis, stimulates insulin secretion, but does not influence protein metabolism. In the absence of surgical stress epidural blockade does not modulate proteolysis or aminoacid oxidation.

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Supported by the Canadian Anaesthetist's Society Research Award

A

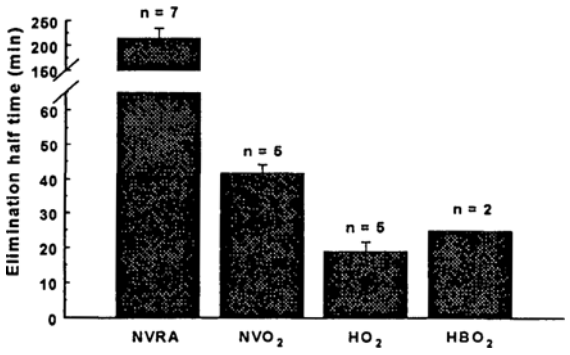
ACCELERATED CARBON MONOXIDE ELIMINATION DURING NORMOCARBIC HYPERPNEA

L.Z. Sommer, J. Rucker, A. Veseley, E. Levene, Y. Greenwald, G.Volgyesi, L. Fedorko, S. Iscoe and J.A. Fisher Department of Anaesthesia, University of Toronto, Toronto, Canada.

Introduction: The major impediment to the use of hyperventilation in the treatment of CO poisoning is the development of respiratory alkalosis. Using a recently described circuit that passively prevents hypocarbia during hyperpnea, we examined the effect of hyperpnea on the rate of elimination of carboxyhemoglobin (COHb) in anesthetized dogs.

Methods: Seven pentobarbital-anesthetized ventilated dogs were exposed to CO and then ventilated with room air at normocarbia (control). Five were then ventilated with 100% O_2 at control and six times control ventilation for 42 min each. Two were placed in a hyperbaric chamber and treated at 2.8 ATA according to a standard protocol. We monitored blood gases, and the rate of COHb elimination.

Results: The control half time ($t_{½}$) for elimination of COHb was 214 ± 20 (SD) min. On 100 % O_2, $t_{½}$ decreased to 42 ± 3 min at control ventilation, 18 ± 2 min at six times control ventilation and 25 min with hyperbaric O_2. During hyperpnea arterial PCO_2 rose on average by 5.0 mmHg.



Conclusion: In anaesthetized ventilated dogs, normocarbic hyperpnea accelerated the rate of COHb elimination to an extent comparable to hyperbaric O_2. This method can provide a readily accessible treatment for CO poisoning, alone or in addition to hyperbaric O_2.

Nusbaum Family Foundation

B

FUNCTIONAL PROTECTION OF HYPERGLYCAEMIA-LIKE PERFUSION ON SYNAPTIC TRANSMISSION IN RAT HIPPOCAMPAL SLICES SUFFERING *IN VITRO* ISCHEMIC INSULT

Guo-Feng Tian MD PhD and Andrew J. Baker MD FRCPC

Brain Injury Research Laboratory, Cara Phelan Centre for Trauma Research and the Department of Anaesthesia, St. Michael's Hospital, University of Toronto, 30 Bond Street, Toronto, Ontario, M5B 1W8

INTRODUCTION: Cerebral ischemic damage is an important cause of morbidity and mortality. Ischemic insults may be global or they may result from a focal interruption of blood flow. Conflicting evidence exists regarding the effects of hyperglycemia in different *in vivo* models of global and focal cerebral ischemia and in different laboratories[1-3]. This study was designed to investigate the effect of hyperglycemia-like perfusion on synaptic transmission in rat hippocampal slices suffering *in vitro* ischemic insult.

METHODS: With animal care committee and institutional approval, hippocampal slices (400 μm thick) were obtained from Wistar rats (30-39 days old). Slices were superfused with the artificial cerebrospinal fluid (ACSF) saturated with 95% O_2 and 5% CO_2 (control) or 95% N_2 and 5% CO_2 (ischemia) at a rate 8.0-9.0 ml/min. The components of the aCSF are (in mmol/L): NaCl 124, KCl 3.0, NaH_2PO_4 1.25, $NaCO_3$ 26, CaCl 2.4, $MgSO_4$, $NaCO_3$ 26, and glucose 0 (ischemia) or 5 (control) or 20 (hyperglycemia). The field excitatory postsynaptic potential and the population spike (PS) responses were evoked by stimulation of Schaffer collateral afferents in the stratum radiatum at the CA1-CA2 border and recorded extracellularly through glass microelectrodes filled with 150 mmol/L NaCl in the somatic layer of the CA1 region. All recordings were performed at slice temperatures of 36° to 37°C. The PS amplitude was evaluated by calculating the voltage difference between the negative peak and the positive one preceding it. Recovery was determined after ischemia by measurement of PS amplitude at 1.0 h and expressed as a percent of baseline amplitude. In order to examine the effect of hyperglycemia-like perfusion on the recovery of synaptic transmission suffering *in vitro* ischemic (oxygen-free and glucose-free) insult, slices were superfused with either 5 or 20 mM glucose ACSF for15 min before and 60 min after ischemia.

RESULTS: *In vitro* ischemic insult abolished the PS within 3.0 min and there was no difference between the control group and the hyperglycemia-like perfusion group. The baseline amplitude ranged from 2.04 to 5.58 mV (4.13 ± 1.04 mV, n=12). The recovery of the PS in control slices after a 4.0-min *in vitro* ischemia was 20% ± 16% (n=5) and 97% ± 13% (n=7) in the hyperglycemia-like slices.

DISCUSSION: The model demonstrated that with normal ACSF a 4.0 min of in vitro ischemia resulted in a clear functional damage to the CA1 neurons. Furthermore, hyperglycemia-like perfusion significantly enhanced recovery of an ischemia-like insult in rat hippocampal slices. Since the amplitude of the PS depends over a wide range on the number of firing neurons and the extent of their synchrony, the model serves as a standard of functional integrity of this neuronal population[4]. While other models of ischemia demonstrated morphological exacerbation of ischemic injury with hyperglycemia, this study suggests a functional improvement and thus may lead to further elucidation of the mechanisms involved in hyperglycemic modulation of ischemic neuronal damage.

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A

A CNS INFLAMMATORY RESPONSE IN HUMAN TRAUMATIC BRAIN INJURY ASSOCIATED WITH PATIENT OUTCOME

F.X. REINDERS MD, A.J. BAKER MD, R.J. MOULTON MD*, J.I.M. BROWN MD*, AND L. SCHLICHTER PhD †

Departments of Anaesthesia and * Surgery, St. Michael's Hospital, 30 Bond St., Toronto, Ontario M5B 1W8, and †The Playfair Neuroscience Unit, University of Toronto, Toronto, Ontario

INTRODUCTION: In order to develop interventional therapeutic strategies to combat the evolution of severe human traumatic brain injury (TBI), it is important to comprehend the pathophysiologic mechanisms underlying the condition. A CNS pro-inflammatory response has been demonstrated to follow brain insult in laboratory studies. There is conflicting evidence regarding its impact on final outcome. Similarly in humans, overexpression of pro-inflammatory mediators (cytokines) has been reported post TBI, however, its role related to clinical outcome is unknown. One important mechanism involved in the evolution of TBI is ischemic neuronal injury. While outcome measures of human TBI may be influenced by clinical and management variables, continuous somatosensory evoked potential (SSEP) recordings have been successfully employed to measure CNS functional integrity. Accordingly, cytokines were measured serially in the CSF of TBI patients along with cerebral blood flow and SSEPs to demonstrate the presence and pattern of their expression, and their relationship to both ischemia and patient outcome.

METHODS: Subsequent to institutional ethical approval, 31 patients with severe human TBI Glasgow Coma Scale (GCS $\leq$ 8) were studied for four to five days. A ventriculostomy drain was inserted in all patients for ICP monitoring and CSF collection. Raised ICP was treated first with CSF drainage, then mannitol, and finally moderate hyperventilation, if necessary. At 12 hour intervals post injury, CSF and arterial blood plasma were collected for cytokine analysis. The levels of IL-1β and IL-6 were measured using enzyme-linked immunosorbent assay (ELISA) technique. Arteriovenonus difference of oxygen ($AVDO_2$) was measured in all patients to determine global cerebral ischemia. If $AVDO_2 \geq 6$ vol% within the first 24 hrs, the patient was categorized as 'ischemic'. A patient was categorized as 'deteriorated' if their 4 day SSEP recording declined to less than 60% of their initial level. This level of decline was clinically relevant as the mean SSEP decline from initial in fatalities was 60%.

RESULTS: The patients in this study were representative of the human head injury population; the mean admission GCS was 5.4(range, 3-8), the mean age was 34 years(17-68), 65% were male and the mortality rate was 26%. Cytokine values were nonparametrically distributed. Both the cytokines IL-1β and IL-6 were significantly elevated in the CSF compared to controls and the concurrently collected Plasma. The CSF IL-1β and CSF IL-6 were higher in stable or improving patients compared to deteriorating patients (median values CSF IL-1β, 4.5 pg/ml vs. 2.6 pg/ml respectively, p =.016, CSF IL-6, 490 pg/ml vs. 340 pg/ml, p = .014). Interestingly, CSF IL-1β was also higher in those patients who were not ischemic within the first 24 hrs. compared to those that were ischemic (4.0 pg/ml vs. 2.7 pg/ml respectively, p = .006).

DISCUSSION: Supportive evidence of a CNS inflammatory response following severe human TBI is presented. Elevated levels of both CSF IL-1β and CSF IL-6 are associated with patients who had better neurologic outcome, i.e. those that remained stable or improved post TBI. CSF IL-1β was also elevated in patients where cerebral ischemia was not a significant component of their TBI. The therapeutic implications of this response remain to be determined.

B

RADIOGRAPHIC EVOLUTION OF ARDS PATIENTS WITH OR WITHOUT INHALED NITRIC OXIDE

Eric Troncy MS DVM, Laurence Van Tulder MD, Stéphane Carignan* MD, Julie Prénovault* MD, Jean-Paul Collet† MD *PhD*, Stan Shapiro† MD, Jean-Gilles Guimond* MD, Louis Blair MD, Thierry Ducruét BSc, Martin Francœur RRT, Marc Charbonneau MD*, Guy Cousineau* MD, Gilbert Blaise MD.
Labo. of Anæsthesia, Dep. of Anæsthesia; *Dep. of Radiology, *Dep. of Medicine; CHUM - Pavillon Notre-Dame; 1560 Sherbrooke St East, Montréal, Québec, H2L 4M1. †Centre for Clinical Epidemiology and Community Studies; Jewish General Hospital; McGill University.

INTRODUCTION

In a pilot randomized placebo-controlled clinical trial of acute respiratory distress syndrome (ARDS) patients treated with inhaled nitric oxide (inhNO), we have measured a chest X-ray score during 10 days post-randomization for control (15 patients receiving usual care) and experimental (15 patients with usual care plus inhNO) and compare its evolution in time and between groups with lung function and outcome.

METHODS

This study was approved by the Human Research and Ethics Committee of Centre Hospitalier de l'Université de Montréal. All therapeutic interventions were standardized. Lung function was assessed by hypoxia score (HS = PaO_2 / FiO_2), PEEP level, dead space ventilation, lung compliance, and venous admixture. The optimal dose of inhNO was determined daily between 0.5 and 40 parts-per-million. Nonresponders to inhNO were defined as patients presenting a ≤ 20% increase in HS after initial optimal inhNO administration. Daily morning radiographs were obtained on portable chest X-ray equipment. After completing the study, 255 radiographs of the 30 ARDS patients were analyzed in blinded and serial fashion by three independent readers. Based on previous studies,[1-3] radiographic criteria were selected in order to reflect the pattern of air-space consolidation (parenchymal opacification, atelectasia) associated with vascular pattern (indistinct vessels) and possible presence of interstitial pattern (septal lines, peribronchial cuffing, pleural effusion) particularly considering the evolution with time (until day 10 after randomization). The reliability of the technique was determined by looking at intra- (45 radiographs blindly evaluated twice) and inter-observer variabilities.

RESULTS and DISCUSSION

ARDS resulted mainly from sepsis (25 / 30). Observed baseline characteristics were similar between groups. During the first day, HS increased greatly in patients treated with inhNO: +70.4 mmHg (**+59%**) *vs* +14.2 mmHg (**+9.3%**) for control group (P=0.02), venous admixture decreased from 25.7 to 15.2% in the inhNO group, and only from 19.4 to 14.9% in the control group (P= 0.05). The status of the lung correlated well with the chest X-ray score. Intra- and inter-observer variability were reasonnable. Five out of 15 patients were nonresponders. After the first day of therapy, no further beneficial effect of inhNO could be detected, whereas studied parameters were never affected by usual care in the control group.
Forty percent of patients treated with inhNO were alive and weaned from mechanical ventilation 30 days after randomization compared to 33.3 % in the control group (P=0.83). The 30-day mortality rate was similar in the two groups: 60% in patients treated with inhNO *vs* 53.3% without inhNO (P= 0.71); most deaths (11 / 17) were due to multiple organ dysfunction syndrome (MODS). On the 5 direct lung injury-induced ARDS, only 1 / 3 died in the control, 0 / 2 in the inhNO group. The 30-day mortality rate of nonresponders, and responders to inhNO was 80%, and 50%, respectively. No correlation was found between the evolution of the chest X-ray score and the outcome, the ARDS origin or the treatment.

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THIAMINE DEFICIENCY AND SUPPLEMENTATION IN INTENSIVE CARE UNIT PATIENTS

Daniel R. Wong BSc, Michele McCall MSc, Fergus Walsh MB, Regina Kurian RT, Mary Keith PhD, Michael J. Sole MD, Kursheed N. Jeejeebhoy MD, C. David Mazer MD
Dept of Anaesthesia and Div of Gastroenterology, St. Michael's Hospital, 30 Bond Street, Toronto, Ontario, M5B 1W8; Div of Cardiology, The Toronto Hospital, General Division, University of Toronto.

Introduction: Thiamine (vitamin B_1) is an important metabolic co-enzyme in the form of thiamine pyrophosphate (TPP). Its deficiency has been linked to poor clinical presentation in several disease states and clinical improvement has been shown to occur with its supplementation. Our objective was to determine thiamine levels among patients in the intensive care unit (ICU) and to seek any correlation between thiamine supplemention and cardiovascular, renal, and other clinical status markers in this diverse patient population.

Methods: After ethics approval and informed consent, prospective data were collected from patients soon after admission to ICU. Medical management of patients was not altered by the study. Baseline and follow-up levels of serum thiamine, urine thiamine metabolites, and erythrocyte TPP were collected prior to and 24 hours following intravenous administration of 200 mg of thiamine, and were analyzed by high performance liquid chromatography as previously described. Clinical parameters and measures of organ dysfunction (MOD score) were also recorded. Paired data was analyzed using the Student's t-Test and is reported as mean ± SD.

