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Original Article

Lower limb orthopedic surgery in geriatric patients under paravertebral blocks: A prospective feasibility study

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ABSTRACT

Background: Aging causes progressive deterioration of all the organ systems. Physiological changes of aging and co-morbidities make regional anesthesia a preferred technique for this age group. Regional anesthesia with risk of hypotension and its consequences is fraught with dangers. Peripheral nerve blocks (PNBs) are much safer and give much superior post-op analgesia. The present study was undertaken to perform major lower limb orthopedic surgeries PNBs in geriatric settings.

Methods: A feasibility study was undertaken in patients above age of 60 years admitted for lower limb surgeries to undertake these surgeries under para-vertebral blocks for a period of one year from Mar 2011 to Feb 2012.

Results: The responses and results of 203 eligible patients averaging 69.5 years. Mean duration of surgical procedure was 174.6 min and surgical analgesia was 334.5 min. Mean time of analgesic supplementation postoperative 398.3 min. The incidence of adverse effects (hypotension) requiring intervention was 5 out of 203, failure rate 2 out of 203.

Conclusion: All major lower limb surgeries can be done under combined lumbar and sacral plexus block with additional supplementation for the skin at the line of incision especially in case the surgery involving hip with intercostal block at 11th ICS. The study strongly recommends it as a technique of choice in geriatric cases rather than reserving it for only moribund cases.

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Introduction

As life expectancy is increasing, the number of geriatric patients requiring surgery and anesthesia is increasing proportionately, in day-to-day practice. Advancing age, co-morbidities, altered pharmacokinetics and dynamics increase the morbidity and mortality of these patients.¹ In the geriatric settings fracture neck femur, total hip arthroplasty (THA), and total knee arthroplasty (TKA) are among the common lower limb surgeries.^{2,3}

Anesthetic and analgesic relief during and after lower limb surgeries, traditionally has been provided through central neuraxial (spinal or epidural) techniques, along with intravenous patient-controlled analgesia using opioids.^{3–6} One of the studies has compared peripheral regional analgesia with femoral catheter and intravenous patient controlled analgesia using morphine after TKA.⁷

The central neuraxial anesthesia can be a risky affair in these cases because of the risk of hypotension. Grossly reduced hemodynamic safety window, stiff or less compliant capacitance vessels cause exaggerated response to peripheral pooling and decreased responsiveness to catecholamines. Co-morbidities such as hypertension and IHD add fuel to the fire.^{8,9} Thus the side effects of these techniques, and of the administered opioids, make their use somewhat undesirable.^{5,8} These drawbacks have led to a shift toward redefining the effectiveness and utility of regional anesthesia, specifically, of peripheral nerve blocks (PNBs) in intraoperative anesthesia and postoperative analgesia.^{3,10,20}

There are very few studies, which claim to have done or which advocate PNBs for lower limb surgery in the elderly especially the surgeries for fracture neck femur and total hip and knee arthroplasties. Most of the studies advocate these blocks for post op pain relief. Very few recommend it as a primary technique for surgery^{11–13} or recommend it only for moribund patients.^{14,18,19} But these are the very group of patients with extremes of age and co-existing physiological derangements, who are likely to derive most benefits from these blocks.^{2,4}

With this background, the present study was undertaken at one of the Orthopedic centers of Armed Forces, where the lower limb surgeries and joint replacements of lower limb among the elderly were being carried out. These surgeries were performed under PNBs anticipating superior intra-operative and postoperative outcomes, particularly in terms of better hemodynamics, adequate analgesia, lower blood loss, and transfusion exposure.

Materials and methods

A feasibility study was undertaken in patients above age of 60 years, who were admitted with lower limb fractures or for joint replacements at a tertiary care hospital of Armed Forces. The study was carried out by enrolling all eligible patients for a period of one year from Mar 2011 till Feb 2012. Total of 203 eligible patients were enrolled for the study and informed consent was obtained from them.

The study patients were placed on standard monitoring devices in the pre-operative room and were administered a

mixture of 0.75% ropivacain 20 ml, 0.5% bupivacain 10 ml, 2% lignocain with adrenalin 10 ml, diluted with saline to 60 ml. 30 ml of the mixture was used for the lumbar plexus block, 20 ml in sacral plexus block using paravertebral approach with a 21/22G, 100 mm nerve stimulator needle while 10 ml was reserved for intercostal block at 11th ICS.

