



Endoscopic correction of vesicoureteral reflux in children with a solitary kidney: The risk of obstruction[☆]



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Received 18 March 2013; accepted 23 April 2013
Available online 5 June 2013

KEYWORDS

Vesicoureteral reflux;
Obstruction;
Solitary kidney;
Dextranomer/
hyaluronic acid
copolymer

Abstract *Purpose:* We aimed to review patients with a solitary kidney and ipsilateral vesicoureteral reflux (VUR) who underwent endoscopic correction of VUR (ECVUR) and to evaluate the prevalence of obstruction in this group of patients.

Materials and methods: We retrospectively reviewed the files of all patients who underwent ECVUR at our center between January 2000 and June 2011. Only patients with a solitary kidney and ipsilateral VUR were included.

Results: Thirteen patients met our criteria. Two patients (15.38%) developed obstruction post-ECVUR. Both patients developed anuria in the first 24 h after surgery and required intervention. Two patients (15.38%) had increasing hydronephrosis that was discovered on follow-up ultrasound, with no symptoms or signs of obstruction. Both were managed conservatively.

Conclusion: Our results showed a higher percentage of obstruction post-ECVUR in patients with a solitary kidney (15.38%), who required immediate intervention. Thus, we recommend giving clear instructions to parents of patients with VUR and a solitary kidney post-ECVUR before discharge from the hospital regarding decreased urine output and loin pain. We recommend a follow-up ultrasound to rule out obstruction and detect new-onset hydronephrosis.

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Abbreviations: VUR, vesicoureteral reflux; ECVUR, endoscopic correction of VUR; VCUG, voiding cystourethrogram; Dx/HA, dextranomer/hyaluronic acid copolymer; MMC, myelomeningocele; HDN, hydronephrosis; HIT, hydrodistension-implantation technique.

[☆] These Data were presented in the 23rd ESPU meeting, Zurich, Switzerland, May 2012.

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Introduction

Since the introduction of endoscopic transurethral Teflon injection for the treatment of vesicoureteral reflux (VUR) in 1981 [1], the procedure has gained widespread acceptance and has become the first-line surgical treatment for VUR, especially after safer materials were introduced [2]. Over time, endoscopic correction of VUR (ECVUR) was associated with increasing success rates, which approached the success rates of open surgery [2,3].

ECVUR has proved to be a safe procedure with very rare major complications. It is usually performed on a day-surgery basis. Postoperative ureteral obstruction is a possible complication of ECVUR, but it has been reported in less than 1% of patients in most published studies [4–8].

Few data are available on the management of VUR in patients with a solitary kidney [9], and to our knowledge no one has specifically examined post-ECVUR ureteral obstruction in patients with a solitary kidney.

In this report, we present the results of our evaluation of patients with a solitary kidney and VUR who underwent ECVUR. We report the prevalence of postoperative ureteral obstruction in this group of patients.

Materials and methods

We retrospectively reviewed the operating room registries of our institution from January 2000 until June 2011. The total number of ECVUR procedures was recorded, and the number of patients treated was retrieved. We included only patients with a solitary kidney and ipsilateral VUR, which was proved on voiding cystourethrogram (VCUG), renal ultrasound and radioisotope renal scans. The medical records of included patients were reviewed, and relevant data were recorded, including demographic data, VUR grade, number of previous procedures, operation details, the occurrence of postoperative ureteral obstruction, and subsequent management and outcome.

Results

Between January 2000 and June 2011, a total of 663 ECVUR procedures were performed on 539 patients. Fourteen patients were found to have a solitary kidney at the time of the procedure, which was confirmed with a renal ultrasound and a radioisotope renal scan. One patient was excluded from the study because of a history of multiple upper and lower urinary tract surgeries.

Table 1 shows the data for the remaining 13 patients who were included in the study. The mean age of the patients at the time of their procedure was 6.87 years. Seventy-seven percent of the patients had Grade 3 or higher VUR. The indication for intervention was break-through febrile urinary tract infection (UTI) in all patients. Eight patients underwent one ECVUR procedure. All of the patients included in the study were injected with dextranomer/hyaluronic acid copolymer (Dx/HA) using sub-ureteric injection technique until 2004 when we shifted to the hydrodistension-implantation technique (HIT) [3]. The mean injected volume was 1.3 ml.

Table 1 Data for the 13 patients included in the study.

