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The Comparative Study of "Combined Lumbar Plexus Block and Low Dose Epidural Anesthesia" With "Epidural Anesthesia" for Surgeries Involving of Upper 1/3rd of Femur

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Abstract: ***Combining epidural anaesthesia along with lumbar plexus block provides effective anaesthesia for operative procedure. It takes care of sparing of lateral cutaneous nerve distribution area, sacral plexus distribution area. Also provides anesthesia for other limb, facilitates patients positioning. Due to epidural supplementation we can avoid sedatives and opioid supplementation during and after surgery with stable hemodynamic profile. This study suggests that the "combined lumbar plexus block and low dose epidural anaesthesia" is a beneficial alternative to existing anaesthesia techniques for high risk elderly patients for surgeries of fractures of upper 1/3rd femur. Further larger scale studies will reveal potential benefits of this regional anaesthesia technique. The results of this prospective, randomized study demonstrated that "combined lumbar plexus block and low dose epidural anaesthesia" is a novel technique of providing effective intraoperative anaesthesia and postoperative analgesia.***

Keywords: edidural anaesthesia, lumbar plexus block

1. Introduction

The term proximal femoral fracture or 'hip fracture' refers to a fracture of the femur in the upper 1/3rd area of bone immediately distal to the articular cartilage of the hip to a level of about five centimetres below the lower border of the lesser trochanter. The majority of these fractures occur in an elderly population with an average age of around 60 years.

Geriatric age group constitutes about 7 % of total population[3]. Fracture of femur are very common in geriatric age group. These patients with cardio-respiratory problems posted for surgical repair of hip fractures impose challenges to anaesthesiologist to maintain homeostasis with good surgical anaesthesia. Usually when such cases are confronted, the choice of anaesthesia would be general anaesthesia or regional namely spinal anaesthesia, epidural anaesthesia and lumbar plexus blockade.

Regional anaesthesia is considered to be a preferred technique when patients with cardio-respiratory compromise are posted for femur fracture surgeries. But regional anaesthesia is also associated with hemodynamic instability and inadequate anaesthesia in very old patients[4,] (fowler et al). Lumbar plexus block although a good option but it is rarely accepted by anesthesiologists because of technical difficulties and inadequate blockade.

Considering pitfalls of various regional anaesthesia techniques, we came up with new technique of combining lumbar plexus block with epidural anaesthesia in low doses (0.5% Bupivacaine 4cc). Combining lumbar plexus block with epidural anaesthesia provides adequate intraoperative motor and sensory blockade and prolonged post-operative analgesia with hemodynamic stability.

Thus we hypothesize that lumbar plexus block with low dose epidural anaesthesia is promising regional technique that offers adequate anaesthesia with lesser rate of complications with stable hemodynamics.

2. Aims and Objectives

1) To assess and compare the onset of sensory and motor block in both the study groups.
2) To assess and compare the duration of motor block and sensory block.
3) To assess the adequacy of anaesthesia.
4) To assess requirements of epidural supplementation following anaesthesia.
5) To assess the hemodynamic stability.
6) To assess the rate of complications.

3. Material and Methods

Sixty adult patients posted for surgeries involving fractures of upper 1/3rd of femur in our institute were selected. Cases were randomly divided into two groups as follows:

1) Group A(LPB+EA)-In thirty patients lumbar plexus block by posterior approach (psoas compartment block) was given first, followed by low dose epidural anaesthesia.
2) Group B (EA)-Another thirty patients were given epidural anaesthesia alone.

Drugs and dosage
Group A (LPB+EA)-For lumbar plexus block Inj. 0.25% Bupivacaine 25cc was used.For low dose epidural analgesia Inj. 0.5% Bupivacaine 4cc was used.

Group B (EA)-For epidural anaesthesia, Inj.0.5, % bupivacaine 8cc was used.

Selection of cases-All the patients underwent thorough pre-anaesthetic assessment including detailed case history, clinical examination and necessary investigations depending on age and disease of patients.

