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Antegrade cystoscopic light source guided laser urethrotomy for the treatment of completely obliterated urethra

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ABSTRACT

Objective: A urethral stricture is the narrowing of the urethra caused by scar formation. The etiologies include infection, trauma with total urethral disruption, and iatrogenic procedures. The impact of urethral stricture diseases is very high. Several kinds of endoscopic procedures have become available for managing the disease. Among them, complete obliteration of the urethra during endoscopic procedures remains a challenge for surgeons. We describe a modified procedure in which laser urethrotomy was guided under the light source from an antegrade flexible cystoscope for treating a short completely obliterated urethra. This procedure is indicated if the obliterated segment is less than 10 mm because longer strictures may increase the chance of extra false lumen formation and bleeding.
Materials and Methods: Forty-three male patients who underwent optical urethrotomy for urethral strictures at Kaohsiung Municipal Ta-Tung Hospital (Kaohsiung, Taiwan) between March 2013 and January 2015 were induced in the study. Five of these patients were diagnosed as having complete urethral obliteration.
Results: In all five patients with a completely obliterated urethra, retrograde laser incision was performed successfully. Three patients had total bulbar urethral obstruction and two had penile obstruction. All patients experienced improved urination after the procedure.
Conclusion: Our preliminary data showed that our modified method for treating a completely obliterated urethra yielded satisfactory results. Long-term follow-up and large-scale studies should be conducted to better examine technique efficacy; however, our current results regarding the simple modification of endoscopic urethrotomy seem promising.

1. Introduction

Urethral stricture disease is characterized by fibrosis of the subepithelial tissue or underlying corpus spongiosum and subsequent narrowing of the urethral lumen. Its incidence is estimated at 200 to 1200 per 100,000 individuals, with a sharp rise in frequency among people over 55 years old.[1] The impact of urethral stricture disease is very high. However, moderate complications such as repeated urinary tract infection, urinary tract calculi formation, and the need for urethrotomy and dilation are experienced by most stricture patients, and a few even experience severe complications such as sepsis and ultimately renal failure, as described previously.[1] Depending on its location and pathogenesis, a urethral stricture can be classified as "anterior" or "posterior." Anterior stricture accounts for most (92.2%) incidences, and most frequently occurs in the bulbar urethra, followed by the penile urethra, penile plus bulbar urethra, and panurethra in developed countries.[2] Nearly 40% of anterior stricture cases are caused by iatrogenic procedures.[2] Since Sachse[3] introduced direct endoscopic urethrotomy with the cold-knife technique in 1973, several types of endoscopic procedures have become available for the management of urethral stricture

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disease. The "cut to the light" and core-through procedures have also been developed to establish continuity of the urethra.[4,5] Furthermore, the benique bougie guide-through suprapubic catheter, which can be used for index finger-guided optical urethrotomy, has also been used for urethral reconstruction.[6] In addition, many incision options have also been applied, including electrotomy and incision by various types of lasers. Complete obliteration of the urethra during endoscopic procedures remains a challenge for surgeons. It is technically demanding because it is difficult to identify the right approach. Surrounding tissues may be injured, and massive bleeding and fluid extravasation may occur. Even after the correct approach to the obliterated site is identified, access to the incision area may be lost.

In the present study, we describe a modified procedure in which an endoscopic retrograde incision is used in combination with antegrade flexible cystoscopy for treating a short completely obliterated urethra. This procedure is indicated if the obliterated segment is less than 10 mm. The latter procedure can guide the direction of the incision and enable passage through all of the urethra after the incision of the completely obliterated area.

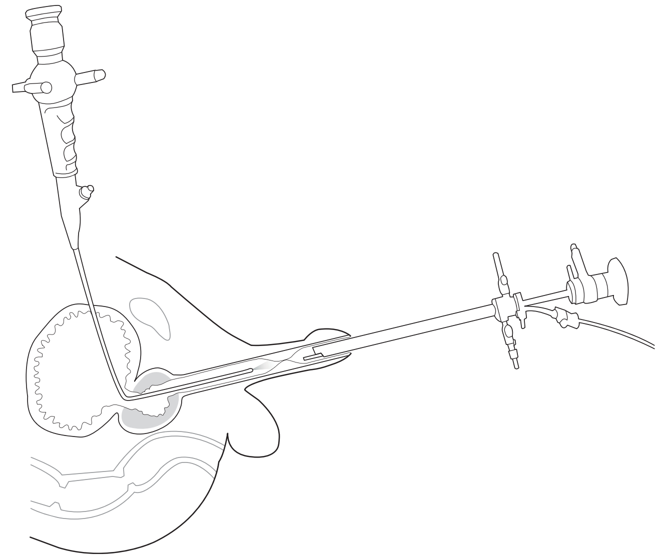

Figure 1. Endoscopic retrograde incision is used in combination with antegrade flexible cystoscopy for treating a completely obliterated urethra.

