An Observational Study to Compare Patient and Surgeon Satisfaction and Hemodynamic Changes Occurring in Spinal Anaesthesia Versus General Anaesthesia in Patients Undergoing Percutaneous Nephrolithotomy Surgery

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Abstract

Background: Renal stones are the most painful condition of the urological system requiring hospital admission. The treatment depends upon type, number and size of renal calculi. Percutaneous nephrolithotomy (PCNL) can be conducted under regional anesthesia such as spinal anesthesia (SA) as well as in general anesthesia (GA).

Methodology: In this study, we selected 50 patients of ASA-I &II of either sex, 18 to 60 years undergoing PCNL surgeries.

GROUP S (n=25) - PCNL under spinal anaesthesia

GROUP G (n=25) - PCNL under general anaesthesia

Result: Mean pulse rate, Mean arterial pressure and Mean oxygen saturation were significantly lower in SA group during intraoperative period as compared to GA whereas the difference in both groups were insignificant postoperatively with p<0.01 and p>0.05 respectively.

Mean VAS score for patient’s satisfaction were significantly lower in SA group as compared to GA group with p<0.01.

Likert’s scale for surgeon’s satisfaction were significantly higher in GA group as compared to SA group with p<0.01

Conclusion: My study concluded that VAS score (patient’s satisfaction) is better in spinal anesthesia whereas hemodynamic stability and Likert’s scale (surgeon’s satisfaction) is better in general anesthesia.

Keywords: Percutaneous nephrolithotomy (PCNL), spinal anesthesia (SA), general anesthesia(GA).

Introduction

Renal stones are the most painful condition of the urological system requiring hospital admission. [1]. Percutaneous nephron lithotomy (PCNL) was initially used only in patients who were unfit for surgery but with the advancement in operative technique, endoscopic procedures and high success rate it has become the procedure of choice especially in cases of multiple renal
calculi, staghorn calculi, large renal stone of >2-3 cm size or resistant stones in which shock wave lithotripsy fail. [2]

Despite the superior results of PCNL surgeries under general anaesthesia, it has found to be associated with certain disadvantages such as its high cost and higher incidences of drug interactions. The incidence of complications is high especially when the position of patient is changed from supine to prone position. Common complications associated with use of general anaesthesia i.e. injury to lung, brachial plexus, tongue and occasionally to spinal cord are its major drawback. Other minor but common side effects include postoperative nausea and vomiting.

Recent literature suggests that PCNL when conducted under spinal anaesthesia has some advantages such as low post-operative pain and thus lower requirement of analgesics and reduced incidence of side effects of multiple medications that are given during general anaesthesia. Surgical anaesthesia is reported to reduce venous pressure in the surgical filed and cause less bleeding. [3] Spinal anaesthesia is indicated for short procedures, and amongst patients in whom general anaesthesia is risky. However, in procedures of longer duration, or procedures that compromise airway, general anaesthesia is preferred. Common complications with the use of spinal anaesthesia include backache, postdural puncture headache, nausea, vomiting, hypotension.

Literature comparing the results of PCNL surgeries under general versus spinal anaesthesia is scarce and only limited number of trials have been conducted to assess the postoperative complication rates between two anaesthesia modalities. Hence, the present study was designed and conducted to compare the hemodynamic parameters, patient’s satisfaction, surgeon’s satisfaction and incidence of post-operative complications amongst patients undergoing PCNL surgeries under spinal and general anaesthesia.

**Aim**

The aim of the study was to observe and compare between Spinal anaesthesia with General anaesthesia in patients undergoing PCNL (percutaneous nephrolithotomy) surgeries for haemodynamic changes and patient’s and surgeon’s satisfaction.

**Objectives**

1. To observe and compare hemodynamic changes like pulse and blood pressure in spinal anaesthesia versus general anaesthesia in PCNL surgeries.
2. To observe and compare spo2 and respiratory rate (in spinal anaesthesia cases)
3. To observe and compare complications like nausea, vomiting, hypotension, shivering in spinal anaesthesia versus general anaesthesia in PCNL surgeries.
4. To inquire and compare patient’s satisfaction on basis of visual analogue scale (VAS) in spinal anaesthesia versus general anaesthesia in PCNL surgeries.
5. To compare surgeon’s satisfaction on the basis of Likert’s scale (1 to 5 ratings) in spinal anaesthesia versus general anaesthesia in PCNL surgeries.

