Typically, ureteral stents are placed to prevent or relieve ureteral obstruction due to an intrinsic or extrinsic etiology, including obstructive ureteral calculi, ureteral stricture, congenital anomalies (ureteropelvic junction obstruction), retroperitoneal tumor, or fibrosis. The stents are also commonly placed before open surgical or laparoscopic procedures to help identify the ureters and prevent inadvertent ureteral injury [1,2]. Due to the widespread usage of indwelling ureteral catheters, a number of possible complications such as migration, infection, pyelonephritis, breakage, encrustation, stone formation, and fragmentation have been noted [3,4]. Several cases of fragmented ureteral stents have been reported in the literature [5]. Herein, we present a case of spontaneous ureteral stent fragmentation and review the relevant literature.

CASE PRESENTATION

A 50-year-old man was admitted to the emergency service with 2 days of right flank pain, fever, and intermittent macroscopic hematuria. He had undergone extracorporeal shock wave lithotripsy for right renal calculi 2 months previously. A double J-stent had been inserted at that time. He had a history of recurrent urinary tract infection, calculi, and lower urinary tract symptoms. Although routine biochemical parameters were within normal limits, urinalysis revealed urinary infection and microscopic hematuria. On physical examination, the costovertebral angle was tender and systemic examination was unremarkable. A plain abdominal X-ray demonstrated five fragments of a double J-stent in the right renal pelvis, the middle and lower ureter, and the bladder, respectively (Figure 1). In addition, two renal pelvis stones approximately 1.5 cm in size surrounding the upper part of the double J-stent, and a bladder stone 3 cm in size were found on plain radiography. Excretory urography showed minimal right ureteral obstruction (Figure 2). Ultrasonographic examination of the kidney also revealed right hydronephrosis. A complete blood
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count demonstrated leukocytosis of 14,000/mm³, with a shift to the left. Creatinine was 1.3 mg/dL. The patient was hospitalized because of right flank pain and recurrent fever. Following antibiotic and fluid therapy, the patient recovered, and one intact stent fragment and the bladder stone were extracted transurethrally from the bladder. The remaining fragments, located in the middle and lower ureter, were removed via ureterorenoscopy. Another fragment in the right renal pelvis with a renal pelvis stone was removed by open procedure. During the preoperative and postoperative periods, no serious complications were seen. The removed catheters were moderately encrusted. After an uneventful period, the patient was discharged on the 7th postoperative day.

**DISCUSSION**

Double J-stents are routinely used in urologic practice as a simple, safe, and cost-effective way to re-establish or to improve drainage from kidney to bladder without external diversion [6,7]. Since the introduction of the double J ureteral stent in 1978 by Finney [8], many improvements have been made in stent composition, indications, and design, but various complications such as stent migration, occlusion, encrustation, fragmentation, and stone formation are often encountered and could result in significant morbidity [9]. Ureteral stent fragmentation rates range between 0.3 and 10% in the literature [1,10].

The clinical presentation of a fragmented ureteral stent may vary, with septic, irritative, and hemorrhagic symptoms. Our patient was admitted to our clinic with right flank pain, intermittent hematuria, and fever. Various mechanisms have been proposed to explain ureteral stent fragmentation. Breakage of a stent has

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**Figure 1.** Spontaneous breakage of stents at the right renal pelvis, mid- and low-ureter and bladder.

**Figure 2.** Minimal right hydronephrosis is shown on excretory urogram.
been attributed to the hostility of the urine. Interaction with urine and extensive inflammatory reaction in situ may be important in the initiation and promotion of degradation [5]. According to Ilker et al [5], it is quite common to find abundant numbers of leukocytes in urine with or without any infection, which may be derived at least in part from depolymerization of biomaterials by release of lysosomal enzymes. Furthermore, degradation of stent polymers, and hardening of polyethylene and polyurethane can lead to fragmentation if the stents are left indwelling for longer than 6 months [5,11]. Rembrink et al [12] reported a multifractured double J-stent, which had been placed 17 months before. Adsan et al [13] and Papo et al [14] noticed multi-piece fragmentation at 14 months and at 2 years in their patients, respectively. As these studies show that long-indwelling stents mostly appear in a fragmented state, however, Mardis and Kroeger [15] suggested that fragmentation occurs at a site previously allowed to kink during stent insertion. Thus, kinking during stent insertion must be avoided. In the study by Zisman et al [6], all breakage lines passed through the side holes, suggesting that this area is a weak point conducive to kinking that may predispose to fragmentation. Another factor, which is associated with stent fragmentation, is stent composition. There is no consensus on what is the ideal material for ureteral stents. Silicone stents may be more advantageous than polyurethane stents due to the lower risk of calcification and prolonged maintenance of tensile strength for up to 20 months [16]. In our patients, we used polyurethane stents.

However, these theories cannot explain why some stent fragmentations occur early after the insertion of the stent. In the study by Kumar et al [17], the stents had fragmented into multiple pieces over a mean indwelling time of only 3.5 months. Accelerated aging process is an important factor leading to early mechanical failure of ureteral stents [7]. In the study by Zisman et al [6], mechanical testing and fractography clearly showed that the stent material changed from ductile to brittle during exposure to a specific environment. Richter et al [9] agree with Zisman et al [6] that the accelerated aging of the stent material is an important factor leading to early mechanical failure. According to Richter et al [9], only this could explain why seven of their 11 stents broke only 3 months after insertion. In our patient, fragmentation was seen in the 3rd month after the insertion of the double J stent.

Retrieval of a proximally fragmented double J ureteral stent can be frustrating and technically challenging. Generally, transurethral intervention is enough for the removal of bladder stents. However, various methods such as ureterorenoscopy and percutaneous procedure have been described for the removal of fragmented stent in a renal pelvis [1,3,4,7,11]. Witjes [18] performed percutaneous nephrostomy to remove 13 fragmented stents. Grossman et al [19] reported the removal of a midureteral stent fragment using a Dormia stone basket under fluoroscopic guidance. Rembrink et al [12] removed a fragmented stent in the renal pelvis via open procedure. In our case, the catheter in the bladder was removed endoscopically under local anesthesia. Initially, we planned to remove the fragmented stent in the renal pelvis and midureter via endoscopic intervention. However, the fragmented stent near the stone lining to the proximal ureter could not be removed by ureterorenoscopy and the double J-stent was broken. Therefore, we decided to perform an open procedure, during which the stone and the broken piece of stent were removed.

Spontaneous breakage of indwelling catheters is an unusual complication with very few examples, and close follow-up is very important to prevent serious complications.

REFERENCES