2. Materials and methods

Forty-three male patients who underwent optical urethrotomy for urethral strictures at Kaohsiung Municipal Ta-Tung Hospital (Kaohsiung, Taiwan) between March 2013 and January 2015 were inducted in the study. Five (11.6%) of them were diagnosed as having complete urethral obliteration, which was defined as failure to view the urethral pathway and the inability to pass a guidewire across the urethra. Six endoscopic incision procedures were performed for these five patients. At least two surgeons (using an antegrade and retrograde cystoscope) performed the procedures at a single hopsital. A standard operation procedure was established in our institute. Furthermore, the procedures were confirmed by postoperative discussion and operation records. The cystostomy trait was usually created in the emergent department because of the acute urine retention with failure of an indwelling Foley catheter. Not until the completely obliterated urethra was visible, the flexible cystoscope was inserted *via* cystostomy to identify the urethral pathway.

Patients were placed under general anesthesia in the lithotomy position. A 20-Fr cystoscope was used to identify the totally obliterated region. An antegrade flexible cystoscope was inserted into the bladder neck *via* cystostomy trait. Both endoscopes were visualized using a standard closed-circuit device camera (Karl Storz; Tuttlingen, Germany). The light from the distal 20-Fr cystoscope was then dimmed, and the resultant light from the proximal site of the urethra enabled the identification of the correct direction for further incision. Retrograde Ho:YAG lasers were then applied (Unique Medical Devices; Haryana, India). A 500-μm laser fiber at 10 W laser power (0.8–1.0 J/pulse and 10 Hz frequency) was used to incise the obliterated tissues until continuity of the urethra was achieved (Figures 1 and 2A). The flexible cystoscope could pass through the entire urethra (Figure 2B) until the urethra opening. It was then exchanged for a guidewire, which allowed through-and-through access. The proximal scope thus showed the right approach, whereas the distal scope could operate on the occlusion sites by allowing visualization of the light from the proximal scope and aiming the beam of the laser fiber during the entire procedure. The laser fiber was positioned approximately 1 mm away from the tissue. The cutting of the scar was initiated most commonly at the 12-o'clock position until suitable caliber of urethra comparable to the proximal site or continuity using the antegrade flexible cystoscope was achieved. After incision of the stricture site, continuity of the urethra was ensured using the antegrade flexible cystoscope *via* suprapubic access to the urethral opening (Figure 2B). Once access was established through the obliterated segment, the guidewire could be passed from within the flexible cystoscope, after which balloon dilation could be performed. Percutaneous nephrostomy balloon dilation was performed [a 5F, 80-cm open lumen and a blunt-tip catheter with a marked 4-cm-long balloon with a 30F, 10-mm diameter, Cook (Bloomington, USA)] for the urethral dilation. After the catheter was positioned over the obliterated site, the balloon was then gradually inflated to 10 atm for 10 minutes with water (maximum inflation, 12 atm) under direct vision. An indwelling 20–24 Fr silicone Foley catheter was left in place for at least 2 weeks. The patients were discharged the next day, and the catheters were removed at the outpatient clinic. Therefore, the Foley catheters were retained. This study was approved by the Institutional Review Board of Kaohsiung Municipal Ta-Tung Hospital (Kaohsiung, Taiwan).

3. Results

In all five patients with a completely obliterated urethra, a retrograde laser incision was performed successfully. The mean age of the patients was 59.7 ± 4.3 years, and the mean operation time was 97.7 ± 29.8 minutes. Three patients had total bulbar urethral obstruction and two patients had penile obstruction. In three patients, the obstruction had been caused by iatrogenic procedures; in one patient, by trauma; and in one patient, by a chronic inflammatory process. Based on our previous experience, retaining the Foley catheter internally for a completely obliterated urethra should be in place for a little longer than usual in urethra stricture patients. Therefore, 2–3 weeks depending on the OPD follow-up time were decided. The Foley catheters were retained for an average of 2.8 weeks.