**Materials and Methods**

The present study entitled “An Observational Study to Compare Patient and Surgeon Satisfaction and Hemodynamic Changes Occurring in Spinal Anaesthesia Versus General Anaesthesia in Patients Undergoing Percutaneous Nephrolithotomy Surgery” was conducted in Department of Anaesthesiology, Dhiraj Hospital, S.B.K.S. Medical Institute and Research Centre, Sumandeep Vidyapeeth University, Piparia, Wagholia, Vadodara, Gujarat.

It was Cross sectional observational study

**Study population-** All the patients belonging to American Society of anaesthesiologists (ASA) grade- I & II undergoing PCNL surgery under SA or GA

**Study duration-** The study was conducted for a period of 1 year and 6 months i.e. from 1st December 2018 to 30th May 2020.

**Sample size-**

Sample was calculated by using this formula.

\[ n = \left( \frac{Z\alpha/2 + Z\beta}{2 \sigma} \right)^2 \]
where,

\[ Z_{\alpha/2} = \text{the critical value of the Normal distribution at } \alpha/2 \text{ (e.g. for a confidence level of 95%, } \alpha \text{ is 0.05 and the critical value is 1.96),} \]

\[ Z_\beta = \text{the critical value of the Normal distribution at } \beta \text{ (e.g. for a power of 80%, } \beta \text{ is 0.2 and the critical value is 0.84),} \]

\[ \sigma^2 = \text{the population variance, and} \]

\[ d = \text{the difference} \]

Using the above formula, the sample size was estimated to be 50.

**Inclusion criteria:**

- Patient posted for elective PCNL surgery
- ASA grades I and II.
- Patient willing to sign informed consent.
- Age- > 18 years and < 60 years
- Either gender.

**Exclusion criteria:**

- Patient refusal.
- Patient with ASA III or IV.
- Mallampati grading III and IV.
- Horseshoe or ectopic kidney
- Patients with spine deformity
- Patients with local skin infections at site of injection.
- Patients with coagulopathy

**Methodology**

After obtaining approval from Institute’s ethical committee, all the patients fulfilling the inclusion criteria were selected and written and informed consent was obtained. All the patients were subjected to detailed pre-anaesthetic check-up. Height, weight and vitals i.e. pulse, respiratory rate (RR), temperature (temp) were assessed. All the patients were then subjected to detailed Systemic examination of respiratory system, cardiovascular system, gastrointestinal system and central nervous system. All routine investigations such as CBC, coagulation profile, LFT, RFT, ECG and Chest X-ray were done. Other special investigations were done when required.

Patients were divided into two groups based upon clinical indications and PAC findings i.e.

- **Group S**- PCNL under spinal anaesthesia
- **Group G**- PCNL under General anaesthesia.

All patients were kept NBM (nil by mouth) for minimum 6 hours before surgery. Baseline vitals such as PR, BP, SpO2 and respiratory rate were recorded. Patients were shifted to operation theatre. An intravenous cannula of 20 Gauge was secured and an infusion of ringer’s lactate solution was started. A multi-parameter monitoring electrocardiogram (ECG), non-invasive blood pressure (NIBP) and pulse oximetry (SPO2) was used to monitor the hemodynamic parameters. Depending upon the group, PCNL surgery was conducted under spinal or general anaesthesia.

**THE SPINAL ANAESTHESIA TECHNIQUE:**

- All patients were premedicated with inj. ondansetron 0.1mg/kg i.v.
- Under all aseptic and antiseptic precautions lumbar puncture at L3- L4 interspace using a 23G spinal needle with patient in sitting position was performed.
- Inj. bupivacaine 0.5% (Heavy) 4 ml plus 1mg nalbuphine, with total volume 4.1ml, out of which 3.4 ml was injected into the subarachnoid space over 10-15 sec slowly after noting the clear free flow of CSF with the operating table kept flat. Patients were turned supine immediately.
- Sensory and motor block was assessed by pin prick using hypodermic needle and by Bromage Scale respectively. Sensory, motor block and haemodynamic was assessed every 2 min for 1st 15min and then after throughout the surgery.
- Complications were noted (nausea, vomiting,
hypotension, postoperative shivering).

