International Journal of Research in Medical Sciences
Talwar N et al. Int J Res Med Sci. 2024 Jun;12(6):2004-2010
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20241549

Original Research Article

Impact of age on perioperative outcome in patients scheduled for lower limb trauma surgery under central neuraxial blockade

Nitika Talwar, Neha Malik*, Y. K. Batra

Department of Anaesthesia and Critical Care, Max Superspeciality Hospital, Mohali, Punjab, India

Received: 10 April 2024
Revised: 14 May 2024
Accepted: 18 May 2024

***Correspondence:**
Dr. Neha Malik,
E-mail: ahenmalik@gmail.com

ABSTRACT

Background: The aim of the study was to compare perioperative outcomes between young and elderly trauma patients scheduled for lower limb corrective surgeries in our hospital under central neuraxial blockade.
Methods: The study was conducted in Max Superspeciality Hospital, Mohali for a period of 1 year, November 2017 to November 2018 after approval from the Institutional Ethics Committee and review board and written informed consent from the patients. Sixty patients having American Society of Anesthesiologists (ASA) I-III physical status scheduled to undergo lower limb trauma surgery were divided into 2 groups as 'young' (≤65 years, group Y) or 'elderly' (≥65 years, group E).
Results: The mean age of patients in group Y was 39.67±12.73 years while the mean age of patients in group E was 74.37±6.13 years. The post-operative pain score i.e. visual analogue scores (VAS) were lower inpatients in group Y as compared to group E. This difference in pain scores was found to be statistically significant especially from 8th hour onwards. Injury severity score (ISS) and pre-existing comorbidities [hypertension, renal failure and coronary artery disease (CAD)] were significant risk factors for mortality in group E patients.
Conclusions: The elderly are more likely to develop adverse perioperative outcomes and are relatively less able to recover from the same.

Keywords: Central neuraxial blockade, Injury severity score, Peri-operative SpO_2, Visual analogue scores

INTRODUCTION

Trauma is associated with a variable survival rate which is dependent on various factors like severity and site of injury, and the timing and quality of care provided to the patient. Age, gender and presence of pre-existing co-morbidities have been reported as independent risk factors. Mortality in patients who survive their initial injury is not due to the injury per se, rather due to complications such as infections and multi organ failure.[1,2] Age is a significant factor that is likely to influence the response to trauma. Though several studies have described an increase in mortality rate with increasing age, an exact cutoff value for age has not been defined.

The influence of anaesthesia type on perioperative complications of lower limb trauma surgery remains a controversial topic in the literature. Potential complications of general anaesthesia include perioperative cardiovascular events(including myocardial infarction and stroke), pulmonary complications (including atelectasis, pneumonia, and pulmonary edema), post-operative nausea/vomiting, adverse drug reactions, and injury to the teeth or other upper airway structures.[3,4] Regional anaesthesia decreases the rate of nausea, vomiting, severe postoperative pain, decreases the incidence of deep-vein thrombosis (DVT) and pulmonary embolism, reduces intraoperative bleeding, the need for transfusion and the length of hospital stay.[5,6] A major concern of regional anaesthesia is the risk of significant intra-operative hypotension, which may also predispose the patients to ischemic cardiovascularevents. Other complications associated with regional anaesthesia include urinary retention, spinal headache, epidural hematoma and infection.

The aim of the study was to compare preoperative comorbidities and postoperative outcomes of young and elderly lower limb trauma patients scheduled for surgery under central neuraxial blockade and analyze the associated risk factors and types of complications these patients develop following surgery.

METHODS

The study was a hospital based, prospective, observational study conducted in Max Superspeciality Hospital, Mohali, for a period of 1 year from Nov 2017- Nov 2018. Approval from the Institutional Ethics Committee and review board and written informed consent from the patients was taken.

Sixty patients having American Society of Anesthesiologists (ASA) I-III physical status scheduled to undergo lower limb trauma surgery were divided into 2 groups as ‘young’ (≤65 years, group Y) or ‘elderly’ (≥65 years, group E). Data included age, gender, Injury Severity Score (ISS), comorbidity, intra operative vitals, critical care stay and mortality. Patients of American Society of Anesthesiologists (ASA) I-III of either gender and who were able to give written informed consent were included in the study. Patients who refused to give consent, allergic to local anaesthetics, patients with contraindication to regional anaesthesia e.g. coagulopathy and patients with concomitant traumatic brain injury were excluded from the study.

