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Loop ureterocystoplasty for multiple reimplantation failures of refluxing megaureter to atrophic bladder: A novel technique and its long term outcome

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ABSTRACT

We encountered a 9-year-old boy with a small bladder who had previously undergone multiple ureteroneocystostomies for unilateral refluxing megaureter. He underwent excision of the affected non-functioning kidney and ureterocystoplasty used the dilated regional ureter, in which the loop shaped urinary bladder was reconstructed without detubularization of the dilated ureter. The long-term postoperative course has been satisfactory. There have been no reports of ureterocystoplasty used a dilated ureter after multiple ureteroneocystostomies and none describing ureterocystoplasty in which the ureter was looped. This case is presented herein.

Key Words: Augmentation cystoplasty, ureterocystoplasty, ureteroneocystostomy.

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Introduction

The most common types of a ugmentation cystoplasty are enterocystoplasty and ureterocystoplasty. Ureterocystoplasty is indicated only in patients with markedly dilated ureters used in bladder augmentation [1]. However, since the ureter, an uroepithelium lined material, is used for ureterocystoplasty, this technique is more advantageous than enterocystoplasty; e.g., there are no complications associated with using the gastrointestinal segments [2], and in some cases, spontaneous voiding can be achieved after surgery. A standard ureterocystoplasty, in which a detubularized ureter is anastomosed to the bladder is performed and the applications of various operative techniques have been reported [1,3-7]. Ureterocystoplasty is regarded as an urodynamically effective and reproducible procedure [8]. Ureterocystoplasty used the ureter in a patient who had undergone a single ureteroneocystostomy was previously reported [9]. However, there have been no reports of ureterocystoplasty used the ureter after multiple ureteroneocystostomies and none describing ureterocystoplasty in which the ureter was looped without being detubularized. We encountered a pediatric patient with a

small bladder who had undergone 3 times ureteroneocystostomies for unilateral refluxing megaureter but in whom recurrent febrile urinary tract infection (UTI) could not be controlled. The patient underwent excision of the affected non-functioning kidney and ureterocystoplasty used the dilated regional ureter, in which the loop shaped urinary bladder was reconstructed.

Case report

The patient, a boy 9 years and 4 months of age, presented with no neurological abnormalities. MRI findings of the spine were normal. For right vesicoureteral reflux (VUR) Grade V (Fig. 1-a), the patient had undergone right ureteroneocystostomy at another hospital 8 months after birth. Dimercaptosuccinic acid (DMSA) renal scintigraphy showed right split renal function of 25%. During the postoperative course, bilateral VUR developed and febrile UTI recurred (Fig. 1-b,c). Therefore, at the same hospital, the patient underwent bilateral ureteroneocystostomy including right ureteroplasty (resection tapering) at the age of 2 years. However, recurrent right pyelonephritis could not be controlled. Thus, the patient was referred to our hospital at the age of 5 years for detailed examination and treatment. VUR was found in the bilateral dilated ureters and no anatomical urethral obstruction was found on voiding cystourethrography (VCUG) (Fig. 2-a-c). While the bladder capacity was small at only 50 mL, it was confirmed that the patient could void without post-void residual urine. Uroflowmetry (UFM) showed normal (Bell-shaped) curve and voided urine volume and post-void residual urine volume were 56 ml and 5 mL respectively.

On cystometrogram (CMG), the bladder capacity was 70 mL, and the intravesical pressure was 6 cmH_2O. The patient was diagnosed with mildly increased intravesical pressure. Timed voiding was started in combination with anticholinergic administration. Voided urine volume increased to 100-150ml on bladder diary. However, post-void residual urine volume also increased and, recurrent right pyelonephritis could not be controlled.

