

# A Prospective Randomized Comparative Study of Epidural Block and General Anesthesia for Percutaneous Nephrolithotomy for Hemodynamic Stability and Postoperative Analgesia

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## Abstract

Percutaneous nephrolithotomy (PCNL) is a minimally invasive procedure for removal of calculi in pelvicalyceal system which is usually performed under general anaesthesia. We conducted a prospective, randomized, comparative study to compare epidural block and general anesthesia with respect to hemodynamic stability and postoperative analgesia in patients undergoing PCNL. *Methods:* 80 urological patients of ASA I and II grade, posted for percutaneous nephrolithotomy were included in our study. They were divided into two groups of 40 each. In patients belonging to Group G, surgery was performed under General Anaesthesia and in Group E, surgery was performed under Epidural Anaesthesia using 1.5mg/kg of 0.5% bupivacaine and 1mcg/kg of Fentanyl to a maximum of 50mcg. Intraoperative hemodynamics, postoperative analgesia, amount of rescue analgesic required and patient satisfaction were compared between the two groups. Complications, if any were also compared. *Results:* In our study, we found that the Heart rate, Mean arterial pressure were increased in the initial 5 minutes after giving General Anaesthesia in patients belonging to Group G when compared to Group E. Time duration of post-operative analgesia was more in Group E with less amount of analgesic requirement than in patients belonging to Group G. Post-operative complications were also less in Group E than in Group G. With the results obtained in our study, we concluded that Epidural anaesthesia is better than General anaesthesia in patients undergoing PCNL.

**Keywords:** Epidural block; General anesthesia; Percutaneous-nephrolithotomy.

## Introduction

Percutaneous nephrolithotomy (PCNL) is a minimally invasive procedure for removal of renal calculi > 20 mm in size, multiple stones, staghorn stone in pelvicalyceal system. This procedure was first described by Fernstrom and Johansson in 1976 [1].

Percutaneous nephrolithotomy can be done under general anesthesia, regional anesthesia, local anesthesia and under interpleural block [2-9]. It is usually done under general anesthesia with endotracheal intubation in most of the centers. Few disadvantages of general anesthesia are polypharmacy, airway complications like endotracheal tube displacement in prone position, aspiration of gastric

contents, pulmonary atelectasis and neurological complications.

Peterson GN et al in 1985 first described the technique of regional anaesthesia for performing PCNL [10]. Since then many authors have used regional anaesthesia techniques like Spinal, Combined Spinal Epidural, sole Epidural for the procedure and have found out that regional anaesthesia is a better choice in patients undergoing PCNL [2-9,11].

Since most of them have used single drug like 0.5% bupivacaine, 0.75% ropivacaine, 0.5% ropivacaine in different doses for performing Epidural anaesthesia for PCNL, we have used 0.5% bupivacaine and fentanyl combination to find out the supremacy and advantage in these patients.

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## Materials and Methods

This prospective, randomized, comparative study was planned at Rajarajeswari Medical College and Hospital after taking approval from institutional ethical committee. 80 Patients aged between 18 to 60 years belonging to ASA I and ASA II grade between 30 to 60 years admitted for elective percutaneous nephrolithotomy were included in the study. Patients with uncontrolled medical illness, severe cardiac disease, severe respiratory disease, hypersensitivity for the drugs which were used for the study, patients with contraindication for regional anesthesia like neuromuscular disease, patients refusing to participate in the study, skin infection at the proposed site of injection and with coagulation abnormalities were excluded from the study. They were randomly divided into two groups of 40 each by computer generated randomization. Group G received General anaesthesia with endotracheal intubation, whereas Group E received 1.5 mg/kg of Inj. Bupivacaine 0.5% + Inj. Fentanyl 1 mcg/kg through epidural catheter inserted at T10-T11 level or T11-T12 level.

Thorough preoperative evaluation was done. Routine and specific investigations required were carried out. Informed and written consent was taken from those patients who were willing to participate in the study. Participants were briefed about the study and were kept nil per oral 6 hours for solids. All the participants were given Tablet Alprazolam 0.25 mg on the previous night.

On the day of surgery, an 18 G intravenous line was secured in preoperative holding area and 500ml of Ringers lactate was started. Standard monitoring like ECG, Noninvasive blood pressure, Pulse oximeter, were monitored.

