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Comparison of spinal anaesthesia with lumbar plexus block for postoperative analgesia in fracture neck femur surgery

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Abstract

Background: Lumber plexus block is technically difficult but with availability of nerve locator, it is relatively easy and reliable technique of anaesthesia. This study was planned to compare lumber plexus block with spinal anaesthesia for postoperative analgesia

Methods: After obtaining permission from institutional ethical committee total 50 patients of either sex with fracture neck femur belonging to physical status ASA group I to III; posted for routine orthopaedic surgery were selected randomly. Group I (SA) received spinal anaesthesia and Group II (LPB) received posterior lumbar plexus block. Time of onset and level of sensory and motor block were noted. Intraoperative vitals were noted at every 15 minute intervals. Patients were observed for 2 hrs at interval of 30 minutes for postoperative pain using visual analogue scale (VAS), vitals and for complications.

Results: Time required for sensory blockade was more 17.32±2.61 in Group II as compared to 3.76±0.91 in Group I ($p<0.05$) and time required for motor blockade was higher in Group II (22.76±2.67) as compared to Group I (8.64±0.91) ($p<0.05$). Hypotension was observed in 15 patients in Group I as compared to 2 patients in Group II. VAS score at interval of 30 min was statistically significant in Group I (3.16±1.11) compared to Group II (1.5±0.51).

Conclusion: LPB provides good sensory and motor block with feasibility to extend block, better haemodynamic stability with less side effects so it is a valuable option as compared to SA with supplementation of sedation in case of insufficient analgesia.

Keywords: Spinal anaesthesia, Lumbar plexus block, Analgesia, Visual analogue scale

Introduction

Modern anesthesiologists are concerned with both intraoperative and postoperative pain relief. They can provide best pain relief; as they are familiar with pharmacology of analgesics, pain pathways and skill for pain management modalities. Among painful conditions fractures are common and fracture neck femur is common amongst elderly especially females because of osteoporosis.(1) These patients are of geriatric age group and may have associated cardiac, respiratory and neurological problems which increases risk for perioperative and postoperative complications.(1,2)

Regional anaesthesia has much to offer to patient, surgeon and anaesthesiologist due to simplicity of administration, preservation of consciousness, good analgesia, least side effects and improved intraoperative as well as postoperative pain relief.(3) Spinal anesthesia in elderly patients can be associated with major haemodynamic changes. Contraindications to spinal anaesthesia includes head injury with neurological damage, history of epilepsy, stenotic valvular diseases etc., whereas peripheral nerve blocks of lower limb can provide ideal perioperative analgesia because there is no haemodynamic instability or depression of pulmonary functions.(4,5)

Upper limb anaesthesia can be achieved with single block like interscalane block, supraclavicular block etc., while in case of lower limb this is not possible, because the nerves of the lower extremity are not bundled in a single fascial sheath and therefore separate injections are needed to adequately anaesthetize all regions, innervated by the lumbar plexus and the sciatic nerve. These anatomic considerations mean that relatively large volumes of local anaesthetic solutions are required for regional blocks in the lower extremity. The multiple injections and large volumes increase the likelihood of adverse reactions.(6)

Lumber Plexus Block by various approaches is becoming a standard technique. At hip level, L_1 to L_4 dermatome blockade is required and posterior approach to lumber plexus block is most appropriate technique.(7,8) Lumber plexus block is technically difficult but with introduction and availability of nerve locator, it is relatively easy to administer and reliable technique of anaesthesia for surgical procedures on hip and knee. Lumber plexus block provides better haemodynamic stability even in high risk geriatric patients with associated medical diseases. Lumber plexus block is associated with potential complications like epidural spread, retroperitoneal haematoma, intravascular injection, ureteral damage etc. but it is an attractive option if performed with caution. Considering popularity of lumber plexus block for lower limb orthopaedic procedures, we decided to compare lumber plexus block with spinal anaesthesia for fracture neck femur surgery.

