

Iatrogenic submucosal tunnel in the ureter: a rare complication during advancement of the guide wire

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BACKGROUND: Inserting a guide wire is a common practice during endo-urological procedures. A rare complication in patients with ureteral stones where an iatrogenic submucosal tunnel (IST) is created during endoscopic guide wire placement.

OBJECTIVE: Summarize data on IST.

DESIGN: Retrospective descriptive study of patients treated from from October 2009 until January 2015.

SETTING: King Fahd Hospital of the University, Al-Khobar, Saudi Arabia.

PATIENTS AND METHODS: Patients with ureteral stones were divided to 2 groups. In group I (335 patients), the ureteral stones were removed by ureteroscopy in one stage. Group II (97 patients) had a 2-staged procedure starting with a double J-stent placement for kidney drainage followed within 3 weeks with ureteroscopic stone removal.

MAIN OUTCOME MEASURE(S): Endoscopic visualization of ureteric submucosal tunneling by guide wire.

RESULTS: IST occurred in 9/432 patients with ureteral stones (2.1%). The diagnosis in group I was made during ureteroscopy by direct visualization of a vanishing guide wire at the level of the stone (6 patients). In group II, IST was suspected when renal pain was not relieved after placement of the double J-stent or if imaging by ultrasound or intravenous urography showed persistent back pressure to the obstructed kidney (3 patients). The condition was subsequently confirmed by ureteroscopy.

CONCLUSION: Forceful advancement of the guide wire in an inflamed and edematous ureteral segment impacted by a stone is probably the triggering factor for development of IST. Definitive diagnosis is possible only by direct visualization during ureteroscopy. Awareness of this potential complication is important to guard against its occurrence.

LIMITATIONS: Relatively small numbers of subjects and the retrospective nature of the study.

The ureteral double J-stent, first introduced by Finney in 1978,¹ has gained wide popularity in everyday urological practice.² However, it can cause complications as hematuria, urinary tract infection, stent encrustation, retained stents, fractured stents, knotted stents and stent migration within the urinary tract.³⁻⁶ Stent migration outside the urinary tract to the common iliac vein and inferior vena cava has also been reported on rare occasions.^{7,8}

We summarize data on a rare complication referred to as iatrogenic submucosal tunneling (IST) in 432 patients with ureteral stones. This complication

occurs during introduction of the guide wire under fluoroscopic guidance. The possible cause, diagnosis and prevention of this complication are discussed.

PATIENTS AND METHODS

This was a retrospective study approved by the local research ethics committee. The study included patients treated by ureteroscopy for removal of ureteral stones from October 2009 until January 2015. The patients were divided to two groups depending on whether intervention was done in one or in two stages.

Group I. One stage procedure (335 patients): the

stones were treated in one stage by ureteroscopy without prior stenting. An open tip 6 Fr. ureteral catheter was first introduced through the ureteral orifice for retrograde injection of contrast. After assessing the course of the ureter and location of the stone, a PTFE guide wire was advanced through the ureteral catheter under fluoroscopic guidance to reach the collecting system. The ureteroscope was then advanced next to the guide wire until the stone was reached. The stone was fragmented using a holmium laser beam. Remaining small fragments were extracted by the Dormia basket.

Group II. Two stage procedure (97 patients): in the first stage, a double J-stent was placed over a guide wire under fluoroscopy guidance. This was either an emergency procedure to control persistent renal colic (79 patients), or electively to dilate the ureter prior to ureteroscopy (18 patients). In the second stage 2-3 weeks later, the vesical distal tip of the double J-stent was partially retrieved using the cystoscope. Once it appeared at the tip of the urethra, a PTFE guide wire was inserted in its lumen and advanced to the kidney under fluoroscopy guidance. The stent was then removed leaving the guide wire in place, and ureteroscopy was performed as with the group I patients.

RESULTS

Among the 432 patients, 294 were males and 138 were females. Their ages were 21-67 years (average 34 years). Renal function and urine analysis were unremarkable in all patients. The stones were single (414 patients) or multiple (18 patients). They were located in the right ureter (n=196; 45%) or left ureter (n=236; 55%). Most of the patients had stones in the lower third of the ureter (n=211; 49%). The remaining were in the upper third (n=147; 34%) and in the middle third (n=74; 17%). IST was noted in 9/432 patients (2.1%). It involved the upper third in 4 patients (44.4%), the middle third in 1 (11.1%) and the lower third in 4 (44.4%) (**Table 1**).

In group I, IST occurred in 6/335 patients (1.8%); 2 had stones in the upper third, 1 in the middle third and 3 in the lower third of the ureter. In group II, IST occurred in 3/97 patients (3.1%); 2 had stones in the upper third and 1 in the lower third of the ureter (**Table 1**). The presence of IST was suspected in 3 patients in group II because of post-stenting renal pain and ultrasound evidence of persistent back pressure. Intravenous urography (IVU) showed persistent obstruction proximal to the stone in spite of presence of the double J-stent (**Figure 1**). Fluoroscopy at the time of stenting in all 9 patients as well as post-stenting scout films of the abdomen in the group II patients (n=3/9) failed to show any abnormal course of the guide wire or the double J-stent in

Table 1. Iatrogenic submucosal tunnel by the level of ureteral stones (n=432).

