Urol Res (2007) 35:215–218
DOI 10.1007/s00240-007-0101-9

CASE REPORT

Perforation of the upper ureter: a rare complication of extracorporeal shock wave lithotripsy

Mehmet Turgut · Cavit Can · Aydin Yenilmez · Nevbahar Akcar

Received: 2 April 2007 / Accepted: 7 May 2007 / Published online: 31 May 2007

Abstract Perforation of the upper ureter is a rare but serious complication of extracorporeal shock wave lithotripsy (SWL). Ureteral perforation can cause a series of problems including the retroperitoneal urinoma, urosepsis, abscess formation, infection, and subsequent renal function impairment. We reported here a rare case of SWL-induced upper ureteral rupture resulting in an expanding retroperitoneal urinoma that required percutaneous drainage. Ureteral perforation was treated successfully without major surgical intervention by employing temporary percutaneous drainage and antibiotics. The present case indicates that potential ureter rupture may form in rare cases; especially in patients having infected stones and exposed to a high number of shock waves. This complication further emphasizes the importance of adequate pre-and post-operative evaluation and the precise identification of the cause of the persistent pain after SWL.

Keywords Extracorporeal shock wave lithotripsy · Complication · Urinary stone · Ureter perforation

Introduction

Extracorporeal shock wave lithotripsy (SWL) has become the preferred treatment modality for many urologists because of its effective, practical and noninvasive nature for the majority of the stones located in the upper urinary tract. The features of the stone, such as size, location, nature, number, and urinary system anatomy, define the indications for SWL. Complications of this procedure are related to the administration of shock waves, which may affect adjacent organs as well as the urinary system, and to the fragmented particles which may cause ureteral colic and ureteral obstruction. The incidence of the major complications after SWL is less than 1% and they include subcapsular and perirenal hematoma, ureterovaginal and ureterocolic fistula, ruptured renal pelvis and spleen, acute pancreatitis and pulmonary complications [1–7]. In addition to these complications, to our knowledge retroperitoneal urinoma resulting from the perforation of upper ureter during or following SWL treatment has not been reported in the English literature. Therefore, this might be the first reported case.

Case report

A 32-year-old female patient was admitted to our clinic with severe discomfort in the right upper abdomen. She also had fever, nausea and anorexia. The patient's history revealed an SWL procedure performed 2 weeks earlier for a right proximal ureteral stone (7 × 5 mm). The stone was diagnosed by the presence of a radio-opacity in the upper ureter trajectory using plain kidney-ureter-bladder (KUB) film and this was further verified by ultrasonography. The stone was present in the upper ureter and a mild to moderate hydroureteronephrosis was seen proximal to it on USG. During the procedure a total of 4,500 shock waves, 80 shocks per min, at 21 kV (for each wave) in one session were applied using an electrohydraulic lithotripter (PCK, Ankara, Turkey).

M. Turgut (✉) · C. Can · A. Yenilmez
Department of Urology,
Eskisehir Osmangazi University, Eskisehir, Turkey
e-mail: mturgut@ogu.edu.tr

