Audit

Morbidity associated with surgical treatment of ureteric calculi in a teaching hospital in Kuwait

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Background: Ureteric lithiasis is a common urological problem in Kuwait. Because of the different interventional approaches, we carried out an audit on the morbidity associated with the surgical management of the disorder.

Patients and Methods: The surgical records were reviewed of all patients with the diagnosis of ureteric lithiasis that were managed surgically by ureteroscopy or ureterolithotomy in Mubarak Al-Kabeer Hospital in Kuwait between January 1996 and December 1999. Patients' bio-data, location of calculi, indications for surgical intervention, types of therapeutic interventions, operating surgeon and complications were analysed. Patients managed primarily and successfully by extracorporeal shockwave lithotripsy were excluded from this analysis.

Results: A total of 1383 patients with ureteric calculus were managed in the period under review – 775 (56%), 567 (41%), and 41 (3%) patients were managed by extracorporeal shockwave lithotripsy, ureteroscopy and ureterolithotomy, respectively. The 608 patients managed by ureteroscopy or ureterolithotomy had a total of 710 operations. The commonest surgical procedure performed was ureteroscopy with Dormia basket with or without double 'J' stenting and this accounted for 418 (58.9%) operations. The least common procedure was ureteric meatotomy with Dormia basket and with or without double 'J' stenting in 9 (1.3%) patients. The overall complication rate was 110 out of 710 (15.5%) operations. Of the complications, 101 (92%) were minor (e.g. haematuria, fever, and mucosal injury). Nine (8%) complications were major complications (e.g. ureteric perforation and ureteric avulsions). Ureterolithotomy and ureteroscopy with intracorporeal lithotripsy were associated with the highest complication rates.

Conclusions: This analysis has shown that with technological advances, the treatment of ureteric lithiasis has improved and major complications have decreased. However, with so many therapeutic options to choose from, there is a need to audit the various therapeutic options and select those associated with the least morbidity rates in each urology unit.

Key words: Ureteric calculi – Ureteroscopy – Ureterolithotomy – Morbidity – Surgical audit

Continuous quality improvement programmes include auditing as part of health care assessment.¹ In the

course of surgical auditing in Mubarak Al-Kabeer Hospital, Kuwait the surgical management of ureteric

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lithiasis was chosen because: (i) it is a common urological disorder in Kuwait; and (ii) there are many therapeutic options for most ureteric calculi.

The management of urolithiasis has undergone a revolution since the introduction of extracorporeal shockwave lithotripsy in the early 1980s.²⁻⁴ It is also true that about 80% of all ureteral stones will pass spontaneously. Factors determining spontaneous passage of calculi are the size of the calculus and its location. Thus for stones less than 4 mm located in the distal ureter, Sandegard⁵ determined a 93% chance of spontaneous passage within 6 weeks of onset of symptoms. A similar stone in the proximal ureter has only an 81% chance of passage. Stones 4–6 mm in largest diameter have a 50% chance of passage from either the proximal or distal ureter. While most urologists agree that the vast majority of stones greater than 6 mm are likely to require surgical intervention, because of advances in technology, the therapeutic options for significant ureteral calculi today are varied.⁶⁻⁸ These options include *in situ* extracorporeal shockwave lithotripsy, with or without 'J' stenting, ureteroscopy, percutaneous litholapaxy, 'push and bang', and ureterolithotomy (open or laparoscopic). This makes the management of ureteric calculi a worthwhile subject for auditing, to assess not only the quality of surgical care but also clinical judgement on the part of the treating surgeon.⁶ Extracorporeal shockwave lithotripsy is very effective in treating many ureteral stones without the potential morbidity associated with ureteroscopy.^{10,11} Ureteroscopy is, therefore, reserved primarily for those patients in whom primary extracorporeal shockwave lithotripsy has failed or in those patients in whom extracorporeal shockwave lithotripsy is contraindicated.^{10,12} The indications for open and laparoscopic ureterolithotomy has diminished with time because of effective therapeutic options like extracorporeal shockwave lithotripsy and ureteroscopy.

The objective of this retrospective study was to identify and quantify the types of morbidities associated with the management of ureteric lithiasis in Mubarak Al-Kabeer Hospital in order to assess the performance of urologists in the hospital with those from other published series.