Results: Data from a total of 15 (7 male and 8 female) patients were collected. Serum thiamine and TPP levels suggested that ICU patients initially had low thiamine levels compared to previously published normal values (22-38 nmol/L and 123 ng/mL packed RBC, respectively). Thiamine levels increased following supplementation. Excretion of thiamine appeared to be high.

	Pre-thiamine	Post-thiamine	P value
Serum thiamine (nmol/L)	7.7 ± 6.9	261 ± 546	0.05
TPP (ng/mL packed RBC)	78.5 ± 22.5	167± 66	0.0001
Urine thiamine metabolites (*μg/gm creatinine*)	2394 ± 7589	48547± 48703	0.001
Heart rate (/min)	91 ± 18	82 ± 14	0.006
MOD Score	5.47 ± 2.85	4.27 ± 3.33	0.04
Urine volume (L/d)	2.6 ± 1.7	3.0 ± 2.0	0.20

Conclusions: Patients in the ICU tend to be moderately thiamine deficient when measured by our laboratory assays. These levels increased with administration of intravenous thiamine, as did urinary excretion of thiamine metabolites. Whether thiamine levels or supplementation correlate with major clinical outcome remains to be determined.

ACTIVATED CLOTTING TIME AS AN INDICATOR OF TRAUMATIC COAGULOPATHY

E Whitten MD, PH Norman MD FRCPC,
JA Aucar MD FACS, LA Coveler MD

Departments of Anesthesiology and Surgery,
Baylor College of Medicine, Houston, Texas

INTRODUCTION: The development of coagulopathy in the multiple trauma patient often heralds death. The early detection of coagulopathy would allow definitive surgical repair to be deferred until after stabilization of the patient in the SICU. Staged surgical repair tactics may increase the survival of multiple trauma victims. Waiting for the development of obvious hemorrhage is crude and unreliable and usual laboratory tests take time to perform and may not be predictive of coagulopathy. The activated clotting time (ACT) is a simple, readily available test that may be of use in the early detection of traumatic coagulopathy.

METHODS: With institutional review board approval and implied consent, victims of major trauma who presented STAT to the OR were randomly selected. Serial ACT and arterial blood gases were obtained. Preoperative systolic, diastolic blood pressures, and heart rate were obtained. Intraoperative pH, ACT and temperature were recorded. ACT was measured with a Hemachron® model 801 two-well coagulation monitor. Coagulopathy was determined clinically at the end of the procedure. Dunn-Sidak adjusted two-group t-tests were used for statistical analysis.

RESULTS: Of the twelve patients studied, two became clinically coagulopathic. The initial pH and initial ACT were both significant predictors of later coagulopathy.

Variable	Normal clot mean ± 1 SD	Coagulopathy mean ± 1 SD	P value
Sys. BP (mmHg)	94 ± 33	68 ± 17.7	0.922
Dias. BP (mmHg)	51 ± 26	30.0 ± 0	NA
Heart rate (bpm)	100 ± 20	118 ± 19	0.873
Initial Temp. (°C)	35.8 ± 1.3	34.6 ± 1.1	0.822
Initial pH (units)	**7.32 ± 0.13**	**6.80 ± 0.02**	**0.003**
2nd pH (units)	7.31 ± 0.22	7.17 ± 0.21	0.997
Initial ACT (sec)	**121 ± 21**	**216 ± 65**	**0.012**
2nd ACT(sec)	121 ± 26	239 ± 125	0.058
RBC given (units)	3.2 ± 3.7	23 ± 9.9	0.001
Total Fluid (L)	4.6 ± 2.8	12.3 ± 1.2	0.016

DISCUSSION: The initial ACT and the initial pH both predict the later development of coagulopathy in this small series of patients. Further investigation of the ACT is justified as an indicator of when to delay primary repair of injuries in the multiply injured trauma victim.

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A

FREE RADICAL SCAVENGING RESCUES RAMOS B LYMPHOBLASTOID CELLS FROM THE GROWTH INHIBITORY EFFECTS OF B CELL RECEPTOR CROSS-LINKING.

Rodney M. Solgonick MD, Y. Bastien, Bruce Mazer MD.
Division of Allergy & Clinical Immunology, and Department of Anaesthesia, Montreal Children's Hospital, Meakins-Christie Laboratories, Montreal, Quebec.

INTRODUCTION: Immune cells initiate important events in the development of multi-organ dysfunction syndrome through intracellular production of free radicals (1). Previous investigators have shown that induction of apoptosis may be due to the production of reactive oxygen species within the cell. Catalase (a hydrogen peroxide scavenger) can abrogate apoptosis induced by cross-linking of the B cell receptor (BCR) in human B lymphoblastoid cells (2). We have studied the effects of free radical scavenging with catalase and N-acetyl cysteine, as well as verapamil on growth arrest and constitutive IgM secretion following BCR cross-linking of the Ramos human B lymphoblastoid cell line.

METHODS: Ramos cells (3.5 X 10^5 per milliliter) were incubated with catalase (a hydrogen peroxide scavenger) (16000 units/ml), N-acetyl cysteine (a nonspecific free radical scavenger) (1 mM), or verapamil (a cell surface calcium channel blocker) (20 μM). BCRs were cross-linked with B cell receptor anti-IgM antibody (2.0 μg/ml) and incubated for 24 hours. Cell proliferation was assayed by [^{3}H]-thymidine incorporation and IgM secretion was determined by an enzyme-linked immunoadsorbent assay.

RESULTS: [^{3}H]-thymidine incorporation was markedly reduced in the presence of anti-IgM antibody, 21% (± 12%) relative to control. However, catalase and N-acetyl cysteine salvaged thymidine incorporation in the presence of anti-IgM antibody, 61% (± 25%) and 108% (± 18%), respectively. Verapamil had no effect on the reduction in [^{3}H]-thymidine incorporation induced by anti-IgM antibody cross-linking, 7% (± 6%). At twenty four hours, IgM secretion was markedly reduced (18 μg/ml ± 16 μg/ml) following BCR cross-linking, compared to control (113 μg/ml ± 10 μg/ml). Catalase and verapamil treatment resulted in moderate recovery of IgM secretion (72 μg/ml ± 28 μg/ml, and 53 μg/ml ± 40 μg/ml respectively) while N-acetyl cysteine did not (12 μg/ml ± 8 μg/ml). All results were statistically significant, $p<0.05$.

DISCUSSION: These results support the hypothesis that immune cell growth arrest induced by cross-linking of IgM receptors may involve a free radical mediated pathway. However, free radical scavenging did not fully recover IgM secretion. This finding suggests that mechanisms other than free radical production may control IgM secretion, or alternatively, hydroxyl radical may lead to signaling events unaffected by N-acetyl cysteine.

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B

Abstracts

Tuesday, June 16 (a.m.)

Richard Knill Research Competition

Poster Discussion Session VII/Pharmacology

Poster Discussion Session VIII/Education

Poster Discussion Session IX/Paediatric

Poster Discussion Session X/Obstetric

NEUROPROTECTIVE EFFECTS AND TEMPERATURE DEPENDENCE OF INTRAVENOUS ANAESTHETICS AGAINST EXCITOTOXICITY AND OXYGEN-GLUCOSE DEPRIVATION IN MOUSE CORTICAL NEURONS

Koji Iihara PhD MD, *Beverley A. Orser PhD MD, Michael Tymianski PhD MD Playfair Neuroscience Unit, Toronto Hospital Research Institute, 399 Bathurst Street, Toronto, Ontario, M5T 2S8; *Department of Anaesthesia, Sunnybrook Health Science Centre, 2075 Bayview Ave, Toronto, Ontario, M4N 3M5.

INTRODUCTION A number of intravenous anaesthetics exhibit properties which might render them suitable as neuroprotectants against cerebral ischemia. Unlike other experimental neuroprotective agents, many of which are poorly tolerated by patients, the safety and tolerability of these anaesthetics have already been demonstrated. However, the underlying mechanisms and efficacy as neuroprotectants are poorly understood.

METHODS Animal treatment protocols were approved by the Animal Care Committee. The efficacy of propofol, ketamine, and pentobarbital were examined in models of glutamate neurotoxicity (GNT) and oxygen-glucose deprivation (OGD) in cultured murine cortical neurons. Neuronal survival was assayed using a modified Cytofluro II fluorescence multiwell plate scanner.[1] Propidium iodide (PI) fluorescence was measured in neurons exposed to excitotoxic insults at various temperatures Statistical analysis was performed using one-way analysis of variance (ANOVA) or multiple regression analysis followed by the Bonferroni test.

RESULTS Propofol (30-300μM) and ketamine (30-300μM), but not pentobarbital (10-1000μM), protected neurons against GNT at 23°C ($p<0.05$). The vehicle, Intralipid, showed no effects. The competitive NMDA receptor antagonist, APV, also decreased cell death. When propofol and APV were co-applied, the protective effect was significantly greater than the theoretical additive effect ($p<0.05$, Mann-Whitney U Test). These data suggest that propofol's actions were not be solely mediated by NMDA channel blockade.[2] Furthermore, propofol's effect was not due to $GABA_A$ receptor activation, as it was not mimicked by applying GABA or inhibited by competitive or noncompetitive $GABA_A$ receptor antagonists. Interestingly, in the OGD model where neurodegeneration was likely due to activation of NMDA receptors by endogenous glutamate, ketamine (3-300uM), but not propofol or pentobarbital, was neuroprotective ($p<0.05$). OGD must be performed at 37°C for toxicity to occur in our model. To explore the hypothesis that protection by propofol was temperature- not model-dependent, the effects of ketamine and propofol against GNT were re-examined at 23°, 30° and 37°C. Surprisingly, the neuroprotective effects of propofol decreased with increasing temperature, whereas those of ketamine remained unchanged.

DISCUSSION The present study revealed efficacy, but marked temperature dependence of the neuroprotective actions of high concentrations of propofol, suggesting the possible use of propofol as a neuroprotectant under hypothermic conditions.

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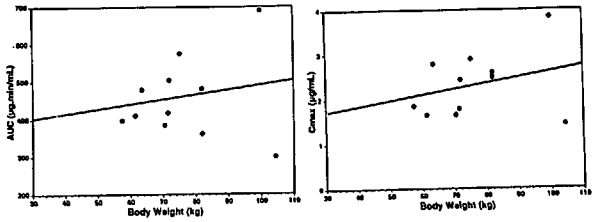
A

THE DOSE OF LIDOCAINE SELECTED FOR AXILLARY BLOCKS SHOULD NOT BE BASED ON BODY WEIGHT IN ADULTS

Brendan T Finucane, MBBCh., Nuzhat Zaman, PhD., Ibrahim Kashkari, MD., Soheir Tawfik DVM., Yun K Tam, PhD
Departments of Anaesthesia and Pharmaceutical Sciences, University of Alberta, Edmonton, Alberta, T6G 2B7

INTRODUCTION: The maximum recommended dose of lidocaine (with epinephrine) for brachial plexus anaesthsia (BPA) is 500 mg or 7 mg/kg.[1] Anaesthetists performing BPA frequently select the dose of local anaesthetic on the basis of body weight. How valid is this premise?
The main purpose of this study was to determine the relationship between body weight and the uptake of lidocaine from the axillary space following a standard dose of lidocaine.
METHODS: Fifteen patients, scheduled for upper extremity surgery under axillary block, participated in this trial. The trial was reviewed and approved by the institutional ethics committee and written informed consent was obtained from each patient prior to the study. Lidocaine 1.5% with epinephrine 1:200,000, 10 mg/kg was injected over a 3 min period. Blood samples were drawn before and at frequent intervals up to 320 min post-injection. Plasma levels were analysed using an HPLC technique and the pharmacokinetic parameters were calculated using a non-compartmental analysis. The effect of weight on $C_p$max and AUC were evaluated using linear regression.
RESULTS: Four patients were excluded from the study because of inadequate blood sampling or sample contamination. The weights of the remaining patients ranged from 57.5 kg to 104.4 kg with an average (± SD) of 76.40 ± 14.92 kg. Absorption of lidocaine from the axillary space was slow and $C_p$max was 2.3 ± 0.7 μg/ml and $T_m$max was 67.27 ± 31.33 min. The area under the curve (AUC 0-320) values were 454.5 ± 108.5 μg/min/ml. Linear regression analysis shows that $C_p$max and the AUC values were not related to body weight. This is indicated by the values of the slopes, which are not significantly different from zero and r^2 values were 0.0872 and 0.0224.



DISCUSSION: One previous study evaluated the influence of body weight on the uptake of bupivacaine into the plasma, following interscalene block.[2] In that study, a standard dose of bupivacaine (200 mg) was given to a series of 35 patients of varying ages. The correlation between weight and uptake of bupivacaine was poor. In the current study, lidocaine was used, the axillary route was selected and a standard dose of lidocaine was administered, based on the weight of the patient (10 mg/kg).
CONCLUSIONS: Doses of lidocaine in excess of those recommended for BPA can be safely used for axillary block. The dose of lidocaine selected for axillary blocks should not be based on body weight in adults.
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B

ARTERIAL OXYGENATION DURING THORACIC SURGERY: A COMPARISON OF ISOFLURANE AND SEVOFLURANE

Peter D. Slinger, MD; Karen McRae, MDCM; Timothy Winton, MD; Alan N. Sandler, MBChB; JE Zamora, MD; Mary Jane Salpeter, RN
Departments of Anaesthesia and Thoracic Surgery, The Toronto Hospital, University of Toronto, 585 University Avenue, Toronto, ON Canada M5G 2C4

Introduction.
Arterial oxygenation (PaO_2) during anaesthesia for thoracic surgery remains a clinically important problem.[1] Animal studies demonstate less inhibition of hypoxic pulmonary vasoconstriction (HPV) with sevoflurane than isoflurane[2]. A previous study of isoflurane and sevoflurane during one-lung ventilation (OLV) found no differences in PaO_2, however the patients also received nitrous oxide which inhibits HPV[3]. This study compared gas exchange and hemodynamics during thoracic surgery with isoflurane and sevoflurane in a randomized crossover design.

Methods.
Twenty consenting patients were studied with IRB approval. Patients received a standardized induction with propofol, vecuronium and sufentanil. In group 1 (n=10) isoflurane in oxygen was titrated to a F_{ET} isoflurane 1 MAC (1.2%). Blood gases and cardiac output were measured during two lung ventilation and every 10 min of OLV with the chest open for at least 30 min, or until the PaO_2 change was < 25 mmHg. Isoflurane was then discontinued and sevoflurane titrated to F_{ET} 1 MAC (1.7%). Blood gases and hemodynamics were measured q.10 min for a further 30 min before surgical manipulation of the lung. In group 2 subjects the order of isoflurane and sevoflurane administration was reversed. The effects of anaesthetic sequence and agents on gas exchange, hemodynamics and recovery were tested by repeated measures ANOVA.

