

An Investigation on the Patients Undergoing Kidney Stone Open Surgery: A Single-Center Report From Sistan and Baluchistan Province, Iran

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Abstract

Introduction: Urinary stones are among major urological diseases. Open kidney surgery has always been of historical importance in the management of most urinary stones, especially in complicated cases. The aim of this study was to investigate the cases of open kidney stone surgery in Amir Al-Momenin hospital of Zabol in 2016-2017.

Method: In the present descriptive cross-sectional study, the patients who underwent open kidney stone surgery in Amir Al-Momenin hospital were evaluated. The investigated variables included gender, age, changes in blood pressure, postoperative complications, and duration of surgery. The information was collected from hospital records and entered into SPSS software for analysis.

Results: In this study, 25 patients were studied, of whom 14 (56%) were females. The mean age of the patients was 37.84 ± 17.15 years. The youngest and oldest patients were 1 and 66 years old, respectively. Twelve patients (48%) had staghorn stones, and the rest (13 patients) had other types of stones. Blood pressure remained unchanged in 80% of the patients while 12% developed hypertension. Postoperative fever and infection were observed in only 4% of the patients. The prevalence of staghorn stones in men and women were 45.5% and 50%, respectively. The difference was not statistically significant ($P=0.821$).

Conclusion: The present study showed that the most common stones leading to open kidney surgery were of the staghorn type. Males were more likely to undergo open kidney surgery than females.

Keywords: Renal stones, Open surgery, Surgical complications

Introduction

Nephrolithiasis or kidney stone disease is a common, painful and costly disease. The resulting medical costs in the United States are estimated to be more than US\$2 billion per year. According to the research conducted in Iran and based on clinical findings, 87 people per 100 000 population in Iran are annually diagnosed with stone-forming kidneys, with the highest prevalence of stones in the northwestern and western regions of the country.¹

Urinary tract stones are the third most common urinary tract disease after urinary tract infection and prostate abnormalities.² Surgery was the main method for treating kidney stone before the invention of lithotripsy. However, today only 1% to 2% of

patients undergo surgery usually when the stone does not respond to other treatments or to correct anatomical abnormalities in the kidney and improve urinary drainage. Surgical procedures include nephrolithotomy (cutting the kidney and removing the stone), nephrectomy (if kidney function is lost due to infections or hydronephrosis), pyelolithotomy (for renal pelvis stones), urolithotomy or transurethral lithotripsy (stone crushing via the duct and ureteral), and cystotomy (for bladder stones). For bladder stones, it is possible to send an instrument to the bladder through the urethra and crush the stone (cystolitholapaxy).³

Open surgery to remove kidney stones has been documented in ancient Greek and

Roman civilizations, and many of these cases date back to the 1500s and 1600s. Since then, surgical procedures for urinary stones have undergone significant changes by the incorporation of technological innovations and advancements. Prior to these advances and over the past two decades, open surgery was the only treatment for removing kidney stones.⁴

The introduction of percutaneous nephrolithotomy (PNL), extracorporeal shock wave lithotripsy, and urethroscopy have had promising achievements for treating urinary tract stones over the recent years. The indications for open or laparoscopic stone surgery are considerably limited due to advances in PNL, and often open surgery is the second or third treatment option. There is a consensus that the most complex stones, including partial and complete staghorn stones, should be treated primarily with PNL. However, open and laparoscopic surgery may be appropriate if percutaneous and endourological methods are not successful. Indications for surgical intervention to remove kidney stones are: stone growth, high-risk stone-developing patients, kidney obstruction, infections, symptomatic stones, stone size >15 mm, stones below 15 mm in the patients who do not adhere to treatment, the patient's preference and social status, and the failure of other treatment modalities.⁵

In open surgery to remove a kidney stone, the surgeon makes an incision on the patient's side to access the kidney and remove the stone. A small tube (drain) is then placed near the kidney, creating a pathway for the discharge of secretions until the kidney heals. The patient will be hospitalized for 3 to 6 days and can usually resume normal activities after 4 to 6 weeks. The complications of open kidney stone surgery include severe bleeding, urinary tract infection, wound infection, the risks associated with anesthesia, and the risk of hernia at the incision site. The success of open surgery depends on the location of the kidney stone; however, this method usually removes the stone completely.⁶ According to a study in Europe and North America, the surgical removal of kidney stones is only indicated in cases with complicated stones or after the failure of lithotripsy, skin nephrolithotomy, or urethroscopy. However, in developing countries where endourological methods are not readily available, these techniques are still important.

