CASE REPORT
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TEFLON INJECTIONS (STING) MIMICKING DISTAL URETERIC STONES: DIAGNOSTIC PITFALLS

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Abstract

This case report highlights the potential diagnostic pitfalls associated with subureteral transurethral injection (STING) of non-biodegradable materials like Teflon, which has been utilised for endoscopic correction of vesicoureteral reflux (VUR). A 27-year-old female with a history of VUR presented with left-sided loin pain, vomiting, and dysuria, which were initially thought to be due to distal ureteric stones. However, non-contrast computed tomography (CT) revealed the presence of calcific densities in the region of the distal ureter and vesicoureteric junction (VUJ) bilaterally, likely as a sequelae of previous Teflon injection treatment. A conservative management approach was undertaken, and follow-up evaluations, including MAG3 renograms, showed normal drainage and stable split renal function. This case emphasises the importance of a comprehensive medical history and vigilance in avoiding unnecessary imaging or surgical interventions for patients with a previous history of STING.

Keywords: subureteral transurethral injection, STING, ureteric obstruction, Teflon, vesicoureteral reflux disease, surgical risks, diagnostic pitfalls

INTRODUCTION

Managing vesicoureteral reflux (VUR) is essential in preventing recurrent pyelonephritis, which can lead to renal scarring and loss of renal function. This can be achieved through the use of continuous antibiotic prophylaxis or surgery.

Endoscopic correction of VUR can be achieved through subureteral transurethral injection (STING) of biodegradable materials such as hyaluronic acid and dextranomer, or non-biodegradable materials like Teflon, which have been used as a bulking agent to lengthen the distal ureteric tunnel.

Teflon, also known as polytetrafluoroethylene, is formed by the polymerisation of tetrafluoroethylene, which has strong carbon-carbon and carbon-fluorine bonds. As a result, Teflon has a wide range of medical applications due to its biocompatibility, durability, non-stick, and heat-resistant properties. It is these properties that have seen Teflon used as a material for vascular and cardiac grafts, as a coating on orthopaedic implants such as knee and hip replacements, as a coating on dental implants, as a material for sutures, as a lining for catheters, and as a filter material in laboratory settings and medical procedures such as dialysis.

However, using Teflon as a bulking agent is associated with some risks. In addition to the inherent risks of surgery, the injection of materials into the subureteral space can cause ureteric obstruction requiring nephrostomy or ureteric reconstruction, with a reported risk of around 1%. Therefore, the benefits and risks of each approach should be
considered when determining the most appropriate management strategy for patients with VUR.

**CASE**

A 27-year-old female patient presented to the ambulatory surgical unit as an emergency referral from her general practitioner, complaining of severe left-sided loin pain, vomiting, and dysuria. A comprehensive evaluation, including laboratory testing, revealed unremarkable results except for a slightly elevated c-reactive protein level of 26.

To further investigate the cause of the patient’s symptoms, a non-contrast computed tomography (CT) scan of the urinary tract was performed. The imaging study revealed the presence of calculi measuring up to 5 mm in diameter located at the left vesicoureteric junction (VUJ) and the distal ureter. Notably, no evidence of hydronephrosis was identified. However, focal areas of cortical scarring in the left kidney were observed. Additionally, similar calcific densities were identified in the region of the right VUJ and distal ureter, although the right kidney appeared normal on imaging.

Given the resolution of the patient’s symptoms, a conservative management approach was undertaken, and the patient was discharged. Follow-up evaluations were performed to monitor the patient’s condition, including repeat CT scans and MAG3 renogram. The repeat CT scan did not reveal any significant changes in the appearance of the calculi or the presence of scarring.

Furthermore, upon a thorough review of the patient’s medical history, it was discovered that the patient had a previous diagnosis of vesicoureteric reflux (VUR) and had been treated with Teflon injections. Based on this information, it was postulated that the calcific densities in the region of the distal ureter were likely a sequelae of the patient’s previous treatment for VUR, rather than an operational condition.

The MAG3 renogram, a functional imaging modality, was utilised to evaluate renal function, which revealed normal drainage of both kidneys. The results of the renogram demonstrated a split renal function of 31% for the left kidney and 69% for the right kidney.

To confirm the stability of the patient’s condition and to monitor for any potential changes in renal function over time, a follow-up MAG3 renogram was performed 12 months later. This examination showed normal kidney drainage and a stable split renal function.

