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Supine percutaneous nephrolithotomy in a high-volume center: First 60 cases

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Abstract

Aim: To present the first 60 supine percutaneous nephrolithotomy (PCNL) surgeries performed in our clinic with regard to the results and reliability of this surgery.

Materials and Methods: A retrospective study carried out on 60 patients who had undergone PCNL in supine position due to the kidney stone between September 2021 and May 2022. The following parameters were studied: Demographic characteristics, stone size and HU index, operation time and postoperative complications.

Results: Patient's mean age was 48.47, the oldest one was 90 years old, and 20 of them were female. Three of the patients had solitary kidney and 23 of them had previous surgery for kidney stone. 10 patients had this surgery under spinal anesthesia. Mean stone surface area and Hounsfield Unit were 590.55 mm^2 and 903.52, respectively. In 3 cases, endoscopic combined intrarenal surgery was performed. Mean operation time was 63,75 minutes and scopy time was 16.5 seconds. 33 patients had totally tubeless procedure and 37 patients had tubeless surgery. None of the patient was required to blood transfusion or any other approach related to bleeding. Only two patients had fever and needed IV antibiotics. Stone free rate was 95 % in one session.

Conclusion: Supine PCNL surgery is a feasible surgery with low complication rate and high stone-free rate. It is easier to switch to the supine position in clinics where this surgery is performed intensively in the prone position. It should become more widespread especially in terms of the advantages it offers compared to prone PCNL.

Introduction

Urology guidelines recommend percutaneous nephrolithotomy (PCNL) as gold standard treatment for kidney stones that larger than 20 mm [1]. PCNL was described Fersnstrom and Johansson in 1976 [2]. In 1980, Vladivia Uria and friends published their PCNL series [3]. Because of first techniques, PCNL performed most widely on prone position. By the time, several positions were described as flank position, supine position and modified supine position [4]. Although prone position provides wider working area and better pelvicalyceal imaging [5], supine position provides more comfort for patient, better for lung ventilation and especially allowing simultaneous retrograde intrarenal surgery (e-CIRS) [6, 7]. Various supine PCNL positions described such as complete supine [8], Valdivia [3], Barts "flank free" [9] and modified Valdivia by Galdakao [10] and Barts [9], but there is still no consensus on optimal supine PCNL position.

The purpose of this study was to analyze our first 60 patients' data that underwent Galdakao modified Valdivia supine PCNL operations in our clinic, which has high prone PCNL volume (over 5000 cases).

Materials and Methods

In this retrospective study, we evaluated our first forty cases of supine PCNL. We started to perform this surgery in September 2021. The patients' demographic and kidney stone features reviewed retrospectively and all patients were included in the study as a result of obtaining all of the information about the patients. The study was approved by the institutional ethical committee of our institute (Institutional Review Board approval number: 2022/3929) in 25/Oct/2022.

Non-contrast CT was performed in all patients presenting with kidney stones. Hemogram and biochemistry tests and urine cultures were taken. Patients with a positive urine culture were operated after appropriate antibiotic therapy.

In all procedures, Galdakao modified Valdivia supine position were given to the patients. Posterior axillary line, 12.

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Figure 1. One of our patients position for supine PCNL surgery (He had open nephrolithotomy history).

costal and iliac bone margins were marked and puncture area determined (Figure 1). A 5-6 Fr ureteral catheter was inserted and the pelvicalyceal system was seen under fluoroscopy. 18 G needle was used to puncture appropriate calyx. According to the stone size and patient, mini or standard nephroscope was used for surgery and holmium 60 W yag laser or pneumatic lithotripter was used to fragment the stones. Aspiration system was used to extract the small stone pieces. In all cases, in calyx stones that could not be entered with nephroscope, the stone was reached by entering with a flexible cystoscope through the sheath or ureter.

After 3 months from surgery, patients controlled with ultrasound, x-ray images or CT according to the stone in terms of the residual fragments and late complications.

