



International Journal of Medical Anesthesiology

E-ISSN: 2664-3774
P-ISSN: 2664-3766
www.anesthesiologypaper.com
IJMA 2024; 7(3): 120-125
Received: 12-06-2024
Accepted: 16-07-2024

Dr. Shilpa Tiwaskar
Department of Anesthesia,
Bhaktivedanta Hospital and
Research Institute, Thane,
Maharashtra, India

Dr. Kshama Shah
Department of Anesthesia,
Bhaktivedanta Hospital and
Research Institute, Thane,
Maharashtra India

Dr. Priyanka Reddy
Department of Anesthesia,
Bhaktivedanta Hospital and
Research Institute, Thane,
Maharashtra India

Dr. Jyotsna Karande
Department of Anesthesia,
Bhaktivedanta Hospital and
Research Institute, Thane,
Maharashtra India

Corresponding Author:
Dr. Shilpa Tiwaskar
Department of Anesthesia,
Bhaktivedanta Hospital and
Research Institute, Thane,
Maharashtra, India

Factors determining choice of anaesthesia procedures in patients undergoing surgery for femur fracture at tertiary care centre

Dr. Shilpa Tiwaskar, Dr. Kshama Shah, Dr. Priyanka Reddy and Dr. Jyotsna Karande

DOI: <https://doi.org/10.33545/26643766.2024.v7.i3b.496>

Abstract

Background: Fracture femur (Hip fracture) is one of the commonest fracture in elderly. These patients have associated comorbidities due to aging. Hence providing anaesthesia presents a challenge in terms of maintaining hemodynamic stability and optimal functions of brain, heart, lungs and kidneys.

Various techniques of anaesthesia are used at our institution for proximal femur fracture, like Subarachnoid block (SAB), Combined Spinal and Epidural anaesthesia (CSE), Continuous Spinal Anaesthesia (CSA), General anaesthesia (GA) and Lumbar plexus block + Sciatic block (LPB+ SCB). We studied factors affecting choice of anaesthesia and correlation between type of anaesthesia and intraoperative stable hemodynamics or adverse events.

Methods: Post ethics committee approval, data such as demographic details of patients, surgery details, ASA grading and associated comorbidities, of patients of age 18 years and above, operated for proximal femur fracture in our institution from January 2020 to January 2022, was analyzed to study whether choice of anaesthesia varied according to age, type of comorbidities, general condition of patient (ASA grading). We checked for any adverse events intraoperatively and whether choice of anaesthesia affected this outcome.

Results: The study included 54.5% females and 45.5% males; most common age group observed was 70 years and above (57.04 %). Most common anaesthesia administered was SAB, though its use decreased with increase in perioperative risk. 61.76% of ASA I patients, 60.20 % of ASA II patients and 50% of ASA III patients received SAB. Use of CSA, LPB+ SCB and GA was seen more in patients of 60 years and above. Out of 24 ASA III patients, 21 (87.5%) received regional anaesthesia compared to 3 (12.5%) receiving general anaesthesia. CSE was preferred followed by GA for patients with multiple comorbidities.

Conclusion: Choice of anaesthesia for proximal fracture femur did depend on age, ASA grading (functional status) and comorbidities.

