Original Research Paper

Volume - 7 | Issue - 7 | July - 2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96

Anaesthesiology

PARAVERTEBRAL BLOCK - A BETTER ALTERNATIVE TO SPINAL ANAESTHESIA FOR UNILATERAL INGUINAL HERNIA REPAIR

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ABSTRACT

Background: Spinal anaesthesia is the most common technique performed for inguinal hernia repair. Since it has a quicker onset, easy to perform, provides adequate anaesthesia and muscle relaxation. But it also has some disadvantages like unpredictable level of block, post dural puncture headache, peripheral arterial vasodilation, bradycardia and hypotension. Paravertebral block, being segmental in nature, can be expected to produce some advantages regarding haemodynamic stability and duration of analgesia.

Methods: Fifty male patients (ASA grade I and II) aged 18-65 years, posted for unilateral inguinal herniorraphy were enrolled into this randomized single blinded study. Patients were divided into two groups, to receive either paravertebral block (group-P, n=25) at T10 to L2 or spinal anaesthesia (group-S, n=25), respectively. Duration of analgesia and intraoperative hemodynamic stability were noted.

Results: Group P had prolonged duration of analgesia ($p<0.0001$) and better intraoperative haemodynamic stability when compared to group S. Group S had a fall in intraoperative MAP (86.7+5.67mmHg) from pre-operative MAP (90.2+3.7mmHg) which is statistically significant when compared with group P as there was not a fall in intraoperative MAP (90.4+4.07) from preoperative MAP (90.9+4.4mmHg).

Conclusion: Paravertebral block is superior to Spinal Anaesthesia in providing excellent surgical anaesthesia with very less hemodynamic disturbances and prolonged duration of analgesia. Moreover paravertebral block can be an attractive alternative in high risk patients as it provides better intraoperative hemodynamic stability and prolonged postoperative analgesia with minimal adverse events.

KEYWORDS : Inguinal hernia repair, paravertebral block, spinal anaesthesia.

INTRODUCTION

Inguinal hernia repair can be done under local, general or regional anaesthesia. Also inguinal herniorrhaphy is being done nowadays on many high risk patients like elderly where avoidance of intubation and general anaesthesia are preferred.

Paravertebral block is a regional technique where local anaesthetics are injected into the space lateral to the vertebral column[1], where the spinal cord emerges from the intervertebral foramina and bifurcates into the dorsal and ventral rami. It provides surgical anaesthesia and postoperative analgesia for procedures involving the thoracic or abdominal wall, mastectomy, inguinal or abdominal hernia repair, and open nephrectomy[2].

Paravertebral block has the advantages of prolonged sensory blockade with less hemodynamic disturbances and it can also be given for patients with comorbid conditions and thus it offers an attractive alternative to spinal anaesthesia in terms of its efficacy but offsetting its disadvantages. In addition paravertebral block produces high quality, long duration of analgesia with minimal haemodynamic adverse events[3].

There have been many studies which have found that paravertebral anaesthesia can be successfully used for inguinal hernia repair with fewer incidences of side effects. So in this study paravertebral block and spinal anaesthesia are prospectively compared for patients undergoing unilateral inguinal hernia repair.

MATERIALS AND METHODS

After getting approval from the institutional ethical committee and informed consent, fifty patients (ASA grade I & II) aged 18-65 years, who are planned for undergoing unilateral inguinal herniorrhaphy were recruited into this randomised single blinded study. Exclusion criteria were patients with coagulopathy, infection at the block site, morbid obesity, lumbar spine deformities, Cardiovascular disease, Respiratory disease, Renal disease, Hepatic disease, Chronic analgesic use, History of substance abuse, Allergy to local anaesthetics.

The patients were randomly divided into two groups. Group P (n=25) received paravertebral block, and Group S (n=25) received Spinal Anaesthesia.

On entering the operating theatre, an intravenous line was started with an 18G intravenous cannula. Monitors which were routinely used like Pulse oximeter, NIBP, ECG were attached to the patient. Prior to performing both the techniques, all things which are needed for inducing General Anaesthesia and other resuscitation kits were made available if there is any chance for a block failure or any other complication. Intra-operative data and post-operative data were recorded by residents who were not involved in the study.

Vital parameters –heart rate , blood pressure, and pulse oximetry readings were monitored when the block was performed.

