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Original Research Article

Observational study of segmental epidural anesthesia for orthopedic surgeries

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ABSTRACT

Background: Epidural anaesthesia is suitable technique for lower abdominal and lower limb surgery. Compared to conventional epidural anesthesia (EA), segmental epidural anaesthesia (SEA) denotes the use of a small volume enough to block only the segments involved in the field with stable hemodynamics and limited spread of analgesia. We decided to do study of SEA for lower limb surgeries. Aim was to observe characteristic of sensory and motor block, quality of analgesia, hemodynamics and peri-operative complications.
Methods: After institutional ethical committee approval, prospective observational study of SEA for orthopedic surgeries was carried out in 130 patients of 18 to 60 years of either sex with ASA grade I-III. For SEA, we used bolus dose of lignocaine with adrenaline (L+A) 2% 8 to 12 ml injected over 4 minutes according to anticipated segments required to be blocked and patient's condition and type of surgery. Top up dosages were repeated every 60 minutes. Quality of analgesia and block, total local anesthetic used and hemodynamics were recorded intraoperatively. Results were analysed statistically and were compared using the student's paired 't' test. P value <0.05 was considered as significant.
Results: Requirement of bolus dose was 8 ml, 10 ml and 12 ml in 78 patients, 31 patients and 7 patients respectively. In all patients 1st top up dose was given while 2nd top up was required in 32 patients only. Intra op MAP remains near to baseline. Quality of block was excellent in 66 patients (55%), good in 35 patients (29%) and fair in 15 patients (12.5%).
Conclusions: We concluded that SEA is a safe and reliable technique for orthopedic surgeries with stable hemodynamics, limited spread of analgesia involving only required segments with minimal side effects.

Keywords: Orthopedic surgery, Segmental epidural anaesthesia, Stable hemodynamic

INTRODUCTION

Regional anesthesia is an important part of the armamentarium of anesthesiologist. It is safe, economical, minimally invasive, provides early ambulation and prolonged pain relief, avoids airway manipulation and unwanted effects of anesthetic drugs used during general anesthesia. Most of the surgeries from the neck to the foot can be comfortably done under epidural anesthesia (EA).[1] EA has some definite advantages over spinal anesthesia like avoidance of post spinal headache, minimal chances of meningitis, and minimal chances of nausea and vomiting in postoperative period.[1]

We decided to use lignocaine and adrenaline (L+A) as it produces early and better muscular relaxation than 0.5% bupivacaine. Conventional dosage of local anesthetic agent (15 ml and above) in EA frequently results in multiple hemodynamic changes including decrease in blood pressure, systemic vascular resistance, cardiac output, and myocardial oxygen consumption.[1] Compared to conventional EA the segmental epidural anesthesia (SEA) denotes the use of a small volume enough to block

only the segments involved in the field of surgery with advantage of accurate limitation of the area of analgesia, minimal or no hemodynamic changes, requirement of small doses of local anesthetic and avoidance of toxic dose and minimal incidence of complications.[2] On literature review very few studies on SEA or lower limb surgeries have been found so we aimed to study the usefulness of SEA for orthopedic surgery to assess the efficacy and safety.

METHODS

After institutional ethical committee approval, we carried out a prospective observational study of SEA for orthopedic surgeries between August 2016 and July 2018 at the PDU Medical College and Hospital, Rajkot (Reg. No. PDU/MCR/IEC/19059/2016). We have included 130 patients of 18 to 60 years of either sex aged between 18-60 years with ASA grade I-III.

We have excluded patients with allergy to local anesthetics, bleeding disorders, infection to local site, neurological deficit and patients unwilling to comply with instructions and refusal from our study.