Group G patients received general anaesthesia. They were given Inj. Ranitidine 1 mg/kg, Inj. Ondansetron 0.08 mg/kg intravenously. Pre-medicated with Inj. Glycopyrolate 0.2 mg, and Inj. Midazolam 0.02mg/kg. Pre-oxygenated for three minutes. Induced with Inj. Propofol 2 mg/kg, Inj. Fentanyl 2mcg/kg. Neuromuscular blockade was obtained with Inj. Vecuronium 0.1 mg/kg and intubated using appropriate size flexometallic endotracheal tube. Anaesthesia was maintained with intermittent doses of Vecuronium 1 mg each, Oxygen and Nitrous oxide and inhalation agent Isoflurane 1MAC throughout the procedure. At the end of the surgery 1gm paracetamol I.V. and local infiltration with 0.25% bupivacaine was given and reversed with Inj. Neostigmine 0.06 mg/kg and Inj.

Glycopyrolate 0.008 mg/kg. Extubation was done when they were fully awake and obeyed verbal commands and had good muscle power. All the vital parameters were recorded and shifted to post anaesthesia care unit for observation for another 2 hours.

Group E Patients were placed in sitting position. Under aseptic precautions, skin over T10-T11/ T11-T12 interspace was infiltrated with 2% lidocaine. Epidural space was located using 18g Tuohy needle by loss of resistance technique to air. Epidural catheter was threaded with 20 G catheter and 5 cm of catheter was left in epidural space and fixed. Epidural test dose was given with 3cc of 2% lidocaine with adrenaline. If uneventful, 1.2mg/kg of 0.5% bupivacaine and 1mcg/kg of fentanyl to a maximum of 50mcg was given through epidural catheter. Level of analgesia was checked with pinprick test and level of sensory block was achieved till T6. Then patients were placed in lithotomy position.

Surgical procedure consisted of Cystoscopy and D J stenting in lithotomy position. Then patients were turned prone followed by percutaneous renal access using fluoroscopy. Stones were removed by fragmenting them. All the precautions were taken to protect the pressure points and neck. Vital parameters were monitored throughout surgery.

Perioperative hemodynamic parameters like Heart rate, Systolic blood pressure, mean arterial pressure along with arterial Oxygen saturation (SpO<sub>2</sub>) were recorded every five minutes for the first thirty minutes and later every fifteen minutes till the end of the surgery. Any Hypotension (>25% fall in systolic blood pressure), Hypertension (>25% rise in the systolic blood pressure) Bradycardia (Heart rate <50/ min) Tachycardia (Heart rate > 100/min) was noted. Total duration of surgery was noted. Side effects if any were noted and recorded. Time taken for complete analgesia (loss of sensation to cold swab), and the level of anaesthesia in Group E patients was noted. Time duration from epidural bolus and patient's request for the first rescue analgesic was taken as total duration of analgesia in Group E patients. Patients were monitored in the post anaesthesia care unit for 2 hours. Haemodynamics and visual analogue score (VAS) for pain intensity were recorded in the scale of 0 to 10. Group G patients received Inj. Paracetamol 15mg/kg as rescue analgesic if VAS score was >4. Group E patients received inj. bupivacaine 0.125% 6 ml with 25mcg fentanyl as post - operative rescue analgesic when the VAS score was >4. Amount of rescue analgesics requested in next 48 hours were

noted. After 48 hours epidural catheter was removed. Patient satisfaction during perioperative period was recorded with a score from 0 to 10, 0 being best score and 10 being worst score.

### Statistical Methods

The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc. Descriptive and inferential statistical analysis has been carried out in the present study. Quantitative data was analyzed using unpaired t-test and qualitative data was analyzed using chi-square test.

### Results

This study was performed in 80 urological patients of ASA I and ASA II grade undergoing elective percutaneous nephro-lithotomy to evaluate the efficacy of Epidural anaesthesia over General anaesthesia. They were randomly divided into two groups, Group G (40 number) and Group E (40 number).

There was no significant difference between the groups with respect to age (45.125±7.34 in Group G and 44.875±8.37 in Group E), weight (63.325±7.65 kg. in Group G and 64.15± 5.916 kg. in Group E), sex, ASA grading, duration of surgery (94.5±23.66

min. in Group G and 86.875±24.66 min. in Group E) Base line Heart rate (88.9±17.376 in Group G and 84.1±7.83 in Group E) and mean arterial pressure (90.08±6.161 in Group G, 88.25±6.634 in Group E) (Table 1, 2 & 3)

No significant difference in the size of stone between the groups was noted (38.4±28.8 mm.in Group G and 36.8±24.6 mm. in Group E). Site of the stone in both the groups in percentage is shown in Table 2.

