

Reconstructive Surgery in Ureter Trauma

Ahn Hyunsu
Ajou medical school

Etiology

✿ External trauma

Rare: 관통상의 경우에 4%
둔상의 경우 1% 미만

Table : 1. American Association for the Surgery of Trauma Organ Injury Severity Scale for the Ureter*

Grade [†]	Type	Description
I	Hematoma	Contusion or hematoma without devascularization
II	Laceration	<50% transection
III	Laceration	≥50% transection
IV	Laceration	Complete transection with <2 cm devascularization
V	Laceration	Avulsion with >2 cm devascularization

*From Moore EE, Cogbill TH, Jurkovich GJ, et al: Organ injury scaling. III: Chest wall, abdominal vascular, ureter, bladder, and urethra. J Trauma 1992;33:337-339.

[†]Advance one grade for bilateral up to grade III.

Etiology-External Trauma

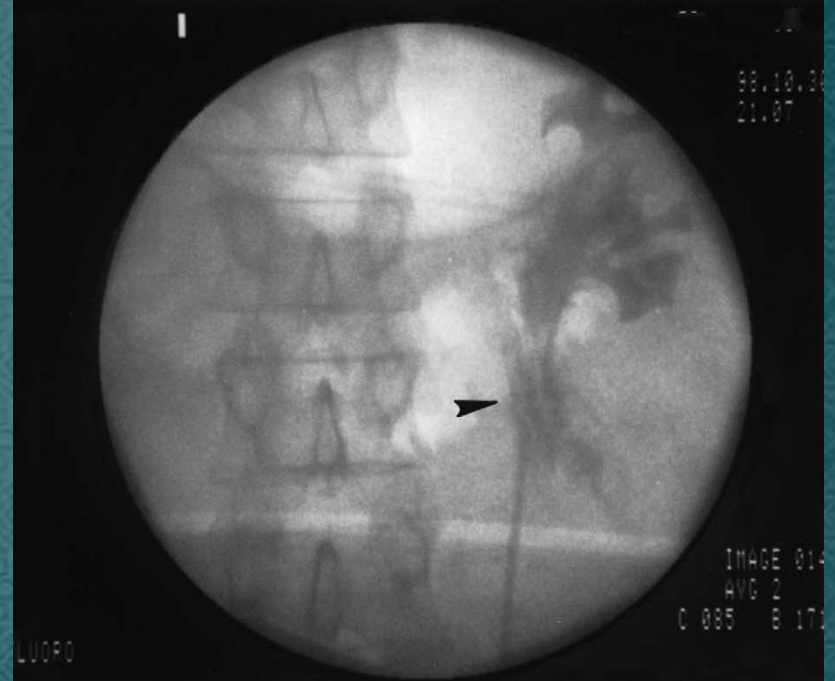
- ✿ Have significant associated injuries and mortality approached 1/3
- ✿ Associated injury
 - * Small bowel injury: 39-65%
 - * Large bowel injury: 28-33%
 - * Renal injury: 10-22%
 - * Bladder injury: 5%
- ✿ Mechanism: 관통상의 경우, 총알과 같이 작은 부위에 큰 에너지가 집중되어 요관 손상에 발생하는데 비하여, 둔상에 의하여 요관 손상이 생긴 경우는 전신에 극심한 힘이 노출된 경우가 많다.

Etiology–External Trauma

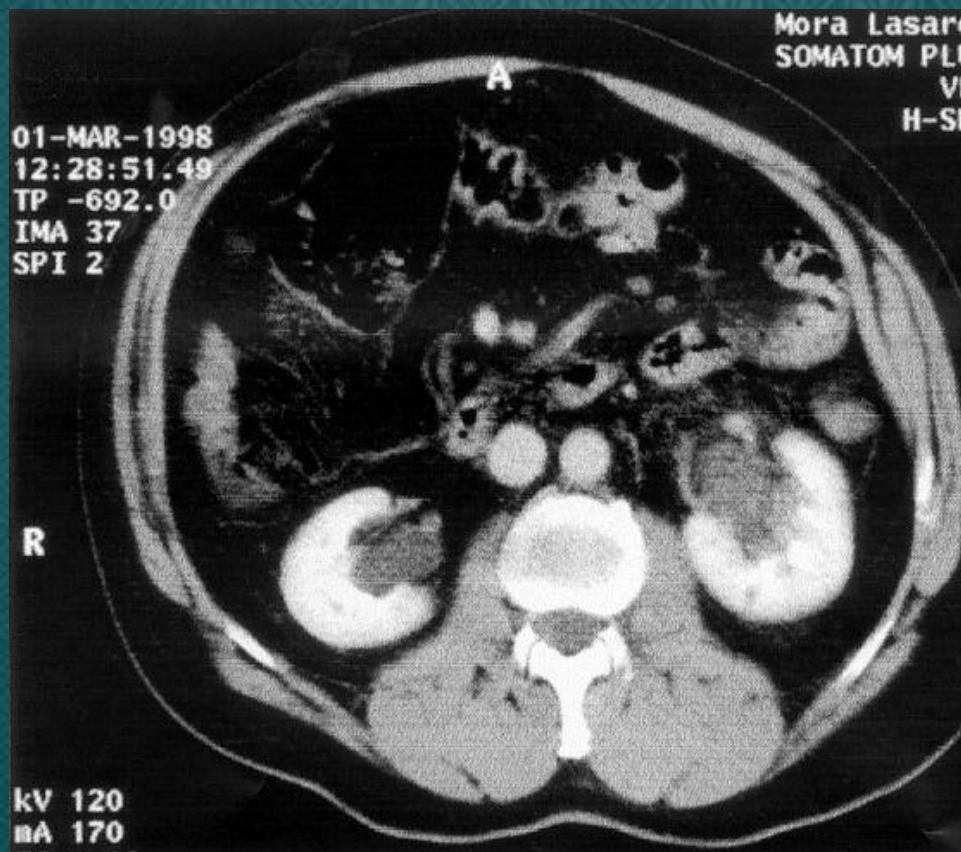
✿ Rare entity of UPJ disruption consequent to blunt trauma is often missed

- Do not always exhibit hematuria
- Difficult to palpate during intra operative manual examination

✿ Recommend abdominal CT with contrast and delayed image or intraoperative “one-shot pyelography”



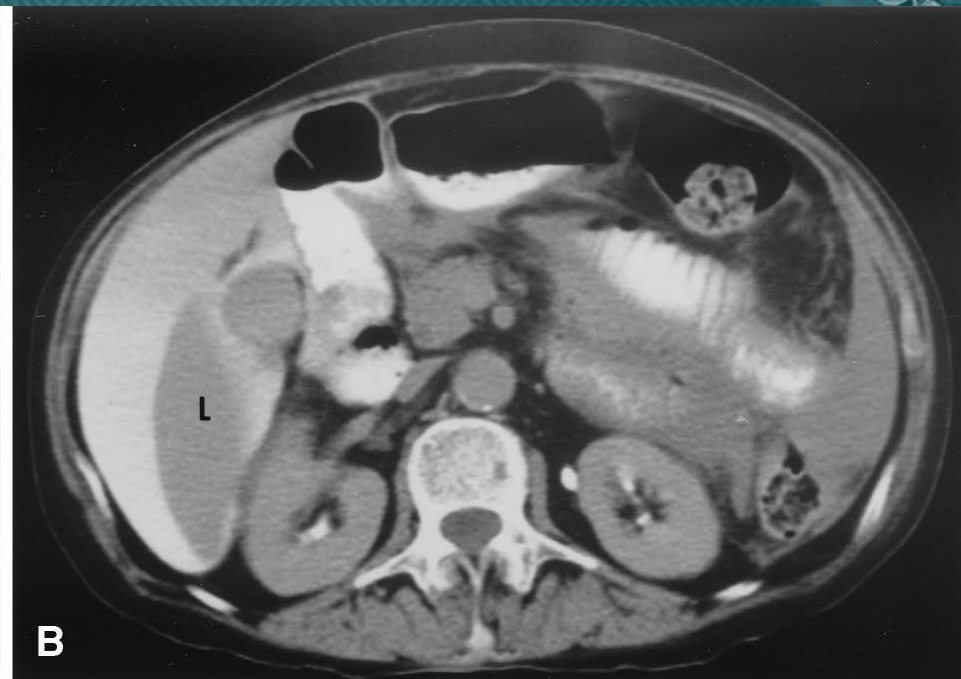
Type IV—partial left UPJ tear. CT shows medial extravasation of contrast from the torn renal pelvis (arrows) (a, b) but with the parenchyma intact. A low cut (c) shows contrast in the ureter on left (arrow) indicative that the tear is incomplete. A retrograde pyelogram (d) shows contrast entering the renal pelvis. Patient was successfully treated with a stent.



CT scan performed immediately after admission.