The patient with chronic inflammation because of poorly controlled diabetes mellitus redeveloped a stricture, which needed a repeated incision. The interval between the two procedures was 3 months because of acute urine retention episode. The patient sought treatment at our emergent department. Cystostomy was performed in our emergent department. For the second precedure, the laser incision of the stricture was arranged for the next day.

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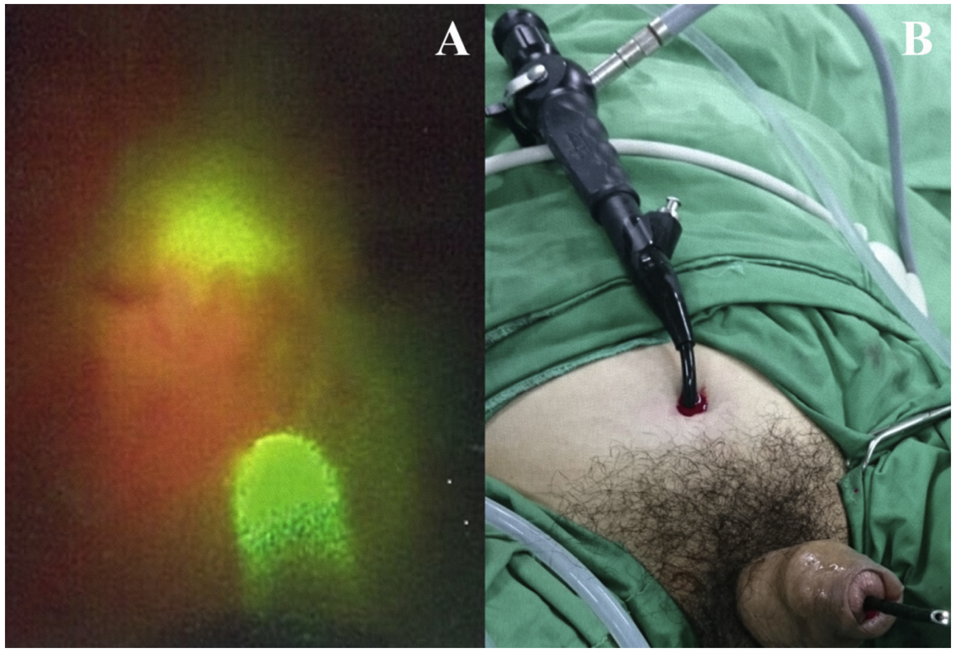

Figure 2. The procedure. (A) A laser fiber is used to incise the obliterated tissues by allowing visualization of the light from the proximal scope and aiming the beam of the laser fiber during the entire procedure. (B) The continuity of the urethra is ensured using the antegrade flexible cystoscope via suprapubic access to the urethral opening.

Urethral sounding was performed in two patients at the outpatient clinic to retain the urethral opening. All patients experienced improvements in urination after the procedure, during an average follow up of 18 months (range, 5–22 months). No intraoperative or postoperative complications from the incision procedures were noted.

