Effects of on-table extubation on resource utilization and maternal anxiety in children undergoing congenital heart surgery in a low-resource environment

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ABSTRACT

Objective : **To study the applicability of on-table extubation (OTE) protocol following congenital cardiac surgery in a low-resource setting and its impact on the length of intensive care unit (ICU) stay, hospital stay, hospitalization cost, parental anxiety, and nurse anxiety.**

Materials and Methods : **In this prospective, nonrandomized, observational single-center study, we included all children above 1 year of age undergoing congenital cardiac surgery. We evaluated them for the feasibility of OTE using a prespecified protocol following separation from cardiopulmonary bypass. The data were prospectively collected on 60 children more than 1 year of age, belonging to the Risk Adjustment for Congenital Heart Surgery 1, 2, 3, and 4 groups and divided into two groups: those who underwent successful OTE and those who were ventilated for any duration postoperatively (30 children in each group). Duration of hospital stay, ICU stay, and total hospital cost were collected. Anxiety levels of the primary caregiver (nurse) in the ICU and the mother were assessed immediately after the arrival of the child in the ICU using the State Trait Anxiety Inventory (STAI).**

Results : **Children who were extubated immediately following congenital cardiac surgery had significantly shorter ICU stay (median 20 [19, 22] h vs. 22 [20, 43] h [*P* < 0.05]). Patients extubated on table had a significant reduction in hospital cost {median Rs. 161,000 (138,330; 211,900), approximately USD 1970 (*P* < 0.05)} when compared to children who were ventilated postoperatively {median Rs. 201,422 (151,211; 211,900) , approximately USD 2464}. The anxiety level in mothers was significantly less when their child was extubated in the operating room (STAI 36.5 ± 5.4 vs. 47.4 ± 7.4, *P* < 0.001). However, for the same subset of patients, anxiety level was significantly higher in the ICU nurse (STAI 46.0 ± 5.6 vs. 37.8 ± 4.1, *P* < 0.05).**

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Conclusion : **OTE following congenital cardiac surgery is associated with a shorter duration of ICU stay and hospital stay. It also reduces the total hospital cost and the anxiety level in mothers of children undergoing congenital heart surgery. However, the primary bedside caregiver during the child's ICU stay had increased anxiety managing patients with OTE.**

Keywords : Fast-tracking pediatric cardiac surgery, on-table extubation protocol, parental anxiety, State-Trait Anxiety Trait

INTRODUCTION

The use of high-dose opioids is a common, time-honored technique for cardiac anesthesia complicated by the imposition of postoperative mechanical ventilation with a relatively high incidence of respiratory complications. Over the past decade, cardiac anesthesia has evolved to allow routine fast-track anesthesia after many cardiac surgical cases. The simultaneous development of enhanced recovery protocols and their adoption into cardiac surgery has led to constant scrutiny of the perioperative care of these patients.[1]

With the increasing use of opioid-sparing techniques to anesthetize cardiac surgical patients, early and immediate extubation practices have become more frequent. Immediate extubation following cardiac surgery has been reported to be both beneficial and safe for the appropriate candidate following cardiac surgery.[2]

However, when it comes to the pediatric population, immediate extubation following congenital cardiac surgery in a low-resource environment remains relatively less common, often reserved for highly limited patient populations and procedures. We have earlier reported our experience with the use of such an early extubation protocol and how our center evolved to adopt it.[3]

There have been multiple reports of decreased resource utilization by the adoption of fast-track protocols following cardiac surgery.[4-6] Although such protocols may offer a particularly attractive option in developing countries where resource constraints exist, few reports have evaluated their feasibility and impact in such an environment. We conducted this study to gauge the effect that such a protocol can have on the main determinants of resource utilization in the perioperative period, namely duration of intensive care unit (ICU) stay, hospital stay, and the total hospital cost.

When it comes to the pediatric population, any form of anesthesia, especially for cardiac surgery, is a major stress for the child and family members. OTE offers numerous benefits in this milieu, such as the reduced need for sedatives, early initiation of feeding, and early parental interaction. Whether OTE can attenuate parental anxiety has not been reported. This study attempts to look at whether parental anxiety during the immediate postoperative period is reduced in children who are extubated on the table following congenital cardiac surgery.

