

Management of ureteric stone in the main referral hospital in Palestine: a retrospective descriptive study

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Abstract

Renal stones disease is one of the most prevalent diseases encountered in the practice of urology. This study described how patients with ureteric stones are managed in the main referral hospital in Palestine. Another aim was to investigate associations between sociodemographic and clinical variables of the patients with the interventions and medications prescribed to manage patients with ureteric stones. Medical and surgical records of patients admitted to the hospital for ureteric stones were reviewed, and relevant data were extracted using a data collection form created for this study. The data extraction form collected the patient's age, gender, comorbidities, interventional procedures, and main laboratory findings like serum creatinine and blood urea nitrogen levels. The final analysis included the complete medical and surgical records of 143 patients in this study. The median age of the patients included was 43.0 [29.0, 55.0] years, the median blood urea nitrogen was 13.8 [10.6, 17.3] mg/dL, and the median serum creatinine was 0.96 [0.75, 1.25] mg/dL. Most patients (79.0%) had a double J stent, and 33 (23.1%) had laser lithotripsy. More than half of the patients (60.8%) received ciprofloxacin. Age had significant and positive moderate correlation with blood urea nitrogen (Spearman's rho = 0.37, p-value < 0.001) and serum creatinine (Spearman's rho = 0.28, p-value = 0.002) levels. Younger age was associated with placement of double J stents patients (Chi-square = 5.1, p-value = 0.039). Placement of double J stent was associated with reporting right or left flanking pain (Chi-square = 16.0, p-value = 0.001). Prescription of ciprofloxacin was associated with prescription of diclofenac sodium (Chi-square = 28.3, p-value < 0.001). In conclusion, patients with ureteric stones were adequately managed using different techniques in a large Palestinian referral hospital. Future studies are still needed to describe how patients with other renal stones are managed in Palestinian urology practice.

Keywords: Ureteric Stones, Renal Stones, Creatinine, Retrospective Study, Urology.

INTRODUCTION

Renal stones, also known as kidney stones, renal calculi, urolithiasis, or nephrolithiasis, are hard deposits of minerals and salts within the kidneys (1). This disease is one of the most prevalent diseases encountered in the practice of urology (2). The leading cause of renal stones is the supersaturation of urine with minerals and salts that deposit and solidify into stones within the renal tract. Notably, the solubility of minerals and salts within the renal system is affected by many factors, including volume of urine, pH, and total excretion of solutes (3).

Stones are often classified based on their composition. Of all stones, calcium oxalate stones are the most prevalent form. Calcium phosphate and oxalate stones account for approximately 75% of all stones (4). Stones are also formed from uric acid, magnesium ammonium phosphate, and cysteine. Predisposing risk factors include male gender, ethnicity, living in hot areas, increased intake of salt and animal proteins, diabetes mellitus, hypertension, obesity, metabolic syndrome, gout, hyperparathyroidism, sarcoidosis, Crohn's disease, renal tubular acidosis, idiopathic hypercalciuria, and homocystinuria (5, 6). Current recommendations to reduce the formation of renal stones include mitigating risk factors like decreasing salt and protein intake and increasing water, fruit, and fiber intake (7).

Previous studies have shown that the prevalence of renal stones varied depending on the climate and population studied. In the United States, renal stones affect approximately 5% of adults (1). A study in King Abdulaziz University Hospital, Saudi Arabia, showed that renal stones were prevalent in 16.9% of 1031 patients (3). Another more extensive study by Ahmad et al. included participants from 30 nationalities who worked in Saudi Arabia (8). The study showed that renal stones were prevalent among 19.16% of the 5371 participants (8, 9). Of the stones, 73.3% were renal stones, 13% were ureteric stones, 9.8% were in the vesicoureteric junction, 2.3% were in the pelvic ureteric junction, and 1.1% were in the bladder, and 0.5% were urethral stones (8). The study showed that renal stones' prevalence varied among participants of different nationalities,

higher among Egyptians (29.5%) and Pakistanis (24.9%).

