Original Research Article

Comparative Assessment of Efficacy of Thoracic Epidural with Low Spinal Block Vs. Spinal Anaesthesia in PCNL

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ABSTRACT

General anaesthesia, spinal anaesthesia, epidural anaesthesia and para vertebral block can be used as anaesthetic techniques for Percutaneous Nephrolithotomy (PCNL) procedure. Associated complications and cost are higher for general anaesthesia than for regional anaesthesia. High risk patients can be managed with minimal haemodynamic changes under regional anaesthesia. The study aimed to compare the efficacy of thoracic epidural with low spinal block versus spinal anaesthesia for percutaneous nephrolithotomy. Sixty healthy patients included in the study who were suffering from renal stone and belonging to ASA physical status grade I and II , aged between 20-60 years and allocated randomly into two groups of 30 each; Group E+S- Thoracic epidural with low spinal block and Group S- Spinal block. It was observed that Thoracic epidural with low spinal block is better technique than Spinal block alone for PCNL. As the Mean arterial pressure till 3 hours was significantly lower in spinal group as compared to epidural group with spinal group. After 160 minutes, differences were not significant. Number of attempts required for epidural catheter placement was higher. Mean time 15.45±2.8 min was required to achieve the block in Thoracic Epidural Block with low spinal, while Mean time for Spinal group was 8.52±2.62 minute. After 40 minutes difference in heart rate was statistically significant and higher in spinal group till the end of 3 hours. Postoperative VAS score was significantly higher in spinal group. Postoperative Nausea Vomiting (PONV) Score was significantly higher in spinal group. Present study shows that for Percutaneous Nephrolithotomy, Thoracic epidural with low spinal block is better than spinal anaesthesia in terms of haemodynamic stability, Postoperative analgesia, patient satisfaction, reduced incidence of PONV.Both types of regional anaesthesia are safe and effective.

KEY WORDS: haemodynamic stability, percutaneous nephrolithotomy, postoperative analgesia, segmental epidural block, spinal anaesthesia

INTRODUCTION:

Percutaneous Nephrolithotomy (PCNL), first described by Fernstrom and Johansson in 1976[1] now is a popular, well established, minimally invasive procedure that is choice for removal of kidney calculi with greater than 2 to 3 cm diameters, multiple kidney calculi, staghorn calculi and the cases of failed extra corporal shockwave lithotripsy (ESWL)[2-4].Several attempts have taken place in last few years to reduce morbidity, analgesia requirements and duration of hospitalization after PCNL. One of this attempts is regional anaesthesia instead of general anaesthesia.

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The choice of anaesthesia technique depends on patient and surgeon's preference, feasibility of technique in a given patient, skill of anaesthesiologists and cost of surgery. General anaesthesia, spinal anaesthesia, epidural anaesthesia, para vertebral block, all can be used as anaesthetic techniques for PCNL procedure. Associated complications and cost are higher for general anaesthesia than for regional anaesthesia [6,7]. Spinal anaesthesia is easier, quick to execute, cheap and patients can be discharged early. Thoracic epidural with low spinal block requires skilled anaesthetist but has the advantage of prolongation of anaesthesia time. Added advantage of epidural is that post-operative analgesia can be provided. High risk patients can be managed with minimal haemodynamic changes under regional anaesthesia. The anaesthesia related complications of regional anaesthesia are comparatively less and easily manageable.

Percutaneous nephrolithotomy (PCNL) is done under General Anaesthesia (GA) in most of the centres. But in our institution we do PCNL under regional anaesthesia. There are studies comparing combined spinal epidural anaesthesia versus GA for same procedure [5].But there are no studies comparing spinal anaesthesia and thoracic epidural with low spinal block for PCNL. Hence, this study.

MATERIALS AND METHODS:

The present study was a comparative prospective study done to compare the effects of Thoracic epidural with low spinal block and Spinal Anesthesia in patients undergoing PCNL surgery. Study was carried out from April 2016 to May 2017 in 60 adult patients of either sex, of ASA grade I & II, between the age group of 20 to 60 years after obtaining approval from Institutional Ethics Committee. Non consenting patients, patients with ASA grade ≥ 3, coagulopathy, neuropathy, vertebral deformity, metabolic acidosis, BMI>30; patients allergic to local anaesthetics, patients requiring supplementation with general anesthesia, patients with history of cardiac, respiratory, neuromuscular, hepatic or major renal disease, systemic illness that may result in hypotension during anaesthesia e.g. haemodynamically significant aortic or mitral valve stenosis, pregnancy or skin infection of the back and patients with contraindications for CSE were excluded from the study.