We also attempted to look at whether immediate postoperative extubation helps allay anxiety in ICU nurses.

MATERIALS AND METHODS

Study design

This prospective, observational study was conducted in children undergoing elective cardiac surgery involving cardiopulmonary bypass (CPB) at G. Kuppuswamy Naidu Memorial Hospital, Tamil Nadu, India. After obtaining ethical committee clearance and registration with the Clinical Trials Registry of India (CTRI/2020/07/026567), children aged 1–18 years assigned for elective cardiac surgery were included in the study. Informed consent was obtained from the parents. We excluded patients with syndromes, preoperative requirement of ventilation or inotropic support, shifted postoperatively with an open chest, and undergoing emergency surgery.

Anesthetic protocol

All enrolled children (including children with single ventricle physiology) were considered candidates for fast-tracking following surgery. These patients were anesthetized by a single cardiac anesthesiologist and surgery was performed by a single pediatric cardiac surgeon to ensure uniformity of anesthetic and surgical technique. All the children were monitored perioperatively with transesophageal echocardiography done by a qualified echocardiographer.

The same anesthetic technique was used in all patients up to the termination of CPB.[3] Physiologically appropriate induction with ketamine or thiopentone was performed. Intravenous (IV) fentanyl (2 μg/kg) was administered at the time of induction. Neuromuscular paralysis was achieved and maintained with vecuronium throughout the surgery. Intraoperative analgesia was maintained with titrated fentanyl boluses (1 μg/kg). Isoflurane (1 Minimum alveolar concentration (MAC)) was used to maintain balanced anesthesia in all cases.

To maintain the optimal depth of anesthesia, the bispectral index (Aspect Medical Systems) was continuously monitored and maintained between 45 and 60.[7,8]

Analgesia was supplemented with ultrasound-guided, bilateral erector spinae block depending on the availability of the ultrasound equipment. The block was performed soon after invasive vascular access deemed necessary for the surgery was secured. A mixture of 0.125% bupivacaine, 1% lidocaine, and 0.1 mg/kg dexamethasone (2 mL/kg total volume) was divided and injected in equal proportions bilaterally at the T_6 transverse process level.

A single anesthesia machine (GE Avance CS_2 Model, Model Number G 1500213, GE Healthcare, Chicago, Illinois, USA) was used for anesthetic management. All patients were ventilated with pressure-controlled ventilation-volume guaranteed (PCV-VG) mode with a tidal volume of 8–10 mL/kg, and the respiratory rate was adjusted to maintain optimal $PaCO_2$ levels. Heparin was administered in a dose of 400 IU/kg to maintain anticoagulation on CPB. Vecuronium (0.1 mg/kg) was administered at the time of heparinization. Following aortic and venous cannulation and establishment of full flows on CPB, anesthesia was supplemented with fentanyl (2–3 μg/kg) and midazolam (5–10 μg/kg). Sevoflurane was administered continuously using a vaporizer inserted into the gas supply line of the CPB circuit.

Following successful weaning off CPB, the surgeon and anesthesiologist made a decision to extubate patients on-table, using the criteria mentioned in Table 1.

Since the patient was extubated only if certain preset parameters were met following termination of CPB, randomization of patients was not possible. The study was designed to be an observational study.

For those patients who were to be ventilated postoperatively, vecuronium was supplemented at the time of sternal wiring. In others who were deemed fit for on-table extubation (OTE), ventilation was weaned to synchronized intermittent mandatory ventilation- pressure controlled ventilation- volume guaranteed mode (SIMV-PCV-VG). Following the reduction of the respiratory rate, continuous positive airway pressure-pressure support ventilation mode was established at the time of sternal wiring. Additional analgesia in the form of paracetamol (15 mg/kg IV) was administered at this time in patients who did not receive regional supplementation at the start of surgery.