Definitions

Standard Supine PCNL – This definition describes the PCNL operation performed with adult sized (24 F, Karl Storz, Germany) nephroscope with or without any tubes [11].

Mini Supine PCNL - This definition describes the PCNL operation performed with pediatric sized (14 F, Karl Storz, Germany) nephroscope with or without any tubes [11].

Tubeless Supine PCNL - This definition describes the situation in which nephrostomy catheter were not placed at the end of the PCNL operation [12].

Totally Tubeless Supine PCNL - This definition describes the situation in which a nephrostomy and dj stent is not placed at the end of the PCNL operation. A 5 or 6 F sized ureteral catheter retained less than 24 hours [3].

Statistical analysis

Statistical analysis was performed using SPSS software (Chicago, IL, USA) version 24 for Microsoft Windows. Average age of patients was presented with standard error mean by (±) and the data of gender (Boys/Girls) were shown as with a proportion in the Table 1. Minimum sample size was determined with power analysis that calculated 52 patients. Shapiro-Wilk test, histogram distribution, and skewness-kurtosis parameters were used for normality analysis. Descriptive statistics are shown as mean ± standard deviation for variables with normal distribution, median (min-max) for variables with non-normal distribution, and the number of cases and (%) for nominal variables.

Results

The mean age of the patients was 48.47 (18 – 90) and gender distribution was 20 females and 40 males. Operation sides were 29 right and 31 left kidneys. Three patients had solitary kidney and one patient had horseshoe-kidney. Open nephrolithotomy, percutaneous nephrolithotomy and retrograde intrarenal surgery was performed previously on 5, 14 and 4 patients respectively. Dj stent was replaced to the 18 patients preoperatively. All the preoperative variable and intraoperative variables are depicted in Tables 1 and 2, respectively.

ASA scores of the patients were 15, 41 and 4 for 1,2 and 3 respectively. Ten patients underwent surgery under spinal anesthesia and 50 patients had general anesthesia.

According to the stone properties, mean stone largest dimension was 2,42 cm (12-51 cm), surface area was 590.55 cm^2 (84-2000) and Hounsfield Units (HU) index was 903,51 (347 – 1450). Guy stone scores were 18, 18, 19 and 5 for 1, 2, 3 and 4, respectively. In 15 patients, the stones were located in the renal pelvis, 14 in the lower pole and 9 in the interpolar. And, four patients with staghorn stone, the

Table 1. Patient demographics and preoperative data.

Mean age (SD, range), year	48.47 ± 15.32	18-90 years
Male/female, n (%)	40/20	
Comorbidities	21	35%
Asthma/COPD	5	8.3%
Hypertension	16	26. %
Diabetes mellitus	8	13.3%
Ischemic heart disease	4	6%
Multipl Sklerosis	1	1.7%
ASA score		
1	15	25 %
2	41	68.3%
3	4	6.7%
Stone size (mean ± SD, range), mm	24.52 ± 10.46 mm	12 – 51 mm
HU index (mean ± SD)	903.52 ± 313.1	347 - 1450
Stone area (mean ± SD, range), mm^2	590.55 ± 433.74 mm^2	84 – 2000 mm^2
Guy stone score		
1	16	26.7%
2	14	23.3%
3	15	25%
4	4	6.7%
Previous surgery history	20	33.4%
PCNL	14	23.4%
Open nephrolithotomy	5	8.4 %
RIRS	4	7%

90 years old one, 8 patients had semi staghorn stone and 10 patients had multiple stones.

All the patients operated in Galdakao modified Valdivia supine position. Out of four patients who had middle pole puncture, puncture was done to lower pole. In four patients, flexible ureterorenoscopy was performed simultaneously to achieve stone free status (e-CIRS). 14 F nephroscope was used in 49 cases and standard nephroscope was used in 11 cases. Mean operation time was 57,26 minutes (30-70) for surgery and 65 minutes (40-100) for anesthesia. Mean scopy time was 16.5 seconds and was higher in nephrostomy or dj stent inserted group. Nephrostomy tube was placed in 23 patients, DJ stent was placed in 8 patients, and 33 patients were totally tubeless. Both nephrostomy and dj stent were placed in 4 patients.

