# Vesicoureteral Reflux (VUR): Endoscopic Treatment

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## 55.1 Introduction

Vesicoureteral reflux (VUR) is one of the most common urologic morbidities in children, with an estimated prevalence of approximately 1% of the general pediatric population, but which can be as high as 30% in children with a history of febrile urinary tract infection (UTI) [1, 2]. The goals of treating a child with VUR are (1) to prevent recurring febrile UTI, (2) to prevent renal damage, and (3) to minimize/prevent adverse effects of treatment [3].

Management regimes incorporate a spectrum of philosophies and modalities ranging from observation with or without continuous antibiotic prophylaxis to active surgical intervention [3]. Essentially, the optimal treatment for VUR has yet to be established. Whether surgical intervention is indicated for treating children with persistent reflux, renal scarring, or recurrent febrile UTI is currently controversial because of the major change in treating VUR that followed Puri's first clinical report about an endoscopic procedure they called the STING method published in 1984 [4]. Since then, the STING method has been modified to improve VUR cure rates, for example, by introducing the hydrodistention implantation technique (HIT) [5] and double HIT [6].

Several tissue-augmenting substances have been used for subureteral injection, such as polytetrafluoroethylene, collagen, silicone, autologous chondrocytes, and Deflux® [7], followed by a succession of new substances; for example, in 2010, the preliminary results of a prospective multicenter study of a new substance "polyacrylate polyalcohol copolymer (PPC/Vantris®)" was published [8]. While Deflux® is still the most widely used bulking agent [9], recently, Deflux® treatment (DT) has been implicated as a potential cause of ureteral obstruction (UB).

Here, we describe a simple noninvasive technique we pioneered to identify post-DT UB and patients at risk for UB, especially late-onset UB.

## 55.2 Preoperative Preparation and Positioning

General anesthesia is induced and the trachea intubated. No other anesthesia is required. The patient is placed in the lithotomy position, prepared and draped, and single dose of an antibiotic is administered intravenously. Figure 55.1 shows the standard layout for left DT. The operating surgeon will stand on the patient's right side for left DT cases and between the patient's legs for right and bilateral DT cases.

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C. Esposito et al. (eds.), *ESPES Manual of Pediatric Minimally Invasive Surgery*,
https://doi.org/10.1007/978-3-030-00964-9_55

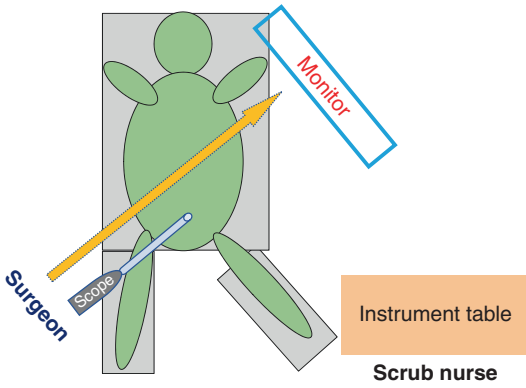


**Fig. 55.1** Diagram of standard operating room layout. Figure shows the standard operating room layout for left DT. The operating surgeon will stand on the right side for left DT, and on the left side for right DT, and between the patient's legs for bilateral cases. The surgeon's direction of view and the orientation of the cystoscope are the same

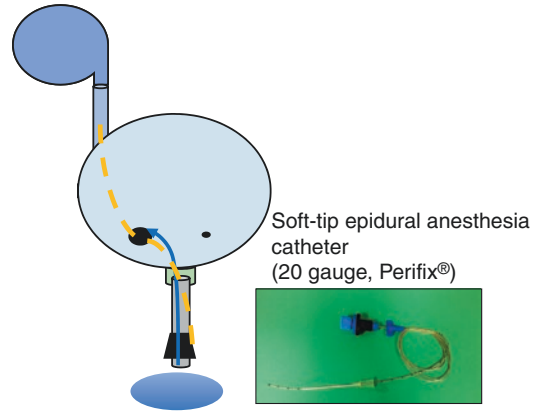


**Fig. 55.2** Diagram of our epidural catheter technique. Our technique involves inserting an epidural catheter into the ureter on the Deflux®-treated side and injecting indigo carmine solution

## 55.3 Technique

We routinely use an 8.0 or 9.5 Fr pediatric cystoscope (Karl Storz, Inc., Tuttlingen, Germany) with an offset lens for injecting Deflux® because the offset lens permits direct passage of a 3.7 Fr needle in line with the ureter without needing to bend the Deflux® needle. After the bladder is filled to three quarter volume to permit visualization of the ureteric orifice, we insert a soft-tip epidural anesthesia catheter (20 gauge, Perifix®) (B. Braun, Melsungen AG, Germany) through a side channel of the cystoscope. Once the epidural catheter is inserted into the ureter, the cystoscope is withdrawn leaving the epidural catheter in the ureter and the urethra (Fig. 55.2). The cystoscope is then carefully reinserted into the urethra with the epidural catheter in situ, and a needle is inserted through the side channel of the cystoscope. After confirmation that the Deflux® needle is in the desired position, Deflux® is injected submucosally according to the original technique reported by O'Donnell [4]. Immediately after this, 1–3 mL of 20% indigo carmine solution is injected through the epidural catheter, and after observation to confirm dye flow from the treated ureteric orifice into the bladder, the epidural catheter is removed (Fig. 55.3).