We conducted a pilot study to observe overall complications in elderly versus younger patients. This preliminary data suggested that 45% of the elderly patients had complications versus 15% in the young patients. To find this difference in proportion with 90% confidence level with power of 0.8, the recommended sample size was 26 participants in each group.

Substituting α (type I error)=0.05 and β (type II error)=0.2.

Assuming d (effect size)=0.8, we get n=26 in each group. Therefore, minimum total sample size needed=26×2=52.

Procedure

One day prior to surgery pre-anaesthetic checkup was done, comorbidities and lab parameters of patients were noted. Two hours fasting for clear fluids and 8 hours for solid foods was advised. In the operation theatre, monitors were attached and baseline parameters recorded- pulse oximetry, NIBP (non-invasive blood pressure), 5-lead ECG and temperature probe. An intravenous access was obtained. Using aseptic precautions, epidural catheter was inserted at L3-L4 or L4-L5 intervertebral space with Tuohy needle 18G using loss of resistance technique. Test dose of 3 ml 2% lignocaine and 15 µg Adrenaline was given into epidural space. Then using 26G Quincke’s spinal needle, subarachnoid space was entered and space confirmed by free flow of CSF technique. 0.5% heavy bupivacaine with 25mcgFentanyl was injected in subarachnoid space and the block height was confirmed by absence of response to pin-prick sensation. For patients receiving only spinal anaesthesia the steps involving the placement of epidural catheter were skipped. Following surgery, patients were shifted to post anaesthesia care unit (PACU) and monitored for 2 days in the ICU.

Post-operative pain was managed with epidural analgesia (0.2% ropivacaine+fentanyl 2 µg/ml) for 48 hours in case of combined spinal epidural anaesthesia. Fentanyl infusion was started for pain relief in patients who received spinal anaesthesia. Rescue analgesia in the form of injection tramadol was given to attain a VAS≤4. Thromboprophylaxis and tranexamic acid was given according to departmental protocol. Patients were stepped down toward after two days in stable condition.

Parameters recorded

Intra-operative parameters that were recorded included duration of anaesthesia, heart rate, blood pressure, oxygen saturation, temperature and blood transfusion units. The patients were monitored post operatively for hemodynamic parameters (HR, SBP, DBP, MAP), pain score and oxygen saturation. Any complications like change of hemodynamic parameters (more than 20% from base line) and SpO_2≤90% were noted. Respiratory parameters were recorded including fall in paO2/hypoxia (≤80 mmHg on ABG), hypercarbia (paCO2≥45 mmHg) on room air, requirement of non-invasive ventilation (duration in hours), invasive ventilation (duration in hours) and chest X-ray changes (consolidation, effusion, lung collapse).

Cardiovascular complications were assessed in terms of ECG changes, myocardial infarction, angina, pulmonary embolism, deep vein thrombosis (USG Doppler, D-dimer), and requirement of vasopressors. Renal complications included in study were urine output≤0.5 ml/kg bodyweight/hr or requirement of dialysis. CNS complications included were acute cerebral stroke and cerebrovascular accident. Post-operative cognitive delirium was assessed using confusion assessmen method (CAM score). Laboratory investigations included haemogram for presence of anaemia (haemoglobin≤8 g/dl), thrombocytopenia (low platelet≤1 lakh), infection (TLC) (≤4,000 and ≥11,000) and renal function tests (blood urea, serum creatinine and electrolyte imbalance).

Statistical analysis

Data was entered in Microsoft excel and analysis was done using SPSS version 20. Descriptive statistical analysis was done. Results on categorical measurements are presented as Percentages.

Results on continuous measurements are presented as mean and standard deviation significance is assessed at 5% level of significance (p≤0.05- statistically significant) Chi square test is used to find out the significance of study parameters on a categorical scale between two groups. Student t test (independent, two tailed) is used to find out the significance of study parameters on a continuous scale between two groups.

RESULTS

The present study was undertaken to compare the preoperative comorbidities and postoperative outcomes of young and elderly lower limb trauma patients scheduled for surgery under central neuraxial blockade. As shown in Table 1, Comparison of research groups by age, group Y patients had a mean age of 39.67±12.73 years, whereas group E patients had a mean age of 74.37±6.13 years. Student t-test showed significant differences across groups (p=0.023).

Group Y comprised 18 (60%) male and 12 (40%) female patients, whereas group E had 16 (53.3%) male and 14 (46.7%) female patients. Group Y contained 21 (70%) ASA class I, 6 (20%) class II, and 3 (10%) class III patients. Group E contained 18 (60%) ASA class I patients, 8 (26.7%) class II patients, and 4 (13.3%) class III patients. Group E (80%) and group Y (70%) were injured by falls and road traffic accidents, respectively. Most patients in group Y had moderate injuries (ISS 9-14; 66.7%), followed by significant injuries (ISS≥15; 20%) and minor injuries (ISS 1-8; 16.7%).

