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CASE REPORT

Robot assisted intra-corporeal ileocalicostomy ureteral substitution for complex uretero-pelvic junction obstruction: a novel and feasible innovation

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Abstract

A 33-year-old female presented to the emergency department of our hospital with urosepsis and hematuria with clot retention secondary to a complicated pyelolithotomy for left-sided pelvic calculus. A percutaneous nephrostomy was placed for drainage as a DJ stent could not be traversed into the left renal pelvis with retrograde pyelography demonstrating complete cut-off at L4–L5 level. After stabilization, she was found to have uretero-pelvic junction obstruction (UPJO) in left solitary functioning kidney with long-segment upper ureteric stricture and nadir serum creatinine 1.5 mg/dL. Nephrostogram and CT scan revealed an intra-renal pelvis with no passage of contrast into the ureter. Primary hyperparathyroidism secondary to parathyroid adenoma was also detected and she underwent excision of the same. The long-segment ureteric stricture and need for a wide drainage ruled out pyeloplasty and ureterocalicostomy as treatment options. A wide-bore communication between the lower calyx and bladder was necessary and robot assisted ileocalicostomy was performed in this case. A 20-cm-long segment of ileum was used to replace the ureter with a suprapubic 16 Fr Foley's catheter as splint. Postoperative course was uneventful with all tubes removed by third postoperative week. Nephrostogram demonstrated gravity-dependent drainage into the bladder with no leak or anastomotic narrowing. The patient is doing well at 6 months of follow-up with a stable renal function. Robot assisted ileocalicostomy is a safe and effective technique which provides wide gravity-dependent drainage in complex UPJO with long-segment ureteric stricture and intra-renal pelvis.

Keywords Ileal ureter · Ileocalicostomy · Ileal ureteral substitution · Robotic ileal ureter · UPJO · Robotic surgery

Case report

A 33-year-old lady diagnosed to have a left-sided pelvi-ureteric junction (PUJ) calculus and a right poorly functioning kidney secondary to lower ureteric calculus underwent left-sided open pyelolithotomy and right open ureterolithotomy at a private center. The patient subsequently developed hematuria with clot retention and urosepsis with AKI (serum creatinine 1.4 mg/dL → 6.3 mg/dL) in the postoperative period, following which she was referred to the emergency department of our institute. The patient was resuscitated with supportive measures and intravenous antibiotics. The clot retention was managed by cystoscopic clot evacuation and a double J stent could not be manipulated into renal pelvis and retrograde pyelography (RGP) revealed complete cut-off at the L4–L5 junction suggestive of upper ureteric stricture. A percutaneous nephrostomy (PCN) was subsequently placed and the patient was continued on intravenous antibiotics and supportive measures for 15 days following which her urosepsis resolved and serum creatinine reached a nadir of 1.5 mg/dl. On evaluation she was also found to have raised serum calcium with increased serum iPTH (943 ng/ml) which led to the detection of a left inferior parathyroid adenoma. The patient later underwent excision of the parathyroid adenoma following which her iPTH and serum calcium levels normalized. Three months later, the patient presented to the outpatient department with PCN draining

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1.5–2 l urine per day and no urine output per urethrally. A non-contrast computed tomography (NCCT) scan revealed a shrunken right kidney and hydronephrotic left kidney with PCN in situ with non-visualized left ureter (Fig. 1c, d). Her serum creatinine was stable at 1.5 mg/dl with an estimated creatinine clearance of 41 ml/min. The patient underwent a nephrostogram (Fig. 1a, b) which revealed a completely intra-renal pelvis with dilated calyces and no contrast flow across PUJ into the bladder (Fig. 1b). The repeat RGP demonstrated the same findings of complete cut-off at L4–L5 junction as before, indicating the final diagnosis of a uretero-pelvic junction obstruction (UPJO) secondary to a long-segment ureteric stricture (10 cm length).