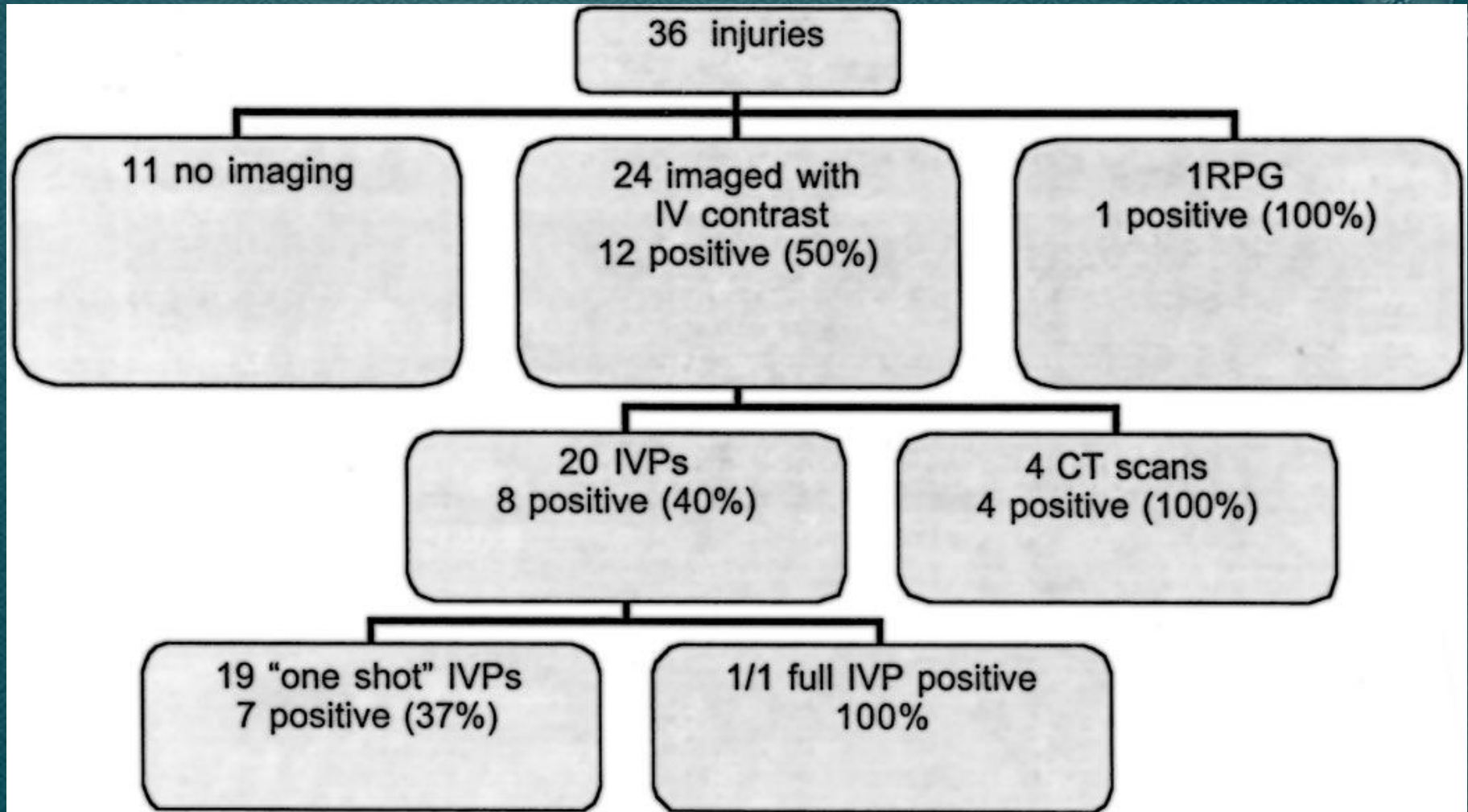
Plain abdominal radiograph performed 2 h after admission revealing extravasation of contrast medium into the retroperitoneal space.



Intraperitoneal free fluid gradually opacifying after intravenous contrast. A Postcontrast scan at the level of the midabdomen shows a moderate amount of fluid that is more prominent on the right (*L liver*). B One hour later, the fluid in the right abdomen has opacified and is denser in its dependent part (*L liver*).

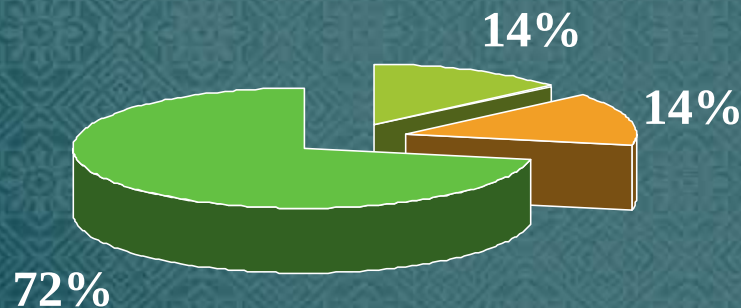
URETERAL INJURIES FROM EXTERNAL VIOLENCE: THE 25-YEAR

EXPERIENCE AT SAN FRANCISCO GENERAL HOSPITAL
JACK W. MCANINCH J Urol 170, 1213-1216, 2003



Results of radiographic studies in traumatic ureteral injury.

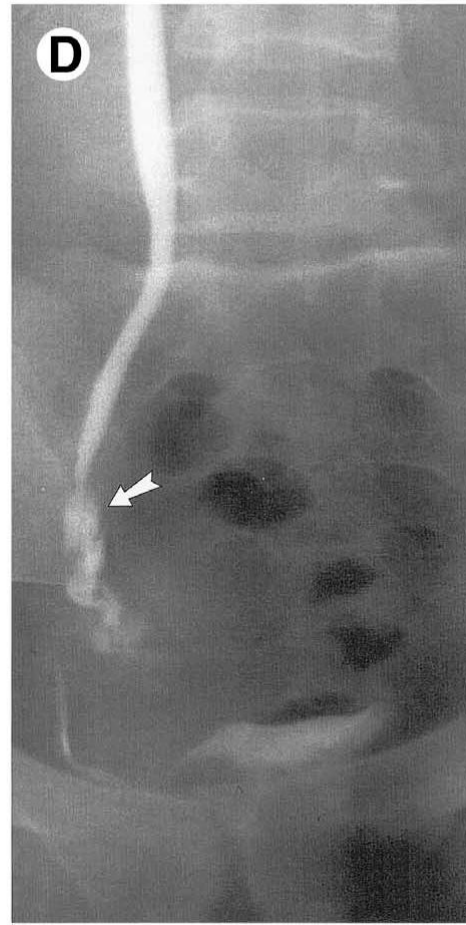
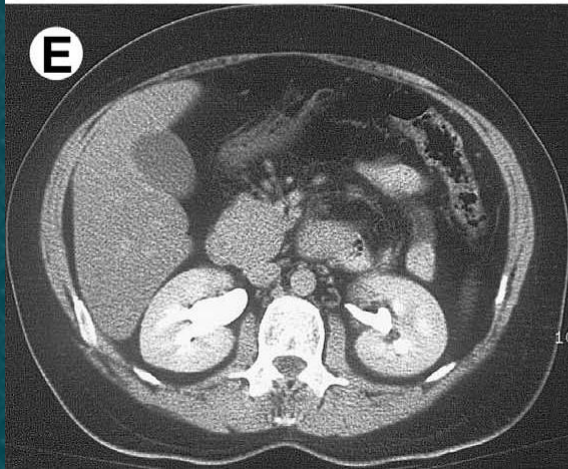
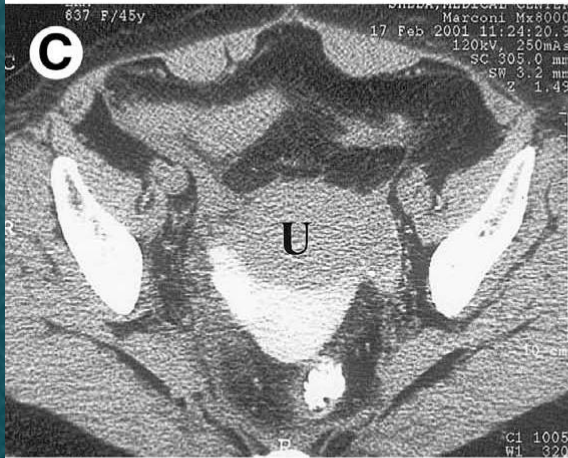
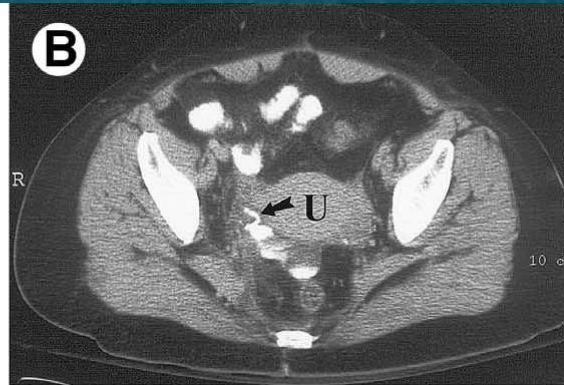
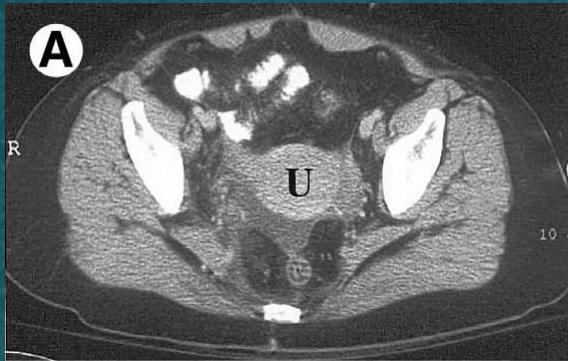
Etiology–Surgical Injury