Thorough preoperative assessment was carried out. Patients fulfilling the inclusion criteria were explained about the study. An informed and written consent was obtained from those who were willing to participate in the study. The patients were randomly divided into two groups of 30 each, Group E+S (thoracic epidural with low spinal) and Group SA (Spinal anesthesia) by computer generated randomize table.

After confirming adequate starvation, inside the operation theatre, ECG leads, a pulse oximeter and a noninvasive blood pressure cuff were attached to the patients and baseline values for heart rate, mean arterial blood pressure (MAP) and peripheral oxygen saturation (Sp02) were recorded. An intravenous access was secured using 20 gauge indwelling cannula in upper limb.

After preloading in group CSE, 3ml of 1% lignocaine was infiltrated in skin & subcutaneous tissue. Tuohy's needle was inserted by midline approach at T10-T11 & epidural space confirmed with loss of resistance technique. Epidural catheter was inserted 4cm in upwards direction and the tip of the catheter was placed at the level of T8space and fixed under all aseptic precautions.A test dose with 3cc of 2% lignocaine with Adrenaline was administered via the epidural catheter and an additional 10ml 0.375% bupivacaine was administered via epidural catheter, following which subarachnoid block was given using 25G Quincke's needle and 10mg(2ml) 0.5% hyperbaric bupivacaine through L3-L4 space. Adequate sensory level was achieved by both epidural and spinal block after every 2 segment regression, epidural top up was given with Inj. Bupivacaine 0.5% to maintain a level of T6.

After preloading in group SA, 25 G Quincke's needle was inserted and Subarachnoid block was given with 17.5mg (3.5ml)of 0.5% Bupivacaine in the L3-L4 space. After achieving adequate sensory level upto T6, patient were positioned in prone position.

All patients were monitored intra operatively in terms of heart rate, MAP, oxygen saturation every five minutes for first twenty minutes, every ten minutes for the next sixty minutes and every twenty minutes thereafter. Any episode of hypotension (>30% fall in systolic blood pressure), hypertension (>30% rise in systolic blood pressure), tachycardia (heart rate >100/min), bradycardia (heart rate <60/minute), desaturation was noted. Episode of bradycardia was corrected by 1mg bolus dose of Inj Atropine and Hypotension was corrected by intravenous fluids and appropriate use of vasopressors.

Insertion of ureteric catheter was done in lithotomy position, to dilate the pelvicalyceal system (PCS) and to delineate it followed by percutaneous puncture of pelvi calcaleal system done under fluoroscopic guidance. Then Development of track was done to dilate a track from the skin through the renal parenchyma into the collecting system, and to place a working sheath. Finally the stone was fragmented with pneumatic/ultrasonic/laser lithoclast and the fragments were extracted with the help of forceps. Continuous irrigation with warm normal saline was required for clear visibility. After complete clearance the ureteric catheter was removed and a double J stent was inserted if needed.

Post operatively, patients were monitored for two hours in post anaesthesia care unit. Incidence of side effects like nausea, vomiting, urinary retention and any other adverse events were noted. Patient satisfaction for pain relief was asked and compared among both the groups.

Statistical analysis was performed with SPSS

for windows (SPSS Inc., Chicago, IL, USA), version 16.0 for analysis of demographic data and comparison of groups, x2, unpaired student's t-test was performed. $p<0.05$ was considered as significant.

RESULTS:

The present study was conducted on ASA I-II patients undergoing PCNL to see for the efficacy of performing the same under thoracic epidural with low spinal block and subarachnoid block alone. Sixty patients were randomly allocated into two groups: Group E+S & Group SA. The two groups were comparable with respect to age, weight, height, sex, duration of surgery.

Table 1: Comparable groups.

Parameters	GROUP E+S	GROUP SA
Age (years)	41.50± 10.40	42.91±11.12
Weight (kg)	54.24±05.23	53.52±05.11
Height(cm2)	160.3±06.81	160.4±05.72
Gender (M:F)	32.14	32.10
Duration of Surgery	146.60±27.28	140.52±23.40

Values are mean±SD or number,E+S= Thoracic epidural with low spinal block, SA= Spinal block, No significant difference between two group (Table 1).

Table 2: Number of attempts in two groups.

