VOLUME-8, ISSUE-6, JUNE-2019 • PRINT ISSN No. 2277 - 8160

Original Research Paper

Anaesthesiology

A COMPARISON BETWEEN LUMBAR PLEXUS BLOCK AND SUBARACHNOID BLOCK IN ORTHOPEDIC PROCEDURES FOR LOWER LIMB SURGERY: A PROSPECTIVE RANDOMIZED STUDY

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ABSTRACT

Background: Peripheral nerve block is gaining popularity as it offers advantage over subarachnoid block.

Aims: To demonstrate the efficacy of lumbar plexus block in view of safer anesthesia and better post-operative analgesia than subarachnoid block in lower limb orthopedic surgeries.

Materials and methods: study was done among 80 American Society Of Anesthesiology Physical status (ASA- PS) I male patients, aged between 55 to 85 years undergoing lower limb orthopedic surgeries. Patients were randomly allocated into two equal groups. Group A patients received lumbar plexus block with 20 ml of 0.5% bupivacaine mixed with 10 ml of sterile water (total 30ml) and Group B patients received subarachnoid block with 3ml of 0.5% hyperbaric bupivacaine. Baseline and intraoperative heart rate, mean arterial pressure oxygen saturation, onset and duration of sensory and motor block, duration of analgesia and any complication were noted.

Results: There was statistically significant fall of average mean arterial pressure($p<0.001$) and heart rate ($p<0.0001$) in the subarachnoid block group (Group B) than lumbar plexus block group(Group A).The onset of sensory and motor block was delayed but the duration of both sensory and motor block and the duration of analgesia were prolonged in lumbar plexus block group(Group A) than subarachnoid block group(Group B) which was statistically significant($p<0.0001$). No major complication was found in the lumbar plexus block group(Group A).

Conclusion: Lumbar plexus block provides effective anesthesia and analgesia without major complication than subarachnoid block.

KEYWORDS : Bupivacaine, lumbar plexus block, lower limb surgery, postoperative analgesia, subarachnoid block.

INTRODUCTION:

Subarachnoid block (SB) is the preferred technique for lower limb surgeries. SB rapidly provides profound analgesia, motor paralysis and adequate muscle relaxation. The incidence of postoperative thromboembolism particularly after hip surgery is less following SB.[1] Sometimes it may be technically difficult to administer SB particularly in elderly patients, those having vertebral deformity and improper positioning due to fracture of the lower limb or pelvic bone. The major complication of SB is hypotension which is more common in the elderly, those having autonomic dysfunction and patients using angiotensin converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs). This hypotension may be aggravated by intraoperative blood loss. Peripheral nerve block is an alternative option to overcome these problems. Lumbar plexus block (LPB) is one of such techniques in which the needle is placed between the psoas major and quadratus lumborum muscles and produces blockade of the three main components like femoral nerve (FN) , lateral femoral cutaneous nerve(LFCN) and the obturator nerve (ON) of the lumbar plexus with a single injection.

LPB also termed as psoas compartment block which was first administered by Winnie[2] as inguinal para vascular block and later modified by Chayen[3] as psoas compartment block. There have been a number of other approaches based on modifications to Winnie's landmark.[4] LPB is often used for postoperative analgesia after major hip and knee surgery[5,6]. The aim of this study was to demonstrate the efficacy of LPB in view of safer anesthesia and better post-operative analgesia than SB in lower limb orthopedic surgeries.

MATERIALS AND METHODS :

After obtaining approval from the institutional ethics committee and written informed consent, this prospective randomized comparative study was done at a tertiary hospital over a period of 6 months among 80 American Society Of Anesthesiology Physical status (ASA- PS) I male patients, aged between 55 to 85 years undergoing lower limb orthopedic surgeries. Patient's refusal, history of previous back surgery, infection at the local site, those having bleeding diathesis or on anticoagulant therapy, those having cardiovascular, respiratory or neurological disorders were excluded from this study. Patients were premedicated orally with Alprazolam (0.5mg) on the night before and Ranitidine (150 mg) with Domperidone (10 mg) 2 hours before surgery. In the operating room, intravenous (I.V) cannulation was done with 18G cannula. Patients were preloaded with 500ml of Ringer Lactate (RL) infusion over 15 minutes and subsequently RL was infused at a rate of 500ml/hour. Standard monitors like noninvasive blood pressure, electrocardiography and pulse oxymetry were attached. Baseline parameters like heart rate (HR), mean arterial pressure (MAP) and oxygen saturation (SpO_2) were recorded. Patients were randomly allocated by sealed envelope method into two equal groups (Group A and Group B) with 40 patients in each group. Group A patients received LPB with 20 ml of 0.5% bupivacaine mixed with 10 ml of sterile water (total 30ml) and Group B patients received SB with 3ml of 0.5% hyperbaric bupivacaine.

