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An Impact and Outcome of Lumbar Plexus Block in Elderly Patients with Hip Fractures: A Prospective Observational Study

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ABSTRACT

Amongst various anesthesia techniques used for management of hip fractures in elderly, lumbar plexus block can prove safer option as it provides good preoperative analgesia and hemodynamic stability by avoiding sympathectomy by just targeting somatic nerves in psoas region. We evaluated efficacy of lumbar plexus block in elderly patients in hip surgery. We enrolled 120 patients in study to receive lumbar plexus block in hip fracture surgeries. We evaluated block characteristics including block execution time, number of pricks, onset and completion of sensory and motor blockade, hemodyanamics and surgeon's satisfaction score intraoperatively. We had average age of patient 67.43±6.56 years with comparable gender distribution. Block execution time was 4.88±1.16 minutes with most patients requiring single prick. Mean time for onset of sensory block was 3.78±1.25 min and for motor block was 6.55± 1.08. Mean time for sensory block completion was 8.85±1.46 minutes and motor block was 16.13±1.96 min. Average surgeon's satisfaction score was 16.13±1.96. All patients were stable hemodynamically throughout surgery and no complications reported. Lumbar plexus block can be considered as satisfactory anaesthesia option in elderly requiring surgical intervention for hip fractures as it preserves haemodynamics and provides satisfactory intraoperative condition.

INTRODUCTION

Due to increase in life expectancy of population and expectations for better quality of life, more number of elderly patients are coming with hip fractures for surgical interventions. This group of patients not only has complex and multiple co morbidities but also tend to have high incidence of morbidity and mortality perioperatively[1,2]. Disability rate of up to 80% and 1 year mortality rate up to 27% have been reported by few studies[3,4]. Apart from this, elderly population with multiple co morbidities, their organ function may decline during perioperative period due to stress of surgery and anesthesia if proper perioperative analgesia is not provided[5]. Furthermore these patients tend to resist early mobilization and functional training due to pain and prolonged bed ridden period which can lead to complications like bed sores and deep venous thrombosis. These along with co-morbid conditions can adversely affect recovery of patient and can prolong stay in hospital. Hence selection of anesthesia technique to improve intraoperative patient comfort as well as reduce postoperative pain is mandatory.

Study by Devisme *et al*.[6] has proved lumbar plexus block as an effective and safe alternative to general and spinal anesthesia. It not only has advantage of limited sympathectomy but also use of nerve stimulator technique avoids damage to vital structure and other complications including hematoma and intraneural injection[7].

Hence we evaluated effectiveness of lumbar plexus block technique in elderly population for hip fractures as its simple technique, minimizes alternations in physiological functions, causes minimal hemodynamic perturbations and has good analgesia postoperatively[8,9].

MATERIALS AND METHODS

This single centre prospective interventional study was conducted in tertiary care institute during period of September 2019-November 2021 after approval from institutional ethics committee. The clinical research was done following the ethical principles for medical research involving human subjects in accordance with the Helsinki Declaration 2013. All patients in age group of 60-80 years posted for hip surgeries and willing to give consent were included in study. Patients having coagulopathies, infection at local site, psychiatric disorder, diabetic neuropathy, allergic to local anesthetics and not willing to participate in study were excluded.

All patients underwent routine pre-anaesthetic evaluation and were investigated according to institutional protocol. Tablet diazepam 5 mg on the night before surgery was given to allay anxiety. Patients were explained about procedure and informed/written consent was taken. Routine nil by mouth protocols was followed. Routine monitoring included ECG, pulse oxymetry, non-invasive BP and temperature monitoring. Inj Midazolam was given in dose of 0.3 mg kg^{-1}. Supplemental oxygen (4-6 L min^{-1}) through face mask was administered to patients after sedation.

Lateral decubitus position with operative site up was given and lumbar area was painted using antiseptic solution. Local infiltration was done using 2 mL of lignocaine 1% solution. Entry point was using modified fingertip width technique from lumbar spinous process i.e. two to three patient's fingertip breadth at the level of anterior superior iliac spine. Twenty one grams insulated stimuplex needle of 120mm length was attached to B Brawn nerve stimulator with its anode attached to ecg lead on ipsilateral thigh. The needle is slowly advanced perpendicular to skin to elicit quadriceps femoris response or till it hits transverse process of lumbar vertebra. At this point needle was withdrawn and redirected above or below transverse process to elicit quadriceps femoris response and current strength was reduced from 1.5-0.3 mA. 30 mL of Drug was injected slowly after repeated negative aspirations. Drug was mixture of 10 ml of lignocaine 1% with 0.25% of Bupivacaine and 10 ml of normal saline. Any degree of resistance to injection was evaluated and needle was repositioned.