In cases where no dye flow is observed after a minimum of 15 min, the epidural catheter is clamped but not removed because the patient is at risk for UB, and the patient is transferred back to the ward with the epidural catheter in situ. The epidural catheter is left overnight during which time dye may appear in the urine. If dye is observed the next day, the patient may be discharged, but if no dye is observed, an ultrasonographic (US) examination is performed to examine for significant hydronephrosis which we consider as pathognomic of UB. If there are no signs of UB on US, the epidural catheter is removed in the ward the next day. Renal and bladder US are planned for 3 weeks later at outpatient clinic follow-up.

## 55.4 Routine Postoperative Care

All patients are commenced on prophylactic antibiotics postoperatively which are discontinued after VUR is confirmed to be absent or downgraded to grade I (both of which we regard as being "cure" of VUR) on voiding cystourethrography performed routinely 1 month after DT. Routine outpatient visits for assessing blood biochemistry and urinalysis and renal and

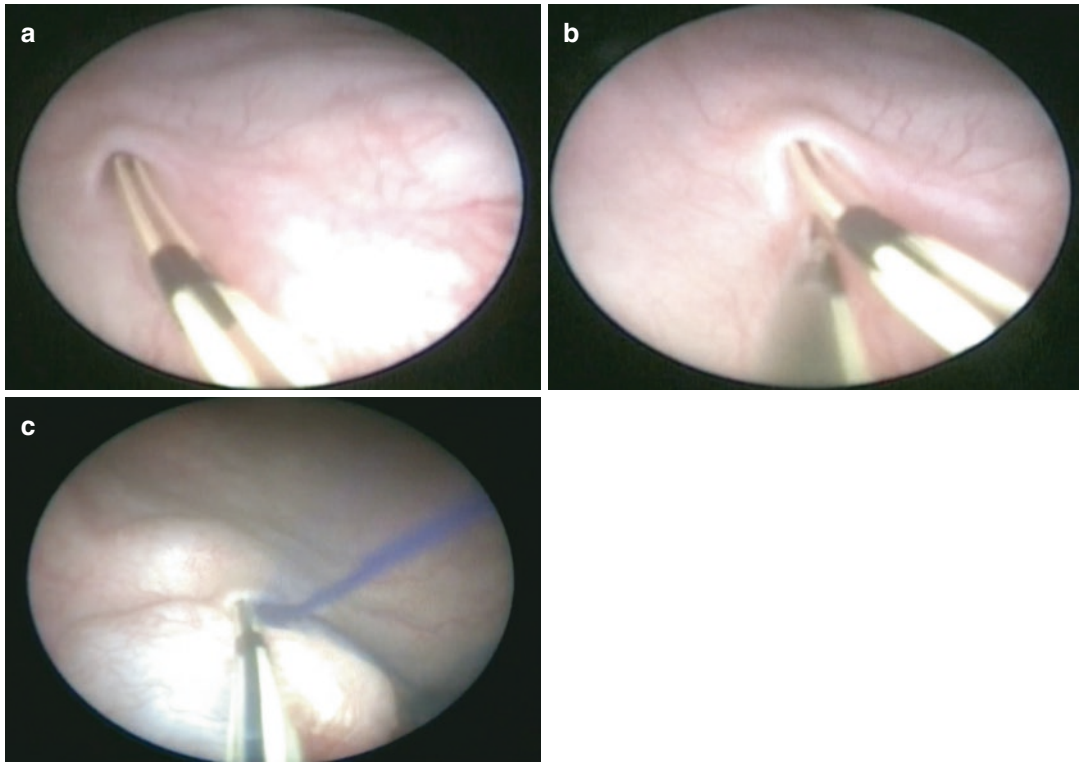


**Fig. 55.3** Our epidural catheter technique being performed. Our epidural catheter technique. An epidural catheter is inserted into the ureter (**a**), then the Deflux® needle is inserted at the 6 o'clock position and Deflux® is injected (**b**). There is flow of dye from the treated ureteric orifice into the bladder (**c**)

bladder US are planned for 2 weeks and 3, 6, 12, and 24 months after DT to identify complications and late-onset UB.

## 55.5 Results

We treated 224 ureters with grades II to V VUR in 153 patients using our epidural catheter technique between 2011 and 2018. Of these, 92 were male and 61 were female; mean age at first DT is 4.4 years (range, 0.7–29.8). VUR severity in our series of 224 ureters was grade II in 38 (17.0%), grade III in 77 (34.4%), grade IV in 88 (39.3%), and grade V in 21 (9.4%). Mean operative time was 29.5 min (range, 9–45). Mean duration of postoperative follow-up was 4.1 years (range, 0.7–6.9).