DMSA renal scintigraphy showed right split renal function of 19%. Radical surgery for bilateral VUR was considered to be necessary, and the patient underwent bilateral ureteroneocystostomy (psoas bladder hitch procedure with bilateral ureteroplasty (folding) at the age of 6 years and 11 months. VCUG was performed 5 months after surgery, revealing a heart-shaped bladder deformity due to the effect of bilateral psoas bladder hitch procedure and the disappearance of the left VUR, while the right VUR worsened, resulting in the formation of a urine reservoir consisting of the bladder and the right ureter with a urine storage capacity of 280 mL (Fig. 2-d). When urine was stored to the maximum capacity, the pressure in the entire reservoir involving the bladder and right ureter was low at 8 cmH_2O.

In addition to urotherapy, clean intermittent catheterization (CIC) was started twice daily because post-void residual urine in bladder and right renal pelvis was confirmed after spontaneous voiding. However, the patient refused the CIC due to urethral pain associated with catheter insertion, subsequently experiencing recurrent right pyelonephritis. DMSA renal scintigraphy showed that recurrent pyelonephritis exacerbated the right renal function, resulting in the non-functioning kidney.

At the age of 9 years and 4 months, the patient underwent right nephrectomy and ureterocystoplasty to enable spontaneous

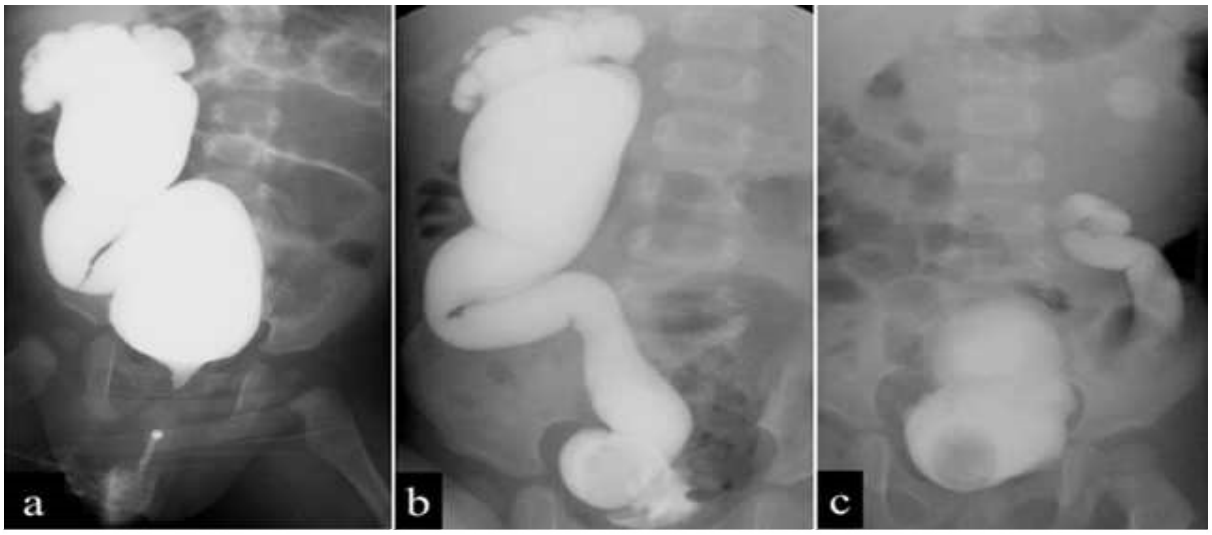

Fig. 1. Voiding cystourethrography before loop ureterocystoplasty: a) Before the first right ureteroneocystostomy; Right VUR Grade V and no bladder deformity are noted; b, c) Before the second ureteroneocystostomy; Bilateral VUR is noted. The bladder is mildly deformed.

