

## Original Article

# Experience of Maharaj Nakorn Chiang Mai Hospital in extravesical ureteral reimplantation for vesicoureteral reflux in pediatric patients

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**Keywords:**

Extravesical, ureteral, reimplantation, vesicoureteral reflux, pediatric

**Abstract**

**Objective:** The most commonly used technique for vesicoureteral reflux (VUR) treatment in pediatric patients in Maharaj Nakorn Chiang Mai Hospital is extravesical ureteral reimplantation (EUR). This report describes our experience of clinical outcomes of this technique.

**Materials and Methods:** A total of 30 children underwent EUR for unilateral and bilateral VUR between July 2007 and June 2015. We retrospectively reviewed their medical records. Patient characteristics, operative time, duration of catheter drainage, length of postoperative hospital stay, and perioperative complications were evaluated.

**Results:** Twenty-two boys and 8 girls with a mean age of 4.4 years (range, 0.5-14.6) were included in the study. Reflux was graded 1 to 5. Fourteen unilateral and 16 bilateral procedures were performed. A Pfannenstiel incision was implemented in the first 20 cases and inguinal incision in the last 10 cases. Mean operative time was 115.5 minutes. Mean duration of catheter insertion was 5.7 days. Mean length of postoperative hospital stay was 6.1 days and mean estimated blood loss was 28.7 ml. Overall success rate was 90%. One patient (3.3%), developed a postoperative urinary tract infection, while 3 cases had persistent VUR after surgery. Acute urinary retention occurred in 1 patient (3.3%) on postoperative day 4 but following catheterization the patient was able to urinate by day 7.

**Conclusion:** EUR for the treatment of VUR is a simple, safe, and effective procedure. The prevalence of postoperative urinary retention in bilateral reimplantation is low and transient. The inguinal approach is a viable option and as effective as classical procedures.

Insight Urol 2021;42(2):90-6. doi: 10.52786/isu.a.29

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**Revision received:** June 5, 2021

**Manuscript received:** May 11, 2020

**Accepted after revision:** June 11, 2021

## Introduction

Vesicoureteral reflux (VUR) is one of the most significant risk factors for febrile urinary tract infection in pediatric patients. VUR occurs in approximately 30% of children who have had at least 1 urinary tract infection (UTI).<sup>1</sup> Nephropathy with associated renal scarring and subsequent hypertension leading to end-stage renal disease is still the most concerning issue in VUR.<sup>2</sup> There are many different treatment modalities for VUR including medical and surgical treatment.

Open ureteral reimplantation has been the gold standard for definitive treatment of primary VUR with a success rate of more than 90%.<sup>3,4</sup> The surgical procedure can be performed either intravesically or extravesically with similar success rates.<sup>5</sup> Extravesical ureteral reimplantation (EUR) is associated with lower morbidity compared to intravesical ureteral reimplantation.<sup>6</sup> The advantage of the EUR approach is that the bladder is not opened, therefore, there is a lower incidence of bladder spasm and post-operative hematuria.<sup>7,8</sup> Also to its advantage is this technique is simple and easy for clinicians to learn. The main concern with this technique has been the development of transient voiding inefficiency which is seen in up to 20% of children who undergo bilateral extravesical reimplants.<sup>9,10</sup>

The extravesical technique of ureteral reimplantation pioneered by Lich in America and Gregoir in Europe in the 1960s has proved to

be an excellent alternative to intravesical techniques for VUR correction, with a success rate of 90-99%.<sup>11-13</sup> This technique is mainly used in our institution, Maharaj Nakorn Chiang Mai Hospital, for both unilateral and bilateral VUR patients. Traditionally, this technique has been performed through a standard Pfannenstiel incision. However, during the 2012, we gradually changed to the inguinal incision approach. This report describes our experience of the clinical outcomes of this technique. The objectives of this report are to retrospectively evaluate the clinical outcomes of EUR in our hospital and to compare outcomes between Pfannenstiel and inguinal incisions for EUR approaches.

## Materials and Methods

Data pertinent to 40 children who underwent EUR for unilateral or bilateral VUR in Maharaj Nakorn Chiang Mai Hospital between July 2007 and June 2015 were reviewed. Ten cases with neurogenic bladder, posterior urethral valves, dysfunctional voiding, ureterocele, or concomitant ureterovesical junction obstruction (UVJO) were excluded. EUR was performed in 30 patients through Pfannenstiel or inguinal incision. Indications for surgery were breakthrough febrile UTI, persistent high-grade reflux, renal function deterioration, new cortical renal scarring and preteen females (Figure 1).

