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BRIEF COMMUNICATION

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Systematic use of magnetic double J stent in pediatric kidney transplantation: A single-center experience

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Abstract

Background: The intraoperative insertion of a double J stent (DJS) is known to reduce urological complications and is broadly accepted in kidney transplant (KTx) patients. The magnetic ureteral DJS (mDJS) represents a valid alternative device as it can be removed without cystoscopy, using a transurethral magnet. This is of particular importance in the pediatrics, allowing us to avoid cystoscopy requiring general anesthesia (GA) in this population. To date, few data are available on the systematic use of mDJS in pediatric patients undergoing KTx.

Methods: We report a retrospective analysis of 32 consecutive pediatric KTx at our center from July 2020 to December 2021.

Results: Ureteral stents remained in place for a median of 35 days (range: 12–76). Non-surgical magnetic removal of the mDJS was attempted in all cases without complications. In most cases (69%), the removal procedure was performed in an outpatient clinic. In 10 cases, the mDJS was removed in the operating room under sedation before removal of the abdominal Tenckhoff catheter. All patients were clinically followed (range: 3–15 months).

Conclusions: We confirm the safety and feasibility of systematic use of mDJS in the setting of pediatric KTx. The systematic use of this device contributes to reduce the need for GA and the rate of hospital admission.

KEYWORDS
outcome, pediatric kidney transplantation, quality-of-life, surgical

1 | INTRODUCTION

Kidney transplantation (KTx) is the treatment of choice for children with end-stage renal disease (ESRD), offering excellent short- and medium-term graft as well as patient survival.[1] Nevertheless, KTx patients remain at risk of multiple interventions and hospital admission throughout their life. The latter, in the pediatric setting, represents a stressful moment for the patient and the caregivers.[2] Moreover, the exposure to multiple general anesthesia (GA) in childhood has been linked with possible later development of a

Abbreviations: DJS, double J stent; ESRD, end-stage renal disease; GA, general anesthesia; KTx, kidney transplant; mDJS, magnetic ureteral DJS.

Trial Registry: Registry "Kidney transplantation in children and adolescents" of the GPN (Society for Pediatric Nephrology) CERTAIN—Protocol 620.

learning disability.[3] Thus, every intervention focused on reducing the exposure to GA and/or hospital admissions are of key importance in the pediatric population. The intraoperative insertion of a double J stent (DJS) between the transplant ureter and the bladder is known to reduce urological complications and prophylacting stenting of the ureteroneocystotomy is broadly accepted in KTx.[4] However, ureteral stents are usually removed by cystoscopy and hence GA is typically required in pediatric patients. To avoid additional cystoscopies, various urinary catheters and magnetic ureteral stents have been developed over the last decades.[5] The magnetic ureteral DJS (mDJS) represents a valid alternative device as it can be removed without cystoscopy, using a transurethral magnet, thus minimizing the need for GA.[5] The use of mDJS in the pediatric urological setting has recently gained attention, with most studies reporting the use of local anesthesia or a combination of local anesthesia and sedation.[6] Specifically, one recent study reported the feasibility and safety of mDJS with a success of stent removal without GA in as much as 98% of children.[7] To date, however, few data are available about the use of mDJS in pediatric patients undergoing KTx. Here we describe our initial experience with the systematic prophylactic use of mDJS in children KTX recipients.

2 | STUDY DESIGN AND CASE DETAILS

This is a case series based on the retrospective analysis of all pediatric KTx performed at our center (Bambino Gesù Children's Hospital, IRCCS, Rome, Italy) from July 2020 (starting date of the systematic use of mDJS at our institution) to December 2021. We included all patients undergoing KTx in the abovementioned period, except those aged >18 ($n=6$). The final study population composed of 32 pediatric patients. The study was reviewed and approved by our Ethics Committee and all participants gave their informed consent to be included in this study. The study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki.

