

Laparoscopic T-Plasty for the Treatment of Refractory Bladder Neck Stenosis

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Abstract

Preliminary results of a case series on refractory bladder neck stenosis treated with laparoscopic T-plasty are presented in this article. This study retrospectively identified nine patients with refractory bladder neck stenosis aged 60 to 80 years between May 2016 and December 2017, who had undergone laparoscopic T-plasty. All patients presented voiding difficulty and failed after two or more prior endoscopic treatments. Laparoscopic T-plasty was performed by incising the anterior wall of the bladder neck in a T-shaped manner and creating two well-vascularized and tension-free flaps, which offer the possibility to reconstruct a wide bladder neck. After a mean follow-up of 14.7 months (ranging 3–22 months), a successful outcome was achieved in eight patients without incontinence secondary to surgery. Recurrent voiding difficulty developed in one patient, which was cured after a following endoscopic treatment. Through these nine patients, a preliminary conclusion can be drawn that a wider bladder neck can be obtained through modified YV-reconstruction of the bladder neck, while avoiding external urethral sphincter injury. And laparoscopic T-plasty has clear advantages compared with an open approach. It is an available and effective option for refractory bladder neck stenosis.

Keywords

bladder neck stenosis, benign prostatic hyperplasia, laparoscopic surgery, reconstructive surgical procedure

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Bladder neck stenosis (BNS) is a relatively infrequent complication, which may occur following transurethral surgery for benign prostatic hyperplasia (BPH). Transurethral resection of the prostate (TURP) is still generally accepted as the gold standard for the surgical treatment of BPH (Foster et al., 2018). TURP has resulted in BNS rates as high as 3.6%–12.3% (Al-Ansari et al., 2010; Lee, Chiu, & Huang, 2005; Puppo et al., 2009), while BNS is relatively uncommon with recently developed BPH treatments (Cornu et al., 2015), such as plasma vaporization of the prostate (3%–5%; Malde et al., 2012; Suk, Chul, Hyeon, Woong, & Jae-Seung, 2010; Xie et al., 2014) and holmium laser enucleation of the prostate (HoLEP; 0.8%; Elzayat & Elhilali, 2007).

There is a consensus that endoscopic procedure (Pansadoro & Emiliozzi, 1999) is preferred in the initial treatment of primary BNS. Endoscopic procedure may be performed with diverse techniques, including cold knife, electrocautery, laser, and loop resection. Endoscopic procedure may require multiple treatments with success rates

decreasing dramatically in patients undergoing repeat surgical intervention (Borboroglu, Sands, Roberts, & Amling, 2000; Ramirez, Simhan, Hudak, & Morey, 2013). Although endoscopic treatment is successful in the majority of patients with initial BNS, operative bladder neck reconstruction remains a viable option for refractory BNS when endoscopic management fails. Musch (Musch et al., 2017) and Sokoloff et al. (Sokoloff, Michel, & Smith, 2010) believe that if a patient experiences at least

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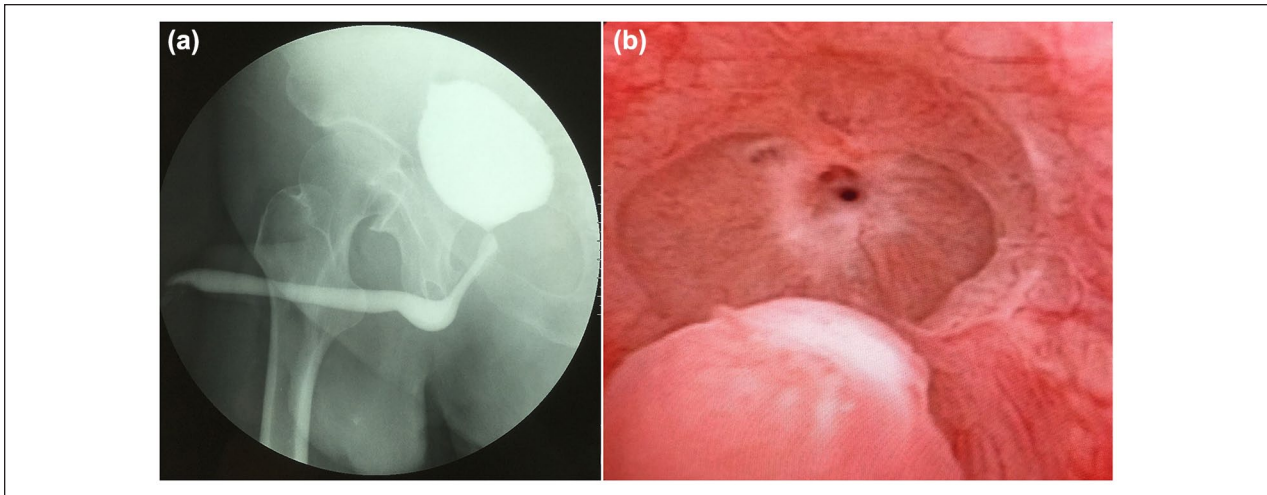