The Paravertebral block was done using a18G Tuohy needle unilaterally following the classic 'loss of resistance' technique with the patient placed in a sitting position. The superior aspect of the spinous processes of levels T10 to L2 was identified by palpation and a mark was made approximately 2.5 cm lateral to that point. An injection of lignocaine 10mg/ ml was given locally at the site of needle insertion. After waiting for 5 min, a 22G Quincke' needle is inserted perpendicularly to the skin to a depth of 3-5 cm until the transverse process was contacted and it is used as a guide for the 18G Tuohy needle to be inserted in the same direction till the transverse process was contacted by the Tuohy needle. Once contacted, the needle was then withdrawn a bit and walked off the transverse process and inserted 1–1.5cm deeper to the superior ridge of the transverse process where a 'loss of resistance' was experienced. After negative aspiration for blood, 5 ml of bupivacaine 5mg/ml with Inj.Epinephrine 1:200000 was injected into the paravertebral space.

Blocks were placed at five levels (T10, T11, T12, L1, and L2) and a total of 25 ml of 0.5% bupivacaine was used[4].

The onset of unilateral pinprick discrimination at 5minutes after block placement and thereafter every 5minutes for upto 30 minutes was noted.The block was considered successful when the following criteria were met after block placement.

1. Onset of pinprick discrimination started within 15 minutes after block placement.
2. Sensory block (T10–L2) achieved within a maximum time of 30 minutes.

Motor block was assessed using a modified Bromage scale of 0–3[6].

Grade 0 - No motor block
Grade 1 - Inability to raise extended leg, able to move knees and feet
Grade 2 - Inability to raise extended leg and move knee, able to move feet
Grade 3 - Complete motor block of the lower limbs.

If there is an absence of onset of pinprick discrimination within 15 minutes after block placement then it was considered as a 'block failure' and the patient was converted to General Anesthesia and the case was excluded from the study. During surgery, patients of P group received IV Fentanyl of 1 mcg/kg in case whenever the patient complained of pain. Hernial repairs were performed.

The patients in group S were pre-loaded with 10 ml/kg of Ringer Lactate Solution. Patients were administered spinal anesthesia with a 25-G Quincke needle in a midline approach at the L2-L3 or L3–L4 intervertebral space with the patients placed in the sitting position, 3 ml of 0.5% hyperbaric bupivacaine(15mg) was injected within 30 seconds. After giving spinal anesthesia, the patients were placed in a supine position. Sensory block was assessed by pinprick discrimination and surgery was allowed to commence when the sensory block was higher than T10. The peak level of the sensory block was recorded.

Motor block was evaluated using a modified Bromage scale which was recorded at the peak of sensory block. In case of any episode of hypotension [mean arterial pressure reducing less than 70mmHg] intra-operatively was managed with 100 ml of intravenous fluid and 6mg of intravenous ephedrine and in case of any episode of bradycardia [heart rate reducing less than 60 beats/minute] the patients were given intravenous atropine 0.6 mg . Hernia repairs were performed.

At the end of surgery patients were shifted to the recovery room and subsequently to the post-operative ward. The onset of incisional discomfort, nausea or vomiting or other side effects in the first 24 hours of post-operative period were noted.

Duration of analgesia is recorded from the onset of block to the time of incisional discomfort postoperatively as reported by the patient. Upon reporting of pain by the patients, they are given injection diclofenac sodium 75 mg intramuscularly.

Nausea is defined as the subjective feeling of a need to vomit. Vomiting is defined as the oral expulsion of gastrointestinal contents. Anti-emetics with 4mg boluses of intravenous ondansetron were administered to patients who either vomitted or who complained of nausea. Patients were asked to note the time of the first passage of urine after the procedure. Those who were unable to void within 3 hours postoperatively or who complained of urinary retention were catheterized with a rubber urinary catheter after maintaining strict asepsis.

Patients were questioned regarding technique satisfaction (unsatisfied/ satisfied/ very satisfied).The time which required to perform the procedure, the time from end of procedure to surgical anaesthesia, the duration of analgesia and intraoperative haemodynamic parameters were recorded. Total dose of fentanyl, requirement of ephedrine were calculated for both groups P and S.

RESULTS

The study was carried out in a total of 50 cases. Three patients (12%) from group P were administered General Anaesthesia due to an inadequate block and were excluded from the study and similarly one patient in group S was administered General Anaesthesia after inadequate level and was also excluded from the study. So, data from 46 patients were available for analysis (n=22 in group P and n=24 in group S).