N. Akcar
Department of Radiology,
Eskisehir Osmangazi University, Eskisehir, Turkey

Both hematological and biochemical parameters were all within normal limits prior to the SWL procedure. Urine analysis demonstrated 2–3 erythrocytes and 4–5 white blood cells per high power field and urine culture was found to be sterile. Twenty-four hours after the SWL procedure, the patient visited the same center because of moderate colic pain attacks localized in her right upper abdomen. The pain was thought to be due to a common complication of SWL and no specific radiological evaluation was done. The patient was prescribed an analgesic and was scheduled for a follow-up appointment. During 2 weeks after SWL, in her history she stated that she had occasional colicky flank pain attacks, presumably due to passing gravel that she did not notice. Since the analgesic did not relieve the pain and the pain attacks became worse and she had fever, the patient sought help from our hospital. Physical examination of the patient in our department revealed an evident tenderness in her right upper abdomen and a KUB film demonstrated a 5 × 4 mm radio-opacity in her right lower ureter at the level of the spina ischiadica. In addition to the presence of a large anechogenic retroperitoneal collection on sonographic examination, computed tomography showed a large retroperitoneal fluid collection behind the right kidney and hydronephrosis characterized by an evident hypodens (Fig. 1). Although laboratory examinations did show an elevated white blood cell count (21,000/μl), urine analysis and other biochemical parameters were all within normal limits and urine culture was sterile. Since intravenous urography (IVU) was not feasible due to the occurrence of massive intestinal gas in the affected area, retrograde pyelography (RGP) was done under local anesthesia. RGP assessment showed that the middle and distal portions of the ureter were intact; a 5 × 4 mm stone was located in the distal ureter, and contrast medium leakage was present from the ureter at the level of L4 transverse process. The leakage was so extensive that no contrast medium was able to get into the pelvis; thus it was not possible to further visualize the proximal ureter and right renal pelvis. To bypass the perforation and confine contrast medium in the upper ureter and pelvis to visualize the proximal ureter and right renal pelvis, a 10F pigtail percutaneous nephrostomy catheter was placed into the renal pelvis; in addition, a 14F Malecot catheter was placed into the retroperitoneal space to drain the fluid collection. Through the Malecot catheter, 800 cc purulent urine was drained. The urine was cultured and found to be *Escherichia coli* positive. Subsequently, antegrade pyelography (AGP) performed through the nephrostomy catheter showed that except for the leakage point the rest of the upper ureter and pelvis were intact and contrast medium leakage was present from the ureter at the L4 transverse process level (Fig. 2). The nephrostomy catheter drainage was 1,000–1,500 ml per day throughout treatment and Malecot catheter drainage was present for the first 48 h

Fig. 1 Large retroperitoneal fluid collection behind the right kidney. CT section shows that the right kidney is hydronephrotic

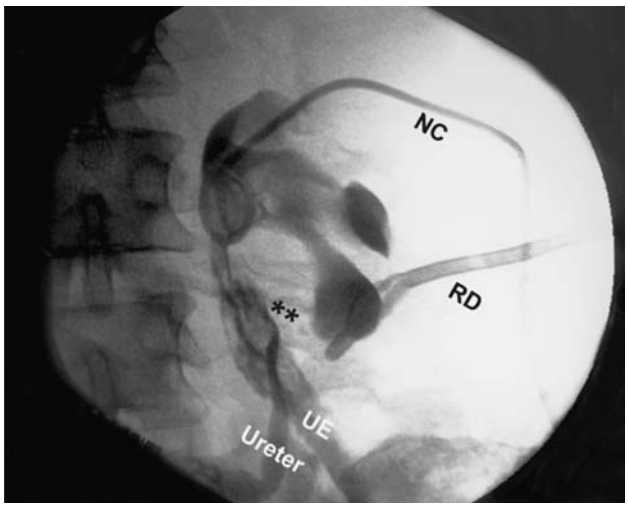

Fig. 2 Antegrade pyelography shows extravasation of contrast media from the ureter (prone position). *NC* Nephrostomy catheter, *RD* retroperitoneal drain, *UE* extravasation of contrast media from the ureter. ** The site of perforation of the ureteral wall

but not thereafter. Even though there was no need for a Malecot catheter after 48 h, we kept the catheter in place for 3 weeks for potential future leakages and to prevent a second catheterization. An AGP was repeated after 3 weeks and there was no leakage from the ureter (Fig. 3). Moreover, the 5 × 4 mm stone in the distal ureter was disintegrated using a pneumatic lithotripter and removed ureteroscopically by forceps, and the day after the ureteroscopy the nephrostomy catheter and the Malecot drain were removed. Since the retroperitoneal fluid was infected and super-imposed pyelonephritis and re-infection from bacterial colonization around the catheters were suspected, the patient was given ciprofloxacin at a 1,000 mg daily dose for 3 weeks. The 6 and 12 months follow-up IVU showed a functioning right kidney with normal appearance of the ureter without any stricture formation.

