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Original Article

Anaesthesia Section

A Comparison of Efficacy of Segmental Epidural Block versus Spinal Anaesthesia for Percutaneous Nephrolithotomy

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ABSTRACT

Introduction: Percutaneous nephrolithotomy (PCNL) is done under general anaesthesia in most of the centres. Associated complications and cost are higher for general anaesthesia than for regional anaesthesia. Present study is designed to compare the efficacy of epidural block versus spinal anaesthesia with regards to intraoperative mean arterial pressure, heart rate, postoperative pain intensity, analgesic requirement, Postoperative complications and patient satisfaction in patients undergoing PCNL.

Materials and Methods: After taking Ethical Committee clearance, patients were randomly allocated into 2 groups using table of randomization (n= 40 each) Group E- Epidural block, Group S- Spinal block. Various parameters like intraoperative mean arterial pressure, heart rate, postoperative pain intensity, analgesic requirement, postoperative complications and patient satisfaction were studied in these groups.

Statistical Analysis: Quantitative data was analysed using unpaired t-test and qualitative data was analysed using chi-square test.

Results: Twenty four times in Epidural as compared to fifteen times in spinal anaesthesia two or more attempts required. Mean time (min) required to achieve the block of anaesthesia in group E and group S was 15.45±2.8 and 8.52±2.62 min respectively. Mean arterial pressure (MAP) at 5 min, 10 min and 15 min were significantly lower in spinal group as compared to epidural group. After 30 minutes, differences were not significant but still MAP was lower in spinal group. After 30 minutes difference in heart rate between two groups was statistically significant and higher rate recorded in spinal group till the end of 3 hours. Postoperative VAS score was significantly higher in spinal group and 4 hours onwards difference was highly significant. Postoperative Nausea Vomiting (PONV) Score was significantly higher in spinal group as compared to epidural group.

Conclusion: For PCNL, segmental epidural block is better than spinal anaesthesia in terms of haemodynamic stability, postoperative analgesia, patient satisfaction and reduced incidence of PONV. Epidural anaesthesia is difficult to execute and takes longer time to act as compared to spinal block which limits its use.

Keywords: Epidural anaesthesia, GA, PCNL

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is done under General Anaesthesia (GA) in most of the centres. But in our institution we do PCNL under spinal anaesthesia. There are studies comparing combined spinal epidural anaesthesia versus GA for same procedure. But there are no studies comparing spinal anaesthesia and segmental epidural block for PCNL. So we felt the need to compare spinal versus segmental epidural anaesthesia for the same.

Percutaneous nephrolithotomy (PCNL) is used for fragmentation and removal of stones from renal pelvicalyceal system by means of nephroscope passed into kidney through a track created in the patient's back. PCNL is the preferred treatment for large (>2 cm) renal stones [1]. The choice of anaesthesia technique depends on patient and surgeon's preference, feasibility of technique in a given patient, skill of anaesthesiologists and cost. 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 [2]. There are studies comparing GA versus combined spinal epidural anaesthesia. Spinal anaesthesia is easier, quick to execute, cheap and patients can be discharged early. Epidural anaesthesia requires skilled anaesthetist but has the advantage of prolongation of anaesthesia time. Added advantage of epidural is that post-operative analgesia can be provided. More high risk patients can be managed with minimal haemodynamic changes under regional anaesthesia. The anaesthesia related complications of regional anaesthesia are negligible and easily manageable.

Present study is designed to compare the efficacy of epidural block versus spinal anaesthesia with regards to intraoperative mean arterial pressure, heart rate, postoperative pain intensity, analgesic requirement, Postoperative complications and patient satisfaction in patients undergoing PCNL.