Procedure time was calculated in minutes which was painting of patient with antiseptic solution till removal of stimuplex needle. Block establishment time was interval between completions of injection to painless abduction of hip joint. Pain on abduction in traumatic limb after 20 min of injection was considered as block failure and patient was considered for general anesthesia.

After block patient was sedated with pentazocine 0.3 mg kg^{-1} and injection ondansetron was also given in dose of 0.08 mg kg^{-1}. Block duration was calculated as interval between establishment of block and patients demand of first analgesic with VAS score of more than 3 within 24 hrs.

Surgery time was recorded as time between preparations of patient's skin in aseptic way till shifting of patient to recovery area. Surgeon was asked to grade muscle relaxation in intraoperative period from zero which means unsatisfactory to 10 which means highly satisfactory. Any additional opioid supplementation in intraoperative period was noted. Also patient was asked to report their pain using visual analogue scale. Patient's vitals were recorded throughout perioperative period.

Statistical analysis: Data was entered in Epi data and analyzed by Epi Info version 2007.

All the categorical variables were presented as number and percentage and continuous variables were presented in mean and SD after normality testing.

Analysis was done by using SPSS version 20 statistical package. Shapiro-Wilk normality test was used to check the normality of the data. In this study, normally distributed data were analyzed using Student's independent t-test and then the result was presented as Mean±SD (standard deviation).

RESULTS

We enrolled 120 patients of ASA I and ASA II status in the study which were having comparable demographic characteristics (Table 1). Duration of surgery of intertrochanteric fracture femur in different patients was also comparable.

We did not report any block failure. Also none of the patients required additional doses of opioids. In most cases surgeons satisfaction score was 9 and above as seen from Table 2.

There was less variation of hemodynamic parameters from baseline and patients had stable hemodynamic intraoperatively (Table 3).

Table 1: Demographic characteristics of the patients

Parameter	Values
Age in years (Mean±SD)	67.43±6.56
Sex	
Male	66(55%)
Female	54(45%)
ASA status	
I	69 (57.5%)
II	51(42.5%)
Duration of surgery in minutes (Mean±SD)	90±12
Weight in kg (Mean±SD)	63.28±9.10

[#]ASA: American Society of Anesthesiologists and[$]Data are presented as Mean±SD or No. (%)

Table 2: Lumbar Plexus Block parameters during surgery

Parameter	Values
Block execution time in minutes (Mean±SD)	4.88±1.16
No. of pricks required	
1	87(72.5%)
2	30(25%)
3	3(2.5%)
Mean time of onset of sensory	
block in minutes (Mean±SD)	3.78±1.25
Mean time of onset of motor	
block in minutes (Mean±SD)	6.55±1.08
Mean time of completion of	
sensory block in minutes (Mean±SD)	8.85±1.46
Mean time of completion of motor	
block in minutes (Mean±SD)	16.13±1.96
Quality score of motor block	
1	21
2	99
Surgeon's satisfaction score (Mean±SD)	9.73±0.45

Table 3: Perioperative vitals of the patients

Haemodynamic parameter (Mean±SD)	Values
Heart rate baseline beats min^{-1}	78.78±13.25
Heart rate intraoperative beats min^{-1}	74.10±11.74
Systolic blood pressure baseline in mmHg	126.38±9.46
Systolic blood pressure intraoperative in mmHg	122.73±9.17
Diastolic blood pressure baseline in mmHg	78.38±7.52
Diastolic blood pressure intraoperative in mmHg	78.03±7.15
Mean arterial pressure baseline in mmHg	94.37±7.08
Mean arterial pressure intraoperative in mmHg	92.92±6.78

DISCUSSIONS

Anesthesia management of high risk elderly patients with hip fractures is always challenging for anesthesia provider as elderly patients tend to have not only long term co morbidities but also have perioperative hemodynamic fluctuations. So appropriate method for perioperative management of these patients still remains matter of discussion, although many of the institutions offer general and neuraxial anesthesia as main anesthesia methods[10,11]. Peripheral nerve block ie lumbar plexus block is being used for years together for providing analgesia in perioperative period and not routinely as sole anesthesia technique which requires expertise and one needs to be aware of complications[12].

