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The oblique supine decubitus position: technical description and comparison of results with the prone decubitus and dorsal supine decubitus positions

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Abstract Our objective was to analyze the advantages of the percutaneous nephrolithotomy in oblique supine decubitus compared to the prone and dorsal supine position. In 87 patients diagnosed with urolithiasis (495.5–530.8 mm^2), percutaneous nephrolithotomy (PNL) was performed from 2000 to 2011. The patients were divided into three groups: Group A, 32 patients, PNL in the prone decubitus position; Group B, 24 patients, PNL in the dorsal supine position; Group C, 31 patients, PNL in the oblique supine position. We analyzed intraoperative parameters, complications, and results among the three groups. The three procedures were performed with a single access, 24-30 Ch. No statistically significant differences were found among the three groups regarding the patients' characteristics, or the morphology or size of the kidney stone treated. The operation time was shorter in the cases of PNL in dorsal supine and oblique supine compared to the prone position. The complication rate was very similar in the three groups. The main advantage of the PNL in oblique supine compared to the dorsal supine was that the puncture could in all cases be directed by ultrasonography, with greater precision, more safety, and more control of the percutaneous renal access. The oblique supine decubitus position is a safe position for the percutaneous treatment of urolithiasis and it becomes easier when the puncture is guided by ultrasound.

Keywords Oblique supine position · Percutaneous nephrolithotomy · Urolithiasis

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Introduction

Percutaneous nephrolithotomy began in 1976 when Fernstrom and Johanssen first removed a kidney stone by percutaneous access performed with the patient in prone decubitus position; a position described in 1955 for urinary deviation by puncture in an obstructed kidney [1]. Percutaneous renal surgery is attributed to Alken and Wickham, who popularized the procedure in the prone decubitus position [2] until 1988, when the supine decubitus position was described for percutaneous access, with good results [3]. The supine decubitus position, described by Valdivia, was modified to facilitate the simultaneous anterograde and retrograde renal access [4].

The supine decubitus position progressed, displaying its advantages over the prone decubitus position [5]. Nevertheless, at present, it is still more frequent to place the patient in prone decubitus than in supine position, and great controversy persists concerning the ideal position. In recent years, some innovations have been made in the percutaneous renal procedure [6, 7] and some other alternatives have been developed in relation to the prone/supine position [8, 9].

The purpose of the present study is to analyze the advantages of the percutaneous nephrolithotomy in oblique supine decubitus position as opposed to the prone and dorsal supine position.

Material and methods

In a retrospective study from 2000 to 2011, we included a total of 87 patients treated for urolithiasis by percutaneous nephrolithotomy. The cases were distributed into three groups according to the patient's position when the percutaneous renal procedure was performed:

Fig. 1 The oblique supine decubitus position keeps the ipsilateral inferior limb parallel and open in position, while the contralateral inferior limb is also open

Fig. 2 The oblique supine position with an inclination of 45º on the operating table is kept by the patient by leaning on two round cushions under the gluteal and costal ipsilateral area, so that the lumbar space is free for ultrasound-guided renal puncture

- Group A: From 2000 to 2003, 32 patients were treated for urolithiasis through percutaneous nephrolithotomy in the prone decubitus position.
- Group B: From 2004 to 2006, 24 patients were treated for urolithiasis by percutaneous nephrolithotomy in the supine decubitus position with a lumbar cushion.
- Group C: From 2007 to 2011, 31 patients were treated for urolithiasis by percutaneous nephrolithotomy in the oblique supine decubitus position.

All procedures were performed by the same surgeon with 14 years of experience in percutaneous nephrolithotomy.

Both the prone decubitus as well as the supine are popular positions. The oblique supine decubitus position consists of placing the patient in supine decubitus with an inclination of 45° on the surgery table, while the patient maintains the position by leaning on two round cushions under the gluteal and costal ipsilateral area so that the lumbar space is free to perform the renal puncture. The ipsilateral inferior limb remains in a parallel, opened position and the contralateral inferior limb also remains open, for easier transurethral renal access (Fig. 1). Therefore, this position allows the application of ultrasound to perform the puncture under supervision and direct control (Fig. 2).

In Group A, 32 patients were treated (18 men and 14 women averaging 47.4 years of age), 17 cases of urolithiasis in the right renal unit, and 15 cases of urolithiasis in the left kidney. The rest of the parameters are presented in Table 1.

In Group B, 24 patients were treated (13 men and 11 women, averaging 49.3 years of age), 12 cases of urolithiasis in right renal unit and 12 cases of urolithiasis in left kidney (Table 1).

In Group C, 31 patients were treated (19 men and 12 women averaging 45 years of age), 17 cases of urolithiasis in the right kidney and 14 cases of urolithiasis in the left kidney.

Table 1 gives the composition of the calculi from the three groups.

In all patients, we made a single access, generally through the inferior calyx but in no case through the superior calyx. The characteristics of the patients and the calculi are presented in Table 1 and, with no significant differences, the groups were considered homogenous and comparable.