In all patients, the KTx was carried out successfully and a mDJS to protect Lich-Gregoir ureteroneocystotomy was used. For the purpose of this study, the following data were recorded: age, gender, weight, ESRD cause, type of renal replacement therapy, donor type, and timing of stent removal. All KTx were performed by one of the three transplant surgeons at our center, using the identical surgical approach. Briefly, after back-table preparation of the graft, extraperitoneal access was achieved using a modified Gibson's incision. Reconstruction of the urinary tract was done via ureterovesical anastomosis (Lich-Gregoir technique). A 4.8 French Magnetic Black-Star ureteric stent (Black Star©UROTECH GmbH, Achenmühle, Germany) was inserted without the use of a guidewire during surgery (Figure 1). We have used a stent of 12 cm length for patients <15 years of age and a stent of 15 cm length for patients up to 18 years of age. Black-Star stents were easily placed, with no increase in operative times. According to our standard practice, we removed Foley bladder catheter on postoperative day 7 and mDJS 4–6 weeks after the transplant.

Stent retrieval was performed in an outpatient setting during routine consultation by a single operator (surgeon) in all patients except those ($n=10$) on previous peritoneal dialysis. In the latter, the mDJS was removed in the operating room under sedation before the removal of the abdominal Tenckhoff catheter. In the outpatient setting, no anesthesiologist was present, and the surgeon was assisted by a nurse. Moreover, the use of X-ray or transabdominal ultrasound to confirm the junction of the magnetic retrieval-catheter and the mDJS was not needed, as previously described.[8] The patient was asked to preferably have an empty bladder, but no fasting was needed. Although we did not have systematically recorded the time required for stent removal, the overall process (from preparation of the material and the patient to the end of the procedure) lasted only few minutes.

With the patient lying supine, a 9 French retrieval catheter with a magnetic tip (Urotech GmbH, Germany) was inserted after the application of local anesthetic gel (lidocaine 1%) inside the urethral meatus and over the tip of the retrieval device. Handling of the retrieval catheter is similar to the insertion of a regular urinary catheter and connection of mDJS and retrieval catheter can be perceived as a "click".[8] Then, the device is pulled back with the mDJS attached. No complications occurred during stent removal.

The details of the patients are shown in Table 1. Briefly, 32 patients (17 boys; age range 24 month to 17.2 years) were included. The youngest girl was 2.8 years old, and the youngest boy was 2 year old. Mean weight was 31.9 kg (range: 8.7–66.8).

Ureteral stents remained in place for a median of 35 days, ranging from 12 days to 76 days. Non-surgical magnetic removal of the mDJS was attempted in all cases without complications. All patients were clinically followed (range: 3–15 months). We did not find an increase in urinary infections or hematuria while the stent was in place. None reported hematuria after the procedure. An interview for the visual analog scale pain scale was not performed at the end of the stent removal procedure, but none of the patient's required painkiller.

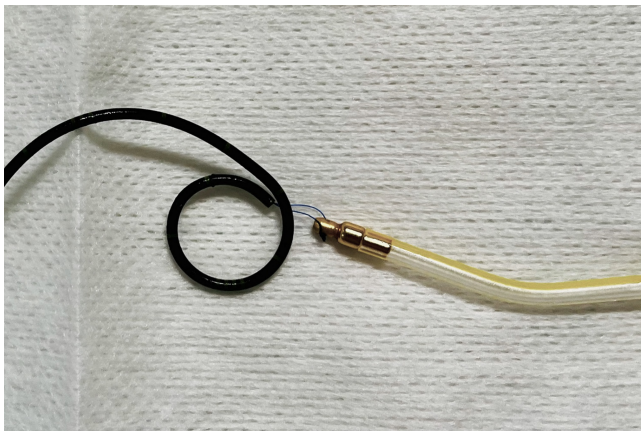

FIGURE 1 Magnetic double J stent (mDJS) with attached retrieval device after removal from the bladder.

TABLE 1 Patients' characteristics.

Number of patients	32
Gender [male/female] (%)	17/15 (53%/47%)
Age (years) (median + range)	12.1 (2.0–17.2)
Recipient weight (kg) (average + range)	31.9 (8.7–66.8)
Cause of end-stage renal disease	
Nephrological	12
Urological	11
Others	9
Donor	
Deceased	21 (66%)
Living donor	11 (34%)
Pre-emptive transplantation [#] (%)	7 (22%)
Patients on dialysis before KTx [#] (%)	24 (75%)
Type of dialysis	
Hemodialysis	14 (56%)
Peritoneal	10 (32%)
Stents in place [week] (median + range)	5 (2–11)

3 | DISCUSSION

We hereby report our single-center experience on ureteral stent removal using magnetic retrieval-catheters in 32 consecutives pediatric KTx patient. Although the use of mDJS in pediatric patients has been largely reported, to the best of our knowledge, this is the first case series specifically focused on the systematic use of this device in pediatric KTx recipients.