Figure 1. (a) Voiding and retrograde cystourethrography showing that stenosis is confined to the bladder neck. (b) Flexible cystoscopy revealing contracture of the bladder neck, a wide prostatic fossa, and a verumontanum.

two unsuccessful transurethral procedures, operative bladder neck reconstruction should be advocated.

Reiss et al. first described a surgical procedure: T-plasty (Reiss et al., 2016). T-plasty is a safe and valuable option in treatment for refractory BNS, offering multiple advantages compared to other approaches and techniques.

An ideal surgical approach for BNS should allow for excellent exposure of the obstructed segment and result in minimal invasiveness. An open surgical approach usually cannot achieve adequate exposure of the surgical field and gives rise to relatively large invasiveness. Laparoscopic T-plasty is an improvement over traditional T-plasty.

This article introduces preliminary results of a case series on refractory BNS treated with laparoscopic T-plasty and describes the surgical technique in detail.

Materials and Methods

Patients

All clinical data of nine patients with refractory BNS secondary to TURP who underwent laparoscopic T-plasty from May 2016 to December 2017 were reviewed retrospectively in the medical record system. Written informed consent was obtained from all patients included in the study, which was approved by Shanghai Sixth People's Hospital ethics committee. Mean age at the time of surgery was 69.1 years (range, 60–80 years). All patients had multiple (≥ 2) unsuccessful previous endoscopic treatments. Preoperative evaluations included history, physical examination, uroflowmetry, and routine laboratory investigations. The mean preoperative maximum flow rate (Q_{\max}) was 7.2 ml/s (range, 3.3–9.2 ml/s). A urodynamic assessment was performed

in selected patients with suspicious history or signs of detrusor overactivity or compliance abnormalities. Voiding and retrograde cystourethrography was performed to reveal location and length of the stenosis (Figure 1a). Flexible cystoscopy allowed for exact location of BNS (Figure 1b).

Surgical Technique

Under general anesthesia, the patient is set in a supine position. The monitor is placed between the patient's legs, as close as possible to the surgeon's eye level. A right-handed surgeon stands on the patient's left with his assistant opposite. A 10-mm trocar is then inserted into the umbilicus for passage of the 30° laparoscope. Two other trocars are inserted: a 5-mm trocar in the left iliac fossa and a 10-mm trocar in the right iliac fossa at McBurney's point (Figure 2).

Laparoscopic T-plasty resembles Reiss's open approach. The critical steps of the procedures are essentially the same. The prevesical space is approached for radical prostatectomy. After removal of the fatty tissue, the perivesical space and the bladder neck are defined. Then the course of the T-shaped incision on the anterior bladder is outlined with ultrasonic scalpels. The T-shaped incision is performed through all tissue layers of the bladder neck with a pair of cold scissors to avoid possible thermal damage to the V-shaped bladder flap (Figure 3). This creates two well-vascularized and tension-free anterior bladder wall flaps, offering the possibility to reconstruct a wide bladder neck and anterior prostatic urethra. The caudal extension of the incision is performed up to the unobstructed prostatic urethra (Figure 4). Afterward, the two anterior bladder wall flaps are sutured in a V-shape, thus accomplishing a wide bladder neck. Interrupted 3/0 polyglactin sutures are