4. Discussion

Although rare disorder, urinary tract stricture is a potentially risky complication. Open urethroplasty has higher long-term success rates (85–90%) than internal urethrotomy (20–30%).[7,8] A previous report[9] also demonstrated that the most cost-effective strategy for the treatment of short (1–2 cm) bulbar urethral strictures is to first try a single endoscopic procedure. If this does not fulfill the patient's expectations, urethroplasty, which is the gold-standard treatment, should be conducted. Even though the long-term success rate of internal urethrotomy is less than 35%, it is more cost effective than urethroplasty as the primary therapy. Some researchers have raised the issue of whether previous internal urethrotomy reduces the success rate of urethroplasty. One retrospective study[10] concluded that a previous failed internal urethrotomy does not affect the long-term results of urethroplasty. As follow-up time increases, the success rate of urethroplasty does decrease, but it is still higher than that of urethrotomy. Despite this, urethroplasty is the least frequently performed of all possible treatment measures,[11] the most popular being direct-vision internal urethrotomy, followed by urethral dilation, and urethral stent/steroid injection; less than 1% of patients undergo urethroplasty.[11] Endoscopic urethrotomy with retrograde incision using a guidewire or ureteral catheter was first introduced by Sachse.[3] In addition to cold-knife incision, the use of lasers for urethrotomy has also been investigated.[12–15] Each laser has distinct risks because of different mechanisms of action of lasers. A survey of members of the American Urological Association (Linthicum Heights, MD, USA) have shown that the most common minimal invasion for the treatment of urethral strictures is dilation (92.8%), followed by cold-knife urethrotomy (85.6%), urethral stent (23.4%), and laser urethrotomy (19%).[16] One prospective randomized clinical trial demonstrated that the operation time was shorter with a better long-term recurrence-free rate in a group that underwent low-power Ho:YAG laser urethrotomy than in a group that underwent cold-knife urethrotomy.[14] A Ho:YAG laser urethrotomy is reportedly safe and effective for internal urethrotomy.[15] Most endoscopic procedures need the creation of a path that passes through the entire stricture site with a guidewire or laser fiber. The problem with passing a guidewire through a completely obliterated urethra is the associated risk of injury to adjacent tissues. The advantage of the "cut to the light" and the core-through procedures is direct visualization, which shows the route to obtain access through the obliterated tissues. However, with these techniques, access may be lost when the laser fiber is replaced with a guidewire. To prevent this, Thomas el al[17] report forming an incision through obliterated tissues by using a laser fiber, which also acts as a guidewire. We modified their procedure by using a flexible cystoscope for light guidance in addition to a guidewire. The proximal light source could be visualized by the distal cystoscope; furthermore, the laser-aiming beam was also visualized by the proximal cystoscope, whereby the correct orientation could be ensured. The advantage of low-power Ho:YAG lasers is that they can focus on the scar tissue and reduce the risk of stricture recurrence.[15] After antegrade penetration from a suprapubic incision to the urethral opening, a through-and-through access was formed whereby the possibility of losing the access was minimized. Balloon dilatation was subsequently performed.

A previous study[18] showed that balloon dilation of the urethra was associated with a low risk of complications, was well tolerated, and reduced the risk of spongiofibrosis. Compared to traditional rigid dilators, balloon dilators apply radial force on the scar segment, with a low shearing force, and reduce the possibility of trauma.[19]

Many recent studies[6, 20–24] have focused on preventing post-endoscopic urethrotomy strictures with techniques such as post-operative catheterization, repeated dilation, and intraurethral

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injection. Postendoscopic catheterization is well accepted, although the optimal duration differs among studies[6,20–22]. Mondy et al[21] stated that the catheter should be left in place for at least 3 days. By contrast, al-Ali et al[6] left a 16-Fr catheter in place for 1 month and a 22-Fr catheter in place for another 2 months. Another report[22] indicates that prolonged use of an indwelling catheter may not yield better results.

Another common method is intermittent self-catheterization. However, This approach may reduce the risk of recurrent urethral stricture after endoscopic treatment[23]; however, patients have a poor quality of life. Furthermore, catheter placement was inconvenient and moderately painful.[24] Other methods for preventing postendoscopic urethrotomy strictures include local or transurethral use of agents. However, related studies include only a small number of patients and the follow-up time is short.

During the procedure of optic urethrotomy for complete urethral obstruction, most surgeons failed to determine the true tract by blind incision. By our technique, we can preserve maximal normal urethral tract with its natural epithelium to prevent further iatrogenic trauma which may cause another episode of stricture in the future.

There are three notable limitation to be acknowledged. First, this procedure is only indicated if the obliterated segment is less than 10 mm. The guiding light cannot be visualized in pts with a long obliterated urethra or traumatic totally transected urethra. Second, in this report, no comparison was made to thereby provide sufficient evidence that the laser energy-based internal urethrotomy is better than the traditional cold-knife internal urethrotomy. Third, we did not perform the uroflowmetry for every patient. Therefore, there were no data to show the improvement in urination.

Our preliminary data showed that our modified method for treating a short completely obliterated urethra yielded satisfactory results. Long-term follow up and large-scale studies should be conducted to better examine technique efficacy; however, our current results regarding the simple modification of endoscopic urethrotomy seem promising for treating a short completely obliterated urethra.

Conflicts of interest

All authors declare no conflicts of interest.

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