East and Central African Journal of Surgery

ACCEPTED RESEARCH ARTICLE

Title:	**A retrospective, cross-sectional analysis of clinical and radiological outcomes following paediatric ureteric reimplantation at a tertiary hospital in Addis Ababa, Ethiopia**
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Received:	24-May-2022
Revised:	22-Nov-2022, 19-Sep-2023
Accepted:	4-Oct-2023
Published:	29-Apr-2024

Citation: Gosaye A, Dejene B, Tadesse A, et al. A retrospective, cross-sectional analysis of clinical and radiological outcomes following paediatric ureteric reimplantation at a tertiary hospital in Addis Ababa, Ethiopia. *East Cent Afr J Surg*. Accepted manuscript. Published online April 29, 2024. doi:10.4314/ecajs.v28i4.3

Competing interests: None declared

ORIGINAL RESEARCH

A retrospective, cross-sectional analysis of clinical and radiological outcomes following paediatric ureteric reimplantation at a tertiary hospital in Addis Ababa, Ethiopia

Running title – Addis Ababa, Ethiopia: Paediatric ureteric reimplantation

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Abstract

Background: Open ureteric reimplantation is considered to be the gold standard treatment for numerous anomalies involving vesico-ureteric junction. The study was conducted to determine the outcome of ureteric reimplantation surgeries in terms of clinical and radiologic improvement.

Methods: A retrospective cross-sectional study with a descriptive approach was implemented. All pediatric patients who underwent ureteric re-implantation surgery in Tikur Anbessa Hospital from September 1, 2015 to August 31, 2020 were included in the study. Data was collected using structured questionnaire from the patients' chart. Data was analysed using SPSS version 23. Patient characteristics, perioperative parameters, indications and outcomes of surgery studied.

Results: A total of 36 including 5 bilateral ureteric reimplantation were done for 31 patients during the study period. Among these 20(64.5%) were male while the rest were female; with male to female ratio of 1.8:1. Age ranged from 4 months to 12 years with the mean age of 41 months. Cohen trans-trigonal ureteric reimplantation techniques used in 22(61.1%), including all bilateral cases, while Politano-Leadbetter and Lich-Gregoire repair techniques used in 11(30.5%) and 3(8.3%) respectively. Complication occurred in 2(6.5%) patients. Around 94 % had their symptoms resolved and showed improvement on the degree of hydronephrosis as evidenced on ultrasound scan done within 6 months of surgical intervention which was confirmed with late ultrasound.

Conclusions: Pediatric open ureteric reimplantation is highly effective procedure in our setting. Ultrasound alone is found to be sufficient to follow the post-operative course of the disease in most patients without a need for other imaging studies.

Keywords: indications, clinical outcome, radiologic outcome, paediatric surgery, ureteric reimplantation, Ethiopia

Introduction

Open ureteric reimplantation is considered to be the gold standard treatment for numerous anomalies involving vesico-ureteric junction due to its high success rate and low complication rate (1). The common indications for

surgery are vesico-ureteric reflux (VUR), ureterocele, primary megaureter and ectopic ureteral insertion and other rare causes. Long-term success of open ureteric reimplantation to correct VUR is 98% (2). Complications such as persistent reflux post-surgery and ureterovesical obstruction may be encountered (3).

Anti-reflux ureteral reimplantation can be performed by a variety of techniques with consistently good results. The Politano and Leadbetter anti-reflux ureteric reimplantation is the most accepted method for ureteral reimplantation (4). This technique involves creating submucosal tunnel superior to the ureteric orifice and recreates the new ureteric orifice in a normal anatomical position. On the other hand, Cohen ureteric reimplantation technique which entails reimplantation of one or both ureters, which will open at a new ureteric orifice located at a region across the bladder trigone is said to have the best success rate. Most of the failures in Cohen's procedures are related to obstruction of the reimplanted ureter (5). Other ureteric reimplantation methods like psoas-bladder hitch is also considered a versatile procedure that can be used for a number of indications (6). One of the relatively common techniques of ureteric reimplantation is modified Lich Gregoire technique. This technique involves extravesical tunneling ureteral reimplantation. It is successful, simple to be performed and reproducible and associated with low morbidity requiring minimal hospital stay (7. 8).

This study was conducted to determine indications, surgical approaches and outcome of ureteric re-implantation surgeries in terms of clinical and radiologic improvement . In this study we report our experience with open ureteral reimplantation for the correction of VUR, ureterocele, megaureter and ectopic ureteral insertion and our evaluation of its viability and success rate in our setting.

Materials and methods

Study design: A retrospective cross-sectional study with a descriptive approach. Surgical technique: The surgical approach and techniques of repair was based on surgeon preference and/or the type of the ureteric pathology.