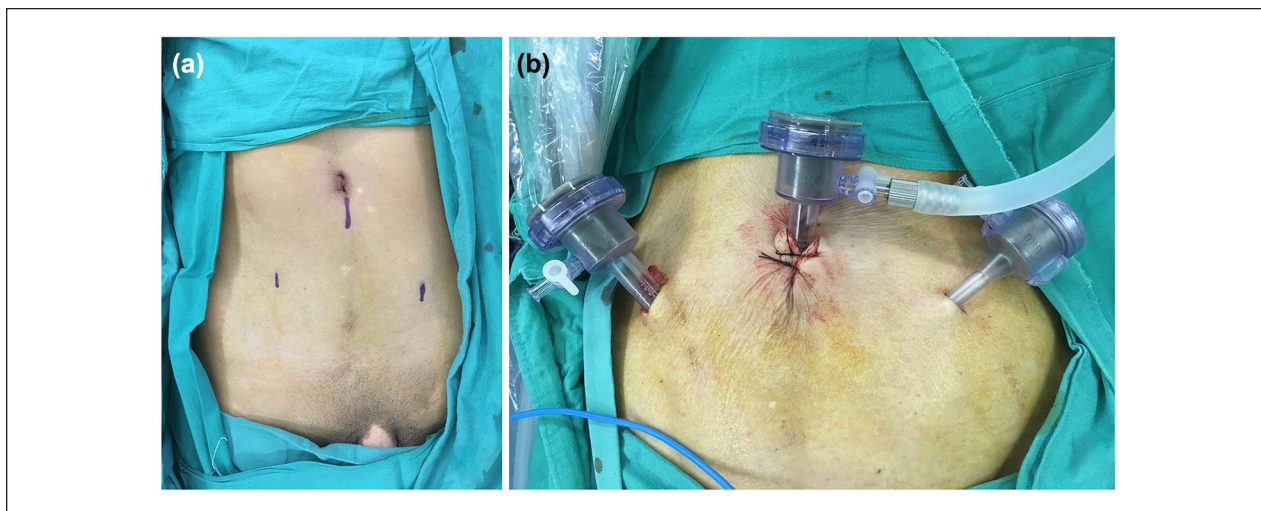


Figure 2. Three-port extraperitoneal approach.

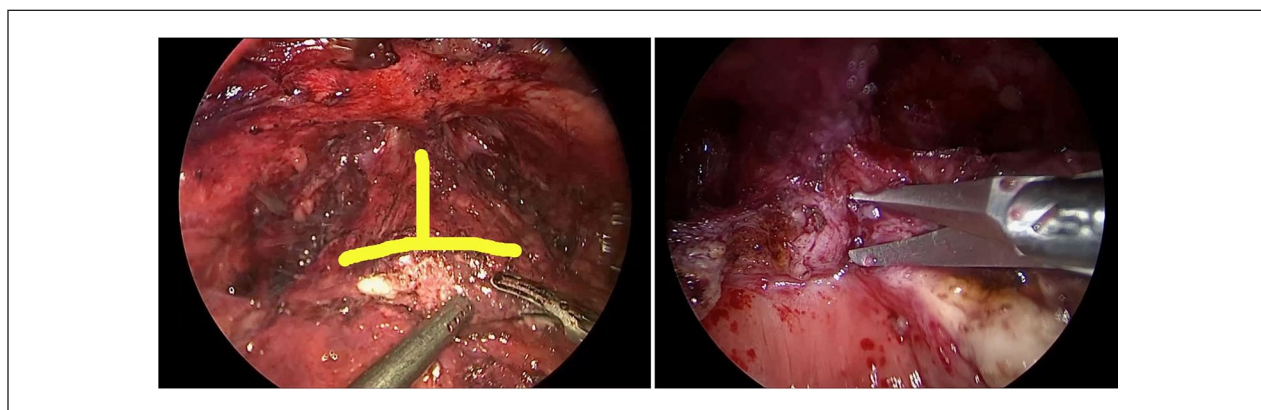


Figure 3. The anterior bladder wall is incised in a T-shaped manner.

