



Combined Spinal Epidural Block Using Low Dose Intrathecal Bupivacaine with Fentanyl in High Risk Geriatric Patients for Proximal Femoral Surgeries

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Abstract

Spinal anaesthesia with hyperbaric Bupivacaine is the most popular technique for lower limb surgeries in geriatric patients. hypotension and bradycardia are very common in this age group .In this study we have tried low dose intrathecal Bupivacaine with Fentanyl combined with epidural block in an attempt to reduce the side effects.120 ASA 3 patients between 65 and 80 years of age were randomly allocated into two equal groups. The control group (B) received spinal anaesthesia alone with 2ml 0.5% hyperbaric Bupivacaine with 25 microgram Fentanyl. The study group (A) received Combined spinal epidural anaesthesia with a low dose of 1ml 0.5% hyperbaric Bupivacaine and 25 microgram Fentanyl intrathecally. The sensory level of T10 if not attained was achieved with small incremental doses of 0.5% Bupivacaine administered through the epidural catheter.The incidence of hypotension in the study group was 25% vs 98.33% in the control group. (p < 0.05). Bradycardia occurred in 6.66% in the study group vs 56.66% in the control group (p< 0.05). The maximum fall in BP from baseline was 20.9±6.4 mmHg in the study group compared to 41.8 ±5.3 mmHg in the control group which was statistically significant. The total dose requirement of vasopressor to treat hypotension in the control group was significantly higher. Only 25% of patients in the study group required a dose more than 6mg of Ephedrine compared to 91.7% in the control group (p<0.01). Administration of Combined spinal epidural anaesthesia with low dose intrathecal Bupivacaine and Fentanylcauses lesser incidence of hypotension and bradycardia with reduced vasopressor requirements. Thus, a low dose intrathecal Bupivacaine with Fentanyl combined with epidural anaesthesia gives a stable haemodynamic profile in high risk geriatric patients for proximal femoral surgeries.

Keywords: Geriatric age group, ASA 3 Physical Status, Proximal femoral surgery, Spinal anaesthesia, Combined spinal epidural anaesthesia.

Introduction

Improvement in living conditions have caused a significant rise in the percentage of patients belonging to geriatric age group. Fracture of hip is

a common problem and so are surgeries on proximal femur. Geriatric patients have a high incidence of morbidity and mortality compared to younger age group because of their reduced cardio

respiratory reserve and concomitant diseases. Spinal anaesthesia is widely used in orthopaedic surgery. A sensory level of T10 is recommended to provide excellent anaesthesia for the patient. The principal mechanism whereby the elderly accentuates their cardiac output during a stressful state is by increasing left ventricular diastolic volume and augmented ventricular preload¹. However a stiffer, less compliant ventricular and atrial myocardium as may often be the case with many elderly subjects, will impair ventricular filling. Even a small decrease in venous return due to vasodilatation of sympatholysis may significantly compromise stroke volume. With limited ability to increase heart rate, hypotension can be frequent and severe in older surgical patients. ASA 3 status had 6.3 times mortality rates of their controls². In our study we have attempted to compare the haemodynamic stability while using two techniques, either spinal anaesthesia alone or combined spinal epidural anaesthesia with low dose intrathecal Bupivacaine¹⁹ in elderly patients undergoing proximal femoral surgeries.

Materials and Methods

One hundred and twenty ASA3 patients aged 65–80 years scheduled for proximal femoral surgery were included for study after obtaining written informed consent and approval from institutional ethics committee. Before the intervention, patients were randomly allocated into two groups by a computer generated random table. After routine investigations and preparation, all patients received anti-aspiration prophylaxis with Tab Ranitidine 150 mg and Tab Metoclopramide 10mg. Non-invasive blood pressure, electrocardiogram and pulseoximeter monitors were attached and baseline values recorded. All patients were given titrated dose of Injection Midazolam 0.5 to 1mg in the theatre before the procedure. Once the anaesthetic drugs and equipments were kept ready, an intravenous access was secured with an 18 G cannula under local anaesthesia in the left forearm and a preload of 500 ml of