Fig. 3 Antegrade pyelography shows no extravasation from the ureter after 3 weeks (prone position). ** Healing site of the ureteral wall that was previously perforated

Discussion

SWL has remained the preferred method of treatment for urinary stones since its introduction in 1980 because it offers non-invasive treatment of most renal and ureteral calculi. Complications related to the passage of fragmented particles include ureteral colic, obstruction and urosepsis. Ureteral obstruction, seen in 3% of cases, occurs due to the presence of a solitary fragment that is large enough to block the ureteral passage. Stone fragments often pass spontaneously and no intervention is required in most cases [8]. However, in rare cases, some major morphologic complications, including damage to the renal unit and surrounding tissues, can occur in less than 1% of patients who are treated with SWL. These complications are important in that they can associate with retroperitoneal infection and severe damage to organs [4, 9, 10], and in turn can necessitate auxiliary procedures or open surgery for definitive treatment [2, 3, 5, 11].

There have been several urinoma cases reported in the literature after SWL but none of them has resulted from perforation of the ureter [6, 7, 12]. Oguzulgen et al. [6] reported an urinothorax case as a complication of SWL treatment but they failed to mention the source of it; in their study it is not known if the source of urine leakage was in the kidney or ureter. Moreover, the reported urinomas are shown to arise from perforation of the renal parenchyma or pelvis after SWL therapy [7, 12]. Our literature search did not reveal any urinoma case resulting from a perforated ureter as a complication of SWL. It appears that retroperitoneal urinoma resulting from perforation of the upper ureter during or following SWL treatment has not been reported in the English literature; therefore, our case might be the first one reported.

What led to the perforation of the ureter in our case is not clear but we think the shock wave number, increased intraureteric pressure, inflamed ureteral wall and impacted stone might be the potential factors. There is no consensus on the maximal number of shock waves that can be delivered at each session and the maximal number depends on the type of lithotripter and the shock wave power used [13]. For instance, the maximum number is 3,500 shock waves for electrohydraulic lithotripter and 5,000 shock waves for piezoelectric lithotripter [14]. The higher number of shock waves (4,500) used in the present case seems to be excessive and might be one of the potential factors leading to ureter perforation. In addition, the presence of infected urine proximal to the stone might also yield to weakening of the ureteral wall by causing inflammation which may ease and accelerate the likelihood of morphologic side effects after shock wave application. Another factor that could exacerbate the ureter perforation may be the increased pressure in the collecting system. Although we did not measure the intrapelvic and intraureteric pressures, acute ureteral obstruction is known to increase intraureteric pressure (by up to 80 mmHg) and the frequency of peristaltic activity (by over 20/min) [15]. The increase in intraureteric pressure caused by incomplete obstruction due to stone fragments after the SWL procedure might also worsen the effect of shock waves.

Spontaneous ureteral rupture due to urolithiasis is a very rare event and it is possible that an impacted stone in the presence of infection could damage the adjacent ureteral wall by causing ureteritis and consequently perforation into the retroperitoneal area [16, 17]. In the present case, the USG examination that had been performed at a previous medical center before the SWL procedure had shown no fluid collection in the retroperitoneal area. Thus, the urinoma detected after the SWL procedure could not be the result of simple complete urinary tract obstruction leading to spontaneous rupture. In our case, the presence of infection proximal to the stone, which was possibly impacted and infected, could cause ureteritis which in turn could damage the adjacent ureteral wall and aggravated the effect of shock waves on the ureteral wall.

Several factors, including stone composition, size, impaction, and stone-induced hydronephrosis, limit the success rate of SWL for ureteral stones [18]. The effect of the degree of hydronephrosis on the effectiveness of SWL is not clear. Ureteral calculi in severely obstructed systems are often considered a contraindication to in situ SWL [19]. By contrast, El-Assmy et al. [20, 21] showed that relieving

hydronephrosis using stents prior to SWL provides no advantage for the SWL success rate in severe cases. The patient had mild to moderate hydronephrosis but the physicians who applied the SWL did not employ JJ stents or percutaneous nephrostomy catheters to alleviate hydronephrosis, since its usefulness is controversial.

The majority of patients with ureteral rupture can be treated without major surgical intervention and complications requiring major surgical intervention after SWL are rare. Nevertheless, potential ureter perforation appears to be possible, particularly if a high number of shock waves is used; therefore, the current case suggests that the presence of persistent pain, especially in patients bearing infected stones, after SWL therapy should prompt the physician to consider potential major complications.