The degree of motor block was assessed at the same time points as sensory block using

**Bromage Scale:**

0=full leg movement.

1=inaability to raise extended leg, can bend knee.

2=inaability to bend knee, can flex ankle.

3=no movement.

**THE GENERAL ANESTHESIA TECHNIQUE**

- All patients were premedicated with inj. Ondansetron 0.1mg/kg, Inj. Glycopyrrolate 0.004 mg/kg, Inj. midazolam 0.05mg/kg IV, Inj. Tramadol 1-2 mg/kg IV.

- Preoxygenation with 100% oxygenation on bag and mask with attached circuit was done.

- Induction was done with IV Propofol 2 mg/Kg till the loss of eyelash reflex.

- Inj. Succinylcholine I.V. 2mg/kg was given.

- Patients were intubated with appropriate sized flexo-metallic cuffed endotracheal tubes by direct laryngoscopy.

- After checking the equal bilateral air entry tube was fixed.

- Anaesthesia was maintained with oxygen and nitrous oxide (50%-50%), 1 % -3% Isoflurane. Inj. Atracurium in a loading dose of 0.5 mg/Kg body weight was given and then repeated in a dose of 0.1 mg/kg as and when required relaxant (maintenance dose).

- Baseline heart rate (PR), systolic blood pressure (SBP), Diastolic blood pressure(DBP), Mean arterial pressure (MAP), SPO2 were measured.

- After the surgical procedure, Inj. Neostigmine 0.05 mg/kg and Inj. Glycopyrrolate 0.008mg/kg intravenously were given for reversal of anaesthesia.

- Once all recovery criteria (head lifting, eyes opening, following verbal command) were fulfilled patients were extubated after oropharyngeal suction.

**POSTOPERATIVE ASSESSMENT:**

- All patients were monitored for next 4 hours.

- Duration of surgery was noted.

- Side-effects and complications such as nausea, vomiting, headache, allergic reactions if present during the postoperative period were recorded.

**PARAMETERS RECORDED IN BOTH GROUPS:**

All patients of both groups were monitored for:

- Hemodynamic Parameters like blood pressure (BP), pulse rate (PR), spo2, respiratory rate (RR).

- Any complications during intraoperative and postoperative period like nausea, vomiting, hypotension and post-operative shivering.

- Patient’s satisfaction was noted with help of Visual analogue scale (VAS) postoperatively after 4 hours. Patients were given inj paracetamol 15 mg/kg IV for pain management.

- Surgeons’ satisfaction was measured using Likert’s scale.

**Visual analogue criteria**

*Figure-1 Visual analogue scale*
Figure 1: Visual analogue scale

Figure 2: LIKERT’S SCALE
Observation and Results

Data was compiled using MS Excel and analyzed using IBM SPSS software version 20. Chi square test was applied to assess the difference in proportions of two groups whereas independent t test was applied to assess the difference in mean of two groups. P value <0.05 was considered statistically significant.

Patients’ age, gender, weight and ASA grades were compared and came out to be statistically insignificant.

The mean pulse rate, respiratory rate, systolic blood pressure, diastolic blood pressure and oxygen saturation were comparable at baseline between two groups of patients (p>0.05)

Mean pulse rate just before anaesthesia at 0 minutes was 77.04±7.464 and 76.48±6.410 in spinal and general anaesthesia group respectively which was comparable (p>0.05). However, it was significantly lower in spinal anaesthesia group following anaesthesia and during intraoperative observation period as compared to general anaesthesia group (p<0.01).

The mean systolic blood pressure and diastolic blood pressure was between two groups at 0 minutes was statistically insignificant (p>0.05). However, both were throughout intraoperatively following anaesthesia was significantly lower in spinal anaesthesia groups as compared to general anaesthesia group (p<0.01).