The overall "cure" rate after the first DT was 57.6%, 79.9% after the second DT, and 82.6% after the third DT (Table 55.1a). The "cure" rate after the first DT for VUR grade II was 65.8%, 63.6% for grade III, 52.3% for grade IV, and 42.9% for grade V. The overall "cure" by the third DT for preoperative VUR grade II was 89.5%, 80.5% for grade III, 86.4% for grade IV, and 61.9% for grade V (Table 55.1b). The mean number of DT required to "cure" grade II was 1.13 times, 1.04 times for grade III, 1.19 times for grade IV, and 0.81 times for grade V.

Of the 224 ureters treated in this series, there were 6 (2.7%) with no dye flow after observing for 15 min. All were treated according to the protocol mentioned earlier (leaving the epidural catheter in situ overnight, reassessment for dye flow the next day, assessment for UB by US,

**Table 55.1** Resolution of vesicoureteral reflux (VUR) per ureter after Deflux® treatment (DT) in our series

(a) "Cure" rates versus number of Deflux treatments (DT)

| | After first DT | After second DT | After third DT |
|---|---|---|---|
| Overall "cure" rate | 129/224 (57.6%) | 179/224 (79.9%) | 185/224 (82.6%) |

(b) "Cure" rates versus grade of vesicoureteric reflux. *DT* Deflux treatment

| VUR grade | After first DT | After second DT | After third DT | Overall "cure" rate after 3 DT |
|---|---|---|---|---|
| II | 25/38 (65.8%) | 25 + 9/38 (89.5%) | 34 + 0/38 (89.5%) | 34/38 (89.5%) |
| III | 49/77 (63.6%) | 49 + 8/77 (74.0%) | 57 + 5/77 (80.5%) | 62/77 (80.5%) |
| IV | 46/88 (52.3%) | 46 + 29/88 (85.2%) | 75 + 1/88 (86.4%) | 76/88 (86.4%) |
| V | 9/21 (42.9%) | 9 + 4/21 (61.9%) | 13 + 0/21 (61.9%) | 13/21 (61.9%) |

"Cure" of VUR was defined as absence or downgrading to grade I on voiding cystourethrography

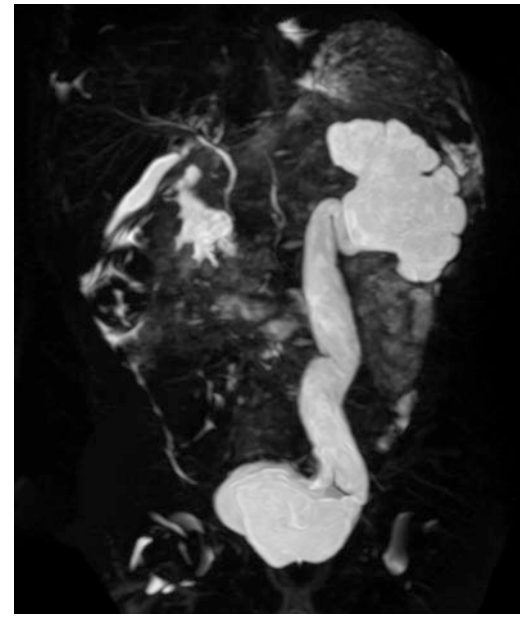

**Fig. 55.4** Magnetic resonance urography appearance of ureteric obstruction after Deflux®. MR urography appearance of ureteric obstruction after Deflux® treatment without confirming passage of dye

repeat US at outpatient follow-up 3 weeks after DT). Of the six, two required surgical intervention. One case was a 10-year-old male whose epidural catheter was left in situ because there was no dye flow after 15 min of observation; however, when the epidural catheter was clamped, he developed flank pain and significant hydronephrosis was identified on US the next day, requiring insertion of a double J stent with complete resolution of pain and hydronephrosis. The stent was removed after 1 month. He has been pain-free with stable US findings since. The other case was a 1-year-old male in whom the epidural catheter was removed before confirming dye flow and required insertion of a double J stent because of gross hydronephrosis caused by Deflux® (Fig. 55.4). The stent is currently still in situ.

## 55.6 Discussion

Endoscopic treatment is now well accepted for treating VUR. The majority of parents clearly prefer endoscopic treatment over open surgery, and a growing number are likely to prefer it over chronic antibiotic prophylaxis [5]. Thus, the demand for DT is likely to increase, and the prevention of complications becomes a major issue.

While endoscopic treatment of VUR is a highly successful minimally invasive procedure with low rates of reported complications requiring surgical intervention, of the order of less than 1% [10], a recent study reported UB rates ranging from 0.7 to 7.6% [11], suggesting that identification of patients at risk for UB may be beneficial. A recently published report about late-onset UB, defined as newly developed or progressive hydronephrosis 8 weeks or more after Deflux® or Vantris® injection, found the rate of late UB after Deflux® or Vantris® injection was 1.9% and the mean time for onset of late UB was 13.4 months [12].

To date, we have not had any late-onset UB develop even though our mean follow-up (4.1 years) is longer than the mean time for late-onset UB to develop reported recently (1.1 years) [12]. We believe our catheter technique effectively identifies patients at risk for UB, both

acute and late onset. If dye flow is delayed or absent, additional follow-up is enforced according to our protocol with early surgical intervention as required.

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