Inclusion criteria

- Age group – 18 years and above.
- ASA grade I to III.
- Emergency and routine procedures on femur fractures were included namely fractures neck of femur, intertrochanteric fractures and fractures of shaft femur in upper 1/3rd.

Exclusion criteria

- Patient's refusal.
- Sensitivity to the local anaesthetic.
- Infection at the site of the block.
- Patient with bleeding disorders.
- Other specific contraindications of psoas compartment block including vertebral and meningeal infectious syndromes, lumbar vertebral trauma and significant scoliosis[17].
- The relative contraindications including sepsis, anxious or agitated patient, psychiatric illness, diabetic neuropathy and neurologic lesion in the lumbar plexus region.

Procedure

- Placement of intravenous cannula 18 or 20G was done and IV fluids started.
- All patients received acid prophylaxis in the form of Inj. Ranitidine 50mg and Inj. Metoclopramide 10mg I.V.
- All the patients received Inj. Midazolam 0.03mg/kg I.V.
- Pulse rate and Blood pressure were recorded in supine position.

Lumbar plexus nerve block by posterior approach (Psoas Compartment Block)
Position- Lateral decubitus with the surgical side up and knee flexed.

Landmarks –
The midline is identified beginning at the L3 spinous process. A parallel line is drawn, originating from the posterosuperior iliac spine usually 4.5 to 5 cm lateral to midline. A vertical line is drawn at the level of the highest point on the iliac crest. The intersection of the two lines determines the site of introduction of needle.

Technique

Under all aseptic precautions, local Infiltration was done with 2% of 2cc Inj. Lignocaine at the point of needle insertion. The insulated needle (100 mm, 21G) connected to nerve stimulator (1.5mA, 2 Hz) ,and is introduced perpendicularly and advanced slowly in search of transverse process. The stimulation of the femoral nerve produces the contraction of quadriceps muscle and the movement of the patella, creating a spectacle known as 'dancing patella'. After appropriate positioning of the needle, allowing motor response with a current less than 0.5mA and negative blood aspiration, the local anaesthetic is injected slowly with repeated aspiration for blood every 5ml and distributed around the lumbar plexus.

If the transverse process is contacted, the needle is walked off the bony structure and the lumbar plexus is identified within the next 1.5 to 2.0 cm. If the stimulation of the lumbar plexus does not occur within 9cm from the skin, the needle is withdrawn to the skin and reintroduced after increasing angulation of the needle by 10^0 laterally.

4. Epidural Anaesthesia

Under all aseptic precautions, local Infiltration was done with 2% of 2cc Inj. Lignocaine. The Epidural space was identified with a 16G Touhy's needle through L2-L3 interspace, using "loss of resistance" technique. 16G epidural catheter was threaded and kept in the epidural space for 4-5cms. After negative aspiration for blood and cerebrospinal fluid, inj bupivacaine 0.5% was given according to study group. Time of injection was noted. Epidural catheter was secured in place. Patient was turned to supine position.

Our observations included the following parameters:-

1) HAEMODYANAMIC PARAMETERS:
   Hemodynamic parameters in the form of pulse rate and blood pressure were recorded.
   a. Before premedication.
   b. After premedication, before block and
   c. After block at 5 min and then at intervals of 10 minutes, till the end of 180 min or end of surgery.
   (Bradycardia when Pulse < 60 /min or <20% from the baseline. Tachycardia when pulse >100/min or >20% from baseline.
   - Hypotension if systolic BP decreased by 30% from the baseline or diastolic decreased by 15% from the baseline).In case of hypotension it was treated with adequate IV fluids and Inj. Mephentaramine IV 3mg.
2) 2)The onset of sensory and motor block in both groups measured from the time of injecting the drug. Sensory analgesia to pinprick was assessed at the operative site using Visual Analogue Scale, in which VAS<3 indicate onset of analgesia. Visual analogue scale involves the use of 10cm scale which was marked from 0-10. It was explained to the patient that one end of the scale represents as much pain as he can possibly imagine while the other end represents no pain at all. The subject rates the degree of pain by making a mark on the linear scale. Values were then obtained by measuring the distance from 0 to 10 that mark. Onset of motor block assessed from Bromage scale 6 or decrease in muscle power in the limb.
3) Onset of motor block assessed from Bromage scale 6 or decrease in muscle power in the limb. The onset is assessed beginning from the time of injecting drug following block in Group A and following epidural in Group B.
4) Duration of motor and sensory block
5) Duration of sensory block is assessed from the time of injecting the drug to the need of epidural top up doses post-operatively.
6) 4)Epidural supplementation was given with 5cc 0.5% bupivacaine whenever there VAS scores were >3 or