Materials & Methods

After obtaining permission from institutional ethical committee total 50 patients of either sex with fracture neck femur belonging to physical status ASA group I to III patients; posted for routine orthopaedic

surgery were selected randomly for study. Preanaesthetic check-up was done on previous day of surgery. All patients were explained about the procedure to be done and informed consent was obtained. Patients with mental disorders, known hypersensitivity to local anaesthetic agent and bleeding disorders were excluded from study. After that 50 patients were divided into two groups. Group I (SA) received spinal anaesthesia and Group II (LPB) received posterior lumbar plexus block.

Procedure for spinal anaesthesia: Subarachnoid block was performed in sitting position, at L_3-L_4 space using 23 G BD spinal needle after local infiltration under all aseptic precautions. Inj. Bupivacaine HCL 0.5% heavy 2-2.5 ml was deposited in subarachnoid space after clear CSF flow.

Procedure for lumbar plexus block: The patient was placed in the lateral decubitus position with affected side up and slight forward tilt. The foot on the side was positioned over the dependent leg so that twitches of the patella can be seen easily. The fingers of the palpating hand were firmly pressed against the paravertebral muscles to stabilize the landmark and decrease the skin-nerve distance. The needle is inserted at a perpendicular angle to the skin after local infiltration under all aseptic precautions. The nerve stimulator should be initially set to deliver 3 mA current. As the needle was advanced, local twitches of the paravertebral muscles were obtained first at a depth of a few cm. The needle was then advanced further until twitches of the quadriceps muscle are obtained (usually at the depth of 6-8 cm). After the twitches are obtained, the current was lowered to obtain stimulation between 0.5 mA and 1.0 mA. At this point, 30-40 ml of local anaesthetic (Inj. Bupivacaine HCL 0.375% & Inj. Lignocaine 1.5%) was slowly injected with frequent aspiration to rule out inadvertent intravascular placement of the needle.

In Grade I all patients were made to lie supine, with precaution to prevent higher spread of drug. In Grade II all patients were kept in supine position if discomfort was there with a wedge on opposite side, preventing spread on other side, or in lateral position only with affected side up. Inj. propofol i.v. in sedating dose (10-50 µg/kg/min) was used in patients who had discomfort during surgery or had failure of block (Grade III or IV). Time of onset and level of sensory and motor block were noted. Intraoperative vitals were noted at every 15 minute intervals. Patients were observed for 2 hrs at interval of 30 minutes for postoperative pain using visual analogue scale, vitals, input/output chart, and for complications e.g. haematoma, ureteric injury etc. Rescue analgesic Inj. diclofenac sodium 50 to 75 mg was administered and time recorded when Visual analogue score (VAS) score was 3-4.

All the data were measured in mean and standard deviation. Statistical analysis was done using students 't' test and p value <0.05 was considered significant.

Results

Both the groups of our study were comparable for age, sex and duration of surgery. Fracture neck femur was more common in females in both the groups. Mean time taken from gowning to end of procedure in group II was statistically significant in Group II than in Group I. Time required for sensory blockade was more 17.32±2.61 in Group II (LPB) as compared to 3.76±0.91 in Group I (SA) which was statistically significant ($p<0.05$) and time required for motor blockade was higher in Group II (22.76±2.67) as compared to Group I (8.64±0.91) ($p<0.05$). (Table 1) Grade 1 complete anaesthesia (loss of all sensations) was observed in 22 patients in Group I as compared to 7 patients in Group II. Grade 1 complete muscle paralysis was observed in 18 patients in Group I (SA) as compared to 2 patients in Group II (LPB). Complete sensory and motor loss was more common in SA group as compared to LPB group.

