

Therapeutic ureteral occlusion with ifabond cyanoacrylate glue: an interesting solution

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ABSTRACT

Objective: The aim of this study was to present a novel approach for complete and permanent ureteral occlusion using a percutaneous injection of Ifabond cyanoacrylate glue.

Methods: We describe in detail all the steps of our surgery, performed on a 79-year-old patient with urinary leakage from ureteral stump following radical cystectomy. N-hexyl-cyanoacrylate glue (Ifabond) was used to occlude the distal ureter and solve the leakage.

Results: Our approach was successful, sparing our already frail patient further surgical procedures. Six months pyelography confirmed the complete ureteral blockage with absence of extravasation.

Conclusions: In complicated scenarios with urinary leakages and frail patients, synthetic glues such as Ifabond might represent an interesting therapeutic option to solve the fistulas, leading to durable success with a minimally invasive approach.

Keywords: Cyanoacrylate, Ifabond, Surgical glue, Ureteral occlusion

Introduction

Ureteral fistulae are among the most disturbing complications in the urological field, harboring a significantly increased risk of urinary tract infections, abscesses, and urosepsis (1). The management of such conditions is challenging and often requires surgical revision. In the last years, thanks to the advances in biomaterials and instrumentation, an endoscopic approach has been made feasible using bioglues and tissue sealants (2). In rare cases of extensive pelvic malignancy associated with urinary leakage, it might be necessary to obtain the complete occlusion of the ureteral lumen (3, 4). Several percutaneous approaches have been described in the literature to achieve such a goal without resorting to open surgery, including the use of silicon-filled balloons, Gianturco coils, and cyanoacrylate glue combined with vascular plugs (2, 3, 5-7). We present a novel approach for complete and permanent

ureteral occlusion using a percutaneous injection of Ifabond cyanoacrylate glue.

Case description

A 79-year-old man underwent open radical cystectomy for BCG-refractory, nonmuscle-invasive bladder cancer. In his medical history, he had undergone aortic valve replacement, for which he was put on warfarin, and partial colectomy for colon cancer. Due to trans-urethral resection (post-TUR) sclerosis and significant adhesions, transection of the left ureter with Ligasure was necessary during cystectomy, leaving a ureteral stump not viable for a ureterocutaneostomy. Considering the scarce preoperative left kidney function, choice was made to insert a percutaneous nephrostomy tube to drain the left kidney, while leaving the ureteral stump sealed by Ligasure. One month after surgery, the patient presented to the emergency ward with urosepsis and dense, foul-smelling discharge from the urethra. Uro-computed tomography (uro-CT) showed an infected pelvic collection, fed by a urinary leakage from the left ureteral stump (Fig. 1). Sepsis resolved after drainage of the pelvic collection through a urethral catheter and broad-spectrum antibiotic therapy. To solve the ureteral leakage, it was necessary to occlude completely the left ureter. In order to spare our already frail patient from another invasive surgery, we believed that the injection of a tissue sealant into the ureter would lead to the occlusion of the ureter. Moreover, the option of left nephrectomy was discarded, as left renal function had significantly

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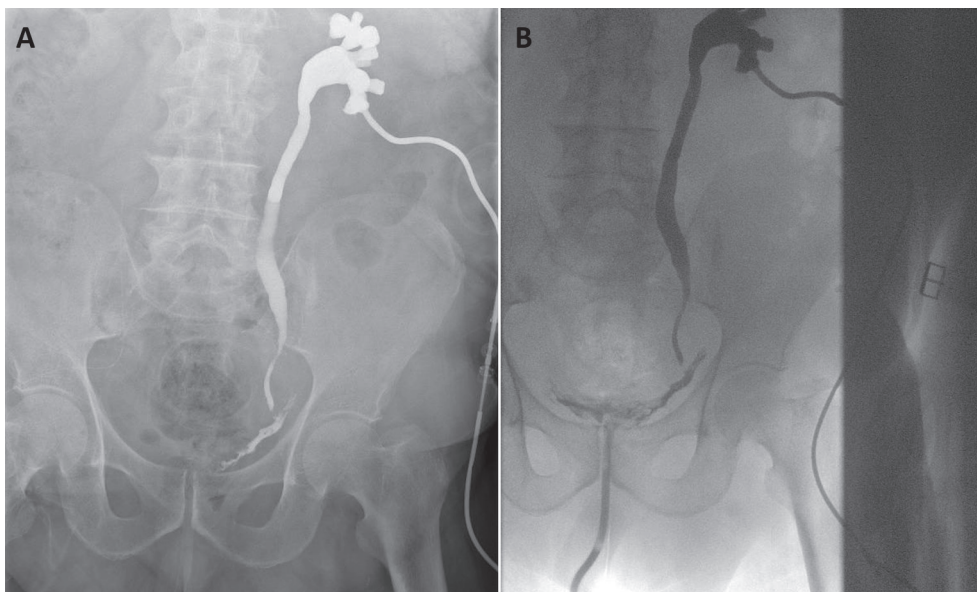