There was significant rise in heart rate (90.9±16.201), and MAP (96.266±6.232 mm. of Hg) in the initial 5 minutes after intubation in Group G, compared to epidural group (76.825±9.156/min. and 80.2±6.812 mm. of Hg). (Group G=90.9±16.201, Group E=76.825±9.156). Intraoperative heart rate was significantly less in the epidural group compared to general anesthesia group. (P value 0.008 at 30 minutes to 0.0001 at 120 minutes) (Table 2). Mean arterial pressure (MAP) was significantly lower in Group E 5 minutes after epidural bolus and remained significantly lower throughout the surgery (P value 0.0001) (Table 3).

Postoperative analgesia was assessed with VAS score. 97.5% of patients in Group E had VAS < 3 at 2<sup>nd</sup> hour postoperatively, while 27.5% patients in Group G had VAS<3 while 17 (42.5%) had VAS between 4 to 7. (Table 5) Total duration of analgesia was significantly prolonged in Group E patients (5.097±1.458 Hrs.) compared with Group G (1.487±0.524 Hrs). with a P value of 0.0001.

**Table 1:** Comparison of demographic characteristics

Demographic Characteristics	Group E	Group G	P Value
Age in Years.	44.875±8.379	45.125±7.34	0.8875
Weight in Kg	64.15±5.916	63.325±7.65	0.5912
Sex			
Male	23	22	chi square
Female	17	18	0.8217
ASA Grade.			
I	23	22	chi square
II	17	18	0.8217
Duration of Surgery in Minutes.	86.875±24.66	94.5±23.66	0.1623

**Table 2:** Comparison of stone size and position

	Group E	Group G
Stone Size(MM)	36.8±26.6	38.4±28.8
Stone Position Number of Patients		
Staghorn	4(10%)	6(15%)
Pelvic Stone	16(40%)	28(70%)
Pelvic and Calyceal	8(20%)	4(10%)
Upper Calyceal	8(20%)	2(5%)
Lower Calyceal	4(10%)	0
Multiple Stones	9(22.5%)	7(17.5%)

**Table 3:** Cardiac parameters

	Heart Rate Group E	Group G	P Value	MAP Group E	Group G	P Value
0MIN	84.1±7.83	88.9±17.376	0.791	88.25±6.634	90.08±6.161	0.223
5MIN	76.825±9.15644	94.9±16.201	0.0001	80.2±6.812	96.266±6.232	0.0001
15MIN	74.475±8.506	86.125±12.916	0.0001	76.175±7.104	82.133±6.381	0.02
30MIN	73.3±8.724	79.05±10.215	0.008	72.966±6.309	83.475±7.333	0.0001
60MIN	69.95±12.238	76.45±8.569	0.001	72.283±4.795	80.466±4.569	0.0001
90MIN	71.775±6.836	77.6±9.896	0.027	75.916±5.831	81.116±5.809	0.0001
120MIN	71.6±7.6524	81.75±13.511	0.0001	82.2±6.771	88.25±6.243	0.0001

**Table 4:** VAS score

	0 TO 3	Group E 4TO 7	8TO 10	0 TO 3	Group G 4TO 7	8 TO 10
2HRS	39 (97.5%)	1(2.5%)	NIL	11(27.5%)	17(42.5%)	12(30%)
4HRS	37 (92.5%)	3(7.5%)	NIL	16(40%)	22(55%)	2(5%)
12HRS	38(95%)	2 (5%)	NIL	30(75%)	10(25%)	NIL
24HRS	40 (100%)	0	NIL	36(90%)	4(10%)	NIL
48HRS	40(100%)	0	NIL	38(95%)	2(5%)	NIL

**Table 5:** Rescue analgesic required

No of Hours	Group G	Group E	Epidural Top Ups in Group E No of Epidural Top Ups	No of Patients
0	NIL	NIL	0	NIL
1	19	NIL	1	NIL
2	17	NIL	2	NIL
4	4	16	3	3
6	ALL 40	17	4	8
12	ALL 40	32	5	13
24	ALL 40	22	6	16
48	28	12		

