Original article

Outcome analysis of Cohen's cross trigonal ureteric reimplantation in paediatric age group

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Abstract

Introduction: Cohen's cross trigonal ureteric reimplantation is the gold standard for surgical management of vesicoureteric reflux (VUR) in children with high success rate. The objective of this study was to evaluate and assess the outcome of open Cohen's procedure in children with VUR.

Methods: A retrospective review of all patients with VUR who underwent Cohen's procedure between March 2010 and February 2020 was done. The following were recorded for each patient: age, sex, grade of reflux, operative time, outcome and complications.

Results: The series consisted of 40 patients (25 girls and 15 boys) who underwent Cohen's procedure with a mean age of 32 months (6 months to 8 years). Bilateral repairs were performed in 16 patients (40%) in the same setting and unilateral repair in 24 patients (60%). Twenty-two patients (55%) had grade IV VUR, 13 patients (32.5%) had grade V VUR and 05 patients (12.5%) had grade III VUR. Mean operative time for bilateral repairs was 249.4(200-290) minutes and 158.3(130-180) minutes for unilateral repair respectively. The mean length of hospital stay was 10.55 (7-15) days. Major complications included two persistent VURs, and one case of bladder hematoma. Postoperative ultrasound abdomen in all patients and micturating cystourethrogram in few patients was obtained, in which 38 patients (95%) had normal study.

Conclusion: Cohen's uretric reimplantation is a standard procedure in paediatric VUR. For better outcome, patient selection and refinement of operative technique should be pursued.

Keywords: Cohen's procedure; Ureteric reimplantation; Vesicoureteric reflux.

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Introduction

Vesicoureteric reflux (VUR) is one of the most common urologic conditions affecting children, with an estimated prevalence of approximately 1% in the general pediatric population.[1] The management of VUR has undergone remarkable changes in recent years and favors non-operative management. However, correction of reflux in some instances still needs surgical correction like in patients with breakthrough Urinary Tract Infection (UTI) while on antibiotic prophylaxis, high grade VUR (Grade IV and V), recurrent UTI after discontinuing antibiotic prophylaxis, compliance issues and persistent reflux with renal scarring.[2-3]

In this era of modern technology, laparoscopic ureteric re-implantation or endoscopic procedures involving subureteric transurethral injection are commonly used for treating VUR with less complications, are easy to perform, quick and minimally invasive and require short hospital stay.[4] However, in developing countries like Nepal where aforementioned facilities are not present, patients with VUR are managed with open ureteric reimplantation. Cohen, in 1975, described ureteric reimplantation technique with a success rate of 95-99% with relatively few complications and minimal morbidity.[5,6]

The aim of the current study is to evaluate the outcomes of Cohen's ureteric reimplantation in our part of world.

Methods

All patients who underwent Cohen's cross trigonal ureteric reimplantation at Ishan Children and Maternity Hospital between March 2010 and February 2020 (10 years duration) were retrospectively reviewed. Approval for this study was received from the hospital's Instituitional Review Board and research center (Ref 030-077/078). The following were recorded for each patient: age, sex, diagnosis of disease, degree and side in case of VUR, operation time, Clavien- Dindo postoperative complications and postoperative follow-up were documented and analyzed. VURs were graded according to the International Reflux Study in Children.[7] Data were assessed using the hospital information systems and fed into an Excel (Microsoft Corporation, Redmond, WA, USA) datasheet. Descriptive statistics were performed with the same software.

Inclusion criteria:

- Patients who underwent Cohens uretric reimplantation (both unilateral and bilateral) during this period were selected.
- Patients who need additional ureteric tapering procedures were also included.
- Patients who needed ureteric reimplantation as an adjunct with excision of bladder diverticulum

Exclusion criteria:

- Patient who were lost in follow up

Operative technique

All ureteric reimplantations were performed using the Cohen cross-trigonal technique. Stents were routinely placed. In all patients, the bladder was accessed using a Pfannenstiel incision and opened vertically. After identification of the ureteric orifices, the distal ureters were dissected and mobilized preserving vessels, nerves and vas in male child. A submucosal tunnel was prepared towards the contralateral trigonum as per Paquin law (5:1 ureteral tunnel length-to-diameter ratio). The ureters were anchored to the trigonal muscle and mucosal re-adaption was performed using 5/0 polyglactin sutures. In case of megaureter, the ureter was tailored or tapered over 12fr feeding tube, ureteric stent was kept. Bladder was closed in two layers. Abdominal wall was closed in layers using absorbable suture. 8-10F retropubic drain tube and foley catheter was kept.