Patients and Methods

Patients with a diagnosis of ureteric calculus that were managed surgically using ureteroscopy or ureterolithotomy in Mubarak Al-Kabeer Hospital from January 1996 through December 1999 were included in this retrospective analysis. The data collected from each case note included age, diagnosis, name and rank of the operating urologist, the type of surgical procedure that

Table 1 Location of calculi treated surgically

Location in ureter	Side		Total	%
	Right	Left		
Upper third	105	115	220	36.2
Middle third	27	18	45	7.4
Lower third	160	183	343	56.4
Total	292 (48.%)	316 (52%)	608	100

the patients had (Fig. 1), the recorded intra-operative and postoperative complications and the duration of postoperative hospital stay. The location of the calculi in the ureter and indications for surgical intervention were also noted. These data were entered into the Statistical Package for Social Sciences Data Base (SPSS) v. 10 for analysis. Patients (775) managed primarily and successfully by extracorporeal shockwave lithotripsy were excluded from this analysis. Also excluded were patients who passed their calculi spontaneously. At the time this analysis was undertaken, we had no facilities for laparoscopic ureterolithotomy. This therapeutic option became available in our unit in early 2002.

Results

In the 4-year period under review, 1383 patients with ureteric lithiasis were managed by our unit – 775 (56%), 567

Figure 1 Types of surgical procedures performed in patients with ureteric calculus. The types of surgical procedures are: (1) ureteroscopy with Dormia basket with or without double 'J' stenting; (2) ureteroscopy with intracorporeal lithotripsy, Dormia basket with or without double 'J' stenting; (3) ureteric dilatation of ureteric stricture + ureteroscopy + double 'J' stenting; (4) ureteroscopy + forceps extraction with or without double 'J' stenting; (5) ureteroscopy 'push' calculus into renal pelvis + double 'J' stenting followed by extracorporeal shockwave lithotripsy ('push and bang'); (6) primary ureterolithotomy; (7) ureterolithotomy proceeded by ureteroscopy (conversion to open); (8) ureteric meatotomy ± Dormia basket ± double 'J' stenting; (9) ureteroscopy followed by ureteric re-implantation.

Table 2 Primary indications for surgical intervention in patients with ureteric calculus

Indications	Number	%
Obstructing ureteric calculus (plus stricture) ^a	139	22.9
Failure of extracorporeal shockwave lithotripsy ^b	135	22.2
Obstructing ureteric calculi (no stricture)	123	20.2
Failure of conservative Mx	89	14.6
Patients desire/choice ^c	66	10.9
Treatment of Steinstrasse	56	9.2
Total	608 ^d	100

^aThree patients had previous ureteroscopy or extracorporeal shockwave lithotripsy, the remaining 136 patients were Egyptians with ureteric stricture secondary to schistosomiasis.

^bFailure of extracorporeal shockwave lithotripsy mostly due to calculi in the lower third of the ureter, or difficulty with localisation especially with radioluscent calculi.

^cPatient desire to get rid of calculi as soon as possible, *i.e.* no initial trial of *in situ* extracorporeal shockwave lithotripsy.

^dSome patients had more than one indication for surgical intervention; however, the most important indication was considered the primary indication for surgical intervention.

(41%) and 41 (3%) patients were managed by extracorporeal shockwave lithotripsy, ureteroscopy and ureterolithotomy, respectively. The case notes of 99 patients either could not be found or contained insufficient clinical data and were excluded from further analysis. The total number of surgical procedures performed on the 608 patients who were managed surgically (ureteroscopy or ureterolithotomy) was 710. There were 447 men and 159 women with a mean age of 37.2 years (range, 15–75 years). Our unit does not treat paediatric patients.

Table 3 Types of morbidity encountered in patients with ureteric calculus managed surgically

Types of morbidity	Number	%
Fever	37	5.2
Haematuria	33	4.5
False passage	14	2
Injury to mucosa	12	1.7
Ureteric perforation	7	1
Urinary tract infection	4	0.6
Ureteric avulsion	2	0.3
Reflux	1	0.1
Total	110	

Some patients had more than one complication. There were a total of 110 complications in 608 patients. Of the 110 complications, 92% could be regarded as minor or intermediate.

