



## General Anesthesia versus Lumbar Subarachnoid Block in PCNL A Comparative Study

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### Abstract

**Objective:** The study was undertaken to compare the relative efficacy and complications of general versus spinal anesthesia in patients undergoing PCNL.

**Materials and Methods:** In this observational study, patients undergoing PCNL were divided into two equal groups of 30 patients each. In group A, spinal anesthesia was administered by injecting bupivacaine and fentanyl in subarachnoid space (L3-L4) in sitting position, a ureteral catheter was placed in lithotomy position, head of the bed was tilted down for 5-10 min and the level of anesthesia checked and PCNL done with standard technique. In group B, PCNL was done using standard technique under general anesthesia.

**Results:** Mean stone size in group A and B was 16.5+6.9mm and 14.4+5.3mm, respectively. Intraoperative hypotension was more in spinal group than the general group with an insignificant difference. There was no transfusion needed intraoperatively. Mean operative time was 68.4+18.71minutes and 90.3+8.70 minutes in spinal and general anesthesia groups, respectively which was statistically significant ( $p < 0.05$ ). Total amount of analgesics required were 132.5+54.0mg of diclofenacin spinal group and 235+38.06 mg of diclofenac in general anesthesia group which was again statistically significant ( $p < .05$ ). Check x-ray KUB revealed complete clearance of stone regardless of technique of anesthesia used..

**Conclusion:** The results of this study showed that spinal anaesthesia using lumbar subarachnoid block is a safe, effective and convenient alternative method for performing PCNL in adult patients; avoiding complications of general anesthesia; decreasing need of postoperative analgesics and short duration of surgery.

**Keywords:** spinal anesthesia, percutaneous nephrolithotomy.

### Introduction

Urinary tract stone disease is one of the major health care problems. It is ranked third among the diseases of urinary tract after UTIs and prostate

pathology.<sup>1</sup> Attempts to dissolve the stones by irrigation with various solutions has not had much success. New extraction techniques have therefore been devised whereby the stones can be removed

through a percutaneous nephrostomy under radiological control.<sup>2</sup>

With the advance in endourology techniques, such as extracorporeal shock wave lithotripsy (ESWL), transurethral lithotripsy (TUL), and percutaneous nephrolithotomy (PCNL) during the last three decades, diagnostic and treatment methods for this kind of disease have been changed remarkably<sup>1</sup>.

Percutaneous nephrolithotomy (PCNL) is a popular method for removal of kidney and ureteral calculi and the treatment of choice for kidney calculi greater than 2cm to 3cm in diameter, multiple kidney calculi, stag-horn calculi, and cases of failed shock wave lithotripsy (such as those with calcium oxalate monohydrate and cystine calculi)<sup>3</sup>.

Anesthesia during PCNL is a challenge because of the possibility of fluid absorption, dilutional anemia, hypothermia, or significant blood loss. It requires anesthesia which ensures surgical comfort and safety for the patients despite changes in position and the prolonged ventral supine position<sup>4</sup>.

General anesthesia during PCNL has many advantages, for example, it enables breathing control and improves patient comfort. The particular advantages of GA in PCNL procedure include its feasibility to control tidal volume, secure patient airway especially in prone position, and extensibility of anesthesia time<sup>5,6</sup>. Thus, at most experienced centers, PCNL is usually performed under general anesthesia. However, associated complications and cost are higher for general anesthesia than for regional anesthesia<sup>7</sup>. Endotracheal tube migration and neurologic problems, particularly at the time of position transition, may arise during PCNL under general anesthesia. Also the disadvantages of general anesthesia compared to regional spinal anesthesia are increased incidence of anaphylaxis due to multiple medication usage.<sup>7</sup>

Although general anesthesia is preferred in many centers for PCNL, but it can be a challenge in some situations, such as PCNL for stag horn calculi or patients with pulmonary or

cardiovascular disorders. Because of the possibility of fluid absorption and electrolyte imbalance especially in stag horn calculi and also in morbid obese patients, regional or local anesthesia may be a good alternative for general anesthesia in these patients<sup>1</sup>.