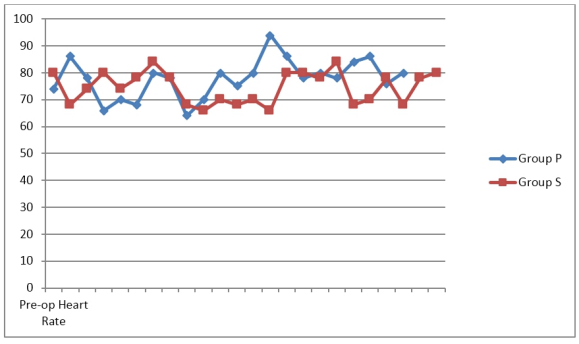
The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using Epidemiological Information Package (EPI) developed by Centre for Disease Control, Atlanta. Using this software range, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated. A 'p' value less than 0.05 is taken to denote significant relationship.

The patients were statistically comparable with respect to age, sex, height and weight and ASA physical status in both groups.

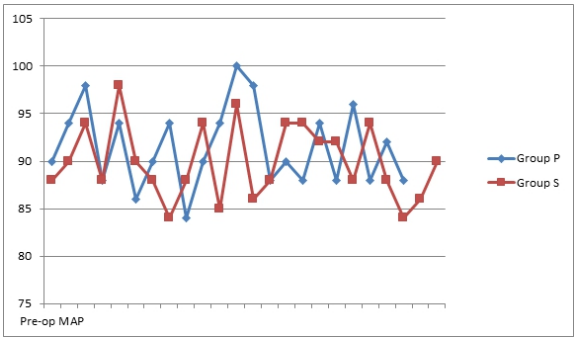
Table 1 :Baseline vital parameters for patients

Parameters	Value (Mean ± SD)for		"p" value
	Group P (n=22)	Group S (n=24)	
Pre-op HR (per minute)	77.7+7.23	74.5+5.9	0.1060 Not significant
Pre-op MAP(mmHg)	90.9+4.4	90.2+3.7	0.5611 Not significant
Pre-op spO2 %	98+0.3	98+0.3	1.0000 Not significant

Graph 1:Pre op Heart rate



Graph 2:Pre op MAP

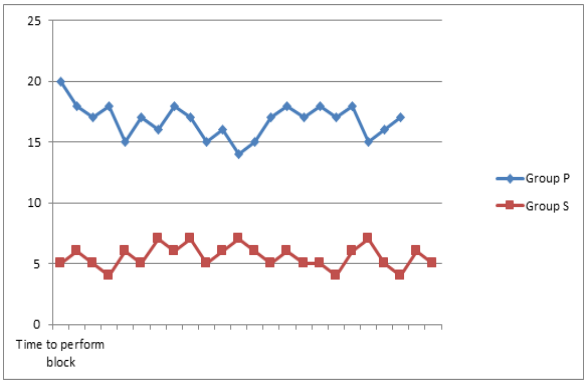


The baseline vital parameters (Pre-op Heart rate, Mean Arterial Pressure and spO2%) for both the groups P and S were not statistically significant.

Table 2:Time to perform block

Time	Value (Mean ± SD) for		'p'value
	P group	S group	
Time to perform block(in minutes)	16.7+1.4	5.5+0.91	<0.0001 Significant

Graph 3:Time to perform block

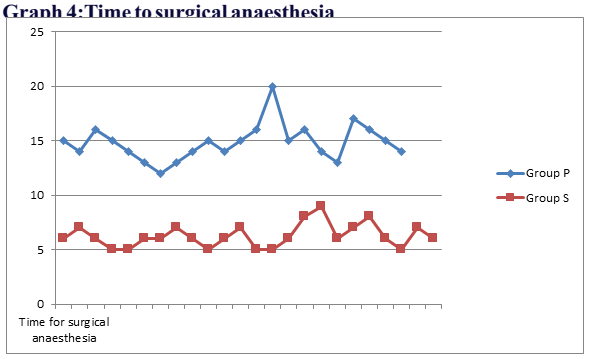


The time to perform the block in group P is 16.7 + 1.4, whereas in group S is 5.5 + 0.91. This means that group P has got a extended time to perform block which is statistically significant as detected by Student't' test – $P < 0.05$.