Keywords: Fracture femur, choice of anaesthesia, ASA grading, age, comorbidities

Introduction

Femur fractures are one of the most common injuries treated by orthopaedic surgeons and account for 14% of all the fractures [1]. The majority of these fractures occur in the elderly population, and more than 30% of the patients are 85 years or older [2]. According to studies from north India, the crude incidence of femur fracture was 105 and 159 per 100,000 among men and women, respectively with an average of 129 per 100,000 population [3]. One more study from India, quoted the annual incidence of femur fracture to be over 120 per 100,000 persons over the age of 50, with higher rates in women [4]. The number of femoral neck fractures worldwide is expected to increase from 1.7 million in 1990 to 6.3 million in 2050 [5]. In India, the population is aging, due to increase in life expectancy. The United Nations Population Fund (UNFPA) has reported that, the number of people aged 60 and above in India, will increase from 149 million in 2022 to 347 million in 2050. So, anaesthesiologists must prowess themselves to face more elderly patients with various comorbidities and fabricate a tailored made approach for each patient. The reported mortality rate of proximal femoral fractures in the literature ranges from 11% to more than 30% [6, 7]. Intraoperative hypotension is one of the factor to cause morbidity postoperatively [8, 9]. This mandates the anaesthesiologist to wisely choose type of anaesthesia to maintain stable hemodynamic perioperatively for favourable outcomes after surgery.

Use of regional anaesthesia, via epidural, spinal, or peripheral neural blockade, as a principal anaesthetic technique has been shown in few studies to reduce the risks of postoperative complications among patients undergoing surgery for hip fracture [10, 11]. However, no consensus has been reached on whether general anaesthesia or regional anaesthesia is optimal for hip fracture surgery, many institutions mainly perform spinal anaesthesia and spinal anaesthesia for hip-fracture surgery in older adults was not superior to general anaesthesia with respect to survival and recovery [12, 13]. Continuous spinal anaesthesia (CSA), though underutilised, is a well-established neuraxial technique. It safely offers reliable and dense anaesthesia with small doses of local anaesthetic that can be easily titrated [14]. Likewise, LPB could be safe because of the targeted somatic nerve block in the psoas region, which prevents dispensable sympathetic block even in cardiovascular-compromised patients. The prevention of intraoperative cardiovascular complications might be a critical factor in reducing postoperative morbidity [15]. At our institution, we use either of the following types of anaesthesia for fracture femur repair, subarachnoid block (SAB), combined spinal epidural (CSE), continuous spinal anaesthesia (CSA), lumbar plexus block + sciatic block (LPB + SCB) and general anaesthesia (GA), apart from nerve blocks perioperatively for pain relief. All anaesthesiologists conducting study cases were expert in all types of anaesthesia. Hence, we wanted to determine whether age, ASA grading and comorbidities affected choice of anaesthesia. The modality of femur fracture fixation was either bipolar hemiarthroplasty or total hip arthroplasty or dynamic hip screw fixation or proximal femur plate or dynamic condylar screw or proximal femur nail.

Materials and Methods

This was a single centre, retrospective study which included data of patients who underwent femoral fracture repair surgery, from January 2020 to December 2022 at a tertiary care institute. After ethics committee approval, demographic details of eligible patients, details of their comorbidities and functional status (ASA grading), type of surgery and anaesthesia received by these patients was retrieved from Anaesthesia department database. Correlation between choice of anaesthesia with respect to age, type of comorbidities, general condition of patient (ASA grading) was analysed. Additionally, any adverse events intraoperatively and whether choice of anaesthesia affected this outcome was analysed. The numeric data is summarized by descriptive statistics like; n, median (average), minimum, maximum. The categorical data is summarized by frequency count and percentage using IBM SPSS software v.23.0.

Results

We identified 156 patients between January 2020 to December 2022, above 18 years of age, who were operated for fracture femur at our hospital. 85 (54.5 %) were females and 71 (45.5 %) were males. (Figure 1) 15 (9.6 %) patients were between 18- 35 years of age, 22 (14.10%) patients were between 36-59 years of age, 30 (19.23 %) were between 60-69 years of age and maximum patients, 89 out of 156 patients (57.05%) were above 70 years of age. (Figure 2) The mean age was 70.67 years. Out of 156, 34 patients (21.79%) were ASA I, 98 patients (62.82) were

ASA II, and 24 patients (15.38) were ASA III (Table 1). As seen in (Table 1), 61.76% of ASA I, 60.20 % of ASA II and 50% of ASA III patients received SAB, so use of SAB decreases and use of other types of anaesthesia increases as ASA grade increases and perioperative risk increases strongly suggesting that ASA risk grading affects choice of anaesthesia. Out of 24 ASA III patients, 21 (87.5%) received regional anaesthesia compared to 3 (12.5%) who received general anaesthesia, indicating that as ASA grade increases, regional anaesthesia administration preference increases.

