LETTER TO THE EDITORS

Ex vivo bench flexible ureterorenoscopy in the diagnosis and treatment of renal stones in deceased-donor kidneys: the first case series

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Dear Editors,
Renal transplant urolithiasis is quite rare (incidence range 0.2–4.4% [1]), but potentially leading to dramatic consequences to the graft [2]. Two categories should be considered, the following: newly formed stones after transplantation and donor-gifted stones (pre-existing in the allograft before transplantation), which might represent almost half (47%) of transplant urolithiasis [3].

Bench flexible ureterorenoscopy for stone treatment has been performed prior to transplantation in a limited number of living-donor allografts, while it may be not so easy to arrange in brain-dead donor (BDD) kidneys because of the on-call setting and the possible use of a nonurological operating theater.

We would like to share our experience on ex vivo bench flexible ureterorenoscopy (BfURS) in the management of renal stones in deceased-donor kidneys.

After obtaining the authorization by the IRB, we organized a prospective observational study. All 168 renal transplantations from BDDs performed in 2018 at Città della Salute e della Scienza, Turin (Italy), were included in the study. BDDs underwent routine abdominal ultrasonography (US) before procurement, according to the Italian transplantation guidelines. Incidentally diagnosed urolithiasis was further investigated with noncontrast CT (NCCT). BfURS was carried out in donor kidneys presenting 4–10 mm stones confirmed by NCCT.

BfURS was performed with cold saline, keeping the allograft in ice slush and preservation solution. No guidewire and no ureteral access sheath were used. FlexX2 (Karl Storz GmbH, Tuttlingen, Germany) 7.5 Fr flexible ureteroscope was used (Fig. 1). In case of small stones, they were extracted through the ureter with a 0-tip nitinol basket. In selected cases, such as bigger stones or narrow UPJ, stones were grasped with a basket, moved to the renal pelvis and extracted through a ureteroscope-guided mini-pyelotomy, in order to avoid grasping-related damages. The incision was closed using 4/0 absorbable Vicryl running suture, checking its waterproof with retrograde irrigation. A ureterorenoscope- and US-guided mini-nephrotomy was performed in case of unsuccessful attempt of ureteroscopic stone relocation, due to the complex renal collecting system anatomy. First, the correct location was assessed with a needle puncture under US and ureteroscopic vision. Second, a tiny kidney incision was made with a scalpel and the stone was grasped with small Randall forceps, under ureteroscope direct vision. The nephrotomy was closed using 3/0 absorbable Vicryl, checking its waterproof with retrograde irrigation.

Kidney transplantation was then performed according to our routine surgical technique: a Lich-Gregoire ureteroneocystostomy was performed using Monosyn 4/0 running suture on a 4.8 Fr double J ureteral stent. Two drains were left at the end of transplantation: one close to the vascular anastomosis and one close to the ureteral anastomosis. Foley catheter was removed in

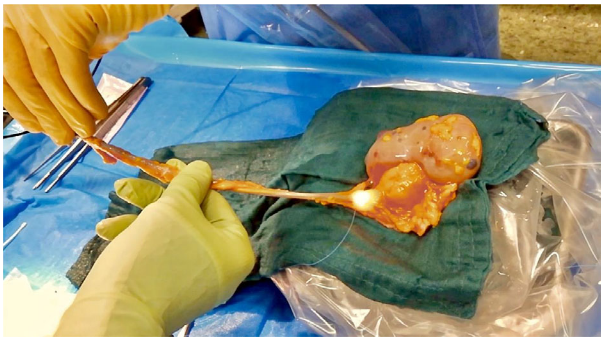

Figure 1 Bench flexible ureterorenoscopy.

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postoperative day six or seven, and the ureteral stent was removed on postoperative week four, which is the usual management we adopt for uncomplicated transplantations. All recipients were followed up by ultrasonographic evaluation a few days after stent removal and then at postoperative month three and six.

Among the 168 kidney transplantations performed in 2018, a total of 11 (6.5%) kidneys were diagnosed with stones $\geq$ 4 mm at NCCT and underwent BfURS. The retrograde access to the renal collecting system was feasible in all cases. Urolithiasis was confirmed in 9 cases (5.4% of all transplantations). In two cases (both 4 mm in the inferior calyx), no stones were found, but hypertrophic and calcified papillas.