Neuraxial blockade for patients subjected to PCNL provide stable hemodynamics, good post operative analgesia and acceptable patient and endoscopist satisfaction<sup>8</sup> and avoidance of side effects from multiple medications used in GA. During supracostal puncture patients with PCNL under regional anesthesia can follow verbal commands and control respiration for prevention of pulmonary events<sup>9</sup>. Besides these, inherent and indisputable fact about RA is its relatively low cost, which is about four times cheaper<sup>10</sup>.

Various studies have been conducted to compare regional and general anesthesia with respect to operative parameters. We also aimed to compare the relative efficacy and complications of general and spinal anesthesia in patients undergoing percutaneous nephrolithotomy for kidney and upper ureteral (PUJ to L4) stone diseases and to evaluate sub-arachnoid block as an alternative method of anesthesia for PCNL.

## Materials and Methods

After obtaining approval from institutional ethical committee and consent of the patients, the present prospective, observational study was conducted on 60 patients above 18 years of age with physical status of American Society of Anaesthesiologists (ASA) Class I and II. The patients were studied under two equal groups Group A and Group B (with 30 patients in each group) with Group A undergoing PCNL under spinal anesthesia and group B undergoing PCNL under general anaesthesia. Patients included in the study were those having ureteral stones larger than 15mm in the upper ureter, renal stones larger than 20mm, staghorn calculi. Patients excluded from the study were those having renal anomalies (horse-shoe or ectopic) kidneys, belonging to ASA class 3 or 4, having any contraindication for spinal anesthesia,

such as skin infection over lumbar spine, increased intra cranial tension, severe kyphoscoliosis, and failure of lumbar subarachnoid block.

Each patient was admitted 24 hours prior to surgery and thorough pre-anaesthetic assessment including history, physical and systemic examination was done at that time. Preoperative laboratory tests, such as complete blood count (CBC), coagulation tests, renal function tests (urea and creatinine), electrolytes (sodium and potassium), ECG, Chest X-ray, LFT, USG abdomen, urine analysis and urine culture were evaluated for all patients. Size and location of stones was checked by intravenous pyelography (IVP) in non-opaque stones, non contrast spiral CT was done for better localization of stones.

In spinal anesthesia group (Group A), multi-channel monitor (MCM) was connected and vitals noted; IV line secured with large bore canula, preloading was done with 10-15ml/kg of crystalloid and after that subarachnoid block was given by injection of 2.5ml bupivacaine (0.5%) and 0.5ml of fentanyl (25 µg) in the L3-L4 intervertebral space by spinal needle (25G) in sitting position. Thereafter, patient was placed in supine position and the bed changed to Trendelenburg position with a gradient of 30 degrees for 5 to 10 minutes. The anesthesia level was checked by anesthesiologist till it reached lower sternum appendage, the xiphoid (T6 to T7). Thereafter patient were positioned in prone position. Wherever there was any failure of anesthesia or return of pain, patient were managed under general anesthesia and patient was excluded from the study.

In general anesthesia group (Group B), multi-channel monitor (MCM) was connected and vitals

noted; IV line secured thereafter surgery was performed by standard procedure under GA with intravenous injection of a midazolam 1mg/kg, and baseline analgesia was provided by giving tramadol 1mg/kg 5 minutes before induction. Induction was done by administering propofol (2mg/kg body weight), muscle relaxation was provided by injection atracurium (0.5mg/kg body weight loading dose and maintenance dose of 0.1mg/kg as per the requirement) and then intubation was carried out. Inhalation of isoflurane as per the MAC was used for maintenance of anesthesia. Top up analgesia during surgery was provided by paracetamol 1g IV infusion.

The amount of drugs used for pain control was recorded for both the groups. Severity of pain was checked by Visual Analogue Scale (VAS) immediately postoperatively, after 2 hours then 6 hourly upto 24 hours. Complications related to both types of anesthesia like nausea, vomiting, hypotension, post operative headache, low back ache, need for blood transfusion etc were noted.

Statistical software SPSS (version 20.0) and Microsoft Excel were used to carry out the statistical analysis of data. For parametric data, Student's independent t-test was employed. Chi-square test or Fisher's exact test, whichever appropriate, was used for non-parametric data. A P-value of less than 0.05 was considered statistically significant.