Patients with renal stones often have flank pain, renal colic, hematuria, obstructive uropathy, urinary tract infections, and hydronephrosis (10, 11). Signs and symptoms vary depending on the site and size of the stone. Patients may also present with dysuria, frequency, and urgency (12). In acute stone events, nausea and vomiting might also be noted (5, 13, 14). Although patients with renal stones often present with one or a combination of the typical signs and symptoms, incidental detection of renal stones was also reported using CT scans (15).

Patients with suspected renal stones are investigated using urinalysis to detect potential hypercalciuria, hyperoxaluria, urine pH, and white blood cells (16). In the emergency department, a CT scan without contrast is the gold standard for diagnosing renal stones in patients with flank pain. Other imaging modalities include pelvic X-ray, kidneys-ureters-bladder radiography, ultrasound, and magnetic resonance imaging (17).

Currently, little is known about how ureteric kidney patients are managed in Palestinian urology practice. This study described how patients with ureteric stones are managed in the main referral hospital in Palestine. Additionally, the study aimed to investigate associations between sociodemographic and clinical variables of the patients with the interventions done and medications prescribed to manage patients with ureteric stones.

METHODS

Study settings and design

This study was conducted in a cross-sectional retrospective design in one of the leading referral hospitals in Palestine. The hospital is located on the West Bank. The hospital provides healthcare services through different departments, including urology.

Sampling and data collection procedures

Because ureteric stones are common among Palestinians (2), more than 20,000 patients should have been managed in the Palestinian urology practice. We calculated the sample size at a 90% confidence interval (90% CI) and accepted a

margin of error of 0.05. The sample size was estimated for the largest population. Based on previous studies, we assumed a prevalence rate of ureteric stones at 12%. Therefore, a population proportion of 12% was used. We used an online sample size calculator (raosoft.com/sample-size.html) to calculate the sample size needed for this study (18). The sample size needed for this study was 115 patients.

Medical and surgical records of patients admitted to the hospital for ureteric stones were reviewed, and relevant data were extracted using a data collection form created for this study. The data extraction form collected the patient's age, gender, comorbidities, interventional procedures, and central laboratory findings like serum creatinine and blood urea nitrogen levels.

The electronic health records were searched for patients admitted with a ureteric stone diagnosis from 2016-to 2021. Different keywords were used to search the electronic system to ensure retrieval of all records. These keywords included all possible variations related to "ureteric stone", "endoscopic double-J ureteric stent", "endoscopy double-J stent", "one side ureteric stone", "middle ureteric stone", "upper ureteric stone", "ureteric stone large volume", "ureteric stone small volume", "ureteroscopy rigid", and "flexible with laser fragmentation". The keywords were searched both individually and collectively. Patient/file identification/serial numbers were used to retrieve medical and surgical records.

Statistical analysis

The data collected in this study were coded and entered into IBM SPSS for Windows v.21.0. The data were assessed for normality of distribution using the Kolmogorov–Smirnov test. As the data were not normally distributed, non-parametric tests were used to analyze the data. Continuous data were presented as median [lower quartile (Q1), upper quartile (Q3)], and categorical data were presented as numbers (percentages). In this study, correlations were assessed using Spearman's rank correlations. Associations were investigated using Chi-square/Fisher's exact tests. A p-value of < 0.05 indicated statistical significance.

RESULTS

Characteristics of the study patients

In this study, the complete medical and surgical records of 143 patients were selected. The median age of the patients included was 43.0 [29.0, 55.0] years, the median blood urea nitrogen was 13.8 [10.6, 17.3] mg/dL, and the median serum creatinine was 0.96 [0.75, 1.25] mg/dL. Of the patients included, 107 (74.8%) were male, 133 (93.0%) had no known allergy, 62 (43.4%) had left ureteric stone, 55 (38.5%) complained from left flank pain, 86 (60.1%) had pre-existing comorbidities, 17 (11.9%) had blood urea nitrogen of 20 mg/dL or more, and 19 (13.3%) had serum creatinine level of 1.35 mg/dL or more. Details of the sociodemographic and clinical characteristics of the patients are shown in (Table 1).