inadequacy of motor blockade i.e. Modified Bromage Scale was more than >3

7) 5)Epidural top ups given intraoperatively with 5cc 0.5% Bupivacaine whenever patient complained of pain or inadequacy of analgesia.
8) Adequacy of motor block was assessed by modified Bromage scale
9) 7)Muscular relaxation was assessed by reference to the "Modified Bromage Scale." Used by Breen et al.
10) Adequacy of anaesthesia due to inadequate sensory or motor blockade was assessed in both groups. VAS >3 or Modified Bromage scale >6 was considered as inadequate or failure of block
11) 8) To assess development of hypotension in both study groups.
12) 9) Any complications.

In the recovery room, pulse rate, blood pressure and SPO_2 was recorded at ten minutes interval for two hours and patient was observed for any complications such as nausea, vomiting, hypotension, intra vascular injection or local anaesthetic toxicity was noted.

Every patient was enquired about pain after surgery and using visual analogue score, duration of post-operative analgesia was noted. In our study, values were presented as mean±SD where appropriate. For comparison between groups, Students t- test and Z-test were applied. Differences were considered statistically significant if p value<0.05.

5. Observations And Results

Onset of sensory and motor block in both study groups

Variables	Group A (LPB+EA)	Group B (EA)	P value	Significance
Onset of sensory block(min)	5.416±1.27	10.66± 2.48	<0.05	Significant
Onset of motor block(min)	10.33± 2.32	19.33±4.03	<0.05	Significant

Duration of sensory and motor block

Variable	Group A (LPB+EA)	Group B (EA) (following last dose)	P value	Significance
Duration of motor block in Hrs	5.45±1.00	1.95±0.620	<0.05	Significant
Duration of sensory block in Hrs	8.18±0.95	4.33±0.88	<0.05	Significant

Adequacy of motor block by using Modified bromage scale

	GROUP A (LPB+EA)	GROUP B (EA)
1	4 (13.33%)	0
2	13 (43.33%)	0
3	12 (40%)	3 (3.3%)
4	1 (3.3%)	16 (53.3%)
5	0	11 (36.6%)
6	0	0

Number of cases where intraoperative epidural supplementation was given after first dose before surgery due to inadequate block.

Variable	Group A (LPB+EA)	Group B (EA)	P	Significance
Cases with epidural supplementation	4	24	<0.01	Significant

Number of cases which needed top up doses Intraoperatively.

Variable	*Group A (LPB+EA)*	*Group B (EA)*	*P*	*Significance*
Cases which needed epidural ups	3	27	<0.01	Significant

Changes in mean pulse rate/min at various periods

	Group A (LPB+EA) (mean±SD)	*Group B (EA) (mean±SD)*	*P value*
Baseline(After premedication)	74.53±.3.96	73.73 ±3.88	NS
After 5 min of induction	75.66±4.72	77.73 ± 4.41	NS
10 min	75.46±.4.06	75.83 ± 3.76	NS
20min	74.44±4.04	74.00±4.00	NS
30min	75.66±4.36	77.06 ±5.24	NS
60min	75.7 ±4.29	77.86 ± 6.38	NS
90min	75.46±4.13	77.26 ± 4.44	NS
120min	75.2 ±4.31	77.53 ± 4.22	NS
150min	75.26±4.11	77.53 ± 5.52	NS
180min	75.33±4.34	78.2 ± 5.95	NS

Changes in mean arterial blood pressure (mm Hg) in both groups.