Table 1: Extubation criteria

Stable hemodynamics
Absence of hemodynamically significant arrhythmias
Pacing independent
Vasoactive inotropic score ≤10
Echocardiographic parameters
Absence of correctable residual shunts
Absence of moderate-severe ventricular dysfunction
Coagulation parameters
Activated clotting time ≤140 s
Absence of ongoing surgical bleeding
Respiratory parameters
Absence of difficult intubation
Physiologically appropriate SpO_2 and $ETCO_2$
Dynamic lung compliance >0.5 mL/kg/cmH_2O
PaO_2/FiO_2 ratio >200 (>80 for single ventricle lesions)
$PaCO_2$ between 35 and 40 mmHg on arterial blood gas
Other parameters
Rectal-nasal temperature <2°C
Rectal temperature >35.5°C

At the time of skin closure, neuromuscular blockade was reversed with neostigmine and glycopyrrolate. The patient was then allowed to breathe spontaneously, provided tidal volume was more than 5 mL/kg. Adequacy of respiratory efforts was ascertained with an arterial blood sample taken before extubation. The time from the application of the surgical dressing to shifting out of the operation theater was monitored in all patients. This time included the time to extubation in OTE patients and was done to assess if the extubation protocol we have adapted increases the time spent in the operation theater.

Patients were then transferred to the pediatric cardiac surgical ICU where intensive care was provided by a dedicated pediatric cardiac intensivist and an experienced team of nurses with a 1:1 nurse-to-patient ratio. Noninvasive ventilatory support was instituted in OTE patients if the ABG done on arrival in the ICU had a $PaCO_2$ >55 mmHg or pH <7.30.

Readiness for weaning and liberation from mechanical ventilatory support in the ICU was evaluated hourly. In those patients where weaning readiness was not attained within 6 h of surgery, a fentanyl infusion (1 μg/kg/h) was started and continued until the parameters were met.

Anxiety levels were measured using the State-Trait Anxiety Inventory (STAI) in the mother of these children as well as the ICU nurse taking care of the patient soon after the child was received in the ICU and the child was stabilized. The scoring was done by an independent nurse in the ICU for both the mother and the primary caregiver.

Pain was monitored continuously using the Face, legs, activity, cry, consolability scale (FLACC) scale in the postoperative period. Pain was treated with boluses of 0.1 mg/kg morphine given intravenously or IV paracetamol 15 mg/kg depending on the severity of pain in those patients extubated on the table. The time to administration of the analgesic agent (opioid or nonopioid) following mechanical ventilatory liberation was taken as the duration to rescue analgesia following extubation. The number of such boluses administered in the first 24 h following extubation was charted in both groups. The time to rescue analgesia (both opioid and nonopioid) following extubation also was monitored, as well as the time to resumption of oral feeds and removal of intercostal drains following extubation of the patient.

Data collection

Data collection was done by the ICU nurse and the anesthesiologist. For those who consented to be part of the study, the patient demographic data, namely age, gender, weight, and body surface area (BSA), were collected. Surgery-related data, including risk score (Risk Adjustment for Congenital Heart Surgery [RACHS]), name of surgery, extubation plan, CPB time, clamp time, duration of surgery, duration of anesthesia, dressing time, and shifting time and other laboratory parameters, were recorded. Data related to opioid, nonopioid, fentanyl, isoflurane use, time to rescue analgesia, and time to feed were noted. Postsurgery details, duration of ICU stay, duration of hospital stay, and hospital cost were collected. The parent and ICU caregiver interview was paper-based and total scores were stored in Excel corresponding to other patient information collected for the study. One patient who had a prolonged postoperative stay in the hospital (to receive IV antibiotic therapy for preoperative infective endocarditis) was dropped from the analysis of hospital stay and total hospital bill to avoid bias in results.

Statistical analysis

The data were represented as frequency, and percentage for categorical variables and mean (standard deviation), and median (interquartile range) for continuous variables. The entire study group was classified into OTE and postoperative ventilation (PV) groups for analysis. The Chi-square test and Fisher's exact test were used to determine any statistically significant difference present among the two groups concerning categorical variables, namely the number of opioid and nonopioid boluses. Continuous variables with skewed distribution including age, weight, BSA, duration of surgery, duration of anesthesia, dressing shifting time, fentanyl dose, isoflurane dose, time to removal of drains, time to rescue analgesia, time to resumption of feeds, and hospital bill, were analyzed using Mann–Whitney *U*-test. STAI scores for nurses and parents with normal distribution were analyzed using the independent sample *t*-test. $P < 0.05$ was considered statistically significant. All analyses were performed using the statistical software Jamovi version 2.3.21.