	Group E	Group G	P value
Time of first Rescue Anagesia (Hours)	5.097±1.458	1.487±.524	0.0001

**Table 6:** Patient satisfaction score

0 TO 3	Group E 4TO 7	8TO 10	0 TO 3	Group G 4TO 7	8 TO 10
37(92.5%)	3(7.5%)	NIL	20(50%)	20(50%)	NIL

**Table 7:** Postoperative complications

	Adverse Effects Group E	Group G
Hypotension	3(7.5%)	2(5%)
Shivering	5(12.5%)	2(5%)
Nausea/ Vomiting	2(5%)	9(22.5%)
Itching	4(10%)	0

Length of Hospital stay was also less in Group E (2.7±0.516 days) than Group G (3.125±0.607 days) with a P value of 0.0012 which is statistically significant. 9 patients in Group G had postoperative nausea and 9 had hypotension while 2 patients in

Group E complained of nausea/vomiting and only one had hypotension postoperatively. 4 patients in Group E complained of itching postoperatively. Patient satisfaction score were significantly better in Group E patients (Table 6).

## Discussion

Though General anaesthesia has been used as a standard technique for PCNL. Many of the previous studies have concluded that general anaesthesia is likely to cause more morbidities like anaphylaxis due to polypharmacy, complications associated with endotracheal intubation, cardiovascular, pulmonary and neurological complications during prone positioning [2-9].

In our prospective, randomized comparative study on 80 patients (40 in each group) we have tried to establish the efficacy and safety of Thoracic epidural anaesthesia for PCNL against General anaesthesia.

Singh V et al in their comparative study epidural anaesthesia with general anaesthesia for PCNL have reported lower VAS score, less need for analgesics, shorter hospital stay [2]. Kimm SS et al have also found haemodynamic stability, better analgesia, better patient satisfaction, lower VAS score in patients undergoing PCNL under regional anaesthesia[11]. Other studies conducted by Kuzgunbay B et al [3], Karacalar S et al [4], Bajwa SJ et al [5], Virkar ND et al [6], Tangpaitoon T et al [7], Parkh DA et al [8] have concluded Epidural anaesthesia is better in terms of hamodynamic stability, lower VAS score, and lower postoperative complications which is in consistent with our study.

We have found that patients under epidural anaesthesia (Group E) have more stable hemodynamic parameters, prolonged analgesia, lower postoperative analgesic requirement, more patient satisfaction (Table 6), and lesser number of days in the hospital compared to patients undergoing PCNL under general anaesthesia (Group G) (2.7+/-0.516 days in Group E against 3.125+/-0.607 in Group G). Postoperative complications like nausea and vomiting was more in Group G (9 compared to 2 in Group E), while 10% of Group E patients had itching compared to no incidence of itching in Group G.

We have also found that blocking the spinal segments with epidural injection to T6-T12, gives good analgesia, anaesthesia, cardio stability with minimal postoperative complications. This may be due to lesser motor blockade in the lower limbs with more intense analgesia in the operative site (T10 to L2). Higher incidence of PONV in Group G may be due to nitrous oxide, opioids and inhalational agents used in the technique.

## Conclusion

Most of the urologists prefer to do PCNL under general anaesthesia. In our study we have found that Thoracic Epidural anaesthesia using T10-T11 or T11-T12 space, gives as effective analgesia and anaesthesia as General anaesthesia with more haemodynamic stability, prolonged analgesia, less VAS score, lesser amount of postoperative analgesic requirement, more patient satisfaction and lesser incidences of postoperative complications. Patient co-operation due to long surgical time and prone position during surgery should be sought out by explaining to the patient preoperatively. Airway and Oxygen saturation should be monitored throughout the procedure. So Thoracic Epidural anaesthesia is an alternative and efficient technique for performing PCNL.

### *Limitations of the Study*

We have conducted our study on a limited number of patients of ASA I/ASA II grade. More studies on increased number of patients with other co-morbidities like diabetes, hypertension may also be required to give it's feasibilities and safety in these patients.

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- 424 Sowmya M. Jois, Sangeetha C., Venkatesh Murthy K.T. et. al. / A Prospective Randomized Comparative Study of Epidural Block and General Anesthesia for Percutaneous Nephrolithotomy for Hemodynamic Stability and Postoperative Analgesia
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