As seen in (Figure 3), Continuous spinal anaesthesia usage slowly increases with age, nil in 18-35 years, minimal 2/19 of total CSA (10.52%) till 59 years of age, it is increased beyond 60 years of age 4/19 (21.05%) and maximum at 70 years and above 13/19 (68.42%). So, age affects choice of anaesthesia. General anaesthesia use is moderate below 35 years of age, 3/ 11 (27.27%) out of 11 patients of GA, minimal in adults beyond 35 years of age 1/ 11 (9.09 %) in both age groups- 36-59 years and 60-69 years but markedly increases at age of 70 years and above to 6/11 (54.54%). Lumbar plexus and sciatic block is seen used above 60 years of age. In Table 3, Out of 15 patients with 4 comorbidities, 2 received SAB, 11 received CSE, 2 received CSA. So, 15/ 15 (100%) patients with 4 comorbidities received regional anaesthesia and nil were given GA. The majority of choice of anaesthesia for patients with 4 comorbidities was CSE, as evident in (Table 3). So as comorbidities increased, there is a shift from use of subarachnoid block to other types of anaesthesia. As seen in (Table 4), perioperative adverse events were very few.

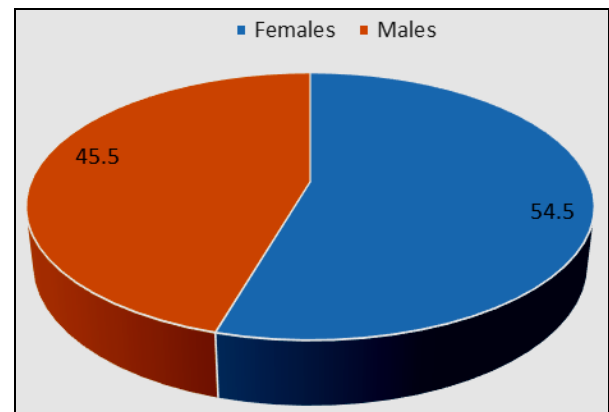


Fig 1: Gender wise distribution

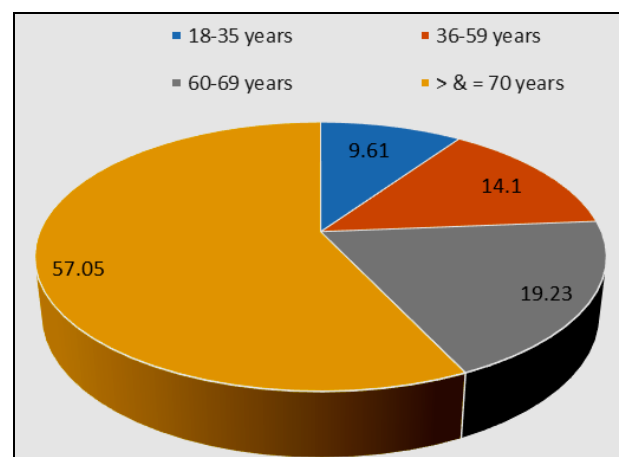


Fig 2: Age distribution

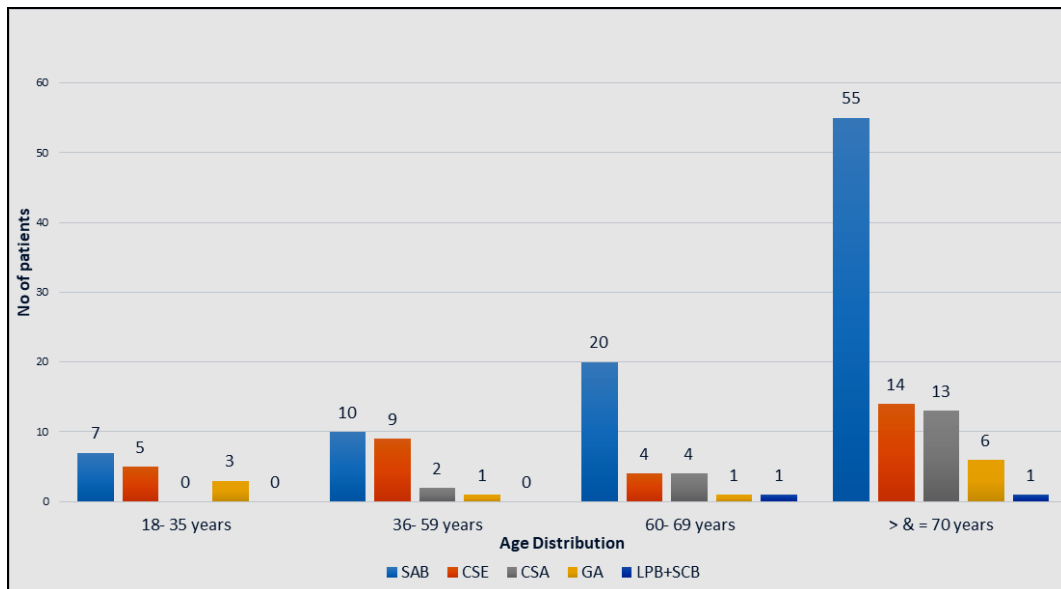


Fig 3: Relation between age and type of anaesthesia

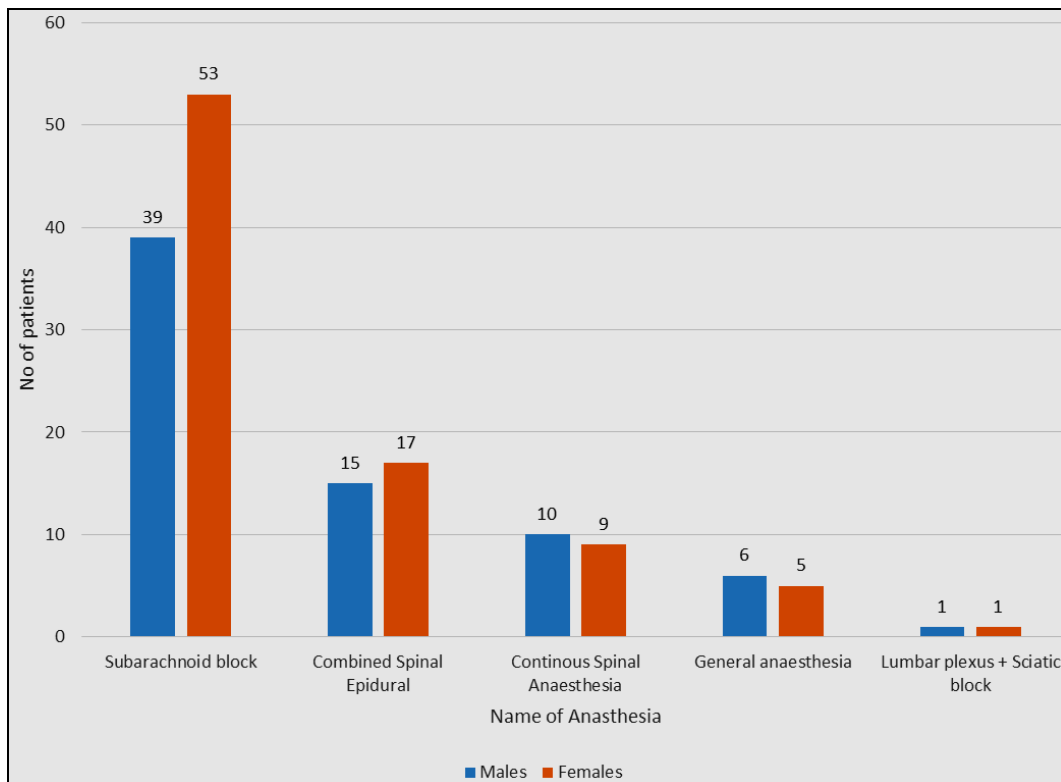


Fig 4: Distribution between gender and type of anaesthesia