Results.
There were no significant differences between groups for baseline or haemodynamic data. During two-lung ventilation mean (± SD) PaO_2 was higher: 474 (± 58) mmHg and shunt was lower 0.14 (± .05) with sevoflurane than isoflurane: 418 (± 49) mmHg (p = .03) and 0.23 (± .08) (P < .01). There were no significant differences during OLV. Mean PaO_2 and shunt after 30 min of isoflurane were: 200 (± 111) mmHg and 0.34 (± .10) and after sevoflurane: 178 (± 77) mmHg and 0.33 (± .08). Spontaneous eye opening was faster following sevoflurane: 7.1 (± 5.6) min than isoflurane: 13.7 (± 6.9) (p = .03).

Discussion.
Decreased inhibition of HPV may result in better oxygenation with sevoflurane than isoflurane during two-lung ventilation. This difference is not detectable during OLV when other variables affect the blood flow distribution between the lungs.

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A

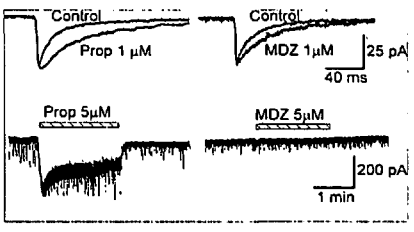
THE EFFECT OF PROPOFOL ON BASELINE CURRENT MEDIATED BY $GABA_A$ RECEPTORS OVERSHADOWS ITS EFFECT ON IPSCs IN CULTURED HIPPOCAMPAL NEURONS

Donglin Bai PhD, John F MacDonald PhD, *Beverley A. Orser PhD MD, Departments of Physiology and *Anaesthesia, 1 King's College Circle, University of Toronto, *Sunnybrook Health Science Centre, 2075 Bayview Ave, Toronto, Ontario, M4N 3M5.

INTRODUCTION Propofol (Prop) is a potent general anaesthetic whereas midazolam (MDZ) is a sedative hypnotic with a relative wide margin of safety. The mechanisms underlying the more potent actions of propofol are not known as both these drugs enhance $GABA_A$ receptor function and slow the decay of spontaneous miniature inhibitory post synaptic currents (IPSCs).[1,2] Voltage clamp recordings from cultured neurons[3] or brain slices[4] suggest that GABAergic inhibitory transmission consists of 2 components: IPSCs resulting from the transient release of GABA and a baseline current resulting from tonic release of the transmitter.[5] Here we compare the effects of Prop and MDZ on tonic and transient activation of $GABA_A$ receptors.

METHODS Animal treatment protocols were approved by the Animal Care Committee. Currents were recorded using the patch clamp method from embryonic hippocampal neurons grown in dissociated culture. TTX (300nM), CNQX (10 μM) and APV (40 μM) were added to the extracellular solution to inhibit action-potentials and glutamate-mediated excitatory currents. The kinetics of spontaneous IPSCs were analyzed using SCAN software and charge transfer (Q) was estimated by integrating the area under the current transients.

RESULTS Prop (1μM) and MDZ (1μM) produced a similar decrease in the rate of decay of IPSCs: $\tau_{control}$ = 32.1 ± 3.4 ms vs τ_{Prop} 64.3 ± 4.4 ms (n=7); $\tau_{control}$ = 33.1 ± 4.0 ms vs τ_{MDZ} = 50.2 ± 4.3 ms (n=5), respectively. Prop, but not MDZ produced a profound increase in the amplitude of a bicuculline-sensitive baseline current: I_{prop} = 38 ± 10.2 pA (n=8). We then compared the effects of Prop (1μM) on Q mediated by IPSCs, to the Q associated with the shift in the baseline current. The increase in Q due to the baseline shift was 18 fold greater than that associated with IPSCs: 38.0 ± 10.2 pA sec (n=8) vs, 2.13 ± 1.2 pA sec (n=4, p<0.05, Mann-Whitney U test).



DISCUSSION These data suggest that Prop and MDZ produce similar changes in IPSCs but only Prop increases the amplitude of the baseline current. Moreover, the increase in charge transfer associated with the baseline current was considerably greater than that resulting from changes in the time course of IPSCs. Prop, but not MDZ, directly activates the $GABA_A$ receptor and this action may underlie the increase in tonic current and play a key role in propofol's anaesthetic properties.

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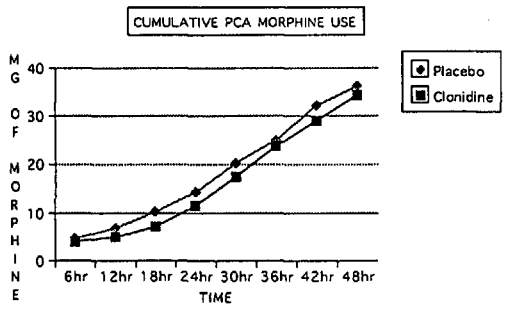
B

ORAL CLONIDINE PREMEDICATION EFFECT ON INTRATHECAL MORPHINE

Kelly Mayson FRCPC, Ed Gofton FRCPC, Keith Chambers MD.MHSc

UBC Department of Anaesthesia, Vancouver General Hospital; Room 2449--910 West 10th Avenue, Vancouver B.C. Canada

INTRODUCTION: A number of studies have demonstrated that perioperative intravenous, intrathecal and epidural clonidine enhances postoperative analgesia. The use of oral preoperative clonidine has been suggested to decrease narcotic requirements (1) as well as enhance the effect of intrathecal morphine (2). The purpose of this prospective, double-blind placebo-controlled study was to determine the effect of a single dose of oral clonidine preoperative on postoperative analgesic requirements in patients undergoing major abdominal surgery.
METHODS: After obtaining institutional approval, and informed consent, 45 males undergoing radical prostectomies were randomized to either receive oral clonidine (3 ug/kg) or placebo 90 minutes prior to surgery. All patients received isobarbic bupivacine 15 mg and intrathecal morphine 5ug/kg, followed by a standardized general anaesthetic, consisting of thiopenthal, sufentanil, rocurium, isoflurane, O2 and air. Postoperatively PCA morphine use, and visual analogue scores were recorded for the first 48 hrs. The incidence and severity of side effects such as sedation, nausea, and pruitits were assessed, as well as patient satisfaction. The study was designed to have a power of 90% to detect a 25-30% reduction in morphine usage by enrolling ~20 subjects in each group.
RESULTS: Two patients were excluded from the study; in one patient a spinal anaesthetic was not technically possible, and the other patient PCA pump was erroneously discontinued after 24 hrs. PCA morphine usage was compared in both groups using a students t test (t=0.04). As seen in figure 1, there was no significant difference in total morphine requirements, nor in six hourly morphine usage(P=0.96). Secondly, there was no significant difference in visual analogue scores, or incidence of side effects. Patient satisfaction was high in both groups and again no significant difference between groups was noted.



CONCLUSION: Studies on the usefulness of preoperative oral clonidine to reduce postoperative PCA morphine requirements have been mixed. (1,3) Contrary to a previously study (2) we found that using a dose of clonidine 3 ug/kg 90 minutes preoperatively produce no significant difference on PCA morphine requirements between clonidine and placebo cohorts.

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INHIBITION OF NITRIC OXIDE SYNTHESIS PREVENTS RECOVERY OF STUNNED MYOCARDIUM

Susan E. Belo PhD MD FRCPC, J. Colin Kay, C. David Mazer MD FRCPC
Department of Anaesthesia, University of Toronto, St. Michael's Hospital, 30 Bond Street, Toronto, Ontario M5B 1W8

INTRODUCTION

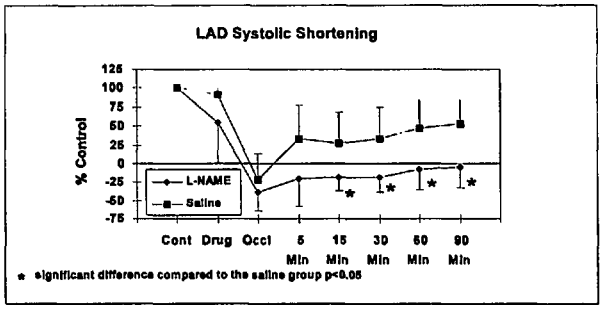
Contractile dysfunction following brief episodes of myocardial ischaemia has been termed stunned myocardium. The mechanisms underlying the development of this phenomenon are not known. However, alterations of blood flow post ischaemia may influence the recovery of contractile function. Nitric oxide (NO) produced by coronary endothelial cells is thought to play a role in the regulation of coronary blood flow. Thus NO may have a role in the recovery of the stunned myocardium. In this study the effect of inhibition of NO synthesis on postischaemic myocardial dysfunction was investigated.

METHODS

With animal care committee and institutional approval, dogs were anaesthetized with sodium pentobarbital and the heart exposed and instrumented through a left thoracotomy. An electromagnetic flow probe was placed around the left anterior descending artery (LAD) distal to the first major diagonal branch. An occluder was placed distal to the flow probe. In the areas supplied by the LAD and circumflex arteries regional systolic shortening was measured using piezoelectric crystals implanted in the mid myocardium and catheters were inserted into two epicardial veins for blood sampling. Left ventricular (LV) and aortic pressures were continuously monitored. There were two groups. In the control group (N=6) the LAD was occluded for fifteen minutes then reperfused for 90 minutes. In the treated group (N=8) the animals received L-NAME 30 mg.kg^{-1} prior to LAD occlusion. Data is reported as mean ± 1 SD, differences between groups were analyzed using analysis of variance and $p<0.05$ was considered significant.

RESULTS

The administration of L-NAME produced a significant increase in control blood pressure from 112 ± 14 to 131 ± 19 mmHg, LV end diastolic pressure from 5 ± 1 to 8 ± 2 mmHg, a decrease in heart rate from 126 ± 19 to 97 ± 14 beats/min and no change in coronary flow. Base line systolic shortening after L-NAME administration was lower but not significantly different compared to the saline group. On reperfusion there was no significant difference in lactate extraction or coronary blood flow between the two groups. In the saline group reperfusion was associated with recovery of systolic shortening to 27% of control initially and to 53% of control by 90 minutes. In the L-NAME group there was no recovery of systolic function (Graph).



DISCUSSION

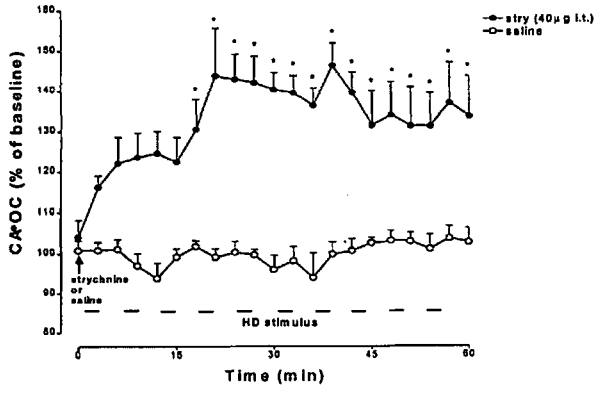
These studies show that inhibition of NO synthesis prevents recovery of the stunned myocardium. The beneficial effects of NO may be due to local changes in blood flow or its known anti-neutrophil effect.

A B

ACTIVATION OF THE ROSTRAL VENTROLATERAL MEDULLA IN AN ACUTE ANAESTHETIZED RODENT MODEL OF ALLODYNIA

Sean R.R. Hall MSc, Louie Wang MSc MD FRCPC, Brian Milne MSc MD FRCPC, Chris Loomis PhD*
Department of Anaesthesia and Pharmacology & Toxicology, Queen's University, Kingston, Ontario, K7L 3N6 and School of Pharmacy, Memorial University, St. John's, Newfoundland

INTRODUCTION: The rostral ventrolateral medulla (RVLM) is an area regulating vasomotor control[1]. However, its role in pain processing is not well understood. The objective of this study was to investigate the effect of non-noxious hair deflection (HD) on adrenergic neuronal activity in the RVLM in the strychnine-induced model of allodynia.
METHODS: Following Animal Care approval halothane anaesthetized rats were artificially ventilated and underwent carotid artery, jugular vein and intrathecal (i.t). cannulation. Neurochemical activity of RVLM adrenergic neurons was assessed by measuring the catechol oxidation (CA·OC) using differential normal pulse voltammetry. Following stabilization, anaesthesia was maintained with i.v. urethane. Animals were given i.t. saline or strychnine (STR) (40µg) followed by repeated HD to lumbar dermatomes at 3 min intervals for a 60 min period. The maximum evoked increase in RVLM CA·OC, mean arterial BP (MAP) and heart rate (HR) for each stimulus period was determined and expressed as % control±SE (repeated measures ANOVA with Neuman-Keuls).
RESULTS: HD following i.t. STR evoked a significant increase in the RVLM CA·OC signal (max 146.4±5.6%, n=4, $p<0.05$, 39 min after i.t. STR) Fig 1. A significant increase in MAP and HR was also evoked by each HD stimulus throughout the i.t. STR time course (peak MAP 159±18.4%, and HR 123±8.2%, $p<0.05$ 15 min after i.t. STR.) In contrast, HD applied to the same caudal dermatomes of i.t. saline-treated rats (n=4) did not affect RVLM CA·OC, MAP or HR.
DISCUSSION: The results of this study show that the RVLM CA·OC represents a sensitive biochemical index of STR-induced allodynia and is temporally correlated with enhanced cardiovascular responses evoked due to stimulation of sensitive (low threshold) mechanoreceptors during spinal glycinergic inhibition. The activation of the RVLM was comparable to that observed in noradrenergic neurons of the locus coeruleus, a supraspinal structure involved in pain processing[2].



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A

COMPARISON OF ANALGESIC TOLERANCE TO INTRATHECAL BUTORPHANOL VS. MORPHINE

Brian K. Tsang, MD, Zhi He, MD, Wichai Wongchanapai, MD*, Ing K. Ho, MD*, and John H. Eichhorn, MD
Dept. of Anesthesiology, and * Dept. of Pharmacology & Toxicology, University of Mississippi Medical Center, Jackson, MS 39216, USA

Introduction: Recently, *it* opioids have gained much wider acceptance in the treatment of patients with nonmalignant sources of pain, such as chronic low back (somatic) pain and chronic pancreatitis (visceral) pain. (1,2) The problem of diminishing effects of those medication from analgesic tolerance is magnified by the long duration of the therapy in these patients. This study compares the characteristics of tolerance to *it* butorphanol vs. morphine.

Methods: After approval by the Institutional Animal Care and Use Committee, male adult Sprague-Dawley rats received 96 hr of *it* infusion ($1\mu l \cdot hr^{-1}$) consisting of saline, butorphanol ($52\ nmol \cdot hr^{-1}$), butorphanol ($52\ nmol \cdot hr^{-1}$) plus naloxone ($5.2\ nmol \cdot hr^{-1}$, 10%), butorphanol ($52\ nmol \cdot hr^{-1}$) plus naloxone ($10.4\ nmol \cdot hr^{-1}$, 20%), morphine ($26\ nmol \cdot hr^{-1}$), or morphine ($26\ nmol \cdot hr^{-1}$) plus naloxone ($2.6\ nmol \cdot hr^{-1}$, 10%). Six hours after the infusion, each rat was challenged by a single *it* dose of either 52 nmol butorphanol (in the saline- and butorphanol-infused groups) or 26 nmol morphine (in the saline- and morphine-infused groups). Radiant-heat tail-flick test was done every 15 min for 2 hr after the challenge dose. Areas under the curves (AUCs) of the time-response (tail-flick) plots of the challenge doses assessed the extent of the tolerance development.