Pre-anesthetic evaluation was done along with all routine investigations. Procedure was explained to the patients and written informed consent was taken. All patients were kept nil by mouth for at least 6 hours. Standard monitors like NIBP, pulse oximeter and ECG were applied to all patients and baseline vitals were recorded. In the operation theatre, epidural anesthesia was given under all aseptic precautions. Epidural space was identified by loss of resistance technique and epidural catheter was advanced through the epidural needle. In present study site of epidural needle puncture was between (L_2-L_3), and catheter tip kept caudally for orthopedic surgeries. After negative aspiration for cerebrospinal fluid and blood, a 3 ml test dose with inj. lignocaine with adrenaline(L+A) 2% was given over 15 seconds through the catheter. If there were no untoward effects after 3 minutes, study drug L+A bolus dose 8 to 12 ml according to anticipated segments required to be blocked, as per the patient's condition and type of surgeries was injected over 4 minutes. Top up dosages were repeated every 60 minutes. The volume of the first top up was half the first dose and subsequent doses were one third of first dose and according to the surgery.

Level of analgesia was checked by needle prick. Dermatome level tested every 5 minutes till adequate sensory block achieved. After conforming the adequacy and level of analgesia, the surgery was commenced. Motor blockage was assessed with Bromage scale.

Quality of block was assessed and graded as following: 1) excellent: patient comfortable, analgesia and surgical relaxation adequate, no supplementation required during surgery, 2) good: analgesia and relaxation adequate, minimal discomfort present during surgical procedure. Additional top-ups of local anesthetic at an incremental dose of 1ml were given, 3) fair: analgesia and relaxation adequate, discomfort present even after additional top-up of epidural local anesthetic which was supplemented by injection dexmedetomidine 0.5 microgram/kg/hour i.v. infusion, 4) poor: patients complaining of severe intolerable pain during surgery without relaxation requiring general anesthesia. These patients were excluded from study.

Pulse rate and blood pressure were recorded at an interval of 1 minute for first 5 minutes and then every 15 minutes till the end of the surgery.

Onset of analgesia, level of analgesia, duration of analgesia, and total local anesthetic used were recorded.

Complications like bradycardia, hypotension, respiratory depression, nausea and vomiting, and inadvertent dural puncture were recorded.

Criteria for hypotension was taken as a fall in systolic or mean blood pressure more than 20% of patients basal reading and treated with vasopressors like injection mephentermine 3-6 mg i.v. Bradycardia as heart rate less than 60 and treated with injection atropine 0.6 mg i.v.

RESULTS

Total of 130 patients came for orthopedic surgeries (neck of femur fracture, intertrochanteric fracture, total hip replacement, distal femur fracture, total knee replacement, upper tibia fracture. during the study period, out of which 120 were recruited after applying the exclusion criteria, of which 4 patients were converted to general anesthesia. Therefore, total of 116 patients were analysed.

Table 1: Demographic data.

Age (years)	**43.12±0.78**
Gender (M/F)	48/72
Height (cm)	163.16±0.75
ASA I/II/III	20/55/45
Duration of surgery (minutes)	120.13±1.65

Demographic data including patient's age, height and total duration of surgery were noted as per Table 1 with mean age (years) 43.12±0.78, height (cm) 163.16±0.75 and duration of surgery (minutes) 220.5±25.7.

We used lignocaine + adrenaline bolus dose 8 to 12 ml according to anticipated segments required to be blocked, as per the patient's condition and type of surgery. Top up dosages were repeated every 60 minutes. We required 8 ml, 10 ml and 12 ml of bolus dose in 78, 31 and 7 patients respectively. All patients required 1st top up dose while 2nd top up dose was required only in 32 patients

depending on type and duration of surgery shown in Table 2.

Table 2: Bolus and top up dose of local anesthetic.

	Bolus dose			1st top up	2nd top up
	8 ml	10 ml	12 ml		
NOF # (neck of femur fracture)	16	7	3	26	6
IT # (inter trochanteric fracture)	25	8	2	35	10
THR (total hip replacement)		6	2	8	5
Distal femur#	15	5		20	7
TKR (total knee replacement)	4	1		5	2
Upper tibia#	18	4		22	2
Total cases	78	31	7	116	32

Table 3: Side effects.

