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Tolerability and quality of life in patient with ureteral stenosis treated with Phosphorylcholine-coated stent

Case Report, 2022

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Introduction

Since the 70's ureteral stents have become an integral tool in treating ureteral obstruction from calculi and other causes[1]. Some possible complications such as migration, infection, pyelonephritis, encrustation, stone formation, and ureteral stents fragmentation have been correlated with the use of these tools. Despite their many advantages, they are often related with irritating lower urinary tract symptoms (LUTS), bladder, and flank or abdominal pain, which might have a negative effect on patients' quality of life (QoL)[2].

We describe a case report of a ureteral stenosis treated with long-term polyurethane Yellow-Star phosphorylcholine-coated double-J stent (Urotech, Germany) to value its tolerability and impact on quality of life.

Case description

A 75-year-old woman had a urological visit in 2018 for renal colic and hydronephrosis at the right kidney. She was affected by rheumatoid arthritis, with no history of renal colic or urinary stones, no fever and no altered blood tests (creatinine was 1 mg/dl).

She has undergone an abdominal tomography without contrast at the emergency department; the exam evidenced a right hydronephrosis without ureteral or renal stones (Fig. 1). Urine cytology was negative. A second tomography with contrast was performed; the exam showed a suspected neoformation at the right ureter (Fig.2) and a right septed and well marginated renal cyst of 2 cm with thin calcification, classified as Bosniak II[3,4].

She underwent right retrograde pyelography and ureteroscopy with evidence of 2cm-length ureteral stenosis in the lumbar tract, no ureteral neoformation was found. During the procedure, biopsies of the ureteral mucosa were performed with negative histological report. The final diagnosis was ureteral stenosis of the lumbar tract with concomitant hydronephrosis. A right Yellow-Star ureteral phosphorylcholine-coated stent (PC) was placed.

In consideration of the hydronephrosis and the therapy with immunosuppressive drugs for rheumatoid arthritis, the risk of infection of this patient was higher than in the normal population; in the same day of the procedure, the patient was running a high fever with chills. Urine and blood cultures were performed, and a cephalosporin was administered. Cultures were positive for E. Coli and antibiotic therapy was performed until negative cultures.

Until now, this patient replaces her ureteral stents yearly. She reports a good tolerability of the stent with occasional flank pain or low irritative symptoms such as strangury, occasional haematuria. No infection and no encrustation were showed during replacements. In the last replacement the patient completed the ureteral stent symptom questionnaire (USSQ) which confirmed a good tolerance of the stent. Finally, quality of life was investigated: the patient did not have an important impact in her routinary activities and only referred small changes in her life.

Fig. 1 Computer tomography without contrast (arrow shows hydronephrosis)

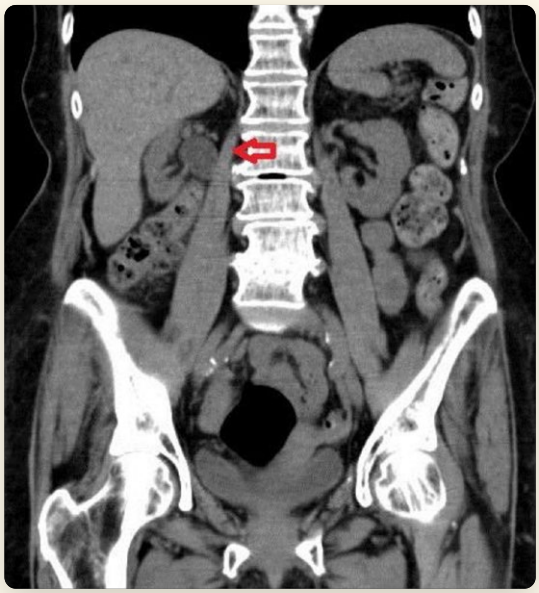
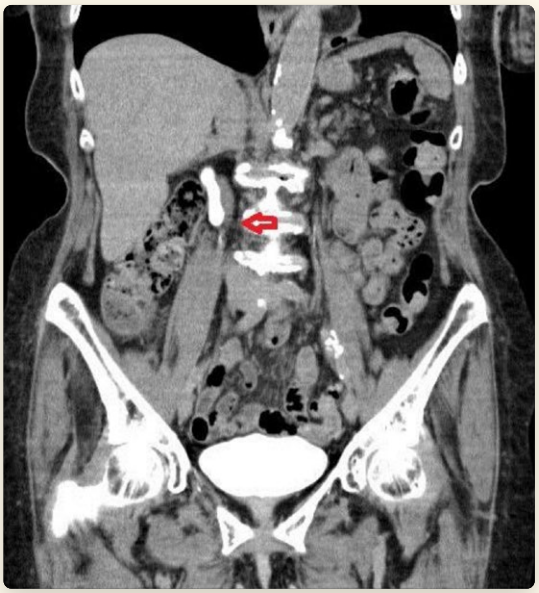


Fig.2 Computer tomography with contrast (arrow shows the ureteral stenosis)



Discussion

The history of ureteral stents begins with Charles Thomas Stent. He was a dentist in London who developed a material in the 1850's that he used to take impressions of teeth. This material consisted of gutta percha (a natural latex) mixed with tallow and talc. His material, called "Stent's compound", was used also by surgeon J.F. Esser to fix skin grafts in place during the Second World War. Ureteral stents were first described in 1949 by Herdman.

