Sarcouncil Journal of Medicine and Surgery

**ISSN(Online): 2945-3534**

Volume- 04| Issue- 10| 2025

**Research Article** **Received:** 11-09-2025 | **Accepted:** 10-10-2025 | **Published:** 24-10-2025

# Comparative Efficacy and Safety of Supine Versus Prone Positioning for Percutaneous Nephrolithotomy Under Spinal Anesthesia

***Dr. Mustafa Mohsin Hammoodi AL_Musawi [1], Dr. Raed Hmood Afiet[2] and Dr. Mohammed Ghanim Alwan [3]***

*[1]M.B.Ch.B., F.I.B.M.S. \ (Urology) Subspecialty Endourology Iraqi Ministry of Health, Medical City Health Directorate, Surgical Speciality Teaching Hospital (Martyr Ghazi Alhariri), Department of Urology, Baghdad, Iraq.*

*[2]M.B.Ch.B., C.A.B.M.S. \ (Urology) Subspecialty Endourology Iraqi Ministry of Health, Baghdad-Medical Teaching City-Surgical Speciality Hospital-Urology Department, Baghdad, Iraq*

*[3]Assistant Professor Urologist M.B.Ch.B., F.I.C.M.S. \ (Urology) Specialist Urology & Male Fertility Ibn Sina University of Medical and Pharmaceutical Sciences, College of Medicine, Department of Surgery, Baghdad, Iraq.*

**Abstract:** Percutaneous nephrolithotomy (PCNL) is the treatment of choice for renal calculi of large size, traditionally performed in the prone position under general anesthesia, which the supine position has been proposed as an alternative, potentially offering logistic and physiological benefits, but relative efficacy and safety, particularly with spinal anesthesia whereby our study compared the safety and efficacy profiles of supine and prone positions for PCNL with spinal anesthesia. Furthermore, a cross-sectional study was performed in 95 patients (49 supine, 46 prone) who underwent PCNL under spinal anesthesia at the Baghdad, Iraq hospitals during 12 12-month follow-up from June 2024 to June 2025. Also, both groups were not different in demographic factors, preoperative factors, and stone burden, as well as our findings evaluated were operative time, stone-free rate (SFR), hemodynamic stability, complications, postoperative pain, and hospital stay. These results found that supine position had associated with highly decreased operative time (58.2 ± 11.2 min vs. 127.7 ± 24.3 min) and faster time to stabilize blood pressure after anesthesia (6.2 ± 1.5 min vs. 8.7 ± 1.3 min), while supine position had a non-significant trend of higher SFR (93.5% vs. 81.6%) and significantly lower hospital stay (2.5 ± 0.9 days vs. 3.8 ± 0.7 days). However, the supine group produced lower pain scores postoperatively at six hours (VAS 2.4 ± 1.5 vs. 5.2 ± 1.2) and more intraoperative hemodynamic stability (91.84% vs. 73.91%) alongside with complications between the groups were statistically similar, where it found supine position has certain advantages in terms of reduced operative time and superior early postoperative pain control, while prone position may lead to reduced hospital stay, where choice of position needs to be individualized, weighing trade-offs between operating efficiency and specific postoperative recovery factors.

**Keywords:**. Percutaneous nephrolithotomy (pcnl), supine position, prone position, spinal anesthesia, stone-free rate, operative time, and postoperative pain.

## INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is considered as the gold-standard procedure in the treatment of large renal stones that are typically bigger than 2 cm in diameter, where the fundamental principle of PCNL included the creation of a percutaneous tract into the renal collecting system, which nephroscopes and energy-based lithotripters are have to fragment and remove stones. Where the unquestioned success of PCNL but it is inherently directly related to the appropriate and safe administration of anesthesia (Yuan, D. *et al.*, 2016; Pradère, B. *et al.*, 2018; Ziemba, J. B., & Matlaga, B. R. 2015)

Also, PCNL has been performed under general anesthesia (GA), that GA has been preferred due to its capacity to provide a safe airway, complete immobilization of the patient, controlled ventilation, and comfort with prolonged operative time (Falahatkar, S. *et al.*, 2008; DasGupta, R., & Patel, A. 2013), where a prone position is known to be advantageous to the surgeon in the form of normal anatomical orientation, greater surface area of percutaneous puncture, and perhaps more ready access to the renal collecting system, which may be partially contributory to the higher stone-free rates, as well as prone position under GA is not devoid of significant physiological effects (Patel, R. M. *et al.*, 2017).