Peripheral nerve block techniques

Lumbar plexus blocks (LPBs) or femoral nerve blocks (FNBs) and sacral plexus or sciatic nerve blocks (SNBs) are the most useful of the lower extremity nerve blocks.^{10–12} Over the years, several techniques have been described for each of these blocks.³ Intercostal nerve block was added to above blocks for superior outcomes to overcome the problem of inadequate analgesia at the site of incision because of overlapping dermatomes.¹⁶ In the present study, the contemporary techniques for LPBs, SNBs, and intercostal nerve blocks were used, which are described as under. We chose the plexus blocks for our study because the femoral nerve block and sciatic nerve block were inadequate for the hip surgery. In the knee surgery, the area under the tourniquet was likely to be missed by them and were likely to cause tourniquet pain

Lumbar plexus block

The site of injection was on the intercrestal line (line joining the highest points of both iliac crests) 3–5 cm from midline. The nerve stimulator was kept at 1 mA and frequency at 2 Hz. The stimulator needle was introduced parallel to the ground and slightly in caudal direction and attempt was made to hit the transverse process and walk off superiorly over it and go 1.5–2 cm deeper and look for quadriceps contractions and the bring down the current to 0.4 mA or lower and then inject 30 ml of local anesthesia (LA) mixture.³

Sacral plexus block

The point of entry was on the line joining posterior superior iliac spine (PSIS) and ischeal tuberosity about three finger breadths (6 cm) from PSIS parallel to the floor and in slightly cephalad direction. An attempt was made to hit the under surface of sacro-iliac joint and the walk off inferiorly, go 3–4 cm deeper and look for contractions in gastrocnemius muscle or anterior compartment in the leg and when movement was still seen below 0.4 mA, 20 ml of drug was given.

Intercostal block

The eleventh rib was followed posteriorly and at a point 3–5 cm from midline and entry was made with the same needle. An attempt was made to hit the rib and then go inferiorly 1 cm deeper. Attempt was made to obtain contractions in the flank and 10 ml of the mixture was injected.

Failure

If surgical analgesia was not achieved after 45 min of the block it was declared a failure and case was done under spinal anesthesia.

Continuous peripheral nerve block

In cases of total hip and knee arthroplasties and some other surgeries where post-op pain was expected to be more,¹⁵ a catheter was placed in the lumbar plexus for post-op infusion with 0.1% bupivacain at 6–8 ml/h by a disposable balloon infusion pump after the patient first complained of pain preceding with a bolus of 10 ml of the infusate.

Data collection

The data were collected on standardized performa on following study parameters:

- (i) Hemodynamic variables viz. pulse rate, blood pressure, ECG, SpO₂ every 5 min interval.
- (ii) Duration of surgery
- (iii) Duration of surgical analgesia
- (iv) Time of onset of block
- (v) Adequacy of block was assessed by Visual Analog Score (VAS) on a scale of 1–10.
- (vi) Incidence of adverse effects.

In the operative room, patients were sedated by IV midazolam 1–2 mg. IV fentanyl 0.5–1 mcg/kg was given to patients if they complained of pain and in case the pain persisted, the case was converted to general anesthesia.

Monitoring was continued in the post-op period also. Pain score was recorded at 30 min interval in VAS from the scale of 1–10 (subjective assessment of patient with 1 being no pain and 10 being maximum pain a patient can imagine), the pain score started increasing. All the patients were given diclofenac Sod 75 mg IM 8 hourly and IV paracetamol 1000 mg 8 hourly (500 mg if weight <50 kg). In cases of THRs and TKRs and some other cases where post-op pain was expected to be more (24 cases), a catheter was placed in the lumbar plexus. When the pain scores started increasing, infusion was given in this catheter with 0.1% bupivacaine at 6–8 ml/h by a disposable balloon infusion pump preceded with a bolus of 10 ml of the same mixture.

Analysis was done using the EPI INFO 2000 using standard statistical procedures. The study variables were analyzed using Chi square test for categorical variables and unpaired t test for continuous variables. The level of significance considered is 5%.

Results

In the present study, responses and results of 203 eligible patients were analyzed. The mean age of the patients was 69.5 years $\pm$ 4.2. There were 105 males and 98 female patients. Average ASA score was 2.9. Distribution of surgeries undertaken during study period is listed in Table 1. Results showing values of various study variables are listed in Table 2.

Number of cases of failed blocks needing conversion to spinal anesthesia was only 2 with more than 99.01% success rate with 95% confidence interval of 98.88–96.44%. Most of the patients had a minor drop in blood pressure on an average 10% of baseline systolic BP, not requiring any intervention.

Table 1 – Distribution of surgeries undertaken during study period.