Results: The AUCs of the challenge dose decreased ($P<0.01$) in the butorphanol- and morphine-infused groups, compared to the saline-infused controls, demonstrating the development of analgesic tolerance. As measured by the AUCs of the challenge dose, the 20% (but not the 10%) naloxone coinfusion inhibited the tolerance development to *it* butorphanol, while the 10% naloxone coinfusion was sufficient to inhibit that to *it* morphine.

Conclusion: Analgesic tolerance develops with both chronic *it* butorphanol and morphine infusion through opioid receptors, as the tolerance was blocked by naloxone coinfusion. However, compared to morphine a higher concentration of *it* naloxone is needed to block the butorphanol-induced tolerance. Probably, different opioid receptors with different affinities to naloxone are involved in the tolerance development. Future studies delineating the various receptors' participation will provide insights into the mechanisms of the tolerance and guide development of ways to combat it.

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B

SPINAL NMDA RECEPTOR REGULATION UPON TOLERANCE DEVELOPMENT TO INTRATHECAL OPIOIDS

Brian K. Tsang, MD, Tangeng Ma, PhD*, Wichai Wongchanapai, MD*, Zhi He MD, Ing K. Ho, PhD*, and John H. Eichhorn, MD
Dept. of Anesthesiology, and *Dept. of Pharmacology & Toxicology, University of Mississippi Medical Center, Jackson, MS 39216, USA

Introduction: Recent studies have shown that the NMDA receptor system participates in the development of tolerance induced by systemic and intrathecal (*it*) opioids and that preemptive NMDA blockade can prevent the development of tolerance (1,2). In this study, we used quantitative autoradiography (3) to examine changes in spinal NMDA receptors.

Methods: After approval by the Institutional Animal Care and Use Committee, 15 male Sprague-Dawley rats, 250-300 grams, were randomly assigned to three groups to receive lumbar *it* saline, butorphanol (52 nmol/h) or morphine (26 nmol/h) for 96 hr. At the end of the infusion, the spinal cord was removed, then frozen by immersion in liquid nitrogen. Ten transverse sections, 14 μm thick, were cut from lumbar spinal cords of five animals in each group. The binding of [^{3}H]-MK-801(a highly selective ligand for the NMDA receptors) assessed the NMDA receptor density by quantitative autoradiography (3). After the binding, the film autoradiograms were developed, fixed, scanned and quantified by densitometry.

Results: The [^{3}H]-MK-801 binding in the lamina I/II and V of the lumbar spinal cord was decreased in the butorphanol-tolerant group (20.5% and 30.0% decrease, respectively), but increased in the morphine-tolerant group (14.1% and 16.5% increase, respectively), compared to the saline-infused controls (one-way ANOVA, $P < 0.05$). There were no differences in the [^{3}H]-MK-801 binding in the ventral horns of the spinal cords in all three groups.

Conclusion: Butorphanol, a κ-agonist and μ-antagonist, and morphine, a μ-agonist, have opposite effects on NMDA receptor regulation in the lamina I/II and V, where most nociceptive inputs are processed. Further studies are warranted to see whether combining the two opioids in *it* administration would cancel out their respective effects on the NMDA receptor system, and possibly prevent the development of tolerance to both opioids.

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A

SPINAL MORPHINE INDUCES PHYSICAL DEPENDENCE THROUGH μ-, δ-, BUT NOT κ-OPIOID RECEPTORS.

Brian K. Tsang, MD, Wichai Wongchanapai, MD,* Zhi He MD, Ing K. Ho, PhD,* and John H. Eichhorn, MD
Dept. of Anesthesiology, and *Dept. of Pharmacology & Toxicology, University of Mississippi Medical Center, Jackson, MS 39216

Introduction: As chronic infusions of intrathecal (*it*) morphine have recently gained acceptance in treating nonmalignant pain, physical dependence to *it* morphine becomes an important issue. Previous studies have demonstrated that dependence on *it* morphine develops primarily in the spinal cord (1,2), and withdrawal signs can be precipitated by *it* naloxone (3). This study investigates the relative contribution of opioid receptors in the development of physical dependence induced by *it* morphine.

Methods: After approval by the Institutional Animal Care and Use Committee, 48 male Sprague-Dawley rats, 250-300 g, received 96 hours of *it* infusion ($1 \mu l \cdot hr^{-1}$) of saline or morphine ($26 \text{ nmol} \cdot hr^{-1}$) from an osmotic mini-pump (Alzet 2001) via microspinal catheters. Three hours after the infusions were terminated, each rat received a dose (48 nmol, 10 μl) of *it* CTOP (μ-antagonist), naltrindole (δ- antagonist) or nor-binaltorphimine (κ-antagonist) followed by a 10 μl saline flush. The animals were intensely observed for 30 minutes for the appearance of 12 withdrawal signs (wet shakes, tooth chattering, rearing, locomotion, stretching, scratching, digging, grooming, penis licking, forepaw tremor, vocalization, and ptosis). One point was given for each sign present and summation of the points yielded a score.

Results: For CTOP-precipitated withdrawal signs, the morphine-infused group showed increases in wet shakes, tooth chattering, locomotion, stretching and ptosis, as well as in the summation score, compared to the saline-infused group ($P<0.05$, χ^2). For naltrindole-precipitated withdrawal signs, the morphine-infused group showed increases in one withdrawal sign (locomotion) and in the summation score, compared to the saline-infused group. There are no differences in the nor-binaltorphimine-precipitated withdrawal signs and summation scores between the two groups.

Conclusion: Ninety-six hours of *it* morphine infusion ($26 \text{ nmol/} \cdot hr^{-1}$) resulted in significant physical dependence mediated in the spinal cord. The dependence involves μ->> δ-, but not κ- opioid receptors. Therefore, any future intervention aimed at preventing or reversing the dependence on *it* morphine should focus on μ- and δ-opioid receptors.

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B

METHYLNALTREXONE DOES NOT ATTENUATE HIGH DOSE FENTANYL INDUCED SUPPRESSION OF THE CORTISOL RESPONSE TO SURGERY.

Damian B. Murphy MD FFARCSI & M.B. Murphy MD FRCPI
Department of Pharmacology and Therapeutics, University College Cork, Ireland.

Introduction: Attenuation of the stress response is considered desirable as increased levels of stress hormones may promote haemodynamic instability, intraoperatively and increase post operative catabolism [1].Fentanyl has been reported to suppress the cortisol response to surgery.[2] Methylnaltrexone is a novel peripheral opioid antagonist with ability to reverse the peripheral side effects of opioids while maintaining their centrally mediated analgesic effect.[3]. The aim of this study was to (I) to confirm the site of opioid inhibition of the hypothalmic-pituitary adrenal (HPA) response to stress and (II) if methylnaltrexone (MNTX) would modify fentanyl induced suppression of cortisol response during surgery

Methods: 36 guinea pig were randomized to 6 groups. Anaesthesia was induced with halothane in nitrous oxide and oxygen and animals were subjected to standard surgical stimulus. Vehicle or drug was administered post induction but pre-incision. Group 1 acted as a control, Group 2 received fentanyl 20 μg/kg, Group 3 MNTX 5mg/kg, Group 4 Naltrexone 2mg/kg, Group 5 Fentanyl 20μg/kg +MNTX 5mg/kg and Group 6 Fentanyl 20μg/kg+NTX 2mg/kg.
Serum cortisol values were measured after induction (A), just prior to incision (B), and at 15 (C) 45(D), 90(E) mins after surgery commenced.Difference in cortisol values between groups were analysed using Students t tests and ANOVA as appropriate.

Results: Plasma cortisol values increased during surgery in the control group. Fentanyl decreased plasma cortisol levels at (C,D,E) when compared to control (P<0.03). The combination of MNTX +Fentanyl resulted in lower serum cortisol values when compared to (I) control (P <0.05), or (II) NTX +Fentanyl group (P0<0.05) and (III) did not differ from the Fentanyl alone group.
Cortisol values in the Fentanyl +NTX group did not differ from control. Plasma cortisol levels in MNTX or NTX group did not differ significantly from control.

Conclusion: The data suggests that MNTX the peripheral opioid antagonist does not attenuate the beneficial effects of high dose Fentanyl induced suppression of the cortisol response to surgery. Fentanyl induced suppression of the HPA axis is centrally mediated

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CHOLINERGIC MECHANISMS MEDIATING PROPOFOL-INDUCED LOSS OF CONSCIOUSNESS IN MAN.

Vincent Bonhomme MD, Pascal Meuret MD, Steven B. Backman MD PhD, Gilles Plourde MD MSc, Pierre Fiset MD. Department of Anaesthesia, Royal Victoria Hospital and McGill Univ., 687 Pine Ave. West, Montreal, QC, H3A 1A1.

INTRODUCTION

The purpose of this study was to test the hypothesis that the loss of consciousness induced by propofol involves depression of central cholinergic transmission.[1] First, we evaluated the ability of the centrally-acting anticholinesterase drug physostigmine to reverse the propofol-induced loss of consciousness. Second, we determined whether the non-selective muscarinic antagonist scopolamine blocks the physostigmine-induced reversal of the loss of consciousness produced by propofol.

METHODS

In 14 healthy volunteers (19-31 yrs, Ethics Committee approval), loss of consciousness was produced by infusion of propofol titrated to achieve stable target plasma concentrations (2-4 $\mu g.ml^{-1}$) using a computer-controlled infusion.[2] Arterial plasma concentration of propofol was determined by HPLC. Loss of consciousness was assessed by the inability to open eyes, and quantified by the electro-oculogram. CNS function was measured by the 40-Hz auditory steady-state response (ASSR, Cz-M2) and the Bispectral Index™ (BIS, C3-M2). Physostigmine (28 $\mu g.kg^{-1}$) and NaCl 0.9% were administered sequentially in a randomized, double-blind design while maintaining a stable propofol plasma concentration (n=10). Scopolamine (8.6 $\mu g.kg^{-1}$) was administered 60 min prior to physostigmine (n=4). ANOVAs and Tuckey's HSD were used for comparisons between groups. A rank order correlation test (Pk) was used to assess correlation between ASSR or BIS and the presence or the absence of consciousness.[3]

RESULTS

Unconsciousness was produced at a plasma propofol concentration of [mean(SD)] 3.32(0.92) $\mu g.ml^{-1}$ (n=14). ASSR and BIS were significantly reduced (33 (30) % baseline, P<0.05; 59(11) % baseline, P<0.0001, respectively) when consciousness was lost. Physostigmine clearly reversed unconsciousness in 9/10 subjects, and also reversed the depression of the ASSR (129(70) % baseline, P<0.01) and BIS (79(10) % baseline, P<0.001). Propofol plasma concentration just before physostigmine injection (unconsciousness) and after recovery of consciousness was 2.99 (0.65) and 3.05 (0.96) $\mu g.ml^{-1}$ respectively. Scopolamine pretreatment blocked the physostigmine-induced return to consciousness in 4/4 subjects, and the reversal of ASSR (30 (17) % baseline) and BIS (58 (9) % baseline) depressions. ASSR and BIS were significantly correlated with the presence or absence of consciousness (Pk = 0.937 and 0.981, respectively).

CONCLUSIONS

The loss of consciousness produced by propofol is mediated at least in part by a decrease in central cholinergic muscarinic transmission. The ASSR and BIS closely reflect CNS processes mediating consciousness.

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EFFECTS OF EDROPHONIUM ON SYMPATHETIC GANGLIONIC TRANSMISSION.

Reuben D. Stein PhD; Steven B. Backman MDCM, PhD, FRCPC; Brian Collier PhD; Canio Polosa MD, PhD. Depts. Anaesthesia, Physiology & Pharmacology, McGill University, 687 Pine Ave. West, Montreal, QC, H3A 1A1

INTRODUCTION

We tested whether edrophonium (EDRO) blocks transmission in the superior cervical ganglion (SCG) by studying its effect on the postganglionic compound action potential (CAP) evoked by stimulation of preganglionic axons. The effect of neostigmine (NEO) was assessed to determine if the block produced by EDRO is secondary to cholinesterase inhibition. To test for a pre-synaptic action, the amount of ACh released from the SCG was compared in the presence and absence of EDRO. To evaluate a post-synaptic action we studied the ability of EDRO to block the postganglionic cell firing evoked by exogenously administered ACh.

METHODS

Following Ethics Committee approval, rats (n=35) were anesthetized (sodium pentobarbital, 35 $mg.kg^{-1}$ *ip*). In one set of *in-vitro* experiments on the SCG the cervical sympathetic trunk and the internal carotid nerve were drawn into bipolar suction electrodes for stimulating and recording, respectively. Drugs superfused included EDRO (0.1-1mM, n=7), NEO (0.1-10 μM n=4), and muscarinic M_1 and M_2 antagonists pirenzepine (PZP, 200 nM-10 μM, n=2) and AFDX-116 (200 nM-10 μM, n=2), respectively. In a second set of *in-vitro* studies (n=14), the effect of EDRO (500 μM) on basal and high-K^+ (40mM) evoked release of [^{3}H]ACh from SCG was determined. In a third set of *in-vivo* experiments (n=6), the effect of EDRO (5-10 $mg.kg^{-1}$ *iv*) on SCG multifibre postganglionic nerve discharge in response to close arterial injection of ACh (100μg) was determined.

RESULTS

EDRO (10 μM - 500μM) caused a decrease in the CAP (ED_{50} 163.5±25.5 μM, n=7). This decrease was not produced by NEO, nor was it reversed by PZP or AFDX-116. While EDRO did not effect the spontaneous ACh release(control: 52±7dpm.min^{-1}; EDRO: 50±9dpm.min^{-1}) it did reduce the high-K^+ evoked ACh release (control: 1232±80% increase; EDRO: 862±100% increase, $p<0.005$). EDRO produced block of postganglionic cell firing in response to exogenously administered ACh.

DISCUSSION

These data show that EDRO blocks ganglionic cholinergic transmission pre- and post-synaptically. The mechanism(s) by which this occurs does not appear to involve inhibition of cholinesterase, or activation of M_1 or M_2 receptor subtypes. These findings may help to explain the clinical observation that less muscarinic antagonist is required to blunt the parasympathomimetic effect of EDRO[1] compared to NEO[2].

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DANTROLENE POTENTIATES THE INHIBITORY EFFECT OF NIFEDIPINE ON NITRIC OXIDE PRODUCTION IN RAT AORTIC SMOOTH MUSCLE CELLS TREATED WITH LIPOPOLYSACCHARIDE AND INTERFERON-γ

Chi-Yuan Li MD, Tz-Chong Chou PhD, Jia-Yi Wang PhD Departments of Anesthesiology, Tri-Service General Hospital, and Physiology, National Defense Medical Center, Taipei, Taiwan, R.O.C.