Follow up

Chemoprophylaxis was continued for the first month after discharge and Ultrasound of Kidney-Ureter-Bladder (KUB) along with urine C/S was performed at one month during follow up. Chemoprophylaxis was stopped if USG of KUB did not show any significant dilatation of ureter and urine C/S showed no growth.

Second USG of KUB was performed at three months of follow up. However, option of performing MCUG or not was given to parents as it is an invasive test (MCUG), and there is chance of introduction of bacteria to urothelium.

Outcome was assessed by degree of radiographic resolution of reflux and resolution of UTI.

Results

This study consisted of 40 consecutive patients who underwent Cohen's procedure from March 2010 to February 2020. There were 25 girls and 15 boys. Mean age was 32 months (6 months to 8 years). Unilateral repair were performed in 24 patients (60%) and bilateral repairs in 16 patients (40%) in the same setting. Mean operative time for unilateral repair was 158.3(130-180) minutes and 249.4(200-290) minutes for bilateral repairs. The mean length of hospital stay was 10.55 (7-15) days (**Table 1**).

Table 1. Patient characteristics

Age at surgery (months)	Mean 32 (Range: 6-96)
Sex Male: Female	15 (37.5%): 25(62.5%)
Site of VUR (Left:Right:Bilateral)	10:14:16
Operation time One side (minutes)	249.4(200-290)
Operation time both sides (minutes)	158.3(130-180)
Hospital stay (days)	Mean 10.55 (7-15)
Follow-up (months)	Mean 28.13 (7-72)

Twenty-three patients (57.5%) had primary VUR while 07 patients (17.5%) were post-electro-fulguration cases for posterior urethral valve with VUR, 04 patients (10%) were post-electro-puncture for ureterocele cases with VUR, 03 patients (7.5%) had obstructed megaureter, 02 patients (5%) had ectopic ureter and 01 patients (2.5%) had urethral diverticulum in close vicinity to ureteric opening (**Figure 1**).

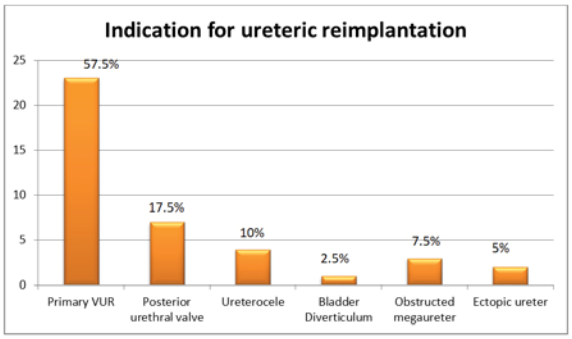

Figure 1. Indication for Cohens ureteric reimplantation (N=40)

Thirty five patients (87.5%) had VUR while 05 patients (12.5%) did not have VUR [03 patients had obstructed megaureter (VUJO), 01 had ectopic ureter and 01 had huge bladder diverticulum in close vicinity to ureteric opening] (**Figure 2**). Among 35 patients with VUR, 16 patients (45.7%) had bilateral VUR and 19 patients (54.3%) had unilateral VUR (Figure 2). All 35 patients had grade III or more VUR. Among which, 19 patients (54.3%) had grade IV VUR, while 13 patients (37.1%) had grade V VUR and 03 patients (8.6%) had grade III VUR (**Figure 3**).

Perioperative complications

Four patients had Grade I complications as described by Clavien-Dindo. Six patients had Grade II Clavien complications (**Table 2**). One patient had reactionary haemorrahge in the first postoperative day for which bladder was re-opened and intravesical clot was removed and haemostasis secured. Another patient developed Hospital Acquired Pneumonia in postoperative period for which ICU admission was required.

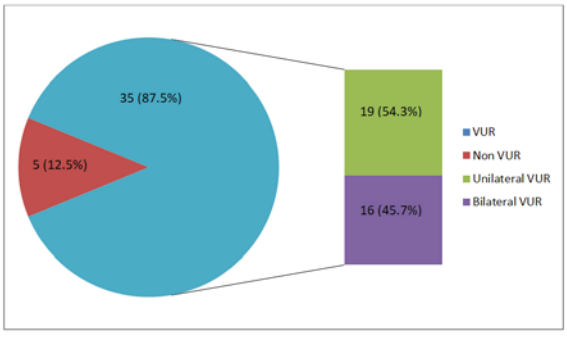

Figure 2. VUR vs Non-VUR (N=40)