Moreover, it imposed changes to cardiopulmonary function in the manner of reduced cardiac output, and potential ventilation-perfusion mismatch, which logistical problems, such as patient repositioning and potential for face, eyes, and peripheral nerve pressure injury, add layers of increased complexity and risk. (Mak, D. K. C. *et al.*, 2016)

In addition, SA for PCNL has been indicated as an effective and safe alternative to GA (Yazici, C. M. *et al.*, 2014), which it avoided polypharmacy and the systemic effected of general anesthetics, provides better intra- and postoperative analgesia, decreases postoperative nausea and vomiting (PONV), and enabled a more rapid recovery profile (Ganpule, A. P. *et al.*, 2016), as well as a substantial amount of evidence now confirms that SA provided equivalent surgical conditions and patient outcomes to GA for PCNL, challenging prevailing dogma. (Jones, M. N. *et al.*, 2016).





***Corresponding Author:** Dr. Mustafa Mohsin Hammoodi AL_Musawi

DOI- https://doi.org/10.5281/zenodo.17437038

Moreover, a revolution of anesthetic technique has also simultaneously reawakened debate on the optimal surgical position for PCN while the prone position remains the default conventional standard, the supine position has gained considerable favor (Sohail, N. *et al.*, 2017), where the supine position has a number of benefits, in the view of supporters including circumvention of unnecessary patient repositioning inconvenience, reduction in anesthesia time, and improvement of ventilatory parameters by prevention of abdominal compression, facilitation of more natural positioning of the collecting system in certain surgeons, and possibly permitting the concomitant combined utilization of retrograde ureteroscopic aid. (Gökce, M. İ. *et al.*, 2017)

## PATIENTS AND METHODS

### Study Design

The study was a cross-sectional study at a single tertiary-care urology center in complex Gazi al Hariri hospital. The study was designed to critically evaluate the postoperative and perioperative outcomes of patients who were made to undergo percutaneous nephrolithotomy (PCNL) using spinal anesthesia in the prone and supine positions.

### Patient Population and Selection Criteria

The population consisted of 95 adult patients with big renal stones (>1.5 cm) who were candidates for PCNL under spinal anesthesia. The patients were divided randomly into two groups based on the operation position: Group S (Supine position, n=49) and Group P (Prone position, n=46), where the assignment was not randomized but instead by a combination of surgical planning for optimal stone access and operating logistically, scheduling the surgeons by position, hence creating a naturally comparative group.

Furthermore, both inclusion and exclusion criteria were employed, where inclusion criteria stipulated that the patients had to be between the ages of 30 and 60 years, with an American Society of Anesthesiologists (ASA) physical status classification of I to III, and must provide informed consent. Exclusion criteria were clearly explained to exclude confounding variables. Patients were excluded from the study for the following indications: a body mass index (BMI) of more than 35 kg/m² (due to possible technical challenges with spinal anesthesia and percutaneous puncture); known contraindications to spinal anesthesia (patient refusal, coagulopathy, infection at puncture site, severe hypovolemia, or elevated intracranial pressure); staghorn calculi with a known complex morphology that would require anticipated multiple tracts or staged procedures; pre-existing severe neurological or musculoskeletal conditions that would make it unsafe to position; and renal anatomical abnormalities such as ectopic kidneys or severe hydronephrosis that would require a specific position.

### Anesthetic and Surgical Technique

All patients received the same protocol of spinal anesthesia. Routine monitors were connected on arrival in the operating room for electrocardiogram, non-invasive blood pressure, and pulse oximetry. An intravenous cannula was inserted, and all patients received a preload of 500 mL crystalloid solution. In total asepsis, spinal anesthesia was administered in a sitting position at the interspace L3-L4 or L4-L5 with a 25-gauge Quincke spinal needle. Intrathecal injection of a hyperbaric solution of 0.5% bupivacaine (12-15 mg) was administered. The supine position was immediately followed by patients of Group S with the operating side elevated by a 3L bag of saline against the flank after injection, and which also Group P patients were also rolled into the prone position carefully on a standardized chest roll support system to achieve adequate abdominal decompression and ventilation. Supplemental oxygen was administered via a facemask to all patients.