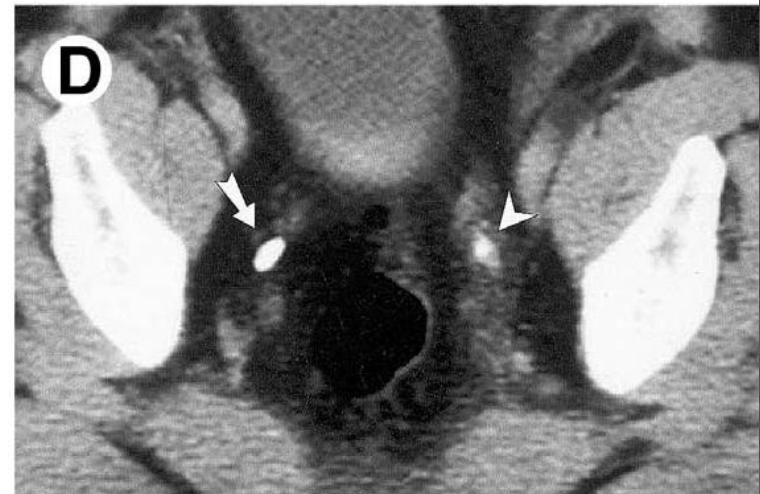
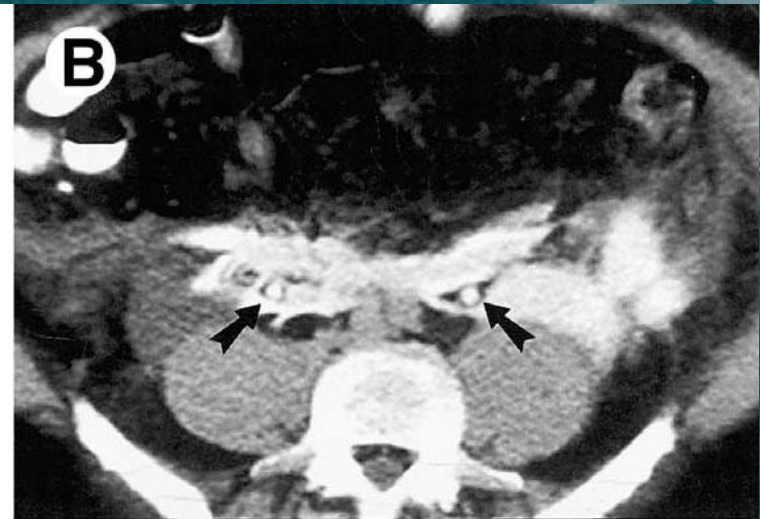
■ General surgery ■ Urologic Surgery
■ Gynecologic surgery

- ✿ hysterectomy (54%)
- ✿ colorectal surgery (14%)
- ✿ pelvic surgery such as ovarian tumor removal and transabdominal urethropexy (8%)
- ✿ abdominal vascular surgery (6%)

St Lezin MA: Surgical ureteral injuries. Urology 1991;38:497-506.

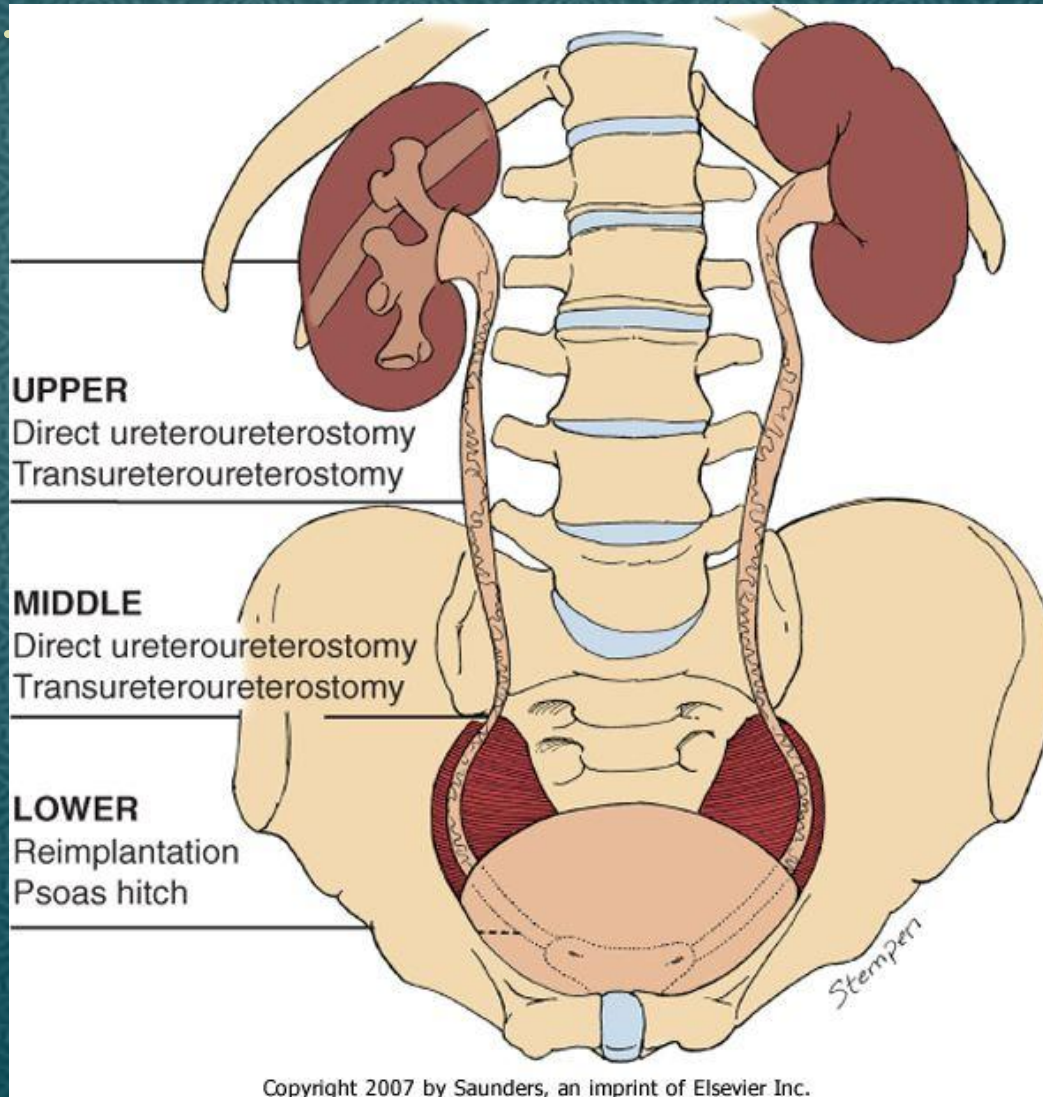


Injury to the right distal ureter resulting in extravasation of urine into the Douglas pouch. A 44-year-old woman presented with severe abdominal pain 4 days after laparoscopic resection of the right ovary. (A) Contrast-enhanced CT shows a small amount of free fluid in the Douglas Pouch (U, uterus). (B) Delayed scanning of the pelvis 20 minutes later shows contrast material partially opacifying the free fluid in the pelvis (uterus, U). It appears to originate in the right distal ureter (arrow). (C) A repeat scan several hours later shows homogeneous enhancement of the free fluid (U, uterus). (D) Antegrade pyelography shows extravasation of contrast material from the right distal ureter (arrow). (E) At the level of the kidneys, there is mild right hydronephrosis, secondary to the injury of the ureter.



Injury to the left distal ureter resulting in extravasation of urine into the retroperitoneum. A 40-year-old man with abdominal pain 2 days after left ureteroscopy and removal of a stone.

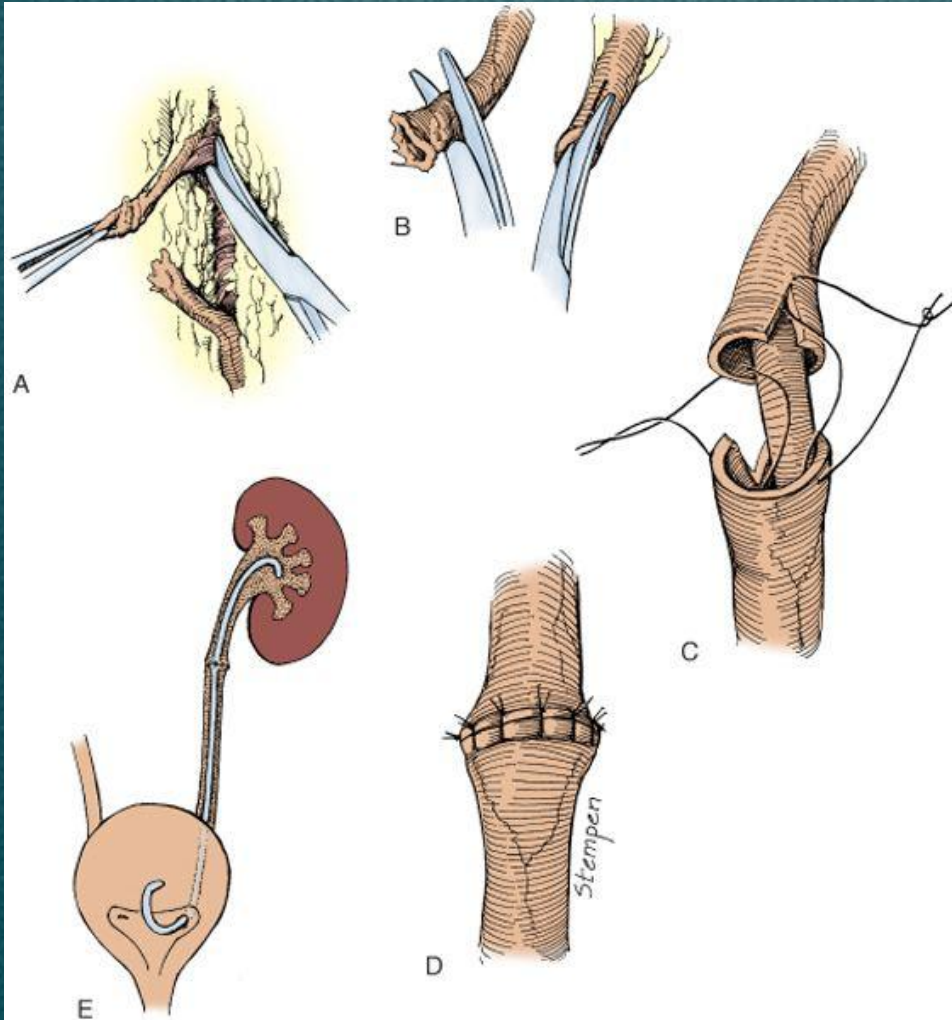
Management



Suggested management options for ureteral injuries at different levels

Management

Technique of Ureteroureterostomy after Traumatic Disruption:

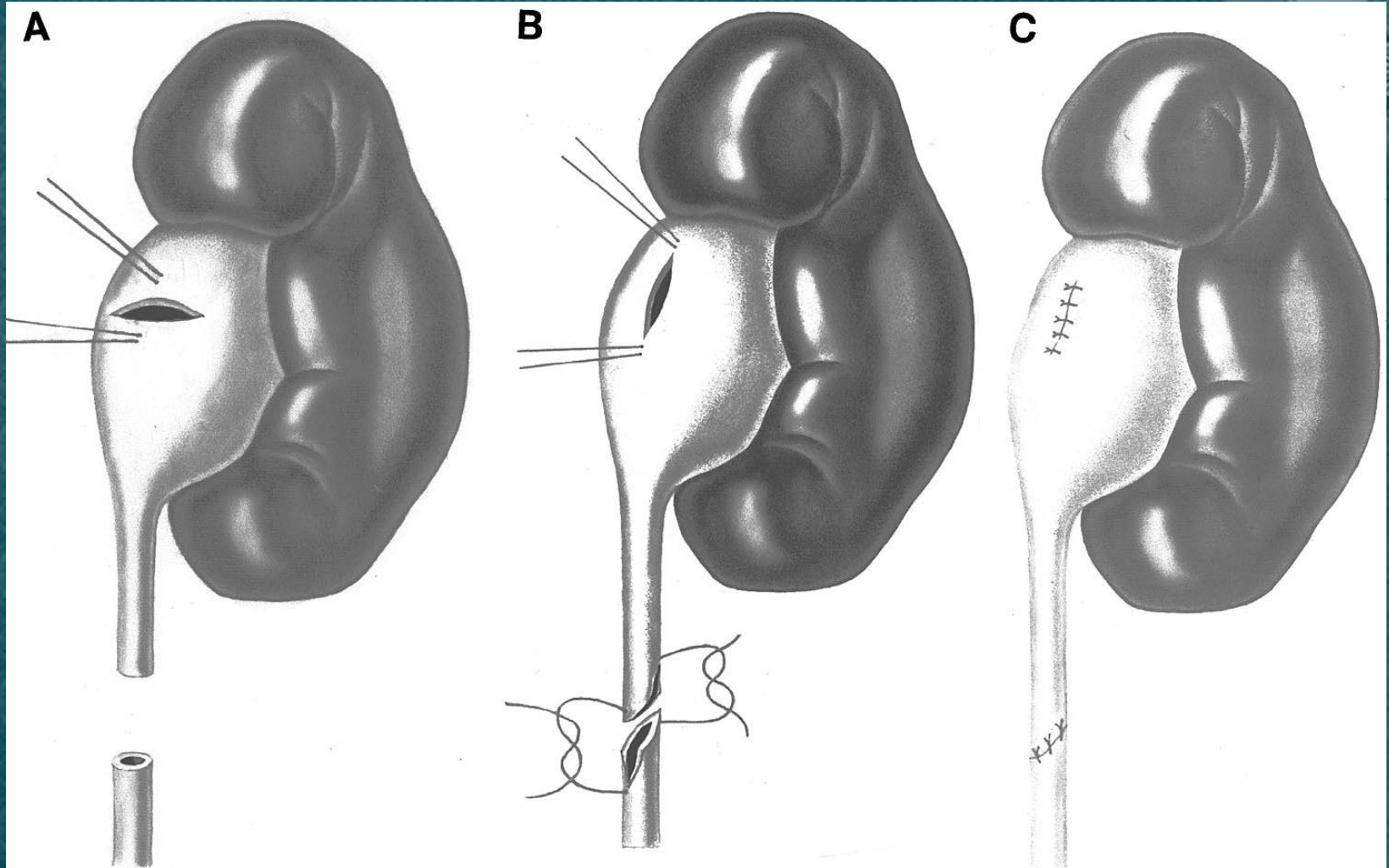


- A, Injury site definition by ureteral mobilization;
- B, Debridement of margins and spatulation;
- C, Stent placement;
- D, Approximation with 5-0 absorbable suture;
- E, Final result.

Management: Principles of ureteral repair

- ✿ Mobilization of ureter with care to preserve the adventitia
- ✿ Debridement of nonviable tissue to a bleeding edge
- ✿ A spatulated, tension-free anastomosis over an internal stent
- ✿ Ensure urothelium-to-urothelium apposition
- ✿ Omental interposition can be used
- ✿ The surrounding retroperitoneum should be drained

Reconstruction of extensive upper ureteral damage.



A, ureteral gap at end of debridement. Transverse incision was made on upper curvature of kidney pelvis. B, spatulated ureteroureteral anastomosis. C, pelvic incision was sewn longitudinally.

PSOAS HITCH URETERAL REIMPLANTATION IN ADULTS—ANALYSIS OF A MODIFIED TECHNIQUE AND TIMING OF REPAIR

UROLOGY 58: 184–187, 2001

TABLE II. Indications for ureteral reimplantation

Indication	n
Operative injury	11
Gynecologic surgery	8
General surgery	3
Planned ureteral resection at time of nonurologic pelvic surgery	4
Resection of distal ureteral transitional cell carcinoma	4
Stricture	4
Trauma	1