For the operation, we used a 20/24 Fr rigid nephroscope, a 15.5 Fr flexible cystonephroscope, a 8.5/11.5 Fr semirigid ureteroscope, and a 8.5/9 Fr flexible ureteroscope, all from Olympus.

Two groups of parameters were analyzed:

- Intraoperative parameters: Puncture site, form of access, dilation, energy applied, manner of kidney-stone extraction, urinary derivation, operation time, kidney-stone manipulation, urinary-tract perforation during the treatment.
- Complications, parameters, and results: Hemorrhage, hematoma, need of blood transfusion, fever, sepsis, intestinal fistula, arteriovenous fistula, hospital stay, residual urolithiasis, kidney-function impairment, need of treatment with extracorporeal shock waves lithotripsy (ESWL).

The results for the three groups were analyzed by a multiple-comparison ANOVA using quantitative/qualitative variables, Student's t test and the Chi-square test, using the SPSS 15.0 statistic program for Windows Statistical significance was set at $p \leq 0.05$.

Table 1 Characteristics of patients included in the study

	Group A	Group B	Group C	p
Number of cases	32	24	31	0.52
Age (years)	47 ± 7.8	49 ± 9.7	45 ± 6.5	0.98
Men/women	18/14	13/11	19/12	0.85
Right/left kidney	17/15	12/12	17/14	0.93
Localization				0.98
Pyelic	10	9	11	
Obstructive pyelic	7	4	6	
Superior calyx	4	3	5	
Multiple	4	3	5	
Pyelocalyceal/staghorn	7	5	4	
Body-mass index (Kg/m^2)	27 ± 5.4	31 ± 6.8	30 ± 7.1	0.97
Stone burden (mm^2)	530 ± 134	510 ± 127	495 ± 154	0.61
Composition				0.85
Calcium calculus	17	14	19	
Uric calculus	4	3	3	
Cistine calculus	1	1	3	
Ammonium phosphate calculus	10	6	6	

Results

In the retrospective study of these three groups of patients according to the position of percutaneous nephrolithotomy, no differences were found in the parameters analyzed before surgery (Table 1). The intraoperative parameters analyzed indicated that in most cases the puncture site was the inferior calyx (90.6% in Group A; 95.8% in Group B; 87.1% in Group C), with no significant differences. On the contrary, the methods used for the dilation of the puncture trajectory statistically differed; in some cases Alken metal dilators were used and in others the dilation was made with a high-pressure ball (Group A: Alken 84.3% and ball catheter 15.7%; Group B: Alken 66.6% and ball catheter 33.4%; Group C: Alken 29.1% and ball catheter 69.1%). The most used fragmentation-energy method in Group A was ultrasonic energy (78.1%) followed by kinetic energy (21.9%); in Group B, it was ultrasonic energy (20.8%), kinetic energy (66.6%), and kinetic energy plus Holmium:YAG laser (12.6%); in Group C, it was kinetic energy (87.1%) and kinetic energy plus Holmium:YAG laser (12.9%). The calculus fragments in Group A were extracted with a metal clamp (81.2%) and a nitinol extraction basket (12.5%); in Group B with a metal clamp (8.3%) and a nitinol extraction basket (66.6%); in Group C with a nitinol extraction basket (77.4%). After finishing the procedure, we left 18 Ch nephrostomy catheters in 27 cases in Group A, in 20 cases in Group B, and in 24 cases in Group C. Only ureteral stent was left in two cases in Group A, in three cases in Group B, and in five cases in Group C. We left a nephrostomy and ureteral stent in three cases in Group A, in one case in Group B, and in two cases in Group C. In all the cases, the nephrostomy catheter was removed between the second and the fourth post-operation day. The average operation time was of 105.3 min in Group A, 81.2 min in Group B, and 73.6 min in Group C; and statistically significant differences were found between Group A and the other two groups ($p < 0.01$). Successful manipulation of the kidney stone was not possible in three cases in Group A and in two cases in Group B, but no difficulties arose in Group C. The tract was punctured during the treatment in two cases in Group A, and in one case in each of the other two groups (Table 2).

In the results analyzed for complications, we should highlight the need for blood transfusion in only two patients in each group, with practically no other complications (Table 3).

The average stay in hospital was similar among the three groups (Group A, 5.2 days; Group B, 5.4 days; and Group C, 5.4 days). Residual fragments persisted in 25% of the patients in Group A, in 20.8% of the patients in Group B, and in 19.4% of the patients in Group C. In most of these cases, a complementary treatment was performed with ESWL (Group A in 21.8%; Group B in 16.6%; Group C in 16% of the cases). The rest of the patients with residual fragments after the treatment with percutaneous nephrolithotomy were treated with ureteroscopy or they spontaneously ejected the kidney-stone remains (Table 3).