isotonic saline was given to every patient before starting the procedure. In lateral decubitus position the inter vertebral space at L3-4 and L2-3 was identified. The prick points were infiltrated with 2 ml 2% lignocaine. Group A (n=60) received low dose spinal anaesthesia combined with epidural technique. A double inter space, double needle technique was used. An 18 G Tuohy needle was introduced in the L2-3 inter vertebral space. Identification of epidural space was done by using loss of resistance technique, with air. After identification of the epidural space an 18 G epidural catheter was inserted and secured. Dural puncture was performed with a 25 G Quincke Babcock needle in the L3-4 interspace. The dose of spinal hyperbaric bupivacaine injected in group A was 5.0 mg, (1 ml of 0.5% Bupivacaine with 25 microgram Fentanyl) which was intentionally kept small, because the aim was to produce a block restricted to T10 segment. The patient was then placed in supine position. Group B (n=60) received spinal anaesthesia with 2 ml hyperbaric bupivacaine and 25 microgram Fentanyl through a 25 G Quincke Babcock needle. They were also then made supine for surgery. Oxygen was supplemented with a transparent face mask. Sensory block was assessed after three minutes by pin prick method. In group A, 1.5 to 2.0 ml of 0.5% Bupivacaine was given for every unblocked segment, after the patient was placed supine, through epidural catheter to extend the block to T10 level. In group B if after 10 to 15 minutes the block did not reach to T10 sensory level supplementation with general anaesthesia was given. The average duration of the surgeries were 1.5 to 2 hours. Pulse rate and blood pressure were checked every minute for the first five minutes, every five minutes for the next twenty minutes and every 10 -15 minutes till the end of the surgery. After epidural top up blood pressure was recorded every 5 minutes for the first 20- 30 minutes. Hypotension, defined as systolic blood pressure less than 90 mmHg was treated with incremental dose of 3 mg Ephedrine hydrochloride. Bradycardia, which was defined as

heart rate less than 60 per minute was treated with 0.6 to 1.0 mg atropine intravenously. The observations made were tabulated and analysed using appropriate statistical tools. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 10. The statistical constants like mean, standard deviation, percentage etc, were completed. The hypotheses formulated were tested statistically by using Chi-square test, Student's test, Fischer's exact test and Mann Whitney U test. p value < 0.05 was considered statistically significant.

Observation and Analysis

The demographic profile of patients in both the combined spinal epidural group and spinal anaesthesia group were comparable with respect to age, height and sex and there was no significant differences ($p > 0.05$) between the two groups. (Table 1)

The patients in both the groups were comparable with respect to ASA physical status – Patients with COPD, Moderate hypertension with Ischaemic heart disease and those with Type 2 diabetes with Ischaemic heart disease. (Table 2). While analyzing the two parameters, pulse rate

and blood pressure, we included the data of the entire duration of surgery. Compared to 15 patients in the combined spinal anaesthesia (test) group, 59 patients in the spinal anaesthesia (control) group had incidence of hypotension in the first 30 minutes of administering the block. The difference was statistically significant. The incidence of Bradycardia was also statistically significant (Table 3). The baseline blood pressure and heart rate were comparable in the two groups. The maximum fall in blood pressure occurred in the first ten minutes. The fall in blood pressure and heart rate was greater in the control group compared to the study group. Statistically significant difference between two groups was present in the first 30 minutes. (Table 4,5) In the study group, 45 patients had no vasoconstrictor requirement, compared to only one patient in the control group. In the study group, only 15 patients (6.7%) required vasoconstrictors, where the total dose required was less than 6.0 mg. Compared to study group, 54 patients (91.7%) in the control group required dose greater than 6.0 mg (p value < 0.01). The difference in vasoconstrictor requirement between the two groups was statistically significant. (Table 6)

Table 1: Demographic data of the patients

Variables	Group A (n=60)	Group B (n=60)	p value
Age in years	71.3 ± 3.2	71 ± 3.3	$p > 0.05$
Height (cm)	158.2 ± 4.9	159 ± 4.4	$p > 0.05$
Sex*	Male 31 (51.7%) Female 29 (48.3%)	Male 28 (46.7%) Female (53.3%)	$p > 0.05$

Group A- combined spinal epidural anaesthesia (test) group

Group B – Spinal; anaesthesia (control) group

Data - mean ± standard deviation *Data as number of patients (Percentage)

