Spinal anaesthesia for surgical correction of fracture of the proximal femur

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SUMMARY

One hundred and one patients underwent surgical correction of fractures of the proximal femur under spinal anaesthesia. There were 14 deaths in the first three months following surgery. Advancing age, poor pre-anaesthetic status, reduced pre-operative mobility and deteriorating mental function were reliable prognostic indicators of fatal outcome. Spinal anaesthesia for this type of surgery may well be the technique of choice because it avoids the use of drugs which depress the respiratory, cardiac and central nervous system. It also reduces the need for potent post-operative analgesics with similar depressant effects, and may afford some protection against thromboembolic complications. The very low early mortality in this series testifies to the safety of the anaesthetic technique.

INTRODUCTION

Fractured neck of femur in the elderly is a common condition associated with substantial morbidity and mortality.[1] These patients occupy surgical beds for long periods of time at a considerable cost to the National Health Service in terms of manpower and services. The main principles of management include early operative fixation, early post-operative mobilisation and early recognition and treatment of post-operative complications. There is evidence to suggest that these management aims may best be achieved by early surgery under spinal anaesthesia.[2] It is established policy in this unit to employ such a technique and the objective of the present study is to identify those peri-operative factors which predispose to a fatal outcome.

PATIENTS AND METHODS

Patients over 60 years of age requiring surgical repair of femoral neck fractures were studied. In line with current policy, these patients were placed on the next available operating list following essential pre-operative preparations. No patient was refused surgery on anaesthetic grounds. All patients were subsequently followed up for three months post-operatively.

The following information was obtained for each patient: Mental state on admission — lucid at all times or confused (assessment was purely subjective and

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was made by the house officer and anaesthetist); pre-admission mobility — fully mobile or restricted; general health status (graded 1 – 5) in accordance with the American Society of Anesthesiologists (ASA) classification,[3] (See Table I); fracture type – subcapital, basal/transcervical, intertrochanteric, subtrochanteric; cardiac status — ischaemic heart disease, hypertension, dysrhythmia, congestive cardiac failure; respiratory status — chronic obstructive airways disease, lower respiratory tract infection; blood urea and haemoglobin concentration.

Only essential pre-operative interventions were performed. These included correction of hypovolaemia by blood transfusion and the treatment of dehydration, congestive heart failure and identified sepsis. Prophylactic antibiotics, either ampicillin and flucloxacillin or erythromycin were given pre-operatively and continued for 10 days after surgery. It was not Unit policy to employ drug prophylaxis against deep venous thrombosis.

Spinal anaesthesia was induced in the lateral position using bupivicaine 0.5% or 0.75% in a dose of 2 – 4 ml according to patient size. Pre-loading of the cardio-vascular system with intravenous fluids was not performed because of the poor cardiorespiratory status of these patients. Hypotension due to spinal anaesthesis was corrected with a methoxamine infusion (0.004%) as required.

Surgery consisted of fixation with either Smith-Petersen trifin pin and plate, Jewett blade plate, or Austin Moore hemiarthroplasty replacement. Surgery was performed by the same team consisting of consultant orthopaedic surgeon and/or registrar. No attempt was made to mobilise patients until the tenth post-operative day. Any significant post-operative complication was noted, and the times from operation to 'fit for discharge' and to 'actual discharge'. Results were analysed using the Chi squared test, Fisher's exact probability test and the Student T test.

RESULTS

A total of 106 unselected consecutive patients were studied. Five of these patients were excluded because satisfactory spinal anaesthesia could not be established. Fourteen of the 101 patients died within three months following operation. There were no deaths within the first 24 post-operative hours. One patient died during the first post-operative week, and a further six by the end of one month.

The mean age was 77 years, the majority (78%) were female. There were no deaths in the 19 patients under 70 years of age. In the 45 patients between 70 and 79 there were three deaths. There was no significant difference in mortality between males and females. There were 11 deaths in the over-79 age group, which was statistically significant ($p < 0.01$) compared with the other age groups. Mortality in groups 1 and 2 (2%) of the American Society of Anesthesiologists classification was significantly lower ($p < 0.01$) than groups 3 and 4 (26%) (Table I).

Admission mental state and pre-admission mobility (Table II) were further prognostic indicators of outcome. There was a mortality of 34% in confused patients compared with 6% in lucid patients. The mortality among those with restricted mobility was 25% compared with 2% among the fully mobile. Both these differences are statistically significant ($p < 0.01$).

There was a substantial incidence of pre-operative medical problems, particularly cardiovascular, in the patient population (Table III). The only condition amidst

TABLE I

Mortality related to the pre-operative classification of the American Society of Anesthesiologists

Pre-operative grade	Number of patients	Deaths	Percentage
1	1	0	0
2	50	1	2
3	44	9	20
4	6	4	67

Grade	Physical status
1	Healthy.
2	Mild systemic disease.
3	Severe systemic disease, limiting activities.
4	Incapacitating systemic disease which is a constant threat to life.
5	Moribund patient not expected to survive 24 hours with or without surgery.