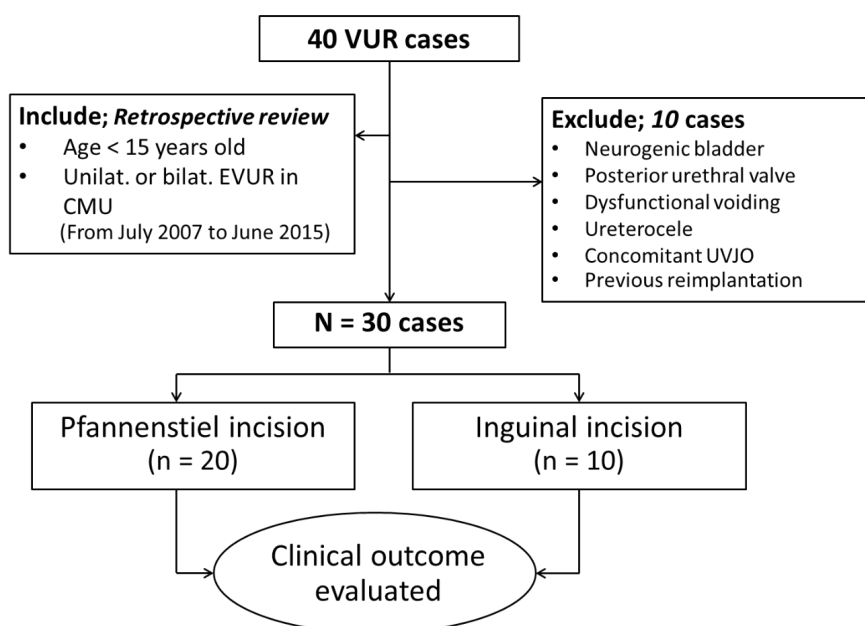


Figure 1. Study population and design

We retrospectively reviewed their medical records. Clinical outcomes of interest were studied, including patient characteristics (age, gender, reflux grade, underlying diseases and anomalies), indications for surgery, operative time, duration of catheter drainage, postoperative hospital stay, postoperative analgesic usage, estimated blood loss, intraoperative, and perioperative complications. After surgery all patients were followed up with urine examination and ultrasound kidneys for between 6 and 24 months. Some patients were re-evaluated using voiding cystourethrography (VCUG) or dimercaptosuccinic acid (DMSA) renal scan when clinically indicated. The success of the operative treatment was defined as no documented UTI and no hydronephrosis on ultrasound during the follow up. An oral prophylactic antibiotic was continued for 3 months postoperative. We compared the surgical outcomes between the two surgical incision groups, Pfannenstiel and inguinal incision, with the parameters listed above. The study protocol was approved by the Ethical Committee of Chiang Mai University (Research ID: 3535/ Study Code: SUR-2558-03535).

## Results

Of the 30 cases who underwent EUR treatment 22 were boys and 8 girls. The mean age of the subjects was 4.43 years old. Mean ages of the Pfannenstiel and inguinal groups were 4.70 and 3.80, respectively. Reflux grades were grade I to V with no significant difference between the two incision groups. The indications for surgery were new cortical renal scarring, breakthrough febrile UTI, deterioration in renal function, persistent high-grade reflux, and preteen female in 20, 11, 9, 4, and 1 cases, respectively. Sixteen cases or 53.3% of all cases had bilateral EUR, whereas 14 cases or 46.7% had unilateral EUR. Mean follow up duration was 19.8 months (Table 1).

Table 2 shows the surgical outcomes of the study. Mean operative time was 115.5 ( $\pm$  27.8) minutes. Mean duration of catheter was 5.7 ( $\pm$  3.5) days. Mean Postoperative analgesic usage was 1.5 ( $\pm$  1.5) doses. Mean length of postoperative hospital stay was 6.1 ( $\pm$  3.5) days and mean estimated blood loss was 28.6 ( $\pm$  14.3) ml.

There was no intraoperative complications during surgery. Postoperative complications developed in 5 patients, specifically 1 patient

(3.3%) developed postoperative UTI, 3 cases (10%) with persistent VUR after surgical correction and 1 case (3.3%) with postoperative urinary retention. The retention case was a 6-month-old boy with bilateral reimplantation who was wean off the catheter one day after surgery. He developed AUR at postoperative day 4. After 7 days of catheterization, he could spontaneously urinate after catheter removal.

When comparing the surgical outcomes between the two EUR techniques we found that duration of catheterization and estimated blood loss were statistically significantly different. As regards success rate of surgery, we considered persistent VUR, abnormal urinalysis to be a failed case. Consequently, the overall success rate of EUR from this study was 90%. The success rate for the Pfannenstiel group was 85% and for inguinal group was 100%.