Table 1: Comparison of both the groups

	Group I (SA) (Mean ± SD)	**Group II (LPB) (Mean ± SD)**	**'p' value**
Age (yrs)	57±17.8	56.2±16.41	0.86 (NS)
Sex ratio	8:17	9:16	
Duration of surgery (min)	117.92±9.48	118.36±8.35	0.86 (NS)
Time taken from gowning to end of procedure (min)	5.56±1.85	13.72±2.61	0.0001 **(S)**
Time for sensory blockade (min)	3.76±0.91	17.32±2.61	<0.05 **(S)**
Time for motor blockade (min)	8.64±0.91	22.76±2.67	<0.05 **(S)**

p<0.05 (Significant), p>0.05 (non-significant)

Pulse rate changes within the group at 15, 30 and 120 min intervals from baseline in Group I were statistically significant. (p values were 0.0001, 0.01 and 0.04 respectively) while in Group II pulse rate changes within the group at 15, 30, 45, 60, 75, 90, 105 and 120 min intervals from baseline were not statistically significant. (p values were more than 0.05) Between the groups pulse rate changes were statistically significant at time intervals of 15, 30, 45 and 120 min (p values were 0.0001, 0.01, 0.02 and 0.01 respectively.)

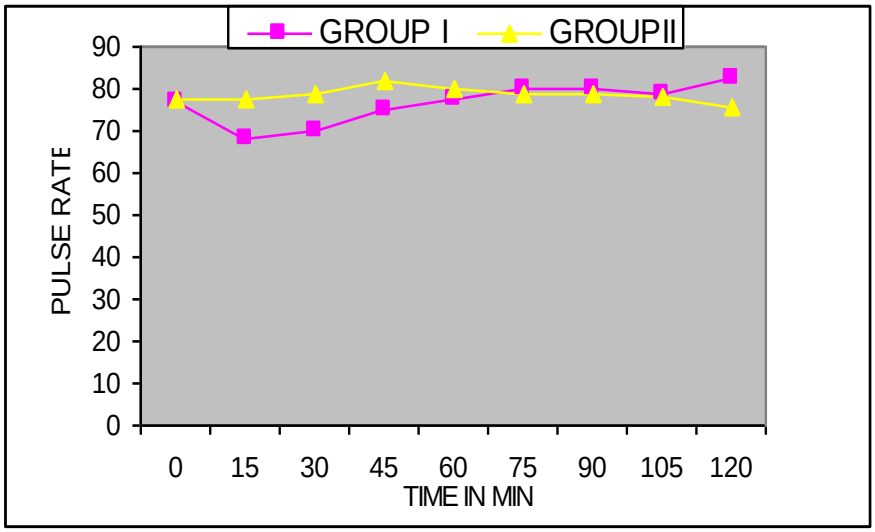

Fig. 1: Pulse rate changes in both the groups at different time interval

Blood pressure changes within the group at 15, 30, 45, 60, 75, 90 and 105 min intervals from baseline in Group I were statistically significant; while in Group II changes were insignificant at all the intervals from the baseline. Between groups blood pressure changes were statistically significant at time intervals of 15, 30, 45, 60, 75, 90, 105 and 120 min. Hypotension was defined as 20% blood pressure fall below baseline blood pressure. It was observed in 15 patients in Group I as compared to 2 patients in Group II. Haemodynamically patients in Group II were more stable as compared to Group-I. (Table 2 and Fig. 2)