Table 1 shows the location of the calculi in the ureter by the time the patients were subjected to surgical intervention. The most common location was in the lower third of the ureter on both sides; the least common being the middle third. The indications for surgical intervention are shown in Table 2. The three most common indications were obstructing ureteric calculus above a ureteric stricture (22.9%), failure of extracorporeal shockwave lithotripsy (22.2%) and obstructing ureteric calculus but with no ureteric stricture (20.2%). Figure 1 shows the type of surgical procedures that the patients received. The commonest surgical procedure was ureteroscopy with Dormia basket stone extraction with or without double 'J' stenting insertion. Table 3 shows the type of complications encountered in patients with ureteric calculus managed surgically. A total of 110 complications were encountered

Table 4 Types of morbidity versus types of surgical procedures

Morbidity	Types of surgical procedures								
	1	2	3	4	5	6	7	8	9
Fever	14	6	0	2	2	8	3	0	1
Haematuria	17	10	4	1	1	0	0	0	0
False passage	9	3	0	0	1	0	0	1	0
Ureteric perforation*	4	2	0	1	0	0	0	0	0
Injury to mucosa	5	3	1	2	0	1	0	0	0
Ureteric avulsion*	2	0	0	0	0	0	0	0	0
UTI	1	2	1	0	0	0	0	0	0
Reflux	0	0	0	0	1	0	0	0	0
Total no. of morbidity	52	26	6	6	5	9	3	1	1
Total no. of procedures	418	115	52	36	34	28	13	9	3
Complication rate (%)	12.4	22.6	11.5	16.7	14.7	32	23.1	11.1	33.3

Types of surgical procedures are: (1) ureteroscopy with Dormia basket with or without double 'J' stenting; (2) ureteroscopy with intracorporeal lithotripsy, Dormia basket with or without double 'J' stenting; (3) ureteric dilatation of ureteric stricture + ureteroscopy + double 'J' stenting; (4) ureteroscopy + forceps extraction with or without double 'J' stenting; (5) ureteroscopy 'push' calculus into renal pelvis + double 'J' stenting followed by extracorporeal shockwave lithotripsy ('push and bang'); (6) primary ureterolithotomy; (7) ureterolithotomy preceded by ureteroscopy (conversion to open); (8) ureteric meatotomy ± Dormia basket ± double 'J' stenting; (9) ureteroscopy followed by ureteric re-implantation.

*Major complications.

Figure 2 Left ureteric avulsion caused by the following factors: (A) attempting to remove a fairly big mid-ureteric calculus by ureteroscopy and Dormia basket; (B) ureter avulsed as the stone was pulled with excessive force in an attempt to get it through the narrowing at the junction of the abdominal and pelvic ureter. Alternative and probably safer treatment options for this patient would include any of the following: as the stone caused complete ureteric obstruction – initial insertion of a PCN tube followed by: (i) *in situ* extracorporeal shockwave lithotripsy; (ii) push calculus into the renal pelvis, insert a 'J' stent, and follow with extracorporeal shockwave lithotripsy; (iii) ureteroscopy + intracorporeal lithotripsy; or (iv) ureterolithotomy (open or laparoscopic).

in 608 patients (*i.e.* an overall complication rate of 15.5%). Some of the patients had more than one complication. Only 9 complications (8.2%) could be regarded as major as shown in Table 3. These major complications were major ureteric perforation in 7 patients and ureteric avulsion in 2 patients. An error of judgement in trying to remove a big mid-ureteric calculus using a Dormia basket was responsible for one of the ureteric avulsions (Fig. 2).

Two patients had nephroureterectomy as a last resort. These were 2 patients in whom the ureters were avulsed and despite repeated surgical repairs, and also because of severely diminished ipsilateral renal function, the renal units could not be saved. Table 4 shows the types of morbidity encountered for each category of surgical procedure. Although the highest complication rate was seen in patients who had ureterolithotomy it was mainly postoperative fever, while patients who had ureteroscopy

with intracorporeal lithotripsy with or without Dormia basket and or double 'J' stent or both had more serious complications (Table 4).

Figure 3 shows the number of surgical procedures performed by each urologist in the unit during the period under review. The highest complication rate was seen with the urologist who did the most surgical procedures (Figs 4&5). This particular surgeon attempted removing more stones located in the proximal ureter than other surgeons.

The median postoperative hospital stay was 10 days (range, 2–41 days) – 457 (75.2%) patients were discharged within 7 days of surgery, while 128 (21.1%) and 23 (3.7%) patients spent 1–3 weeks and greater than 3 weeks, respectively, in hospital after surgery.

It was noticed that Arabs constituted 55.7% of the total number of patients treated. Patients of Egyptian nationality

Figure 3 Number of surgical procedures performed by each urologist. Numbers on the x-axis represent different doctors performing the procedure. For reasons of confidentiality, the names of the operating surgeons have not been disclosed. Number 1 is the operating surgeon while number 9 is the most junior urologist. Number 10 represents other doctors performing less than 5 procedures each during the 4 years of this review.

constituted 44% of the total number. The majority of the Egyptian patients had concomitant ureteric strictures in addition to ureteric calculi (Fig. 6). In this group of patients, treatment was often difficult because of concurrent schistosomiasis-induced ureteric stricture; therefore, a high rate of morbidity and prolonged postoperative hospital stay can be expected. There was one mortality (0.2%) in patients with ureteric calculus managed surgically in our unit in the period under review. The cause of death was myocardial infarction on postoperative day 3. The patient had bilateral ureterolithotomy in a procedure lasting about 4 h.