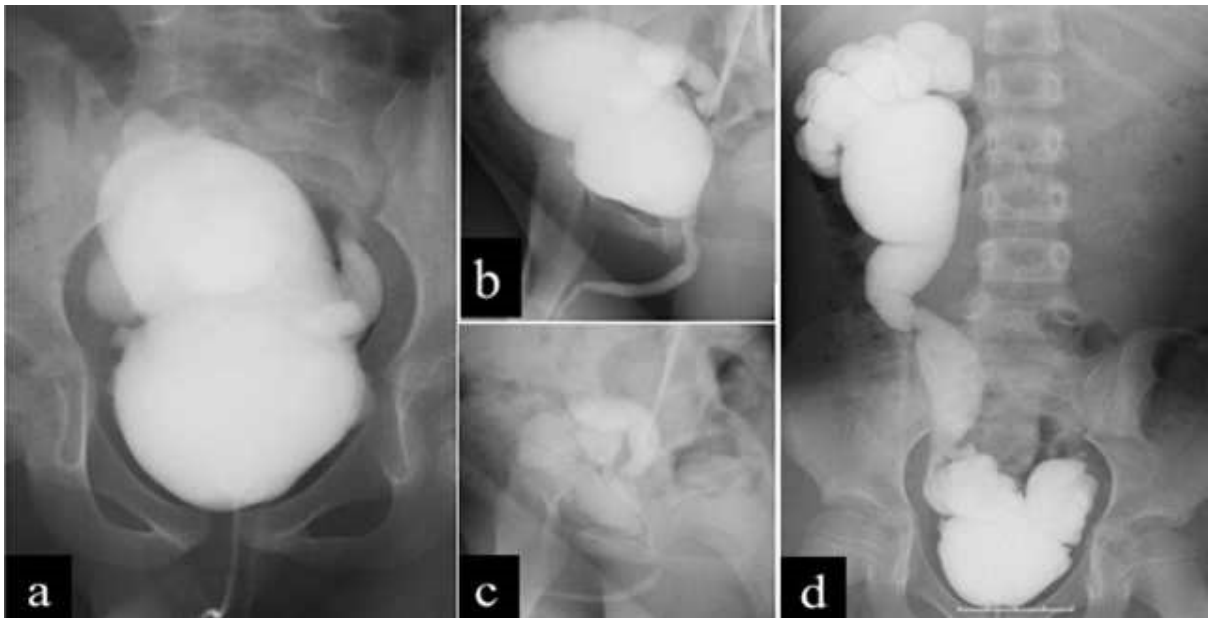

Fig. 2. Voiding cystourethrography before loop ureterocystoplasty: a, b, c) Before the third ureteroneocystostomy; VUR is noted in the lower segments of the bilateral ureters. The bladder is mildly deformed. The patient can void without post-void residual urine; d) After the third ureteroneocystostomy; Severe right VUR and heart-shaped bladder deformity are noted.

voiding. The right kidney was first removed transabdominally (Fig. 3-a) and the renal pelvis was separated at the border between the kidney and the extrarenal pelvis (Fig. 3-b). The vessels from the renal artery to the renal pelvis were severed. A Pfannenstiel incision was then made to reach the prevesical space and the bladder was identified (Fig. 3-b). Since the right lower ureter had previously been used 3 times ureteroneocystostomies, excessive detachment from the surrounding tissue was considered likely to be the cause of poor blood

supply to the right ureter, and detachment of the middle to distal portion of the right ureter from the surrounding tissue was therefore avoided. The blood flow in the right ureter was considered to possibly be exacerbated by detubularization of the ureter during augmentation cystoplasty. Thus, the right ureter was looped without being detubularized, and the right renal pelvis was reverted and anastomosed to the bladder by continuous suturing with 3-0 Vicryl suture (Fig. 3-c). A suprapubic catheter was placed for 14 days after surgery. On postoperative day (POD) 18, the patient was discharged from our hospital.

VCUG at 12 months after surgery showed that the bladder capacity was 250 mL. Spontaneous timed voiding by abdominal straining was performed; 200 mL could be drained from the bladder, and the post-void residual urine volume was 50 mL on US (Fig. 4). At and after postoperative 1 year, voiding function was assessed by UFM, because the patient rejected VCUG and CMG due to urethral pain associated with catheter insertion, which revealed that, after 3 years, the patient's bladder capacity had increased to 350 mL and subsequently remained unchanged, and no bladder overdistension was observed. To date, for the 7 years since the surgery, the postoperative course has been favorable. Intermittent spontaneous voiding by abdominal straining has been performed, enabling the drainage of 300-350 mL of urine, and the post-void residual urine volume has