Table 3: Time to surgical anaesthesia

Time	Value (Mean ± SD) for		'p'value
	P group	S group	
Time to surgical anesthesia(in minutes)	14.81+1.68	6.25+0.4	< 0.0001 Significant

Graph 4: Time to surgical anaesthesia

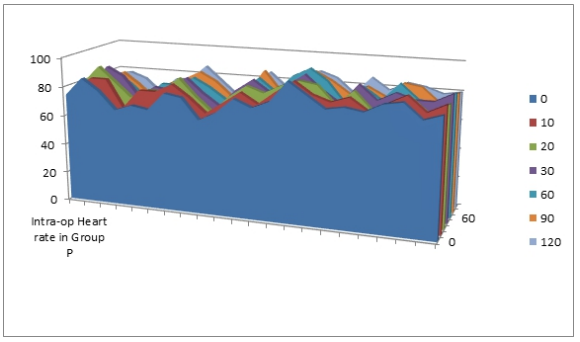


The time to surgical anaesthesia in group P is 14.81+1.68, whereas in group S is 6.25+0.4. This means that group P has got a extended time to surgical anesthesia which is statistically significant as detected by Student't' test –P < 0.05.

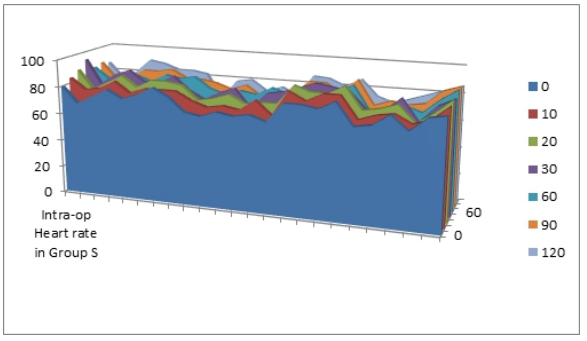
Table 4: Intra-op Heart rate

Parameter	Value (Mean + SD) for		'p'value
	P group	S group	
Intra-op Heart rate	78.84+6.34	78.24+5.47	0.7321 Not significant

Graph 5: Intra-op Heart rate in group p



Graph 6: Intra-op Heart rate in group s

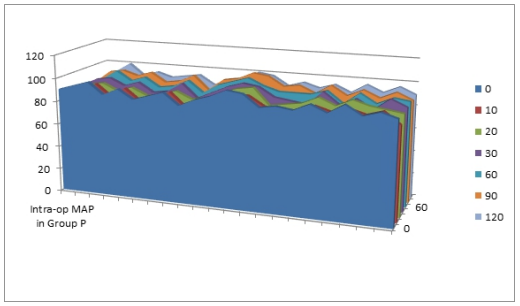


The intra-operative heart rate were not significant between the two groups P and S are not significant (p >0.05).

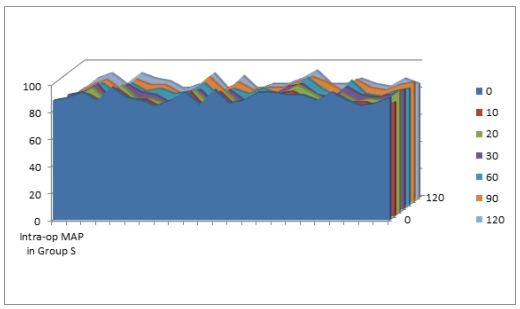
Table 5: Intra-op MAP

Parameter	Value (Mean + SD) for		'p'value
	P group	S group	
Intra-op MAP	90.4+4.07	86.7+5.67	0.0154 Significant

Graph 7: Intra-op MAP in group p



Graph 8: Intra-op MAP in group s

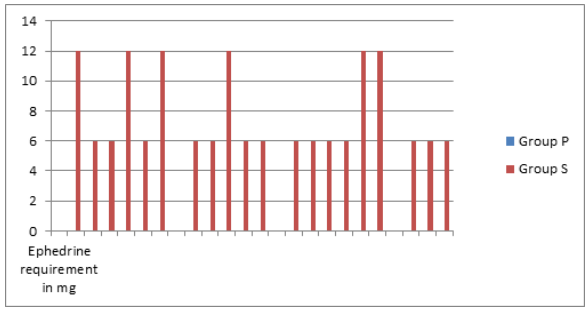


The intra-operative Mean Arterial Pressure in group P is 90.4+4.07 mmHg (Mean+ SD) while in group S is 86.7+5.67mmHg (Mean+SD). This is statistically significant as there was a decrease in MAP in the S group when compared with the P group as p is 0.0154 (p<0.05).