Most patients in group E had minor injuries (ISS 1-8; 56.7%), followed by moderate injuries (ISS 9-14; 40%) and catastrophic injuries (ISS≥15; 3.3%). According to Chi-square test, group E had a higher incidence of hypertension (13.3% verses 50%; p=0.002), renal failure (10% verses 40%; p=0.007), coronary artery disease (CAD) (10% verses 33.3%; p=0.028), and neurologic disease (3.3% verses 40%; p=0.001). The trauma to treatment time in group Y was 1-3 and 4-6 days in 19 (63.3%) and 6 (20%) patients, and 7-9 and 10-11 days in 3 (10%) and 2 (6.7%) patients. The average trauma-to-surgery time was 4.03±2.48 days. The trauma to treatment time in group E was 1-3 and 4-6 days for 16 (53.3%) and 8 (26.7%) patients, and 7-9 and 10-11 days for 2 (6.7%) and 4 (13.3%) patients. Group Y had a mean operation length of 2.11±0.52 hours, whereas group E had 2.24±0.39 hours.

Distribution of patients according to injury severity score (ISS)

As shown in Table 2, majority of patients in group Y had mild injury severity (ISS 9-14; 66.7%) followed by major injury severity (ISS≥15; 20%) and minor injury severity (ISS 1-8; 16.7%).

Majority of patients in group E had minor injury severity (ISS 1-8; 56.7%) followed by mild injury severity (ISS 9-14; 40%) and major injury severity (ISS≥15; 3.3%). There was significant difference between the groups as per Chi-square test (p=0.001).

Comparison of mean VAS score between study groups

As shown in Table 3, the post-operative pain score (visual analogue scores were lower in patients in group Y as compared to group E. This difference in pain scores was found to be statistically significant especially from 8th hour onwards.

Distribution of patients according to requirement of rescue analgesic

As shown in Table 4, seven (28%) patients in group Y required 50 mg of tramadol while 1 (4%) patient required 75 mg of tramadol. Seventeen (68%) patients in group Y did not require rescue analgesic. Ten (40%) patients in group E required 50 mg of tramadol while11 (44%) and 1 (4%) patients required 75 mg and 100 mg of tramadol respectively.

Six (12%) patients in group E did not require rescue analgesic. It was observed that significantly higher number of patients in group E required rescue analgesic (p=0.001) and at higher dosages (mean dose being 60.83 mg as compared to 24.17 mg in group Y).

Comparison of post-operative complications among study groups

As shown in Table 5, The incidence of bradycardia (6.7% verses 3.3%; p=0.148), hypotension (3.3% verses 13.3%; p=0.159), postoperative myocardial infarction (0% verses 3.3%; p=0.256), renal complications (3.3% verses 6.7%; p=0.148), wound infection (13.3% verses 20%; p=0.162), drop in saturation (3.3% verses 6.7%; p=0.148) and requirement of NIV ventilation (0% verses 3.3%; p=0.256) was comparable between the groups. There was significantly lower incidence of Neurological changes (6.7% verses 53.3%; p=0.001) and mortality (0% verses 10%; p=0.001) in group Y compared to group E as per Chi square test.

Distribution of patients according to length of stay in ICU

As shown in Table 6, The mean length of stay in ICU in group Y was 2.50±0.65 days while the mean length of stay in ICU in group E was 5.14±2.38 days.

There was significant difference between the groups as per Student t-test (p=0.001).

Association of factors with mortality in patients

As shown in Table 7, It was observed in group E that age, injury severity score (ISS) and pre-existing comorbidities [hypertension, renal failure and coronary artery disease (CAD)] were significant risk factors for mortality in patients.

Table 1: Demographics of different variables.