S. No.	Surgery conducted	Frequency
1.	Hemi Replacement Arthroplasty Hip	61
2.	Proximal Femoral Nailing:	109
3.	Total Hip Arthroplasty	3
4.	Total Knee Arthroplasty	12
5.	Others	18

However, five patients had a severe drop in BP which needed active inotropic support. Two of them were found to have epidural extension but became normotensive by the end of surgery. Three needed active inotropic support for 24–48 h. There was no mortality in post-op period in these high-risk geriatric cases under PNBs. The post-op morbidity was significantly less in these patients. Only one patient, a 72-year-old lady, a known case of PSVT on treatment, who underwent THR developed PSVT in the second post-op evening and required aggressive management and cardiology consultation.

There was requirement of rescue top up with analgesic, on and average after 6–8 h postoperatively in 94% cases. The lumbar/sacral plexus catheters were placed for post-op continuous analgesic infusion with LA in 24 cases. No signs of complication of LA toxicity were reported during this infusion.

Discussion

Anesthesiologists world over, in orthopedic surgery, are most challenged both professionally and intellectually by these geriatric cases. Regional Anesthesia is considered better than General Anesthesia in these cases.^{5,8,17,18} But central neuraxial blocks are also fraught with dangers because of the narrow hemodynamic safety window.^{9,11} There is severe paucity of data on PNBs being used for major orthopedic surgery in lower limbs especially in the elderly. Most of the authors have used

Table 2 – Results showing values of various study variables.

S. No.	Study variable	Mean $\pm$ SD
1.	Heart rate before the block	84 $\pm$ 8.2
2.	Heart rate after the block	76.4 $\pm$ 7.4
3.	Systolic BP before the block	144 $\pm$ 11.2
4.	Systolic BP after the block	129.2 $\pm$ 9.7
5.	Time of onset of block (min)	24.2 $\pm$ 7.6
6.	Duration of surgical procedure (min)	174.6 $\pm$ 37.2
7.	Duration of surgical analgesia (min)	334.5 $\pm$ 32.3
8.	Time of analgesic supplementation (min)	398.3 $\pm$ 38.4
9.	Incidence of adverse effects requiring intervention	5/203
10.	Failed block needing conversion to spinal anesthesia	2 (0.98%)
11.	Conversion to GA	Nil

these techniques quite successfully for post-op pain relief.^{11–13} In a study by Shanthanna et al.¹⁷, they compared continuous femoral nerve block with epidural analgesia and found to provide equivalent analgesia but with lesser degree of common side effects.

In the present study, large numbers of major surgeries were successfully conducted under combined lumbar plexus and sacral plexus block. Large number of authors considered their peripheral nerve block a failure, because the site of incision was not pain free. The authors submit that the actual line of incision for the hip surgery has overlap of dermatomes supplied by T12 and L1 roots. These dermatomes are quite likely to be missed by conventional psoas compartment block. Therefore, it could be either covered by local infiltration of line of incision or by giving intercostal block at T11–T12 or by giving the lumbar plexus block at L2–L3, one space higher than the conventional level.¹⁹ Before the present study, the authors practiced all these with significant success rate. Best results were obtained when the plexus for nerve block was located one space higher. This was achieved by choosing the entry point not on the inter costal line but by locating the next higher inter-spinous space then going 3–5 cm lateral to it and moving cephalad to the transverse process. By doing so during Lumbar plexus block the line of incision was properly anesthetized and another needle prick was avoided. However, it was difficult to locate the plexus at this level and in few cases the block had to be administered by conventional route. Highest success rate was achieved when conventional lumbar plexus block was given along with intercostal block at 11th ICS hence this technique was chosen for the present study. Experiences of author suggest that the intercostal block was most successful, when muscle contraction at the flank was obtained.

Review of literature shows that one of the main reason, why most of the Anesthesiologists avoid PNBs is that these blocks are considered difficult. Many studies and recent meta-analysis^{4,7} recommend against them being used for surgery. Authors differ from such recommendations because experiences by conducting more than 203 major lower limb surgeries solely under these blocks with more than 99.01% success rate with 95% confidence interval of 98.88–96.44% prove the case otherwise. The surgical team has to take judicious decision by comparing the advantages and disadvantages of various anesthetic techniques in hand. Authors submit that the quality of post-op analgesia was much superior to conventional methods.

Conclusion

Lumbar plexus block and sacral plexus block along with perioperative sedation appear to be an effective alternative to central neuraxial anesthesia for lower limb surgeries in geriatric settings. It appears by the present study that all major lower limb surgeries can very well be done under combined lumbar and sacral plexus block with some form of additional supplementation for the skin anesthesia at the line of incision especially in case the surgery involves hip. It has all the ingredients to become a technique of choice in geriatric cases such as adequate intraoperative anesthesia, much lower incidence of complications, morbidity and mortality and

superior post-op analgesia, which can be further extended by continuous catheter techniques and reduced post-op narcotic requirement.