MATERIALS AND METHODS

This was a prospective randomized comparative study in which data was collected from July 2013 to July 2014 after IRB II permission. Sample size was calculated on the basis of a pilot study to compare efficacy of epidural block with spinal anaesthesia in which 20 patients were randomly selected and divided into two groups. Mean difference between findings of two groups was 0.55; power of study was 80 with allowable error 5%. Pilot study was analysed and sample size of 40 was calculated in each group using 'openepi'. Patients included in the study who had stone in the pelvi-calyceal system, between age group 18-60 years and with ASA grade I or II. Written informed consent is taken. Exclusion Criteria were 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, allergy to local anaesthetics, patient refusal, and pregnancy or skin infection of the back. Patients were randomly allocated into 2 groups using table of randomization (n= 40 each) Group E- Epidural block,

Group S- Spinal block. For Group E- patients, 3ml of 2% lignocaine was infiltrated in skin & subcutaneous tissue. Tuohy's needle was inserted by Para median approach & epidural space confirmed with loss of resistance to air technique. Epidural catheter inserted 4cm inside the T10-T11 space and fixed. Test dose was given with 3 cc of 2% lignocaine and further dose was given accordingly to achieve sensory level of T-6. After achieving adequate sensory level, patient was positioned prone and epidural infusion with 0.25% bupivacaine was started at the rate of 5ml/hr. Time taken to achieve T6 level and dose of bupivacaine was noted and infusion was continued till the end of the surgery. After the surgery epidural buprenorphine 60-90mcg was given 12 hourly for Postoperative analgesia. On day two epidural catheters was removed after giving epidural top.

For Group S patients, 2ml of 2 % lignocaine was infiltrated in skin and subcutaneous tissue. Quincke's needle was inserted. Spinal block was given with 3.5ml of 0.5% Bupivacaine and 60mcg Norphine in the L3-L4 space. After achieving adequate sensory level, patient was positioned in prone position. All patients from both the groups were transferred to ward where they were monitored. The Postoperative pain was assessed using VAS (Visual Analog Scale) - score where '0' score corresponds to no pain and '10' to maximum or worst pain. Patients were given IV tramadol for pain relief in the Postoperative period every eight hourly in spinal group and when required in epidural group. Parameters evaluated in study groups E (Epidural) & S (Spinal) were patient characteristic and operative details, intra-op mean arterial blood pressure, intraoperative heart rate, time taken for surgery, intraoperative blood loss, the severity of postoperative pain for 24 hours using VAS score, Number of patients requiring postoperative analgesia, Intensity motor blockade using Bromage scale, incidence of side effects like nausea, vomiting, urinary retention and any other adverse events were noted. Patient satisfaction for pain relief and intraoperative patient comfort for prone position was asked in postoperative period on Visual Analogue Scale parameter [3].

STATISTICAL ANALYSIS

Data was presented as mean (SD). Complete failure and unsatisfactory block (where even after giving block patient still had sensations of touch) were grouped together as failure and excluded from the study. Results of the study were observed and analysed statistically. Quantitative data was analysed using unpaired t-test and qualitative data was analysed using chi-square test. Statistical difference was considered significant if p< 0.05.

RESULTS

[Table/Fig-1] shows that patients in both the groups were comparable with respect to age, gender, ASA grade.

	Epidural (n=40)	Spinal (n=40)	p-value	t-test	Significance
Age (mean ± SD)	45.97 ± 11.38	40.7 ± 14.08	0.06941	1.84106	(Unpaired t-test) Not significant
Sex					
Male	29	23	0.1597		(chi-square test) Not significant
Female	11	17			
ASA (American Society of Anaesthesiologists) grade					
1	23	25	0.6481	0.2083	(chi-square test) Not significant
2	17	15			

[Table/Fig-1]: Patient's profile

[Table/Fig-2] shows that patients in both the groups were comparable with respect to stone size, puncture site and duration of surgery.

[Table/Fig-3] shows that number of attempts were significantly higher in epidural 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/Fig-4] shows, baseline MAP was comparable in both the groups and difference was not significant (p= 0.1065). MAP at 5min (p=0.001372), 10min (p=0.000008587), 15min (p=0.0006086) were significantly lower in spinal group as compared to epidural group. After 30 minutes, differences were not significant but still MAP was lower in spinal group. After 1 hour 30 minutes, MAP was low in epidural group as compared to spinal group but differences were not significant. At 2 hours and 15 minutes MAP was lower in group E and difference was significant (p=0.006716).