Variables	Group Y		Group E		P value
	N	%	N	%	
Age (years)	30		30		0.023
Sex					0.129
Male	18	60	16	53.3	
Female	12	40	14	46.7	
Total	30	100	30	100	
BMI (kg/m^2)					0.394
Normal (18.5-24.9)	26	86.6	25	83.3	
Overweight (25-29.9)	2	6.7	3	10	
Obese (≥30)	2	6.7	3	6.7	
Total	30	100	30	100	
Mean BMI	21.91±3.41		22.67±3.44		
ASA grading					0.719
I	21	70	18	60	
II	6	20	8	26.7	
III	3	10	4	13.3	
Total	30	100	30	100	
Mode of injury					
Fall due to slip	9	30	24	84	0.036
RTA	21	70	6	20	
Total	30	100	30	100	
ISS					0.001
1-8	4	13.3	17	56.7	
9-14	20	66.7	12	40	
≥15	6	20	1	3.3	
Total	30	100	30	100	
Comorbidities					
Hypertension	4	13.3	15	50	0.002
Renal failure	3	10	12	40	0.007
CAD	3	10	10	33.3	0.028
Diabetes mellitus	0	-	4	13.3	0.161
Neurologic disease	1	3.3	12	40	0.001
Respiratory disease	1	3.3	2	6.7	0.553
Time between admission and surgery (days)					0.238
1-3	19	63.3	16	53.3	
4-6	6	20	8	26.7	
7-9	3	10	2	6.7	
10-11	2	6.7	4	13.3	
Total	30	100	30	100	
Duration of surgery (hrs)	30		30		0.369

Table 2: Injury severity score.

ISS	Group Y		Group E		P value
	N	%	N	%	
1-8	4	13.3	17	56	0.001
9-14	20	66.7	12	40	
≥15	6	20	1	3.3	
Total	30	100	30	100	

Table 3: Comparison of mean VAS score between groups.

VAS score	Group Y	Group E	P value
	Mean±SD	**Mean±SD**	
Post-op	2.77±1.44	2.60±1.41	0.162
2 hours post-op	2.42±1.08	2.58±0.77	0.157
4 hours post-op	2.06±1.08	2.36±0.63	0.203
8 hours post-op	1.24±0.58	2.10±0.84	0.001
12 hours post-op	1.46±0.73	1.85±0.76	0.001
16 hours post-op	0.85±0.44	1.12±0.66	0.001
20 hours post-op	0.61±0.71	1.28±0.78	0.001
24 hours post-op	0.34±0.72	0.96±0.86	0.001

Table 4: Distribution of patients according to requirement of rescue analgesic.

Tramadol (mg)	Group Y		Group E		P value
	N	**%**	**N**	**%**	
50 mg	10	33.3	12	40	
75 mg	3	10	11	36.7	
100 mg	0	-	4	13.3	0.001
No requirement	17	56.7	3	10	
Total	30	100	30	100	

Table 5: Comparison of post-operative complications among study groups.

Complications	Group Y		Group E		P value
	N	**%**	**N**	**%**	
Bradycardia	2	6.7	1	3.3	0.148
Hypotension	1	3.3	4	13.3	
Post-operative myocardial infarction	0	-	1	3.3	0.256
Renal complications	1	3.3	2	6.7	0.148
Neurological changes	2	6.7	16	53.3	0.001
Wound infection	4	13.3	6	20	0.162
Drop in saturation	1	3.3	2	6.7	0.148
Requirement of NIV ventilation	0	-	1	3.3	0.256
Mortality	0	-	3	10	0.001

Table 6: Distribution of patients according to length of stay in ICU.

Length of stay in ICU (days)	Group Y	Group E	P value
	Mean±SD	**Mean±SD**	
	2.50±0.65	5.14±2.38	0.001

Table 7: Association of factors with mortality in patients.

Parameters	Group Y			Group E		
	OR	**95%CI**	**P value**	**OR**	**95%CI**	**P value**
Age	1.8	0.31-1.39	>0.05	1.70	1.15-2.50	<0.05
ISS	1.23	1.00-1.51	>0.05	1.42	1.26-1.60	>0.05
Hypertension	0.75	0.54-1.03	>0.05	1.12	1.01-1.25	>0.05
Renal failure	0.81	0.61-1.09	>0.05	1.61	1.43-1.83	>0.05
CAD	1.39	0.85-2.31	>0.05	2.70	2.33-3.13	>0.05

DISCUSSION

Trauma is a major cause of mortality and morbidity with varied epidemiology, survival rate and risk factors. The outcome of surgical intervention depends on interrelationship between baseline vulnerability and precipitating insults occurring during hospitalization.[7] The present study was undertaken to compare the preoperative co-morbidities and postoperative outcomes of young and elderly lower limb trauma patients undergoing surgery under central neuraxial blockade. As shown in Table 1, the mean age of patients in our study was 39.67±12.73 years in group Y and74.37±6.13 years in group E. The male: female ratio in group Y was 1.5:1 and in group E was 1.1:1. The mean BMI of patients was 21.91±3.41 kg/m^2 in group Y and 22.67±3.44 kg/m^2 in group E. The gender distribution and BMI were comparable and statistically not significant (p=0.129 and p=0.394 respectively).