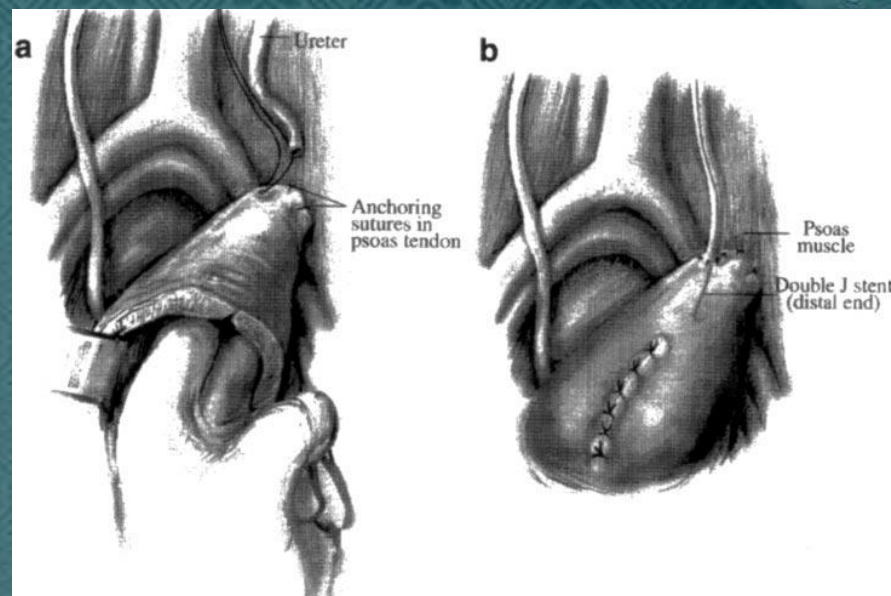


TABLE III. Psoas hitch ureteral reimplantation for operative injury

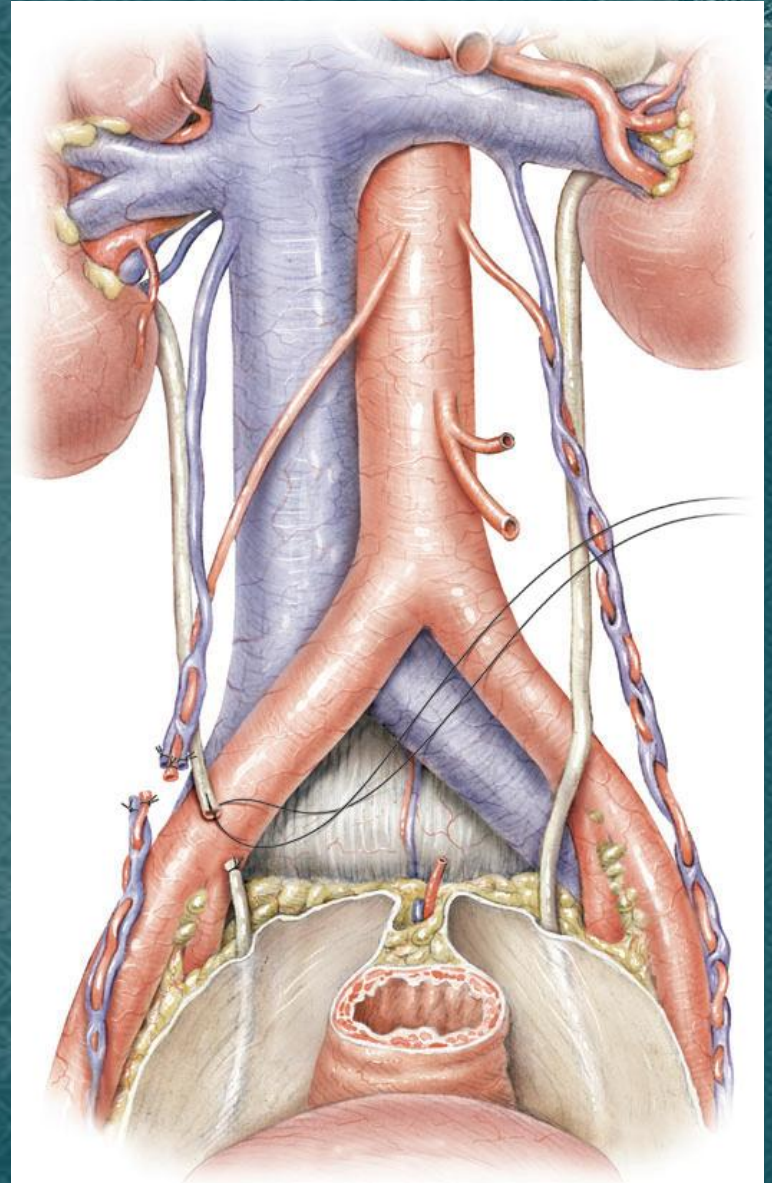
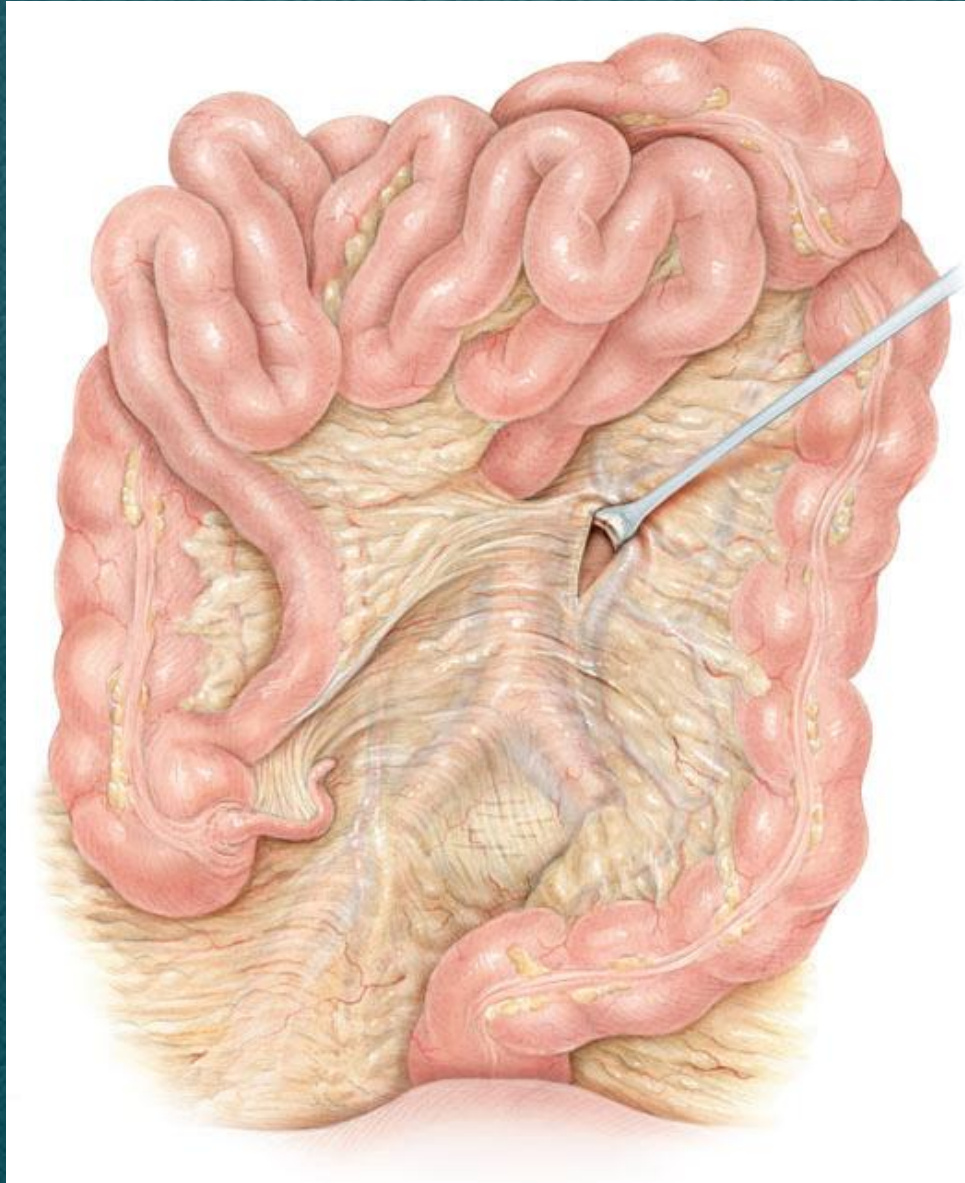
	Time from Injury to Repair		P Value
	<6 wk	≥6 wk	
Mean age at time of repair (yr)	52.8 (27–70)	44.3 (38–56)	0.445
Mean elapsed time from injury to repair (wk)	3.3 (0.57–4)	14 (6–24)	0.036
Mean operative time (min)	233.2 (187–299)	237.7 (191–291)	0.902
Intraoperative complications (n)	1*	1†	

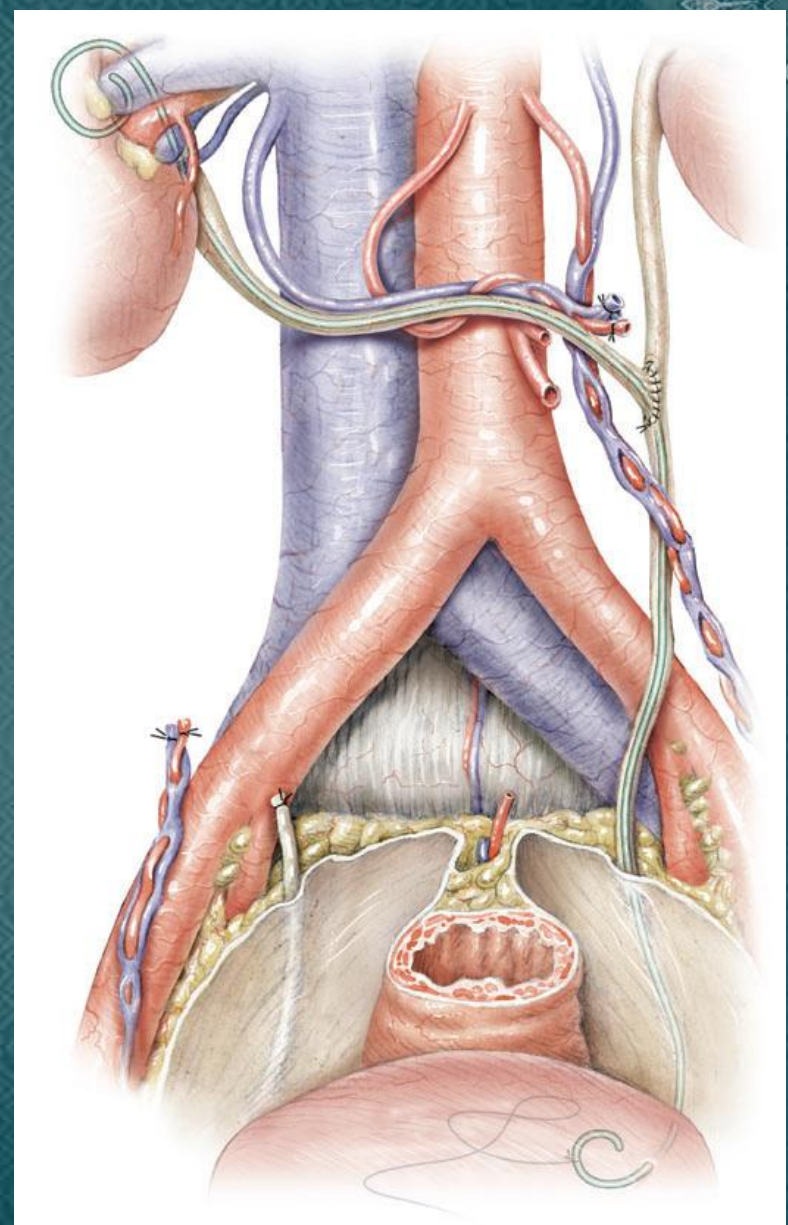
Numbers in parentheses are the range.

* Iliac vein injury requiring repair without graft.

† Small bowel injury requiring small bowel resection and reanastomosis.

Surgical Atlas Transureteroureterostomy





Transureteroureterostomy: an adjunct to the management of advanced primary and recurrent pelvic malignancy

Int J Colorectal Dis (2003) 18:40–44

Eleven patients with advanced pelvic malignancy underwent this procedure. There was one major complication requiring ureteronephrectomy of the crossed system.