Table 1: Association between ASA grade and type of anaesthesia in study group

Sr. No.	Type of anaesthesia	ASA I	ASA II	ASA III	Total number of patients in each type of anaesthesia
1	Subarachnoid block (SAB)	21 (61.7%)	59 (60.2%)	12 (50%)	92 (58.9%)
2	Combined Spinal Epidural (CSE)	11 (32.35%)	18 (18.3%)	3 (12.5%)	32 (20.5%)
3	Lumbar plexus + sciatic block (LPB+ SCB)	1 (5%)	1 (1%)	0	2 (1.2%)
4	Continuous spinal anaesthesia (CSA)	0	13 (13.2%)	6 (25%)	19 (12.1%)
5	General Anaesthesia (GA)	1 (5%)	7 (7.1%)	3 (12.5%)	11 (7%)
	Total number of patients in each ASA category	34	98	24	156

Table 2: Different types of anaesthesia given in patients with various comorbidities

Comorbidities & Number of patients having those comorbidities	Types of anaesthesia				
	SAB	CSE	CSA	GA	LPB + SCB
Hypertension (77)	46	14	12	5	
Diabetes (56)	30	11	8	6	1
Ischemic heart disease (IHD) (26)	12	5	5	4	
COPD/ Asthma/ ILD* (19)	11	2	4	2	
Hypothyroid (8)	5	1	1	1	
CKD (9)	4	1	4		
CVA (7)	5	1	1		
Obese class II & III (3)	1	1	1		

*ILD = Interstitial lung disease

Note: One patient can get repeated in various comorbidity groups

Table 3: Distribution of different types of Anaesthesia in patients with various comorbidities

Sr. No.	Number of comorbidities & Number of patients having them Total n= 156	Type of Anaesthesia				
		SAB(n=92)	CSE(n=32)	CSA (n=19)	GA (n=11)	LPB + SCB (n=2)
1	Nil or one (n= 77)	55	9	6	5	2
2	Two (n= 41)	23	8	9	1	-