Furthermore, hemodynamic parameters of systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were measured every 3 minutes for the first 15 minutes and every 5 minutes thereafter, including intravenous ephedrine (bolus 5-10 mg) was administered for the management of hypotension (reduction in SBP >20% of baseline), and atropine (bolus 0.5 mg) was given for the management of bradycardia (HR <50 bpm), where time to reach spinal injection and a stable sensory block (up to T6 level) and time to reach stable hemodynamics were taken note of carefully.

Moreover, the procedure was standardized and performed by two senior urologists with extensive experience, each operating in their own patient position, which renal access was established under fluoroscopic control, and the tract was dilated using telescopic metal dilators, followed by stone fragmentation using a pneumatic lithotripter, where routine nephrostomy at the conclusion of the procedure was performed.





**Publisher: SARC Publisher**

**Intraoperative and Postoperative Outcomes Measures**

The primary outcomes measured were intraoperative hemodynamic stability and surgical efficiency including hemodynamic stability was defined as the lack of hypotensive or bradycardia events requiring pharmacologic correction, as well as the incidence of these events, total vasopressor or atropine required, and time to stabilize blood pressure were significant measures, due to that, surgical efficiency was quantified by total operative time, defined as the time from initial needle placement for renal access to the last nephrostomy tube insertion.

**Secondary outcomes were broad and concerned safety, efficacy, and recovery, and included:**

**Stone-free status:** Evaluated on the first postop day by kidney-ureter-bladder (KUB) X-ray and ultrasonography, as the absence of any stone fragments >4mm.

**Rates of complications:** Recorded in accordance with the modified Clavien-Dindo classification system, such as intraoperative complications (e.g., bleeding, conversion to general anesthesia, O2 desaturation <92%) and postoperative complications (e.g., fever, transfusion requirement, PONV, urinary leakage, sepsis).

**Pain and patient experience:** Pain in the postoperative period was assessed with a Visual Analog Scale (VAS, 0-10) at 6 hours from surgery. Discomfort during the procedure and overall satisfaction with the process of positioning were also recorded with VAS.

**Recovery parameters:** These included time to motor recovery (Bromage score return to 0), hemoglobin loss, and hospital stay.

**Statistical Analysis**

SPSS version 24.0 software was used to perform the analysis. Continuous variables, i.e., age, BMI, operation time, and VAS scores, were expressed as mean ± SD and were compared by an independent Student's t-test. The Buffet Categorical variables such as sex, ASA status, stone-free rate, and complication rates were expressed as numbers and percentages (n, %) and were compared with the Chi-square test or Fisher's exact test, whichever was appropriate. Univariate analysis was performed to identify risk factors for intraoperative hypotension as odds ratios (OR) with 95% confidence intervals (CI). P-value <0.05 was used as significant for all analysis.

## RESULTS

**Table 1**. Patients' Demographic Characteristics**.**

| *Characteristic* | *Supine (n=49)* | *Prone (n=46)* | *p-value* |
|---|---|---|---|
| ***Age groups, (years), n (%)*** | | | 0.85 |
| *30 - 40* | 12 (24.5%) | 10 (21.7%) | |
| *41 - 50* | 18 (36.7%) | 19 (41.3%) | |
| *51 - 60* | 19 (38.8%) | 17 (37.0%) | |
| ***Sex, n (%)*** | | | 0.69 |
| *Male* | 32 (65.3%) | 29 (63.0%) | |
| *Female* | 17 (34.7%) | 17 (37.0%) | |
| ***BMI (kg/m²), Mean ± SD*** | 28.4 ± 3.1 | 27.9 ± 2.8 | 0.42 |
| ***Smoking Status, n (%)*** | | | 0.82 |
| *Smokers* | 15 (30.6%) | 13 (28.3%) | |
| *Non-smokers* | 34 (69.4%) | 33 (71.7%) | |
| ***Diet, n (%)*** | | | 0.66 |
| *Good* | 22 (44.9%) | 19 (41.3%) | |
| *Bad* | 27 (55.1%) | 27 (58.7%) | |
| ***ASA Score, n (%)*** | | | 0.91 |
| *I* | 18 (36.7%) | 18 (39.1%) | |
| *II* | 23 (46.9%) | 21 (45.7%) | |
| *III* | 8 (16.3%) | 7 (15.2%) | |
| ***Comorbidities, n (%)*** | | | |
| *None* | 20 (40.8%) | 22 (47.8%) | 0.49 |
| *Hypertension* | 16 (32.7%) | 13 (28.3%) | 0.64 |
| *Diabetes Mellitus* | 8 (16.3%) | 7 (15.2%) | 0.88 |
| *COPD* | 3 (6.1%) | 2 (4.3%) | 0.69 |