INTRODUCTION

It has been demonstrated that several different Ca^{2+} channel antagonists protect against cardiovascular failure and prolong survival time in various models of endotoxin shock. Intracellular free calcium concentration plays an important role in the metabolic abnormalities during sepsis. The present study is to examine the effects of dantrolene, an inhibitor of Ca^{2+} release from sarcoplasmic reticulum and nifedipine on nitric oxide (NO) as well as tumour necrosis factor-α (TNF-α) production induced by lipopolysaccharide (LPS) plus interferon-γ (IFN-γ) in rat aortic smooth muscle cells (ASMC).

METHODS

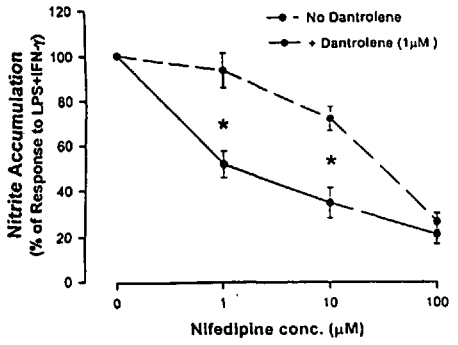
Aortic smooth muscle cells isolated from Spraque-Dawley rats were used in this study. After incubation of ASMC with dantrolene (1 to 100 μM) alone or in combination with nifedipine (1 to 100 μM) and LPS (100 $\mu g \cdot ml^{-1}$) plus IFN-γ (100 $u \cdot ml^{-1}$) for 24 hr, the cell-free medium was removed for measuring the nitrite and TNF-α levels by Griess reaction and ELISA kit, respectively.

RESULTS

In ASMC, (i) dantrolene (1 to 100 μM) dose-dependently suppressed the production of nitrite and TNF-α induced by LPS plus IFN-γ and (ii) dantrolene (1 μM) potentiated the inhibitory effect of nifedipine on the production of nitrite and TNF-α in response to LPS plus IFN-γ.

DISCUSSION

The present study suggests that dantrolene (at low dose) potentiated the inhibitory effect of nifedipine on NO as well as TNF-α production in ASMC treated with LPS plus IFN-γ and might provide new therapy for endotoxic shock.



A B

ANAESTHESIA RESIDENCY PROGRAM SELECTION: FACTORS OF IMPORTANCE TO TRAINEES

John Fuller MD, Ronald Butler*MD, Salvatore Spadafora, MD, Departments of Anaesthesia, St. Joseph's Health Centre and*London Health Sciences Centre, London, ON. N6A4V2

INTRODUCTION: The purpose of this study was to determine the factors trainees consider in making their final anaesthesia program selections in the Canadian Residency Matching Service (CaRMS) rank order list.

METHODS: Thirty-six medical student applicants for PGY-1 positions in 1997 who interviewed with our residency program were surveyed using an open-ended questionnaire.

Surveys were sent out upon completion of the 1997 CaRMS match. Interviewees were asked to give the primary reason behind their ultimate choice of individual anaesthesia program.

RESULTS: Of the 36 eligible trainees, 21 replied for an overall response rate of 58%.

Of the eligible trainees, 19 selected and matched to the specialty of anaesthesia. Fifteen of these 19 candidates who selected anaesthesia responded to the questionnaire, providing a 79% response rate of the targeted trainees.

Selection Factors Used By Trainees Matched To Anaesthesia Programs

Ultimate Selection Criteria	#	%
Program Quality	4/15	27%
Geographic Location	5/15	33%
Family Home Location	6/15	40%

DISCUSSION: While our numbers are small, the response rate of almost 80% of the target population is notable.

A similar survey of applicants to U.S. anaesthesia programs found geographic location and program quality were the highest ranked factors used by candidates in selecting among anaesthesia residency programs. [1]

The important finding of our survey is that many Canadian trainees base their selection of anaesthesia training program on factors which are entirely external to the programs being considered. These results should help residency programs channel their recruiting efforts.

The results may also have implications for selection and recruitment of medical school entrants as well as the location of new training programs.

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DAILY RESIDENT LOG SHEET - EDUCATIONALLY USEFUL AND VALUABLE

Neil Donen FRCPC, Laurence Brownell FRCPC. Department of Anesthesia, University of Manitoba, LB315-60 Pearl Street, Winnipeg, MB. R3E 0Z3

INTRODUCTION

In Canada, anesthesia residents are not required to document their case loads or case experience. In order to identify and document what experiences the residents were being exposed to, a daily log sheet, documenting the information was instituted at the University of Manitoba. Each resident was required to record a daily tally of anesthesia cases managed and procedures undertaken. Log sheets are turned in monthly and the information entered into a database. Tabulated individual results and a running average of cases and procedures by peers are provided to both residents and resident site-coordinators on a regular basis.

METHODS

All data is collated and entered into a relational database (RBASE 4.5++, Microrim Inc.) by one of the authors (ND). Information is recorded under a series of broad areas (adult anesthesia - adult cases, special cases, procedures and techniques; pediatric anesthesia - age groupings, neonatal anesthesia, pediatric cases, special cases, procedures and techniques; and obstetric anesthesia - special cases and procedures). Data analysis is also available by rotation and hospital. Patients seen in the chronic pain clinic and in the critical care areas are excluded from analysis.

RESULTS

Adult anesthesia:- Exposure to adult cases appears to be well balanced. Eleven percent of cases are over age 75 yrs. Residents averaged 28 awake intubations during their training. Regional anesthesia was employed in 33% of cases.

Pediatric anesthesia:- Most children were between ages 1 and 5 years (42%). Twenty-two percent of cases had a regional anesthetic technique performed, the large majority being caudal anesthesia for post-operative analgesia.

Obstetric anesthesia:- Residents averaged 270 regional procedures, the large majority being epidurals (68%). General anesthesia was provided in 7% of cesarean sections.

Community hospitals:- Differences in case loads and procedures were noted between individual tertiary and community hospitals. However, there were comparable frequency of cases when community hospitals were grouped together and compared to the tertiary care institutions.

DISCUSSION

The daily log system has enabled us to ensure a balanced exposure to cases by trainees. It has proved simple and easy to implement at a low cost.

ANESTHESIA CRITICAL INCIDENTS DURING RESIDENCY TRAINING

Neil Donen FRCPC, Laurence Brownell FRCPC

Department of Anesthesia, University of Manitoba. 315-60 Pearl Street, Winnipeg, Manitoba. R3E 0Z3

INTRODUCTION

Discussions at previous CAS meetings questioned whether residents are able to manage critical incidents because of an apparent low frequency of such occurrences. Since 1990 the Department of Anesthesia at the University of Manitoba has had a daily resident evaluation and feedback system in place. Included on the form is space for documentation of any critical incidents. These are defined as any event in the perioperative period which may be life threatening or have the potential to severely compromise the patient. To respond to this concern we undertook a retrospective analysis of the daily evaluation forms at one institution.

METHODS

1500 forms were analyzed. All critical incidents were entered into a relational database, RBASE 4.5++ (Microrim Inc.). Incidents were grouped as either patient, surgical or anesthetic related. Nineteen major factors were used to better define the occurrences. Groupings and occurrences were analyzed according to level of training.

RESULTS

A total of 307 (20.5%) critical incidents were identified. The table below shows the frequency of distribution

Training level	*percent distribution*	*patient related(%)*	*surgical related (%)*	*anesthesia related (%)*
PGY2	20.4	31.6	10.7	58
PGY3	23.7	24.4	14.4	61.1
PGY4	17.3	36.8	34.2	28.9
PGY5	15.6	53.3	26.7	20

Cardiovascular and Respiratory (including airway) occurrences were the most frequent, 39.4% and 20.2% respectively. There was a 17.3% incidence of equipment related critical incidents. These were highest amongst the senior residents. Drug errors constituted 5.8% of all incidents, occurring almost exclusively amongst the junior residents.

DISCUSSION

Our data indicates that critical incidents are not a rarity and that residents appear to identify and manage these promptly and appropriately. We have instituted a greater vigilance program amongst junior residents regarding drug identification. Similarly senior residents have been made aware of the greater potential of equipment malfunction.

THE CANADIAN AND U.S. PERSPECTIVE ON SETTING THE COMPETENCY LEVEL FOR RESIDENTS: MINIMUM NUMBERS OF CASES AND PROCEDURES.

Sandy Shysh MD FRCPC, Keith Carter MD FRCPC, and Chris Eagle MD FRCPC.

Department of Anaesthesia, Foothills Medical Centre at The University of Calgary, 1409 - 29th Street N.W., Calgary, Alberta, T2N 2T9

PURPOSE

To determine the average number of cases and the procedures done by anaesthesia residents at the Foothills Medical Centre (FMC) at The University of Calgary, Canada. Then, to compare these actual numbers to those suggested by the U.S. Residency Review Committee (RRC)[1] and in the Canadian literature (CAN)[2] as the "minimum" numbers to ensure competency.

METHODS

Data were obtained from the hospital's operating room computer database that was taken directly from coded anaesthetic records. For each resident, the actual number of cases and procedures in the study period was extrapolated to reveal the expected number of cases and procedures to be done over the entire residency. Anaesthesia residents included in the study completed at least six months of adult anaesthesia training over the 16 month study period from September 1994 to December 1996. Cardiac, obstetric, and pediatric cases were excluded.

RESULTS

A total of 4,962 cases done by 18 Postgraduate Year (PGY) 1-5 residents were identified. There were no statistically significant differences in the numbers of cases or procedures performed between the PGY groups. The following table compares the suggested "minimum" numbers to the actual numbers done:

	Suggested Minimum		Actual Numbers	
	RRC[1]	CAN[2]	CAN[2]	FMC
(over *x* years)	3	4	4	3
Total cases*	325	–	–	1140
Spinals	50	60	48	63#
Epidurals†	(50)	–	–	33
Arterial lines	60	40	108	231#
Central lines	60	27	68	111#
Swan-Ganz	60	40	37	45#

* excluding cardiac, obstetric, and pediatric cases.
† excluding cesarean sections and labour epidurals.
# $p<0.001$ (one-way ANOVA) vs. actual CAN[2].

In their residency, residents at FMC are very likely to surpass the "minimum" numbers of cases and procedures as suggested in the literature. In fact, residents at FMC performed significantly more spinals, arterial lines, central lines, and Swan-Ganz catheterizations than the actual numbers done by the "average" resident in the study by Duncan et al.[2]

DISCUSSION

While these results are comforting, setting specified "minimum" numbers to any procedure in order to ensure a minimal competency level by all trainees has not been shown for any skill. Different individuals will attain proficiency in different skills at different rates. Instead of arbitrarily setting "minimum" numbers for cases and procedures, perhaps proper evaluation mechanisms should be used to determine whether the trainee indeed has achieved competent performance of a skill.

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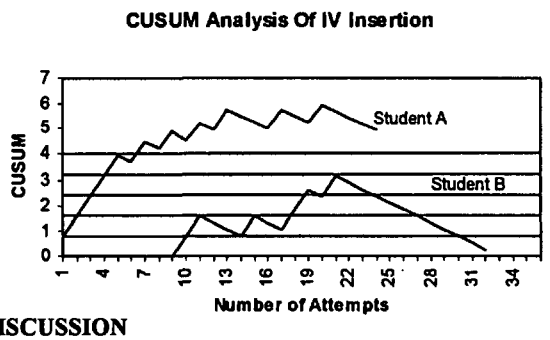
CUSUM ANALYSIS OF INTRAVENOUS INSERTION BY MEDICAL STUDENTS: HOW MANY MUST BE DONE BEFORE A STUDENT ATTAINS COMPETENCE?

Isabella Devito MD, FRCPC, Stephen Halpern MD, M Sc, FRCPC
Affiliation: Departments of Anaesthesia, Mount Sinai Hospital, Women's College Hospital, Toronto, Ontario

INTRODUCTION
Cusum (Cumulative Sum) analysis has been used in industry for quality control. It has been described as statistical measure of competence in medical procedures[1,2]. We used cusum analysis to objectively determine how many intravenous (IV) insertions are required by medical students to become competent.

METHODS
REB approval and informed consent were obtained. All students doing an anaesthesia rotation at Women's College Hospital kept a log of the number of IVs attempted in surgical patients and the number that were successful. Students were allowed only one attempt per patient. To devise the cusum plan, a failure rate between 15% (target) and 20% (upper limit) was considered acceptable. Students were also asked how confident they were with respect to IV insertion prior to the rotation and at the end of the rotation. The cusum scores for each student were plotted against the number of procedures. Students who remained "in control" as defined by the cusum plan were considered competent at the end of the rotation.

RESULTS
8 students were studied. The number of IVs attempted ranged from 17-60. 4 students attained competence at IV insertion. All those that became competent had greater than 30 attempts, (range 32-60). The number of attempts ranged from 17 to 29 for those that did not. 7 of the 8 students did not feel confident at the start of the rotation, but all students felt confident at the end of the rotation. The cusum of 2 students are shown in the figure. Student B became competent, student A did not.



DISCUSSION
During medical school, students are expected to become competent in certain procedures such as IV insertion. In many medical schools, their only exposure to this procedure is their anaesthesia rotation. This study demonstrates that students require a minimum of 30 attempts at IV insertion before they can achieve competence at this procedure. Anaesthesia rotations in medical schools should be designed to provide a minimum of 30 attempts at IV cannulation.

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A

EVALUATION OF ANAESTHETIC PRACTITIONER CLINICAL PERFORMANCE

J Hugh Devitt MD MSc FRCPC, Doreen A Yee MD FRCPC, John L deLacy MBBS FRCPC, Donald C Oxorn MDCM FRCPC

Sunnybrook Health Science Centre, University of Toronto, 2075 Bayview Ave Toronto, Ontario, M4N 3M5.

INTRODUCTION There is an increasing demand by medical licensing authorities and governance structures for evaluation of physician clinical performance. Our academic department has offered an anaesthesia evaluation program since 1993. The following is a report of our experience.

METHODS All participants signed a consent for evaluation and were interviewed on the first day of a two week assessment period to determine their scope of practice. Candidates then received an orientation and familiarization of the drug carts, anaesthetic machines, policies, procedures and general organization of the operating room. Participants were booked into appropriate lists with one of two assessors, who observed clinical performance and questioned the physician on a wide range of aspects of perioperative care. The cases on the list were used to stimulate questions that probed the candidate's knowledge base. A daily evaluation form was completed by the assessor and listed all the cases done, observations, and specific discussions on various topics. The candidate was judged daily in 9 areas (Table) with a three point scale: unsatisfactory=0, satisfactory=1 and outstanding=2. The score for each category was averaged over the nine day assessment period and tabulated for comparison purposes. At the end of the two week assessment period, a conference of the two reviewers was conducted to rank candidates into one of the six competence categories developed by the College of Physicians and Surgeons of Ontario (CPSO). A full report was submitted to the referring body.