Side effects	No. of patients	Percentage
Hypotension (fall of MAP ≥ 20 % from baseline and/or SBP <90 mmHg)	23	19.1
Bradycardia (HR<50/minute)	2	1.66
Inadvertent dural puncture	2	1.66
Nausea/vomiting	4	3.33

As shown in Table 3, we reported 23 cases of hypotension, bradycardia in 2 patients, nausea and vomiting in 4 patients and inadvertent dural puncture in 2 cases.

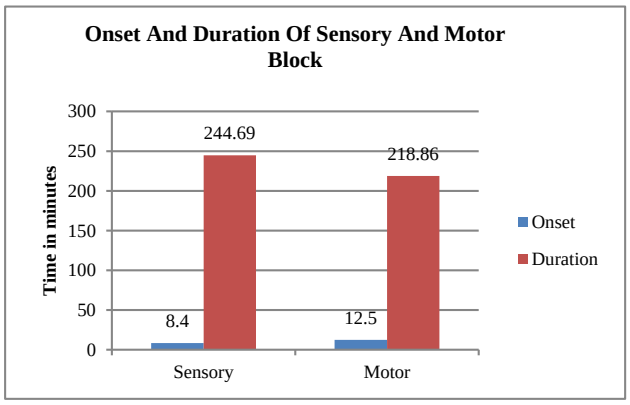

Figure 1: Characteristic of sensory and motor block

Figure 1 shows characteristic of sensory and motor block with onset of sensory and motor blockage was 8.4±1.13 (minutes) and 12.5±1.59 (minutes) respectively while duration of sensory and motor blockage was 244.69±27.21 and 218.86±25.87 respectively.

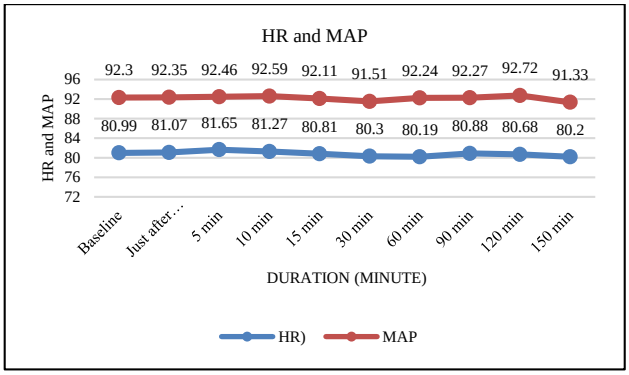

Figure 2: Intra-operative hemodynamic changes.
HR= heart rate and MAP= mean arterial pressure.

As shown in Figure 2 intraoperative HR and MAP remains near to baseline.

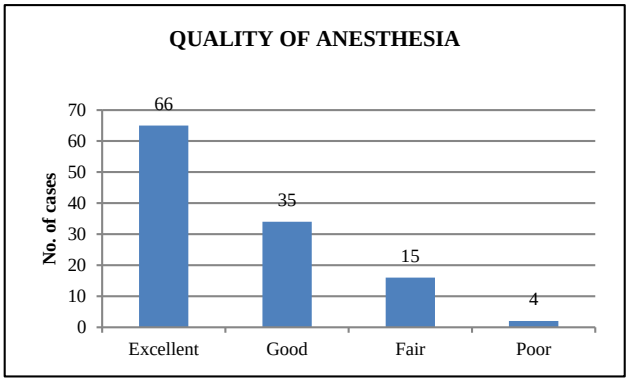

Figure 3: Quality of anesthesia.

Figure 3 shows the quality of anesthesia. 66 patients (55%) had an excellent type of analgesia and relaxation. In 35 patients (29%), analgesia and relaxation were adequate but minimal discomfort was present during surgical procedure without requirement of top up dose. 15 patients (12.5%) had discomfort which required the addition of top up dose of epidural local anesthetic. 4 patients (3%) had no analgesia at all, patients were complaining of severe intolerable pain during surgery without relaxation so, GA given to these patients and excluded from our study.

DISCUSSION

Epidural anesthesia is suitable as a sole agent for lower abdominal and lower limb surgeries. SEA selectively blocks pain fibres from the surgical site.[1] It limits sympathetic and motor block which could probably avoid hypotension.