Urothelium is always considered the best replacement in any case of ureteric stricture, but a multitude of obstacles were encountered in planning reconstruction for this patient. Firstly, pyeloplasty or pyeloureterostomy were impossible as the renal pelvis was extensively scarred secondary to previous surgery. A ureterocalicostomy was not possible in view of a long-segment ureteric stricture, making it impossible to create a tension-free anastomosis between the ureter and the lower pole calyx. Also, primary hyperparathyroidism placed her at a higher risk of forming recurrent stones. Hence, a wide drainage in the form ileal ureter replacement was considered necessary for this patient. In contrast to the pyelo-ileal anastomosis as in conventional ileal ureters, no extra-renal pelvis was available in this patient and proximal ileal anastomosis to the dilated lower calyx was considered, forming ileocalicostomy.

The patient underwent robot assisted intracorporeal ileocalicostomy using the da Vinci Si system. The patient was laid in steep Trendelenburg position (Fig. 2a) and ports were placed with pelvic docking of the robot. Intra-abdominal adhesions were released and a 20-cm-long segment of ileum with a wide based mesentery was isolated around 15 cm proximal to the ileocaecal junction (Fig. 2b). End-to-end intestinal anastomosis was also performed intracorporeally using Endo-Gia staplers (Fig. 2c). Retroperitonealization of the ileal segment was done by creating a window in the sigmoid colon mesentery and passing the segment through it; avoiding twisting/kinking of the ileal segment throughout the mobilization (Fig. 2d). Suprapubic cystotomy (SPC) was done extraperitoneally using a 16 Fr Foley's catheter after filling the bladder. The SPC was brought into the peritoneal