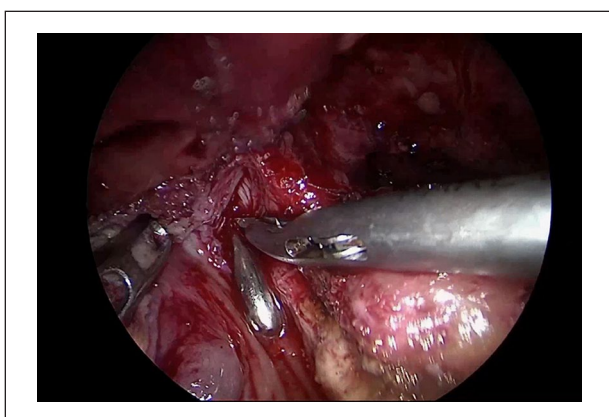


Figure 4. The narrow bladder neck is incised to achieve a wide lumen that an Fr20 urethral dilator can pass through easily.

placed from the apex of the V-flap to the base of the T-incision and tied under direct vision (Figure 5). Thereafter, bladder irrigation is performed to confirm no leakage. A urethral catheter, a suprapubic catheter, and a pelvic drain are placed at the end of the procedure.

The urethral catheter was left indwelling for 3–4 weeks. All patients were evaluated with uroflowmetry at the time of urethral catheter removal. A successful outcome was defined as fluent voiding via the urethra without further instrumentation.

Results

The study comprised 9 patients with a median age of 69.1 years (range, 60–80 years). The patient characteristics and

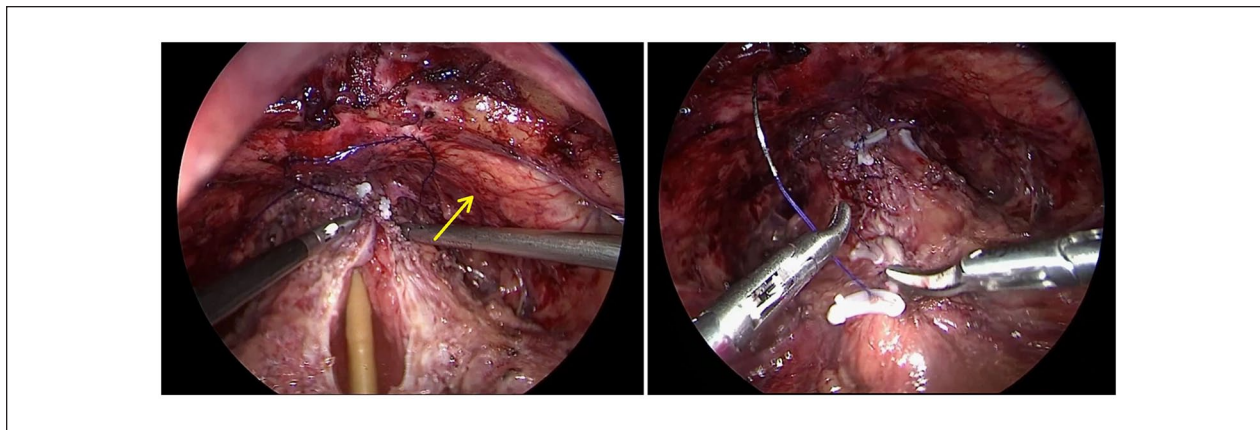


Figure 5. Interrupted 3/0 polyglactin sutures are placed from the distal end to the proximal (the arrow shows the anterior pelvic wall).

perioperative results are shown in Table 1. The etiology of BNS was TURP in all patients. There were no significant intraoperative or postoperative complications. All patients were evaluated with uroflowmetry and cystourethrography at the time of urethral catheter removal (Figure 6a, b). The mean Qmax was 20.2 ml/s (range, 8.3–30.8 ml/s). During the follow-up, no de novo stress incontinence was observed. Eight patients regained a good voiding function without evidence of a recurrent BNS and were satisfied with the laparoscopic T-plasty. An example of a wide bladder neck after laparoscopic T-plasty is presented in Figure 6b. Recurrent voiding difficulty developed in one patient 1 week after urethral catheter removal. This patient underwent endoscopic BNS incision with cold knife 3 months after the laparoscopic T-plasty. After BNS incision, the symptom of dysuria was significantly relieved. At the time of writing, this patient voided satisfactorily with no postvoiding residual urine.

Discussion

Refractory BNS is often defined as highly recurrent in case of stricture recurrence after three or more failed endoscopic treatment attempts (Reiss et al., 2016). Refractory BNS is still an intractable problem even though various treatment regimens have demonstrated >80% effectiveness for management of initial BNS (Ramirez, Zhao, et al., 2013). There is no generalized consensus on the best therapeutic strategy.