RESULTS

Out of 60 children included in the study, 30 children were extubated on-table and 20 children were extubated within 6 h of completion of surgery (10 children within 2 h and 10 between 2 and 6 h). In 10 patients, extubation was delayed beyond 6 h. With the implementation of our protocol, only one patient who was planned for OTE had to be ventilated postoperatively due to inadequate respiratory efforts. Five children who were extubated on the table had postextubation stridor, which was treated with adrenaline nebulization. None of the children who had to be ventilated postoperatively developed postextubation stridor. Twenty children in the OTE group and 25 children in the PV group required respiratory support in the form of noninvasive ventilation following extubation. However, none of the patients in either group were reintubated during the course of their hospital stay using this protocol.

Data were analyzed separately for children who underwent OTE and those who received PV. Overall, 7 children in the PV group and 19 children in the OTE group received supplemental analgesia in the form of bilateral erector spinae block. No statistically significant difference was found in the demographic parameters in both the groups. Age between the two groups was comparable with a median of 25 (12, 60) months in the group PV and 60 (12, 120) months in the group OTE. There was no significant difference in the weight (20.5 [9.4, 28] kg in the group PV vs. 13.2 [8.8, 13] kg in the group OTE) or BSA (0.5 [0.42, 0.65] kg/m^2 in the group PV vs. 0.57 [0.43, 1] kg/m^2 in the group OTE) as well. The duration of anesthesia and surgery in both the groups was significantly different (243 [228, 277] min in the group OTE vs. 300 [240, 327] min in the group PV). The time taken to shift the patient out of the operation theater following the application of dressing was significantly less in the OTE group compared with the PV group (9 [8, 10] min vs. 11 [10, 12] min) [Table 2]. The diagnosis of all the patients included in the study is provided in Table 3 and categorization according to the RACHS score in Table 4. Following extubation, children in the OTE group seemed to be more comfortable. This was evidenced by the fact that half of the children (15) in the OTE group required fewer than 2 opioid boluses in the first 24 h following surgery. On the other hand, 21 children (70%) required more than 2 opioid boluses following extubation in the PV group. Similar trends were observed for nonopioid analgesics as well. This difference was, however, not statistically significant [Table 5]. The time to rescue analgesia was significantly prolonged in the children who were extubated on the table (median of 120 min vs. 60 min, $P = 0.013$). There was no

Table 2: Demographic profile of patients in on-table extubation and postoperative ventilation groups

Parameter	OTE group	PV group	*P*
Age (months)	60 (12–120)	25 (12–60)	0.147*
Weight (kg)	13.2 (8.8–13)	20.5 (9.4–28)	0.135*
Body surface area (m^2)	0.57 (0.43–1)	0.5 (0.42–0.65)	0.216*
Duration of anesthesia (min)	243 (228–277)	300 (240–327)	0.014*
Duration of surgery (min)	180 (150–215)	233 (180–250)	0.013*
Dressing-shifting time (min)	9 (8–10)	11 (10–12)	<0.001*

*Mann–Whitney *U*-test. OTE: On-table extubation, PV: Postoperative ventilation significant difference in the time to resumption of feeds or removal of drains following extubation in both these groups ($P = 0.676$) [Table 5].

The duration of ICU stay was significantly shorter in the patients extubated in the operation theater itself (median 20 h vs. 22 h, $P < 0.05$). There was a significant difference in the duration of hospital stay as well (median 96 h vs. 103 h, $P = 0.008$) [Table 6]. The cost of hospitalization was significantly lesser in those patients extubated on the table (median Rs. 161,000 [138,330; 211,900] vs. Rs. 201,422 [151,211; 211,900], $P < 0.05$) (approximately USD 1970 vs. USD 2464) [Figure 1]. Although this figure did not look significant when quoted in dollars, further scrutiny showed a 20% reduction in the total hospital bill when patients were extubated immediately postoperatively. In an austere environment where the resources were limited, OTE protocols may lead to a significant reduction in the resources consumed.

The State-Trait Anxiety Index (STAI) was lesser in mothers of children who were extubated in the operation theater itself (STAI 36.5 ± 5.4 vs. 47.4 ± 7.4, $P < 0.001$) [Figure 2]. On the other hand, the scores were higher in the nurses taking care of these patients in the ICU (46 ± 5.6 vs. 37.8 ± 4.1, $P < 0.001$) [Figure 3].