Discussion

Urolithiasis is the commonest urological disorder managed in our urology unit. There are various treatment options depending on the size of the calculus, the location of the calculus, presence or absence of ureteric strictures and or obstruction and whether the patient has one or two kidneys. This makes the management of ureteric lithiasis an ideal subject for auditing with the aim of identifying treatment options associated with higher complication rates.

Complications can be classified as minor (those responding to conservative or ureteral catheter drainage) or major (those requiring immediate or delayed surgical intervention). The reported incidence of minor complication is 0–35%^{10,13–18} compared to a crude rate of 15.5% in this series. In this study, the rate of major ureteric perforation was 1% using a rigid ureteroscope, while in other published studies the rates were 2% using semirigid

Figure 4 Complication rates of each operating urologist. For reasons of confidentiality, the identity of the operating surgeons has not been revealed.

Figure 5 Percentage of morbidity of operations for each doctor. The percentage morbidity for each surgeon derived from the total number of operations performed *versus* the total number of complications per surgeon.

ureteroscopes, 11.2% with rigid ureteroscopes, and 4.5% when electrohydraulic lithotripsy was used during ureteroscopy.^{7,13,14,19–23} The rate of mucosal injury in this study was 2% while it was 6.1% with the use of a semirigid ureteroscope in another study.²⁰ In this study, the morbidity rates were better than those reported in some published studies.

Overall, the complications were minor (*e.g.* fever and haematuria). The number of patients developing fever or sepsis after ureteroscopy can be reduced further by appropriate pre-operative antibiotic usage. Antibiotic prophylaxis is, therefore, recommended prior to ureteroscopy. The complication rates per urologist range from 0% to 14.8%, this is within accepted limits.^{10,13,15} However, it is interesting to note that the surgeon who performed the highest number of procedures (153) also had the highest

Figure 6 Typical intravenous urography in an Egyptian patient with schistosomiasis-induced left ureteric stricture with massive stone burden above the stricture. Note the faint ring calcification of the bladder and lower third of the ureters – tell-tale signs of previous infestation with schistosomiasis. This patient also had a small non-obstructing right lower third ureteric calculus. The patient was successfully managed by a one stage procedure: (A) right ureteroscopy + Dormia basket extraction of calculus in the right ureter; (B) open left ureterolithotomy, excision of left ureteric stricture with end-to-end anastomosis.

complication rate of 14.8%. A possible explanation for this may be that the Urologist concerned, being more experienced, took on the more difficult cases that were liable to result in higher complication rates. The surgeon concerned did more ureteroscopy for stones located in the proximal ureter than other surgeons. His learning curve has since dramatically improved. Ureteroscopy for calculi located in the proximal ureter are often associated with higher complication rates.^{7,24} As in other series, this review has also confirmed that open surgery for stones is associated with higher complication rates.¹⁰ For patients subjected to ureteroscopy, patients having intracorporeal lithotripsy are also more likely to have higher complication rates. Ureteric avulsion remains the most important complication of ureteroscopy. As illustrated in Figure 2, sound clinical judgement is the most important factor to avoid this complication. The duration of postoperative hospital stay in our unit appears long compared to other published series.^{13–15,24} However, this was partly due to the management of complicated cases in

our unit particularly patients with schistosomiasis-induced ureteric strictures with significant burden of ureteric calculi as shown in Figure 6. The only mortality occurred in a patient who had bilateral ureterolithotomy. The cause of death was myocardial infarction on the third postoperative day.

Conclusions

Complication rates associated with the surgical management of ureteric lithiasis in Mubarak Al-Kabeer Hospital are lower than those from some published studies, presumably because of a large patient population treated by our unit. The complication rates per operating urologist vary widely, but are within accepted limits. Fever in the postoperative period is the commonest complication after ureteroscopy in Mubarak Al-Kabeer Hospital. To reduce the incidence of this complication, the use of prophylactic antibiotics is highly recommended prior to ureteroscopy. With many treatment options to

choose from, sound clinical judgement remains of paramount importance in minimising the morbidity associated with the surgical treatment of ureteric calculi.