Lumbar plexus block is considered safe in hemodynamically compromised patients as it just targets somatic nerves in poses region and does not cause sympathetic blockade[13,14]. in contrast general anaesthesia , not only cause hemodynamic instability to certain extent but may have poor pain control which may remain concern[15,16]. Neuraxial anaesthesia particularly spinal anaesthesia not only leads to hemodynamic instability but may also have unpredictable block[17]. Also sudden and drastic decrease in cardiac output and blood pressure after spinal anaesthesia in elderly patients can be of great concern as it may sustain for longer period as demonstrated by Devisme *et al*.[6]. This sustain fall in mean arterial pressure particularly of less than 55 mm of hg for more than 15-20 min duration can lead to myocardial and renal injury as demonstrated by few studies[18-20].

Many of past studies including that conducted by Stebler *et al.*[21] recommended use of continuous epidural technique as anesthesia technique of choice in elderly patients with hip fractures. Although epidural anaesthesia is being employed by many institutions for hip fractures but hemodynamic fluctuations and unpredictability of block occurring limits its widespread application[10]. Lumbar plexus block not only avoids sympathectomy but also bladder paralysis as lumbar plexus mainly includes anterior branch of 12th thoracic nerve and anterior branches of first to fourth lumbar nerves as demonstrated by newer studies and these are mostly supplying muscles and skin overlying medial side of thigh, leg and foot[22,23]. Hence lumbar plexus block remains safer alternative in elderly population with co morbidities.

With availability of ultrasound, risk of renal injury and hematoma formation has reduced but it does not avoid risk of nerve injury besides being time consuming, expensive and probably may fail to locate plexus due to posterior shadow of bony elements in

this region particularly in less experienced hands[24,25]. So electrical stimulation remains handy and convenient technique and will avoid nerve injuries too.

In our study, we included 120 elderly patients of age group 65-80 years with average age being 67 years. We had block execution time of approximately 4.88 min with most patients requiring single prick as seen from Table 2. As can be seen from block characteristics in table no 2. most of the factors were satisfactory including surgeon's satisfaction score. Surgeon satisfaction score is mostly based on muscle relaxation which is mandatory especially during orthopedic surgery. Elderly patients with less of muscle mass, motor blockade provided by block is sufficient to give satisfactory muscle relaxation during surgery which makes block acceptable in all means to surgeons too. Intraoperative vitals were stable throughout procedure and didn't require any kind of intervention. Xu *et al*.[26] in their series of 58 patients found similar results and suggested that light sedation with lumbar plexus block could be satisfactory anaesthesia technique in elderly patient with hip fracture due to its minimal effects on haemodynamics.

Kaçmaz and Turhan[27] compared lumbar plexus block with epidural anaesthesia in elderly patients with hip fractures and suggested that lumbar plexus block can be a good alternative to epidural anaesthesia with good hemodynamic stability, reduced anaesthesia induction time and better pain management. Although epidural anaesthesia is commonly employed technique in various institutions for lower limb fractures, hemodynamic fluctuations are still unavoidable with varying degree of block as suggested by Kaçmaz and Turhan[27].

Stebler *et al*.[21] compared different anaesthesia technique in elderly patients with hip fractures with an average age of 85 years with multiple co morbidities. They suggested using continuous lumbar epidural technique instead of spinal anaesthesia in elderly patients so as to maintain hemodynamic stability. This finding was although contrary to our study but they also mentioned use of lumbar plexus block in patients with instrumented and pathological spines to maintain haemodynamics.

Kaçmaz and Turhan[27] compared spinal anaesthesia and lumbar plexus block in geriatric population posted for hip surgeries. They found lumbar plexus block with light sedation was more effective than spinal anaesthesia in terms of haemodynamic stability intraoperatively, lesser length of hospital stay and lesser mortality in postoperative period.

Although, lumbar plexus block is advanced deep block and should be performed by experienced hands as it comes with risk of epidural diffusion, lumbar plexopathy and local anaesthesia toxicity but it can prove effective technique in management of elderly patients with comorbidities[28-30]. Good analgesia provided by block can reduce postoperative cognitive dysfunction in elderly patients as well as can reduce perioperative stress as suggested by few studies[31].

Limitations of our study were we included only ASA I and ASAII category of patients to begin with but study can also be conducted with higher ASA category of patients which will ensure safety of elderly population with multiple co morbidities. Also sample size was small. We did not assess other outcomes of patients including hospital stay and postoperative recovery duration.

CONCLUSION

Lumbar plexus block with mild sedation can be preferred technique in elderly patients with co morbidities undergoing hip surgeries so as to provide stable hemodyanamics and satisfactory operative conditions. It provides good postoperative analgesia without hemodynamic compromise.

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