Table 3: Patient diagnosis in on-table extubation and postoperative ventilation groups

Diagnosis	OTE	PV
Endocardial cushion defects		
Ventricular septal defects	6	3
Atrial septal defects	8	3
Partial AV canal defects	3	3
Tetralogy of Fallot	2	13
Single ventricle physiology		
Bidirectional Glenn	0	3
Completion Fontan	2	1
Valvular defects		
Ozaki aortic valve replacement	2	0
Cone repair Ebstein's	2	0
Others		
Coarctation of aorta	2	0
Aortoplasty	1	1
Ascending aortic replacement	1	0
Rastelli	1	2
Left pulmonary artery plasty	0	1
Total	30	30

OTE: On-table extubation, PV: Postoperative ventilation, AV: Atrioventricular

Table 4: Risk Adjustment for Congenital Heart Surgery classification

RACHS	OTE group	PV group
1	16	6
2	12	22
3	2	1
4	0	1
Total	30	30

RACHS: Risk Adjustment for Congenital Heart Surgery, OTE: On-table extubation, PV: Postoperative ventilation

DISCUSSION

The present study was undertaken to apply an OTE protocol at a single-center in a low-resource environment and check the impact it has on perioperative resource utilization. During the study, we also looked at the effects that OTE has on anxiety levels in the mother and the primary bedside ICU caregiver.

Perioperative care of children undergoing cardiac surgery is a constantly evolving field. Routine use of prolonged ventilation was the standard practice in the 1960s and 70s owing to the high doses of narcotics (>20 μg/kg fentanyl) used to limit the stress response in the perioperative period.[9] However, with changing concepts and the emphasis on balanced anesthesia in the 1980s, anesthetic

Table 5: Differences in postoperative parameters between the on-table extubation group and postoperative ventilation group

Parameter	OTE group	PV group	*P*
<2 opioid boluses	15	9	0.114#
<2 nonopioid boluses	5	1	0.195†
Time to rescue analgesia (min)	120 (60–180)	60 (30–143)	0.013*
Time to resumption of feeds (min)	150 (120–240)	180 (120–240)	0.684*
Time to the removal of pleural drains (min)	900 (420–1080)	720 (360–1170)	0.676*

*Mann–Whitney *U*-test, #Chi-square test, †Fisher's exact test. OTE: On-table extubation, PV: Postoperative ventilation

Table 6: Differences in outcome parameters between the on-table extubation group and postoperative ventilation group

Parameter	OTE group	PV group	*P*
Duration of ICU stay (h)	20 (19–22)	22 (20–43)	0.004*
Duration of hospital stay (h)	96 (77–102)	103 (98–125)	0.008*
Cost of hospitalization (Rs.)	161,000 (138,330–211,900)	201,422 (151,211–211,900)	0.031*
Cost of hospitalization (USD)	1970	2464	0.031*
STAI in parents	36.5±5.4	47.4±7.4	<0.001††
STAI in ICU caregiver	46±5.6	37.8±4.1	<0.001††

*Mann–Whitney *U*-test, ††Independent sample *t*-test. OTE: On-table extubation, PV: Postoperative ventilation, STAI: State-Trait Anxiety Inventory, ICU: Intensive care unit

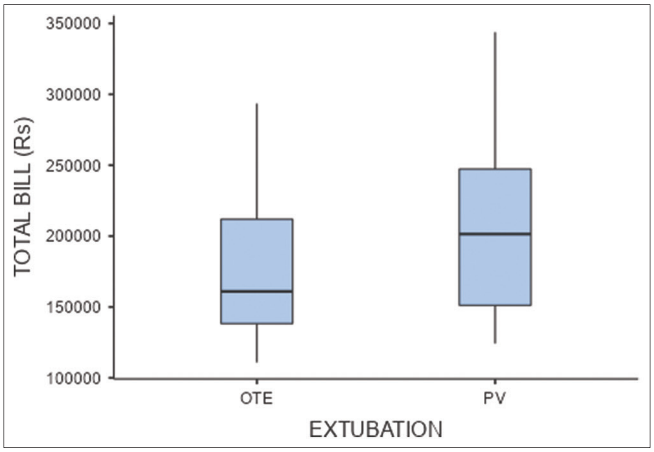

Figure 1: Difference in total cost amount between patients extubated on-table and prolonged ventilation. PV: Postoperative ventilation, OTE: On-table extubation