	Epidural (n=40)	Spinal (n=40)	p-value	t-test	Significance
Stone size(cm)	2.01±1.35	2.39±1.23	0.1920	-1.31595	Not significant
Puncture site					
Superior calyx	2	6	0.549306		(chi-square test) Not significant
Middle calyx	11	8			
Inferior calyx	27	26			
Success					
Stone free	37	38	0.54930614		(chi-square test) Not significant
Retained stone	3	2			
Duration of surgery(min)	81.37±43.085	80.25±35.67	0.8996	0.126639	Not significant

[Table/Fig-2]: Access tract, success rate and duration of surgery

	Epidural (E) (n=40)	Spinal (S) (n=40)	p-value	t-test	Significance
No. of attempts					
1	16	25	0.04411		(chi-square test) significant
2 and more	24	15			
Time (min) required to achieve the level	15.45±2.80	8.52±2.62	<0.0000001	11.4298	(Unpaired t-test) Highly Significant

[Table/Fig-3]: Number of attempts and Time required achieving the level

	Epidural (n=40)	Spinal (n=40)	p-value	t-value	Significance
Baseline (0 min)	107.88 ±12.63	102.38±17.15	0.1065	1.63319	Not significant
5 min	101.36±13.57	91.22±13.75	0.001372	3.31965	significant
10 min	97.88±15.02	82.84±13.15	0.000008587	4.76487	significant
15 min	93.44±15.48	81.78±13.65	0.0006086	3.57312	significant
30 min	86.08±15.71	82.37±12.00	0.2389	1.18693	Not significant
45 min	83.62±10.47	84.49±11.04	0.7186	-0.361636	Not significant
1 h	86.90±9.59	84.75±12.39	0.377	0.88	Not significant
1h 15 min	89.13±10.72	89.42±12.20	0.9104	-0.112934	Not significant
1h 30 min	88.62±15.03	90.92±13.91	0.479	-0.710	Not significant
1h 45 min	89.35±13.88	91.20±9.14	0.4835	-0.704036	Not significant
2 h	90.83±13.84	91.75±10.31	0.7369	-0.337	Not significant
2 h 15 min	88.5±8.99	89.18±9.25	0.739	--0.333	Not significant
2 h 30 min	87.63±8.34	88.78±4.23	0.439	-0.777	Not significant
2 h 45 min	89.50±9.87	90.33±4.62	0.631	--0.481	Not significant
3 h	90.08±7.50	89.50±10.61	0.778	0.282	Not significant

[Table/Fig-4]: Mean Arterial Pressure (MAP) mm of Hg (Unpaired t-test)

[Table/Fig-5] shows that baseline Heart Rate (beats/min) was comparable in both the groups with insignificant difference (p=0.2390). But, after 30 minutes difference in heart rate between two groups was statistically significant and higher rate recorded in spinal group till the end of 3hours.

	Epidural (n=40)	Spinal (n=40)	p-value	T-value	Significance
Baseline (0 min)	88.55±15.67	93.03±18.02	0.2390	-1.1865	Not significant
5 min	86.38±15.83	92.93±17.94	0.08733	-1.73145	Not significant
10 min	85.33±14.98	90.50±18.86	0.1785	-1.35759	Not significant
15 min	83.53±15.71	86.83±18.97	0.3994	-0.847363	Not significant
30 min	79.45±15.56	87.58±19.97	0.04566	-2.03105	significant
45 min	75.73±14.08	88.88±20.51	0.001275	-3.34305	significant
1 h	74.67±14.41	90.09±21.53	0.0003219	-3.76437	significant
1h 15 min	75.51±13.65	86.50±20.37	0.005839	-2.83463	significant
1h 30 min	75.70±10.94	86.82±22.99	0.007155	-2.76231	significant
1h 45 min	77.24±9.95	86.29±24.28	0.03217	-2.18132	significant
2 h	78.81±15.33	88.53±21.45	0.02230	-2.33168	significant
2 h 15 min	74.45±14.42	89.82±23.70	0.0007625	-3.504	significant
2 h 30 min	78.38±21.35	104.00±8.66	<0.0000001	-7.03293	significant
3 h	81.75±28.18	109.00±10.39	0.000000174	-5.73823	Significant

[Table/Fig-5]: Heart Rate (beats/min)
(Unpaired t-test)

[Table/Fig-6] shows that Postoperative VAS score was significantly higher in spinal group and 4 hours onwards difference was highly significant.