References

- Rowland HS, Rowland BL. *Hospital and Health Quality Management*, vols 1 and 2. Aspen(Denver), Colorado, USA, 1996.
- Chaussy C, Schmidt E, Jochan D, Schuller J, Brandl H, Liedl B. ESWL for treatment of urolithiasis. *Urology* 1984; **23** (Suppl.): 59–64.
- Tolley DA, Downey P. Current advances in shockwave lithotripsy. *Curr Opin Urol* 1999; **9**: 319–23.
- Chow GK, Stroom DB. Extracorporeal lithotripsy. Update on technology. *Urol Clin North Am* 2000; **27**: 315–22.
- Sandegard E. Prognosis of stone in the ureter. *Acta Chir Scand* 1956; **219** (Suppl.): 1–30.
- Ueno A, Kawamura T, Ogawa A, Takayashi H. Relationship of spontaneous passage of ureteral calculi to size. *Urology* 1997; **10**: 544–6.
- Daniel GF, Garnett JE, Carter MF. Ureteroscopic results and complications: experience with 130 cases. *J Urol* 1988; **139**: 710–5.
- Micali S, Moore RG, Averch TD, Adams JB, Kavoussi LR. The role of laparoscopy in the treatment of renal and ureteral calculi. *J Urol* 1997; **157**: 463–6.
- Keeley FX, Gialas I, Pillai M, Chrisofos G, Tolley DA. Laparoscopic ureterolithotomy. The Edinburgh experience. *BJU Int* 1999; **84**: 765–9.
- Ather MH, Paryani J, Memon A, Sulaiman MN. A 10 year experience of managing ureteric calculi: changing trends towards endourological intervention. *BJU Int* 2001; **88**: 171–7.
- Anderson KR, Keetch DW, Albala DM, Chandoke PS, McClennan BL, Clayman RV. Optimal therapy for distal ureteral stone: ESWL *versus* ureteroscopy. *J Urol* 1994; **152**: 62–5.
- Albala DM. How to approach the problematic ureteral stone. *J Urol* 1993; **150**: 65–70.
- Francesca N, Scattoni V, Nava L, Pompa P, Grasso M, Rigatti P. Failures and complications of transurethral ureteroscopy in 297 cases: conventional rigid instruments *versus* small caliber semirigid ureteroscopes. *Eur Urol* 1995; **28**: 112–5.
- Turk TM, Jenkins AD. A comparison of ureteroscopy to *in situ* extracorporeal shock wave lithotripsy for the treatment of distal ureteral calculi. *J Urol* 1999; **161**: 45–7.
- Du Fosse W, Billiet I, Mattelaer J. Ureteroscopic treatment of ureteric lithiasis. Analysis of 354 procedures in a community hospital. *Acta Urol Belg* 1998; **66**: 33–40.
- Preston JM. Iatrogenic ureteric injury: common medico legal pitfalls. *BJU Int* 2000; **86**: 313–7.
- Stackl W, Marberger M. Late sequelae of the management of ureteral calculi with the ureteroscope. *J Urol* 1986; **136**: 386–8.
- El-Faqih SR, Hussein I, Ekman PE, Sharma ND, Chakrabarty A, Talic R. Primary choice of intervention for distal ureteric stone: ureteroscopy or ESWL. *Br J Urol* 1988; **62**: 13–8.
- Singal RK, Razvi HA, Densted JD. Secondary ureteroscopy: results and management strategy at a referral centre. *J Urol* 1998; **159**: 52–5.
- Yang SS, Hong JS. Electrohydraulic lithotripsy of upper ureteral calculi with semirigid ureteroscope. *J Endourol* 1996; **10**: 27–30.
- Ilker Y, Dillioglulugil O, Tercan T, Turkeri L, Akdas A. The role of ureteroscopy as a diagnostic and therapeutic tool in various indications. *Int Nephrol* 1994; **26**: 647–54.
- See AC, Ng FC, Chung HC. Electrohydraulic lithotripsy: an effective and economical modality of endoscopic ureteric lithotripsy. *Aust NZ J Surg* 1997; **67**: 551–3.
- Elashry OM, DiMeglio RB, Nakada SY, McDougall EM, Clayman RV. Intracorporeal electrohydraulic lithotripsy of ureteral and renal calculi using small caliber (1.9) electrohydraulic lithotripsy probes. *J Urol* 1996; **156**: 1581–5.
- Puppo P, Ricciotti G, Bozzo W, Introini C. Primary endoscopic treatment of ureteric calculi. A review of 378 cases. *Eur Urol* 1999; **36**: 48–52.