Table (1): Demographic and clinical characteristics of the patients ($n = 143$).

| Characteristic | n | % |
|-------------------------------|-----|------|
| Age (years) | | |
| < 43 | 69 | 48.3 |
| ≥ 43 | 74 | 51.7 |
| Gender | | |
| Male | 107 | 74.8 |
| Female | 36 | 25.2 |
| Having a known allergy | | |
| Yes | 10 | 7.0 |
| No | 133 | 93.0 |
| Diagnosis | | |
| Right ureteric stone | 55 | 38.5 |
| Left ureteric stone | 62 | 43.4 |
| Bilateral ureteric stone | 12 | 8.4 |

| Characteristic | n | % |
|--|-----|------|
| Other | 14 | 9.8 |
| Chief complaint | | |
| Right flank pain | 51 | 35.7 |
| Left flank pain | 55 | 38.5 |
| Bilateral pain | 6 | 4.2 |
| Other descriptions of pain | 31 | 21.7 |
| Presence of known comorbidities | | |
| Yes | 86 | 60.1 |
| No | 57 | 39.9 |
| Blood urea nitrogen (mg/dL) | | |
| < 20 | 126 | 88.1 |
| ≥ 20 | 17 | 11.9 |
| Serum creatinine (mg/dL) | | |
| < 1.35 | 124 | 86.7 |
| ≥ 1.35 | 19 | 13.3 |

Interventions and medications prescribed for the study patients

The majority of the patients (79.0%) had a double J stent placed, 1 (0.7%) had nephrostomy, 22 (15.4%) had their stents removed, 11 (7.7%) had retrograde pyelogram, 2 (1.4%) had fluoroscopy, and 33 (23.1%) had laser lithotripsy. Details of the interventions made in this study are shown in (Table 2).

Table (2): Interventions made in this study

| Intervention | n | % |
|----------------------|-----|------|
| Double J stent | 113 | 79.0 |
| Nephrostomy | 1 | 0.7 |
| Stent removal | 22 | 15.4 |
| Retrograde pyelogram | 11 | 7.7 |
| Fluoroscopy | 2 | 1.4 |
| Laser lithotripsy | 33 | 23.1 |

More than half of the patients (60.8%) received ciprofloxacin, 13 (9.1%) received levofloxacin, 15 (10.5%) received cefuroxime, 2 (1.4%) received ceftriaxone, 5 (3.5%) received cefixime, 61 (42.7%) received paracetamol, 65 (45.5%) received diclofenac sodium, 2 (1.4%) received captopril, 13 (9.1%) received tamsulosin, 6 (4.2%) received bendamustine, 2 (1.4%) received potassium citrate, and 8 (5.6%) received esomeprazole. Details of the medications prescribed for the study patients are shown in (Table 3).

Table (3): Medications prescribed for the study patients.

| Medication | n | % |
|-------------------|----|------|
| Ciprofloxacin | 87 | 60.8 |
| Levofloxacin | 13 | 9.1 |
| Cefuroxime | 15 | 10.5 |
| Ceftriaxone | 2 | 1.4 |
| Cefixime | 5 | 3.5 |
| Paracetamol | 61 | 42.7 |
| Diclofenac sodium | 65 | 45.5 |
| Captopril | 2 | 1.4 |
| Tamsulosin | 13 | 9.1 |
| Bendamustine | 6 | 4.2 |
| Potassium citrate | 2 | 1.4 |
| Esomeprazole | 8 | 5.6 |

Associations between variables of the patients, interventions, and treatments

Age had significant and positive moderate correlation with blood urea nitrogen (Spearman's rho = 0.37, p-value < 0.001) and serum creatinine (Spearman's rho = 0.28, p-value = 0.002) levels. There was a significant positive strong correlation between blood urea nitrogen and serum creatinine levels (Spearman's rho = 0.63, p-value < 0.001).