Publisher: SARC Publisher

| | | | |
|---|---|---|---|
| *Others* | 5 (10.2%) | 4 (8.7%) | 0.80 |

**Table 2**. Pre-Operative Diagnostic Parameters.

| Parameters | Supine (n=49) | Prone (n=46) | p-value |
|---|---|---|---|
| **History of Stone Surgery, n (%)** | | | 0.83 |
| **Yes** | 11 (22.4%) | 9 (19.6%) | |
| **No** | 38 (77.6%) | 37 (80.4%) | |
| **Laterality, n (%)** | | | 0.84 |
| **Left** | 24 (49.0%) | 21 (45.7%) | |
| **Right** | 25 (51.0%) | 25 (54.3%) | |
| **Stone Size (cm), Mean ± SD** | 2.8 ± 0.7 | 2.7 ± 0.6 | 0.47 |
| **Symptoms for PCNL, n (%)** | | | |
| **Severe Flank Pain** | 45 (91.8%) | 43 (93.5%) | 0.76 |
| **Hematuria** | 28 (57.1%) | 25 (54.3%) | 0.78 |
| **Fever** | 12 (24.5%) | 10 (21.7%) | 0.75 |
| **Chills** | 8 (16.3%) | 7 (15.2%) | 0.88 |
| **Nausea/Vomiting** | 15 (30.6%) | 12 (26.1%) | 0.62 |
| **Urinary Frequency/Urgency** | 20 (40.8%) | 17 (37.0%) | 0.70 |

**Table 3**. Intraoperative and Postoperative Outcomes.

| *Variables* | *Supine (n=49)* | *Prone (n=46)* | *p-value* |
|---|---|---|---|
| *Operative Time (min), Mean ± SD* | 58.2 ± 11.2 | 127.7 ± 24.3 | 0.01 |
| *Hemodynamic Stability, n (%)* | 45 (91.84%) | 34 (73.91%) | 0.05 |
| *Transfusion Rate, n (%)* | 5 (10.2%) | 3 (6.5%) | 0.51 |
| *Fever, n (%)* | 4 (8.2%) | 3 (6.5%) | 0.75 |
| *Hemoglobin (g/dL), Mean ± SD* | | | |
| *Pre-operative* | 13.2 ± 1.5 | 13.4 ± 1.4 | 0.51 |
| *Post-operative* | 11.8 ± 1.3 | 12.2 ± 1.2 | 0.11 |
| *Blood Pressure (mmHg), Mean ± SD* | | | |
| *Systolic BP* | 124.3 ± 10.5 | 125.1 ± 9.8 | 0.69 |
| *Diastolic BP* | 78.6 ± 7.2 | 77.9 ± 6.8 | 0.63 |
| *Heart Rate (bpm), Mean ± SD* | 76.4 ± 8.1 | 75.2 ± 7.5 | 0.45 |
| *$O_2$ Desaturation, n (%)* | 7 (14.3%) | 2 (4.3%) | 0.09 |
| *Stone-Free Rate, n (%)* | 40 (81.6%) | 43 (93.5%) | 0.08 |
| *Patient Discomfort During Procedure, n (%)* | 6 (12.24%) | 14 (30.43%) | 0.07 |
| *Hospital Stay (days), Mean ± SD* | 2.5 ± 0.9 | 3.8 ± 0.7 | <0.01 |
| *Time to Motor Recovery (min), Mean ± SD* | 175.4 ± 27.3 | 183.8 ± 25.1 | 0.25 |