Overall, treatment options for kidney and urinary tract stones have evolved significantly over the past few decades, so that almost any stone can be treated in a non-invasive or minimally invasive manner including shock wave lithotripsy, uroscopy, and cutaneous nephrolithotomy. The safety of these techniques compared to traditional methods is desirable; however, they require unique skills, access to instrumentation with relatively high maintenance costs, which potentially limit their use on a global scale. With the advent of endourology, significant advances have been made in laparoscopic surgical techniques

so that almost any open surgery can be performed in a minimally invasive laparoscopic procedure.⁷

Urinary stones are among the most common diseases of the urinary system and constitute a high percentage of urology referrals. Therefore, studying the epidemiological characteristics of patients with urinary tract stones and examining the most appropriate treatment measures in these patients are essential. A high percentage of patients who can undergo PNL surgery and be treated with fewer complications are treated with open surgery methods.⁸ Our aim in this study was to investigate the patients undergoing open surgery for kidney stone removal in a hospital in South-east of Iran.

Patients and Methods

This was a cross-sectional-descriptive study performed on the patients undergoing open kidney stone surgery in Amir Al-Momenin hospital of Zabol, Sistan and Baluchistan province of Iran, in 2016-2017.

Sample Size Calculation and Sampling Method

All the patients who underwent open kidney stone surgery in Amir Al-Momenin hospital within the study period were included in the study following the accessible sampling method.

Data Collection Tools and Study Protocol

Data were collected using a researcher-made checklist to document patients' information from their clinical records. After coordination with the hospital's managers, the researcher referred to the HIS department and collected the file of the patients who underwent open surgery to remove kidney stones in 2016-2017. The necessary information was collected, and if more information was needed, the patients, or their physicians, were contacted using the registered phone numbers.

Statistical Analysis

SPSS version 22 software was used to analyze the data. Data were described with the mean and frequency indices and displayed using tables. The independent student *t* test was used to compare the means of variables between different groups, and the Spearman correlation coefficient was used to examine the relationship between quantitative variables.

Results

In this study, 25 patients were studied, of whom 14 (56%) were males. The mean age of the patients was 37.8 ± 17.15 years. The youngest and oldest patients were 1 and 66 years old, respectively. Overall, 12 patients (48%) had staghorn stones and the rest (13 patients) had other types of stones. Ten patients (40%) underwent surgery on the right side and the rest (15 patients) on the left side. Table 1 shows the demographic and clinical information of the

patients.

Regarding post-operative changes, blood pressure remained unchanged in 20 (80%) of patients, 3 (12%) developed hypertension, and 2 (8%) developed hypotension in postoperative recovery. Vomiting and wound infection were not observed in any of the patients while urinary tract infection was observed in one of the patients (4%), who was a 1-year-old boy with a 5 mm non-staghorn stone in the left side, who also developed postoperative fever. Table 2 shows the patients' clinical findings after surgery.

Overall, staghorn stones were recovered from 12 patients while others had other types of stones. According to Table 3, the frequency of staghorn stones was not associated with gender ($P=0.821$), mean surgery duration ($P=0.852$), and occasions of receiving pain-killers ($P=0.067$), hospitalization duration ($P=0.538$). There was no statistically significant correlation between stone size and the duration of surgery ($r = 0.169, P=0.420$).

Table 1. The Patients' Demographic and Clinical Information

Variables	Mean	SD	Min	Max
Age (y)	37.8	17.15	1	66
Hospitalization period (d)	5.7	2.3	3	16
Anesthesia time (h)	3.3	1	2	6
Surgery time (h)	2.7	0.99	1.3	5.3
Stone size (mm)	39.9	16.4	5	60
Number of received packed cells	0	0	0	0
Occasions of receiving pain killers	14.8	4.9	3	22

Table 2. Post-operative Clinical Information in the Studied Patients

Variables	Frequency	Percent	
Blood pressure	Unchanged	20	80
	Hypertension	3	12
	Hypotension	2	8
Urinary tract infection	Present	1	4
	Absent	24	96
Post-operative fever	Present	1	4
	Absent	24	96

Table 3. The Distribution of Staghorn Kidney Stones Based on Different Demographic and Clinical Variables

Variables		Kidney Stone Type		P Value
		Staghorn (n=12)	Other (n=13)	
		No. (%)	No. (%)	
Gender	Female	7 (50)	7 (50)	0.821
	Male	5 (45.5)	6 (54.5)	
Mean surgery duration (h, mean ± SD)		2.6 ± 0.8	2.8 ± 1.1	0.852
Occasions of receiving pain killers (mean ± SD)		16.67 ± 4.36	13.08 ± 4.8	0.067
Hospitalization duration (h, mean ± SD)		5.25 ± 0.865	6.23 ± 3.166	0.538

Also, no significant correlation was observed between stone size and the mean occasion of receiving pain killers ($r = 0.017, P=0.937$).