Fig. 1 - Uro-CT showing the infected pelvic collection, fed by a urinary leakage from the left ureteral stump.

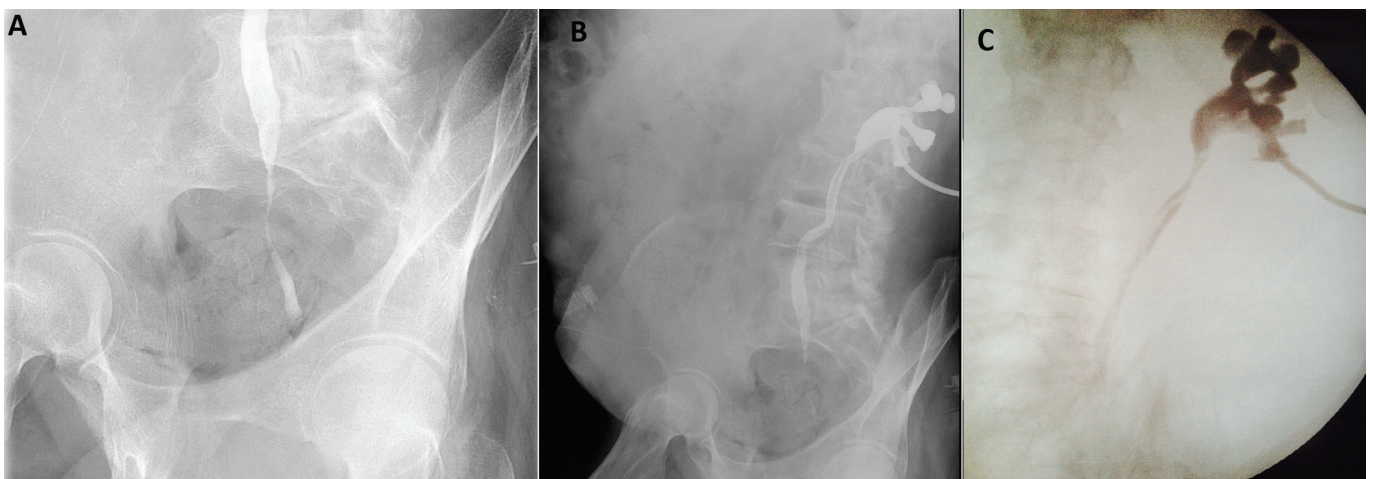


Fig. 2 - (A) Pyelography showing the complete occlusion of the distal ureter shortly after glue delivery. (B) Two-day pyelography confirming the complete ureteral blockage. (C) 6-month pyelography confirming absence of extravasation.

improved in the meantime. Antegrade pyelography was performed through the left nephrostomy tube, confirming distal ureteral extravasation. A 0.035 inch hydrophilic guide wire (Terumo Medical, Somerset, New Jersey, USA) was then introduced and advanced into the proximal ureter. A second guide wire was placed in the upper calyx for safety reasons. After removing the nephrostomy tube, a flexible 6-Ch renal dilator was introduced over the guide wire and advanced at the level of L3-L4. Three cc of n-hexyl-cyanoacrylate glue (Ifabond, Péters Surgical, Bobigny, France) were directly administered into the dilator, which was progressively retracted during the injection. After 3 minutes, pyelography showed the complete occlusion of the distal ureter shortly after glue delivery (Fig. 2A). The nephrostomy tube was replaced at the end of the procedure using the safety guidewire. A new pyelography performed 2 days later confirmed the complete

ureteral blockage with absence of extravasation (Fig. 2B). The patient was discharged 4 days after the procedure in good health conditions after removing the urethral catheter. At 6-month follow-up, he is in good general conditions and left nephrostomy drains well; the pyelography still confirms complete ureteral blockage (Fig. 2C).