Older age was associated with presence of known comorbidities (Chi-square = 10.6, p-value = 0.001). On the other hand, younger age was associated with placement of DJ stents (Chi-square

= 5.1, p-value = 0.039) and prescription of cefuroxime (Chi-square = 6.8, p-value = 0.013). Male gender was associated with serum creatinine higher than 1.35 mg/dL (Chi-square = 7.4, p-value = 0.008) and prescription of tamsulosin (Chi-square = 4.8, p-value = 0.039).

Patients who had right ureteric stone complained from right flanking pain and patients who had left ureteric stone complained from left flanking pain (Chi-square = 168.0, p-value < 0.001). Placement of double J stent was associated with reporting right or left flanking pain (Chi-square = 16.0, p-value = 0.001). Blood urea nitrogen of 20 mg/dL and more was associated with prescription of captopril (Chi-square = 15.0, p-value = 0.013). Removal of double J stent was associated with prescription of bendamustine (Chi-square = 5.8, p-value = 0.047). Similarly, having retrograde pyelogram was associated with prescription of bendamustine (Chi-square = 15.8, p-value = 0.006).

Prescription of ciprofloxacin was associated with prescription of diclofenac sodium (Chi-square = 28.3, p-value < 0.001). Patients who received ciprofloxacin were less likely to receive other antibiotics like levofloxacin (Chi-square = 22.2, p-value < 0.001), cefuroxime (Chi-square = 26.0, p-value < 0.001), and cefixime (Chi-square = 8.0, p-value = 0.008). Similarly, patients who received ciprofloxacin were less likely to receive paracetamol (Chi-square = 14.8, p-value < 0.001), and bendamustine (Chi-square = 9.7, p-value = 0.003). Prescription of levofloxacin was associated with prescription of esomeprazole (Chi-square = 8.3, p-value = 0.025). Prescription of cefuroxime was associated with prescription of captopril (Chi-square = 17.3, p-value = 0.010). Patients who received cefuroxime were less likely to receive diclofenac sodium (Chi-square = 7.0, p-value = 0.012) and patients who received paracetamol were less likely to receive diclofenac sodium (Chi-square = 59.6, p-value < 0.001).

DISCUSSION

Renal stones are a joint presentation in urology practice (2). This study reviewed medical and surgical records of patients presenting with ureteric stones to one of the leading referral hospitals in Palestine. This was the first study to describe how patients with ureteric stones were managed

in a Palestinian hospital to the best of our knowledge. Moreover, this study established associations between variables of the patients with the interventions and medications prescribed to manage their condition. The findings of this study might be informative to peer clinicians interested in gaining insight into how patients with ureteric stones are managed in one of the leading referral hospitals in Palestine. Additionally, the findings of this study might be informative to decision-makers who might be interested in improving patient experiences and outcomes in urology practice in Palestine.

In this study, the sample of patients was predominantly of the male gender. The findings of this study were consistent with previous studies that showed that male patients were at higher risk for developing renal stones than female patients (5, 6, 19). More extensive studies in Saudi Arabia, Korea, and Northern Ireland showed gender disparity in the prevalence rates of renal stones (3, 19-21). These studies showed that male patients were 2-3-fold more likely to develop renal stones than female patients. 9.1% of the patients were on tamsulosin for benign prostatic hyperplasia in this study. The findings of this study were consistent with those reported in a retrospective study in Korea in which 9.1% of male patients had a renal stone with benign prostatic hyperplasia as a comorbidity (21). These results might indicate a higher need for mitigating risk factors among men.