Statistical test - student's t test

* Chi-square test

p value < 0.05 is considered statistically significant

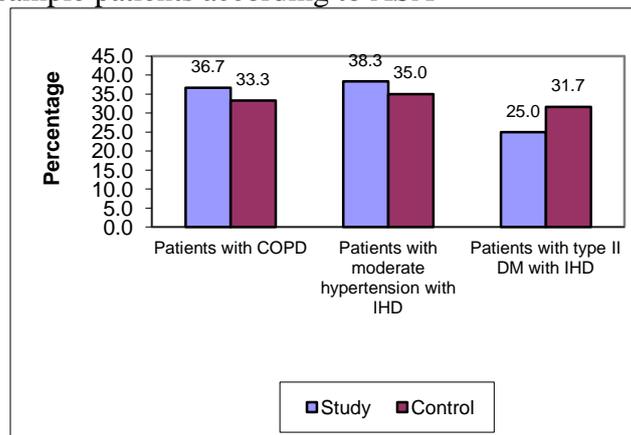
The patients in both the CSEA group and spinal anaesthesia group were comparable with respect to age, height and sex.

Table 2: Distribution of the sample patients according to ASA III PS type

Type of ASA III patients	Group A (n=60)		Group B (n=60)		p value
	Count	Percent	Count	Percent	
Patients with COPD	22	36.7	20	33.3	p>0.05
Patients with moderate hypertension with IHD	23	38.3	21	35	
Patients with type II DM with IHD	15	25	19	31.7	

COPD – chronic obstructive pulmonary disease, IHD – Ischaemic Heart Disease
 DM – Diabetes mellitus, Data –n = numbers (percentage)
 Group A- combined spinal epidural anaesthesia (test) group
 Group B – Spinal anaesthesia (control) group
 Statistical test= Chi-Square test

Figure 1 Distribution of the sample patients according to ASA



P value <0.05 is considered statistically significant.

Table 3: Comparison of hemodynamic parameters

Parameters	Group A n=60	Group B n=60	p
Hypotension	15(25%)	59(98.33%)	p <0.05
Bradycardia	4(6.66%)	34(56.66%)	p <0.05

Table 4: Comparison of blood pressure at different intervals of time based on group

Blood pressure in mm Hg	Group A n=60	Group B n=60	p value
Baseline	136.4 ± 5.7	136.4 ± 2.8	p >0.05
0-5 minutes	115.8 ± 7.4	94.5 ± 7.5	p <0.01
5-10 minutes	105.4 ± 9.3	97.8 ± 5.5	p <0.01
10-15 minutes	106.4 ± 7.0	98.8 ± 6.7	P <0.01
15-30 minutes	112.0 ± 5.7	101. ± 4.3	p <0.01
After 30 minutes	105.7 ± 7.6	105 ± 4.5	p <0.05

Group A- CSEA (test) group ,Group B- Spinal anaesthesia (control) group
 Data –mean ± standard deviation, Statistical analysis –student’s t test
 p value<0.05 is statistically significant

Figure 2 Comparison of blood pressure at different intervals of time based on group

