
ORIGINAL ARTICLE

Robotic ileal ureteral reconstruction for radiation-induced ureteral strictures in pelvic malignancy survivors: experience from a multi-institutional database

Yishun HUANG ¹, Xiang WANG ¹, Fangzhou ZHAO ¹, Guanpeng HAN ¹,
Zhihua LI ^{1,2}, Yiming ZHANG ¹, Xinfei LI ¹, Jing LIU ³, Hongjian ZHU ³,
Kunlin YANG ¹, Kai ZHANG ¹, Liqun ZHOU ¹, Xuesong LI ¹ *

¹Department of Urology, Peking University First Hospital, Institute of Urology, Peking University, National Urological Cancer Center, Beijing, China; ²Department of Nursing, Peking University First Hospital, Peking University, Beijing, China; ³Department of Urology, Beijing Jiangong Hospital, Beijing, China

Robotic ileal ureteral reconstruction for radiation-induced ureteral stricture

The perioperative strategy as the key to surgical success

BACKGROUND

- Radiation-induced ureteral stricture (RIUS) is a late complication of pelvic radiotherapy, with a prevalence of 1.2–13.5%.
- Chronic microvascular damage and retroperitoneal fibrosis result in long, often bilateral strictures that respond poorly to endoscopic treatment.
- Ileal ureter replacement (IUR) is an option for extensive defects, but historical open surgery series report substantial morbidity (bowel obstruction, fistulas, nephrectomy).

MATERIALS AND METHODS

35

patients

3

tertiary centers

20 months

median follow-up

- Retrospective analysis of a prospective multi-institutional cohort (RECUTTER database), March 2019 – April 2024
- Primary outcomes: clinical success (stent-free status) and complications per the Clavien-Dindo classification
- Objective: to assess the feasibility and medium-term clinical efficacy of robotic IUR for RIUS

THE PERIOPERATIVE STRATEGY

Success is built before and during surgery

1

PRE-OPERATIVE

Ureteral rest. stents removed ≥ 4 weeks beforehand; percutaneous nephrostomy placement with daily monitoring of urine output. Benefits: stricture maturation, reduced local inflammation, optimized tissue conditions for reconstruction, and better delineation of the stricture margin.

• **Morphological imaging.** Antegrade and/or retrograde pyelography → to define stricture length. Cystography in cases of altered bladder compliance to quantify functional capacity.

• **Functional imaging.** Diuretic renography.

• **3D planning.** CT urography with three-dimensional reconstruction, used for both preoperative planning and intraoperative navigation.

• **Exclusion of recurrence.** Careful oncologic reassessment to exclude pelvic disease recurrence as the cause of the stricture, an exclusion criterion of the study.

2

INTRAOPERATIVE

Robotic platform — six standardized strategies for the post-radiation surgical field:

1 Intraoperative indocyanine green

- Via nephrostomy: identification of the stricture
- Intravenous: for real-time assessment of ureteral and anastomotic perfusion

3 Bowel inspection

excludes radiation enteritis, minimal manipulation

5 Antireflux valves

prevents reflux-related damage to renal function

2 3D models

spatial orientation, fewer iatrogenic injuries

4 Concomitant ileocystoplasty

In low-capacity bladders, to mitigate the rise in intravesical pressure.

6 Omental flap

covers the anastomoses → promoting local neovascularization and long-term patency

RESULTS

0 conversions

29 / 6 bilateral / unilateral

12 cystoplasties

Female-only population

1 case of failure: right ureteral
restenosis after bilateral IUR →
surgically corrected at 7 months

Parameter	Value
Clinical success	34/35 (97.1%)
Mean operative time	331.6 ± 112.3 min
Median EBL	50 mL (range 20-100)
Postoperative hospital stay	12.43 ± 6.00 days
Early complications (<30 days)	20% (CD-I 11.4%; CD-II 8.6%)
Late complications (>30 days)	25.7% (all CD-II)
CD ≥III complications	0
Creatinine pre → post	103.75 → 93.44 μmol/L (p<0.01)
eGFR pre → post	66.28 → 77.76 mL/min/1.73 m ² (p<0.01)

TAKE-HOME MESSAGES

- ✓ RIUS is a uniquely challenging reconstructive problem due to fibrosis, microvascular ischemia, and frequent bilateral/bladder involvement, which make standard endoscopic approaches less effective.
- ✓ In experienced hands, robotic ileal ureter reconstruction is feasible and safe even in this unfavorable surgical field.
- ✓ Planned ureteral rest and preoperative 3D imaging optimize the conditions for reconstruction.
- ✓ The integrated intraoperative strategy is not a set of isolated measures but a synergistic protocol that compensates for the challenges of irradiated tissue.
- ✓ These results, while encouraging, should be interpreted as proof of feasibility in high-experience centers rather than generalizable evidence: the learning curve for robotic IUR in irradiated tissue remains a key factor to consider before scaling up the protocol.