RESULTS Over a four year period, six anaesthetists were referred for evaluation, two from a provincial licensing body and four from department heads. The average scores by category on the daily evaluation form are presented in the table (1=satisfactory). The overall competence evaluation of candidates by the two assessors was as follows: two individuals displayed the ability to be competent and safe with moderate deficiencies, two individuals demonstrated serious competency deficiencies requiring practice supervision and two individuals demonstrated very serious competency deficiencies and were considered unsafe to remain in independent practice.

Table

Category	Score
Preop Assessment	0.8
Anaesthetic Plan	0.8
Intraop Management	0.6
Postop Management	0.9
Judgment	0.7
Knowledge	0.4
Technical Skills	0.9
Self Assessment	0.6
Documentation	0.7

DISCUSSION Assessment of clinical competence is a challenging process. Direct observation of clinical performance may have value as an assessment tool but may be prone to subjective impressions. Further validation of our evaluation methods is needed. This process could be achieved by comparing scores generated form clinical observation with other test methods such as written examinations or simulation based assessments.

B

THE INFLUENCE OF HEALTH CARE REFORM ON GP ANAESTHESIA SERVICES IN SASKATCHEWAN

Gary F. Morris MD FRCPC, Raymond W. Yip MD FRCPC

Department of Anaesthesia, Royal University Hospital, University of Saskatchewan, 103 Hospital Drive, Saskatoon, Saskatchewan, S7N 0W8

INTRODUCTION

GP anaesthetists[1] exclusively provide anaesthetic services in hospitals outside of major urban centres in Saskatchewan. The volume of services provided varies greatly between communities and among practitioners. Health care reform had established local boards to manage the resources within each of 31 regional districts by early 1994. We wished to examine the change in GP anesthesia manpower and volume following this change.

METHODS

The Medical Care Insurance Branch of Saskatchewan Health (MCIB) supplied historical billing information which was analyzed to estimate anaesthetic volumes for each community providing anaesthesia services and the workload for each GP anaesthetist within the province for the periods May 1, 1994 to April 30, 1995, and May 1, 1996 to April 30, 1997.

RESULTS

Number of communities by annual hours of GP anaesthesia services billed

Hours	1995	1997
< 10	9	4
10-50	6	6
50-200	1	2
200-1000	9	9
> 1000	6	5
total	31	26

Number of GP anaesthetists by annual hours of services billed

Hours	1995	1997
< 10	27	22
10-50	15	14
50-200	21	18
200-1000	26	22
> 1000	6	6
total	95	82

GP anaesthetists provided 21.7% of all anaesthesia services in 1994-5 and 19.1% in 1996-7. Seven communities and 36 physicians that had provided services in 1994-5 no longer provided this service in 1996-7. Two communities and 23 physicians were added to the 1994-5 list of anaesthesia providers in 1996-7 assessment. Of these new GP anaesthetists, 15 submitted claims to MCIB for less than 10 hours of anaesthetic services annually and only 6 had billed for more than 50 hours.

DISCUSSION

The ability to deliver anaesthetic services within a community greatly adds to the service profile and community value of a local hospital. There has been a modest decrease in community hospitals providing anaesthesia services since the introduction of local health boards. Sharing of resources both within and across health districts may allow for expansion of regional services while coping with limited financial resources. However, even with regionalization, many hospitals continue to deliver infrequent anaesthetic services despite significant associated costs. Anaesthesia practice requires the continued practice of technical skills to maintain proficiency as well as an access to continuing education. More than 40% of GP anaesthetists in Saskatchewan practice less than 50 hours annually. Creative approaches for maintenance of competence should be explored.

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Propofol vs Fentanyl and Midazolam as Sedation for Pediatric Gastrointestinal Endoscopy

M.G. Gregoret-Quinn MD, R.F. Seal MD FRCP, L.J. Smith MD FRCP, A.B. Jones MD FRCP, C. Tang MD FRCP, A.S. Clanachan PhD, B.J. Gallant RRT, L.A. Nadwidny MD FRCP
Department of Anaesthesia and Department of Paediatric Gastroenterology, University of Alberta Hospital, Edmonton, Alberta, T6G 2B7

Introduction: The use of sedation for pediatric gastrointestinal endoscopy (PGE) is a valuable adjuvant for both practitioner and patient[1]. Techniques utilizing combinations of benzodiazipines, opioids and tranquillizers for sedation have been found to be lacking, with prolonged recovery times and inadequate endoscopy conditions experienced[2]. Studies have cited Propofol as a reasonable agent for pediatric procedures requiring sedation[3,4]. However, many of these studies compared Propofol to drugs such as Demerol and Diazepam, when shorter acting agents from the same drug classes do exist. Therefore, we proposed a study comparing the shorter acting Fentanyl (F) and Midazolam (M) in combination (FM) vs Propofol (P) as sedating medications for pediatric endoscopy.

Methods: With institutional ethical approval and parental consent, 60 pediatric patients scheduled for PGE, were randomized to receive either P or FM as sedation for the procedure. Patients in the P group received lidocaine 1mg/kg iv followed by an initial bolus of P 2.5mg/kg iv. Additional amounts of P were given in 0.5 mg/kg iv increments to establish and maintain sedation as needed. Patients in the FM group were also given an initial bolus, F 1ug/kg iv and M 0.1mg/kg iv. Supplemental doses of F 1ug/kg iv alternating with M 0.1 mg/kg iv every three minutes were also given for signs of inadequate sedation, judged by the anaesthetist, to a maximum dose of F 4ug/kg and/or M 0.4mg/kg. The Endoscopist, blinded to the medications given, graded the adequacy of sedation by rating the conditions using the "Endoscopist's Score"[2]. A second blinded observer then recorded the time required for the patient to awake, show spontaneous movement, eye opening, oral intake, and meet standard discharge criteria as markers. Any adverse events, during or after the endoscopy, were recorded. Comparisons using Fischer Exact and T tests at a 0.05 significance level were made.

Results: The groups were comparable with relation to age, weight and length of procedure. The mean dose of P was 7.5mg/kg vs 3.3ug/kg and 0.3mg/kg for F and M respectively. P achieved sedation quicker than FM, 2.24 +/- 1.0 vs 10.45 +/- 4.9 min ($p<0.0001$). Two of the 29 P patients required minor physical restraint compared to 11 of 31 in the FM group. Six of these 11, or 35% of the whole FM group, were considered protocol failures by reaching the dosage ceiling and still requiring excessive restraint. The endoscopist's score reflects better conditions provided by P compared to FM, 4.34 +/- 1.0 vs 6.77 +/- 3.8 ($p<0.0016$). P also allowed for a faster recovery than FM with return of purposeful movement at 21.24 +/- 13.1 vs 34.61 +/- 24.2 min ($p<0.01$) and meeting discharge criteria at 66.97 +/- 18.8 vs 120.65 +/- 31.2 min ($p<0.0001$). There was no statistical difference in hemodynamics measured and adverse events were few and of similar characteristics within the two groups.

Conclusion: Propofol (P) allows for faster sedation, better endoscopy conditions and a quicker recovery when compared to the combination of Fentanyl and Midazolam (FM) for PGE.

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Ondansetron Cost Effectiveness For Tonsillectomy in Children

Gerald V. Goresky,MD, Tara Cowtan, MD
Department of Anaesthesia at The University of Calgary
1820 Richmond Rd. SW, Calgary, AB T2T 5C7

Purpose: To quantify both the clinical and financial impact of ondansetron administration for postoperative vomiting in the first 6 hours post tonsillectomy.

Methods: This is a retrospective comparison of two patient groups. Hospital charts from children who sequentially underwent tonsillectomy with or without adenoidectomy between September 1, 1995 and November 30, 1995 were reviewed and patients were allocated into those receiving ondansetron and no ondansetron intraoperatively. The number of episodes of vomiting in the first 6 postoperative hours, hospital admissions for vomiting, and the effects of concurrent drug administration were compared between groups. Costs of administering ondansetron to all patients and estimates of the costs of hospital admission for vomiting with or without pain were calculated.

Statistical analysis

The Kruskal-wallis one-way analysis of variance was used to compare the Ondansetron and the No Ondansetron groups for vomiting. Logistic regression analysis was used to identify the effects of ondansetron, propofol, and midazolam on vomiting. A dose-response graph was developed to determine a threshold dose of ondansetron for vomiting. Ondansetron doses administered $\leq 0.05 mg \cdot kg^{-1}$ were compared with a dose $>0.05 mg \cdot kg^{-1}$ for vomiting, using Chi-square analysis.

Results:

	Ondansetron	No Ondansetron
Numbers (Total 149)	56	93
*Vomiting within 6 hours	15 (27%)	48 (52%)
*Vomiting >2 episodes	0%	15(16%)
*Unplanned Admissions	0	5

* Vomiting occurred with ondansetron: 39% with a dose $\leq 0.05 mg \cdot kg^{-1}$, and 5% with a dose $>0.05 mg \cdot kg^{-1}$.

* Propofol was associated with reduced frequency of vomiting, with or without ondansetron.

* = Significant difference between groups, where $p<0.05$

Charges for:	Home Province	Other Province	Self Insured
Day Surgery	Nil	$195	$439
Admission	Nil	$1315	$2959

Ondansetron $0.06 mg \cdot kg^{-1}$ estimated cost per patient was $7.33. Overnight closure of a post tonsillectomy ward could generate savings of $90,000 in nurse salaries, or a total cost savings of $1838 per night if all hospital expenses are included.

Conclusion:

1. Intraoperative IV ondansetron reduces the number of episodes of postoperative vomiting.
2. With a dose > $0.05 mg \cdot kg^{-1}$ postoperative vomiting can be reduced to <6% of patients in the first 6 hours postoperatively.
3. The need for hospital admission for vomiting with or without pain within 6 hours of surgery can be reduced if ondansetron is administered intraoperatively.
4. Cost savings generated from reducing the need for hospital admission vary according to the measures used.
5. Where the either the user pays or patients are from outside the home province, admission for persistent vomiting generates funds for the hospital.

A

ANALGESIC EFFICACY OF KETOROLAC 0.5% OPHTHALMIC SOLUTION (ACCULAR®) IN PAEDIATRIC STRABISMUS SURGERY

Hilary S Bridge MD, Carolyne J Montgomery MD, Ross A Kennedy MD, Pamela M Merrick BSN.
Department of Anaesthesia and Ophthalmology, University of British Columbia, B.C. Children's Hospital, 4480 Oak Street, Vancouver, B.C. V6H 3V4

INTRODUCTION: Intravenous ketorolac is an effective analgesic associated with a lower incidence of emesis in children undergoing strabismus repair.[1] Topical NSAIDs also reduce pain after eye surgery.[2,3] This prospective study was designed to assess the analgesic efficacy of ketorolac 0.5% ophthalmic solution (Acular®, Allergan) in paediatric patients undergoing extraocular muscle recession for correction of strabismus.

METHODS: Following institutional approval and informed written parental consent, 30 children, ASA PS I or II, aged 4 to 12 years were randomly assigned to receive ketorolac or placebo eye drops intraoperatively in a double blind fashion. After acetaminophen 20 mg/kg preoperatively a standard anaesthetic of propofol 5 mg/kg, lidocaine 0.3 mg/kg, atropine 20 mcg/kg and maintenance with halothane, N_2O and O_2 via a LMA was given. CHEOPS (4-13) and faces pain scale (FPS) scores (0-6)[4], eye rubbing and postoperative vomiting (POV) episodes were recorded. Standard analgesic rescue of morphine 20 mcg/kg IV for CHEOPS >8 and codeine 1.5 mg/kg PO for FPS ≥2 was given. After discharge data of FPS score, analgesics given and POV was collected for 24 hr.

RESULTS: 28 patients have completed the study. Preliminary analysis reveals no difference in demographic variables, number of eye muscles operated upon, anaesthetic time, time to discharge, CHEOPS and FPS scores, requirement for supplementary analgesia or in POV. POV in hospital was 4% overall. At 24 hours there was no difference in FPS scores or analgesic usage (85% received acetaminophen at home). Using CHEOPS scores as outcomes, power to find a 2 point reduction in the scores is ≥ 0.98.

	Control (n=12)	Ketorolac (n=16)	p value
Age (months)*	81 (50-149)	63 (51-117)	0.52‡
Max CHEOPS*	9 (6-11)	8 (6-11)	0.71‡
Max FPS (hospital)*	2 (0-5)	2 (0-5)	0.64‡
Max FPS (home)*	1 (0-6)	1 (0-4)	0.44‡
Total vomiting†	4 (33%)	2 (13%)	0.35¶
Morphine use†	6 (50%)	6 (38%)	0.51§

*median (range), †n(%) ‡Mann-Whitney, ¶Fisher Exact, §Chi^2

DISCUSSION: This study did not demonstrate improved postoperative analgesia when topical ketorolac eye drops were given in addition to acetaminophen. This observed lack of efficacy may reflect difficulties in the use of CHEOPS and FPS in this age group (54% <6 yr.) with this pain model. These scores may not differentiate nociceptive vs. affective stimulus intensity. This technique warrants further investigation in an older population.

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B

A simple paediatric epidural catheter introducer.

M . Yamashita, MD and K. Wada, MD
Department of Anaesthesiology
Ibaraki Children's Hospital
Mito, Ibaraki-Prefecture, 311-4145, Japan

Introduction: Epidural catheters of smaller gauges are used for continuous epidural anaesthesia in infants and children. These catheters are often difficult to introduce into the epidural space because of their small size and flexibility[1]. To overcome this problem, stiletted catheters or threading devices have been marketed. However, often these devices are only available in expensive paediatric epidural kits. We have found that a short piece of suction catheter tubing may serve as an epidural catheter introducer.

Methods: With ethics approval and parental informed consent, one hundred infants and children scheduled to undergo surgical procedures lasting over two hours were included in the study. For continuous epidural anaesthesia, we used a 19-gauge epidural needle (Uniever, Japan) and a 22-gauge epidural catheter (Vygon, France). We made an epidural catheter introducer from a 3cm long piece of 6-Fr suction catheter tubing (Termo, Japan) that had been re-sterilised. The introducer is threaded over the epidural catheter down to the hub orifice of the epidural needle. The catheter can then be advanced into the epidural space through this introducer.

Results: We attempted to place epidural catheters in 100 infants and children without the introducer , and we were able to pass the catheter only in 48 subjects. Using our introducer, we were able to advance the catheters into the epidural space in an additional 46 patients. The overall success rate of catheter advancement into the epidural space improved from 48 to 94 % ($P<0.005$, Chi-square analysis) utilizing our introducer. No dural penetrations occurred.

Conclusions: Our introducer is simple and inexpensive, but quite effective in passing the epidural catheter into the epidural space in infants and children.

Reference: 1. Anaesthesia 1994 ;49:832

DEVELOPMENT OF A MEASURE OF SURGEON SATISFACTION WITH ANESTHESIA SERVICES

(1) Sylvie Le May PhD (cand.), (2) Jean-François Hardy MD, FRCPC
(1) Ph.D student, Faculty of medicine (Biomedical sciences), University of Montreal, C.P. 6128, Succ. A, Montreal. (2) Associate professor, Department of anesthesia, University of Montreal, Montreal.