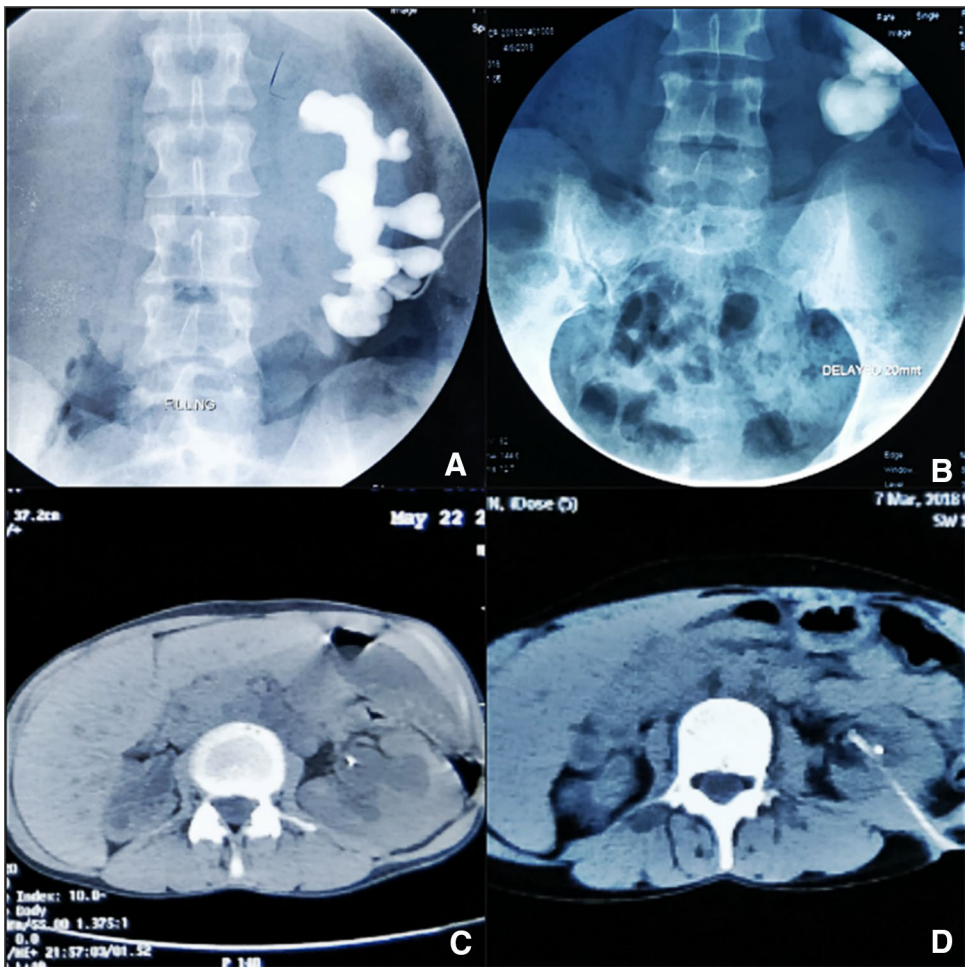

Fig. 1 **a** Nephrostogram of the patient showing dilated intra-renal pelvis with no excretion of contrast across the pelvi-ureteric junction into the ureter. **b** Delayed films of the nephrostogram demonstrating no passage of contrast into the urinary bladder. **c** Non-contrast CT scan of the patient demonstrated dilated intra-renal pelvis with no visualization of the ureter or the pelvi-ureteric junction. **d** Dilated intra-renal pelvis with PCN in situ