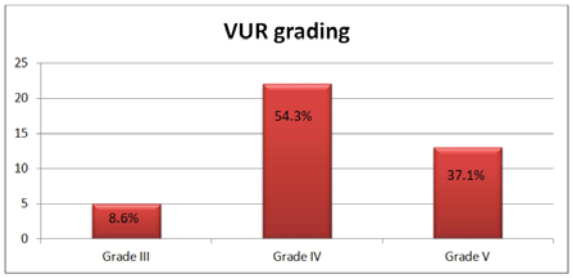

Figure 3. Vesicoureteric Reflux grading (N=35)

During follow-up (mean 28.13 months), four patients (10%) suffered febrile UTIs. Non-febrile UTIs were recorded in eight patients (20%) (**Table 3**). All patients had ultrasound of kidney, ureter and bladder at 3 months of postoperative period. Among the 24 unilateral procedures, 01 patient with obstructed megaureter had moderate to severe hydroureteronephrosis. MCUG showed persisting grade IV VUR and re-operation was performed later. Among 16 bilateral procedures, one patient (2.5%) were diagnosed with a grade III VUR of one side and was kept in prolong chemoprophylaxis.

Table 2. Complications/follow-up

Complications	N (%)
Clavien-Dindo grade I	4 (10%)
Clavien-Dindo grade II	6 (15%)
Clavien-Dindo grade III	2 (5%)
Clavien-Dindo grade IV	1 (2.5%)

Table 3. Late complications during follow up

Complications	N (%)
Febrile UTI	4 (10%)
Non-febrile UTI	8 (20%)
Ureteric Obstruction	0 (0%)
Recurrent VUR	2 (5%)
Re-do surgery later	1 (2.5%)

Discussion

The link between vesicoureteric problems like reflux or obstruction, urinary tract infections (UTIs), and kidney damage after acute pyelonephritis has been understood since the mid-to late 20th century.[8] Subsequently, concepts of surgical anti-reflux reimplantation of the ureters swiftly gained popularity and were demonstrated to be reliable and efficient.[9] For high-risk patients with dilated VUR or marked post-pyelonephritic changes on dimercaptosuccinic acid (DMSA) scans, open ureteric reimplantation remains the risk adapted, standard treatment.[10] The most commonly used technique for ureteric reimplantation with less complications in children is Cohen's cross-trigonal reimplantation.[9,11,12]

There have been many reports on Cohen's repair with success rates of 95-99%.[6] With increasing experience to the technique, the current institution has had two postoperative persistent VUR in last 40 patients operated, leading to an effective success rate of 95% (38/40); which was almost similar findings with Kim et al[13] and Haid et al[14]. These two complications were encountered in the early phase of practice.

However, the idea of relocating the ureteric orifices to an extra anatomical position with associated problems possibly accruing later like obstruction, persistent VUR, stone formation[12,15] make it less popular among some urologist. None of patients in our study had obstructive hydronephrosis and stone formation.

At the outset of our experience, complications are regrouped according to the Clavien-Dindo classification,[16] grade II complications are more likely to occur after a Cohen's reimplantation. One patient had grade III complication in the form of reactionary haemorrhage for which reoperation was required. One patient had grade IV complication due to associated hospital acquired pneumonia.

Additional factors (ureteroceles, bladder diverticulum, posterior urethral valves) that make reimplantation more challenging, thus creating risk factors of lower success rates, were also present. The length of the submucosal tunnel and its relation to the diameter of the ureter is reported to be an important factor in successful ureteric reimplantation. One possible explanation for a persistent VUR in our study after ureteric reimplantation might be insufficient tunnel length which was created in the initial phase of practice. Based on histological observations, an optimal anti-reflux tunnel length to- ureteric diameter ratio of up to 1:4-5 was assumed.[17] Therefore, tunnel length was measured arbitrarily in our patients to maintain the aforementioned ratio, thus reducing the risk of persistent VUR.

In our series, non-febrile UTIs (20%) and febrile UTIs (10%) could be due to relative obstruction, possibly created by the cross trigonal transfer of the ureter or due to persistent reflux.

The current study was limited by the retrospective nature of the design. Additionally, there were fewer numbers of reimplantated ureters as this is private children hospital. Furthermore, our results might also have been influenced by suboptimal patient selection, reserving only complex cases for open reimplantation. Finally, the median follow-up time reported was suboptimal for clinical outcome.

Enhanced refinement of surgical technique involving further work on the configuration and trigonal anchorage of the ureteric orifice could optimize the results.

Conclusion

Cohen's ureteric reimplantation is a standard procedure in paediatric age group with VUR. For better outcome, patient selection and refinement of operative technique should be pursued.

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