

Technique of Tubularized Bladder Mucosa Method for Treating Recurrent Vesicoureteral Reflux

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INTRODUCTION

Conventional open ureterovesical reimplantation is the gold standard in vesicoureteral reflux (VUR) treatment and is associated with low complication rates and success rates as high as 95–98%.^[1] Complications of VUR can be treated with direct ureteroneocystostomy in most cases. If the ureter is not long enough for reimplantation, the bladder may be mobilized, and ureteral continuity achieved with the creation of a psoas bladder hitch or Boari bladder flap.^[2] These techniques were reported to be traumatic, difficult to perform and destructive. Herein, we describe a tubularized bladder mucosa (TBM) method for treating this type of VUR. This method was designed to simplify the operation and reduce the trauma.

PATIENTS AND METHODS

Patients

This was a retrospective study conducted using data retrieved from the database of Beijing Children's Hospital. A total of 13 patients underwent TBM management of VUR after ureterovesical reimplantation at our institution during the defined study period (January 1996 to February 2014). All patients had been diagnosed as primary VUR or primary obstructive megaureter and undergone cross-trigonal intravesical reimplantation before receiving TBM. We learned medical history of the patients and performed examinations of intravenous pyelogram (IVP), voiding cystourethrogram (VCUG) and ultrasonography, patients with secondary VUR (lower urinary tract obstruction) were excluded. Reoperation with TBM was performed over 12 months after the previous operation.

Grades of VUR were defined by the International Reflux Study Committee. Antibiotic prophylaxis was given if the

preoperative evaluation demonstrated VUR and maintained until TBM. The postoperative follow-up at 6 months included assessment of the surgery outcomes, IVP, VCUG, and ultrasonography. Patients who had postoperative voiding dysfunction, renal insufficiency, or persistent urinary tract infections (UTIs) were followed longer than 6 months as needed. Urodynamics study was performed when bladder dysfunction was suspected.

Surgical technique

First, the bladder was opened through the original incision. The procedure began by making a U-shaped incision of 2–3 cm in length and 1.0–1.5 cm in width over the bladder mucosa, extending from the ureteral orifice and along submucosal ureteric direction. The original ureteric orifices were usually on the top of bladder or in the middle of the trigone, so there was enough space for TBM to avoid ureteric orifice extending to the side wall of bladder and twisting the distal end of ureter. A sufficient relaxed mobilization was made at bilateral margins of the mucosa plate to allow tension-free tubing. To prevent mucosa tearing with a running suture, a neotunnel was formed over a 6F stent by tubing the mobilized margins of the bladder mucosal plate with interrupted sutures [Figure 1]. Then the bilateral mucosa around the plate was closed with a running suture. The newly formed ureteric orifice (TBM orifice, precisely) was completed with interrupted sutures encompassing the TBM wall and bladder mucosa only, all using absorbable 4/0 poly-p-dioxanone suture. The external ureteral stent was placed along the TBM until it reached the middle of the ureter. All patients were treated with external ureteral stent and catheter as follows: Before closing the bladder, the external ureteral stent was passed through the anterior bladder wall and an 8–10F cystostomy catheter was placed into the bladder, both of which were also brought out and sutured to the skin. The external ureteral stent was removed between days 7 and 10. After removal of the stent, the cystostomy was clamped, and the patient resumed voiding. The catheter was removed or not depending on the

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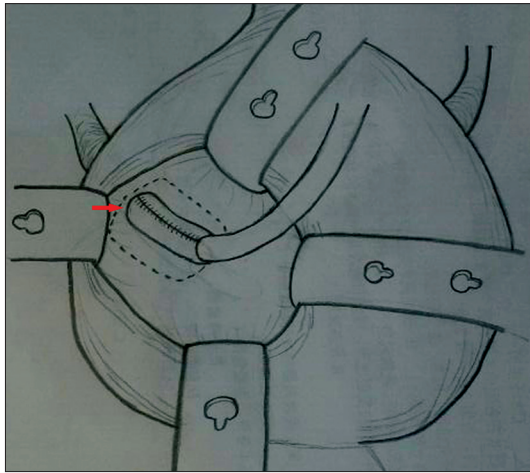


Figure 1: Mobilized U-shaped plate was sutured. The internal urethral orifice was pointed out by red arrow.

results. It was removed after clamping for 3 days without fever and dysuria (a total of 10–13 days). Antibiotics were started at the time of surgery and were continued until the cystostomy was removed (10–13 days). We retained the cystostomy in patients with fever and dysuria until VUR and/or UTIs were cured.

RESULTS

Patients

Data on 13 patients (9 boys and 4 girls) were collected from January 1996 to February 2014. The reflux in 16 units (3 bilateral) was grade III in 5, IV–V in 11. The mean age at surgery was 39.4 month (range 10–96 months at surgery). Repeat UTIs were presented in 9 patients with grade III–V VUR. The indications for surgery were unimproved VUR, progressive hydronephrosis, and recurrent symptomatic UTIs.