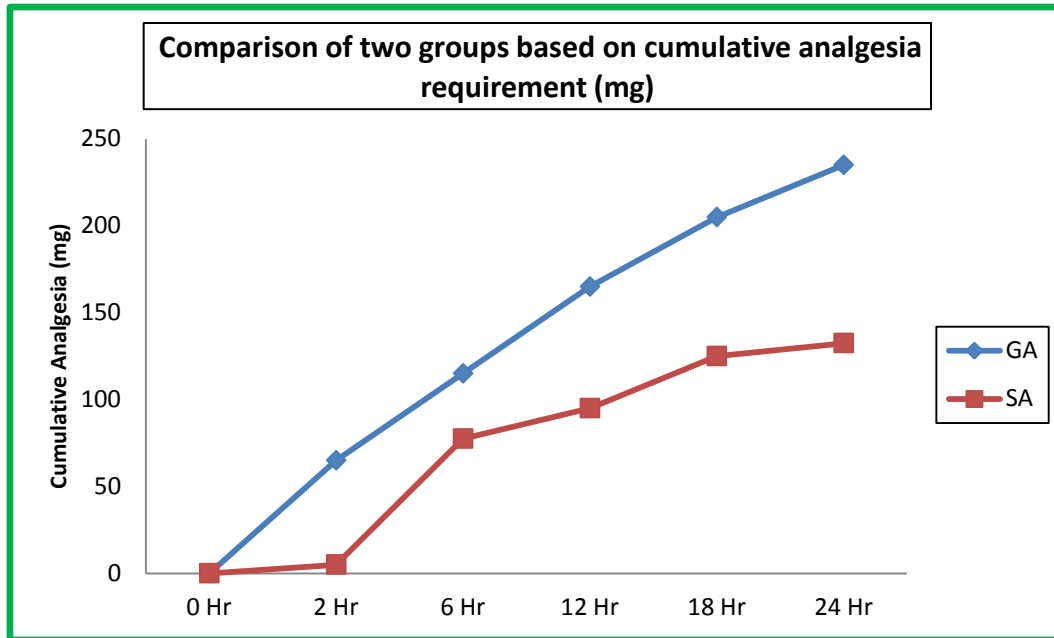
## Results

Demographic characteristics and baseline variables in the two groups were comparable. There was no statistically significant difference between two groups with regard to age, gender, ASA class, mean stone size, location of stone and site of puncture. Table 1.

VARIABLE	General Anesthesia	Spinal Anesthesia	P value
Age (years)	37.8±9.41	39.2±10.41	0.587
MALE/FEMALE	20/10	22/8	0.57
WEIGHT	60.4±10.33	62.3±11.57	0.505
ASA/II	23/7	24/6	0.754
STONE SIZE	14.4±5.32	16.5±6.94	0.193

VARIABLE	General Anesthesia	Spinal Anesthesia	P value
OPERATIVE TIME	90.3±8.70	68.4±18.71	0.001
Hypotension	6.7	13.3	0.671
Bradycardia	6.7	3.3	1.00
Tachycardia	0	6.7	0.492
Nausea	3	1	0.612
Vomiting	1	0	1.00
Headache	0	2	0.492

**Fig.1:** Comparison of two groups based on cumulative analgesia requirement (mg).



In group A, spinal anesthesia group, intraoperative tachycardia was reported in 2 patient and hypotension in 4, rest all vitals were normal. There was no transfusion needed intraoperatively. Mean operative time was 68.4+18.71minutes. Postoperatively only 1 patient reported nausea, 2 patients reported headache, none of the patient reported vomiting. Total amount of analgesics required were 132.5+54.0 mg of diclofenac and mean time to discharge was 2.9 days with check x-ray KUB revealing complete clearance of stone. In group B, general anaesthesia group, intraoperatively, bradycardia was reported in 2 patients, and hypotension in 2 patients. There was no transfusion needed intraoperatively. Mean operative time was 90.3+8.70 minutes. Postoperatively only 3 patients reported nausea, 1 patient reported vomiting. Total amount of analgesics required were 235+38.06 mg of diclofenac and mean time to discharge was 3.1

days with check x-ray KUB revealing complete clearance of stone. Table 2. Fig 1.

**Discussion**

Percutaneous nephrolithotomy (PCNL) remains the first-line treatment for managing renal stone disease<sup>11,12</sup>. Maintaining a good postoperative quality of life, may be achieved in most patients regardless of the technique of anesthesia. However, the technique of anesthesia can influence the early postoperative patient's recovery, and because the aim of a urologist is to discharge the patients from the hospital in safe condition as early as possible, the choice of anesthesia makes a significant impact on all these factors<sup>13</sup>.