INTRODUCTION. Continuous quality improvement (CQI) is of increasing interest to anesthetists (1, 2). Since surgeons are one of their significant clients, it is important for anesthetists to include the level of satisfaction of surgeons regarding anesthesia services in their CQI efforts. The present study was designed to develop and test a Surgeon Satisfaction with Anesthesia Services (SSAS) scale.

METHODS. A pool of possible questions was first elaborated following discussions on the principal aspects of quality of services in anesthesia (3). The preliminary version of the instrument was then reviewed by three surgeons (external revision) from different specialties to achieve content validity (4). From their comments, a first version of the SSAS was elaborated. It consisted of 17 Likert type questions and 4 open-ended questions covering 5 major criteria concerning surgeons' satisfaction with anesthesia i.e. : clinical expertise, attitude and behavior, efficiency, trust, and communication. The instrument was then submitted for a pre-test to a group of 8 surgeons (convenience sample) in a university teaching hospital.

RESULTS. The response rate was 50% (4/8). In general, surgeons were satisfied with the clinical expertise of anesthetists and the consideration of their professional opinion by anesthetists (trust). But they indicated that : 1) anesthetists adopt a defensive attitude when discussing with them and they are not open to criticism (attitude and behavior), 2) they would like the staff anesthetist to be more present in the O.R. (efficiency), 3) induction should proceed more rapidly (efficiency), 4) more interdepartmental reunions be held (communication), 5) they should be more informed about anesthesia research (communication).

CONCLUSIONS. Surgeons are satisfied with the clinical expertise of anesthetists but our results suggest that anesthetists should encourage open discussion with surgeons in view of identifying targets for CQI by the department of anesthesia. A more extensive study using the SSAS scale and involving 250 surgeons is in progress for further validation of the scale.

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A COMPARISON OF MATERNAL SATISFACTION BETWEEN EPIDURAL AND SPINAL ANAESTHESIA FOR ELECTIVE CAESAREAN SECTION

Pamela Morgan MD*, Steven Halpern MD$^{\Psi}$,
Jana Evers RRT*
Departments of Anaesthesia, *Mount Sinai Hospital/The Toronto Hospital, $^{\Psi}$Women's College Hospital
University of Toronto
600 University Avenue, Toronto, Ontario M5G 1X5

INTRODUCTION

Patient satisfaction is an important issue in health care. Although spinal anaesthesia is now routine for Caesarean section, it is not known whether maternal satisfaction is better with this technique than with epidural anaesthesia.

METHODS

After REB approval, 24 patients participated in this pilot project. The study was prospective, randomized with patient, surgeon and data collector blinded to the regional technique used. Once consent was obtained, patients received either: epidural carbonated lidocaine, 1:200,000 epinephrine, 100 μg fentanyl and 4 mg morphine or spinal hyperbaric bupivacaine 0.75%, 10 μg fentanyl and 200μg morphine. Both surgeon and data collector waited 30 minutes before entry. Maternal satisfaction was assessed at 2 and 24 hours postpartum using a previously developed satisfaction scale. [1] Other data collected included: time to T4 block, vasopressor use, VAS and obstetrician satisfaction.

RESULTS

	EPIDURAL	SPINAL
SATISFACTION 2 HR. (Max. 154)	130.4 ±11.8 NS	120.7±15.5 NS
SATISFACTION 24 HR. (Max. 154)	129.2 ±17.1 NS	117.3±14.2 NS
VAS 24 HR (0-10)	8.28±1.29 NS	8.09±1.76 NS
OBSTETRICIAN SATISFACTION VAS (0-10)	9.90±0.17 * *p<0.05	9.27±0.96* *p<0.05
VASOPRESSOR USE (mg ephedrine)	19.2±12.2 NS	20.0±11.9 NS
TIME TO T4 BLOCK (mins)	14.75±4.09$^{\Psi}$ $^{\Psi}$p<0.01	6.42±4.58$^{\Psi}$ $^{\Psi}$p<0.01

17 of the 24 patients incorrectly assessed or did not know what regional technique they had received. Satisfaction scores are more sensitive than VAS since individual items can be identified. Good correlations were found between 2 and 24 hour scores and poor correlation between obstetrician and patient satisfaction.

DISCUSSION

Obstetrician satisfaction was higher in the epidural group but might be different if they had entered after establishment of the block. Although the sample size is too small to draw any conclusions, there is a trend towards higher maternal satisfaction with epidural anaesthesia for elective Caesarean section. We are continuing this work to determine the differences in maternal satisfaction with a larger sample size.

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A

SATISFACTION: RELATIONSHIP TO PAIN AND DROWSINESS FOLLOWING OUTPATIENT GENERAL ANAESTHESIA

P Ronaldson, DK Rose, F Dexter, MM Cohen, D Wigglesworth

The Departments of Anaesthesia, St. Michael's Hospital, the University of Toronto, Toronto, Ontario, and the University of Iowa, Iowa City, Iowa

Introduction: Patient satisfaction, although an important indicator of anaesthetic care, can be influenced by multiple factors including patient morbidity. Therefore, the amount of pain and drowsiness and the satisfaction following outpatient surgery was determined and the relationship of patients' pain and drowsiness to satisfaction was assessed.

Methods: Following Ethics approval, patients who had general anaesthesia for day care procedures (non-English speaking patients and ophthalmology and hand surgery patients excluded) were assessed 45 minutes after return to the second stage recovery room. Patients rated both pain and drowsiness on a visual analogue scale (VAS none - 0, worst - 10). Patients also completed a modified version of the Iowa Satisfaction with Anaesthesia Scale[ref], independent of any assistance. The questionnaire included 14 statements related to anaesthetic care (satisfaction - 3 statements, well-being -10, nursing care -1), e.g. "If I needed another anaesthetic I would want to have the same anaesthetic again", "I was satisfied with my anaesthetic care", "I felt pain", "I felt sleepy". Patients chose 1 of 6 responses ranging from "disagree very much" - score -3 to "agree very much" - score +3. Scores for negative statements were reversed such that a positive score indicated a desirable outcome. Mean VAS scores were calculated for pain and drowsiness, each of the 14 statements, and all statements combined. Cronbach's alpha was calculated to determine if responses to the 14 statements were correlated (<0.6 poor, >0.8 very good). Pearson's coefficient (r) was used to compare patients' pain and drowsiness scores with their responses to the statements (r = 0.3 medium validity, 0.5 high validity).

Results: One hundred and eighteen patients completed all aspects of the survey; 69% were female, 96% ASA 1 and 2, 83% <60 years, and 62% had an OR procedure <1 hr. Mean pain score was 3.3 ± 2.3, drowsiness 4.4 ± 2.7, and overall satisfaction score was 1.2 ± 0.8 (range -0.5 to 3.0). Only 5 of 118 patients had mean satisfaction scores <0. Pain and drowsiness VAS scores were highly correlated with statements on the questionnaire about pain and drowsiness. Three statements on satisfaction and one on well-being and their relationship to pain and drowsiness are noted in the table.

Statements	Mean Score (±sd)	r	
		Pain	Drowsy
"If I need another anaesthetic, I would like the same one."	2.6 ± 1.1	+0.1	0.0
"I felt safe."	2.7 ± 0.8	-0.1	0.0
"I was satisfied with my anaesthetic care."	2.7 ± 1.0	+0.1	+0.1
"I felt good."	0.7 ±1.8	-0.3*	-0.4*

*P<0.01 r = Pearson's coefficient

Conclusion: Although patients responded very positively to statements indicating satisfaction with anaesthesia care following outpatient surgery, pain and drowsiness were significant findings. Many "did not feel good", and pain and drowsiness were inversely related to "feeling good". However, pain and drowsiness were not related to questions which described satisfaction with anaesthesia care.

Ref. Anesthesiology 1997;84:867-73.

B

EPIDURAL ANAESTHESIA FOR CAESAREAN SECTION: DOUBLE-BLIND COMPARISON OF ROPIVACAINE, 7.5 MG/ML, AND BUPIVACAINE, 5 MG/ML. Desmond Writer FRCPC, Holly Muir FRCPC, Romesh Shukla FRCPC, Rob Nunn FRCPC, John Scovil FRCPC, Jeremy Pridham FRCPC, Ola Rosaeg FRCPC, Allan Sandler FRCPC, Patricia Morley-Foster FRCPC, Simon Lucy FRCPC, Lesley-Ann Crone FRCPC, Karen Zimmer MSc, Depts of Anaesthesia, Dalhousie University; Memorial University; U of Ottawa; North York Hospital; U of Western Ontario; U of Manitoba; U of Saskatchewan; Astra Canada.

INTRODUCTION. In the late 1970's, several maternal deaths from inadvertent intravascular bupivacaine administration prompted the search for safer local anaesthetics.[1] The s-enantiomer, ropivacaine, underwent extensive testing after withdrawal of 0.75% bupivacaine from obstetric practice, and phase 3 trials have confirmed its efficacy and safety. Less cardiotoxic than bupivacaine, it produces comparable sensory block, but less motor block in equipotent concentrations.[2] We report the results of a Canadian multicentre trial which assessed the safety and efficacy of 0.75% ropivacaine, when compared to 0.5% bupivacaine, for women undergoing elective caesarean section.

METHODS. After IRB approval and informed consent, 129 women were randomized to receive ropivacaine, 7.5 mg/mL (max. 187.5 mg), or bupivacaine, 5 mg/mL (max. 150 mg) for the procedure. After a 20-mL main dose, subjects could have up to two 5-mL increments, to achieve satisfactory block (>T6). We recorded maternal vital signs, ECG, SaO2 and noted time to onset of T6 block, maximum upper level and quality of sensory block, degree of motor block (modified Bromage scale), and time to regression of sensory and motor blocks. Neonatal evaluation included Apgar scores, and Neurologic Adaptive Capacity Scores (NACS). Adverse events were recorded for mothers and neonates.

RESULTS. Treatment groups were similar demographically and in ASA status, and subjects in both groups received comparable drug volumes. Onset, spread and regression of sensory block did not differ significantly between groups. Thirty-three (62%) of ropivacaine subjects vs. 19 (40%) bupivacaine recipients had grade 3 motor block ($P<0.05$), but time to regression of this block did not differ. Significantly fewer ropivacaine recipients had pain on insertion of the last suture (4 vs.17%:$P<0.05$). Quality of analgesia was statistically better with ropivacaine (89 vs. 74% excellent relief). No other significant differences emerged between groups.

DISCUSSION. These results suggest that epidural ropivacaine, 7.5 mg/mL (max. 187.5 mg) provides more effective sensory and motor block than bupivacaine, 5 mg/mL (max. 150 mg), for caesarean section. On these preliminary findings, ropivacaine, 7.5 mg/mL, appears at least as safe as the more dilute bupivacaine concentration.

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Study funding provided by Astra Canada.

THE EFFECTS OF PREOPERATIVE GLUCOSE ADMINISTRATION ON SPINAL-INDUCED HYPOTENSION IN ELECTIVE C/S DELIVERY

Deborah J. Wilson, MB.BS, Robert Heid, MD, M. Joanne Douglas, MD, Dan W. Rurak, PhD
Departments of Anaesthesia and Obstetrics, BC Women's Hospital, The University of British Columbia, Vancouver, B.C., Canada.

Introduction: Elective caesarean section delivery is commonly performed under spinal anaesthesia. A major side effect is hypotension, which is usually treated with fluid loading and/or vasopressor. An observational study by Marx[1], suggested that hypoglycaemia increases the incidence and severity of hypotension. This randomized, double blind study was designed to determine if preoperative intravenous glucose has an effect on the incidence, degree and ease of treatment of spinal-induced hypotension.

Methods: Following informed consent, ASA I, II parturients for elective c.s. were randomized to receive IV 5% glucose or NS (125 ml/hr). These solutions were enclosed in an opaque bag to maintain blinding. Following an IV bolus of NS (15ml/kg), spinal anaesthesia was induced with hyperbaric 0.75% bupivacaine, fentanyl and morphine. Hypotension, (SBP >20%), was treated with IV fluid and/or vasopressor. Data collected:demographics, glucose (fasting, time of spinal, delivery), blood pressure (baseline, q1 min. spinal-delivery), neonatal Apgars, umbilical blood gases, glucose and lactate. Power analysis indicated a sample size of 120 was required. Statistical analysis: student's t-test, Chi square or Fisher's exact test, as appropriate. $p<0.05$ was considered statistically significant.

Results: To date, the groups are similar with respect to age, height, weight, fasting time, total study solution received, total IV preload, neonatal Apgars, umbilical cord gases, glucose and lactate levels. Glucose levels($mmol.L^{-1}$); mean(range) and hypotension number (%) are shown (Table).

	Group A (n=35)	Group B(n=35)
Fasting glucose	4.36 (3.5-6.7)	4.41 (3.3-4.9)
Prespinal glucose	4.66 (2.8-8.6)	4.03 (2.9-5.8)
Delivery glucose	5.29 (3.6-8.6)	4.54 (3.0-8.0)
Hypotension	23 (65)	22 (65)
Fluid only	3 (8)	9 (25)
Fluid & vasopressor	20 (57)	13 (37)

Discussion: To date, 20/70 parturients had a fasting glucose<4.0 $mmol \cdot L^{-1}$ precaesarean. As the incidence of hypotension was similar in both groups it appears that preoperative administration of glucose (mean 1 g) was not a factor. This may be related to the small amount of glucose administered.

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PREVENTION OF SIDE-EFFECTS DURING CAESEREAN SECTION UNDER SPINAL ANAESTHESIA

Anna Fabrizi, M.D.; Chantal T. Crochetière, M.D.; Louise Roy, M.D.; Edith Villeneuve, M.D.; Louise Lortie, R.N.

Dept. of Anaesthesia, Hôpital Sainte-Justine, 3175 Côte Sainte-Catherine, Montréal, Qc, H3T 1C5

INTRODUCTION

Nausea, vomiting and hypotension are common complications during caesarean section under regional anaesthesia. Although interventions directed at preventing these undesirable effects have been proposed, they still affect a significant number of patients.[1,2,3] Patel and al.[4] have shown that patients undergoing combined spinal epidural technique in the sitting position for caesarean section were less likely to present hypotension and nausea then patients whose block was installed in the left lateral position. This study compares hemodynamic stability and incidence of side-effects in two groups of patients receiving spinal anaesthesia in the sitting position (immediate vs delayed recumbence) for elective caesarean section.