Table 6: Requirement of ephedrine

Parameter	Value (Mean + SD) for		'p'value
	P group	S group	
Ephedrine Requirement (boluses of 6mg)	0.0	6.5+3.9	<0.0001 Significant

Graph 9: Requirement of ephedrine

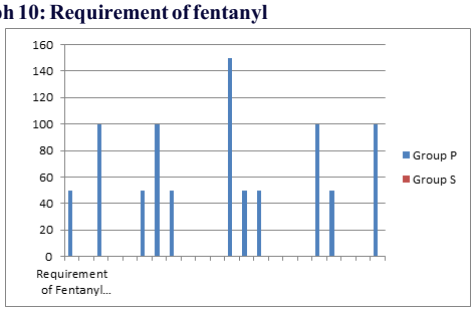


The requirement of ephedrine was 6.5+3.9 in the S group while it was 0 in the P group. As the p is <0.0001, this is statistically significant. So Patients in group S had requirements of ephedrine during the surgery.

Table 7: Requirement of fentanyl

Parameter	Value (Mean + SD) for		'p'value
	P group	S group	
Fentanyl(boluses of 1mic/kg)	38.63+46.11	0.0+0.0	0.0002 Significant

Graph 10: Requirement of fentanyl

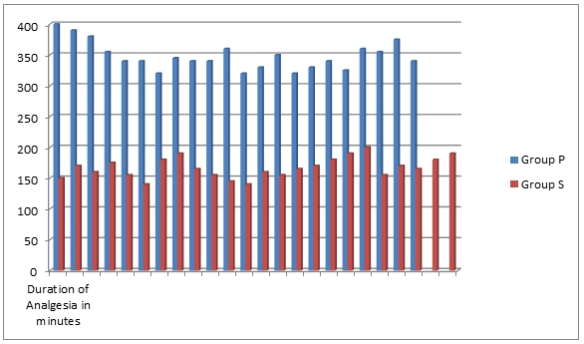


The requirement of Fentanyl(boluses of 1mic/kg) was 38.63+46.11 in the P group while it was 0 in the S group. As the p is 0.0002, this is statistically significant and the requirement of fentanyl was more in the P group.

Table 8:Duration of Analgesia

Parameter	Value (Mean + SD) for		'p'value
	P group	S group	
Duration of analgesia(in minutes)	347.95+22.39	166.8+16.4	<0.0001 Significant

Graph 11: Duration of analgesia



The mean duration of analgesia in group P is 347.95+22.39, whereas in group S is 166.8+16.4. This means that group P has got a extended duration of analgesia when compared with group S which is statistically significant as detected by Student't' test – P < 0.05.

Side effects were present in 27% of cases in P group and 28.5% of cases in S group. But the difference is not statistically significant (p = 0.7249)

2 patients in group P required urinary catheterisation while 5 patients in group S required urinary catheterisation. The difference between the two groups is not statistically significant as p=0.4860.

Patient satisfaction was compared between the two groups P and S with no patients unsatisfied in both groups P and S. 12 patients satisfied in group P and 11 patients satisfied in group S while 10 patients were very satisfied in group P and compared to 13 patients in group S. However the difference between the two groups is not significant as p is 0.7679.

In our study, failure of paravertebral block occurred in three cases. In all the three cases, the block was patchy and incomplete. Patients had pain and were converted to general anaesthesia. Failure of subarachnoid block occurred in one case which was also converted to general anaesthesia. These four unsuccessful cases were excluded from the study.

DISCUSSION

The main findings in this study were prolonged duration of analgesia, and better intraoperative haemodynamic stability for whom paravertebral block was administered as compared to those who were administered spinal anaesthesia for unilateral inguinal hernia repair.

The quality of anaesthesia provided by paravertebral block was equally efficacious as spinal anaesthesia as evidenced by a good analgesia and muscle relaxation as interpreted by the operating surgeons. In fact the patients were more comfortable with minimal sedation and required fewer intraoperative supplementation.