## Discussion

There are several surgical techniques to correct VUR. Both extravesical and intravesical reimplantations are considered to be the gold standard for definitive treatment of VUR. The extravesical approach is generally accepted in Europe and Canada whereas the intravesical approach is more popular in United States for unilateral EUR.<sup>14-16</sup> At Maharaj Nakorn Chiang Mai Hospital EUR is usually selected for both unilateral and bilateral VUR cases. The reasoning behind this is that in general the extravesical approach is considered to be less invasive than the intravesical approach. The bladder is not opened resulting in reduced post-operative bladder spasm and hematuria as well as less postoperative pain.<sup>7,8</sup> In addition, no ureteral stent or perivesical drainage were needed in the extravesical approach. Other studies have shown that this technique requires shorter operative time and hospital stay than the intravesical approach.<sup>9,17</sup> Although there are several advantages to EUR, the main concern with this technique has been the development of transient postoperative urinary retention in children who undergo bilateral EUR. It is thought to be due to the bilateral disruption of the nerves to the bladder. The risk factors for this condition are bilateral procedure, male patients who are younger than 3 years old, and bilateral high grade reflux.<sup>18</sup>

**Table 1.** Patient characteristics and duration of postoperative follow up

	Total (N=30)	Pfannenstiel (n=20)	Inguinal (n=10)	P-value
Gender, n (%)				0.770
Male	22 (73.33)	15 (75.00)	7 (70.00)	
Female	8 (26.67)	5 (25.00)	3 (30.00)	
Age (years)				0.546
Median (25%, 75%)	3.58 (1.37,6.67)	4.25 (1.25,6.96)	2.79 (2,4.25)	
Mean (SD)	4.43 (3.56)	4.70 (3.79)	3.8 (3.14)	
Range	0.5-14.67	0.5-14.67	0.83-11.7	
Reflux Grade, n (%)				0.502
Grade I	2	2 (10.00)	0 (0.00)	
Grade II	1	0 (0.00)	1 (10.00)	
Grade III	2	2 (10.00)	0 (0.00)	
Grade IV	10	6 (30.00)	4 (40.00)	
Grade V	8	5 (25.00)	3 (30.00)	
Operation, n (%)				0.936
Bilateral EUR	16 (53.33)	11 (55.00)	5 (50.00)	
Unilateral EUR	14 (46.67)	9 (45.00)	5 (50.00)	
Underlying disease, n (%)	5 (16.67)	3 (15.00)	2 (20.00)	0.729
Previous surgery, n (%)	6 (20.00)	11 (25.00)	1 (10.00)	0.333
Associated anomaly	10 (33.33)	8 (40.00)	2 (20.00)	0.273
Indications for surgery (N=45)*				0.091
New renal cortical scarring	20 (44.44)	11 (40.74)	9 (50.00)	
Breakthrough febrile UTI	11 (24.44)	6 (22.22)	5 (27.78)	
Renal function deterioration	9 (20.00)	6 (22.22)	3 (16.67)	
Persistent high-grade reflux	4 (8.88)	4 (14.81)	0 (0)	
Preteen female	1 (2.22)	0 (0)	1 (5.56)	
Duration of follow up (months)				0.011
Median (25%,75%)	11 (6, 31)	16 (9,44.5)	6 (5,10)	
Mean	19.83 (19.74)	26.15 (21.57)	7.2 (2.78)	
Range	0-70	0-70	4-11	

EUR = extravesical ureteral reimplantation, UTI = urinary tract infection.

\*15 cases presented with 2 indications for surgery and 15 cases presented with 1 indication for surgery.

The surgical technique used was the classical EUR first described by Lich and Gregoir in 1961 and 1964. To prevent nerve injury in bilateral EUR we limit the extent of the ureteral dissection to not proceed distally to the ureterovesical junction and approach the anteromedial part of the bladder. We also limit ureteral mobilization, minimize cauterization and avoid bladder overdistention.<sup>19-21</sup> Traditionally, EUR in our institution had been performed through a standard Pfannenstiel incision. We changed to the inguinal incision approach in 2012. This technique was first described by Chen and colleagues in 2004.<sup>22</sup> The authors claimed that this technique uses a mini-inguinal incision so it may be considered as a less invasive surgical approach. The technique has been shown to be simple, safe and highly

effective with lower morbidity.<sup>22</sup> Wiygul and Palmer<sup>23</sup> also supported the advantages of the inguinal approach for EUR and promoted this technique as a practical approach in pediatric patients as a minimally invasive ureteral reimplantation. We performed EUR via inguinal incision in unilateral EUR in early cases, then we progressed to bilateral EUR surgery. Although the bilateral EUR via inguinal incision may result in an equal length of incision as the Pfannenstiel, we continued to use the bilateral inguinal incision according to the informed preference of the surgeon.