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS 20.0.1 and GraphPad Prism version 5. Data had been summarized as mean and standard deviation for numerical variables. Student's independent sample's t-test was applied to compare normally distributed numerical variables between groups. Once a t value was determined, a p value was found from Student's t-distribution. The calculated p value ≤ 0.05 was considered for statistically significant.

RESULTS:

LPB and SB were achieved in all patients of Group A and Group B respectively. There was no difference in baseline

MAP, baseline HR and intraoperative SpO_2 among the study groups (. But intraoperative MAP was much lower in Group B or SB group (69.49 ±5.29) than Group A or LPB group (78.69 ±7.24) with p value <0.001which was statistically significant .. Intraoperative HR was much less in Group B or SB group (69.75 ±5.86) than Group A or LPB group (77.83 ±7.63,p value 0.0001) which was statistically significant The onset of sensory and motor block was later in LPB group or Group A(21.85 ±4.04 and 28.55±4.72) than SB group or Group B (2.16 ± 0.27 and 2.85 ±0.26) respectively with p value < 0.0001which was statistically significant . The duration of sensory and motor block was more in LPB group or Group A(394.62 ±34.93 and 372.25 ±34.61) than SB group or Group B(135.88±7.93 and 121.90 ±.15.80) respectively with p value <0.0001 which was statistically significant .The duration of analgesia was prolonged in LPB group or Group A(491.12 ±19.98) than SB group or Group B(151.80±12.06) with p value <0.0001 which was statistically significant No serious complication was found in Group A (LPB group) patients .

DISCUSSION:

The studied population belonged to geriatric age group (Group A:68.87 ±8.48 and Group B:67.18 ±7.64).The average intraoperative MAP and HR were lower in Group B (SB group) than Group A (LPB group) which was statistically significant (69.49±5.29 vs 78.69±7.24, 69.75 ±5.86 vs 77.83 ±7.63 and p <0.001 vs p<0.0001 respectively). The height of block was achieved upto L_1 and T8 (8^{th} thoracic) in Group A (LPB group) and Group B(SB group) respectively. Both groups received equal amount of RL and blood loss was not statistically significant. Higher sympathetic tone, higher height of block and greater fall of systemic vascular resistance than cardiac output in elderly are responsible for abrupt and persistence hemodynamic changes following SB.[8] Only somatic nerves in this region were blocked in Group A (LPB group), sparing the sympathetic fibres. This may be the probable mechanism of stable MAP value following LPB. This hemodynamic stability of Group A (LPB group) was also supported by other studies.[9] There was report of hypotension following LPB but persistent fall of MAP was observed following SB.[10] However, hypotension was not observed in LPB group(group A) in this study. The fall of MAP was treated with i.v phenylephrine (50 mcg) which was required in 32 patients (n=40) of Group B (SB group). Phenylephrine was not required in Group A (LPB group). Bradycardia was found in 11 patients (n=40) of Group B (SB group) and not in a single patient of Group A (SB group). The onset of sensory and motor block was delayed in group A (LPB group) as compared to Group B (SB group) with p value < 0.0001 which was statistically significant (21.85 ±4.04 and 28.55±4.72 vs 2.16 ± 0.27 and 2.85 ±0.26 respectively).The duration of analgesia was prolonged in Group A (LPB group) than Group B (SB group) with p value <0.0001 which was statistically significant (491.12 ±19.98 and 151.80±12.06 respectively). These findings corroborate with other studies. It was observed that LPB produces less postoperative pain, lesser postoperative analgesic consumption compared with general anesthesia and other peripheral nerve block techniques. The use of continuous analgesia by catheter insertion during LPB is extremely effective during the postoperative period after total hip or total knee arthroplasty. Any surgery of the lower limb can be performed with SB or LPB along with sciatic nerve block (SNB). In this study only LPB was performed as combination of both LPB and SNB would have required multiple punctures and administration of larger volume of local anesthetics (LAs), increasing the risk of local anesthetic systemic toxicity (LAST). In the LPB group (Group A), the point of needle insertion was 1cm cephalad of intercristal line(L_4-L_5) as it is easier to reach the lumbar plexus through this wider interspace and reduce the likelihood of complications. Incomplete block may occur as ON may be separated from FN and LFCN by a muscular fold.There was no block failure or incomplete block in both groups.

The limitations of this study were that the number of study population was small,it was not a multi centric study and the innervation of lower extremity by lumbar plexus restricts the use of LPB.

CONCLUSION:

In conclusion, the results of this prospective, randomized study demonstrated that LPB provides effective and safe unilateral anesthesia, analgesia and hemodynamic stability than SB. This technique may be a beneficial alternative in lower limb orthopedic procedures.

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