Perils of guide wire fracture - Unrecognized retained foreign body
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ABSTRACT
A case is presented of retained guide wire fragment after percutaneous stone removal with probable mechanism of breakage.
Nephrostomy access was obtained using Seldinger technique and the wire passed through a stenotic ureter with difficulty. After removal of the stone, the wire fragmented on removal and the upper and lower fragments were removed from above and below, respectively.

Years later, recurrent stone in the kidney contained an unsuspected wire fragment. Guide wire fracture may result in multiple fragments within the urinary tract. An understanding of mechanisms of wire failure may prevent unsuspected retained foreign bodies.

1. Introduction
Minimally invasive surgical procedures require guide wires to maintain access and facilitate passage of instrumentation. Wire malfunctions occur infrequently. We describe the first reported case of multiple fracture, resulting in an occult wire fragment causing multiple subsequent interventions.

2. Case presentation
A 30-year-old man without previous stone history presented with severe left flank pain, nausea and vomiting. Intravenous pyelogram demonstrated high-grade obstruction from a 2 × 1.5 cm calculus at the left ureteropelvic junction, and smaller lower pole stones. Partial obstruction of the distal left ureter was also noted, seemingly from poorly-opacified stone.

A nephrostomy was placed. The following day he underwent percutaneous nephrolithotomy (PCNL). A Teflon-coated 0.038” safety wire was passed with difficulty through the stenotic distal ureteral segment to the bladder. A second dilation wire was inserted using a Lieberman B catheter. A 30-French operating sheath was placed and the initial Teflon-coated wire was left outside the sheath as a safety.

The distal ureter was examined from below by retrograde ureteroscopy. Tight stenosis of the ureteral segment was noted, but no stone. The percutaneous safety wire was observed in the distal ureter. A retrograde wire was passed for stent placement. As the percutaneous wire was withdrawn from above, resistance was encountered. After removal, the end of the wire appeared frayed, indicating wire fracture. The ureteroscope was reintroduced, the remaining distal wire fragment was extracted and stent was placed. Subsequent plain films showed no stones or foreign bodies. The ureteral stent was left for four weeks. The patient did well after removal.

Multiple stone recurrences were noted: At three years, extracorporeal shockwave lithotripsy (ESWL) was performed for upper pole stone. Clearance of fragments was noted. Recurrent stones in the same location at four and six years were treated with ESWL with incomplete clearance. 18 months later, the patient underwent PCNL for complete removal of a dumbbell-shaped stone within the upper-pole infundibulum. That stone contained a 1.5 cm length of metallic wire (Fig. 1), not seen on preop CT scan. This fragment appeared to be wire mandrel from eleven years before.

3. Discussion
Guide wires are indispensable in urology, and fragmentation is rare. When instruments break within the urinary tract, complete removal is imperative, as foreign bodies calcify and obstruct the urinary tract.

Guide wires are generally constructed with a helical outer wrap, providing flexibility, smoothness and protection; the wrap overlies an inner core mandrel, providing rigidity and stability.1,2 The mandrel may...
be welded or soldered at the ends of the outer wrap to maintain integrity. Flexible guide wire tips use thinner or flattened terminal mandrel segments.

Various authors report fracture of wires with retained fragments, mostly within the vascular system but also after orthopedic and urologic applications. Resistance is typically encountered on withdrawal and a break is recognized when the terminal end appears damaged. Fluoroscopy usually reveals a retained wire fragment.

Mechanisms of breakage vary. Wires may fragment after being over rotated, entrapped or wedged in stenotic segments, or during excessive bending. The mandrel may break from acute flexion resulting in a kink, especially at the junction of the floppy tip with the more rigid body where shear stresses occur. Mandrel breakage allows the outer wrap to unwind under tension. Also, the outer helix may separate from the mandrel, either from misuse or simply from manufacturing flaws. Wires may be damaged by laser energy used in procedures. Wires may loop and entrap above an impacted stone.

A literature review identified no reports of multiple fragmentation, except during radiographic snaring procedures to remove a fragment. The urologic literature has little reference of wire fracture mishaps, possibly because successful removal events seemed of low interest. The current case reports an unexpected, tiny retained fragment, resulting in multiple kidney stones until the calcified foreign body was recognized and removed.

A mechanism of fracture is suggested to explain this unusual event. Initially, the safety wire was passed by means of an angiographic catheter prior to percutaneous tract dilation (Fig. 2a). Difficulty passing the wire through the stenotic segment may flex the tip to the point of mandrel breakage (Fig. 2b). Mandrel breakage may be unapparent during subsequent working of the wire (Fig. 2c). Schwartz et al. describe a case of a wire passed with mild resistance that broke at the junction of the flexible and rigid portions with protrusion of the mandrel tip.
through the outer wrap. Mandrel protrusion may initiate this course of events (Fig. 2b and c). Withdrawal of the wire may embed the mandrel in the stenotic ureteral segment (Fig. 2d). Further tension could unwind the wrap, exposing and embedding the mandrel (Fig. 2e), with breakage of the mandrel to generate a retained, 1.5 cm segment (Fig. 2e and f), which was invisible on subsequent conventional imaging.

Recognizing this possibility, we suggest an alternate method: When a wire shows resistance to withdrawal, the possibility of wire damage with protruding mandrel should be considered. In this situation, percutaneous endoscopy and cutting the frayed wire with laser to remove the proximal segment with wire removal of the distal end via cystoscope may be a safer alternative. This might have prevented residual mandrel fragment. In addition, when a wire appears to bind and then breaks, one should consider a retained mandrel segment and use appropriate endoscopic or imaging measures to prevent retained fragments. However, non-contrast CT imaging may not always identify retained mandrel segments.

4. Conclusions

This case describes multiple fracturing of a guide wire heralded by resistance upon withdrawal, causing retained foreign body. An alternate method of removal when resistance is encountered may prevent this complication.

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