This provided compelling evidence that the conservative management approach and monitoring plan implemented at discharge was effective in maintaining the stability of the patient’s renal function and that the patient did not require any surgical intervention.

**DISCUSSION**

Vesicoureteral reflux (VUR) is a pathological condition characterised by the retrograde flow of urine from the bladder into the ureter and the upper urinary tract. The condition can lead to various urologic and renal complications, including urinary tract infections, renal scarring, and chronic kidney disease.

The exact aetiology of VUR is not fully understood; however, several factors have been identified as potential contributors to its development. Primary VUR is a congenital condition in which the ureter inserts into the bladder in an ectopic location and lacks the muscular valvular mechanism that prevents reflux. Secondary VUR, on the other hand, results from an underlying functional or structural abnormality of the urinary tract that leads to increased pressure within the bladder and impaired bladder emptying, resulting in reflux. Secondary VUR can be caused by various factors such as neurogenic bladder, urethral obstruction, bladder outlet obstruction, and detrusor dysfunction.

Estimates of the prevalence of VUR in normal children have varied, with ranges from 0.4% to 1.8% reported in the literature. However, a more comprehensive understanding of the incidence of VUR may be gleaned from epidemiological data, suggesting that 2.2% of girls and 0.6% of boys may be diagnosed with VUR due to an investigation for urinary tract infection. This indicates that while most children with VUR are likely to experience urinary tract infections, not all cases of VUR identified through screening...
processes will result in such infections. Consequently, the actual prevalence of VUR in normal children may be greater than previously estimated.1

The impact of VUR on health outcomes has been widely studied and documented. Prolonged VUR has been associated with various adverse health outcomes, including recurrent urinary tract infections, renal scarring, and impaired renal function. Additionally, VUR can lead to Hypertension and increase the risk of chronic kidney disease, which can cause progressive kidney damage and end-stage renal disease. These health outcomes can significantly impact a child’s quality of life, and it is important to diagnose and treat VUR early to mitigate these potential consequences.

VUR can be classified into 5 grades based on the extent of reflux. Grade 1 is the mildest form, with reflux limited to the ureter, whereas grade 5 is the most severe and is characterized by a tortuous ureter, marked dilatation of both the ureter and the pelvicalyceal system, and a loss of the renal fornices and papillary impressions.

There is no consensus on the optimal diagnostic procedures, treatment options, or most effective timing of treatment for VUR. To address this, early stratification based on risk factors such as family history, gender, laterality, age at presentation, presenting symptoms, VUR grade, duplication, and other voiding dysfunctions can assist in identifying patients who are at high potential risk for renal scarring and urinary tract infections (UTIs).

Imaging is a crucial component in the diagnosis and further management of VUR. The standard imaging tests for this condition include renal and bladder ultrasonography, voiding cystourethrography, and nuclear renal scanning. A well-documented correlation exists between VUR and lower urinary tract dysfunction (LUTD). Patients with both LUTD and febrile UTI are highly likely to present with VUR. The diagnosis can be confirmed through a video urodynamic study and a urodynamic investigation.2 Given the potential consequences of VUR, early screening of siblings and offspring of patients with reflux is recommended.2

Conservative therapy includes watchful waiting, intermittent or continuous antibiotic prophylaxis, and bladder rehabilitation in patients with LUTD. This approach aims to prevent febrile UTIs, as VUR will not cause damage to the kidney in the absence of infection.2

Interventional therapies for VUR include the injection of bulking agents and ureteral reimplantation. Reimplantation can be performed through several different surgical approaches, with a recent emphasis on minimally invasive techniques.2

Various open surgical techniques have been described for the surgical correction of VUR, including Cohen cross-trigonal reimplantation, supravesical reimplantation, infravesical reimplantation, and the Lich-Gregoir technique. These techniques all aim to lengthen the intramural part of the ureter and be safe, with a high success rate (92–98%). Laparoscopic procedures, both conventional and robot-assisted, have shown comparable outcomes to open surgery but with longer operative times. Laparoscopic procedures are more invasive than endoscopic correction, and the advantages over open surgery are still debated, so they are not recommended as routine procedures.2

In the endoscopic treatment of VUR, various injection techniques have been described, including subureteral transurethral injection (STING), hydrodistension implantation technique (HIT), and (Double-HIT) which is a combination of the STING and HIT.