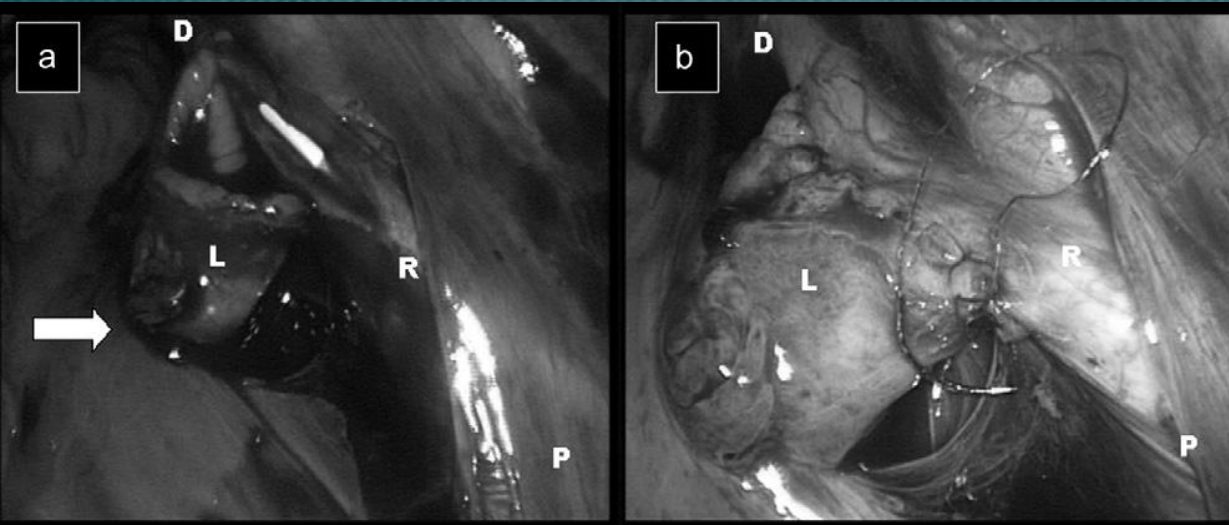
Conclusion: Transureteroureterostomy should be considered as a treatment option in patients with unilateral ureteral obstruction.

	Recommended with prior pelvic radiotherapy	Recommended with partial excision of the bladder
Repair with stent	No	No
Reimplantation	No	—
Ileointerposition	Possible	Yes
Bladder flap	No	Possible
Transureteroureterostomy	Yes	Yes
Ureteral ligation	Yes	Yes
Ureteronephrectomy	Yes	Yes

Laparoscopic Transureteroureterostomy: A Novel Approach

J Urol 177, 2311-2314, 2007

Performed transperitoneal laparoscopic transureteroureterostomy in 3 children with a mean age of 63 months. Diagnoses were unilateral ureteral obstruction after cross-trigonal reimplantation for vesicoureteral reflux (1 patient), unilateral refluxing megaureter (1) and ureteral injury after bladder diverticulectomy



a, alignment of 2 ureters in case of left (L) to right (R) LTUU. Note indwelling stent in recipient ureter and donor ureter coming from retroperitoneal tunnel (arrow). b, completion of anastomosis. D, distal. P, proximal.

Modern large series of TUU and its complications

References	No. Adults/ Children	No. TUU Failures (%)	No. Obstructions of Common Ureter (%)	No. Other Complications (%)	No. Reoperations for TUU/Other Cause
Hendren and Hensle ⁴	10/65	2 (3)	1 (1)	0 (0)	2/1
Hodges et al ¹⁴	100	8 (8)	3 (3)	12 (12)	5/5
Chilton et al ³	0/55	1 (2)		12 (22)	1/3
Rushton et al ⁶	0/31	0 (0)	2 (6)	4 (13)	0/3
Noble et al ¹⁵	253	0 (0)	3 (1)	18 (7)	0/3
Mure et al ⁵	0/69	1 (1)	0 (0)	4 (6)	1/1
Pesce et al ¹³	0/70	0 (0)	2 (3)	3 (4)	1/1

THE LAPAROSCOPIC BOARI FLAP

J Urol 166, 51-53, 2001

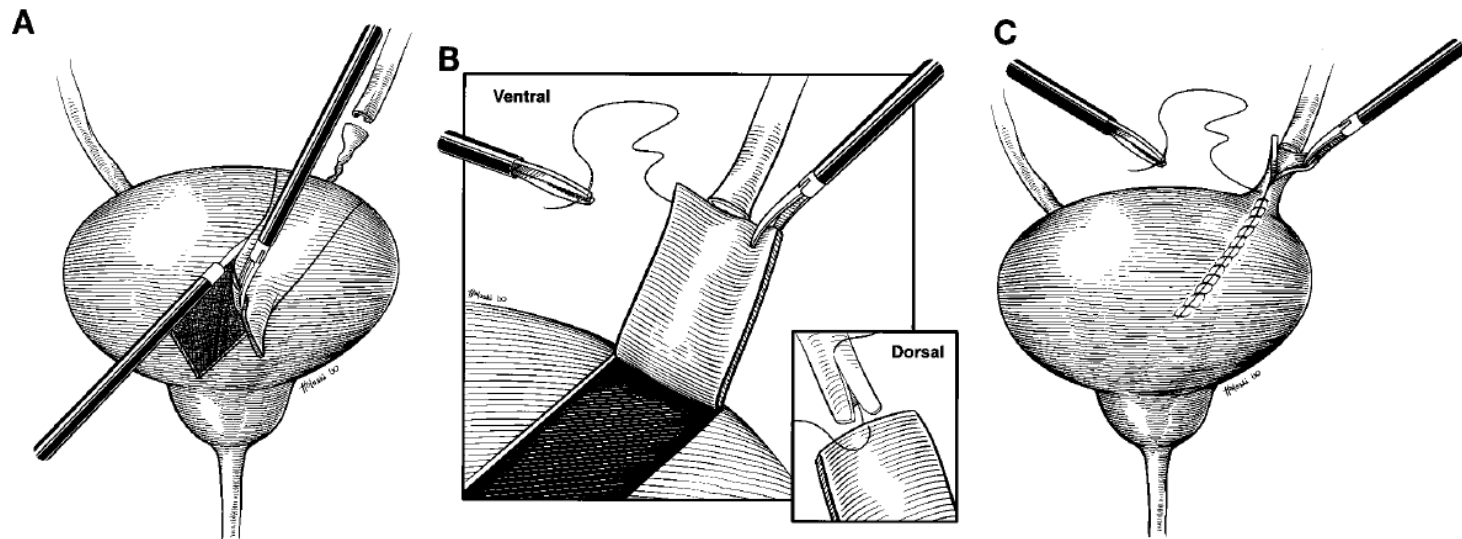
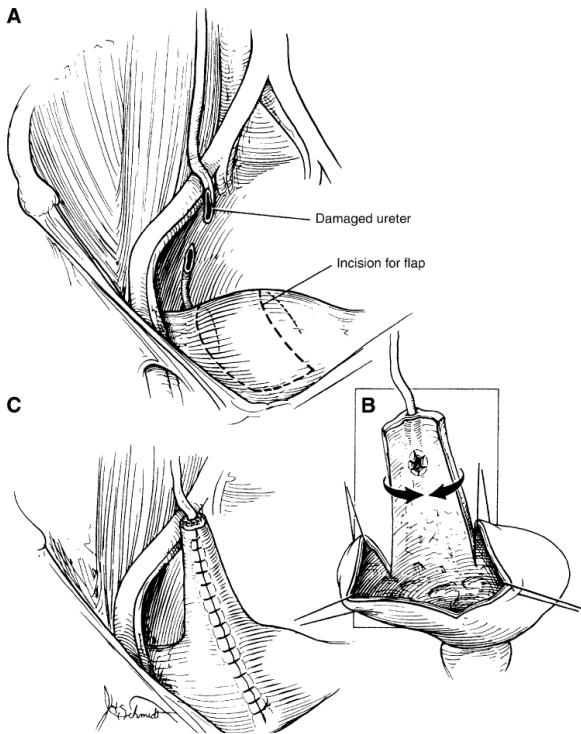


FIG. 2. A, anterior bladder flap extends to posterior dome. B, ureter is spatulated and anastomosed to flap using interrupted suture. C, flap is closed with running suture.