Conclusion

Although rare, permanent occlusion of the distal urinary tract may be desirable, such as in cases of extensive pelvic malignancy associated with urinary leaks (3). In such cases, several percutaneous approaches have been described, in the attempt of sparing another surgery to these patients who are often already frail and weakened from previous interventions and underlying pathology. Previous studies have shown that

silicone-filled detachable balloons are more effective than the combined use of Gianturco coils with a cyanoacrylate-based tissue adhesive (3, 5, 6). More recently, successful occlusion has been reported with vascular plugs alone or associated with cyanoacrylate injection (3, 7). This combination has been used in the attempt to overcome the drawbacks of tissue adhesives alone, including softening, dissolution, and recanalization (3, 5, 6), and devices alone, which might migrate or dislocate (3). In our case, we attempted to obtain a complete ureteral occlusion with a tissue sealant alone. Our choice was to use a synthetic glue, a cyanoacrylate-based polymer (CA), which has shown to provide high adhesion strength and is cheaper than biological glues (8). In the last years, cyanoacrylates have found application in several medical fields, from surgical wound closure to hemostasis of bleeding gastric varices, interventional radiology, and ophthalmology (8, 9). They have shown adhesive, bacteriostatic, and hemostatic qualities, together with a good profile of safety and biocompatibility (10). Their main disadvantage (cytotoxicity) can be mitigated by increasing the length of their alkyl-chain. More in detail, Ifabond is composed of n-hexyl-cyanoacrylate, which polymerizes when in contact with a moist environment forming an adhesive film within 60 seconds from the application. Histological studies have shown that n-hexyl-cyanoacrylate polymer is still present 3 months after its use. When using surgical glues based on n-hexyl-cyanoacrylate, a certain risk of toxicity linked to the products of degradation of n-hexyl-cyanoacrylate must be taken into account, mainly the formaldehyde.

In a *in vitro* study (11), led to evaluate alkyl-cyanoacrylate cytotoxicity versus longer-chain cyanoacrylate, the n-hexyl-adhesive exhibited higher formaldehyde release levels. *In vivo* tissue toxicity of cyanoacrylate has been suggested to occur in different ways that affect biocompatibility: foreign body reaction is the first thing that causes a low absorption of the CA that leads to macrophage infiltration as well as polymorphonuclear cells attempting to remove the polymerized CA and the rest of the damaged tissue. This process, along with the production and accumulation of formaldehyde and cyanoacetate, leads to cell death and release of oxygen free radicals, with consequent loss of tissue and overgrowth of different mediators, which exacerbate local ischemia and necrosis (12). The presence of macrophages and foreign body cells was observed delimiting the area occupied by the adhesive bead and sometimes in scar tissue but did not compromise the healing process. In summary, in the *in vivo* n-hexyl-cyanoacrylate has shown good integration and effective short-term biocompatibility.

Referring to our case, we were confident that n-hexyl-cyanoacrylate glue would be effective in sealing the ureteral lumen of our patients, while being safe and well tolerated. Among the advantages of our approach, we highlight the avoidance of a second surgery for the patient and the rapidity

of the procedure, conducted on local anesthesia. One might argue that left nephrectomy could have been performed, also for oncologic reasons; however, considering the improvement of the left renal function and the frailty of our patient, we discarded this option.

In our belief, this report shows us that when dealing with complicated scenarios with urinary leakages and frail patients, the use of synthetic glues such as Ifabond can be an interesting therapeutic option, leading to durable success while sparing the patient further surgical procedures.

Disclosures

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Conflicts of interest: No potential conflict of interest relevant to this article was reported.

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