**Table 4:** Intraoperative and Postoperative Complications.

| Complications | Supine (n=49) | Prone (n=46) | p-value |
|---|---|---|---|
| **Conversion to GA, n (%)** | 1 (2.04%) | 4 (8.7%) | 0.33 |
| **Dural Puncture Headache, n (%)** | 2 (4.1%) | 5 (10.87%) | 0.59 |
| **Bleeding, n (%)** | 3 (6.12%) | 6 (13.04%) | 0.57 |
| **Infection, n (%)** | 2 (4.1%) | 3 (6.5%) | 0.51 |
| **Postoperative Nausea/Vomiting (PONV), n (%)** | 6 (12.24%) | 8 (17.39%) | 0.68 |
| **Respiratory Distress, n (%)** | 2 (4.1%) | 4 (8.7%) | 0.18 |
| **Urinary Leakage, n (%)** | 2 (4.1%) | 3 (6.5%) | 0.69 |
| **Pneumothorax, n (%)** | 0 (0%) | 1 (2.17%) | 0.33 |
| **Sepsis, n (%)** | 1 (2.0%) | 2 (4.35%) | 0.33 |

**Table 5:** Hemodynamic Changes during Anesthesia Administration.

| Parameters | Supine (n=49) | Prone (n=46) | p-value |
|---|---|---|---|
| **Hypotension Requiring Vasopressor, n (%)** | 5 (10.20%) | 10 (21.74%) | 0.22 |
| **Bradycardia Requiring Atropine, n (%)** | 3 (6.12%) | 6 (13.04%) | 0.26 |



**Publisher: SARC Publisher**

| | | | |
|---|---|---|---|
| **Time to Stable BP (min), Mean ± SD** | 6.2 ± 1.5 | 8.7 ± 1.3 | <0.01 |

**Table 6:** Patient Satisfaction and Pain Scores.

| *Parameters* | *Supine (n=49)* | *Prone (n=46)* | *p-value* |
|---|---|---|---|
| *Satisfaction with Position (VAS 0-10), Mean ± SD* | 8.6 ± 1.8 | 8.0 ± 1.2 | <0.01 |
| *Postoperative Pain (VAS 0-10) at six h, Mean ± SD* | 2.4 ± 1.5 | 5.2 ± 1.2 | <0.01 |
| *Willing to Have Same Position Again, n (%)* | 43 (87.76%) | 37 (80.43%) | 0.04 |

**Table 7**: Univariate Analysis of Risk Factors for Intraoperative Hypotension**.**

| **Risk Factors** | **Odds Ratio** | **95% CI** | **p-value** |
|---|---|---|---|
| Age >50 years | 1.45 | 0.62 - 3.42 | 0.39 |
| BMI >30 kg/m² | 2.10 | 0.87 - 5.08 | 0.10 |
| Smoking | 1.32 | 0.54 - 3.22 | 0.54 |
| Hypertension | 3.25 | 1.32 - 8.02 | 0.01 |
| Stone Size >3 cm | 1.88 | 0.78 - 4.52 | 0.16 |

## DISCUSSION

The stone-free rate (SFR), our primary efficacy outcome, has a tendency to favour the prone position (93.5% versus 81.6%, p=0.08). This observation is consistent with the previously reported findings of the prone position resulting in better calyceal access, especially for complex and staghorn stones, leading to more effective stone fragmentation and clearance (de la Rosette, J. J. *et al.*, 2008), although the p-value does not meet the conventional limit for statistical significance, an absolute difference of almost 12% is clinically significant, and an advantage in efficacy might exist for the prone position with larger or more complicated stone burdens (Liu, L., Zheng, S. *et al.*, 2010), where our findings echo the results from a meta-analysis conducted in China (Basiri, A., & Sichani, M. M. 2009), which noted a slightly better SFR for the prone PCNL.

In contrast, the supine position showed statistically and clinically important benefits in a few other areas. The operative time was notably less with the supine position (58.2 ± 11.2 min vs. 127.7 ± 24.3 min), which most surgeons tend to find the steps of tract establishment and nephroscopy easier to perform in the position for which they received the bulk of their training (Desai, M. *et al.*, 2017), as well as the hospital stay is much shorter for the supine patients (2.5 ± 0.9 vs. 3.8 ± 0.7 days), where shorter stay is a more novel and impactful finding, which implied that better stone clearance and improved efficiency in the supine group could facilitate faster patient recovery and readiness for discharge, which is an important metric in today's value-based healthcare. (Liu, Y. *et al.*, 2018)

Although spinal anesthesia is an effective approach for patient management, it is important to analyze the safety concerns of patients using this approach, as well as the data shows a strong correlation with the prone position in relation to hemodynamic stability (Mulay, A. *et al.*, 2022), where a larger portion of patients in the supine position maintained hemodynamic stability (91.84% vs. 73.91%), which they stabilized their blood pressure faster following the administration of anesthesia (6.2 ± 1.5 min vs. 8.7 ± 1.3 min).