This study has the limitation of being only a feasibility study. The superiority of this technique over central neuraxial blocks in geriatric cases needs to be further evaluated by larger comparative studies.

Conflicts of interest

The authors have none to declare.

REFERENCES

1. Sophie S. Anaesthesia for the elderly patient. *J Pak Med Assoc.* 2007;54:196–201.
2. Chelly JE, Ben-David B, Williams BA, Kentor ML. Anesthesia and postoperative analgesia: outcomes following orthopedic surgery. *Orthopedics.* 2003;26:865–871.
3. MaCalus V, Hogan MD, Richard E, Grant MD, Lee L. Analgesia for total hip and knee arthroplasty: a review of lumbar plexus, femoral, and sciatic nerve blocks. *Am J Orthop.* 2009;38:129–133.
4. Francis Jr J. Surgery in the elderly. In: Goldman DR, Brown FH, Guarneri DM, eds. In: *Peri-Operative Medicine* 2nd ed. USA: McGraw-Hill Inc.; 1994:385–394.
5. Dilger JA. Regional anesthesia: lower extremity nerve blocks. *Anesthesiol Clin N Am.* 2000;18(2):319–340.
6. Chan EY, Fransen M, Parker DA, Assam PN, Chua N. Femoral nerve blocks for acute postoperative pain after knee replacement surgery. *Cochrane Database Syst Rev.* 2014;13(5):314–324.
7. Baranović S, Maldini B, Milosević M, Golubić R, Nikolić T. Peripheral regional analgesia with femoral catheter versus intravenous patient controlled analgesia after total knee arthroplasty: a prospective randomized study. *Coll Antropol.* 2011;35(4):1209–1214.
8. Urwin SC, Parker MJ, Griffiths R. General versus regional anaesthesia for hip fracture surgery: a meta analysis of randomized controlled trials. *Br J Anaesth.* 2000;84:450–455.
9. Stevens RD, Van Gessel E, Flory N, Fournier R, Gamulin Z. Lumbar plexus block reduces pain and blood loss associated with total hip arthroplasty. *Anesthesiology.* 2000;93:115–121.
10. Capdevila X, Macaire P, Dadure C, et al. Continuous psoas compartment block for postoperative analgesia after total hip arthroplasty: new landmarks, technical guidelines, and clinical evaluation. *Anesth Analg.* 2002;94:1606–1613.
11. Allen HW, Liu SS, Ware PD, et al. Peripheral nerve blocks improve analgesia after total knee replacement surgery. *Anesth Analg.* 1998;87:93–97.
12. Touray ST, de Leeuw MA, Zuurmond WWA, Perez RSG. Psoas compartment block for lower extremity surgery: a meta-analysis. *Br J Anaesth.* 2008;101:750–760.
13. Buckenmaier CC, Xenos JS, Nilsen SM. Lumbar plexus block with perineural catheter and sciatic nerve block for total hip arthroplasty. *J Arthroplast.* 2002;17:499–502.
14. Ho AM, Karmakar MK. Combined paravertebral lumbar plexus and parasacral sciatic nerve block for reduction of hip fracture in a patient with severe aortic stenosis. *Can J Anaesth.* 2002;49:946–950.
15. De Visme V, Picart F, Le Jouan R, Legrand A, Savry C, Morin V. Combined lumbar and sacral plexus block compared with plain bupivacaine spinal anesthesia for hip fractures in the elderly. *Reg Anesth Pain Med.* 2000;25:158–162.

16. Capdevila X, Biboulet P, Morau D, et al. Continuous three-in-one block for postoperative pain after lower limb orthopedic surgery: where do the catheters go? *Anesth Analg*. 2002;94:1001–1006.
17. Shanthanna H, Huilgol M, Manivackam VK, Maniar A. Comparative study of ultrasound-guided continuous femoral nerve blockade with continuous epidural analgesia for pain relief following total knee replacement. *Indian J Anaesth*. 2012;56(3):270–275.
18. Tantry TP, Kadam D, Shetty P, Bhandary S. Combined femoral and sciatic nerve blocks for lower limb anaesthesia in anticoagulated patients with severe cardiac valvular lesions. *Indian J Anaesth*. 2010;54:235–238.
19. Koşucu M, Beşir A, Eroğlu A. Peripheral nerve block to the lower extremity despite relative contraindication (two cases). *J Anesthesiol Clin Sci*. 2013;2:29. <http://dx.doi.org/10.7243/2049-9752-2-29>.
20. de Leeuw MA, Zuurmond WWA, Perez RSG. The psoas compartment block for hip surgery: the past, present, and future. *Anesthesiol Res Pract*. 2011;2011: Article ID 159541, 6 pages, doi:10.1155/2011/159541.

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