	Group A (LPB+EA) (mean)	Group B (EA) (mean)	P value
Baseline(After premedication)	90.66	91.3	NS
After 5 min of induction	94	91.3	NS
10 min	90.33	85.66	NS
20min	89.33	83.66	NS
30min	92.66	86.66	NS
60min	92.66	88	NS
90min	92.66	87.66	NS
120min	93.33	88.33	NS
150min	93.66	87.66	NS
180min	92.66	87.33	NS

	Group A (LPB+EA)	*%*	*Group B (EA)*	*%*
Systolic Hypotension	2	6.66	10	33.33

6. Discussion

The onset of sensory and motor block was assessed beginning from the time of injecting drug following block in Group A. (as block was given before epidural). In Group B onset was assessed from drug injection in epidural space.

Sensory analgesia to pinprick was assessed at the operative site of affected limb in both groups and by using Visual analogue scale[29], in which VAS<3 indicates onset of analgesia.

Onset of motor action was assessed in both the groups by modified bromage scale[30]. Bromage scale of 6 or decrease in

muscle power in the anaesthetised limb indicates onset of motor blockade.

In Group A (LPB+EA) onset of sensory block is 5.816±1.27min and in Group B (EA) it is 10.66± 2.48 min. The difference in both groups is found to be statistically significant.

In Group A (LPB+EA), the onset of motor action is 10.33± 2.32 min and in Group B (EA), 19.33±4.03 min. The difference is found to be statistically significant.

In our study the Group A (LPB+EA) had earlier onset of action of both motor and sensory block than Group B. Early onset may be due to combination of low dose epidural anaesthesia along with lumbar plexus block. Onset of both motor and sensory block in Group B (EA) was delayed may be due to lower doses of epidural drug.

The mean duration of sensory block in Group A (LPB+EA) is 8.18±0.95 Hrs and in Group B (EA) it is 4.33±0.88 Hrs. The mean duration of motor block is 5.45±1.0 Hrs in Group A (LPB+EA) and 1.95±0.620 Hrs in Group B (EA). Duration of sensory and motor blockade is prolonged in Group A (LPB+EA) compared to Group B (EA).It is statistically very ($p<0.05$) significant.
Twenty nine patients (97%) in Group A (LPB+EA) had motor blockade with bromage scale 1, 2 and 3 where surgery is possible. While only three (10%) patients in Group B (EA) had blockade with bromage scale 2 and 3. Degree of motor blockade improved with epidural supplementation with 5 cc 0.5 % Bupivacaine in group B.
Adequacy of anaesthesia was assessed in both groups. VAS[29] >3 or Modified Bromage scale >4 was considered as inadequate or failure of block. Inadequate anaesthesia was found in 13.33% (4/30) in Group A (LPB+ EA) and 80% (24/30) cases in Group B (EA).
This difference is found to be statistically very significant ($p<0.05$).
All four cases in Group A and 24 cases in Group B (EA) having inadequate anaesthesia, epidural supplementation of 5cc of 0.5%Bupivacaine was required to achieve adequate anaesthesia.

There was no sparing of areas of lower limb supplied by sacral plexus, lateral cutaneous nerve of thigh, obturator nerve, in Group A (LPB+ EA) due to epidural supplementation.

De Visme et al[15]compared 'lumbar plexus block + sacral plexus block' with spinal anaesthesia for hip fractures. In lumbar plexus block with sacral plexus block the group, anaesthesia was inadequate in four out of the 15 patients (27%). Three of the four patients reported pain at incision that was relieved by a single bolus of alfentanil 250 mg, whereas the fourth patient required sedation.

Horasanli, et al[13] study, compared 'lumbar plexus block + sacral plexus block' with epidural anaesthesia for lower limb surgeries. In this study inadequate block was supplemented with intravenous midazolam and propofol. Mean propofol requirement was 54.5±4.7 mg in the epidural group and 56.3±3.5 mg. in the.lumbar plexus block with sacral plexus block group ($p=0.648$). Mean midazolam requirement was 3.6±0.3 mg in the epidural group and 3.5±0.2 mg in the lumbar plexus block with sacral plexus block group ($p=0.210$).