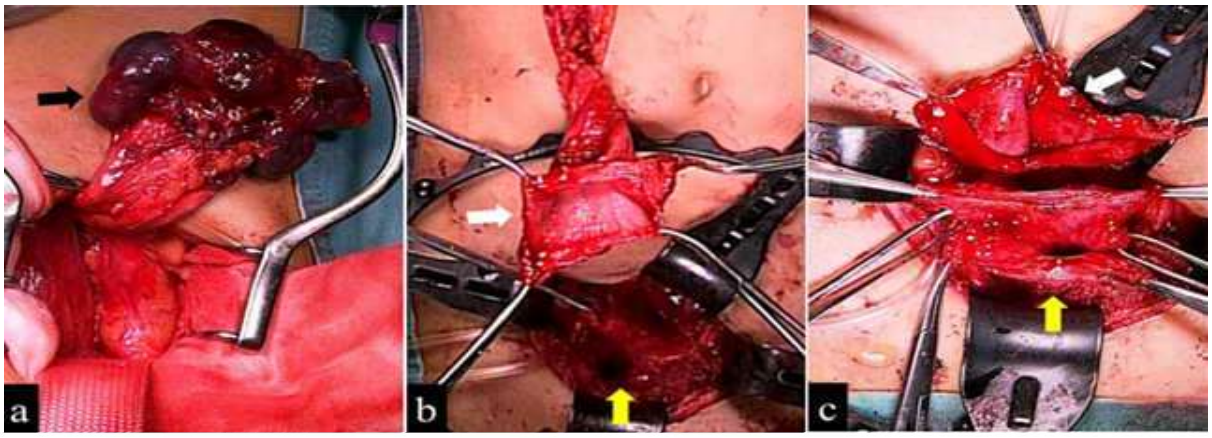

Fig. 3. Intraoperative findings during loop ureterocystoplasty: a) The non-functioning right kidney is removed transabdominally via a para-rectus muscle incision; b) The dilated renal pelvis separated from the right kidney is reverted caudally; d) The anastomotic site between the right renal pelvis and bladder is visible. The black, white, and yellow arrows indicate the right kidney, right renal pelvis, and bladder, respectively.

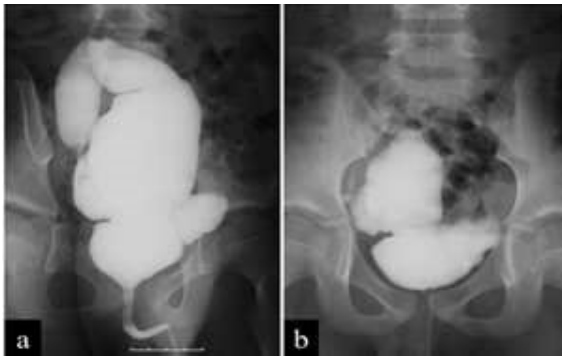

Fig. 4. Voiding cystourethrography after loop ureterocystoplasty: a) A loop shaped bladder consisting of the bladder anastomosed to the right renal pelvis is observed during voiding (maximum bladder capacity: 250 mL); b) Post-void residual urine volume is 50 mL on ultrasonography.

remained as small as 10–25 mL without urinary incontinence. There have been no occurrences of febrile UTI postoperatively, and on DMSA renal scintigraphy, the unaffected left kidney has been functioning normally without renal scarring.

Discussion

To our knowledge, this is the first report of ureterocystoplasty in which the ureter after multiple ureteroneocystostomies was looped without being detubularized and was then anastomosed to the bladder. The various techniques of ureterocystoplasty have been reported [3-8]. As shown in this case, ureterocystoplasty is considered to be the most reasonable method in patients who have a small bladder with a markedly dilated ureter associated with a unilateral non-functioning kidney and who may be judged to be capable of spontaneous voiding.