Postoperatively, the mean hemoglobin decrease was 0.63 g/dl (-1.2 – 2.1) and GFR decrease was 7.03 ml/min (-29.68 – 49.86). None of the patients required blood transfusion. Mild fever occurred in 4 patients and required IV antibiotic and antipyretic therapy but one of these patients had sepsis and died in postoperative 4th day. This patient was 86-year-old and preoperatively she had treatment for ESBL positive E. coli infection. No other complications such as colonic or any other solid organ injury and nephrostomy leak was observed. Converting to open surgery was not needed in any cases.

Table 2. Intraoperative variables.

Side of the procedure, n (%)		
Right	29	48.3%
Left	31	51.7%
Punctured calyx, n (%)		
Middle	4	6.7%
Lower	56	93.3%
Multipl	0	0
Types of approach, n (%)		
Standard supine PCNL	11	18.3%
Mini supine PCNL	49	81.7%
Tubeless PCNL	37	61.7%
Totally tubeless	33	55%
Mini	28	84.8%
Standard	5	15.2%
Lithotripter		
Laser	35	58.4%
Pneumatic	25	41.6%
Preoperative Dj stent, n (%)	18	30%
Duration of procedure, mean ± SD	63.75 ± 9.85 min	30 – 70 min
Standard supine PCNL	64.28 ± 2.74 min	45 – 70 min
Mini supine PCNL	56.19 ± 10.51 min	30 – 70 min
Tubeless PCNL	59.28 ± 10.74 min	30 – 70 min
Totally tubeless	58.75 ± 2.89 min	30 – 70 min
Mean scopy time, sec, mean ± SD	16.5 ± 10.41 sec	6 – 46 sec
Anesthesia, n (%)		
General anesthesia	50	83.4%
Spinal anesthesia	10	16.6%

Table 3. Postoperative variables.

Stone free status, n (%)		
Yes, confirmed by intraoperative look	57	95%
Yes, confirmed by postoperative imaging	52	86.7%
No	3	5%
CIRF	5	8.4%
Conversion to open surgery, n (%)	0	
Angioembolization, n (%)	0	
Preoperative hemoglobin (mean ± SD, range), g/dl	14.25 ± 1.89	9.9 – 17.5
Postoperative hemoglobin (mean ± SD, range), g/dl	13.62 ± 1.90	9.1 – 17.7
Hemoglobin change (mean ± SD, range), g/dl	0.63 ± 0.70	-1.2 – 2.1
GFR change (after 3 months) (mean ± SD, range), mL/dk/1.73 m^2	7.03 ± 15.9	-29.68 – 49.86
Complications, n (%)		
Fever	4	6.7 %
Exitus	1	1.7 %
Postoperative hospital stay (mean ± SD, range), day	1.54 ± 0.94	1-6 days

The mean hospitalization time was calculated as 1.53 days (1-6). Stone free status was achieved in 52 patients (86.7%) in one session, whereas residual stones were detected in 3 patients, micro-pcnl was performed in two and the other patient had extracorporeal shock wave lithotripsy. 5 of the patients had clinically insignificant residual fragments (CIRF). All these post-operative variables are depicted in Table 3.