Surgical outcomes

All 13 patients were undergone operation until UTIs were under control, and the 16 units were performed with TBM. The mean length-diameter ratio of U-shape incision was 5.2:1, operative time and follow-up time was 83 min (skin incision to closure, range 65–105 min) and 21 months (range 6–54 months), respectively. Postoperative complications were observed in one patient: The patient had persistent grade III VUR with breakthrough febrile UTI in the ipsilateral ureter (left ureter) after TBM. This patient sustained fever immediately after clamping the cystostomy catheter and was cured by antibiotic treatment continuing for 1 week. VCUg demonstrated grade III VUR 3 months later, and the cystostomy catheter was removed after clamping for 1 week without febrile UTI. Since then, he received antibiotic prophylaxis for 18 months without a progressive decline of kidney function, but still had persistent I–II grade VUR. Now, He was followed-up closely on observation of renal function and reflux grade. VURs were resolved in 12 patients, 15 ureters with 6-month follow-up VCUg (92.3%, 93.8%, respectively), and IVP demonstrated improvement of renal function. No patient

had postoperative urinary retention, persistent hematuria, and contralateral VUR.

DISCUSSION

Despite various described techniques for treating VUR, such as invasive endoscopic injection and minimally invasive surgery, conventional open ureteroneocystostomy is the gold standard in VUR treatment.^[1] The main purpose of these techniques is to provide the flap valve mechanism to temporarily close the ureter under increased intravesical pressure and also to provide a nonobstructed urinary flow toward the bladder with a normal ureteral peristalsis. The most widely used method is the cross-trigonal intravesical reimplantation technique described by Cohen.^[3] Regardless of which method is used, all procedures are associated with certain failure rates. The most common complications are VUR, followed by vesicoureteral junction obstruction.

Vesicoureteral reflux recurs potentially because of the ineffective flap valve mechanism when the length-to-ureteral-diameter ratio of the submucosal tunnel is <5:1.^[1] To shrink the diameter and ensure the ratio of the submucosal tunnel, ureteral plication or excisional ureteral tapering must be performed in the dilated ureters.^[3] Dissection of too much distal ureter for reimplantation increases the risk of devascularization, while resultant necrosis and obstruction also may develop.

For treating recurrent VUR, we usually can mobilize sufficient length of ureter for vesico-ureteric reimplantation. If ureters were fibrosed and difficult to dissect, or not long enough after excessive mobilization, ureteroneocystostomy is difficult by conventional methods. Extravesical reimplantation seems to be an easy technique for this situation, but it is difficult to dissect peritubal adhesions and has the risk of increased postoperative temporal urinary retention in patients undergoing bilateral ureteral reimplantation.^[3] For these cases, psoas hitch or Boari flap can be performed in the reconstruction of the ureter, but the success rates were 88% and 83%, respectively.^[2] Nevertheless, mobilization of the bladder with fixation above the iliac vessels to guarantee a tension-free ureteric anastomosis can result in great injury to the bladder and can also cause potential injury to the pelvic plexus nerves. In addition, excessive mobilization of the distal ureter for an adequate submucosal tunnel can result in injury to the distal ureteral vessels and nerves.^[4] Moreover, these approaches are more complex than TBM. For these cases, we proposed an easy method derived from the Duplay technique for hypospadias repair to treat VUR,^[5] and use of the extended submucosal tunnel reconstructed by TBM provides the flap valve to prevent reflux. Intravesical TBM technique without the mobilization of ureter decreased the difficulty and has no risk of distal ureteral devascularization and necrosis. Although the previous submucosal tunnel might be existed and had little function to resist reflux. The TBM length-to-diameter ratio of 5:1 was created by a U-shaped incision with a length-to-width ratio of 5:3 over the bladder mucosa extending from the distal ureteral orifice as the conventional ureteroneocystostomy.

TBM has no peristalsis, but the urine can flow from the pelvis toward the bladder entrance with residual ureteral peristalsis and run into the bladder if there is no obstruction of TBM. The bladder mucosa along the distal ureteral orifice, which may become fragile, fibrotic, thickened or metaplastic due to previous conditions such as exstrophy, vesicostomy or neurogenic dysfunction, is considered unfit for TBM. Because of the poor elasticity of the bladder mucosa, the submucosal tunnel is at the risk of kinking or obstruction and should be created in the direction of the distal ureter. The TBM remains temporarily closed under increased intravesical pressure and also provide a nonobstructed urinary flow from the kidneys toward the bladder. Similar to the bladder mucosa graft for urethral reconstruction,^[5] complications of tunnel fistula and stenosis may develop. Incising a wide-enough U-shaped plate and retaining a long-enough stent may decrease stenosis. A part of the blood supply can be preserved to reduce fistula and stenosis by preserving a narrow strip of mucosa from the new hiatus to the original orifice, while the bilateral margins of the mucosa plate are mobilized. In our study, only one presented with grade III VUR postoperation, The success rate was 92.3% (12/13) in patients and 93.8% (15/16) in ureters, similar to traditional procedures such as Cohen,^[1] and higher than psoas hitch and Boari flap.^[2]

TBM is still a premature technique that only affords a choice of a simple method by which to deal with failed ureteral reimplantation patients, those with suitable bladder

mucosa. We do not know whether the TBM method can be applied to treat primary VUR or all reflux, and the method still needs further research to expand on results of the present study.

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