Segmental epidural block or conventional epidural block can be performed at any region like cervical, thoracic, lumber or caudal. However, the volume used in the segmental block is very small so as to block the particular segments only providing some advantages over the conventional epidural block. In conventional block, the

required volume was large enough to spread widely giving rise to complications like arterial hypotension, bradycardia etc.

Prys-Roberts et al stated that segmental epidural block with local anesthetic is far more satisfactory when placed at correct vertebral level in more than 90% patients undergoing lower abdominal surgeries and lower limb surgeries.[4]

In present study total 120 patients were taken for study. 4 patients were excluded from the study. So total 116 patients posted for orthopedic surgeries were taken for study.

The catheter tip has to be placed in the center of the dermatomes to be blocked. In orthopaedic surgeries block required segments from T_{10}-S_2, so epidural needle entry was taken between L_2/L_3 or L_3/L_4 and the direction of catheter tip kept caudally so, maximum sensory block level achieved up to T_{10} level. Study by Silamban et al found that the direction of catheter entry (cephalic/caudal) was insignificant and it was only the site of catheter tip placement which was of paramount importance and determines the spread of LA.[5]

Sachidanand et al done the study of SEA block for inguinal hernia repair in 100 patients. and used 0.5% bupivacaine as a LA and found 53% pts had excellent quality of analgesia and relaxation while our study used L+A 2% 66 patients had an excellent type of analgesia and relaxation out of 120 pts taken for lower abdominal and lower limb surgeries with L+A 2% as a study drug for LA.[2]

Parikh et al done the study of SEA block for PCNL surgery and they compared GA with SEA for PCNL and found better pt satisfaction (p=0.005) with SEA compared to GA and also stable HR with SEA.[6] We did observational study of SEA for lower abdominal and lower limbs surgeries and found MAP and HR throughout intra op remained near the baseline reading with marked hemodynamic stability.

Rao et al did the study on segmental dose requirement of epidural lignocaine and stated that dose required to block each segment in males was about 22.3 mg/segment and in females about 19.7 mg/segment.[7] Another study by Pinnock et al suggested volume required for epidural for each pair of segments are: cervical- 1.5 ml/segment, thoracic- 2.0 ml/segment, lumbar- 2.5ml/segment.[8]

Based on these studies, dose for SEA in our study was 1.5-2.0 ml/segment for lumbar and lower thoracic region. so, the calculated volume of the bolus drug injected was 8-12 ml, depending on the surgery which limit the spread to only the segments involved in the field of surgery. In our study, bolus dose required for orthopedic surgeries was 8 ml,10 ml and 12 ml in 78, 31 and 7 patients respectively.

Parikh et al studied comparison of general anesthesia with SEA (0.75% ropivacaine) for PCNL surgeries and found that mean dose of ropivacaine required for the entire surgery was 70.27±17.02 mg (9-10 ml).[6] In our study, we used L+A as a study drug and found the mean total dose of L+A (bolus + top up doses) for entire surgery was 14.69±2.59 ml.

Korula et al studied comparison of equipotent doses of ropivacaine and bupivacaine for epidural anesthesia in bilateral inguinal hernia.[9] They used 15 ml 0.75% ropivacaine or 15 ml 0.5% bupivacaine in bilateral inguinal mesh hernioplasty for epidural anesthesia while our study for SEA required the mean total dose of L+A (bolus + top up doses) for entire surgery was 14.69±2.59 ml.

Bhosle et al studied retrospective analysis of segmental epidural anesthesia for abdominal surgeries and found hemodynamic changes resulting from epidural anesthesia was significantly less than that seen with comparable levels of subarachnoid block.[10] In Our study, we also found better hemodynamic stability in SEA.