Discussion

In this study, we found that the majority of patients who underwent surgery for urinary tract stones were men. In a 2017 study on the patients referred for open surgery for kidney stones, Çakici et al stated that the ratio of men to women was 13 to 5.⁹ Also, in a study by Paik et al, males were more common among the patients undergoing open kidney surgery.¹⁰ These studies are consistent with the present study. However, in a study by Ozgor et al, this ratio did not show a significant deviation despite the fact that men were still more likely to be candidates for surgery.¹¹ The reason for the higher prevalence of urinary stones in males may be due to the higher secretion of calcium oxalate and uric acid and less citrate production in men than women, leading to more severe complications.¹²

In the present study, almost half of the patients were identified with staghorn stones. In the study of Çakici et al⁹ and Aydemir et al,¹³ the most common stones leading to open surgery were staghorn stones. Other studies by Ozgor et al¹¹ and El-Husseiny & Buchholz¹⁴ also showed that the most common stones leading to open surgery were staghorn types. Actually, the renal structural changes created by staghorn stones in most cases force the physician to consider surgery to remove the stone.¹⁴

In the present study, postoperative complications such as wound infection and vomiting were not observed in patients, and only one person developed urinary tract infection and fever, which could be explained by his young age (1 year). In the study of Çakici et al, they reported a low prevalence of complications following surgery,⁹ which was consistent with our study. However, in another study by Yan and Wei, in addition to urinary tract infection and fever, wound infection was also observed in a small number of patients.¹⁵ Among the most important factors determining the risk of post-operative complications are the surgeon's skill, the procedure's efficiency, and the type of sterilization of surgical instruments.¹⁶ Overall, it can be said that urological surgeries are safe in terms of complications.

Although the majority of our patients did not experience changes in blood pressure, 20% of them developed either hypertension or hypotension after surgery, which merits further investigations. In the present study, we noticed that older people were more prone to changes in blood pressure, suggesting that these people should be more closely examined for hemodynamic stability and underlying cardiovascular diseases before undergoing stone surgery. In one study, Rowley and Wolf stated that age was an important risk factor for open kidney surgery.¹⁷ In fact, advanced age has always been a relative risk factor for surgery due to the instability of the cardiovascular condition during surgery.¹⁸ Therefore, it is recommended to accurately monitor blood pressure during open kidney stone surgery, especially in the elderly.

In our study, gender was not significantly associated with the type of stone. Nevertheless, Costa et al. in their study reported that gender was related to the type of stone.¹⁸ On the other hand, the type of stone had no effects on the durations of surgery and hospitalization in our study. In another study, it was stated that complex stones could prolong the surgery.¹⁹ We also found that the type of stone did not affect patients' needs for additional analgesia. The size of the stone also had no effect on the duration of the surgery or the need for taking pain killers. As previously noted, one of the main factors influencing the amount of analgesia consumption and the duration of surgery is the surgeon's skill in reducing the rate of tissue damages and complications.²⁰

Limitations

The limitations of this study include the impossibility of performing PNL in our hospital, incomplete files, the lack of follow-up of the patient after discharge, and the low sample size. In addition, the number of the patients who experienced different complications was small, so it was not amenable to effectively investigate postoperative outcomes and late complications (stone recurrence, etc.). One reason for the low prevalence of postoperative complications in the present study was the selection of low to moderate risk patients for surgery.

Conclusion

Our study showed that the prevalence of staghorn stones in Sistan region was relatively high. However, neither the type nor the size of stones was associated with clinical outcomes such as the length of hospitalization, duration of surgery, and the need for analgesics administration. It is recommended to perform studies with larger sample sizes in the future. Elderly patients should be monitored in terms of cardiovascular condition before performing stone surgery.

Ethical Approval

In this study, all procedures were in accordance with the national

ethical guidelines in research on human subjects.

Competing Interests

There is no conflict of interest to declare.

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