The Use of Bowel for Ureteral Replacement for Complex Ureteral Reconstruction: Long-Term Results

J Urol 175, 179-184, 2006

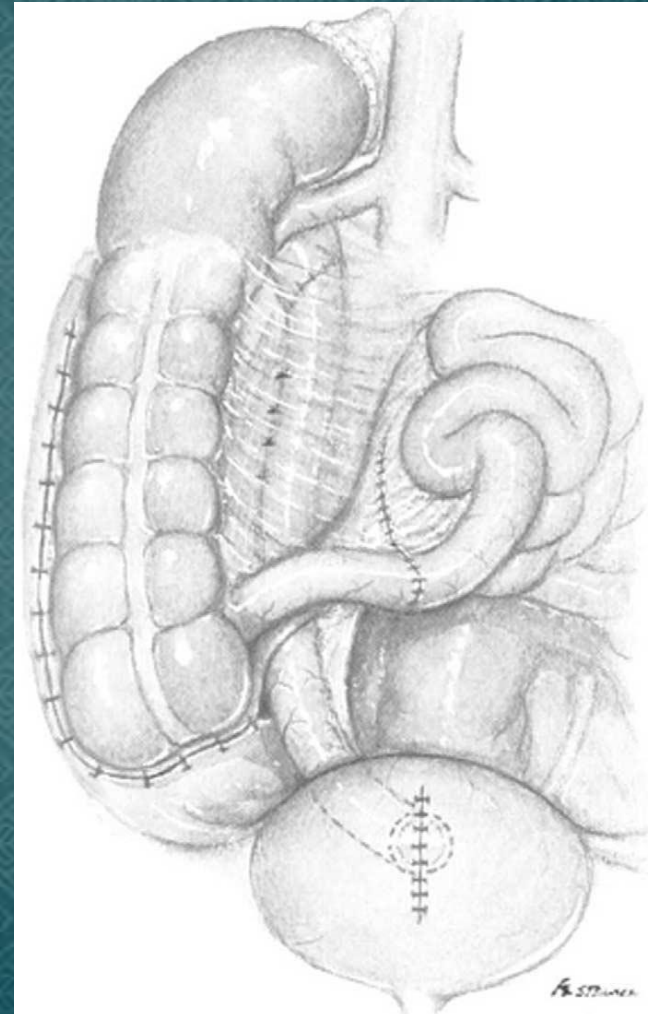
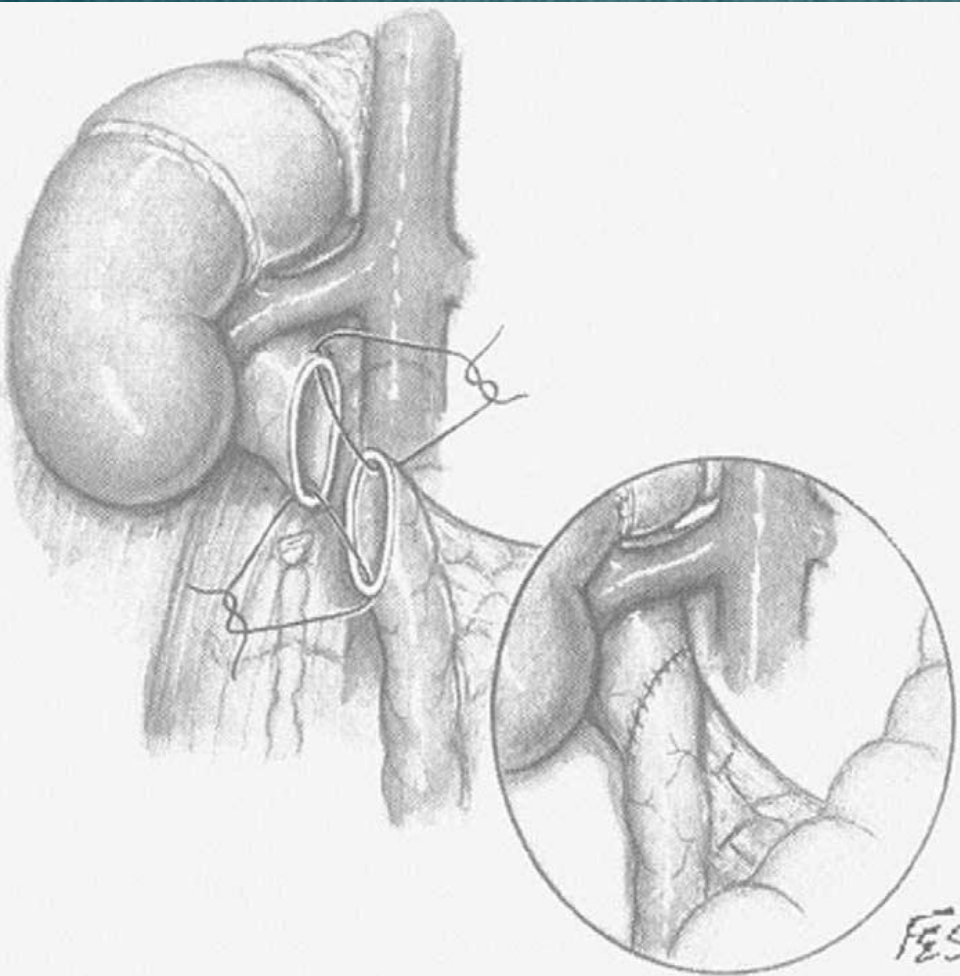


TABLE 1. *Procedural subtype*

Procedure	No. Pts
Ileal ureteral replacement	52
Sigmoid colon ureteral replacement	2
Bilat replacement, 1 side colon, 1 side ileum	2

TABLE 2. *Indications*

Indication	No. Pts
Iatrogenic ureteral stricture	23
Recurrent calculi leading to stricture	8
Retroperitoneal fibrosis	7
Recurrent ureteropelvic junction obstruction	7
Stone chute	4
Stricture secondary to external beam radiation	3
Ureteral transitional cell Ca	2
Other	2

TABLE 3. *Complications*

Type	No. Pts	Comments
Pyelonephritis	4	Hospitalized for intravenous antibiotics (2)
Chronic renal failure	3	All pts had serum creatinine ≥ 2
Incisional hernia	2	Required surgical repair
Fever of unknown origin	1	Pt hospitalized but no source ever found, fever spontaneously resolved
Neuroma	1	Treated conservatively
Deep venous thrombosis	1	Treated conservatively
Recurrent urolithiasis	1	Required extracorporeal shock wave lithotripsy on ileal ureteral replacement side
Ileal segment obstruction	1	Caused by kinking due to redundancy in segment, subsequently shortened
Pyeloileal anastomotic stricture	1	Treated conservatively with balloon dilation
Wound dehiscence	1	Closed in operating room

Renal Autotransplantation in Management of Bilateral Ureteral Mortar Shell Injuries: A Case Report

MILITARY MEDICINE. 169, 11:894. 2004



Fig. 1. Retrograde ureteropyelography before reconstructive surgery.

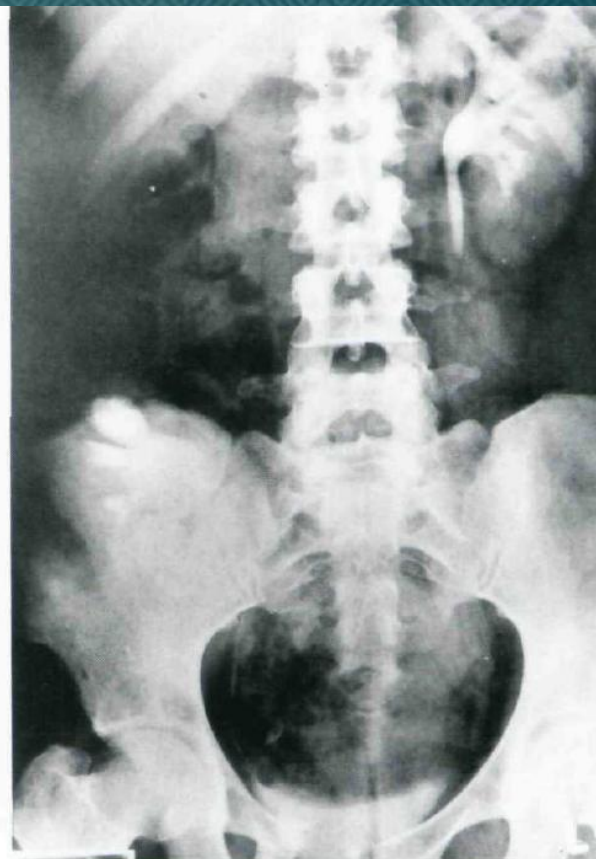
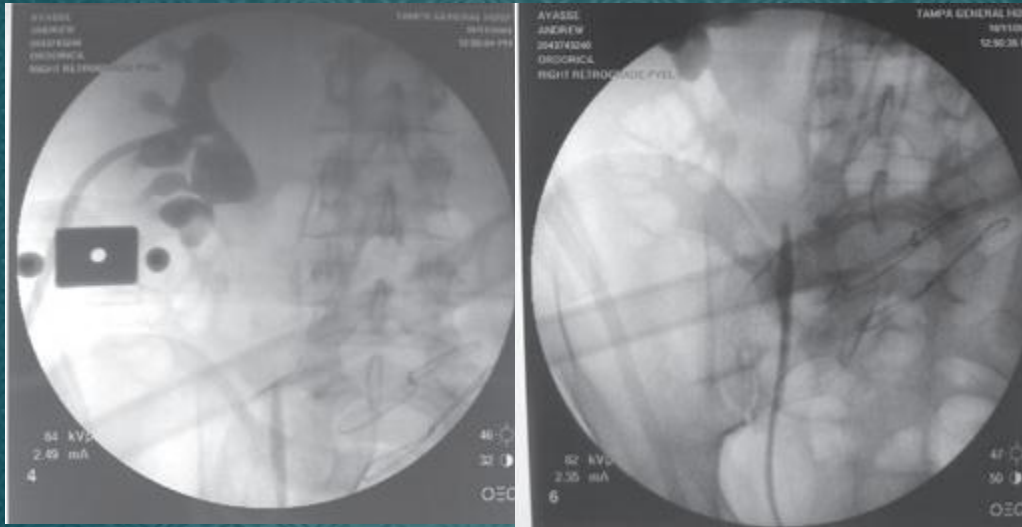


Fig. 2. Intravenous urography after reconstructive surgery.

Bilateral cutaneous ureteroneostomy
Autotransplantation of the right kidney with ureteroneocystostomy
6 weeks later left ureteric repair

Renal autotransplantation for managing a short upper ureter or After *ex vivo* complex renovascular reconstruction

BJU Int. 2005 ;96:871-4.