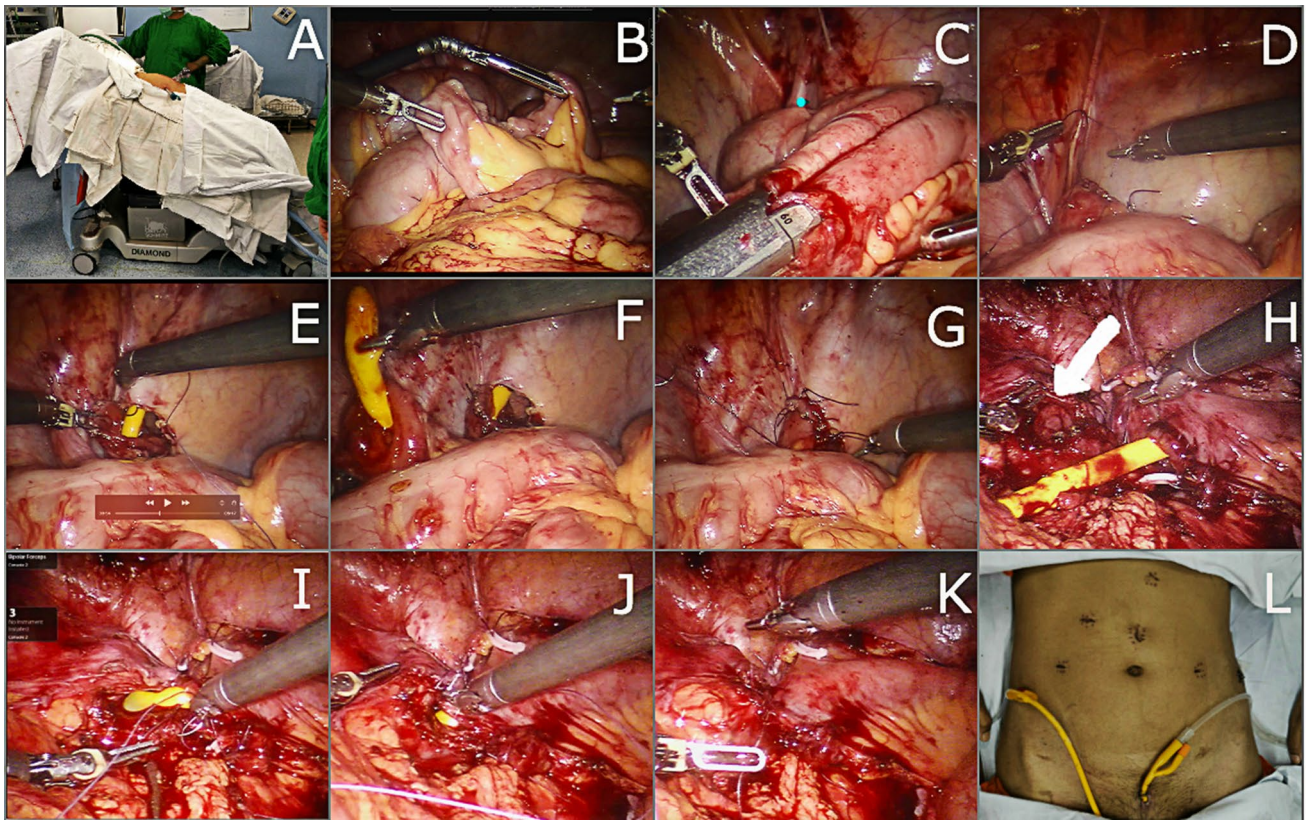

Fig. 2 **a** Positioning of the patient in steep Trendelenburg with pelvic docking of the robot. **b** Identification and isolation of 20 cm of ileum. **c** End-to-end anastomosis using Endo-GIA staplers. **d** Retroperitonealization of the ileal segment with distal end of the ileal loop brought to the bladder in an isoperistaltic fashion. **e** 16Fr SPC placed extraperitoneally and brought into the peritoneal cavity through the vesicostomy; placed into the ileal ureter segment. **f** SPC brought out through the proximal end of the ileal ureter segment. **g** The completed ileovesicostomy using 2-0 polyglactin a continuous fashion. **h** 2.5 cm rim of lower calyx (arrow) excised. **i** SPC placed into the opened lower calyx. **j, k** Ileocalicostomy completed over 16 Fr Foley's catheter. **l** Postoperative status of the patient with per urethral catheter and 16Fr SPC as splint

cavity through a 2-cm vesicostomy created on the dome of the bladder on the left side (Fig. 2e). The SPC was thereafter passed through the ileal segment and brought out through the proximal end (Fig. 2f). The distal end of the ileal segment was anastomosed to the bladder over the 16 Fr SPC using polyglactin 2-0 suture creating the ileo-vesicostomy (Fig. 2g). Thereafter, the robot was de-docked and the patient was positioned in right lateral oblique decubitus position, with the robot repositioned perpendicular to the patient. The kidney was exposed after mobilization of the descending colon and saline was filled through the PCN for better visualization of the lower pole calyx. A 2.5-cm disc of renal parenchyma was excised after dissection of the lower pole (Fig. 2h) and ileocalicostomy performed over the SPC (Fig. 2i, j) after inflating the bulb with 5 ml saline using polyglactin 2-0 suture in a continuous manner (Fig. 2k). The operating time was 270 min with a blood loss of 50 ml.

The postoperative period was uneventful. The pelvic drain was removed on POD2 and oral diet was resumed on POD3. Bladder wash to flush the mucus was started from POD4 onwards and a nephrostogram done on POD14 revealed prompt drainage of contrast into the bladder (Fig. 3). The perurethral catheter and 16 Fr SPC (placed as a splint) were removed 1 week and 3 weeks later, respectively. 6 months post-surgery, the patient is doing well with adequate urine output and a stable serum creatinine of 1.56 mg/dL.

Discussion

Although the use of ileum for replacement of ureter dates back to the early 1900s, the procedure was popularized by Goodwin in late 1950s [1]. Urothelium remains the best replacement whenever dealing with ureteral strictures with ileum being used for substitution when urothelium is unavailable. Ileal replacement is recommended in cases of extensive ureteric strictures secondary to trauma, tumors, retroperitoneal fibrosis, infections such as schistosomiasis and tuberculosis and also as a 'chute' procedure for recurrent stone formers. However, use of ileum