Mean stone size was 6 mm (range 4–9 mm) (Table 1). Mean duration of BfURS was 12.5 min (range 9–20 min). In five cases, stones were grasped with basket and removed through the ureter. In two cases, stones were grasped and extracted through a mini-pyelotomy. Two stones of 7 mm each in the inferior calyx were extracted through a mini-nephrotomy. No postoperative leakage complications were observed adopting the drainage, catheter and stent usual management. Mean serum creatinine at six month was 1.5 $\pm$ 0.5 mg/dl. None of the patients developed stone recurrence, and no ureteral stricture was observed after transplantation at month 6.

BfURS proved to be feasible and useful, as it allowed to confirm and treat stones in all cases. According to stone size and graft anatomy, we chose different approaches. There are few studies in literature about ex vivo pretransplant ureteroscopy, almost all reporting on living-donor kidneys [4]. The large majority of procedures were performed with semirigid instruments, and holmium laser lithotripsy was often used [5]. Only two retrospective cases have reported BDD kidneys [6]. The largest series about ex vivo pretransplant ureteroscopy regards living-donor kidneys [7]: median stone size was small (2 mm) and the authors themselves questioned about the real need of the procedure in stones < 4 mm due to the relatively high spontaneous stone passage rate (38-60%) in transplanted kidneys [8,9].

In our view, the goal of BfURS should be to guarantee a real stone-free status through a minimally invasive fast procedure. Thus, we did not use holmium laser for lithotripsy, not to increase the duration and avoid residual fragments. Furthermore, laser can lead to damage of pelvis and calyxes and potential bleeding, not immediately obvious in an ex vivo setting. Although the large majority of bench

Table 1. Stone characteristics of the 11 grafts undergone to ex vivo bench flexible ureterorenoscopy (BfURS)

Case	Number of stones	Size (mm)	Stone location	Treatment	Technique for stone extraction	Composition	Result
1	1	4	Lower calyx	BfURS	Basket extraction through the ureter	Calcium oxalate	Success
2	1	5	Middle calyx	BfURS	Basket extraction through the ureter	Oxalate and calcium phosphate	Success
3	1	8	Renal pelvis	BfURS	Flexible ureteroscope-guided mini-pyelotomy	Calcium oxalate	Success
4	1	9	Middle calyx	BfURS	Flexible ureteroscope-guided mini-pyelotomy	Uric acid	Success
5	1	5	Renal pelvis	BfURS	Basket extraction through the ureter	Calcium oxalate	Success
6	1	4	Middle calyx	BfURS	Basket extraction through the ureter	Oxalate and calcium phosphate	Success
7	1	7	Lower calyx	BfURS	Flexible ureteroscope and US-guided nephrotomy	Uric acid	Success
8	1	7	Lower calyx	BfURS	Flexible ureteroscope and US-guided nephrotomy	Calcium oxalate	Success
9	1	4	Lower calyx	BfURS	No stones. Renal papilla's calcification.		Success
10	1	4	Lower calyx	BfURS	No stones. Renal papilla's calcification.		Success
11	3	4 + 4 + 3	Lower and middle calyx	BfURS	Basket extraction through the ureter.	Calcium oxalate	Success

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ureteroscopies in literature were performed with semi-rigid instruments, we agree with other authors [7] stating that ex vivo bench ureterorenoscopy should be performed with flexible ureteroscopes, as they can completely inspect the collecting system, respecting intrarenal anatomy. Interestingly, BfURS excluded the presence of stones in two cases, similarly to other living-donor series [7-10]. The current limit of NCCT in differentiating renal stones from calcifications represents one more reason to perform BfURS before transplant in case of suspected stone at NCCT.

If we consider the risks and complexity of stone treatment after transplantation, we believe that ex vivo BfURS should become a standard treatment in renal stone cases in order to avoid challenging subsequent surgery and stone-related complications due to donor-gifted stones.

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Conflict of interest

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