References

1. Jang YB, Kang KP, Lee S, Kim W, Kim MK, Kim YG, Park SK (2006) Treatment of subcapsular hematoma, a complication of extracorporeal shock wave lithotripsy (ESWL), by percutaneous drainage. Nephrol Dial Transpl 21:117–118
2. Kumar RV, Kumar A, Banerjee GK (1994) Ureterovaginal fistula: an unusual complication of stone fragments after extracorporeal shock wave lithotripsy in situ. J Urol 152:2096–2097
3. Flood HD, Jones B, Grainger R (1992) Ureterocolic fistula: a unique complication of shock wave lithotripsy. J Urol 147:122–124
4. Fugita OE, Trigo-Rocha F, Mitre AI, Arap S (1998) Splenic rupture and abscess after extracorporeal shock wave lithotripsy. Urology 52:322–323
5. Karakayali F, Sevmis S, Ayvaz I, Tekin I, Boyvat F, Moray G (2006) Acute necrotizing pancreatitis as a rare complication of extracorporeal shock wave lithotripsy. Int J Urol 13:613–615
6. Oguzulgen IK, Oguzulgen AI, Sinik Z, Koktürk O, Ekim N, Karaoğlan U (2002) An unusual cause of urinothorax. Respiration 69:273–274
7. Alkibay T, Karaoğlan U, Gundogdu S, Bozkırlı I (1992) An unusual complication of extracorporeal shock wave lithotripsy: urinoma due to rupture of the renal pelvis. Int Urol Nephrol 24:11–14
8. Roth RA, Beckman CF (1988) Complications of extracorporeal shock wave lithotripsy and percutaneous nephrolithotomy. Urol Clin North Am 15:155–166
9. Donahue LA, Linke CA, Rowe JM (1989) Renal loss following extracorporeal shock wave lithotripsy. J Urol 142:809–811
10. Unal B, Kara S, Bilgili Y, Başar H, Yılmaz E, Batislam E (2005) Giant abdominal wall abscess dissecting into thorax as a complication of ESWL. Urology 54:389
11. Castillon I, Frieyro O, Gonzalez-Enguita C, Vela-Navarrete R (1999) Colonic perforation after extracorporeal shock wave lithotripsy. BJU Int 83:720–721
12. Perez HS, Castellanos AR, Cotadellas AR, Guzma FA, Ballesteros SJJ (1992) Nephrectomy following treatment with ESWL of staghorn lithiasis complicated with urinoma. Arch Esp Urol 45:691–693
13. Tiselius HG, Ackermenn D, Alken P, Buck C, Conort P, Gallucci M, Knoll T (2006) Active removal of stone in the kidney. Guidelines on urolithiasis. EAU 22–30
14. Tiselius HG, Ackermenn D, Alken P, Buck C, Conort P, Gallucci M (2001) Appendices 6, The infundibulopelvik angle. Guidelines on urolithiasis. EAU 26–27
15. Crowley AR, Byrne JC, Vaughan ED Jr, Marion DN (1990) The effect of acute obstruction on ureteral function. J Urol 143:596–599
16. Goel MC, Ramanathan R, Banarjee G, Ahlawat R, Kapoor R (1996) Spontaneous perforation of the ureter: endourological management with renal preservation. Urol Int 57:122–125
17. Leuthardt R, Beruhardt E, Gasser T, Kummer M (1994) Spontaneous perforation of the ureter: a rare complication urolithiasis. Eur J Pediatr Surg 4:205–206
18. Abdel-Khalek M, Sheir K, Elsobky E, Showkey S, Kenawy M (2003) Prognostic factors for extracorporeal shock-wave lithotripsy of ureteric stones-a multivariate analysis study. Scand J Urol Nephrol 37:413–418
19. Tiselius HG, Ackermenn D, Alken P, Buck C, Conort P, Gallucci M (2001) Guidelines on urolithiasis. Eur Urol 40:362–371
20. El-Assmy A, El-Nahas AR, Youssef RF, El-Hefnawy AS, Sheir KZ (2007) Does degree of hydronephrosis affect success of extracorporeal shock wave lithotripsy for distal ureteral stones? Urology 69:431–435
21. El-Assmy A, El-Nahas AR, Sheir KZ (2006) Is pre-shock wave lithotripsy stenting necessary for ureteral stones with moderate or severe hydronephrosis? J Urol 176:2059–2062