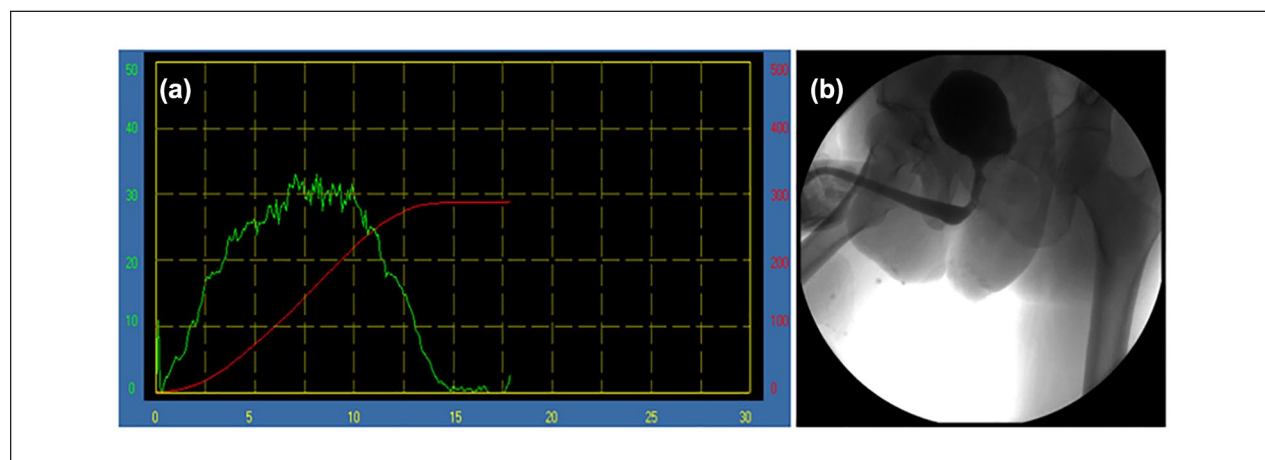
There have been several reports that investigated the utility of urethral dilation for BNS (Besarani, Amoroso, & Kirby, 2004; Park, Martin, Goldberg, & Lepor, 2001). This procedure relieves the symptom of dysuria temporarily, but cannot prevent repeated scarring of the bladder neck. And due to its complications including urinary retention, gross hematuria, infection, false passage, and synchronous urethral stricture, multiple urethral dilation is avoided at the first author's institution.

Owing to the often disappointing success rates of traditional endoscopic procedures, several centers have advocated endoscopic incision followed by injection of antiproliferative agents. Steroid injections are used in an effort to combat fibrosis and scarring and decrease BNS recurrence. Eltahawy et al. (Eltahawy, Gur, Virasoro, Schlossberg, & Jordan, 2010) successfully managed the majority ($n = 24$, 83%) of patients at 24 months of follow-up with triamcinolone injection after holmium laser BNS incision. Vanni et al. (Vanni, Zinman, & Buckley, 2011) reported a similar success rate of 89% in 18 patients with the use of mitomycin C, an agent known to inhibit fibroblast proliferation, collagen deposition, and scar formation. It is noteworthy that concerns over the safety profile of novel injection treatments have been raised. It is reported that mitomycin C treatment resulted in perivesical necrosis (Doherty, Trendell-Smith, Stirling, Rogers, & Bellringer, 1999). Steroid injections may give rise to severe anaphylaxis (Moran, Moynagh, Alzanki, Chan, & Eustace, 2012).

Although the above-mentioned strategies have been proposed and yield promising results, a considerable scale of about 11.5% of patients finally develop complex refractory BNS that makes further treatment cycles necessary (Ramirez, Simhan, Hudak, & Morey, 2013). For those patients who experienced at least two unsuccessful transurethral procedures, operative bladder neck reconstruction should be recommended. Simonato et al. (Simonato, Gregori, & Carmignani, 2007) described a staged transperineal approach where end-to-end anastomosis was performed through a perineal incision followed by transperineal artificial urinary sphincter (AUS) implantation once patency was achieved. Schlossberg et al. (Schlossberg, Jordan, & Schellhammer, 1995) and Theodorou et al. (Theodorou et al., 2000) reported a combined abdominoperineal bladder neck reconstruction technique. This approach may provide improved

Table I. Patient Characteristics and Perioperative Results of Patients Undergoing Laparoscopic T-Plasty.