3	Three (n=23)	12	4	2	5	-
4	Four (n= 15)	2	11	2	-	-

Table 4: Distribution of intraoperative symptoms over different types of Anaesthesia

Sr. No.	Symptoms	Type of Anaesthesia				
		SAB (n=92)	CSE (n=32)	CSA (n=19)	GA (n=11)	LPB + SCB (n=2)
1	Bradycardia	-	-	-	1	-
2	Hypotension	3	1	-	-	-
3	Hypoxia	-	-	-	-	-
4	Arrhythmia/ST-T changes/ Premature beats	3	1	-	1	-

Discussion

Fracture femur is associated with increase morbidity and mortality [1, 4]. Most of the articles regarding anaesthesia considerations for fracture femur, compare spinal anaesthesia (subarachnoid block) with general anaesthesia. [10-12, 16]. C. Shelton *et al.* [9] found that there were variations in practice regarding use of various types of anaesthesia for fracture femur. They further postulated that probably, the type of anaesthesia has less impact on perioperative morbidity and mortality and that the outcome depends on early surgery and good rehabilitation. We feel that because anaesthesiologists choose type of anaesthesia meticulously considering the patient- type, type of anaesthesia does not lead to any adverse outcome [14, 15, 17, 20]. Guay J, *et al.* [19] made a systemic review of data from 2003 to 2014, regarding anaesthesia for hip fracture surgery in adults. They included neuraxial blocks and peripheral nerve blocks, under the term regional anaesthesia. Similar to our study, they included a wide variety of clinical anaesthesia practices.