No. of Pts	13
Gender	7 males/6 females
Age at procedure	Mean age 6.87 years (range, 3–13 years)
VUR grade	Grade 2 in 3 patients (23.07%) Grade 3 in 3 patients (23.07%) Grade 4 in 3 patients (23.07%) Grade 5 in 4 patients (30.76%)
No. of procedures	One procedure: 8 patients (61.5%) Two procedures: 4 patients (30.76%) Three procedures: 1 patient (7.69%)
Injected volume	Mean injected volume 1.3 ml (range, 0.4–3 ml)

Two patients had complete ureteral obstruction post-ECVUR. The first patient was a 7-year-old girl with Grade 4 VUR who was undergoing her first ECVUR procedure. She received an injection of 0.7 ml Dx/HA using the HIT technique. The patient developed anuria and high blood pressure reaching 157/93 on the night of the procedure. A renal ultrasound was performed and revealed new-onset hydronephrosis. The patient was admitted to the pediatric intensive care unit, and percutaneous nephrostomy tube insertion was performed 72 h post-operatively due to failure to improve with conservative treatment. A follow-up antegrade nephrostogram was completed one week later during the hospital stay. It revealed a partial ureterovesical junction obstruction. The patient then underwent antegrade double-J stent insertion. She was discharged home on day 10 post-ECVUR with normal urine output and blood pressure and no need for antihypertensive medications. After 3 months the double-J stent was removed. A follow-up renal ultrasound after one week revealed resolved hydronephrosis and later VCUG showed resolution of VUR.

The second patient was a 5-year-old boy with Grade 3 VUR. He underwent his first ECVUR with an injection of 0.4 ml Dx/HA using the HIT technique. The patient became anuric within 24 h after the procedure, but his blood pressure was normal. The patient underwent cystoscopy and retrograde insertion of a double-J stent the following morning. He was discharged home on postoperative day 3 in good health. The double-J stent was removed after 3 months. A follow-up renal ultrasound was performed within one week and revealed no hydronephrosis while VCUG showed complete resolution of VUR. The patient was producing normal urine output.

Another two patients were found to have partial obstruction on follow-up renal ultrasound at six weeks. Both patients were asymptomatic. They were managed expectantly, and the resolution of hydronephrosis was confirmed on the repeat follow-up renal ultrasound.

Discussion

Ureteral obstruction post-ECVUR is a serious complication that can result in permanent renal damage if it is not recognized. Logically, it has more detrimental effects on renal function of the growing kidney, especially in patients

with a solitary kidney. Fortunately, the reported rate of post-ECVUR ureteral obstruction is less than 1% in all patient groups with VUR [4–8]. But, a recent report from Switzerland showed a higher percentage of significant ureteral obstruction post-ECVUR using Dx/HA, with 9.3% of the treated patients requiring active intervention [10].

Vandersteen et al. reported their multi-institutional study of 745 patients (1155 ureters). The incidence of post-ECVUR ureteral obstruction was 0.7% [4]. Eighty percent of obstructed patients in that study became immediately symptomatic, while one patient presented late after 6 months with pyelonephritis and increasing hydronephrosis. They treated obstructed patients with retrograde ureteral stents that were left indwelling for 2–6 weeks.

Our results showed a high rate of ureteral obstruction post-ECVUR in patients with a solitary kidney. Fifteen percent of patients in our series had complete obstruction that required immediate intervention with ureteral stenting, with or without initial percutaneous nephrostomy tube insertion. Obstructed patients had complete resolution of obstruction after removal of double-J stents 3 months later. Resolution of obstruction after ureteral stenting is explained by decreased local tissue edema at the site of injection and the proven 25% volume loss of Dx/HA, as documented in human and animal studies [11,12].

Snodgrass reported the first case of post-ECVUR ureteral obstruction after injection of Dx/HA in a patient with a dysmorphic ureter [13]. Two more similar cases were reported later. These patients were diagnosed with congenital refluxing megaureters and distal aperistaltic ureteric segments [14]. All of the mentioned cases required open ureteral reimplantation to manage the obstruction. In our study, VCUG revealed no distal ureteric narrowing. Moreover, all of the obstructions resolved with time after ureteral stent placement, which makes distal ureteric anatomic abnormalities less likely in our patients.

Controversy still exists regarding the proper follow-up protocol for patients post-ECVUR. One of the most controversial issues is whether patients post-ECVUR need a follow-up renal ultrasound. Yu et al. reported the renal ultrasound findings in 100 patients post-ECVUR with Dx/HA [15]. Eighty percent of their patients had a normal renal ultrasound, while 10% had minimal pelvic ectasia. No patients showed any significant changes on the follow-up ultrasound. Therefore, they concluded that a renal ultrasound post-ECVUR is unnecessary. On the other hand, Palmer et al. studied 21 patients with VUR and a solitary or solitary-functioning kidney [9]. Fourteen patients were managed by surgery, and only one patient was managed by ECVUR with Teflon injection. They stated that VUR in patients with a solitary kidney could be managed using the same strategies used to treat unilateral VUR in children with bilateral normal kidneys.

No one has elaborated on the incidence of obstruction post-ECVUR in patients with a solitary kidney. Because of the high rate of post-ECVUR ureteral obstruction and the new-onset hydronephrosis in our data, we think patients who have a solitary kidney and ipsilateral VUR who are planned for ECVUR must have a follow-up renal ultrasound to rule-out obstruction and detect new-onset hydronephrosis which may dictate more strict follow-up protocol.

Data in this study were retrieved from a tertiary center with most of the patients being referred from distant peripheral regions, which mandated keeping some patients in the hospital 24 h postoperatively for observation.