Buckenmaier et al[16] study group used propofol as an adjuvant to psoas compartmental and sacral plexus block for hip arthroplasty. In Gaillat F et al[14] study, psoas compartmental and sacral plexus block was supplemented with sedatives to achieve adequate anaesthesia.

Türker et al[11] compared epidural anaesthesia with psoas compartmental block. In this study, epidural group were given general anesthesia plus epidural block with 15 ml of 0.5% bupivacaine and Psoas compartmental block group were given general anesthesia plus psoas compartment block with 30 ml of 0.5% bupivacaine.

In all above mentioned studies, cases with inadequate anaesthesia required general anaesthetic agents, sedatives or opioids. Hip fracture incidence is high in old age group. Old age patients are usually associated with various comorbidities. Considering this we always prefer to avoid general anaesthetic agents, sedatives or opioids in these patients. By putting epidural catheter in our study we overcame inadequate anaesthesia by epidural supplementation and avoided respiratory depressant drugs and general anaesthesia.

Systolic hypotension was observed in two (6%) out of 30 patients in Group A (LPB+EA) and ten patients (33.33%) in Group B (EA). It was observed that only the patients those received epidural supplementation in group B had hypotension. This indicates that initial dosage of 0.5% 8cc of bupivacaine in group B is inadequate to achieve surgical anaesthesia however larger doses are associated with hypotension.

Türker et al[11] compared epidural anaesthesia with psoas compartmental block. In this study, epidural group were given general anesthesia plus epidural block with 15 ml of 0.5% bupivacaine and Psoas compartmental block group were given general anesthesia plus psoas compartment block with 30 ml of 0.5% bupivacaine. They found significant drop in mean arterial pressure at 30, 40, and 50 minutes in epidural group.

Türker et al[11] found that patients who received epidural (0.5% 15 cc bupivacaine) + General anaesthesia had systolic hypotension which correlates our study. In our study the patients those received epidural anaesthesia (group B) had hypotension than group A. Indicating hypotension is an adverse effect of epidural anaesthesia in conventional doses in old aged moribund patients. This is particularly important in old aged moribund patients where hemodynamic alterations lead to adverse cardiac events.

In our study the total dosage of bupivacaine in combined technique was well below the maximum dosage of bupivacaine in average built adult. (62.5mg lumbar plexus block + 20mg in epidural block. The total dose was 82.5 mg). It reduced possible systemic toxicity of local anaesthetic agents.

Leeuw et al[12] used 150 mg bupivacaine (with epinephrine 1:200.000) (30 mg bupivacaine for the sciatic nerve block and 120 mg bupivacaine for the psoas compartment block) for hip arthroplasty. Combined Psoas Compartment–Sciatic Nerve Block does not appear to induce clinically significant haemodynamic changes in the study group of patients.

Accordingly Leeuw et al[12] study, in hip arthroplasty, cardiac index did not change after a combined Psoas Compartment–Sciatic Nerve Block (pre block cardiac index 2.98 ± 0.54 l Min^{-1} m^{-2} versus post block cardiac index 2.99 ± 0.60 l Min^{-1} m^{-2}). There was a significant reduction in mean arterial blood pressure (108 ± 16 mmHg pre block versus post block 99 ± 16 mmHg (P < 0.001)) and diastolic blood pressure (75 ± 9 mmHg pre block versus post block 68 ± 10 mm of Hg (P = 0.001)). Heart rate increased significantly (68 ± 9 beats Min^{-1} pre block versus post block 73 ± 10 beats Min^{-1} (P = 0.001))

Compared to Leeuw et al[12] study our study groups received significantly lower doses of Bupivacaine (82.5mg). So less hemodynamic alterations were observed in our lumbar plexus block group (only two patients out of 30). Although 33% of patients had hypotension in epidural group which might be because of epidural supplementation given to achieve adequate intraoperative anesthesia. There were no statistically significant variation found in pulse rate, mean arterial pressure, diastolic blood pressure.
In our study no patient developed any significant complications.