	Epidural (n=40)	Spinal (n=40)	p-value	t-value	Significance
2h	0.7±1.0	2.3±1.4	<0.0000001	-5.88172	significant
4h	2.4±1.0	5.4±0.8	<0.0000001	-14.8159	significant
6h	3.2±1.4	6.2±0.6	<0.0000001	-12.4568	significant
12h	2.9±0.9	5.7±0.5	<0.0000001	-17.2003	significant
24h	2.9±0.8	5.4±0.6	<0.0000001	-15.8114	Significant

[Table/Fig-6]: VAS (Visual Analogue Scale) Score
(Unpaired t-test)

[Table/Fig-7] shows that PONV Score was significantly higher in spinal group as compared to epidural group.

	Epidural (n=40)	Spinal (n=40)	p-value	t-value	Significance
4h	0.2±0.4	0.3±0.6	0.3831	-0.877	Not significant
6h	0.3±0.6	0.8±0.7	0.0009	-3.429	significant
12h	0.2±0.5	0.6±0.6	0.001	-3.239	significant
24h	0.2±0.4	0.6±06	0.0007	-3.50	Significant

[Table/Fig-7]: PONV (Postoperative Nausea Vomiting) Score
(Unpaired t-test)

[Table/Fig-8] shows that patient satisfaction was greater in epidural group as compared to spinal group

	Epidural (n=40)	Spinal (n=40)	p-value	t-value	Significance
4HR	2.93±0.27	2.63±0.54	0.002367	3.1427	Significant
6HR	2.83±0.38	2.08±0.35	<0.0000001	9.18157	Significant
12HR	2.90±0.30	2.05±0.32	<0.0000001	12.2559	Significant
24HR	2.83±0.38	2.05±0.32	<0.0000001	9.93006	Significant

[Table/Fig-8]: Patient Satisfaction
(Unpaired t-test)

DISCUSSION

In present study, we have compared the safety and efficacy of segmental epidural 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 Singh V et al., [4] reported lower VAS score, less need for analgesics and shorter hospital stay in spinal epidural group. Kuzgunbay et al., [2] compared general anaesthesia 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 which was reported more with spinal epidural block [5,6]. General Anaesthesia prone to complicate in terms of vascular, pulmonary and neurological issues, especially during changing patient's position from lithotomy to prone [7]. Spinal Anaesthesia is usually associated with hypotension during changing into prone position [8,9].

Mehrabi et al., evaluated 160 patients who were submitted to PCNL in the prone position under spinal anaesthesia [7]. Six patients developed mild to moderate headache, dizziness and low back pain. Ten patients (6.3%) received blood transfusion. 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 [10].

In present study, intraoperative MAP was significantly lower in spinal group as compared to epidural 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 group. Postoperative VAS score was significantly higher in spinal group and 4hours onwards difference was highly significant. Less PONV score was noted in epidural 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 group than spinal. This may be attributed to better Postoperative analgesia and mobility in Postoperative period and less PONV. One more advantage of epidural block is that patient can himself take prone position without much assistance. So, less Operative Theatre assistants were required for positioning of patients in epidural group.

Present study shows that segmental epidural anaesthesia 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. But, our study was limited by the fact that only ASA grade 1 and 2 patients were included and patients with creatinine >3.5 mg % and serious co-morbidities were excluded. Also, number of patients was less.

CONCLUSION

From present study, it was concluded that for PCNL, segmental epidural block is better than spinal anaesthesia in terms of better haemodynamic stability, Postoperative analgesia, patient satisfaction, 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; which limits its use.

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