

The influence of ureteral orifice configuration on the success rate of endoscopic treatment of vesicoureteral reflux

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Abstract

Background: To investigate the effect of polyacrylate polyalcohol copolymer (Vantris) injection for the correction of VUR in children according to ureteral orifice shape and VUR grade.

Materials and Methods: Forty children (29 girls and 11 boys) with 61 renal refluxing units (RRU) and primary VUR underwent endoscopic correction of their reflux, using Vantris. Under general anesthesia, routine cystoscopy was performed and ureteral orifice configuration and dynamic hydro distention grade were determined. The injection technique was STING, HIT or a combination of them. Ultrasound scan was performed one and 3 months after injection and radionuclide cystography (RNC) was performed 3 months after the operation.

Results: The mean volume of injected Vantris was 0.62 cc. Reflux was corrected in 52 (85.2%) of the 61 RRU after single injection and this equates reflux correction in 37 of the 40 patients. No significant correlation was observed between ureteral orifice shape and VUR correction rate.

Conclusions: Our results showed that there was no correlation between the ureteral orifice configuration and the success rate of endoscopic surgery for VUR in short term.

Key Words: Endoscopic, polyacrylate polyalcohol copolymer, ureteral orifice, vesicoureteral reflux

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INTRODUCTION

Vesicoureteral reflux, the retrograde flow of urine from the bladder into the upper urinary tract, is the most common urological abnormality in children. It occurs in 1%-2% of the pediatric population and in 30%-40% of children presenting with urinary

tract infection (UTI).^[1,2] The association of reflux, UTI and renal scarring is well recognized and reflux nephropathy is a major cause of childhood hypertension and chronic renal failure.^[2,3] The goal of vesicoureteric reflux (VUR) treatment is to prevent pyelonephritis and to preserve renal function. The method of treatment has traditionally been surgical intervention or medical treatment. The endoscopic use of tissue bulking agents has been gaining popularity as an alternative to medical treatment and surgical intervention. The long-term requirement of prophylactic antibiotic therapy and the complications of open surgical treatment led to the development of endoscopic treatment of VUR in early 1980s.^[4,5] This treatment was popularized

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by O'Donnell and Puri when they presented their first report in 1984.^[6] They coined the term STING (subureteric Teflon injection) and Kirsch presented the modified STING procedure to correct VUR, using dynamic hydro distention and intraureteral injection of bulking agent.^[6,7] The aim of all injection techniques is to achieve a volcano-shaped, mound orifice at the end of the injection. Achieving this goal was associated with an 87% success rate, compared to only 53% for other shapes.^[8] Polyacrylate polyacohol copolymer (Vantris) is a new bulking agent for the correction of VUR^[9] High-grade VUR seems to be a possible cause of an unsuccessful endoscopic treatment in children. On the other hand, ureteral orifice configuration has been shown to be related to its competency and hence, possibility of reflux. The aim of this study is to assess the efficacy of Vantris for treatment of VUR according to ureteral orifice appearance and VUR grade.

MATERIALS AND METHODS

From June 2011 to October 2011, we treated 40 children with 61 refluxing renal units (RRU), using Vantris injection and then prospectively followed them. Demographic data are presented in Table 1. Reflux grade was determined based on voiding cystoureterography (VCUG) before the surgery, according to international classification system. The indication for intervention in majority of children was persistent high-grade VUR or breakthrough UTI while on medical treatment. Inclusion criterion was documented UTI accompanied by all grades of reflux. Exclusion criteria were duplex system, failed ureteroneocystostomy or endoscopic injection, secondary VUR due to neuropathic bladder, urethral stricture, posterior urethral valve, anterior urethral valve, and ureterocele and voiding dysfunction.

Under general anesthesia, routine cystoscopy was performed with an 8-9.8Fr offset lens Wolf cystoscope and ureteral orifice shape and location and bladder wall trabeculation were observed. The orifice of a normal ureter has the appearance of volcanic cone. That of a slightly weaker valve looks a football stadium; an even weaker one has the appearance of a horseshoe. The completely incompetent orifice has a golf-hole orifice that lies over the ureteral hiatus.^[10] Then, hydro distention of the ureteral orifice was determined by approaching the ureteral orifice by the cystoscope with open water flow. hydro distention grading (HD grade) was recorded as: H0-no hydro distention, H1-ureteral orifice open but tunnel not evident, H2-intramural tunnel seen only and H3-extravesical ureter visualized.^[11] Ureters with HD grades H0-H1 were considered

as low grade hydro distention and H2-H3 as high grade. Endoscopic treatment was performed with a 3.6 Fr (22G) metallic semi-rigid injection needle. All injections were performed by a single pediatric urologist (FA) as part of the study protocol, using subureteral injection (STING) or intraureteral (HIT) or a combination of them according to dynamic hydro distention (HD grade) and the anatomy of ureteral orifice. With hydro distention, the initial injection should impinge the floor of the mid-ureteral tunnel at the 6 o'clock position. This injection should lead to coaptation of the ureteric tunnel. The distal HIT is performed by placing the needle to the same depth just within the ureteral orifice and injecting until the ureteral orifice is coapted. If adequate coaptation of the ureteral orifice is not achieved following the two intra-ureteric injections then a classic STING injection is performed.^[2,7,11] The injection was performed until the ureteral orifice become slit like(Volcano-shaped mound) and hydro distention, if present, disappeared. According to our protocol, ultrasound scan was performed 1 and 3 months after treatment to identify de novo hydronephrosis and to rule out obstruction. Radionuclide cystography (RNC) was performed 3 months after single injection to evaluate success of treatment and antibiotic prophylaxis was stopped if RNC showed no VUR.