There was a positive correlation between age, blood urea nitrogen, and serum creatinine levels among the patients in this study. These findings were not surprising as the advancement of age was associated with a higher prevalence of diseases like hypertension, diabetes mellitus, and benign prostatic hyperplasia (21, 22). In Saudi Arabia, advancement of age was positively correlated with the prevalence of renal stones among residents of Makkah (23). In this study, receiving tamsulosin for benign prostatic hyperplasia was associated with advanced age.

Placement of double J stents was the most common intervention, and nephrostomy was the least common intervention performed on the patients included in this study. Studies have shown that double J stents and percutaneous nephrostomy had very high success rates (24). Since

Finney's first description of the double J stents in 1978, ureteral stenting has become one of the most frequent interventions in urological practice (25, 26). Ureteral stents are commonly used to facilitate drainage of the upper urinary tract. In this study, younger age was associated with the placement of double J stents. Although double J stenting was frequently reported in managing obstructive uropathies, many studies have shown that percutaneous nephrostomy could be a safer and superior method in temporary urinary diversion (27, 28). Previous studies have shown that the placement of double J stents caused discomfort and reduced the patients' quality of life (29). The findings of this study were consistent with those reportedly practiced elsewhere in the world (27, 28). In this study, complaining of right or left flanking pain was associated with the placement of double J stents. The findings of this study were consistent with those reportedly practiced elsewhere in the world (27, 28). Results of this study might indicate that clinicians need to adhere to the recent guidelines in choosing the safer and optimal treatment modality for patients with ureteric stones.

In this study, patients have been prescribed fluoroquinolone antibiotics (ciprofloxacin and levofloxacin) and cephalosporin antibiotics (cefuroxime, ceftriaxone, and cefixime). Additionally, the patients also received analgesics (paracetamol and diclofenac sodium). The patients were prescribed the proton pump inhibitor esomeprazole to reduce gastric discomfort with certain medications. Our findings indicated appropriate prescribing behavior (30, 31).

The findings of this study should be interpreted considering several strengths and limitations. First, this was the first study to describe how patients with ureteric stones are managed in the main referral hospital in Palestine and to investigate associations between sociodemographic and clinical variables of the patients with the interventions done and medications prescribed to manage patients with ureteric stones. Second, a data extraction form was specifically created to collect the primary data from the medical and surgical records of the patients. Third, all complete medical and surgical records of the patients admitted for ureteric stones were included in this analysis. Fourth, the sample size was adequate for

this study design. Fifth, appropriate statistical analyses were used to analyze and facilitate interpreting the data. Finally, the study adhered to the STROBE checklist.

This study also had several limitations. First, this was a retrospective study. Compared to prospective, comparative, and/or interventional studies, retrospective analysis is limited by design. Second, the data collected in this study were obtained from the medical and surgical records of the patients. In this study, we did not collect blood samples or interview the patients to collect their sociodemographic data. Third, the data collected in this study was limited to patients with ureteric stones. Including patients with another type of renal stone could have provided more comprehensive findings. Fourth, this was a single-center study. A more extensive multicenter study should have reported more reliable experience managing ureteric stones in Palestinian hospitals. Finally, the data analyzed in this study were collected from the primary referral private hospital. Treatment modalities could vary between private and governmental hospitals in Palestine. Including patients from governmental and private hospitals should have provided a more comprehensive experience for patients with ureteric stones in Palestine.

CONCLUSION

In conclusion, using various procedures, patients with ureteric stones were satisfactorily handled in a big Palestinian referral hospital. Medication prescriptions were also sufficient. Age, blood urea nitrogen, and serum creatinine levels had a favorable relationship. The presence of a double J was connected with younger age. Future research must detail how patients with additional renal stones are treated in Palestinian urological practice.

Ethics approval and consent to participate

Approval was obtained from the Institutional Review Board of An-Najah National University. Approval was also taken from the hospital before the medical and surgical records were accessed. The patients' anonymity was maintained throughout the trial, and no information that may have been used to identify the patients was obtained.

Consent for publication

Not applicable.