Group Y had 21 (70) patients with ASA class I, 6 (20) patients with class II and 3 (10) patients with class III grading. Group E had 18 (60) patients with ASA class I, 8 (26.7) patients with class II and 4 (13.3) patients with class III grading. In the study conducted by Kirshenbom et al to determine the impact of age, injury severity and pre-existing comorbidities on outcome following blunt trauma in patients ages ≥65 years, the mean age of patients was found to be 78.8±8.3 years (range 65-109 years).[8] Srilata et al observed that mean age of geriatric patients in the group 1999 was 73.53±6.96 and in group 2007 was 71.6±6.32. We observed that the most common cause of lower limb trauma in group Y patients was RTA (car/bike collision) (70) whereas that in group E was fall (80).[9]

As shown in Table 2, the ISS in majority of patients in group Y was mild (ISS 9-14;66.7) followed by major (ISS≥15; 20) and minor (ISS 1-8; 16.7) while in group E it was minor (ISS 1-8; 56.7) followed by mild (ISS 9-14; 40) and then major in (ISS≥15; 3.3). Gowing et al demonstrated that the most frequent mechanism of traumatic injury experienced by patients over 65 years of age is falls (64 patients), followed by motor vehicle collisions (27 patients.[10] As shown in Table 3, We found that the post-operative pain score i.e. visual analogue scores were lower in patients in group Y as compared to group E. This difference in pain scores was found to be statistically significant especially from 8th hour onwards, although the scores in both the groups were <3.

As shown in Table 4, in the initial 4 hours, the need for rescue analgesia was more in the elderly group of patients, as compared to the younger patients (p=0.001) in spite of no significant difference in the VAS scores. The reason might be that rescue analgesia dose was administered also as per patient's comfort. The mean dose of tramadol used as rescue analgesic was 24.17 mg in group Y whereas in group E it was 60.83 mg. The above findings are in contrast to the results of studies by Dalton et al who determined that the intensity of pain is lessened with advancing age. However, this difference in findings may be to the difficulty for elderly patients to comprehend the scoring system.[11] As shown in Table 5, the rate of postoperative wound infection was comparable in the two groups (13.3 in group Y verses 20 in group E; p=0.162). However, more elderly patients suffered from the same; reduced immune function and poor nutritional status being the risk precipitating factors.

Gaunder et al studied wound complications after open reduction and internal fixation of tibial plateau fractures in the elderly and found the overall infection rates in elderly patients is in a similar range to published data on younger patient populations.[12] Three out of 30 patients in the elderly group in our study succumbed to postoperative complications. One patient suffered from myocardial infarction while two patients developed acute on chronic kidney disease requiring haemodialysis. As shown in Table 6, The mean length of stay of patients in ICU in this study was 2.50±0.65 days in group Y and 5.14±2.38 days in group E. This significant difference between the groups was attributed to higher predisposition of older patients to develop post-operative complications due to frailty and pre-existing co-morbidities. Leung et al observed a median hospital stay of 4 days in their study on patients aged 70 years and older.[13] They reported that patients who developed postoperative adverse outcomes had significantly longer median hospital stay (9 days) than those without complications (3 days).

As shown in Table 7, The significant risk factors for mortality were noted to be ISS and co-morbid health conditions which led to development of complications. Kirshenbom et al also found a statistically significant association between mortality and existence of certain comorbidities (CAD, renal failure, dementia, and warfarin use; p≤0.05). Number of comorbidities and ISS score were found to be definite riskfactors for morbidity in elderly trauma patients.[14]

Limitations

Few potential limitations do exist in the present study. Firstly, patients were followed up only for 48 hours post operatively. This may have underestimated the rate of postoperative morbidity and complications. Secondly, the small sample size of the study decreased the statistical power and might have given less conclusive results. Thirdly, postoperative pain scores were difficult to apprehend in the elderly population, especially in patients with pre-existing neurological diseases. Lack of complete understanding would have led to false pain scores in such patients.

CONCLUSION

Advanced age, co-morbidities, multiple medications, poor nutritional status, disturbed mental health and cognitive impairment make the older patients more vulnerable to trauma and subsequent complications. They are more likely to have adverse perioperative outcomes and are less likely to recover from the same.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Talwar N, Malik N, Batra YK. Impact of age on perioperative outcome in patients scheduled for lower limb trauma surgery under central neuraxial blockade. Int J Res Med Sci 2024;12:2004-10.