Table 2: Blood pressure changes in both the groups at different time interval

		0 min	**15 min**	**30 min**	**45 min**	**60 min**	**75 min**	**90 min**	**105 min**	**120 min**
Group I (n=25)	Mean ± SD	146.24 ± 17.8	115.2 ± 11.65	102.04 ± 9.44	117.1 ± 6.14	121.9 ± 15.3	120.16 ± 9.98	129.28 ± 15.3	126.2 ± 15.5	139.4 ± 15.58
	'p' value (within group)		0.0001 (S)	0.001 (S)	0.002 (S)	0.004 (S)	0.003 (S)	0.001 (S)	0.001 (S)	0.21 (NS)
Group II (n=25)	Mean ± SD	152.66 ± 16.7	148.44 ± 15.58	147.12 ± 14.53	148.3 ± 15.6	146.6 ± 15.3	147.92 ± 15.0	146.08 ± 12.5	147.28 ± 15.63	151.5 ± 12.47
	'p' value (within group)		0.37 (NS)	0.23 (NS)	0.36 (NS)	0.20 (NS)	0.31 (NS)	0.13 (NS)	0.26 (NS)	0.83 (NS)
'p' value between two groups		0.2	0.001 (S)	0.001 (S)	0.001 (S)	0.001 (S)	0.001 (S)	0.001 (S)	0.001 (S)	0.02 (S)
'p' value' < 0.05→ S (significant) 'p' value' > 0.05→ NS (not significant)										

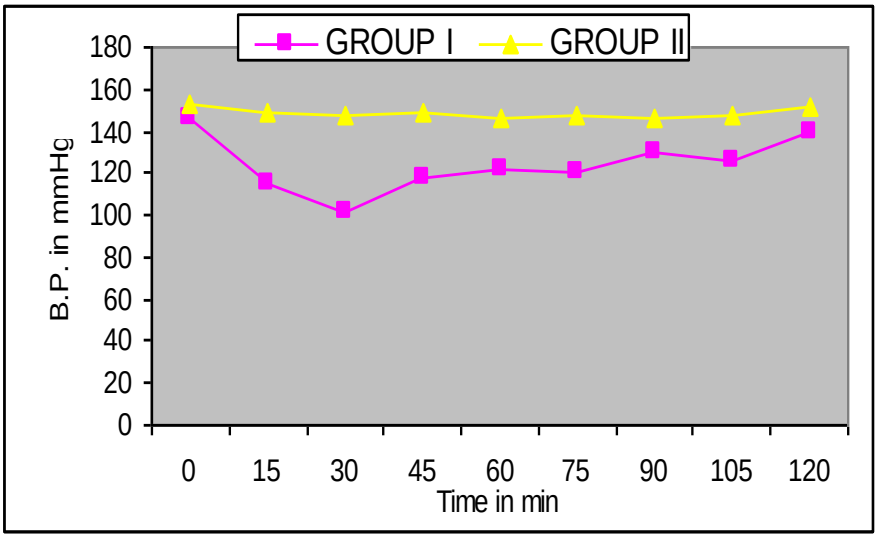

Fig. 2: Blood pressure changes in both the groups at different time interval

VAS score at interval of 30 min was statistically significant in Group I (3.16±1.11) compared to Group II (1.5±0.51). VAS score at 60, 90 and 120 mins were not statistically significant between groups I and II. (Table 3) When VAS score was 3-4, inj. diclofenac sodium 1.5mg/kg i.m. was supplemented in all patients. Rescue analgesics were needed more in Group I; 15, 7, 3 and 0 patients as compared to 0, 1, 8 and 1 patients in Group II respectively at 30, 60, 90 and 120 min intervals. So postoperative pain relief was for longer interval with LPB as compared to SA.

Table 3: Postoperative visual analogue scale (VAS) score in both the groups

Time interval in min	VAS score in Group I (Mean ± SD)	VAS score in Group II (Mean ± SD)	'p' value
30	3.16±1.11	1.5±0.51	**0.0001(S)**
60	2.04±1.14	1.8±0.58	0.35 (NS)
90	1.72±1.02	2.2±0.65	0.07 (NS)
120	1.76±0.44	1.72±0.54	0.77 (NS)

Discussion

Peripheral nerve blocks improve analgesia and reduce the analgesic requirement after many orthopaedic surgeries. Lumber plexus block as sole anaesthetic technique with sedation is frequently advocated in selected patients for unilateral lower limb orthopaedic procedures e.g. surgeries on hip, proximal femur fracture, arthroscopic surgery of knee etc.[9] The results of the present study indicated that single shot lumbar plexus block, by both the techniques, was effective in providing prolonged postoperative analgesia and reducing the pain scores and requirement of supplemental analgesics during first 24 hrs.