MATERIALS AND METHODS

After Ethics Committee approval and informed consent, 40 healthy women (ASA I & II) with uncomplicated term pregnancies and scheduled for elective caesarean section under spinal anaesthesia were randomly assigned to one of two groups. Group 1 patients (G1) were put in the recumbent position immediately after completion of the spinal injection while those in Group 2 (G2) remained seated for 75 seconds after the start of the injection. Injection time was standardised to 25 seconds. All patients received 15 ml/kg of a Ringer's lactate solution before spinal anaesthesia using 12 mg of hyperbaric bupivacaine 0.75%, fentanyl 15 g and morphine 0.15 mg at the L3-4 interspace. Once in the supine position with left uterine displacement, arterial pressure was measured every minute until delivery, and progression of the sensory level was assessed every 2 minutes for the first 14 minutes. Hypotension (i.e. systolic arterial pressure <100mmHg and <90% of baseline value) was treated with ephedrine (5-10 mg). Nausea, vomiting, volume of crystalloids received, and time to T10 regression of the sensory block were recorded. For statistical analysis, CHI square and repeated measures ANOVA were applied as appropriate and a $p<0.05$ was considered significant.

RESULTS

Of the twenty patients recruited in each group, only one had to be excluded due to a failed spinal. No statistical difference was noted in the incidence of hypotension, but nausea was significantly higher during the first 20 minutes following spinal injection in G1 (10/19) when compared with G2 (4/20), $X^2=4.52$, $p=0.045$. Maximum sensory levels achieved were identical in both groups.

DISCUSSION

Allowing patients to remain sitting 75 seconds after the injection of a spinal block for elective caesarean section produces an equally effective anaesthesia and can reduce the frequency of nausea in these patients.

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TESTING MULTIORIFICE EPIDURAL CATHETERS: INJECT BRISKLY

Sandra Katsiris MD, FRCPC, Barbara Leighton, MD, DABA, Stephen Halpern, MD, M Sc, FRCPC, Donna Wilson, RN, BSL, B. Sc. N, MN, Jean Kronberg MD, Ph D, FRCPC

Department of Anaesthesia, Women's College Hospital, The University of Toronto, 76 Grenville St., Toronto, Ontario, Canada M5S 1B2

INTRODUCTION: Multiorifice epidural catheters provide better analgesia than single-orifice catheters but have a 12% incidence of two-compartment placement[(1)]. Slowly injected test doses which exit only from the proximal orifice will not detect two-compartment catheters[(2)]. The minimum speed has not been determined for the widely used 20 gauge catheters. To simulate two-compartment placement we determined the minimum speed required to engage three orifices during saline and air injection with 0, 1, 2, or 3 orifices under pressure.

METHODS: We tested commercially available, unfiltered 20 gauge three-orifice epidural catheters: nylon (n=3) and polyamide (n=3). We inserted the catheters into 1 L bags of normal saline (NS) through 20 gauge holes placed 10 or 20 cm down from the fluid meniscus. Each catheter was sequentially positioned with 0, 1, 2, or 3 orifices in the NS bag. We used a timer to regulate injection speed and determined the slowest speed at which injected air or coloured saline exited through all three orifices. Injections (using a three mL Monoject syringe) were done with the distal catheter orifice facing down. During each experiment one investigator observed while a second investigator injected saline or air and manipulated the timer.

RESULTS:

		Number of Orifices Under Pressure			
		0	1	2	3
Minimum Injection Speed (mL/sec)	SALINE 10 cm	0.06	0.07	0.05	0.006
	SALINE 20 cm	0.06	0.1	0.08	0.006
	AIR 10 cm	-	3	3	2
	AIR 20 cm	-	4	3	2

Data for the two catheter types did not differ and were combined. The speeds of injection were averaged (Table). The required speed of injection increased as the number of orifices in saline decreased. Required speeds were significantly faster with air than with fluid injection.

DISCUSSION: Epidural catheters are generally tested with isobaric local anesthetic to rule out intrathecal placement and with epinephrine or air[(3)] to rule out intravenous location. Injecting fast enough to test the worst case (one distal hole in CSF or a blood vessel) is vital. With 20 gauge catheters, the required minimum injection speed spans four orders of magnitude. Saline injection speeds are within the clinically practiced range, but air injection must be done quite quickly. Brisk test dose injection is mandatory to rule out two-compartment placement of multiorifice epidural catheters.

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PATIENT CONTROLLED EPIDURAL ANALGESIA WITH HYDROMORPHONE VERSUS SINGLE DOSE EPIDURAL MORPHINE FOR POST-CAESAREAN ANALGESIA.

Leszek Swica MD, Janet Midgley MD, Robert Nunn MD, Holly Muir MD, Romesh Shukla MBBS, Bruce Smith MD
Anaesthesia Department, IWK Grace Health Centre, Dalhousie University, Halifax, Nova Scotia, B3H 4N1

INTRODUCTION: The current practice at our institution for postop analgesia following Caesarean delivery involves use of neuraxially administered morphine (MS). Although the quality of analgesia is superior to parenterally administered narcotics, it is associated with a significant incidence of pruritus and nausea.[1] Hydromorphone (HM) also provides excellent analgesia when administered in the epidural space[2]; however, it has a shorter duration of action, usually requiring continuous infusion or repeated bolus dosing. A recent study has shown no difference between MS and HM in terms of analgesia or side effects when they are both administered as a single large dose following delivery.[3] Patient-controlled epidural analgesia (PCEA) with HM may permit lower bolus doses of HM, thereby limiting the incidence of side effects, while continuing to provide adequate analgesia. The purpose of this study is to compare PCEA HM with epidural MS in terms of efficacy and side effect profile as a postop analgesic for Caesarean delivery.
METHODS: After HRC approval, informed consent was obtained from 28 healthy women scheduled to undergo elective Caesarean section. Subjects were randomized in a double-blind fashion into two groups. Both groups received a standardized anaesthetic. After delivery, Group A patients received a bolus of 300 mcg of HM via the epidural catheter. PCEA was instituted in the post-anaesthesia care unit (PACU) with a 150 mcg bolus of HM and a 30 minute lock-out interval. Group B patients received a bolus of 3.0 mg of MS after delivery. In the PACU, PCEA was initiated with a placebo normal saline solution. All patients also received 250 mg of naproxen orally every 6 hours for 24 hours. Patients recorded visual analog scales (VAS) for pain at rest, pain with movement, nausea and pruritus preoperatively (baseline), and at postop hours 0,1,2,4,8,12 and 24. Sedation scores and respiratory rates were also recorded at these times. Patient demographics and the use of rescue medications were analyzed with unpaired *t*-tests. VAS scores were compared using the method of summary measures and the Mann-Whitney test. A p value of <0.05 was considered significant.
RESULTS: To date, 28 patients have been studied. No significant difference has been found in patient demographics or pain scores. Patients who received PCEA HM had significantly lower nausea scores and their antiemetic requirements were lower.
CONCLUSIONS: The results from the 28 patients studied thus far indicate that there is no significant difference between PCEA HM and single dose MS with respect to pain scores, pruritus, or patient satisfaction. The use of PCEA HM appears to result in less severe nausea, as reflected by lower VAS scores and lower antiemetic requirements.
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INTRATHECAL MORPHINE FOR POSTOPERATIVE PAIN RELIEF FOLLOWING POSTPARTUM TUBAL LIGATION SURGERY

Michael E. Rooney MD, David C. Campbell MSc MD, Celina M. Riben, Lesley-Ann Crone MD, Ray W Yip MD
Royal University Hospital, University of Saskatchewan, Saskatoon, Saskatchewan, S7N 0W8

Introduction: Patients undergoing postpartum tubal ligation (PPTL) surgery often experience considerable incisional and spasmodic (crampy) abdominal pain for 24 hours postoperatively (1,2). We hypothesized that half (100 mcg) of the usual dose of intrathecal morphine (200-300 mcg) routinely administered to provide postoperative analgesia following caesarean delivery would provide effective pain relief following PPTL. Therefore, this prospective, randomized, double blind study was designed to determine the efficacy of intrathecal morphine (100 mcg) for postoperative analgesia following PPTL surgery.

Methods: Following IRB approval and informed consent, 66 patients undergoing spinal anaesthesia (SA) for PPTL surgery within 72 hours of an uncomplicated, vaginal, term delivery were enrolled. All patients received 500 mg of naproxen 60 min preoperatively. Each patient was then randomized to receive one of two SA study solutions (1.6 ml) consisting of either NS (n=33): 60 mg (1.2 ml) of 5% hyperbaric lidocaine, 10 mcg (0.2 ml) of fentanyl and normal saline (0.2 ml) or MORPH (n=33): 60 mg (1.2 ml) of 5% hyperbaric lidocaine, 10 mcg (0.2 ml) of fentanyl and 100 mcg (0.2 ml) of morphine. Supplementary intraoperative analgesia was limited to intravenous fentanyl. Each patient was assessed using a visual analogue scale (VAS) for both spasmodic (crampy) and incisional pain at rest and with movement. Postoperative analgesia was limited to intravenous PCA morphine.

Results: 6 patients were excluded as 2 (1 NS; 1 MORPH) received local anaesthetic infiltration prior to skin incision; 1 (NS) required GA due to prolonged difficult surgery; 3 (1 NS; 2 MORPH) did not continue the PCA morphine for the entire 24 hour study period. In the remaining 60 patients, NS (n=30); MORPH (n=30), there was no statistical difference between the two groups as to demographic data, gestation at delivery, parity, birth weight, breast feeding, time from delivery to SA, preoperative VAS scores for spasmodic abdominal pain, and duration of surgery. All patients reported VAS scores for spasmodic and incisional pain in the recovery room as zero. Postoperatively VAS scores for spasmodic (crampy) and incisional pain, at rest and with movement, were significantly higher in the NS group compared to the MORPH group at 4, 8, 12 and 24 hours ($P<0.001$). PCA morphine utilization was significantly greater in the NS group compared to the MORPH group at 4, 8, 12 and 24 hours ($P<0.0001$). The mean cumulative PCA morphine utilization at 24 hours in the NS group was 39.6 $\pm$ 19.6 mg compared to 1.1 $\pm$ 2.5 mg in the MORPH group ($P<0.0000000001$). VAS satisfaction scores were also significantly higher in the MORPH group compared to the NS group.

Discussion: Intrathecal morphine (100 mcg) provides effective postoperative analgesia following PPTL without clinically significant adverse effects.

References:
1) Anesthesiology 73:381-5, 1990
2) Anesthesiology 73:A932, 1990

DOES EPIDURAL ANALGESIA CAUSE AN INCREASE IN THE CAESAREAN SECTION RATE? A META-ANALYSIS

Stephen Halpern MD, M Sc, FRCPC.

Department of Anaesthesia, Women's College Hospital and the University of Toronto, 76 Grenville Street, Toronto, Ontario M5S 1B2.

INTRODUCTION

Whether or not epidural analgesia for labour pain causes an increased caesarean section (C/S) rate is controversial. To date there have been six randomized controlled trials (RCTs) performed to answer this question. The purpose of this study is to combine the results of these trials to determine whether or not epidural analgesia causes an increased risk of C/S.

METHODS

MEDLINE was searched from 1/66 -- 11/97 using the keywords and text terms EPIDURAL ANALGESIA, PREGNANCY, CESAREAN SECTION. Other sources included: the Cochrane library, bibliographies, and personal files. Only RCTs were included. The relative rate difference between groups (epidural analgesia vs parenteral narcotic) and 95% confidence interval were estimated. The studies were combined using the method of DerSimonian and Laird. The pooled rate difference was considered statistically significant if zero was not included in the 95% confidence interval.

RESULTS

Seven studies were retrieved, one was discarded because it did not report a C/S rate. The results are shown in the table. A negative difference favours epidural analgesia, a positive difference favours narcotic.

Reference	# of pts	Rate Diff	95% C.I.
Eur J Ob Gyn 1989;30:27	111	6.4%	-6.5 – 19%
Am J Ob Gyn 1993;169:851	93	22.7%	9.7 – 35.8
Obstet Gyne 1995;86:783	869	5.1%	1.9% – 8.4%
Can J Anaesth 1996;43:A60b	50	1.6%	-15.0 – 18%
Am J Ob Gyn **1996** SPO #442	145	-4.2%	-15.1 – 6.6%
Anesthesiol **1997**;87:487	715	-0.8%	-3% – 2.0%
Pooled Rate Difference		**4.0%**	**-1.5% –9.5%**

* Available in abstract form only.

CONCLUSION

This meta-analysis does not support the hypothesis that epidural analgesia causes an increase in the C/S rate. However, the results are heterogeneous because of differences in study design and populations studied. Further trials are required, using and intent-to-treat analysis and a strict obstetrical protocol to answer this question.

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DOES EPIDURAL ANALGESIA INFLUENCE BREAST-FEEDING OUTCOMES SIX WEEKS POST-PARTUM?

Stephen Halpern MD, MSc, FRCPC , Jo MacDonell RN, MSc N, IBCLC, Tracey Levine, Donna Wilson BSL, RN, B.Sc.N, MN

Departments of Anaesthesia, Faculty of Nursing University of Toronto, Women's College Hospital, 76 Grenville Street. Toronto, Ontario M5S 1B2

INTRODUCTION

Breastfeeding (BF) is an important aspect of early development. A recent review concerning pain medications during labour suggests that BF would be enhanced by "reducing the use of epidurals[1]". The purpose of this observational study is to determine whether or not epidural analgesia reduces the success of BF.

METHODS

After obtaining REB approval and informed consent, low risk women delivering at Women's College Hospital in July and August, 1997 were studied. Data, including previous BF experience, length of 1st and 2nd stage of labour, delivery mode delivery, 5 minute Apgar score, the use of narcotics, induction or augmentation of labour, epidural use and continuous spinal/epidural technique were recorded. In addition, the use of formula supplements in hospital was noted. A structured telephone interview 6 weeks later was performed to determine whether or not the woman was still BF. The following classification was used: none, token, partial and full. Logistic regression was used to determine whether or not intrapartum medication use influenced BF outcome, controlling for other intrapartum events. The odds ratios and 95% confidence intervals are reported. Post hoc power analysis reveals a power of 0.82 to detect a 25% difference in BF rates.

RESULTS

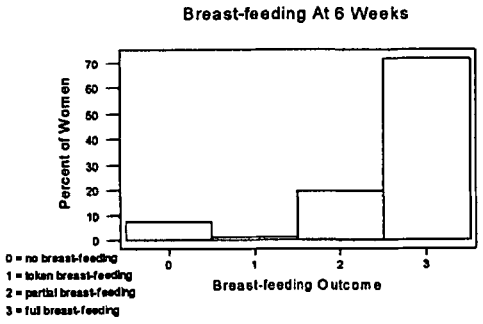
189 women were enrolled in the study. 12 could not be reached at 6 weeks. Of these 114 were nulliparous. The incidence of BF success is shown in the figure. There was no significant effect of epidural analgesia (OR 1.67 [0.58 -- 4.79]), narcotic analgesia (OR 1.00 [0.99 – 1.01]) or CSE (0.85 [0.32–2.23]) on the success of BF.

CONCLUSIONS

This study does not support the claim that epidural analgesia reduces the incidence of BF 6 weeks postpartum. Care must be exercised when extrapolating surrogate outcomes such as Neuroadaptive Capacity Scores to BF success[1]. A larger study is warranted to detect a smaller than 25% difference in BF between medicated and non-medicated groups.

REFERENCE

1) J Hum Lact 1997;13:131



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