Availability Of Data And Materials

The data relevant to this work were included in the body of the manuscript and tables. The data sets used in the analysis can be obtained from the corresponding author upon request.

AUTHOR'S CONTRIBUTION

Hatem Hijaz and Ramzi Shawahna: conceptualization, writing-original draft, data curation, formal analysis, investigation, methodology, project administration, supervision, validation, visualization, and writing review & editing.

Enas Al-Naser, Ahmed Younis, and Amal Obaid: writing-original draft, data curation, formal analysis, investigation, validation, visualization, and writing review & editing.

COMPETING INTEREST

The authors declare no competing interests.

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REFERENCES

- 1) Worcester EM, Coe FL. *Nephrolithiasis. Primary care*. 2008;35(2):369-91, vii.
- 2) Tae BS, Balpukov U, Cho SY, Jeong CW. Eleven-year cumulative incidence and estimated lifetime prevalence of urolithiasis in Korea: a national health insurance service-national sample cohort based study. *J Korean Med Sci*. 2018;33(2):e13-e.
- 3) Safdar OY, Alblowi SS, Aboulola NA, Alharazy DT. Renal stones and risk factors in Jeddah and Riyadh. *Saudi journal of kidney diseases and transplantation : an official publication of the Saudi Center for Organ Transplantation, Saudi Arabia*. 2021; 32(1): 191-8.
- 4) Viljoen A, Chaudhry R, *Bycroft J. Renal stones*. *Ann Clin Biochem*. 2019; 56(1): 15-27.
- 5) Corbo J, Wang J. Kidney and ureteral stones. *Emerg Med Clin North Am*. 2019; 37(4): 637-48.
- 6) Thongprayoon, C, Krambeck AE, Rule AD. Determining the true burden of kidney stone disease. *Nat Rev Nephrol*. 2020; 16(12): 736-46.
- 7) Ferraro PM, Bargagli M, Trinchieri A, Gambaro G. Risk of kidney stones: influence of dietary factors, dietary patterns, and vegetarian-vegan diets. *Nutrients*. 2020; 12(3).
- 8) Ahmad F, Nada MO, Farid AB, Haleem MA, Razack SM. Epidemiology of urolithiasis with emphasis on ultrasound detection: a retrospective analysis of 5371 cases in Saudi Arabia. *Saudi journal of kidney diseases and transplantation : an official publication of the Saudi Center for Organ Transplantation, Saudi Arabia*. 2015; 26(2): 386-91.
- 9) Sorokin I, Mamoulakis C, Miyazawa K, Rodgers A, Talati J, Lotan Y. Epidemiology of stone disease across the world. *World J Urol*. 2017; 35(9): 1301-20.
- 10) Misgar RA, Sehgal A, Masoodi SR, Wani AI, Bashir MI, Malik AA, et al. A Comparison between silent and symptomatic renal stones in primary hyperparathyroidism. *Indian journal of endocrinology and metabolism*. 2019; 23(1): 46-9.
- 11) Ragab M, Baldin N, Collie J, Tran MGB, Al-Hayek S, K SP, et al. Qualitative exploration of the renal stone patients' experience and development of the renal stone-specific patient-reported outcome measure. *BJU international*. 2020; 125(1): 123-32.
- 12) Streeper NM. Asymptomatic renal stones-to treat or not to treat. *Current urology reports*. 2018; 19(5): 29.
- 13) Alelign T, Petros B. Kidney stone disease: an update on current concepts. *Adv Urol*. 2018; 2018: 3068365.
- 14) D'Costa MR, Haley WE, Mara KC, Enders FT, Vrtiska TJ, Pais VM, et al. Symptomatic and radiographic manifestations of kidney stone recurrence and their prediction by risk factors: a prospective cohort study. *J Am Soc Nephrol*. 2019; 30(7): 1251-60.