STING is the most popular technique worldwide, and there is no evidence that it leads to a higher incidence of postoperative ureteral obstruction (UO) compared to other techniques. However, a large series from Russia showed a lower incidence of postoperative UO with STING (0.5%) compared to HIT (1.6%).3

The volume of bulking agent injected has also been suggested as a factor in the development of UO, with reported volumes causing UO ranging from 0.3 to 3.0 mL. However, there is no clear correlation between the injected volume and the incidence of UO.4

The possibility of repeated injections as a risk factor for UO has been discussed, but there is limited evidence to support this theory. In a series of 851 children with high-grade VUR, no UO was
reported following 259 re-injections and 133 third injections, suggesting that repeated injections may not be a significant factor.5

The timing of UO after endoscopic treatment of VUR is highly variable, ranging from immediately after the procedure to 63 months postoperatively. Early-onset UO may be associated with pain, nausea, vomiting, or anuria and can occur due to increased resistance at the ureterovesical junction caused by the tissue augmenting substance or improper injection. Late-onset UO may be due to a gradual increase in resistance, ineffective ureteral peristalsis, coaptation, or chronic inflammation.6

In a study by Sfakianos et al., the safety and efficacy of subureteral injection of a bulking agent for the treatment of vesicoureteric reflux disease (VUR) were evaluated in a cohort of 42 pediatric patients. The patients underwent subureteral injection of the bulking agent, with a mean follow-up period of 26.5 months. The results indicated that the procedure effectively treated VUR and reduced the incidence of recurrent UTIs in children, with a success rate of 77.8%. However, the study also revealed a complication rate of 1.1%, in which patients developed UO. This required further treatment, such as nephrostomy or ureteral reconstruction.7

Subureteral transurethral injection using non-biodegradable materials such as Teflon is no longer widely practised today. Still, given its historical use as a treatment for vesicoureteric reflux disease, we may start seeing more cases of patients with long-term consequences, which could include ureteric obstruction and non-functioning kidneys.8

Differentiating between distal ureteric calculi and subureteral transurethral injection with non-biodegradable materials such as Teflon (STING) can be challenging. This highlights the importance of having a high level of clinical suspicion in patients with a prior history of STING. The significance of this case report is to serve as a reminder of the need for healthcare providers to consider a patient’s medical history in their diagnostic and treatment decisions.

Limited information is available on the long-term consequences of subureteral transurethral injection with Teflon and the most effective approaches for managing patients who received this treatment in childhood.8

An awareness of the previous medical history can avoid unnecessary imaging or surgical interventions. A thorough history taking, the correct imaging and investigation, and even a high index of suspicion to minimise the number of unnecessary ureteroscopies and avoid the potential negative consequences of surgery, unnecessary radiation exposure and increased patient discomfort. However, despite these precautions, ureteroscopy may still be necessary in some cases, especially if the patient presents with symptoms such as loin pain or a decline in renal function (Figures 1–5).

The literature currently does not suggest any significant underestimation of ureteric obstruction due to STING. Still, there is not much information on the clinical decision-making when this cohort of patients presents with abdominal or loin pain later in their lives.

CONCLUSION

The use of subureteral transurethral injection with non-biodegradable materials such as Teflon has declined in recent years. However, the potential for long-term consequences, such as ureteric obstruction and non-functioning kidneys, may become

FIGURE 1 Coronal CT imaging showing ill-defined high attenuation in both distal ureters.
FIGURE 2 Axial CT imaging showing areas of high density in seen at both distal ureters.

FIGURE 3 The same image as shown in Figure 2 but with inverted contrast.

FIGURE 4 99mTc-MAG3 renogram showing normal drainage of both kidneys with no evidence of obstruction, although the left kidney is atrophic and scarred with impaired cortical tracer uptake.

The significance of this issue necessitates that healthcare professionals maintain a high level of vigilance when taking the medical history of patients with a previous history of STING.

A comprehensive medical history is crucial in avoiding unnecessary imaging or surgical interventions and ensuring that these patients receive prompt and appropriate treatment. However, even with the most diligent efforts, there may be instances where ureteroscopy remains necessary, particularly in cases where the patient is symptomatic with loin pain or declining renal function.

The literature currently does not indicate a significant underestimation of ureteric obstruction due to STING. However, further research focused on the long-term effects of STING and the most effective approaches for managing patients who present with symptoms later in life would help improve clinical decision-making and the quality of care for these patients.
REFERENCES