	GROUP (E+S) (n=30)	Spinal (S)	p-value	Significant
1	12	19	0.0441	Significant
2 or more	18	11		
Time (min) required to achieve the level	15.45± 2.80	8.52±2.62	<0.0000001	Highly Significant

Number of attempts were significantly higher in epidural with spinal group as compared to spinal group (p=0.04411). Mean time (min) required to achieve the level in group E and group S was 15.45±2.8 and 8.52±2.62 min respectively and difference was highly significant (p<0.0000001) (Table 2).

Baseline Heart Rate (beats/min) was comparable in both the groups with insignificant difference (p=0.874). but at 5 min Heart rate was more in E+S group as compared to SA showing significant differences with (p= 0.0001) again it was showing insignificant difference till 40 minutes. But, after 40 minutes difference in heart rate between two groups was statistically significant and higher rate recorded in spinal group till the end of 3 hours (p= 0.0001) (Table 3).

Table 3: Comparison of heart rate in two groups.

Time	E+S		SA		t-value	p-value
	Mean	SD	Mean	SD		
0 min	91.77	3.56	91.93	4.47	0.160	0.874
5 min	95.43	4.40	90.40	3.92	4.679	0.0001
10 min	91.60	4.61	89.83	5.99	1.280	0.206
15 min	88.67	4.67	89.47	6.27	0.561	0.577
20 min	88.67	4.71	88.87	5.65	0.149	0.882
40 min	84.33	3.25	89.07	5.97	3.816	0.0001
60 min	84.07	3.08	86.27	2.89	2.852	0.006
80 min	85.10	3.34	86.73	2.41	2.175	0.034
120 min	83.70	2.81	88.43	4.30	5.052	0.0001
160 min	85.43	3.26	100.00	3.93	15.633	0.0001
180 min	86.20	2.91	99.83	3.82	15.571	0.0001

Table 4: Comparison of Arterial Pressure in two groups.

Time	E+S		SA		t-value	p-value
	Mean	SD	Mean	SD		
0 min	93.33	2.37	60.37	2.41	53.39	0.0001
5 min	84.93	3.44	61.43	2.65	29.63	0.0001
10 min	84.90	3.09	62.70	2.44	30.90	0.0001
15 min	86.00	2.52	67.47	3.31	24.41	0.0001
20 min	86.00	2.27	70.77	3.42	20.31	0.0001
40 min	87.33	2.17	73.10	3.21	20.12	0.0001
60 min	87.30	1.99	75.57	3.15	17.26	0.0001
80 min	87.90	2.67	77.37	3.10	14.09	0.0001
120 min	88.43	1.91	79.10	3.71	12.26	0.0001
160 min	80.00	1.97	81.50	4.20	1.77	0.082
180 min	86.40	1.22	82.90	4.23	4.35	0.0001

Baseline MAP was comparable in both the groups and difference was highly significant at 5 min till 2 hours (p= 0.0001) MAP were significantly higher in epidural with spinal group as compared to spinal group. At 2 hours 40 minutes, MAP was slightly higher in epidural with spinal group with no significant differences (p=0.082) Again at 3 hours MAP was higher in group E+S group as compared to SA group and showing significant difference (p=0.0001) (Table 4).

PONV Score was nonsignificant at 4 hours (p=0.38) but PONV Score was significantly higher in spinal group as compared to epidural with spinal group at 6 hours,12 hours and 24 hours (Table 5).

Table 5: Comparison of PONV in two groups.

Time	E+S		SA		t-value	p-value
	Mean	SD	Mean	SD		
4 hrs	0.20	0.40	0.30	0.46	0.88	0.38
6 hrs	0.33	0.47	0.70	0.45	3.00	0.004
12 hrs	0.20	0.40	0.60	0.49	3.40	0.001
24 hrs	0.20	0.40	0.60	0.49	3.40	0.001

Table 6: Comparison of Pain Monitoring Score in two groups.

Time	E+S		SA		t-value	p-value
	Mean	SD	Mean	SD		
2 hrs	0.70	0.46	2.30	0.46	13.29	0.0001
4 hrs	2.33	0.66	5.20	0.48	19.16	0.0001
6 hrs	3.30	0.70	6.10	0.30	20.03	0.0001
12 hrs	3.00	0.58	6.00	0.37	23.64	0.0001
24 hrs	3.00	0.45	6.30	0.46	27.75	0.0001

Postoperative VAS score was significantly higher in spinal group and 2 hours onwards difference was highly significant (Table 6).