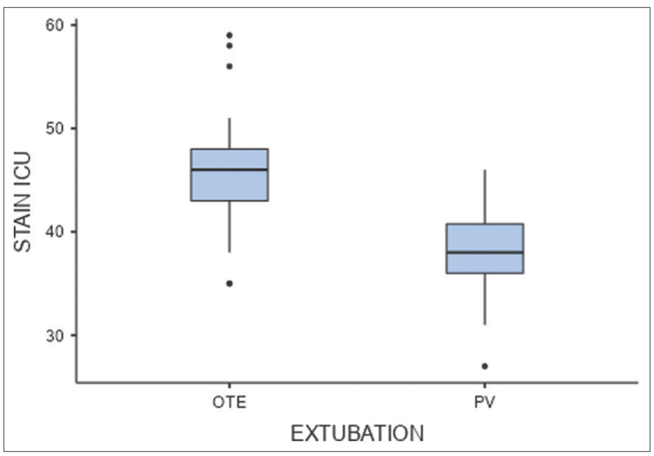

Figure 2: Difference in state trait anxiety inventory (STAI) scores between intensive care unit caregivers of patients extubated on the table and prolonged ventilation. PV: Postoperative ventilation, OTE: On-table extubation

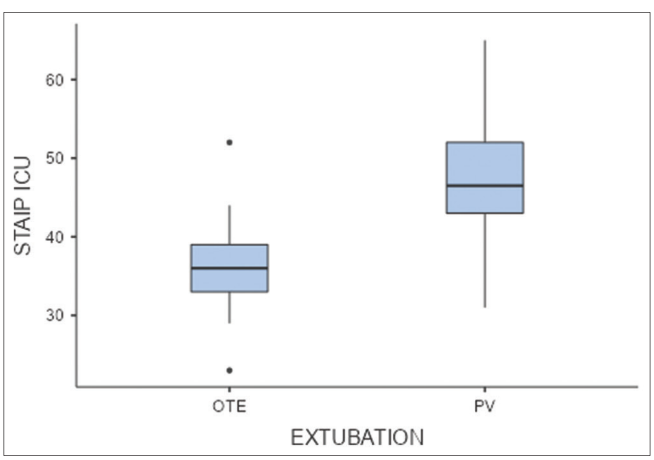

Figure 3: Difference in state trait anxiety inventory (STAI) scores between mothers of patients extubated on the table and prolonged ventilation. PV: Postoperative ventilation, OTE: On-table extubation

practice changed significantly in the latter part of the previous century. The change in practice paralleled a continuous improvement in the results of surgical treatment. This resulted in the development of various fast-track protocols over the turn of the century with the ultimate goal of early extubation to reduce the duration of mechanical ventilation, length of stay in the ICU, and overall resource utilization.[10] Fast-track protocols have been widely adopted in the adult population with a growing emphasis on enhanced recovery after cardiac surgery.[1]

When it comes to the pediatric setting, adoption of such protocols may be challenging owing to the heterogeneity of pediatric cardiovascular surgical procedures.[11] Multiple articles exist outlining the predictors of prolonged ventilation in the pediatric population undergoing cardiac surgery.[12-15] However, only a few articles outline the anesthetic protocol employed to enable fast-track cardiac anesthesia in this population.[16,17] We have earlier published one such protocol.[3] In the absence of well-established protocols, the approach to the timing of extubation following pediatric cardiac surgery still varies widely. In an interesting study conducted by the Pediatric Heart Network, the proportion of children achieving early extubation increased significantly from 11.8% to 66.9% following the implementation of a collaborative learning model to promote early extubation.[18]

In the absence of such collaborative learning models in developing countries, extubation practices vary widely, but delayed extubation practices in the ICU predominate. However, this is the era of the Vitruvian anesthesiologist, who plays multiple roles in the operating theater including perioperative echocardiography. Armed with this echocardiographic knowledge, and as a witness to all the happenings during surgery, anesthesiologists are therefore well equipped to determine the optimal extubation timing.