First ureteral stents were made from polyethylene and used in open surgery, projected from the kidney all the way to the exterior of the urethra. Silicone and polyurethane became then materials of choice because they reduced encrustation[5]. Ureteral stents started to evolve to allow endoscopic placement in 1967[6]. Nowadays ureteral stents are commonly used to resolve ureteral obstruction and are both used for temporary and long-term ureteral stenting. Patients with ureteral stents may have problems such as pain, discomfort, infection, encrustation, haematuria, dislocation or urinary symptoms such as frequency and urgency.

Despite the high prevalence of stent-related symptoms (SRS) and a large body of research into them, the exact cause of stent pain and irritative voiding symptoms remains unknown. Joshi et al. reported that 78% of patients with double-J ureteral stents had disturbing urinary symptoms. More than 80% had pain that affected their daily lives, 58% reported reduced work performance, and 32% reported sexual dysfunction[7].

Stent-related flank pain and renal colic may be secondary to reflux of urine through the stent during voiding. Intravesical pressure increases with detrusor contraction transmitting this increased pressure to the renal collecting system as well and ultimately resulting in flank pain. The main stent-related irritative symptoms are caused by the presence of the pigtail in the bladder[2,8]. With activity and detrusor contraction, there is also movement of the stent inside the urinary tract, in particular in the bladder. Some studies have shown that stents move as much as 2.5 cm with normal daytime activity[6,9] and the contact with the vesical mucosa may cause haematuria and pain.

Indeed, the tolerability of a stent is related to its length, position and diameter; for this reason, it is important to analyse some selection criteria before choosing the stent. Encrustation of ureteral stent is another frequent problem that can lead to severe complications. Encrustations on stents are caused by the crystallization of urinary salts, predominantly calcium oxalate[10]. Patients with a high excretion of salt-forming ions tend to have a higher deposition of crystals on urological implants. This process can occur in a sterile environment without significant bacterial presence. However, if bacteria are present, this process promotes their adhesion, persistence and multiplication[11,12]. Encrustation of ureteral stent can also activate inflammatory pathway with a worsening of pain and other irritative symptoms[6]. In patients with stent placed for urolithiasis, literature describes 26.8% of encrusted stents at less than 6 weeks, and 75.9% at more than 12 weeks[13]. Despite the use of a variety of materials with different physical characteristics, none of them are completely resistant to crystal deposition and eventual encrustation[14]. However, long indwelling times in non-stone patients with durations beyond 6 months or even 12 months and more appear to be still requested and are relatively well supported by this population with a lower risk rate of encrustation[15].

Current generation of stents is composed of polymeric materials to improve stability and reduce encrustation[5]. Many of these include polyurethane, with or without an outer layer coating. Modern polymeric stents aim to improve biocompatibility, biodurability, ease of insertion and retrieval, duration of effective dwell time, and cost, all the while remaining radiopaque. Polymers tend to be inert, although they are often approved for up to 12 months of dwell time. Tunney et al. demonstrated that silicone and polyurethane have a higher resistance to encrustation compared to other materials, after 2 weeks of stent placement[16]. Polyurethane is a third-generation polymer which is largely used and remains undisputed for its remarkable properties[17].

To assess tolerability and impact on quality of life after Yellow-Star stent placement, we used USSQ (Ureteral Stent Symptom Questionnaire). The USSQ is a validate questionnaire introduced by Joshi et al. in 2003[18] which has got good evaluative and discriminant properties, that make it a valid outcome measure.

In our urological activity more than 90% of patients are treated with Yellow-Star stents. Thanks to the used Hybrid-PRO material, these stents seem to have a low inflammatory effect: stents appear stiff at insertion and then become very soft at the temperature of the body (37°C), likely to reduce discomfort and stent-related symptoms. In addition, Yellow-Star stents also present a smooth surface, prone to reduce encrustation, and the coating made of phosphorylcholine further reduces this phenomenon as well as bacterial adhesion[19]. In our practice, encrustation is very rare even for long indwelling times.

The patient described in this case report, but also many of our patients treated with PC-coated stents from Urotech®, reported a good tolerability and our clinical practice shows a good performance in treating ureteral obstructions, with a low impact on the quality of life.

Conclusion

During the last decades, ureteral stents have been widely used as a mean for temporary or permanent drainage of the upper urinary tract. Silicone and polyurethane stents are nowadays frequently used. In our experience, polyurethane stents coated with phosphorylcholine are easy to implant and are well tolerated with a low rate of irritative symptoms, pain, and complications such as encrustation. Also, the impact on quality of life is limited. Currently, there is no ideal stent that does not experience complications and failures, and for this reason, research is still essential to optimize biocompatibility and decrease stent-related complications[19,20].

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