Postoperative complications among the 30 cases numbered only 1 (3.3%), the complication being postoperative urinary retention due to early catheter removal. This patient maybe should not

**Table 2.** Perioperative and postoperative clinical outcomes

	Total (N=30)	Pfannenstiel (n=20)	Inguinal (n=10)	P-value
Operative time (minutes)				0.168
Mean (SD)	115.5 (27.83)	120.5 (30.68)	105.5 (18.47)	
Range	80-135	60-130	80-135	
Duration of catheter (days)				0.039
Mean (SD)	5.73 (3.49)	6.65 (3.78)	3.9 (1.85)	
Range	1-14	1-14	2-7	
Postoperative analgesic dosage, n (%)				0.108
Mean (SD)	1.53 (1.52)	1.89 (1.53)	0.9 (1.37)	
Range	0-6	0-6	0-4	
Length of hospital stay (days)				0.282
Mean (SD)	6.1(3.54)	6.6 (3.23)	5.1 (4.09)	
Range	1-16	1-14	2-16	
Estimated blood loss (ml)				0.002
Mean (SD)	28.67 (14.31)	34 (13.91)	18 (7.88)	
Range	1-2	1	2	
Postoperative complications, n (%)				0.392
Urinary retention	1 (5.0)	1 (5.0)	0 (0)	
Urinary tract infection	1 (5.0)	1 (5.0)	0 (0)	
Persistent VUR	1 (5.0)	3 (15.0)	0 (0)	
Overall success rate, n (%)	27	17 (85)	10 (100)	0.196

SD = standard deviation, VUR = vesicoureteral reflux.

have been considered as a good candidate for early removal of catheter because he had risk factors for postoperative urinary retention. Other than postoperative urinary retention, there was a single case (3.3%) who developed UTI and 3 cases (10.0%) that had persistent VUR. All 5 patients with postoperative complications had undergone surgery using the Pfannenstiel incision, the method used by the surgeons in the early cases before the department switched to using the inguinal approach. This higher number of complications, however, may be in cases in the Pfannenstiel group due to less surgical experience of the surgeons.

With regard to the bilateral VUR, the bilateral inguinal incisions may need more operative time than surgery involving the Pfannenstiel incision. On the other hand, the bilateral inguinal incisions may result in less operative pain, better cosmetic outcomes, and less transient bladder dysfunction. However, the number of the patients in our study was too small for a statistically robust analysis comparing the treatment outcomes between these two types of incisions. Also, there is no comparative study investigating the advantages and disadvantages of Pfannenstiel versus bilateral inguinal incisions for bilateral

VUR in current literature. Interestingly, the case of postoperative transient bladder dysfunction in our study had undergone the Pfannenstiel not the bilateral inguinal incision.

The rationale of the use of a postoperative prophylactic antibiotic after surgery is still controversial. A prophylactic antibiotic was given to all the patients in our study for 3 months. We believed that the use of a postoperative prophylactic antibiotic still has some benefits especially for the cases that have high grade reflux and/or a history of breakthrough UTI before the surgery. Since the success rate of ureteral reimplantation for primary VUR is very high we did not need to perform the VCUG in every case after surgery unless clinically indicated. We tried to perform a DMSA renal scan at least once in the 6-12-month period postoperative. The postoperative follow up schedule with periodic urine examination and ultrasound kidneys is universally acceptable. The period of follow up was 3-24 months depending on time after surgery and may stop when the patients become adult.

A retrospective study of pneumovesicoscopic Cohen's cross-trigonal ureteral reimplantation for primary VUR was reported by Semmard et al. in 2016. There were 50 pediatric patients



(20 girls and 30 boys) with an age range of 11-132 months. The total success rate was 78% and the mean blood loss was 22.8 (range 5-100) ml. The mean operative time was 184 (range 140-270) minutes for unilateral reimplantation and 222 (range 180-2,600) minutes for bilateral reimplantation. The urethral catheter duration and the length of stay in hospital were 9.5 and 11.3 days, respectively.<sup>24</sup> The results of this minimally invasive surgery study were not superior to our open surgery in terms of operative time, urethral catheter duration, postoperative hospital stay, and success rate.

There are some limitations to this study. First, this is a retrospective study so there are some cases with incomplete records which had to be excluded from the study. Second, the sample size is relatively small. Third, improved skills of a single surgeon during the study may result in better surgical outcomes in the later cases especially in the inguinal group. Fourth, low compliance of the patients and their parents in this study results in the short follow up period as reported.

## Conclusion

EUR for treating VUR is a simple, safe, and effective procedure. The prevalence of postoperative urinary retention in bilateral reimplantation is low and transient. The inguinal approach is a viable option and as effective as the classical method used prior to 2012 in this institution.

## Conflict of Interest

The authors declare no conflict of interest.

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