Patient	Age (years)	BMI (kg/m ²)	Previous treatments	Preoperative Qmax (ml/s)	Operation time (min)	Blood loss (ml)	Postoperative hospital stay (days)	Postoperative Qmax (ml/s)	BNS recurrence
1	60	22.8	2× bladder neck resection, multiple transurethral dilation	6.7	100	100	7	23.3	No
2	80	23.9	3× bladder neck incision, multiple transurethral dilation	5.5	110	110	8	19.0	No
3	65	24.2	2× bladder neck resection, multiple transurethral dilation	8.8	126	100	7	21.9	No
4	73	23.1	3× bladder neck resection, multiple transurethral dilation	7.8	160	250	14	18.0	No
5	65	22.9	3× bladder neck incision	6.9	110	100	5	30.8	No
6	68	29.8	4× bladder neck incision, multiple transurethral dilation	7.9	120	100	7	20.6	No
7	71	25.3	2× bladder neck incision	9.2	95	100	8	20.0	No
8	77	26.0	3× bladder neck resection, multiple transurethral dilation	3.3	130	107	10	8.3	Yes
9	63	22.4	3× bladder neck incision, multiple transurethral dilation	8.7	120	100	6	20.1	No

**Figure 6.** (a) Postoperative uroflowmetry showing a bell-shaped curve; (b) postoperative cystourethrography showing a wide anastomosis.

exposure but may be more invasive, compared to the pure transperineal approach. YV-plasty was described first by Young in 1953, and it is one of the most widely used techniques in patients in whom the refractory BNS is the result of a benign condition (Musch et al., 2017; Reiss et al., 2016). This technique prevents repeated scarring of the widened bladder neck by transposition of a well-vascularized bladder wall flap into the completely transected anterior aspect of the bladder neck. Musch et al. (Musch et al., 2017) initiated their study on 12 patients with refractory BNS treated with robot-assisted laparoscopic YV-plasty (RAYV). Results with this novel technique using the robotic system have been promising. But due to the high expenses of the robotic system, RAYV is difficult to popularize in developing countries such as China.

T-plasty reported by Reiss et al. first is a modified technique of YV-plasty (Reiss et al., 2016). According to Reiss et al. compared to the well-established YV-plasty, T-plasty has several advantages due to the utilization of two well-vascularized flaps. A wider bladder neck can be reconstructed by using these two instead of one flap. Less tension is exerted on the flaps. Laparoscopic T-plasty has all the advantages of T-plasty but is minimally invasive. Patients undergoing a laparoscopic approach benefit from improved cosmesis and faster functional recovery in comparison to an open approach. Alternatively, BNS reconstruction through this laparoscopic approach may provide improved exposure, tissue mobilization, scar excision, and bladder outlet reconstruction in the limited space of the pelvis.

According to Pansadoro et al. (Pansadoro & Emiliozzi, 1999), iatrogenic strictures of the prostatic urethra have been classified according to location and etiology into three categories: type I, located exclusively at the bladder neck; type II, located in the midportion of the prostatic fossa; and type III, when the whole prostatic fossa is replaced by stricture. The cases with refractory BNS presented here pertain to type I: fibrous tissue involving the bladder neck only with a wide prostatic fossa and a verumontanum that is present at flexible cystoscopy (Figure 1). The external urethral sphincter of these patients was not destroyed. With Simonato's or Theodorou's technique, transsphincteric mobilization of the urethra leads to aggravated urinary incontinence and AUS implantation is necessary. Nevertheless, a wider bladder neck can be obtained through laparoscopic T-plasty, while avoiding damage to the external urethral sphincter. During the follow-up, no de novo stress incontinence was observed in these nine cases. Hence, AUS implantation is not necessary.

Due to the small number of patients and limited follow-up in this study, more clinical data with a longer follow-up are needed to verify results.

Conclusion

Refractory BNS is an uncommon but challenging entity. In summary, the findings of this study demonstrated that laparoscopic T-plasty is a feasible and safe surgical option in patients with refractory BNS secondary to TURP.

Declaration of Conflicting Interests

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