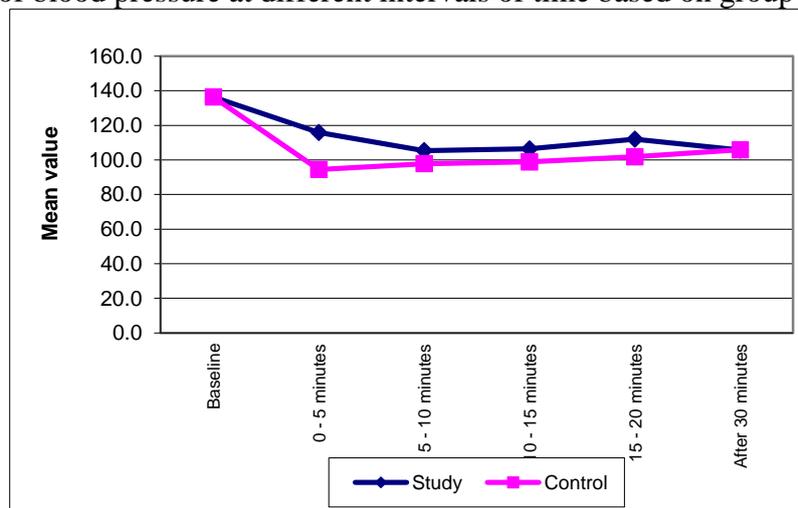


Table 5: Comparison of pulse rate at different intervals of time based on group

Pulse rate (Beats per minute)	Group A n=60	Group B n=60	p value
Baseline	67.9±4.9	67.5±4.8	p>0.05
0-5 minutes	63.8±4.1	57.7±3.8	P<0.01
5-10minutes	63.4±3.6	61.6±4.3	p<0.05
10-15 minutes	62.6±2.7	62.9±5.0	p>0.05
15-30minutes	63.1±2.9	62.3±2.4	p>0.05
After 30 minutes	63.0±2.5	62.1±2.5	p>0.05

Figure 3. Comparison of pulse rate at different intervals of time based on group

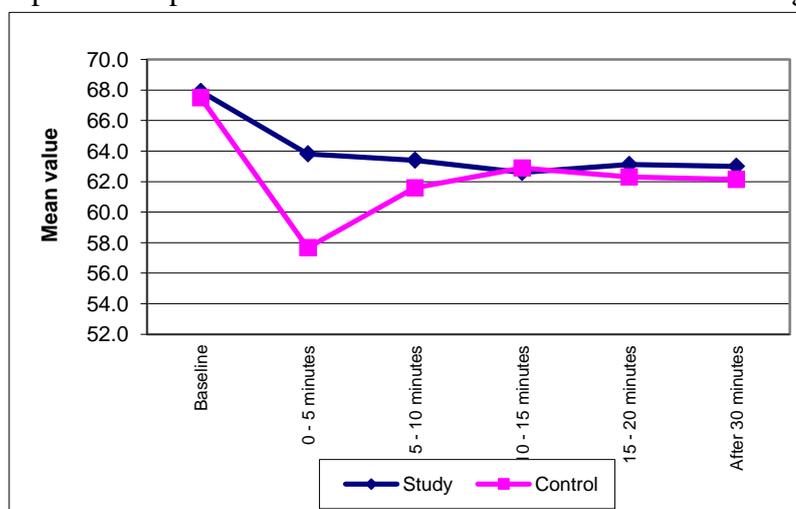
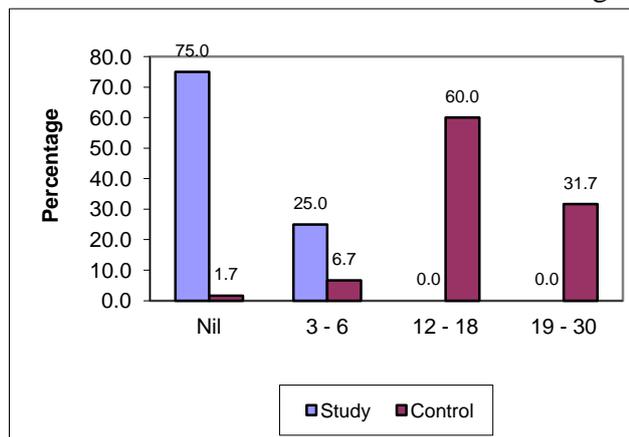


Table 6: Comparison of total dose of vasoconstrictor requirement based on group

Total dose of vasoconstrictor in milligrams	Group A n=60	Group B n=60	P value
Nil	n=45(75%)	n=1 (1.7%)	P<0.01
3-6 mg	n=15 (25%)	n=4 (6.7%)	
12-18	n=0 (0%)	n=36 (60%)	
19-30	n=0 (0%)	n=19 (31.7%)	