Table 1 Demographic data and patient characteristics

Gender	
Male	11
Female	29
Age (years)	
Mean \pm SD	4.4 \pm 2.9
Range	0.5- 11
Laterality	
Unilateral	19
Bilateral	21

Table 2: Reflux resolution according to VUR grade

VUR	RRU	Resolved VUR (%)
Grade 1	1	1 (100)
Grade 2	14	12 (85.7)
Grade 3	16	13 (81.3)
Grade 4	19	16 (84.2)
Grade 5	11	10 (90.9)

Table 3: Reflux resolution according to orifice shape

Orifice shape	Number	Resolved VUR (%)
Volcano(Normal cone)	7	7(100)
Stadium	8	8(100)
Horseshoe	18	12(66.7)
Golf hole	28	25(85.2)

RESULTS

All children completed 3 months of follow up. Vesicoureteral reflux was grade 1 in one ureter (1%), grade 2 in 14 (23%), grade 3 in 16 (26%), grade 4 in 19 (32%) and grade 5 in 11 (18%) ureters. Of the studied patients, 7RRU (11.5%) had volcanic cone configuration, 8 RRU (13%) were stadium shaped, 18 RRU (29.5%) were of horse shoe type and 28 RRU (46%) had a golf hole appearance. The hydro distention grade was recorded as H0 grade in 7RRU (11.5%), H1 grade in 22 RRU (36%), H2 grade in 15 RRU (24.5%) and H3 grade in 17 RRU (28%). The reflux was corrected in 52 (85.2%) of 61 RRU and this equates reflux correction in 37 of the 40 patients. Reflux correction outcomes according to ureteral orifice shape are presented in Table 2 and reflux correction outcomes according to VUR grade are presented in Table 3.

DISCUSSION

The normal non refluxing orifice may have the configuration described as a volcano-shape but the ureteral orifice may be quite variable in position and appearance.^[10, 11] In an attempt to establish a uniform classification of orifice characteristics, Lyon and colleagues suggested categorizing the urethral orifice. Furthermore, they also graded the ureteral orifice according to its configuration: grade 0, the normal cone or volcano orifice; Grade 1, the stadium orifice; grade 2 the horse shoe orifice; and grade 3, the golf-hole orifice.^[10] These configurations were associated with an increasing tendency to laterality and reflux as the grade progressed. Furthermore, orifice shape, VUR grade and hydro distention grade seem to be some of the possible causes of an unsuccessful endoscopic treatment of VUR.^[12] Our preliminary results are similar to the previously published series. In 2010 Ormaechea and colleagues introduced their experience with Vantris in 83 children, reporting an 83.6% cure rate at one year of follow up.^[3] Chertin and colleague, on the other hand, reported a 94.9% success rate with Vantris.^[1] In their series, 59 RRU were treated with Vantris injection and reflux was corrected in 100% of the grade 1, grade 2 and grade 3, 93.3% of grade 4 and 60% of grade 5.^[1] In our series, overall success rate was 85.2% of 61 RRU, similar to other series. However, by increasing VUR grade, treatment outcome did not change and the success rate even in grade 5 VUR was 90.9%. Mann-Whitney test showed no significant relationship between ureteral orifice shape and VUR correction rate ($P = 0.82$). In addition, there was no significant relationship between VUR grade and treatment outcome ($P = 0.79$) and no

association between hydro distention grade and treatment outcome ($P = 0.63$). However, we observed an association between the shape of the ureteral orifice and hydro distention grade ($P = 0.001$) and VUR grades ($P = 0.03$). Kirsch *et al.* reported a significant correlation between hydro distention and VUR grade.^[7] Our results confirm that endoscopic treatment of Vantris can correct all grades of reflux.^[7] Although ureteral orifice configuration was associated with VUR grade, since unlike some other series, the latter parameter did not influence the surgical outcome, we found no correlation between the two parameters. Published article regarding the efficacy of bulking agents for the treatment of VUR, have not addressed the effect of ureteral orifice configuration on the success rate and as far as we know, our article is the first one in this regard. More studies are required to confirm our findings.

CONCLUSIONS

Endoscopic subureteric injection of Vantris is an effective method for VUR correction in short term. The success rate is not influenced by reflux grade and ureteral orifice configuration. However, long term results are lacking and highly required.

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