Setting: This study was conducted in the division of Pediatric Surgery, Department of Surgery, Tikur Anbesa Specialized Hospital (TASH), Addis Ababa University. The Pediatric Surgery division deals with surgical illnesses of population under 14 years of age.

Study population: Children admitted and operated in our unit in Tikur Anbessa Specialized Hospital from September 1, 2015 to August 31, 2020.

Inclusion criteria: All pediatric surgical patients who underwent ureteric re-implantation surgery in Tikur Anbessa Specialized Hospital from September 1, 2015 to August 31, 2020.

Exclusion criteria: Ureteric re-implantation done during bladder neck reconstructions or urinary diversion procedures were excluded.

Data collection: The patients' chart was retrieved using the chart number obtained from the operation log book. Data was collected using structured questionnaire from the patients' chart.

Data analysis: The data was checked for completeness and consistency. Data was analysed using SPSS version 23. Descriptive analysis was done to study the patient demography, indications and outcome of surgery.

Ethical concerns: Ethical clearance for the study was obtained from departmental research ethical committee. The protocol number was DOS/76/20/09. Protocol version number was 01 and version date was September 2020. Data collection was undertaken after permission was obtained from the administration.

Results

Patient characteristics

A total of 36 ureteric reimplantation, bilateral reimplantation in 5 cases, were done for 31 patients during the study period. Among these 20(64.5%) were male while the rest were female; with male to female ratio of 1.8:1. Age ranged from 4 months to 12 years with the mean age of 41 months. Thirteen (41.9%) had symptoms onset since birth. Others presented with febrile urinary tract infection (UTI), lower urinary tract symptoms (LUTS) and incontinence in one female patient with ectopic ureter. Duration of illness, before operative management, ranged from 1-96 months with median duration of 17 months. Seven (22.6%) had associated congenital anomalies.

Pre-operative work up and surgical procedures

As part of pre-operative investigations urine analysis, urine culture and ultrasound were done for all patients. Patients were taken to operating room when urine culture result was negative for re-implantation. Voiding cysto-uretherogram (VCUG) had been done for all patients. Intra-venous pyelogram (IVP) done for 9 patients. Cystoscopy was done at the time of surgery, to assess the bladder mucosa, position and configuration of the ureteric orifices and to look for additional anatomical abnormalities.

Indications for ureteric re-implantation surgery were: VUR which accounts for 17 patients (Rt. 7, Lt. 6 and 4 bilateral), ureterocele accounting for 6 patients (Rt. 4 and Lt.2), ectopic ureters in 4 patients (Lt. 3 and Rt. 1), vesico-ureteral junction obstruction (VUJO) in 2 patients (Rt. 1 and 1 bilateral) and megaureter in 2 patients (Rt.1 and Lt. 1) (Table I). The reasons for surgery in VUR patients were symptomatic patients with breakthrough infections while on antibiotics prophylaxis in 7 patients and the rest, 10 patients, had grade IV/V reflux that persisted for a mean duration of 1.5 years or bilateral VUR in older children in which spontaneous resolution is low. Both megaureter patients had breakthrough infection while on prophylactic treatment.

During cystoscopic evaluation 3(9.7%) patients were found to have ureteric duplication on the affected side while 2(6.5%) had ectopic ureteric insertion. During intra-operative evaluation 10(32.3%) patients had megaureter. Based on surgical approach to ureters, intravesical approach was used in 24(77.4%) while extravesical approach was used in 3(9.7%) and approach was combined in 4(12.9%). Cohen trans-trigonal ureteric reimplantation techniques used in 22(61.1%) including all bilateral cases while Politano-Leadbetter and Lich-Gregoire repair techniques used in 11(30.5%) and 3(8.3%) respectively (Table II). Length of ureteric tunneling ranged from 3-4.5cm depending on the width of ureteric caliber with the ratio of 5:1. Ureteric imbrication done in 6(19.3%) patients during re-implantation. Ureteric drains, peri-vesical drain and trans-urethral catheter left in place for all patients.

Outcome and post-operative follow-up

Ureteric stents kept in place for 5-10 days with a mean duration of 7 days. Antibiotics discontinued after ureteric stents are removed. Complication developed in 2(6.5%) patients. The first patient developed leak from bladder perforation. This was a patient for whom cystoscopic incision was tried for an indication of right ureterocele but endoscopic procedure failed and immediately converted to open re-implantation. Bladder perforation diagnosed later on the third post-operative day and repaired surgically. The other complication occurred in a patient who underwent bilateral Cohen trans-trigonal reimplantation for bilateral VUR. She developed acute kidney injury (AKI) on the background of chronic kidney disease (CKD) due to post-operative acute ureteric obstruction. Serum creatinine became 8.1 mg/dl. This patient required bilateral percutaneous nephrostomy tube insertion until the creatinine gradually dropped to 2.3 mg/dl. Nephrostomy tube removed after 6 weeks when AKI subsided. This patient is still on follow-up at renal clinic for CKD.