DISCUSSION:

PCNL remains the first-line treatment of choice for managing renal stone disease, although minimally invasive modalities, such as retrograde intrarenal surgery, have been introduced [8,9]. Furthermore, most urologists prefer general anesthesia for PCNL owing to the high level of anesthesia achieved, the ability to control the patient's breathing, and because it is more comfortable for patients [10,11]. However, general anesthesia is more likely to cause severe morbidities, such as drug-induced anaphylaxis, complications associated with endotracheal tube insertion, and cardiovascular, pulmonary, and neurologic complications[12].

Studies have been conducted to demonstrate the benefits of regional anesthesia in other types of surgery, such as radical retropubic prostatectomy and total hip arthroplasty[13,14]. Regional anesthesia permits fine muscle relaxation and achieves excellent surgical outcomes after radical retropubic prostatectomy.[13] Furthermore, regional anesthesia has been reported to reduce the risk of intraoperative hemorrhage, to be associated with less postoperative pain, and to allow earlier restoration than general anesthesia[14-17]. The cost of regional anesthesia is 40% less than that of general anesthesia during orthopedic surgeries.[18] Several comparative studies on anesthesia methods in PCNL have demonstrated various benefits for PCNL under regional anesthesia compared with general anesthesia.

In a retrospective comparative study of 37 patients who underwent regional anesthesia and 45 who underwent general anesthesia, it was concluded that the results were comparable in terms of general profiles, operative times, and stone-free rates [11]. In another study of 50 patients who underwent PCNL, regional anesthesia was found to be associated with greater patient satisfaction, less early postoperative pain, and fewer adverse events than general anesthesia [12]. Furthermore, in a prospective randomized study on PCNL in 64 patients (32 general and 32 regional anesthesia), patients in the regional anesthesia group were found to have significantly lower postoperative analgesic demands and shorter hospitalization periods [10].

The present study has compared safety and efficacy of thoracic epidural with low spinal block versus spinal anaesthesia for PCNL. Epidural block was associated with more intraoperative haemodynamic stability, reduced postoperative pain and lower postoperative analgesic requirements for 24 hours than the spinal group. Number of attempts required for epidural placement of needle was higher as compared to spinal block which suggest that epidural block is technically more difficult than spinal block. Also time required to achieve the desired level is more in epidural group than the spinal group.

In a prospective randomized study comparing spinal epidural block vs. general anaesthesia lower VAS score, less need for analgesics and shorter

hospital stay in spinal epidural group has been reported. General anaesthesia has been compared with spinal epidural anaesthesia with respect to operative time, postoperative haemoglobin level, hospital stay, success rate and postoperative complications and found no difference between two, besides patient's satisfaction was reported more with spinal epidural block [12,21].

General Anaesthesia is prone to complicate in terms of vascular, pulmonary and neurological issues, especially during changing patient's position from lithotomy to prone[22]. Spinal Anaesthesia is usually associated with hypotension during changing into prone position [23,24]. One hundred sixty patients who were submitted to PCNL in the prone position under spinal anaesthesia[22], six patients developed mild to moderate headache, dizziness and low back pain.
Among these patients, 18 patients had hypotension controlled by intravenous ephedrine. They concluded that PCNL under spinal anaesthesia is an alternative technique to GA. In contrast, several reports failed to found haemodynamic instability during changing the patient position from supine to prone [25].

In the present study, intraoperative MAP was significantly lower in spinal group as compared to epidural with spinal group and was statistically highly significant. Also, heart rate was more in spinal group throughout the procedure suggesting that haemodynamic stability is better in epidural with spinal group. Postoperative VAS score was significantly higher in spinal group and 4 hours onwards difference was highly significant. Less PONV score was noted in epidural with spinal group as compared to spinal group. Higher incidence of Postoperative nausea and vomiting in spinal group may be due to use of Tramadol (synthetic opoid) as analgesic. Greater patient satisfaction was noted in epidural with spinal group than spinal. This may be attributed to better Postoperative analgesia and mobility in Postoperative period and less PONV.

Present study shows that thoracic epidural with low spinal block is also a good alternative for PCNL. Epidural anaesthesia has the advantage of patient self-positioning for surgery, option of prolongation of anaesthesia time available, safer in high risk cardiac patients.

CONCLUSION:

It is inferred that for PCNL, thoracic epidural with low spinal block is better than spinal anaesthesia in terms of better haemodynamic stability, postoperative analgesia, patient satisfaction and reduced incidence of PONV. Though both types of regional anaesthesia are safe and effective, epidural anaesthesia is difficult to execute and takes longer time to act as compared to spinal block.

LIMITATION OF THE STUDY:

1. Only ASA grade 1 and 2 patients were included and patients with creatinine >3.5 mg % and serious co-morbidities were excluded.
2. Number of patients was less.

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