In this era of economics-driven medicine, there have been multiple reports of how early extubation protocols have reduced resource utilization.[6,19] The health-care expenditure in the developing world pales when compared to that of developed countries. For instance, health-care expenditure takes up 16.77% of the gross domestic product (GDP) in the United States of America. In India, however, it is a meager 3% of the GDP, which is much less than the world average (9.83% of GDP).[20] The per capita government expenditure on health care in India as of 2018–2019 was USD 22.12 (Rs. 1815).[21] In comparison, the per capita national health expenditure in the United States of America during the same time was USD 11,582 (Rs. 815,372).[22] In this resource-limited scenario, we as perioperative physicians in developing countries are met with contrasting goals: to provide high-quality cardiac care with minimal utilization of resources.

While fast-track protocols may offer an attractive solution to ensure cost-containment and efficient resource utilization in all countries, such protocols may have an even greater impact in developing countries with relative resource scarcity. In our study, we found that children who were extubated in the operating room (OR) had a significantly shorter stay in the ICU as well as the hospital. The cost of hospitalization also was significantly less in these patients.

When it comes to any intervention to optimize resource utilization, the bottleneck must be identified. In hospitals where OR occupational charges are high, immediate extubation would be counterproductive if extubation takes time. Immediate extubation in the OR would therefore have an adverse impact on the cost of hospitalization. In our hospital, the operation theater is billed in minutes, whereas the ICU and hospital stay are billed in hours. We, therefore, studied the time taken for patients to be shifted out of the OR following the application of the surgical dressing. This time, therefore, included the time taken to extubate the OTE patients. This was done to investigate if this protocol was predisposed to increased consumption of OR time. We found that the OTE protocol we employed did not lead to an increased consumption of OR time. Conversely, patients who were extubated in the OR were shifted out of the OR more expeditiously. This could be related to physician anxiety about reducing the transit time between the OR and the ICU following extubation.

Parents experience considerable stress when their children undergo any serious intervention such as cardiac surgery.[23] Parental anxiety in the perioperative period may be attributed to the novel environment of the hospital, fear of pain, and uncertainty of fate.[24] As a perioperative physician, the anesthesiologist plays an important role in reducing stress and anxiety in patients. Although many reports studying parental anxiety have been published, none have ascertained the effect that extubation has on the parents. During the implementation of this protocol, we studied the anxiety levels in the mother using the STAI index soon after the child was shifted into the ICU. The STAI is a validated tool used to assess the presence and severity of current symptoms of anxiety and the propensity to be anxious.[24] We found that the scores were significantly lower in mothers whose children were extubated immediately following surgery, suggesting that OTE helps allay maternal anxiety in the immediate postoperative period.

We also implemented the same scale to study if there was heightened anxiety in nurses taking care of ventilated patients. The score was recorded by the nurse soon after the patient was stabilized in the ICU. Surprisingly, it was found that the STAI scores were higher in nurses who were taking care of extubated patients. This may be attributed to the uncertainty surrounding the respiratory status of the patient and the fear of reintubation. In ventilated patients, a stable hemodynamic profile removes any uncertainty regarding the clinical status of the patient until the time of extubation.

CONCLUSIONS

This study details the anesthetic protocol that was used to ensure fast-tracking following cardiac surgery. It is the first study that investigates the impact of OTE on maternal anxiety. OTE is associated with significantly reduced ICU and hospital stay. It, therefore, optimizes resource utilization and results in substantial cost savings. Thus, implementation of such a protocol, especially in developing countries, has the potential to significantly improve healthcare resource utilization. Maternal anxiety can be significantly reduced by extubating patients immediately following surgery.

Limitations

Our study was conducted at a single-center in India which may limit its generalizability to other patient care centers. This study is also limited by the relatively small number of patients and the short duration of follow-up. Since the sample size is small, there is an in-homogeneous distribution of patients between both groups with regard to the demographic profile (although not statistically significant) and type of surgery performed. Further evaluation of the protocol and intergroup analysis requires a larger sample size to determine generalizability and is being currently undertaken at our institute. Furthermore, the results cannot be extrapolated to patients with ventricular dysfunction, emergency surgeries, and infancy. Moreover, STAI was evaluated at a single point of time and thus may not be reflective of all hospitalization time points.

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Conflicts of interest

There are no conflicts of interest.

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