Parikh et al studied comparison of general anesthesia with SEA for PCNL surgeries found that in SEA group mean HR (heart rate) was remains near to baseline while SEA group had fall in MAP (mean arterial pressure) intraoperatively while in our study MAP and HR remains near to baseline.[6]

Kulkarni et al studied a comparison of 15ml 0.5% ropivacaine with 15 ml 0.5% bupivacaine in lower limb surgery found that mean duration of analgesia was 97.86±8.53 minutes in group B and 78.25±5.13 minutes in group R.[11] It was observed that bupivacaine provides prolong anesthesia than ropivacaine. In the present study mean duration of analgesia was 267.13±22.46 minutes (220-290 minutes).

Contrary to our study Gopal et al used single dose extradural analgesia with 20 ml 0.5% bupivacaine and 20 ml 1.5% lignocaine with adrenaline.[12] They found that lignocaine with adrenaline 2.0% provided a shorter onset time and longer duration of postoperative analgesia than the same volume of bupivacaine 0.5%. These results were comparable to our study.

In our study as the volume of the drug used was minimal and height of the block was limited, the incidence of hypotension was only in 23 patients which was treated with injection mephentermine 3-6 mg i.v.. our study there were 2 cases of dural puncture which were excluded from the study. Study done by Bhosle et al for retrospective analysis of segmental epidural anesthesia for abdominal surgeries found that 7 patients required vasopressors while no cases of bradycardia, shivering and dural puncture.[10]

Limitations of our study were that we have done this study in ASA grade I-III patients and routine surgeries. We can extend this study for high-risk ASA grade IV with cardiac patients. Further studies are needed for evaluation in emergency cardiovascular unstable patients as well as high risk patients having respiratory compromise.

CONCLUSION

We concluded that segmental epidural anesthesia is a safe and reliable technique for orthopedic surgeries with stable hemodynamics, limited spread of drugs involving only required segments with minimal side effects. We can provide post operative analgesia.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee of PDU Medical College and Hospital, Rajkot (Reg. No. PDU/MCR/IEC/19059/2016)

REFERENCES

1. Miller RD, Erikkson LI, Fleisher LA, Wiener-Kronish JP, Cohen NH, Young WL, eds Miller's anesthesia. 8th edn. Vol. 1. Elsevier; 2014:1684-1716.
2. Sachidanand RS, Devulapalli PK, B. Rao BS, Chandrashekhar B, Srinath M. Segmental epidural anesthesia for inguinal hernia repair. J Evid Based Med Healthcare. 2015;2(39):6244-57.
3. Deschner B, Allen M, Leon OD. Epidural blockage. In: Hadzic A, ed. Textbook of regional anesthesia and acute pain management.1st edn. Philadelphia: McGraw Hill; 2007:229-267.
4. Cedric Prys-Roberts and Burnell R. Brown. International practice of anesthesia. 1st ed. Vol. 2. Oxford: Butterworth, Heinemann; 1996.p.140/9.
5. R Silamban, RACE 2006, how to make an epidural work, chapter 6, 44-50.
6. Parikh DA, Patkar GA, Ganvir MS, Sawant A, Tendolkar BA. Is segmental epidural anesthesia an optimal technique for patients undergoing percutaneous nephrolithotomy? Indian J Anaesth. 2017;61:308-14.
7. Rao MH, Thota P. Segmental dose requirement of epidural lignocaine. J Anaesth Clin Pharmacol. 1995;11:99-102.
8. Collins VJ. Principles of anesthesiology: general and regional anesthesia. 3rd edn. Vol. 2. 1993:1578-1580.
9. Korula S, George GM, Ipe S, Abraham SP. Comparison of equipotent doses of ropivacaine and bupivacaine. Saudi J Anaesth. 2011;5:277-81.
10. Bhosle P. Retrospective analysis of segmental epidural anaesthesia for abdominal surgeries. Emergency. 2014;7:23-33.
11. Kulkarni J, Tammewar A, Jewalikar S, Bengali R. Epidural anaesthesia in elderly: A Comparison of Ropivacaine with Bupivacaine. IOSR J Dent Med Sci. 2013;6:3.
12. Gopal VM. A comparative study of single dose extradural analgesia with bupivacaine and lignocaine with adrenaline. Ann Int Med Den Res. 2017;3(1):AN13-6.

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