



# Comparison of intravesical (Cohen) and extravesical (Lich–Gregoir) ureteroneocystostomy in the treatment of unilateral primary vesicoureteric reflux in children

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## Keywords

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## Summary

### Introduction

Various intravesical and extravesical techniques have been described for the surgical correction of vesicoureteral reflux (VUR). Among those techniques Cohen (intra-vesical) and Lich-Gregoir (extra-vesical) are the most commonly used ones. However, there are limited studies that compare those two surgical techniques in the literature.

### Objective

In this study, we aim to compare the outcomes of the open intravesical and extravesical procedures for unilateral primary VUR in children.

### Methods

We analyzed the records of 118 consecutive children with primary VUR who underwent open ureteral reimplantation surgery by single surgeon from January 2011 to October 2015 at our institution. Among them, intravesical reimplantation was group A, and extravesical reimplantation procedure was group B. We retrospectively analyzed the clinical data of both groups, including age, sex, preoperative reflux grade, presence of lower urinary tract symptoms (LUTS), operative time, postoperative complications and hospitalization period. Success of surgery was defined as the resolution of the VUR as determined by voiding cystourethrography 6–12 months after surgery. All the parameters were statistically compared.

### Results

A total of 58 patients were found eligible for the study. In 23 cases intravesical (group A) and in 35 cases extravesical

(group B) procedure were performed. The operative time in group A was significantly higher than group B ( $110.3 \pm 16.9$  and  $87 \pm 29.8$  min, respectively,  $p = 0.002$ ). The mean hospital stay was also longer in group A ( $2.8 \pm 0.8$  and  $1.2 \pm 0.6$  days, respectively,  $p = 0.007$ ). The ureteral catheterization periods were  $14.1 \pm 6.1$  days for group A and there was no ureteral catheter placement in group B. The success rate of the two groups were comparable (100% vs 94.9%,  $p = 0.513$ ). No intraoperative complications were detected in either group. The number of febrile urinary tract infections were similar between the groups after a mean follow up of 18.2 months ( $p = 0.746$ ).

### Discussion

Our results confirmed that both Cohen and Lich-Gregoir procedures had equivalent success and complication rates. Lich-Gregoir technique was found superior to Cohen technique in terms of hospital stay and operative time. Moreover, it avoids the necessity of urethral and ureteral stenting which probably might increase the comfort of the patients postoperatively. The main limitations of our study are unrecorded pain scores and amount of analgesics taken the after surgery and retrospective analysis of the data.

### Conclusion

Both the open intravesical and extravesical ureteroneocystostomy procedures are equally effective in the treatment of primary unilateral VUR. Any of the techniques can be opted by the surgeons depending on their surgical experience.

**Table** Patient demographics.

	Cohen ( $n = 23$ )	Lich–Gregoir ( $n = 35$ )	$p$
Age (years) (Mean + SD) (range)	$4.6 \pm 1.6$ (1–7)	$7.6 \pm 4.2$ (3–17)	0.002
M/F ratio	17/6	2/33	<0.001
Prior endoscopic injection ( $n$ )	13/23	19/35	0.866
Reflux grade	$3.4 \pm 0.6$ (3–5)	$3.9 \pm 0.5$ (3–5)	0.870
Split kidney function (%)	$41.5 \pm 10.8$ (32–49)	$34.5 \pm 10.1$ (28–45)	0.242
Anticholinergic usage (%)	6 (26.1%)	16 (45.7%)	0.132

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## Introduction

Vesicoureteral reflux (VUR) is defined as reflux of the urine from the bladder to the upper urinary tract caused by an anatomic and/or functional disorder with potentially serious consequences such as renal scarring, hypertension, and renal failure. Patients with VUR demonstrate a wide range of severity, and the majority of reflux patients do not develop renal scars and do not need any intervention [1].

The main goal in the management of patients with VUR is the preservation of kidney function by minimizing the risk of pyelonephritis. Various intravesical and extravesical techniques have been described for surgical correction of VUR. Although each method has specific advantages and complications, all the techniques share the basic principle of lengthening the intramural part of the ureter by submucosal embedding of the ureter. Majority of the ureteroneocystostomy (UNC) techniques have been shown to be safe, with a low rate of complications and excellent success rates (92–98%) [2].

Among those techniques Cohen and Lich–Gregoir are the most commonly used techniques according to the published data. However, there are limited studies that compare the surgical techniques in the literature. In this study, we aim to compare the outcomes of the open intravesical (Cohen) and extravesical (Lich–Gregoir) procedures for unilateral primary VUR in children.