We had a 100% success rate of stent removal with no need for cystoscopy.

To date, there is a single study[7] on the use of mDJS in pediatric patients, with a study population of 100 patients, including 23 KTx. Of note, the authors report a failure of non-surgical removal in 2 KTx patients (9% of the whole Ktx population), suggesting that in both cases the failure was due to the presence of a posterior urethral valve with a bladder diverticulum that prevented the magnet contact. In our study, a posterior urethral valve was present in five cases, and we did not experience any difficulty to remove the stent in those patients.

The avoidance of cystoscopy is of outmost importance as this is a procedure that almost always requires GA in the pediatric setting.[9]

The chance to avoid GA and multiple hospital admissions play a key role in pediatric care and this is of relevance in the COVID era. Indeed, the pandemic posed an unprecedented burden on the healthcare system, healthcare workers, and chronic and fragile patient's worldwide.[10]

Thus, performing a safe and quick outpatient procedure proved particularly helpful in the last few months. Moreover, reducing admissions, operating room hours, and surgical instruments could reveal highly cost-effective, as some authors previously reported.[11,12]

Although a thorough cost analysis is beyond the scope of this article, some considerations deserve a mention. Although the crude cost of the mDJS is far more than the standard DJS (about 148 vs. 28 euros, respectively), the costs are probably counterbalanced by the fact that the standard DJS requires a cystoscopy (which is prized roughly 250 euros). Moreover, in the pediatric setting, cystoscopy usually requires GA, which, in turn, needs to be performed during a hospitalization and with the occupation of the operating room. All the above mentioned factors might contribute to increase the overall cost of the standard DJS use.

Furthermore, there is solid evidence on how important is trying to reduce the exposure of children to GA and this makes the routine use of mDJS highly advisable. Indeed, several studies[3,13] report an increased incidence of learning difficulties in children exposed to repetitive GA.

Another benefit of this procedure is that fluoroscopy is not required for retrieval, thus allowing us to avoid radiation exposure in a population particularly susceptible to X-ray-induced damage.[14]

As already discussed by Mitchell et al.,[8] one of the possible drawback of the mDJS use, is that, being magnetic, patients cannot undergo magnetic resonance imaging (MRI). This is a hypothetic disadvantage after renal transplantation as MRI could be preferred to computed tomography scan to investigate postoperative complications in pediatric population. However, this needs to be balanced with the potential neurotoxicity of the GA and our opinion is that the risk–benefit balance tilts in favor of the use of mDJS.

It is important to acknowledge that the Black-Star Double-J Ureteral Stent with Magnetic Retrieval Device (Urotech, Achenmühle, Germany) is not available for worldwide use.[11]

In conclusion, we here confirm the safety and feasibility of the systematic use of mDJS in the setting of pediatric KTx, with a success rate of stent removal with no need for GA of 100%. The systematic use of this device contributes to reduce the need for GA, the rate of hospital admission as well as radiation exposure. All the above likely reflect on healthcare costs reduction and better care for children.

AUTHOR CONTRIBUTIONS

Gionata Spagnoletti involved in surgical management, draft conception and design, data acquisition, drafting the manuscript, critical revision, and approval of the final version. Zoe Larghi Laureiro involved in data acquisition, drafting the manuscript, critical revision, and approval of the final version. Giuseppe Marincola involved in data acquisition, drafting the manuscript, critical revision, and approval of the final version. Isabella Guzzo involved in medical management, critical revision, and approval of the final version. Luca Dello Strologo involved in medical management, draft conception and design, critical revision, and approval of the final version. Marco Spada involved in surgical planning and management, draft conception and design, drafting the manuscript, critical revision, and approval of the final version.

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CONFLICT OF INTEREST STATEMENT

The authors of this manuscript have no conflicts of interest to disclose as described by Pediatric Transplantation.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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