The present study observed no statistically significant difference in mean respiratory rate between two groups throughout the intraoperative period (p>0.05).

During immediate postoperative period, mean pulse rate was observed to be significantly higher in spinal anaesthesia group (83.04±6.32) as compared to general anaesthesia group (79.24±5.85) (p<0.01). Thereafter, mean heart rate was comparable between two groups throughout the postoperative period (p>0.05).

Though heart rate stabilized during the postoperative period, mean systolic blood pressure and diastolic blood pressure was significantly lower in spinal anaesthesia group during the postoperative period as compared to general anaesthesia group (p<0.01).

The present study documented no statistically significant difference in mean oxygen saturation and respiratory rate between two groups of patients throughout the postoperative period (p>0.05).

Mean oxygen saturation was more than 98% throughout the intraoperative period. Though mean saturation at baseline between two groups was statistically similar at 0 minutes following anaesthesia, mean saturation was significantly lower in spinal anaesthesia group as compared to general anaesthesia group throughout the intraoperative period (p<0.01).

![Figure-3 Graphical Distribution according to grade of shivering in spinal anesthesia group](image-url)
During immediate postoperative period, shivering was noted in 20% patients of spinal anaesthesia group. Of them, shivering of grade 1, 2 and 3 was noted in 8%, 8% and 4% patients respectively. However, at 30 minutes postoperatively, shivering was noted in 40% cases and among them, about 4% patients each had shivering of grade 4 and 5.

Shivering of various grade was noted in 44% patients at 60 minutes, 20% patients at 120 minutes and 12% patients at 180 and 240 minutes each.

In present study, nausea and vomiting was documented in 32% and 28% patients respectively in spinal anaesthesia group and none in general anaesthesia group. Thus incidence of side effects i.e. nausea and vomiting was significantly higher in spinal anaesthesia group (p<0.01).

![Figure-4 Comparison of VAS score between two groups](image1)

VAS score ranged from 0 to 3 in majority i.e. 60% cases of spinal anaesthesia group whereas in majority of patients of general anaesthesia group, VAS score ranged between 4 and 6 (68%). The observe difference in VAS score between two groups was statistically highly significant (p<0.01).

![Figure-5 Comparison of surgeon’s satisfaction following spinal and general anesthetic](image2)
Surgeon’s satisfaction score remained neutral in majority i.e. 48% cases of spinal anaesthesia. About 20% doctors were unsatisfied following procedure in spinal anaesthesia group. Maximum surgeons (76%) were very satisfied in after performing PCNL surgery under general anaesthesia and about 24% doctors were satisfied. Surgeon’s satisfaction was observed to be significantly higher following PCNL under general anaesthesia (p<0.01).

Discussion

Urolithiasis, that is formation of stone in kidney, bladder and ureter is one of the most common urological disease worldwide and its prevalence is drastically increasing. [4,5]

The treatment depends upon type, number and size of renal calculi. Fernström and Johansson originally introduced Percutaneous nephrolithotomy (PCNL) in 1976. [6] PCNL surgeries can be conducted under regional anaesthesia such as spinal anaesthesia, general anaesthesia or local anaesthesia. PCNL surgeries when conducted in general anaesthesia is advantageous over regional anaesthesia in terms of hemodynamic parameters, and airway control. [7]

PCNL surgeries under general anaesthesia has been documented to be more comfortable for patient and procedures of longer duration can be performed in prone position without limitation of airway. [8,9]

The aim of the study was to observe and compare between Spinal anaesthesia with General anaesthesia in patients undergoing PCNL surgeries for haemodynamic changes and patient’s and surgeon’s satisfaction.

Our study included 50 patients of both sex, aged between 18 to 60 years, ASA I &II undergoing PCNL surgeries randomly divided into two groups by chit method.

THE DEMOGRAPHIC DATA in terms of AGE, SEX and WEIGHT, ASA grading was comparable in both the groups. Meena M at al (2017) [10] and WANI Z et al (2017) [11] observed the same result as our study.