Sympathetic blockade is showed in spinal anesthesia and increases the risk of developing hypotension, largely during changes in posture. Turning a patient from supine to prone is a delicate process and worsens hypotension (McCahy, P. *et al.*, 2013), where our study proved that this stress can be mitigated by performing the entire procedure in the supine position, as well as it provided by the univariate analysis, which showed that hypertension is a major risk factor for intraoperative hypotension (OR: 3.25, p=0.01), indicating a subset of patients who might clearly benefit from the supine approach.

Patients with the supine position experienced notably less pain than prone after surgery (2.4 ± 1.5 vs. 5.2 ± 1.2 VAS score), expressed higher satisfaction levels with their positioning (7.2 ± 1.5 vs. 8.6 ± 1.2), and were more willing to undergo the same positioning (87.76% vs. 80.43%). These findings contradict what is often regarded as an advantage of the supine position. Even though the supine position offers easier airway access and communication, our findings suggest that the prone position is easier to tolerate once established and leads to less pain post-procedure (Satyagraha, P. *et al.*, 2018; Desoky, E. A. *et al.*, 2022). The cause for this improvement could be the more stable spinal anaesthesia parameters, reduced strain on secondary muscle groups, or more effective surgery leading to less tissue trauma.





**Publisher: SARC Publisher**

No notable differences in complications were reported for the two groups. Rates of bleeding, transfusion, infection, sepsis, and other major complications were similar. This finding aligns with large meta-analyses, like the Japanese study (Rehan, M., & Elnady, E. A. 2022), which found that both positions have similar safety outcomes. Interestingly, although not statistically significant, incidents of respiratory distress (4.1% vs. 8.7%) and $O_2$ desaturation (14.3% vs. 4.3%) were lower in the supine group.

## CONCLUSION

Spinal anesthesia is a viable alternative to general anesthesia in PCNL, particularly in selected patients. Supine positioning under spinal anesthesia offers advantages such as better hemodynamic stability, shorter operative time, and improved patient comfort. While prone remains effective, the supine approach is gaining acceptance for its safety and feasibility, especially in high–risk patients. In terms of the study's recommendation, supine PCNL under spinal anesthesia can be considered the preferred technique in elderly and cardiopulmonary–compromised patients. Further multicenter randomize controlled trails are needed for broader validation.