They concluded that they did not find any difference in regards to morbidity and mortality, between the regional anaesthesia techniques and general anaesthesia, except that regional anaesthesia decreases the risk of deep venous thrombosis only in the absence of potent thromboprophylaxis (very low quality of evidence). Comparable to their study, our study also did not show increase association of any perioperative adverse event with general anaesthesia. (Table 4)

In our institute, we give either subarachnoid block, or lumbar plexus and sciatic block, or combined spinal and epidural anaesthesia or continuous spinal anaesthesia or

general anaesthesia for anaesthetizing fracture femur cases. All anaesthesiologists practising in our hospital are trained in all the above techniques. So, provider skill factor doesn't affect the process of choosing type of anaesthesia. We undertook this retrospective study to analyse the factors, determining choice of anaesthesia procedures in patients undergoing surgery for femur fracture at our tertiary hospital. Diwan S, *et al.* [18], though in their study discussed about different types of anaesthesia similar to our study, but they did not analyse factors influencing choice of anaesthesia, instead they analyzed impact of different types of anaesthesia on patient outcome.

In our study, we found that percentage of females were more than males, 54.5 % and 45.5 % respectively. Chincholi. S, *et al.*, [2] had similar finding where 60% of 30 patients were females. Dhanwal *et al.* [3] had similar observation. They postulated that above age of 55 years, incidence of hip fracture is 105 men and 159 females per 100,000 individuals. In females, the cause could be osteoporosis due to menopause. In our study about patients above 18 years of age, the incidence of femur fracture is seen more in elderly, 87.05%. At 60 years and above and 57.05 % at 70 years and above. Bergh, C *et al.* [21] had similar observation in a 4-year study on 23,917 individuals, that the mean age of fracture was 57.9 years (range 16-105 years) and 64.5 % fractures occurred in women. Most of the other studies have considered patients above 50 years of age [3, 4] or above 55 years of age [2]. Age-related bio-mechanical changes in bone strength, imbalance while walking, sedentary life style, chronic medications for non-communicable diseases, make elderly more prone to fractures. Zhou SL, *et al.*, did a systematic review and meta-

analysis of randomized controlled trials, regarding regional versus general anesthesia in older patients for hip fracture surgery. They searched PubMed, EMBASE, Web of Science, and the Cochrane Central Register of Controlled Trials from January 2000 until April 2022. RCTs directly comparing regional and general anesthesia in hip fracture surgery were included in the analysis. They have considered different techniques of regional anaesthesia under one heading. Our study is different from theirs, in respect to analysing causes for selection of various subtypes of regional anaesthesia, which we have done. We have found that our selection changes according to age, ASA grading and comorbidities. Continuous spinal anaesthesia, Lumbar plexus and sciatic block and General anaesthesia is used more in elderly patients, above 60 years of age. (Figure. 3) (Table 2, 3). As the ASA grade increases, percentage use of spinal anaesthesia decreases. (Table 1) Patients with 4 morbidities received combined spinal epidural instead of spinal anaesthesia. (Table 2). We did not have any perioperative adverse events. (Table 4)

Conclusion

In our single centre retrospective study of 156 patients of fracture femur, we found that age, comorbidities and ASA grading affected our selection of type of anaesthesia, which ultimately resulted in a safe perioperative outcome.

Acknowledgments

We would like to thank Ms Vedanti Patil data entry and for assisting in publication process.

Limitations: More studies are needed to analyse the selection and effects of various subtypes of regional anaesthesia during repair of fracture femur cases.

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How to Cite This Article

Tiwaskar S, Shah K, Reddy P, Karande J. Factors determining choice of anaesthesia procedures in patients undergoing surgery for femur fracture at tertiary care centre. *International Journal of Medical Anesthesiology* 2024; 7(3): 120-125.

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