## Materials and methods

We analyzed the records of 118 consecutive children with primary VUR who underwent open ureteral reimplantation surgery by a single surgeon (M.S.S.) from January 2011 to October 2015 at our institution. We excluded patients who had undergone bilateral UNC, ureteral tapering, repeat procedures, and who were diagnosed as neurogenic bladder or megaureter. The intravesical reimplantation (Cohen) procedure was group A, and the extravesical reimplantation (Lich–Gregoir) procedure was group B.

The indication for ureteroneocystostomy (either intravesical or extravesical) was similar among the procedures and was based on the EAU/ESPU guidelines for risk stratification [3]. Briefly, if the patient had symptomatic high-grade reflux refractory to conservative treatment, or if the patient had recurrence of VUR after endoscopic injection, open surgery was decided. Age, presence of scar, gender, presence of LUTS, and other risk factors were taken into account when deciding surgery. In the end, an individual decision was made for each patient depending on their risk factors. We performed the extravesical procedure in the initial series at our institution and then we switched to the intravesical procedure for the remainder of the patients.

We retrospectively analyzed the clinical data of both groups, including age, sex, preoperative reflux grade, operative time, postoperative complications, and hospitalization period. Reflux grade was classified as grades I–V according to the International Classification System of the International Reflux Study Committee [4]. The presence of lower urinary tract symptoms (LUTS) and anticholinergic use were also documented. All toilet-trained patients were evaluated using a 2-day bladder diary, a dysfunctional

voiding symptom questionnaire (DVSS), urinalysis, uroflowmetry, and post-void residual urine. The definition of LUTS was based on clinical judgment and according to the above test results. Each patient who had LUTS in the preoperative period received urotherapy initially. Anticholinergic drugs were prescribed to patients who had complaints and were used for at least a 6-month period. Success of surgery was defined as the complete resolution of VUR as determined by voiding cystourethrography (VCUG) 6–12 months after surgery. All the parameters were statistically compared.

Statistical analysis was performed using IBM SPSS Statistics ver. 21 (IBM Co., USA). The Student *t* test and chi-square tests were applied to compare the parameters of each group;  $p < 0.05$  was considered to be statistically significant.

## Results

After the application of eligibility criteria, a total of 58 patients (male/female, 19/39) were included in our study. In 23 cases the intravesical (Cohen) procedure was performed and in 35 cases the extravesical (Lich–Gregoir) procedure was performed. The mean ages of groups A and B were  $4.6 \pm 1.6$  (1–7) years and  $7.6 \pm 4.2$  (3–17) years, respectively ( $p = 0.002$ ). The male/female (M/F) ratio was significantly different for each group ( $p = 0.001$ , Summary table). The mean reflux grades in groups A and B were similar ( $3.4 \pm 0.6$ , range (3–5), and  $3.9 \pm 0.5$ , range (3–5), respectively,  $p = 0.870$ ). The split ipsilateral renal function (DMSA) was also similar ( $41.5 \pm 10.8\%$  vs.  $34.5 \pm 10.1\%$  for groups A and B, respectively). The percentage of patients who received anticholinergic treatment is shown in the Summary table. Prior endoscopic injection in the two groups was also found to be similar (group A 13/23; Group B 19/35,  $p = 0.866$ ).

The operative time for unilateral cases in group A was significantly higher than group B ( $110.3 \pm 16.9$  min and  $87 \pm 29.8$  min, respectively,  $p = 0.002$ ). The mean hospital stay was also longer in group A ( $2.8 \pm 0.8$  days and  $1.2 \pm 0.6$  days, respectively,  $p = 0.007$ , Table 1). The ureteral catheterization period was  $14.1 \pm 6.1$  days for group A, and there was no ureteral catheter placement in group B. No intraoperative complications were detected in either group. One stent migration was detected in group A postoperatively. The mean duration of follow-up for groups A and B were  $13.1 \pm 10.4$  months and  $21 \pm 14.7$  months, respectively ( $p = 0.892$ ). The success rate of the two groups were similar (100% vs. 94.9%,  $p = 0.513$ ). Reflux resolution was detected in all patients in group A. Surgery was not successful in two patients in group B and they underwent another operation (Cohen). The number of febrile urinary tract infections were similar between the groups during the follow-up period ( $0.17 \pm 0.3$  vs.  $0.22 \pm 0.4$ ,  $p = 0.746$ ).

## Discussion

In the last decade, a relevant decline in the incidence of ureteral reimplantation has been observed globally. This may be attributed to decreased VCUGs carried out and an increase in endoscopic intervention in the treatment of primary VUR [5]. Beyond this point, there is a significant

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