Discussion

In general, today, few urologists dispute the validity and utility of the supine decubitus position to treat urolithiasis

Table 2 Intraoperative parameters analyzed in the three groups

	Group A	Group B	Group C	*p*
Number of cases	32	24	31	0.52
Place puncture				0.53
Medium calyx	3	1	4	
Inferior calyx	29	23	27	
Dilation				<0.001
Alken	27	16	9	
Balloon	5	8	22	
Lithotripsy energy				<0.001
Ultrasonic	25	5	0	
Electrokinetic	7	16	27	
Laser	0	0	0	
Combined (laser + other)	0	3	4	
Extraction				<0.001
Clamp	26	2	0	
Basket	4	17	24	
Nothing	0	6	7	
Urinary derivation				0.73
Nephrostomy	27	20	24	
DJ stent	2	3	5	
Both	3	1	2	
Operating time	105 ± 34.5	81 ± 23.5	73 ± 21.6	0.89
Handling failure	3	2	0	0.24
Urinary perforation	2	1	1	0.77

Table 3 Complication parameters and results in the three groups

	Group A	Group B	Group C	*p*
Number of cases	32	24	31	0.52
Complications				0.79
Hemorrhage[a]	4	5	4	
Hematoma	1	0	1	
Transfusion	2	2	2	
Fever	2	0	1	
Sepsis	1	0	0	
Intestinal fistula	0	0	0	
Arteriovenous fistula	0	0	0	
Hospital stay (days)	5.2 ± 2.5	5.4 ± 2.7	5.4 ± 2.8	0.94
Residual stones (%)	25	20.8	19.4	0.65
Second look	0	0	0	1
ESWL posterior (%)	21.8	16.6	16	0.62
Renal failure	0	0	0	1

[a] Loss of more than 2 g/dl of hemoglobin

through percutaneous access. Different studies indicate that percutaneous nephrolithotomy in the supine decubitus position gives similar results as in the prone position, with an equivalent or lower rate of complications [10, 11]. A comparison of the results in the literature for both positions reflects no differences related to the stone-free percentage or the complications between one or the other procedure depending on the position. In a retrospective study, De Sio [12] presented a stone-free rate of 88.7% in supine decubitus versus 91.6% in prone decubitus, without any significant differences, and the complication rates of both procedures were similar. Shoma et al. [13], comparing both procedures prospectively, presented similar results without any significant differences related to the approach, overall success, or complications. In general, analyzing the position in some series in prone decubitus versus in supine decubitus, the stone-free rate was 79–89% for the patients treated in the prone versus 69–90% in the patients treated in the supine position [14]. Our study registered a similar stone-free rate in the three groups (75% in Group A, 79.2% in Group B, and 80.6% in Group C) without significant differences.

The percutaneous nephrolithotomy and post-operation complications have been thoroughly analyzed by Skolarikos, who detected complications in up to 83% of the cases; however, these are usually minimal and can even be disregarded. Serious complications include: sepsis, in 1–5% of the cases; hemorrhage, which demands a new intervention in 0.6–1.4% of the cases; pleural injury, in 2.3–3% of the cases; and colon injury, in up to 1% of the cases [15]. In our series, the complication rate was similar in the three groups with no significant differences and comparable to the data found in literature or even lower.

In relation to the operation time, the literature reports a shorter time in the supine decubitus versus the prone position, although the results are not significant. This difference is due to the need to turn the anesthetized patient to the prone decubitus position [11]. Our study reflects a shorter average time of 20–30 min to perform the procedure when the patient is placed in the supine decubitus or oblique supine position compared to the prone position. Despite the lack of significant time differences, the supine decubitus position did present the advantage of requiring fewer medical staff during the operation and a lower risk in moving the patient.

Another major advantage that the supine position offers versus the prone position is the lower anesthetic risk, given that the patient has better pulmonary ventilation and cardiorespiratory dynamics [16, 17], it is especially important in obese and high-risk patients [18]. The other advantage that the supine position offers is the retrograde approach which it is not possible with the patient in prone decubitus [4]. Nevertheless, the correct learning of the procedure, both in supine decubitus as well as in the prone decubitus position, demands lengthy training, with a learning curve of around 60 cases [19].

One of the greatest advantages of this oblique supine decubitus position, in our opinion, is the percutaneous approach. Most studies advocate a fluoroscopic approach [6–8, 20], but we recommend an ultrasound and fluoroscopic approach in order to avoid bleeding complications or viscera puncture such as the colon in complex cases. The oblique supine decubitus position provides enough free space to apply the ultrasound transductor and to puncture behind the posterior axillary line in an echo-guided way, as explained above, constantly visualizing the punctured structures at all times, so that we minimize the risk of colon perforation. Thus, our colon-perforation rate is nil.

Conclusion

Although our study is retrospective, our results show that percutaneous nephrolithotomy in oblique supine decubitus position is a safe position, facilitating renal access under ultrasound and fluoroscopic control.

Conflict of interest The authors declare that they have no conflict of interest.

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