Figure 4. Comparison of total dose of Vasoconstrictor based on group

Discussion

Marked haemodynamic derangements are often seen following subarachnoid block: especially in elderly patients because of their reduced physiological reserve³. Neuraxial opioids are not associated with sympathetic system denervation, skeletal muscle weakness or loss of proprioception⁴. Several studies have shown that, analgesia level obtained after subarachnoid injection of hyperbaric local anaesthetic solution are approximately, 3-4 spinal segments higher in elderly compared with young patients^{5,6}. Precipitous arterial hypotension due to high levels of sympathetic block remains a problem associated with anaesthesia in geriatric patients. Despite prophylactic measures like fluid preload and prophylactic vasopressor, it may be difficult to maintain a near normal blood pressure in these patients. With sequential combined spinal epidural anaesthesia, adequate level of sensory block is obtained with the particular advantage of gentle onset of sympathetic block and less haemodynamic side effects^{7,8,9}. The recommended level of regional anaesthesia for procedures on the hip is T₁₀. Previous studies have indicated a dose of 12.5 to 15.0 mg of 0.5% hyperbaric bupivacaine to attain a sensory level of T₇ –T₁₀. It has been common practice now to add opioid additives to local anaesthetics to reinforce the spinal block and at the same time to reduce the dose of local anaesthetics. These effects have been well exemplified by a series of studies by Ben David et al¹⁰. In our study, both the test group A

(CSEA) and control group B (spinal anaesthesia), received 25 micrograms fentanyl. In this dose it does not produce any respiratory depression which is dose dependent¹¹. In our present study, the test group A (CSEA) received 5 mg of 0.5% hyperbaric bupivacaine and 25 microgram fentanyl. The resulting incompleteness of the block was corrected by 1.5- 2.0ml of 0.5% bupivacaine, for every unblocked segment, through epidural route. The control group B (spinal anaesthesia group) received 10 mg (2ml) of 0.5% hyperbaric bupivacaine with fentanyl 25 microgram. The receding level of block from T₁₀ was supplemented with small incremental doses of bupivacaine epidurally in the study group. The haemodynamic parameters – blood pressure and heart rate changes, were compared. The prime objective of this study was to find out whether the new technique provided a safer cardiovascular profile. In our study 59 out of 60 patients in the spinal anaesthesia (control) group developed hypotension, while only 15 out of 60 patients developed hypotension in the combined spinal epidural (test) group. The lower incidence of hypotension in the combined spinal epidural anaesthesia (test) group is not surprising, because we could limit the extent of block to T₈-T₁₀ sensory level and thus the extent of sympatholysis. Percentage of patients in the study group, who developed hypotension, had a sensory level of T₆. Our study also revealed that the degree of blood pressure fall was lower in the test group compared to spinal anaesthesia group.

These findings are in agreement with the findings of Fan et al¹², Swami et al¹³, Wakamatsu M et al⁷, Marc Van de et al¹⁴ and Dipasri Bhattacharya et al¹⁵. None of the patients in the combined spinal epidural group required general anaesthesia. In our study, insertion of the epidural catheter had a 100 % success rate. Cook¹⁶, in his study of double interspace combined spinal epidural anaesthesia in 201 parturients, reported 99.5% technical success rate. Out of 4 patients, who received general anaesthesia in the control group, 3 patients had patchy blocks, and one patient complained of pain towards the end of the surgery. Even though it is not very large, our sample has been statistically adequate enough to make our study relevant and representative. In our study double blinded method was not used, but the difference in incidence of hypotension and bradycardia between the groups were great. Therefore it was thought that the distinct difference could overcome the possible bias. We conducted this study on a group of subjects who are going to be benefited the most by using the study technique. More over most of the similar studies worldwide were done on Caesarean patients and there is a scarcity of such data among elderly high risk patients. A similar study among cardiac patients may be of much relevance. E.L.Hamlyn et al¹⁷, has reported using low dose sequential combined spinal epidural anaesthesia technique for caesarean section in patients with significant cardiac disease. R Landan et al¹⁸ has reported using sequential combined spinal epidural anaesthesia for caesarean section in a woman with double outlet right ventricle. The clinical usefulness of these findings could be a subject of further study.

Conclusion

ASA 3 geriatric patients coming for proximal femur surgeries are commonly given spinal anaesthesia alone. This may lead to bradycardia and precipitous fall in blood pressure due to a higher level of sympathetic blockade and inability of the ageing haemodynamic compensatory mechanisms. Low dose spinal combined with

epidural block is a suitable and safer alternative. It causes lesser hypotension and bradycardia and lower requirement of vasopressors, thus lowering the risk of proximal femoral surgery in high risk geriatric population.