Except for one patient who underwent right ureteric reimplantation and lost from follow-up, all patients had 2 or 3 ultrasound scans within six months postoperatively. From the rest 35 ureteric reimplantations 33 (94.3%) had reduction in the degree of hydronephrosis within 6 months which was confirmed with late ultrasound done in the 1st year after surgery. Two patients had no reduction on degree of hydronephrosis. One was right grade V VUR for whom Cohen trans-trigonal implantation and ureteric imbrication was done. The other patient was the one

for whom Lich-Gregoire right ureterocele excision and ureteric implantation was done. The patient's parents went against medical advice of the need for redo surgery while the one with VUR opted for conservative management and still on follow-up. Post-operative VCUG was done only for one patient with pre-operative grade III VUR with ureterocele. It was done on 6th months after surgery and there was improvement to grade I reflux.

Discussion

The main goal of any ureteric reimplantation surgery is to restore the near normal antirefluxing mechanism of the ureterovesical junction in order to prevent retrograde flow of urine. Based on established principles, ureteric re-implantation was done for VUR, ureterocele, ectopic ureteric insertion, VUJO and megaureter. The patients were followed for a minimum and maximum follow-up duration of 1 month and 36 months with a median duration 18 months. None of patients on follow-up had symptoms recurrence or new onset UTI post-operatively. Except for a patient with AKI, renal function test was normal for all operated patients. In 94% of operated patients there was radiologic improvement on the degree of urinary outflow obstruction and none of the patients had recurrence of symptoms. This makes the outcome of ureteric re-implantation in our setting is to be 94%. This finding is comparable to studies done in America and Europe which reported success rate of 95-98% (9, 10, 11).

Although open ureteric reimplantation is still considered the gold standard treatment for numerous anomalies involving vesico-ureteric junction, currently this notion is being challenged by many surgeons. Different studies showed that Open and laparoscopic or robot-assisted approaches are successful in correcting reflux and obstructive megaureter with similar results (12, 13, 14). Systematic review done on laparoscopic extra-vesical ureteric re-implantation concludes that laparoscopic approach is equally effective to open approach (15).

The techniques of repair used in our setting were; Cohen trans-trigonal ureteric re-implantation techniques in 22(61.1%) including all bilateral cases while Politano-Leadbetter and Lich-Gregoire repair techniques in 11(30.5%) and 3(8.3%) respectively. Due to our limited sample size comparing outcome in terms of surgical approaches and technique implemented was not possible. But, the Cochrane review supports that all techniques to be safe, with low complication and excellent success rates (92–98%) and the choice of the procedure in the individual case is more a matter of the surgeon's personal preference than a result of an evidence-based analysis (16). Recent study also showed that laparoscopic Politano-Leadbetter and Cohen are both found to be reliable techniques for ureteric reimplantation in children with VUR and obstructive megaureter with comparable results in solving reflux and obstruction (17). In literature, complications following ureteric reimplantation are generally low with reported post-operative ureteric obstruction rate of 1% (18). However, in our study complication occurred in 6.5% of our patients which is relatively high although one of the complications was from attempted cystoscopic puncture of a ureterocele. Relatively high complication rate might be due to small number of patients.

In our study only one patient had post-operative VCUG while all patients had regular ultrasound scan post-operatively. 94.3% had improvement on the degree of hydronephrosis based on ultrasound scan done within 6 months which was confirmed with late ultrasound done during 1st post-operative year. Different studies showed that in most cases post-operative hydronephrosis is transient and not clinically significant with a high incidence of complete resolution during the first 2 years. But patients with high-grade VUR and hydronephrosis pre-operatively are at risk for developing moderate or severe hydronephrosis and should be followed with a routine 3- month post-operative ultrasound. These studies concluded that VCUG may not be necessary unless clinically indicated or there is worsening of hydronephrosis on follow-up ultrasound (19, 20, 21, 22).

In conclusion, Pediatric open ureteric reimplantation is highly effective procedure in our setting. Ultrasound alone is found to be sufficient to follow the post-operative course of the disease in most patients without a need for other imaging modalities.

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Table 1: Table showing primary vesico-ureteric junction anomalies and involved ureter.

Diagnosis		VUR	Ureterocele	Ectopic ureters	VUJO	Megaureter
Involved ureter	Right	7	4	1	1	1
	Left	6	2	3		1
	Bilateral	4	-	-	1	-

Table 2: Table showing choice of surgical method and diagnosis.

Diagnosis		VUR	Ureterocele	Ectopic ureters	VUJO	Megaureter
Techniques of surgical repair	Cohen*	11	-	4	1	1
	Politano-Leadbetter	3	6	-	1	1
	Lich-Gregoire	3	-	-	-	-

*All bilateral ureteric pathologies were repaired using Cohen's technique.