In present study both the Groups I (SA) and II (LPB) were comparable in terms of age, sex, mean duration of surgery and type of surgical procedure. Urbanek et al studied 60 ASA I-III patients scheduled for surgery on lower limb and compared time of onset, quality of blockade and duration between bupivacaine (0.5%), levo bupivacaine (0.5%) and levo bupivacaine (0.25%) and observed that mean times of onset of action were 27 min, 24 min and 30 min in these group respectively.[10] In our study we used a combination of 0.5% bupivacaine mixed with 2% lignocaine with adrenaline 1:200000 and mean time of onset of sensory blockade was 17.32 min. Faster onset of action in our study results can be due to addition of inj. lignocaine along with inj. bupivacaine.[11]

Eyrolle et al compared lumbar plexus block and spinal anesthesia for fracture neck femur surgery in 50 patients. They observed more hypotension (n=18) in SA group as compared to LPB group (n=3), i.v. propofol supplementation was needed more in LPB group (n=19) as compared to SA group (n=5), while VAS scores at 3 min was 14 ± 16 in LPB group as compared to 20 ± 24 in SA group and at 8 min 26 ± 18 in LPB group as compared to 38 ± 24 in SA group, the difference was not statistically significant.[12] In our study we observed hypotension in episodes of LPB group (n=2) as compared to SA group (n=15), i.v. propofol supplementation was needed more in LPB group (n=8) as compared to often compared to no patient in SA group (n=0). VAS score at 30 min was 1.5±0.51 in LPB group while it was 3.16±1.11 in SA group, which was statistically significant.

Jankowski et al[13] compared LPB, SA and GA (General Anaesthesia) for out-patient knee arthroscopy in 60 patients randomly received propofol/nitrous oxide/fentanyl general anesthetic, SA with 6 mg of bupivacaine and 15 µg of fentanyl, or psoas compartment block with 40 ml of 1.5% mepivacaine. Pain scores were highest in patients receiving general anaesthesia at 30, 60, 90, and 120 min ($P < 0.001$); and there were no significant difference between LPB group and SA group while in our study results VAS score at 30 min statistically significant between LPB group and SA group 3.16±1.11 and 1.5±0.51 respectively. It was statistically insignificant at 60, 90 & 120 min.

Mannion et al[14] compared approaches of Winnie and Capdevila for LPB and evaluated risk of epidural spread and observed that the incidence of epidural spread was 16% with Capdevila's approach while it was 20% with Winnie's approach. In our study using modified Winnie's approach we had incidence of epidural spread of 8%.[15] Bilateral spread can result in significant hypotension but this was not observed in our study. Less incidence in our study can be due to use of modified Winnie's approach in which puncture site is located at the union of lateral third and medial two third of line joining spinous process of L_4 to line passing through PSIS (Posterior superior iliac spine) thus avoiding too lateral insertion, risk of epidural spread and damage to renal parenchyma.

Comparing our study results and other researchers results, we observed that lumber plexus block by modified Winnie's approach is safe, effective method of providing anaesthesia for hip joint surgery with feasibility of extension of block by putting catheter with better VAS score in postoperative period as compared to spinal anaesthesia, though at times lumber plexus block provides insufficient analgesia which can be supplemented by i.v. propofol for sedation or by other means. Lumber plexus block has fewer chances of hypotension and other side effects.

Conclusion

Our study results conclude that both SA and LPB are choice of technique for hip joint surgery. LPB provides good sensory and motor block with feasibility to extend block, better haemodynamic stability with less side effects and is the choice of technique where SA is contraindicated. LPB is a valuable option as compared to SA with supplementation of sedation in case of insufficient analgesia.

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