Iatrogenic submucosal tunnel	Upper third n (%)	Middle third n (%)	Lower third n (%)	Total n (%)
Group I (by guide wire) (n=97)	2 (1.9)	1 (1.7)	3 (1.7)	6 (1.8)
Group II (by double J-stent) (n=335)	2 (4.8)	0 (0.0)	1 (2.6)	3 (3.1)
Total	4 (2.7)	1 (1.4)	4 (1.9)	9 (2.1)

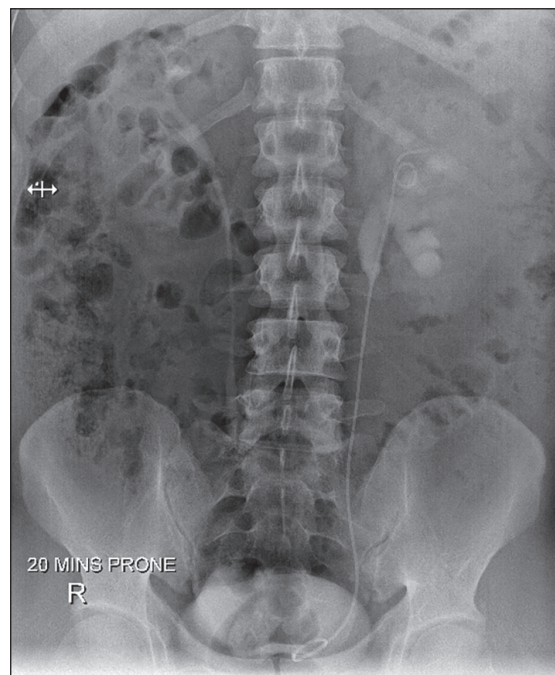


Figure 1. IVU showing persistent obstruction proximal to the stone in left renal pelvis in spite of presence of double J-stent.

the ureter. When IST of the double J-stent was suspected in group II patients, ureteroscopy was scheduled as an emergency procedure.

Ureteroscopy performed in the presence of IST showed an inflamed mucosa at the level of the stone which always appeared impacted with variable degrees of mucosal edema. The guide wire was seen penetrating the mucosa and vanishing just distal to the stone (**Figure 2**). After stone fragmentation and proximal advancement of the ureteroscope, the guide wire was seen penetrating the mucosa to emerge back to the lumen, and continue its normal course to the renal pelvis. In the presence of IST, a second guide wire was placed under ureteroscopic guidance prior to stone fragmentation in 6 patients. In the remaining 3 patients, the wire

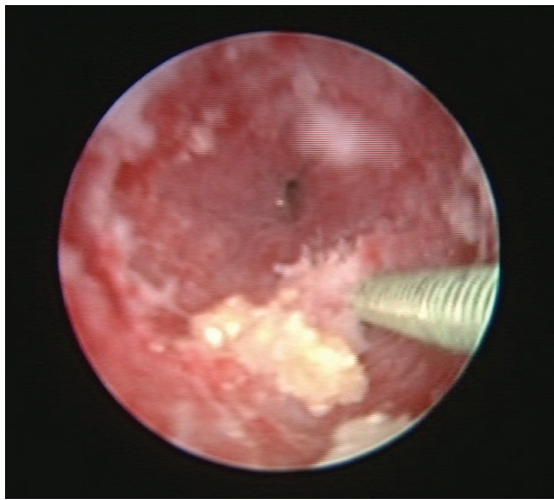


Figure 2. Guide wire penetrating the ureteral mucosa distal to the stone.

failed to bypass the impacted stone but fragmentation was successfully completed with the IST guide wire in place alone.

DISCUSSION

We describe a rare complication that occurred during placement of the guide wire under fluoroscopy guidance prior to double J-stenting. The guide wire accidentally punctured the ureteral mucosa at the level of an impacted stone. It thereafter created a false passage in the submucosa to produce an iatrogenic submucosal tunnel (IST).

IST was probably caused by forceful advancement of the guide wire in the ureter against high stone resistance in the presence of an inflamed edematous ureteral wall at the level of the stone. The guide wire penetrated the mucosa at the level of the stone to dissect its way through the less resistant edematous submucosa producing IST. After bypassing the stone, the wire in the submucosa punctured the mucosa to re-enter the ureteral lumen proximal to the stone. This was attributed to a gradual decline in submucosal edema together with gradual increase in resistance of the submucosal plain. The submucosally positioned wire punctured the less resistant mucosa proximal to the stone and continued its course in the ureteral lumen to the kidney. When a double J-stent was advanced over that misplaced wire, IST of the double J-stent oc-

curred. IST of the guide wire or of the double J-stent was always missed by fluoroscopy and scout films of the abdomen.

The double J-stent with IST failed to relieve ureteral obstruction caused by a stone. Persistence of renal colic and ultrasound or IVU evidence of persistent back pressure on the kidney after double J-stent placement raised the possibility of IST. Diagnosis was confirmed only by ureteroscopy that revealed vanishing of the guide wire from the ureteral lumen at the level of the stone.

The difference in incidence of IST between group 1 (1.8%) and group 2 (3.1%) is probably because group 2 cases were easier to recognize than in group 1. The persistence of hydronephrosis and/or renal pain in the group 2 patients after placement of the guide wire was the reason for diagnosis of IST. On the other hand, diagnosis of IST in group 1 that was done during ureteroscopy at the time of stone laser fragmentation can sometimes be easily missed.

The retrospective nature of this study and the procedure being performed by more than one surgeon were limiting factors in this study. Most cases with IST were encountered during the early stages of this study. The incidence dropped markedly thereafter when the operators became aware of this potential complication and never used force during advancement of the guide wire. Very soft-tip guide wires were not used with our patients, but their use is strongly advised.

In conclusion, the driving force for IST to occur in the ureteral wall is forceful advancement of the guide wire against resistance by an impacted stone. IST is suspected when double J-stenting fails to relieve renal pain and/or persistent renal back pressure by ultrasonography or IVU. Ureteroscopy is done to confirm the diagnosis by direct visualization of a vanishing double J-stent at the level of the stone and its re-emergence at a more proximal level. The operator should be aware of this potential complication, and should use very soft tip guide wires without forceful advancement in the presence of resistance.

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Conflict of interest

None to declare.

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