VCUG before the first ureteroneocystostomy showed no bladder deformity (Fig. 1-a). Bladder deformity occurred and progressed during infancy after the first ureteroneocystostomy, resulting in decreased bladder capacity (Fig. 1-b,c and Fig. 2). Regarding the cause of the small bladder in this patient, no neurological abnormalities and no anatomical/functional urethral obstruction were detected and it remains unclear whether the patient's condition was due to a detrusor disorder associated with multiple ureteroneocystostomies or to nonneurogenic neurogenic bladder [10, 11]. We should had been regarded his bladder function as low compliant rather than relatively high on the first CMG, because the patient had bilateral high grade VUR. Recurrent febrile UTI resulted in a non-functioning right kidney. Early cutaneous vesicostomy [10, 11] or early augmentation cystoplasty should have been performed before the loss of the right renal function. In the patient before the loss of the right renal function, the distal segment of the right ureter should be used for ureterocytoplasty, and the proximal segment of the right ureter should be anastomosed to the bladder [3, 5] or to the contralateral left ureter [4,7]. It is assumed that transureteroureterostomy [4,7] might have been selected for this patient because a 4th ureteroneocystostomy may well have increased the risk of complications such as VUR and ureteral obstruction.

Churchill et al. reported ureterocystoplasty used the ureter in a patient who had undergone a single ureteroneocystostomy [9]. In our patient with multiple ureteroneocystostomies, the blood supply from the iliac artery and the bladder to the lower segment of the ureter was considered to be insufficient. It was also considered to be preferable that the blood vessels from the renal artery to the renal pelvis and upper segment of the ureter be preserved during ipsilateral nephrectomy. However, it was essential to sever these vessels in order to pull the renal pelvis caudally to the bladder without tension. In this patient, the main blood supply to the right ureter was highly likely to be dependent only on the blood vessel distribution from the gonadal artery to the middle segment of the ureter. Churchill et al. reported that, even in patients presenting with damaged blood vessels from the iliac artery to the ureter due to prior surgery, blood supply to the ureter can be maintained even after detubularization of the dilated ureter used for ureterocystoplasty if blood supply from the renal and gonadal arteries to the ureter are preserved [9]. In our case, it appeared to not be feasible to preserve the blood vessels not only those from the iliac artery but also the vessels from the renal artery. Therefore, it was

determined that, for preservation of blood supply to the ureter, the dilated ureter to be used for augmentation cystoplasty not be detubularized. Accordingly, loop ureterocystoplasty was performed. The persistent of reflux to the ureteral stump after nephrectomy is often symptomatic after ureterocystoplasty. In the patient, no persistent of reflux to the ureteral stump after nephrectomy was observed. This is the advantage of our loop ureterocystoplasty over standard ureterocystoplasty.

The difference between ileum and ureter is bladder compliance after augmentation cystoplasty. The bladder compliance after ureterocystoplasty is higher. Therefore, some of the patients who underwent ureterocystoplasty can void spontaneously. In the case we present here, the persistence of massive post void residual urine in the bladder due to the urine in refluxing ureter was observed before loop ureterocystoplasty. Therefore, the patient was required CIC for the purpose of preventing from recurrent UTI. However, after loop ureterocystoplasty, the urine in refluxing ureter flowed into bladder automatically. The patient was not required CIC and satisfactory spontaneous voiding could be achieved employing timed voiding by abdominal straining. We didn't perform a construction of abdominal continent catheterizable stoma, because some of the patients who underwent ureterocystoplasty could void spontaneously. However, if the patient had not voided spontaneously after ureterocystoplasty, we would have constructed abdominal continent catheterizable stoma in reoperation. Further long-term follow-up examinations are considered to be essential for monitoring of the functions of the unaffected left kidney and the bladder function.

Conclusion

When ureterocystoplasty is performed on patients with a history of multiple surgeries on the distal side of the ureter, loop ureterocystoplasty might be one of the treatment options. However, it must be recognized preoperatively that, if poor blood flow in the renal pelvis and ureter to be used for augmentation cystoplasty is observed intraoperatively, ureterocystoplasty should be discontinued and switched to enterocystoplasty with or without abdominal continent catheterizable stoma.

Compliance with ethical statements

Conflicts of Interest: None.

Financial disclosure: None.

Consent: All photos were taken with parental consent.

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