## REFERENCES

1. Yuan, D., Liu, Y., Rao, H., Cheng, T., Sun, Z., Wang, Y., ... & Zhu, J. "Supine versus prone position in percutaneous nephrolithotomy for kidney calculi: a meta-analysis." *Journal of endourology* 30.7 (2016): 754-763.
2. Pradère, B., Doizi, S., Proietti, S., Brachlow, J., & Traxer, O. "Evaluation of guidelines for surgical management of urolithiasis." *The Journal of urology* 199.5 (2018): 1267-1271.
3. Ziemba, J. B., & Matlaga, B. R. "Guideline of guidelines: kidney stones." *BJU international* 116.2 (2015): 184-189.
4. Falahatkar, S., Moghaddam, A. A., Salehi, M., Nikpour, S., Esmaili, F., & Khaki, N. "Complete supine percutaneous nephrolithotripsy comparison with the prone standard technique." *Journal of endourology* 22.11 (2008): 2513-2518.
5. DasGupta, R., & Patel, A. "Percutaneous nephrolithotomy: does position matter?–prone, supine and variations." *Current opinion in urology* 23.2 (2013): 164-168.
6. Patel, R. M., Okhunov, Z., Clayman, R. V., & Landman, J. "Prone versus supine percutaneous nephrolithotomy: what is your position?." *Current urology reports* 18.4 (2017): 26.
7. Mak, D. K. C., Smith, Y., Buchholz, N., & El-Husseiny, T. "What is better in percutaneous nephrolithotomy–Prone or supine? A systematic review." *Arab journal of urology* 14.2 (2016): 101-107.
8. Yazici, C. M., Kayhan, A., & Dogan, C. "Supine or prone percutaneous nephrolithotomy: do anatomical changes make it worse?." *Journal of Endourology* 28.1 (2014): 10-16.
9. Ganpule, A. P., Vijayakumar, M., Malpani, A., & Desai, M. R. "Percutaneous nephrolithotomy (PCNL) a critical review." *International Journal of Surgery* 36 (2016): 660-664.
10. Jones, M. N., Ranasinghe, W., Cetti, R., Newell, B., Chu, K., Harper, M., ... & McCahy, P. "Modified supine versus prone percutaneous nephrolithotomy: Surgical outcomes from a tertiary teaching hospital." *Investigative and clinical urology* 57.4 (2016): 268-273.
11. Sohail, N., Albodour, A., & Abdelrahman, K. M. "Percutaneous nephrolithotomy in complete supine flank-free position in comparison to prone position: A single-centre experience." *Arab Journal of Urology* 15.1 (2017): 42-47.
12. Gökce, M. İ., Ibiş, A., Sancı, A., Akıncı, A., Bağcı, U., Ağaoğlu, E. A., ... & Gülpınar, Ö. "Comparison of supine and prone positions for percutaneous nephrolithotomy in treatment of staghorn stones." *Urolithiasis* 45.6 (2017): 603-608.
13. de la Rosette, J. J., Tsakiris, P., Ferrandino, M. N., Elsakka, A. M., Rioja, J., & Preminger, G. M. "Beyond prone position in percutaneous nephrolithotomy: a comprehensive review." *European urology* 54.6 (2008): 1262-1269.
14. Liu, L., Zheng, S., Xu, Y., & Wei, Q. "Systematic review and meta-analysis of percutaneous nephrolithotomy for patients in the supine versus prone position." *Journal of endourology* 24.12 (2010): 1941-1946.
15. Basiri, A., & Sichani, M. M. "Supine percutaneous nephrolithotomy, is it really effective? A systematic review of literature." *Urology Journal* 6.2 (2009): 73-77.
16. Desai, M., Sun, Y., Buchholz, N., Fuller, A., Matsuda, T., Matlaga, B., ... & Ganpule, A. "Treatment selection for urolithiasis: percutaneous nephrolithomy, ureteroscopy,



**Publisher: SARC Publisher**

shock wave lithotripsy, and active monitoring." *World journal of urology* 35.9 (2017): 1395-1399.
17. Liu, Y., Chen, Y., Liao, B., Luo, D., Wang, K., Li, H., & Zeng, G. "Epidemiology of urolithiasis in Asia." *Asian journal of urology* 5.4 (2018): 205-214.
18. Mulay, A., Mane, D., Mhaske, S., Shah, A. S., Krishnappa, D., & Sabale, V. "Supine versus prone percutaneous nephrolithotomy for renal calculi: Our experience." *Current Urology* 16.1 (2022): 25-29.
19. McCahy, P., Rzetelski-West, K., & Gleeson, J. "Complete stone clearance using a modified supine position: initial experience and comparison with prone percutaneous nephrolithotomy." *Journal of endourology* 27.6 (2013): 705-709.
20. Satyagraha, P., Alluza, H. H. D., Daryanto, B., & Nurhadi, P. "Prone vs supine PCNL: what about the cost." *J Med Clin Res & Rev* 2.6 (2018): 1-6.
21. Desoky, E. A., Sakr, A. M., ElSayed, E. R., & Ali, M. M. "Ultra-mini-percutaneous nephrolithotomy in flank-free modified supine position vs prone position in treatment of pediatric renal pelvic and lower caliceal stones." *Journal of endourology* 36.5 (2022): 610-614.
22. Rehan, M., & Elnady, E. A. "Is A Modified Supine Nephrolithotomy Better Than Prone Percutaneous Nephrolithotomy?." *International Journal of Medical Arts* 4.11 (2022): 2828-2834.

**Source of support:** Nil; **Conflict of interest:** Nil.

**Cite this article as:**
AL_Musawi, M. M. H., Afiet, R. H. and Alwan, M. G. " Comparative Efficacy and Safety of Supine Versus Prone Positioning for Percutaneous Nephrolithotomy Under Spinal Anesthesia.." *Sarcouncil Journal of Medicine and Surgery* 4.10 (2025): pp 17-23.



**Publisher: SARC Publisher**