The high rate post-ECVUR ureteral obstruction in this study does not imply technical causes on the part of the performing urologists because we had no recorded cases of post-ECVUR in patients with unilateral or bilateral VUR and bilateral kidneys. This fact probably indicates either: a higher risk of post-ECVUR ureteral obstruction in patients with solitary kidneys, or that cases of post-ECVUR temporary ureteral obstruction in patients with bilateral kidneys are overlooked.

We acknowledge that some limitations do exist in our study. The first limitation is that this study is a retrospective evaluation. Second, the number of patients included is limited. However, this group of patients is very selective, and we believe that our data will be verified by similar studies.

Moreover, both patients with obstruction in this study were managed using one injection technique and one type of material. Thus, we cannot answer whether this technique or material has a direct causative effect on the high rate of post-ECVUR ureteral obstruction.

Conclusion

Ureteral obstruction post-ECVUR is a serious complication, especially in patients with a solitary kidney. Our results showed a high percentage of obstruction and hydronephrosis post-ECVUR in patients with a solitary kidney and ipsilateral VUR. Patients should be discharged with clear instructions to the family about symptoms related to obstruction and when to report immediately to the emergency department. We believe that a follow-up renal ultrasound to rule out a possible obstruction is a significant tool that can reassure the family and the urologist.

Large multicenter studies are needed to further elaborate on the prevalence of post-ECVUR ureteral obstruction in patients with solitary kidney and to draw more solid conclusions regarding their management and follow-up. However, we stress on the importance of always keeping in mind the possibility of post-ECVUR ureteral obstruction as a serious complication.

Conflict of interest

No conflict of interest exist for all authors.

Funding source

None.

Ethical approval

This is a retrospective study and IRB approval was not required.

References

- [1] Matouschek E. Treatment of vesicorenal reflux by transurethral Teflon-injection. *Urologe A* 1981;20:263.
- [2] Hacker FM, Frech-Dorfler M, Rotz MV, Rudin C. Endoscopic hyaluronic acid/dextranomer gel implantation is effective as first-line treatment of vesicoureteral reflux (VUR) in children: a single centre experience. *Eur J Pediatr Surg* 2011;21:299.
- [3] Kirsch AJ, Perez-Brayfield M, Smith EA, et al. The modified STING procedure to correct vesicoureteral reflux: improved results with submucosal implantation within the intramural ureter. *J Urol* 2004;171:2413.
- [4] Vandersteen DR, Routh JC, Reinberg Y, et al. Post-operative ureteral obstruction after subureteral injection of dextranomer/hyaluronic acid copolymer. *J Urol* 2006;176:1593.
- [5] Roman JM, Lago CM, Duro G, et al. Obstruccion URETERAL postoperatoria despues de antirreflujo endoscopico. *Arch Esp Urol* 2008;61:323.
- [6] Holmdahl G, Brandstrom P, Lackgren G, Sillen U, Stokland E, Jodal U, et al. The Swedish reflux trial in children: II. vesicoureteral reflux outcome. *J Urol* 2010;184:280.
- [7] Birmingham Reflux Study Group. Prospective trial of operative vs non-operative treatment of severe vesicoureteral reflux in children: five years observation. *Br Med J* 1987;295:237.
- [8] Durba SA, Garcia BM, Estornell MF, Hinarejos DC, Sanguesa C, Verduch MM, et al. Vesicoureteric reflux endoscopic treatment complications in childhood. *Actas Urol Esp* 2006;30:170.
- [9] Palmer LS, Andros GJ, Firlit CF, et al. Management considerations for treating vesicoureteral reflux in children with solitary kidneys. *Urology* 1997;49:604.
- [10] Mazzone L, Gobet R, Gonzalez R, Zweifel N, Weber DM. Ureteral obstruction following injection of dextranomer/hyal-uronic acid copolymer: an infrequent but relevant complication. *J Pediatr Urol* 2012;8:514.
- [11] McMann LP, Scherz HC, Kirsch AJ. Long-term preservation of dextranomer/hyaluronic acid copolymer implants after endoscopic treatment of vesicoureteral reflux in children. *J Urol* 2007;177:316.
- [12] Stenberg A, Larsson E, Lindholm A, Ronneus B, Stenberg A, Lackgren G. Injectable dextranomer-based implant: histopathology, volume changes and DNA-analysis. *Scand J Urol Nephrol* 1999;33:355.
- [13] Snodgrass WT. Obstruction of a dysmorphic ureter following dextranomer/hyaluronic acid copolymer. *J Urol* 2004;171:395.
- [14] Aaronson DS, Siddiqui SA, Reinberg Y, Baskin LS. Relative contraindication to endoscopic subureteral injection for vesicoureteral reflux: congenital refluxing megaureter with distal aperistaltic segment. *Urology* 2008;71:616.
- [15] Yu RN, Jones EA, Roth DR. Renal ultrasound studies after endoscopic injection of dextranomer/hyaluronic acid copolymer for vesicoureteral reflux. *Urology* 2006;68:866.