- 15) ISaeed S, Ullah A, Ahmad J, Hamid S. The prevalence of incidentally detected urolithiasis in subjects undergoing computerized tomography. *Cureus*. 2020; 12(9): e10374-e.
- 16) Williams JC, Jr., Gambaro G, Rodgers A, Asplin J, Bonny O, Costa-Bauzá A, et al. urine and stone analysis for the investigation of the renal stone former: a consensus conference. *Urolithiasis*. 2021; 49(1): 1-16.
- 17) Brisbane W, Bailey MR, Sorensen MD. An overview of kidney stone imaging techniques. *Nat Rev Urol*. 2016; 13(11): 654-62.
- 18) Raosoft I. Sample size calculator. 2020.
- 19) Amir A, Matlaga BR, Ziemba JB, Sheikh S. Kidney stone composition in the Kingdom of Saudi Arabia. *Clin Nephrol*. 2018; 89(5): 345-8.
- 20) Tyson M, Grimes N, McAuley L, Hennessy D, Pahuja A, Young M. Renal and Ureteric Stone Composition: A five year retrospective study for Northern Ireland. *Ulster Med J*. 2019; 88(1): 21-4.
- 21) Jung JH, Park J, Kim WT, Kim HW, Kim HJ, Hong S, et al. The association of benign prostatic hyperplasia with lower urinary tract stones in adult men: a retrospective multicenter study. *Asian J Urol*. 2018; 5(2): 118-21.
- 22) Sancak EB, Reşorlu M, Akbas A, Gulpinar MT, Arslan M, Resorlu B. Do hypertension, diabetes mellitus and obesity increase the risk of severity of nephrolithiasis? *Pak J Med Sci*. 2015; 31(3): 566-71.
- 23) Nassir AM. Prevalence and characterization of urolithiasis in the Western region of Saudi Arabia. *Urol Ann*. 2019; 11(4): 347-52.
- 24) Weltings S, Schout BMA, Roshani H, Kamphuis GM, Pelger RCM. Lessons from literature: Nephrostomy versus double J ureteral catheterization in patients with obstructive urolithiasis-which method is superior? *J Endourol*. 2019; 33(10): 777-86.
- 25) Farouk A, Tawfick A, Hasan M, Abuftira AA, Maged WA. Can magnitip double-J stent serve as a substitute for a standard double-J stent? *Turk J Urol*. 2019; 45(6): 437-43.
- 26) Chew BH, Knudsen BE, Denstedt JD. The use of stents in contemporary urology. *Curr Opin Urol*. 2004; 14(2): 111-5.
- 27) Mokhmalji H, Braun PM, Martinez Portillo FJ, Siegsmund M, Alken P, Köhrmann KU. Percutaneous nephrostomy versus ureteral stents for diversion of hydronephrosis caused by stones: a prospective, randomized clinical trial. *J Urol*. 2001; 165(4): 1088-92.
- 28) Ahmad I, Saeed Pansota M, Tariq M, Shahzad Saleem M, Ali Tabassum S, Hussain A. Comparison between double J (DJ) ureteral stenting and percutaneous nephrostomy (PCN) in obstructive uropathy. *Pak J Med Sci*. 2013; 29(3): 725-9.
- 29) Bosio A, Alessandria E, Dalmasso E, Peretti D, Agosti S, Bisconti A, et al. How bothersome double-J ureteral stents are after semirigid and flexible ureteroscopy: a prospective single-institution observational study. *World J Urol*. 2019; 37(1): 201-7.
- 30) Deliveliotis C, Giftopoulos A, Koutsokalis G, Raptidis G, Kostakopoulos A. The necessity of prophylactic antibiotics during extracorporeal shock wave lithotripsy. *International Urology and Nephrology*. 1997; 29(5): 517-21.
- 31) Wollin DA, Joyce AD, Gupta M, Wong MYC, Laguna P, Gravas S, et al. Antibiotic use and the prevention and management of infectious complications in stone disease. *World Journal of Urology*. 2017; 35(9): 1369-79.