In a study by Kuzgunbay and colleagues, general versus combined spinal-epidural anesthesia was compared in patients that were candidates for PCNL. There was no significant difference

between two groups regarding pre and post operative variables, such as operation time and hospital stay<sup>7</sup>. Operative time of PCNL mainly depends on patient characteristics, surgeon's experience, and anesthesia. Different studies so far carried out define operative time differently. In our study also there was no significant difference between two groups regarding efficacy of operation, and intra op complications, which is consistent with above study. However, there was a statistically significant difference between the two groups regarding mean operative time which was less in spinal anesthesia group (68.4+18.71) than in general anesthesia group (90.3+8.70). This could be reflected on higher satisfaction rates which were recorded by surgeons. The feasibility of general anesthesia to be prolonged might provide enough time to finish PCNL without burden of anesthesia end-time.

Different complications favor different anesthesia types. Mehrabi S et al studied results and complications of spinal anesthesia in PCNL. The most common reported side effects were hypotension (20%) during operation and headache (5-8%) in post-operative period<sup>14</sup>. Results of our study were consistent with the above study as 13.3% patients developed hypotension during operation which in most cases improved spontaneously and in some with intravenous fluid administration. Hypotension can be attributed to vasodilation caused by sympathetic blockade. Also about 6% of patients in our study experienced headache in post op period, which was relieved with post-operative rest and analgesics, again consistent with above study.

In a prospective randomized study comparing spinal epidural block vs. general anesthesia Singh et al., reported lower VAS score and less need for analgesics in spinal epidural group<sup>9</sup>. These superior results of spinal epidural block have been supported by other reports<sup>15</sup>. Our study also confirms the above findings as the patients in spinal anesthesia group recorded lower VAS scores and lower consumption of analgesics post operatively. There was a significant difference

between two groups regarding cumulative analgesic requirement ( $p < 0.001$ ). This may be due to the continuation of pain relief provided by spinal anesthesia into the postoperative period. Accordingly, the postoperative analgesic demand was significantly lesser in the spinal anesthesia group, thereby reducing the risk of adverse effects of analgesic drugs. Patients probably get better quality of life and sooner recovery if the postoperative pain is lesser.

Saied et al. investigated efficacy of intrapleural bupivacaine injection combined with meperidine and diazepam in PCNL with spinal anesthesia. In their study, the bupivacaine analgesia had a quite painless course in the post operative period, and a lower dose of analgesic medication was needed<sup>16</sup>. Andreoni C, and colleagues studied the impact of one dose of subarachnoid spinal analgesia on postoperative pain and recovery after PCNL in 20 patients; they concluded that a single preoperative dose of subarachnoid spinal analgesia, provides a statistically significant decrease in postoperative parenteral pain medication and earlier ambulation, and also, reduce the amount of postoperative pain and nausea ( $P > 0.05$ )<sup>17</sup>. In our study also, we used combination of bupivacaine and fentanyl for induction of spinal anesthesia. As far as efficacy and safety of low dose fentanyl with bupivacaine were concerned our results were similar to Singh et al. study showing that regional anesthesia with low dose fentanyl and bupivacaine could be a good alternative for general anesthesia in PCNL<sup>18</sup>. Despite spinal anesthesia at the L3-L4 interspaces, incidence of upper calyx access were 23.3% without significant anesthesia and surgery associated complications in comparison to sub costal access ( $P$ -value = 0.41) in our study. This observation is similar to study carried out by BabakBorzouei et al. where upper calyx access was 20.9% with no significant anesthesia or surgery related complications<sup>19</sup>. Patients with stone in upper pole of kidney, tolerated efficiently, but our sample size was designated for a whole kidney and not solely for upper pole. In our study



we found no statistically significant difference in the stone-free rate consistent with other studies. From the above, we can find some merits of Regional anesthesia over General anesthesia.

### Conclusion

Spinal anesthesia is a safe and effective alternative method of anesthetising patients for PCNL by achieving less post-op pain, and less adverse effects from medications used for general anesthesia. This technique is well tolerated by patients, and also provides a good operation scope for access to all parts of kidney. Successfulness of operation in terms of stone clearance is comparable regardless of the technique of anesthesia.

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