Discussion

In our center, PCNL operations have been performed since March 1998 and over 4000 patients operated with this method on prone position. Then we decided to perform PCNL operations on supine position. We searched "supine PCNL" on YouTube, watched on webinars and performed our first operation in September 2021. In 10 months, we performed 60 supine PCNL operations and decided to share our results. Prone position was the valid surgery position for PCNL operations except selected patients such as pelvic kidney, transplanted kidney [13]. But there are some problems in prone PCNL, such as colonic perforation, ventilation problems especially in obese or elder patients. Among other problems, more radiation exposure for both the staff and the patients, increased operation time, difficulty to convert spinal anesthesia to general anesthesia and position problems for patients with postural disorders like kyphosis, scoliosis, neck or limb contracture [14-15]. Due to these problems, various techniques were tried in different positions. Nowadays, supine PCNL has become widespread at the clinics to minimize the problems. Although supine PCNL has a lower stone free rate, it is preferred more because of the less incidence of blood transfusion and radiation exposure time [4]. In our study, we operated 60 patients and 33 of them was totally tubeless

(55 %), which was higher than literature [16]. Access was achieved by single puncture in all patients and 56 (93.4 %) of them was to the inferior calyx which was higher than current data (55.4-72 %) [14, 16, 17]. Our oldest patient was 90 years old and he had standard supine PCNL surgery and nephrostomy tube because of his age with the staghorn stone. According to the literature, he is the oldest patient who had supine PCNL. Mean operation time was similar in all subgroups that 64.28 minutes for standard and 56.19 minutes for mini PCNL. The operation times were like the literature [14, 16, 17]. We achieved complete stone clearance in 52 patients (86.7 %) which was same as the literature [16, 18]. In our cases, just four patient had complications, postoperative fever (6.7 %). One of them had 6 days intravenous antibiotic treatment and the other two patient had 3 days of treatment but 86-year-old patient had died due to sepsis. There was no blood transfusion and other complications. In the literature, fever is one of the most common complication and seen around 2-8% [14, 16]. 10 patient (16.7 %) had just spinal anesthesia and the others had general anesthesia. This was lower than Gupta and friends' study that they performed this surgery under regional anesthesia in 38.1 % of the patients [16]. Supine PCNL is the new star that the consequences are equal with prone PCNL and has shorter operation and radiation time. But the learning curvature is longer. Urologists are familiar with prone position but thanks to training courses and training videos, we think that urologists, especially experienced in the prone position, can perform this surgery with some courage [16, 19, 20].

Limitations

We are some limitations in this study that firstly, the number of the patient are limited, they are selected patients. And secondly, we did not look the visual pain scores of the patients.

Conclusion

PCNL operations are one of the beautiful examples of the minimally invasive urologic operations. We think that supine PCNL surgery should become widespread because in addition to the timesaving, reliable and stone-free promise of supine PCNL surgery, it also causes fewer complications than prone PCNL surgery, and allows simultaneous flexible URS surgery.

Limitations of this study are the cases performed until experience gained in operations performed in this position were also included, but these cases were not evaluated in a separate group within the study. In addition, cases used in resident training were also included in the study.

Scientific responsibility statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Ethical approval

This study was approved by the İnönü University Health Sciences Non-invasive Clinical Research Ethics Committee (Decision number: 2022/3929). Animal and human rights statement all procedures performed in this study were in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflict of interest

The authors declare no conflicts of interest.