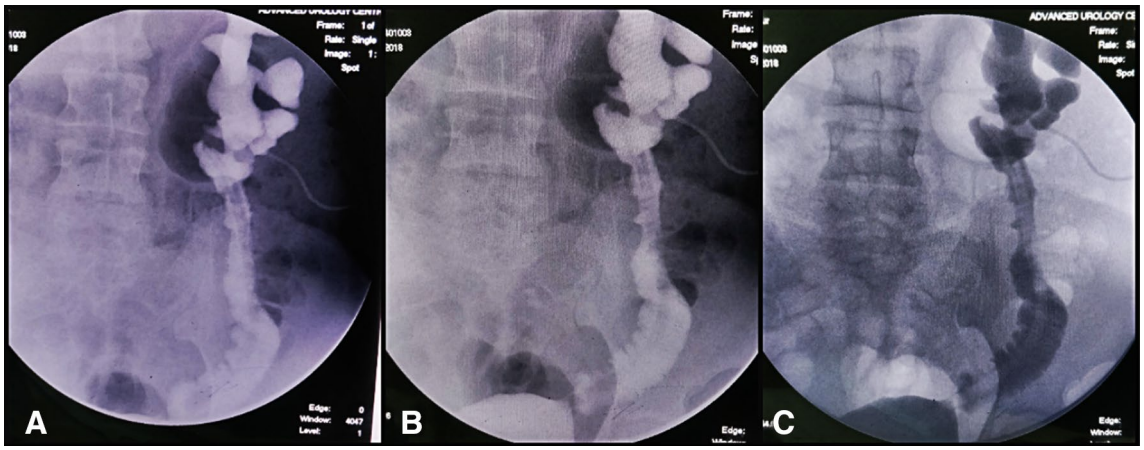

Fig. 3 **a–c** Postoperative nephrostogram of the patient demonstrating free drainage of contrast into the bladder through the ileal ureter from the lower calyx of the kidney

is contraindicated in patients with inflammatory bowel disease, radiation enteritis, neurogenic bladder, bladder outlet obstruction and in patients with creatinine > 2 mg/dl and hepatic dysfunction [2].

When considering the use of ileal ureter, one should avoid using more than 25 cm of bowel and the intestinal segment should always be placed in an isoperistaltic fashion as in our case[1]. The possibility of reflux and associated reflux nephropathy in such patients has been concern since the very inception of this technique but no significant difference in renal function has been seen in various studies [3], irrespective of the type of anastomosis. Chronic retention and infection are the only two factors predisposing to renal function deterioration in these patients. Oral bicarbonate replacement for associated hyperchloremic metabolic acidosis is recommended for these patients. Although two-thirds of patients have positive urine cultures, asymptomatic bacteriuria seldom needs treatment in these patients. Screening of upper tracts and follow-up of these patients is a must to detect deterioration of renal function and formation of stones [4]. A rare (< 1%) but real complication associated with ileal ureters is ureteroileal anastomotic site malignancy and these patients must be followed up with yearly urinary cytology [5].

In the recent years, the Yang–Monti tube [6] created from a smaller (6–8 cm) segment of ileum has been used to replace the ureter in such complex cases. This technically demanding innovation markedly reduces the problems associated with conventional ileal ureter whilst mimicking the normal ureter in motility with decreased mucus production. It was not considered as an option in our patient as she is predisposed to forming recurrent renal calculi and a wide drainage in the form of ilea replacement was deemed necessary. Renal auto-transplantation, although described for such patients is associated with graft loss [7] (up to 20%) and acute kidney injury.

The presence of an intra-renal dilated pelvis with dense long-segment proximal ureteric strictures precludes the use of routine procedures such as pyeloplasty and ureterocalicostomy. Ileo-calicostomy is a novel technique which circumvents dissection of the native ureter which may be difficult in previously operated cases, whereby all anatomic landmarks maybe lost. This technique also provides the advantage of preforming a wide anastomosis in the absence of an extra-renal pelvis as opposed to an ileal ureter and provides good drainage in a gravity-dependent fashion as in our case.

Both laparoscopic as well as robot assisted ileal ureter have been described recently with the first totally intra-corporeal ileal ureter described by Brandao et al. [8] in 2014. Ileocalicostomy has been described laparoscopically [9] and more recently by Khoneim et al. [10] in their two cases via open approach. As opposed to the technique described by Brandao et al. [8], we needed to de-dock and reposition the robot only once leading to a decreased operative time. The PCN helped us in filling the pelvis to identify and dissect the lower calyx better. Also, the 16 Fr SPC ensures a wide patent drainage and acts as a splint to the anastomosis which can be easily removed postoperatively. These also help in performing postoperative dye studies.

Conclusion

The advent of robotic assisted surgery with improved vision and easier maneuverability has made complex surgeries feasible with minimal invasiveness and improved convalescence as in this case. To our knowledge, this is the first case of robot assisted totally intra-corporeal ileocalicostomy and

represents a feasible technique in managing patients with complex long-segment proximal ureteric strictures and dilated intra-renal pelvis.

Compliance with ethical standards

Conflict of interest Santosh Kumar, Abhishek Chandna, Ashish Khanna, Kalpesh M. Parmar, Tushar Aditya Narain and Nripesh Sadasukhi declare that they have no conflicts of interest.

Informed consent Written informed consent was obtained from the patient for publication of this case report/any accompanying images. A copy of the written consent is available for review by the Editor-in-chief of this journal.

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