One patient in the SU group had a renal vein thrombosis that necessitated transplant nephrectomy

SU group

1/29	M	UI	-	-
2/47	F	UI	-	-
3/47	F	UI	-	-
4/52	F	UI	Failed open repair	-

RAS, renal artery stenosis; FMD, fibromuscular dysplasia; NF, neurofibromatosis; PTA, percutaneous angioplasty; UI, ureteric injury.

SU

Mean (range)			
creatinine level, mg/dL	1.3 (1.0–1.7)	1.2 (0.7–1.8)	
μmol/L	115 (88–150)	106.1 (62–159)	stabilized
blood pressure, mmHg			
systolic	142 (128–152)	134 (130–137)	stabilized
diastolic	78 (68–83)	78 (75–80)	stabilized

EXPANDED EXPERIENCE WITH LAPAROSCOPIC NEPHRECTOMY AND AUTOTRANSPLANTATION FOR SEVERE URETERAL INJURY

J Urol 169, 1363–1367, 2003

TABLE 1. *Preoperative patient characteristics and history*

Pt. — Age — Sex No.	Side	History	Intervention	Outcome	Failed Prior Manipulation
1 — 32 — M	Lt.	Nephrolithiasis	Percutaneous nephrolithotomy	Ureteral avulsion	Endoscopic incision
2 — 36 — F	Lt.	Placenta accretia	Emergency laparotomy	Ureteral avulsion	—
3 — 47 — M	Lt.	Ureteral stone	Ureterscopy	Ureteral avulsion	Ileal ureter
4 — 59 — F	Rt.	Ureteropelvic junction obstruction	Acucise (Applied Medical, Rancho Santa Margarita, California) endopyelotomy	Ureteropelvic junction disruption	—
5 — 48 — F	Lt.	Staghorn calculus	Percutaneous nephrolithotomy	Ureteropelvic junction disruption	Antegrade nephroscopy
6 — 51 — F	Rt.	Ureteral stones	Open ureterolithotomies	Ureteral stricture	Endoscopic incision
7 — 49 — F	Lt.	Ureteropelvic junction obstruction + stone	Laser endopyelotomy, shock wave lithotripsy	Ureteropelvic junction disruption	Open pyeloplasty

TABLE 2. *Preoperative studies and operative findings*

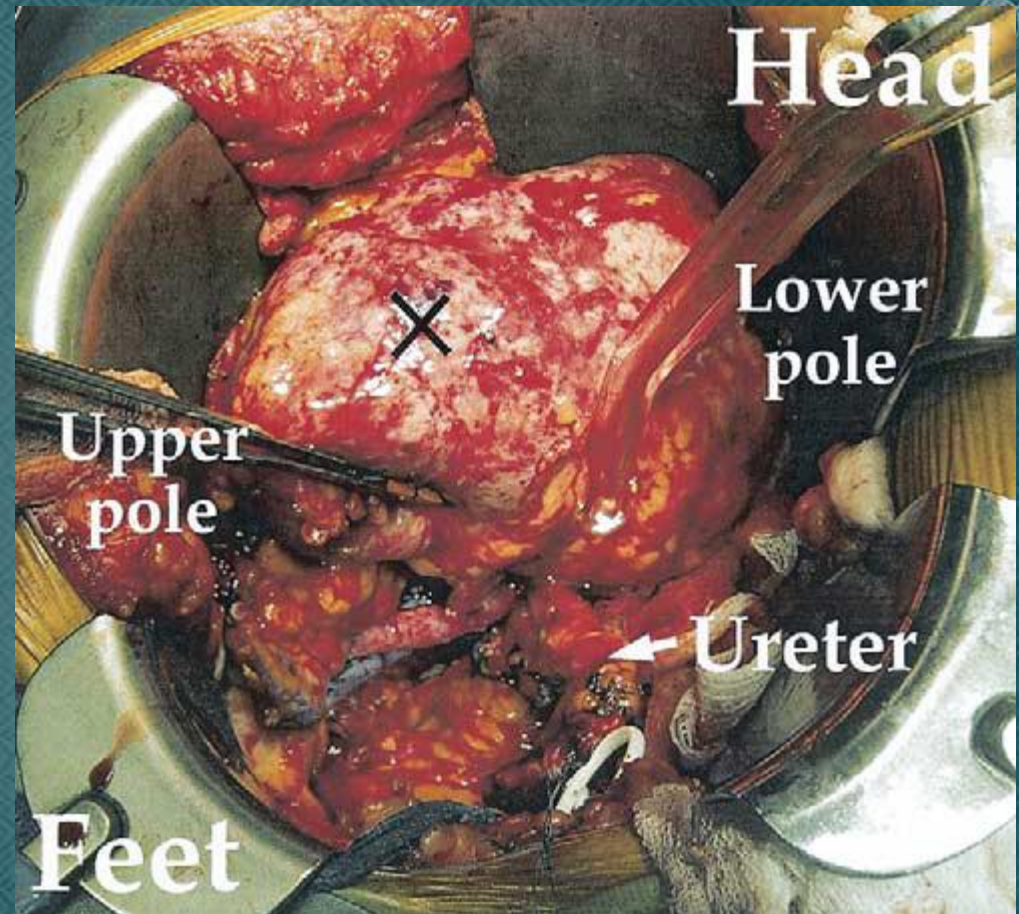
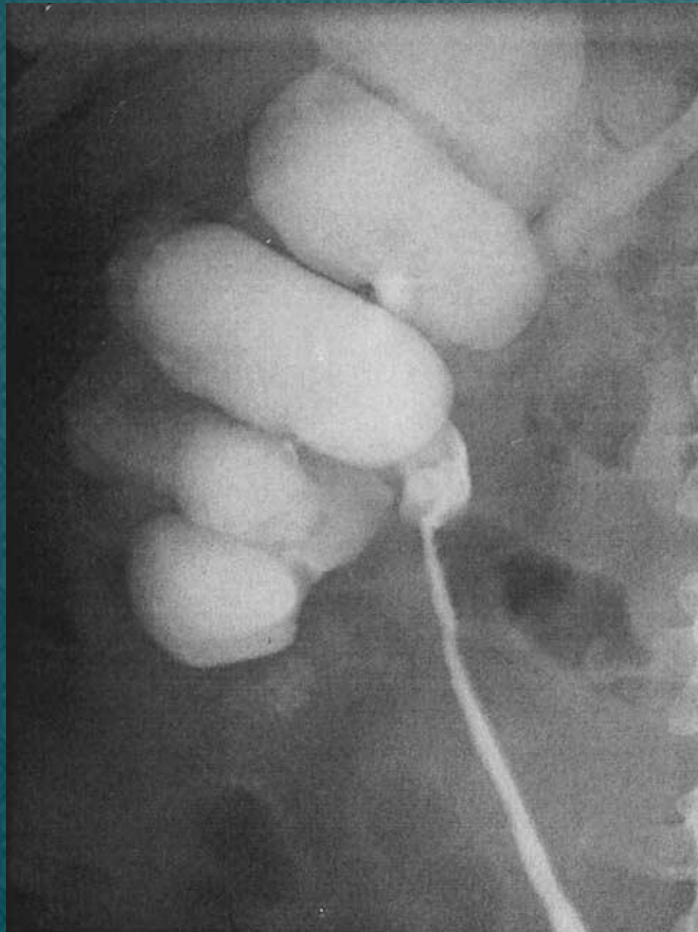
Pt. No.	Preop.			Intraop. Findings	Reconstruction	Time (mins.)	
	Serum Creatinine (mg./dl.)	Urinary Drainage	% Relative Function			Nephrectomy	Total
1	1.3	Nephrostomy	50	Severe fibrosis, no proximal ureter	Ureteropyelostomy	300	500
2	0.7	Nephrostomy	50	Severe fibrosis, 2 cm. ureter	Ureterovesical	180	350
3	1.1	Nephrostomy	48	Severe fibrosis, ileal ureter excised	Ureterovesical	384	672
4	0.8	Nephrostomy	33	Fibrosis, absence of pelvis, 2 arteries	—	319	374
5	0.9	Nephrostomy	45	Severe fibrosis, no proximal ureter	Ureteropyelostomy	358	572
6	0.8	Nephrostomy	50	Severe fibrosis, pelvic stone	Ureteropyelostomy	316	626
7	0.7	Ureteral stent	30	Severe fibrosis, no proximal ureter	Ureteropyelostomy	201	465

TABLE 3. *Transplant and postoperative characteristics*

Pt. No.	Warm Ischemic Time (mins.)	Anastomotic Time (mins.)	Complications	Hospitalization (days)	Followup (mos.)	Creatinine (mg./dl.)
1	4.5	25	Pneumonia	9	25	1.3
2	4	20	—	5	24	0.5
3	4	35	Ileus	13	19	1.1
4	8	—	Not transplanted	3	15	1.0
5	6	37	—	5	15	0.8
6	5	41	Retained drain	5	11	0.8
7	4	28	—	5	10	0.6

LAPAROSCOPIC-ASSISTED UPPER POLE URETEROCALICOSTOMY USING RENAL INVERSION AND AUTOTRANSPLANTATION

UROLOGY 63: 1182.e6–1182.e8, 2004



Intraoperative photograph demonstrating kidney after vascular anastomoses and preparation for upper ureterocalicostomy. “X” denotes location of calicostomy over dilated collecting system. Note, external iliac artery has been “medialized” to facilitate anastomosis.

Gastroureteroplasty in a woman with bilateral ureteric strictures after pelvic radiotherapy

BJU International (1999), 84, 883–884