References

1. Assimos D, Krambeck A, Miller NL, Monga M, Murad MH, Nelson CP, et al. Surgical Management of Stones: American Urological Association/Endourological Society Guideline, PART I. J Urol. 2016; 196(4): 1153-60.
2. Fernström I, Johansson B. Percutaneous pyelolithotomy. A new extraction technique. Scand J Urol Nephrol. 1976; 10(3): 257-9.
3. Valdivia Uría JG, Lachares Santamaría E, Villarroya Rodríguez S, Taberner Llop J, Abril Baquero G, Aranda Lassa JM. Nefrolitectomía percutánea: técnica simplificada (nota previa) [Percutaneous nephrolithectomy: simplified technic (preliminary report)]. Arch Esp Urol. 1987; 40(3): 177-80.
4. Yuan D, Liu Y, Rao H, Cheng T, Sun Z, Wang Y, et al. Supine Versus Prone Position in Percutaneous Nephrolithotomy for Kidney Calculi: A Meta-Analysis. J Endourol. 2016; 30(7): 754-63.
5. de la Rosette JJ, Tsakiris P, Ferrandino MN, Elsakka AM, Rioja J, Preminger GM. Beyond prone position in percutaneous nephrolithotomy: a comprehensive review. Eur Urol. 2008; 54(6): 1262-9.
6. Cracco CM, Scoffone CM. ECIRS (Endoscopic Combined Intrarenal Surgery) in the Galdakao-modified supine Valdivia position: a new life for percutaneous surgery? World J Urol. 2011; 29(6): 821-7.
7. Scoffone CM, Cracco CM. Invited review: the tale of ECIRS (Endoscopic Combined IntraRenal Surgery) in the Galdakao-modified supine Valdivia position. Urolithiasis. 2018; 46(1): 115-123.
8. Falahatkar S, Asli MM, Emadi SA, Enshaei A, Pourhadi H, Allahkhah A. Complete supine percutaneous nephrolithotomy (csPCNL) in patients with and without a history of stone surgery: safety and effectiveness of csPCNL. Urol Res. 2011; 39(4): 295-301.
9. Bach C, Goyal A, Kumar P, Kachrilas S, Papatsoris AG, Buchholz N, et al. The Barts 'flank-free' modified supine position for percutaneous nephrolithotomy. Urol Int. 2012; 89(3): 365-8.
10. Ibarluzea G, Scoffone CM, Cracco CM, Poggio M, Porpiglia F, Terrone C, et al. Supine Valdivia and modified lithotomy position for simultaneous anterograde and retrograde endourological access. BJU Int. 2007; 100(1): 233-6.
11. Ichaoui H, Samet A, Ben Hadjalouane H, Hermi A, Hedhli H, Bakir MA, et al. Percutaneous Nephrolithotomy (PCNL): Standard Technique Versus Tubeless - 125 Procedures. Cureus. 2019; 11(3): e4251.
12. Desai J, Solanki R. Ultra-mini percutaneous nephrolithotomy (UMP): one more armamentarium. BJU international. 2013; 112(7): 1046-9.
13. Manohar T, Jain P, Desai M. Supine percutaneous nephrolithotomy: Effective approach to high-risk and morbidly obese patients. J Endourol. 2007; 21(1): 44-9.
14. Rana AM, Bhojwani JP, Junejo NN, Das Bhagia S. Tubeless PCNL with patient in supine position: procedure for all seasons?--with comprehensive technique. Urology. 2008; 71(4): 581-5.
15. Huang T, Jiao BB, Luo ZK, Zhao H, Geng L, Zhang G. Evidence of the outcome and safety of upper pole vs. other pole access single puncture PCNL for kidney stones: which is better? Eur Rev Med Pharmacol Sci. 2023; 27(10): 4406-4420.
16. Gupta S, Sandhu A, Pal DK. Supine PCNL-5 year experience in a tertiary care center. Urologia. 2022; 89(3): 404-409.
17. Wahab OA, Sherif H, El-Karamany T. Tubeless PNL in the supine position. Turk J Urol. 2012; 38(3): 138-42.
18. Ibrahim A, Elsotohi I, Mahjoub S, Elatreisy A, Soliman K, Mabrouk M, et al. Factors determining perioperative complications of percutaneous nephrolithotomy: a single center perspective. African Journal of Urology. 2017; 23(4).

19. Nerli RB, Devaraju S, Hiremath MB. Training in percutaneous nephrolithotomy: A structured apprenticeship program. Journal of the Scientific Society. 2014; 41(1): 26.

20. Nerli RB, Koura AC, Prabha V, Kamat G, Alur SB. Use of LMA Stonebreaker as an intracorporeal lithotrite in the management of ureteral calculi. J Endourol. 2008; 22(4): 641-4.