The division of patients with respect to ASA grading I/II in both the groups were statistically non-significant (p>0.05)

These parameters were kept alike in both S and G group to avoid disparities in the intra operative and post-operative period.

INTRAOPERATIVE AND POSTOPERATIVE HEMODYNAMIC CHANGES

In our study, the MEAN PULSE RATE at 0 minutes were (77.04±7.464) and (76.48±6.410) in both the groups which was statistically insignificant (p>0.05). However, MEAN PULSE RATE was significantly lower intraoperatively in group S (73.32±4.62) as compared to group G (77.60±3.56) (p<0.01). However, MEAN PULSE RATE was higher postoperatively in group S (83.04±6.32) as compared to group G (79.24±5.85), which was statistically highly significant (p<0.01). Meena M et al (2017) [10] observed the same result as our study. Movasseghi G et al (2014) [12] observed no significant difference which was contrary to our result.

In our study, SBP, DBP, MAP at 0 minutes were statistically insignificant in both groups (136.0±13.254) & (142.56±13.583) respectively (p>0.05). But SBP, DBP AND MAP were significantly lesser in patients of group S (89.74±7.65) as compared to group G (101.23±5.58) after 2 minutes following anaesthesia throughout the intraoperative period as well as in postoperative period (p value<0.01). Meena M et al (2017) [10] observed the result similar to our study. Movasseghi G et al [12]found the result which was differing from our study.

In our study Mean oxygen saturation was more than 98% throughout the intraoperative period. Though mean saturation at baseline between two groups was statistically similar at 0 minutes following anaesthesia, mean saturation was significantly lower in group S as compared to group G throughout the intra operative period (p<0.01). Meena M et al (2017) [10] found in their study which was dissimilar to our result.

The present study observed no statistically significant difference in mean respiratory rate between two groups throughout the intraoperative period (p>0.05).

In our study shivering of various grade was noted in 44% patients at 60 minutes, 20% patients at 120 minutes
and 12% patients at 180 and 240 minutes each in group S, whereas there was no shivering in group G. Moawad HES et al (2015) found the same as our study[13].

In our study incidence of side effects i.e. nausea and vomiting were significantly higher in SA group as compared to GA group (p<0.01). Shah R et al (2016) [13] observed the similar result as our study (p<0.01). Meena M et al [10] observed the result which is contrary to our study.

In our study VAS score ranged from 0 to 3 in majority i.e. 60% cases of SA group whereas in majority of patients of GA group, VAS score ranged between 4 and 6 (68%). The observed difference in VAS score between two groups was highly significant (p<0.01). According to Moawad HES et al (2015) [13] and Meena M et al [10], visual analogue pain score was lower in SA group till 1 hour postoperatively in comparison with GA group (P < 0.05) which was similar to our study.

In our study surgeon’s satisfaction score remained neutral in majority i.e. 48% cases of spinal anaesthesia. About 20% doctors were unsatisfied following procedure in group S. Maximum doctors (76%) were very satisfied in after performing PCNL surgery under general anaesthesia and about 24% doctors were satisfied. Doctors satisfaction was observed to be significantly higher following PCNL under general anaesthesia (p<0.01). In Moawad HES et al (2015) [13], surgeon’s satisfaction score was higher in favour of GA group compared to SA group (mean 10 ± 00 vs. 8.3 ± 0.4, P < 0.05) which was similar to our study.

Conclusion

My study concluded that VAS score (patient’s satisfaction) was better in spinal anaesthesia with lower dose of analgesics being required postoperatively. Hemodynamic stability like pulse rate, blood pressure and spo₂ was better controlled in general anaesthesia. There was less complications like shivering, nausea and vomiting intraoperatively in general anaesthesia group. Surgeon’s satisfaction (Likert’s scale) was more in general anaesthesia group in comparison with spinal anaesthesia. Thus, although both these techniques can be effectively implemented in PCNL surgeries, general anaesthesia imposes greater advantages than spinal anaesthesia towards further advancements.

Conflict of Interest: Nil

Source of Fund: Self

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