7. Conclusion

The results of this prospective, randomized study demonstrated that “combined lumbar plexus block and low dose epidural anaesthesia” is a novel technique of providing effective intraoperative anaesthesia and postoperative analgesia. Combining epidural anaesthesia along with lumbar plexus block provides effective anaesthesia for operative procedure. It takes care of sparing of lateral cutaneous nerve distribution area, sacral plexus distribution area. Also provides anesthesia for other limb, facilitates patients positioning. Due to epidural supplementation we can avoid sedatives and opioid supplementation during and after surgery with stable hemodynamic profile.
This study suggests that the “combined lumbar plexus block and low dose epidural anaesthesia” is a beneficial alternative to existing anaesthesia techniques for high risk elderly patients for surgeries of fractures of upper 1/3rd femur. Further larger scale studies will reveal potential benefits of this regional anaesthesia technique.

References

[1] WHO study group 1994 Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. WHO; 1994 WHO technical report series no.: 843.
[2] Melton LJ III. Hip fractures: a worldwide problem today And tomorrow. Bone 1993;14 Suppl 1:S1–8.
[3] http://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS
[4] Epidural analgesia compared with peripheral nerve blockade after major knee surgery: a systematic review and meta-analysis of randomized trials S. J. Fowler, J. Symons1, S. Sabato1 and P. S. Myles1 2 British Journal of Anaesthesia 100 (2): 154–64 (2008)
[5] Parker MJ, HandollHHG, Griffiths R. Anaesthesia for hip fracture surgery in adults. Cochrane Database of Systematic Reviews2004, Issue 4
[6] ModigJ. Regional anaesthesia and blood loss. Acta Anaesthesiologica Scandinvica Supplementum1988;89:44–8.
[7] Winnie AP, Ramamurthy S, Durrani Z, Radonjic R. Plexus blocks for lower extremity surgery. *Anesthesiology Reviews* 1974;1:11–6.
[8] Mansour NY. Reevaluating the sciatic nerve block: another landmark for consideration. Regional Anesthesia 1993;18:322–3.
[9] Sorensen 1992 Sorenson RM, Pace NL. Anesthetic techniques during surgical repair of femoral neck fractures. A meta-analysis
[10] Rodgers 2000 Rodgers A, Walker N, Schug S, McKee A, Kehlet H, van Zundert A, et al.Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. BMJ 2000; 321:1493–7.
[11] Turker G, Uckunkaya N, Yavascaoglu B, Yilmazlar A, Ozcelik S. Comparison of the catheter-technique psoas compartment block and the epidural block for analgesia in partial hip replacement surgery. Acta Anaesthesiol Scand 2003; 47: 30–6.
[12] de Leeuw MA, Slagt C, Hoeksema M, Zuurmond WW, Perez RS. Hemodynamic Changes During a Combined Psoas Compartment–Sciatic Nerve Block for Elective Orthopedic Surgery Anesth Analg. 2011 Mar;112(3):719-24. Epub 2010 Dec 14
[13] A comparison of epidural anesthesia and lumbar plexus-sciatic nerve blocks for knee surgery Eyup Horasanli[I]; Mehmet Gamli[I]; YasarPala[II]; Mustafa Erol[III]; FaziletSahin[IV]; BayazitDikmen[I])
[14] Gaillat F, Thibault S, Scemama F, Joly F, Paladini M, Auffray J. Bloc lombaire et sciatique posterieur pour fracture du col du femur du sujet age: experience clinique. Cah Anesthesiol 2002; 50: 99–104
[15] De Visme V, Picart F, Le JouanR, Legrand A, Savry C, Morin V Combined lumbar and sacral plexus block compared with plain bupivacaine spinal anesthesia for hip fractures in the elderly. RegAnesth Pain Med 2000; 25: 158–62
[16] Buckenmaier CC, 3rd, Xenos JS, Nilsen SM. Lumbar plexus block with perineural catheter and sciatic nerve block for total hip arthroplasty. J Arthroplasty 2002; 17: 499–502)