Source of Support: Self

References

1. Folkow B, Savanborg S : The physiology of cardiovascular ageing. *Physiology Review* 1993; 73:725-64.
2. White BL, Fisher WD, Laurin CA. Rate of mortality for elderly patients after fracture of the hip. *J Bone Joint Surgery* 1987;69(A):1335.
3. H.J. Priebe: The aged cardiovascular risk patient. *Br J Anesth* 85(5): 763-78, 2000.
4. Critchley L.A.H: Hypotension, subarachnoid block and the elderly patient *Anaesthesia* 51:1139-1143, 1996.
5. Rack JP, Ben Khadsa A, poly JY et al. Special anaesthesia with hyperbasic bupivacaine, influence of age. *Br. J Anaesth* 1988; 60:508-14.
6. Verring BT, Busmagl MD, Vletter AA et al. The effect of age on systematic absorption of bupivacaine after subarachnoid administration. *Anaesthesiology* 1991; 74: 250-57.
7. Wakamatsu M, Katoh H, Kondo U, et al. Sequential combined spinal and epidural anaesthesia for orthopaedic surgery in elderly *Masui* 1991; 40 :1766-69.
8. Backe, S., Sheikh, Z., Wilson, R., & Lyons, G. (2004). Combined epidural/spinal anaesthesia: Needle-through-needle or separate spaces? *European Journal of Anaesthesiology*, 21(11), 854-857
9. Ahn, H. J., Choi, D. H. and Kim, C. S. (2006), Paraesthesia during the needle-through-needle and the double segment technique for combined spinal epidural anaesthesia*. *Anaesthesia*, 61: 634-638.

10. Ben - David B, Solomon E, Levin H et al. Intrathecal fentanyl with small dose dilute bupivacaine. Better anaesthesia without prolonging recovery *Anaesth Analog*; 85:560-65.
11. Zin SS, Chin AA, Carpenter RL et al. Fentanyl prolongs lidocaine spinal anaesthesia without prolonging recovery. *Anaesth Analog* 1995; 80:730-74.
12. Fan SZ, Succt IL, Wang YP, Cheng YJ, Lin ce. How dose of intrathecal hyper basic bupivacaine combined with epidural lidocaine for caesarean section – a balance block technique. *Anaesth Analog* 1994; 78: 474-7.
13. Swami A, Mcftale S, Abbot P et al, how dose spinal anaesthesia for caesarean section having combined spinal epidural technique (Abstract) *Anaesth Analog* 1993; 76: S 423.
14. Marc Van de Velde, MD, Ph D, Dominique Van Schrubroeck, MD, Jacques Jani, MD, AND J Deprest . combined Spinal-Epidural Anesthesia for Cesarean Delivery: Dose-Dependent Effects of Hyperbaric Bupivacaine on Maternal Hemodynamics. *Anaesthesia Analg* July 2006; vol 103(1):187-190.
15. Bhattacharya D, Tewari I, Chowdhuri S. Comparative study of sequential combined spinal epidural anaesthesia versus spinal anaesthesia in high risk geriatric patients for major orthopaedic surgery. *Indian J Anaesth* 2007; 51:32-6
16. Cook TM. 201 Combined spinal-epidurals for anaesthesia using a separate needle technique. *Eur J. Anaesth* 2004; 21:679-683
17. E.L.Hamlyn, C.A.Douglass, F.Pleat, J.A. Crowhurst, G.M.Stock. Low Dose Sequential combined spinal – epidural: an anaesthesia technique for caesarean section in patients with significant cardiac disease. *International Journal of obstetric Anaesthesia*, 2005; Vol 14. Issued P: 355-361
18. R.Landan, R.Girand, M.Mosales, C.Kern, P.Trivdade. Sequential combined spinal – epidural anaesthesia for caesarean section in a woman with double outlet right ventricle. *Acta Anaesthesiologia Scandinavia* 2004; Vol 48: Issue 7; 922-926
19. Singh TK, Anabarsan A, Srivastava U, Kannaujia A, Gupta A, et al. (2014) Unilateral Spinal Anaesthesia for Lower Limb Orthopaedic Surgery Using Low Dose Bupivacaine with Fentanyl or Clonidine: A Randomised Control Study. *J Anesth Clin Res* 5:484.