Paravertebral block is associated with better intraoperative haemodynamic stability when compared with spinal anaesthesia. This is another advantage of paravertebral blocks. In our study patients in group S had a fall in intraoperative MAP (86.7+5.67mmHg) from pre-operative MAP (90.2+3.7mmHg) which is statistically significant when compared with group P as there was not a fall in intraoperative MAP (90.4+4.07) from preoperative MAP (90.9+4.4mmHg). Further patients of group S required ephedrine of 6.5+3.99 mg while patients of group P did not require ephedrine which is statistically significant. This shows that Paravertebral block provides better intraoperative haemodynamic stability when compared with spinal anaesthesia.

Prolonged duration of analgesia is one of the advantages of paravertebral block. The mean duration of analgesia provided by paravertebral block was 347.95+22.39 minutes as compared to subarachnoid block 166.8+16.4 minutes.

Klein et al in 1998[7] published a case report of 22 patients undergoing outpatient inguinal herniorrhaphy under Paravertebral nerve block of T10 – L2 and demonstrated that bupivacaine paravertebral blocks provide surgical anaesthesia within 15– 30 minutes and prolonged postoperative analgesia with a mean time to first opioid of 22 hours which is strikingly longer than our result. This because in this study they have also used 100-250 microgram of fentanyl as premedication along with midazolam and intermittent intravenous doses of 25 microgram of fentanyl for intravenous sedation. Intravenous ketorolac 30 mg was also administered at the end of surgery.

Weltz et al. in 1998[8] documented low pain scores for 48 hours postoperatively. They have also used narcotic premedication and intraoperative supplementation in addition to naproxen 500mg twice daily and acetaminophen with codeine.

In a study by Hadzic et al in 2006[9] showed that paravertebral blocks provide superior same-day recovery over general anesthesia for patients undergoing inguinal hernia repair.

In a nonrandomized study, Naja et al. [10] compared multilevel PVBs from T12 to L2 versus general anaesthesia versus spinal anaesthesia. Naja et al. have used a combination of local anaesthetics, clonidine and fentanyl for block and intravenous midazolam, propofol for supplemental sedation. The patients in the PVB group had better postoperative analgesia, a lower incidence of postoperative nausea and vomiting (0 [PVB] vs. 21% [general anaesthesia] vs. 19% [spinal anaesthesia]; p <0.001) and a shorter duration of hospital stay (1.2 days [PVB] vs. 2.9 days [general anaesthesia] vs. 2.5 days [spinal anaesthesia]; p <0.0001). Although Naja et al. did not comment on this, another potential advantage of paravertebral blocks over spinal anaesthesia involves a lower incidence of postoperative urinary retention.

In a randomized trial, Wassef et al. in 1998[8] compared lignocaine paravertebral blocks (T12-L2) to field blocks performed with both lignocaine and bupivacaine. The paravertebral blocks were associated with less-frequent intraoperative supplementation (20% vs. 41%; p <0.01), a lower rate of conversion to general anaesthesia (0 vs. 6.7%) and greater patient satisfaction (p <0.05). The most striking outcome of this study is the prolonged duration of analgesia associated with the paravertebral block technique in comparison with subarachnoid block. The quality of block at the dermatomal site of injection is very high. It may also be due to the relative avascularity of the paravertebral space and hence the slow uptake of local anaesthetics. The other studies conducted elsewhere, report an analgesic duration between 13 and 18 hours, whereas our study found a mean duration of around 6 hours. This difference may be due to the addition of adjuvants like fentanyl, clonidine etc. used in those studies.

The reduced incidence of nausea and vomiting are again due to excellent afferent nerve blockade and prolonged duration of analgesia. In a study by Akcaboy EY et al in 2009[11] , paravertebral block provided shorter home readiness time and long lasting postoperative analgesia comparing with spinal anaesthesia.

Bhattacharya et al in 2010[12] compared paravertebral block and spinal anaesthesia in inguinal hernia surgeries and concluded that unilateral paravertebral block is more efficacious than conventional Spinal Anaesthesia in terms of prolonging post-operative analgesia and reducing morbidities in patients undergoing elective unilateral inguinal hernia repair.

CONCLUSION

We conclude that Paravertebral block is superior to Spinal Anaesthesia in providing excellent surgical anaesthesia with very less hemodynamic disturbances and prolonged duration of analgesia. Moreover , the paravertebral block can be an attractive alternative in high risk patients as it provides better intraoperative hemodynamic stability and prolonged postoperative analgesia with minimal adverse events.

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