TABLE II

Effect of mental state and mobility on outcome

	Number of patients	Deaths	Percentage
Mental state:			
lucid	72	4	6
confused	29	10	34
Mobility:			
full	49	1	2
restricted	52	13	25

TABLE III

Medical problems on admission in 101 patients with fractured neck of femur

Condition	Number of patients
Ischaemic heart disease (ECG diagnosis)	92
Ischaemic heart disease (with symptoms)	37
Hypertension (on treatment)	27
Congestive cardiac failure	11
Permanent dysrhythmia	17
Chronic obstructive airways disease (on treatment)	26
Lower respiratory tract infection	7
Elevated blood urea (sustained) $> 10\,mmol/l$	10
Anaemia requiring blood transfusion	8
Diabetes mellitus (on treatment)	8
Cerebrovascular accident	5
Other	18
Concurrent drug therapy	65

this widespread spectrum of disease found to contribute significantly to mortality was a sustained elevation of blood urea greater than 10 mmol/l after adequate hydration — the associated mortality was 40% ($p < 0.01$).

There was no correlation between the type of fracture or method of fixation and survival, nor was there any significant relationship between survival and the delay between injury and operation. The mean duration of operation, including the establishment of anaesthesia, was 95 ± 4 minutes. Hypotension requiring methoxamine infusion occurred in 32% of patients. The duration of surgery and frequency of hypotension did not differ between survivors and non-survivors. Intra-operative complications included tachyarrhythmias in three patients and severe hypotension in one patient, the latter in association with the use of bone cement. This patient suffered a moderate hemiplegia which resolved only partially, but all four of these patients were alive at three months. Eighteen per cent of patients did not require post-operative pain relief, and the remaining patients did not require any analgesia for 8 – 16 hours post-operatively. Headache, probably of spinal origin, developed in one patient and responded to simple analgesics.

Serious complications developed in 31% of patients, of whom 14% subsequently died (Table IV). A single cause of death could not be identified in most instances since a number of pre-terminal conditions usually co-existed and post-mortem examination was not performed. Bronchopneumonia, congestive cardiac failure, myocardial infarction and cerebrovascular accident were all associated with a high mortality. There were no deaths recorded among the four patients with diagnosed thromboembolic disease. The only death in the first post-operative week (day two) was due to bronchopneumonia which had been present prior to surgery.

TABLE IV

Serious post-operative complications and mortality

Condition	Number of patients	Percentage fatal
Congestive cardiac failure	6	67
Myocardial infarction	5	60
Bronchopneumonia	22	59
Cerebrovascular accident	4	50
Fixation failure	5	20
Wound breakdown	10	20
Thromboembolism	4	0

The median delay between operation and mobilisation was 14 days. The median delay between operation and clinically 'fit for discharge' was 25 days (mean 31 days) and the median delay between operation and 'actual discharge' was 38 days (mean 53 days). This added delay was due to a variety of social reasons. The total bed days attributable to social reasons was 1081. At the conclusion of the three-month follow-up, 72% of the patients had been discharged and 14% remained hospitalised. Full pre-injury mobility was achieved by 23% of the discharged patients and the remainder were mobile with the support of an aid.

DISCUSSION

Fractured neck of femur in the elderly is a common condition with a high mortality. The largest published series of over 2600 patients by Gallannaugh and colleagues reported a mortality of 20% at one month.[1] The mean duration of hospital stay was 34 days. A major disadvantage of a large multicentre retro-spective study is the absence of standardisation of anaesthetic and surgical management. Furthermore, most series have data with general and regional anaesthetic techniques combined, even though there is evidence to suggest that the latter have a lower morbidity and mortality.[2] The present review is confined to the standardised anaesthetic and surgical management employed in a single unit.

The low mortality in our series, 1% at one week and 14% at three months, compares favourably with other studies in which the mortality frequently exceeded 20% at three months.[4] It is now recognised that patients surviving the first three post-operative months have a similar life expectancy to the general population.[4] The single most important contributor to mortality in the present study is advancing age.[5] Men may have a significantly higher mortality than women,[6,7] although we did not find this. The other well-recognised factor influencing outcome is the pre-operative classification used by the American Society of Anesthesiologists which is related closely to advancing age.[8]

Impairment of pre-admission mobility and of mental state on admission was associated with a mortality of 34% and 26% respectively. An elevated pre-operative blood urea of greater than 10 mmol/l, not attributable to dehydration, was also an indication of a fatal outcome. The delay between injury and operation, the duration of surgery, or the occurrence of intra-operative complications had no bearing on subsequent outcome. We were not able to demonstrate a significant association between fracture type and mortality, although several workers have found increased mortality in patients with trochanteric fractures.[9,10]

A single cause of death was in most cases difficult to identify. Commonly, death was preceded by two or more conditions, such as bronchopneumonia, congestive cardiac failure, cerebrovascular accident and myocardial infarction. Notably absent from this list is pulmonary embolism which Davis and Lawrenson suggest is responsible for up to 30% of peri-operative deaths and is frequently misdiagnosed as bronchopneumonia.[11] We made no specific investigations to detect pulmonary embolism, and it is therefore possible that this was a cause of death in some patients. Some authors recommend spinal anaesthesia for surgical fixation because it induces vasodilatation of the leg vessels and increases peripheral blood flow while maintaining cardiac output. In the present study all four patients with diagnosed thromboembolic episodes survived.

Pre-operative morbidity added considerably to the surgical problems in this series. No single condition was statistically associated with a fatal outcome, but not surprisingly those patients with the largest number of complications were more likely to die.[12] These conditions also contributed to a median duration of hospital stay of 38 days (mean 53 days), which was further prolonged by delay attributable to social reasons.

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