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Urological Research

Optimization of uretero-intestinal anastomosis in urinary diversion: an experimental study in dogs

III. A new antireflux technique for uretero-ileal anastomosis: a serous-lined extramural tunnel

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Summary. A new antireflux uretero-ileal reimplantation technique suitable for use with bladder substitutes is presented. This procedure entails creation of a serous-lined extramural tunnel. Following detubularization of the bowel segment, the adjacent flaps are approximated by continuous 4/0 non-absorbable sutures 1.5 cm from the cut edges. The ureters are laid in the trough thus fashioned. "Button-holes" are created in the bowel flaps and a mucosa-to-mucosa uretero-ileal anastomosis is carried out. The mucosal edges of the flaps are then approximated by one layer of continuous 4/0 (PGA) suture resulting in closure of this artificial tunnel. The feasibility and functional outcome of this technique were experimentally investigated in 8 dogs. Follow-up was carried out up to 30 weeks. Assessment by intravenous urography and ascending studies showed that the procedure is an efficient method of providing an unobstructed unidirectional flow of urine.

Key words: Ureter – Implantation – Ileum – Anti-reflux – Diversion

On the basis of our previous findings [1, 2] it was evident that there are two requirements for a successful uretero-ileal anastomosis. First, the adventitia of the reimplanted part of the ureter must be covered and protected from the urinary stream. Secondly, a definitive mucosa-to-mucosa anastomosis between the ureter and ileal mucous membrane should be carried out. We present here a new technique for uretero-ileal reimplantation that satisfies both these criteria and furthermore provides a sound antireflux system without the need for creation of an intussuscepted nipple valve.

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Material and methods

Experimental animals

Eight mongrel dogs weighing 15–20 kg were used for the experiments. The procedures were carried out with the animals under general anaesthesia. Thiopental sodium (20 mg/kg) was used for induction and maintenance of anaesthesia, with endotracheal intubation and mechanical ventilation.

Operative procedure

A segment of the terminal ileum 30 cm long was isolated and the continuity of the small intestine re-established. The proximal 20 cm of the isolated segment was turned into a U configuration (Fig. 1A). A running seromuscular suture using 4/0 silk was used to join the adjacent limbs of the U close to the mesenteric border (Fig. 1B). The antimesenteric border of the intestine was then incised by a diathermy knife. The result was the creation of two intestinal flaps joined at their base (Fig. 1C). The ureters were laid in the through thus fashioned. "Button-holes" were created at the distal end of the intestinal flaps and a mucosa-to-mucosa uretero-ileal anastomosis carried out (Fig. 1D). The mucosal edges of the flaps were then approximated by a layer of continuous 4/0 Vicryl suture resulting in closure of this extramural serous-lined artificial tunnel (Fig. 1E). The reservoir was then closed leaving two ureteral stents for 10 days (Fig. 1F). The intact distal end of the intestine was brought out as a cutaneous stoma in the right lower quadrant of the abdomen. Parenteral antibiotics and fluids were given for 5 days, followed by a fluid oral diet for 2 days and then solid food as tolerated.

Evaluation

The dogs were evaluated 30 weeks following surgery. The evaluation included a gravity ascending pouchgram (water head 60 cm) and excretory urography. The dogs were then killed for assessment by necropsy. The implantation sites were grossly examined and microscopic sections obtained for histopathological evaluation.

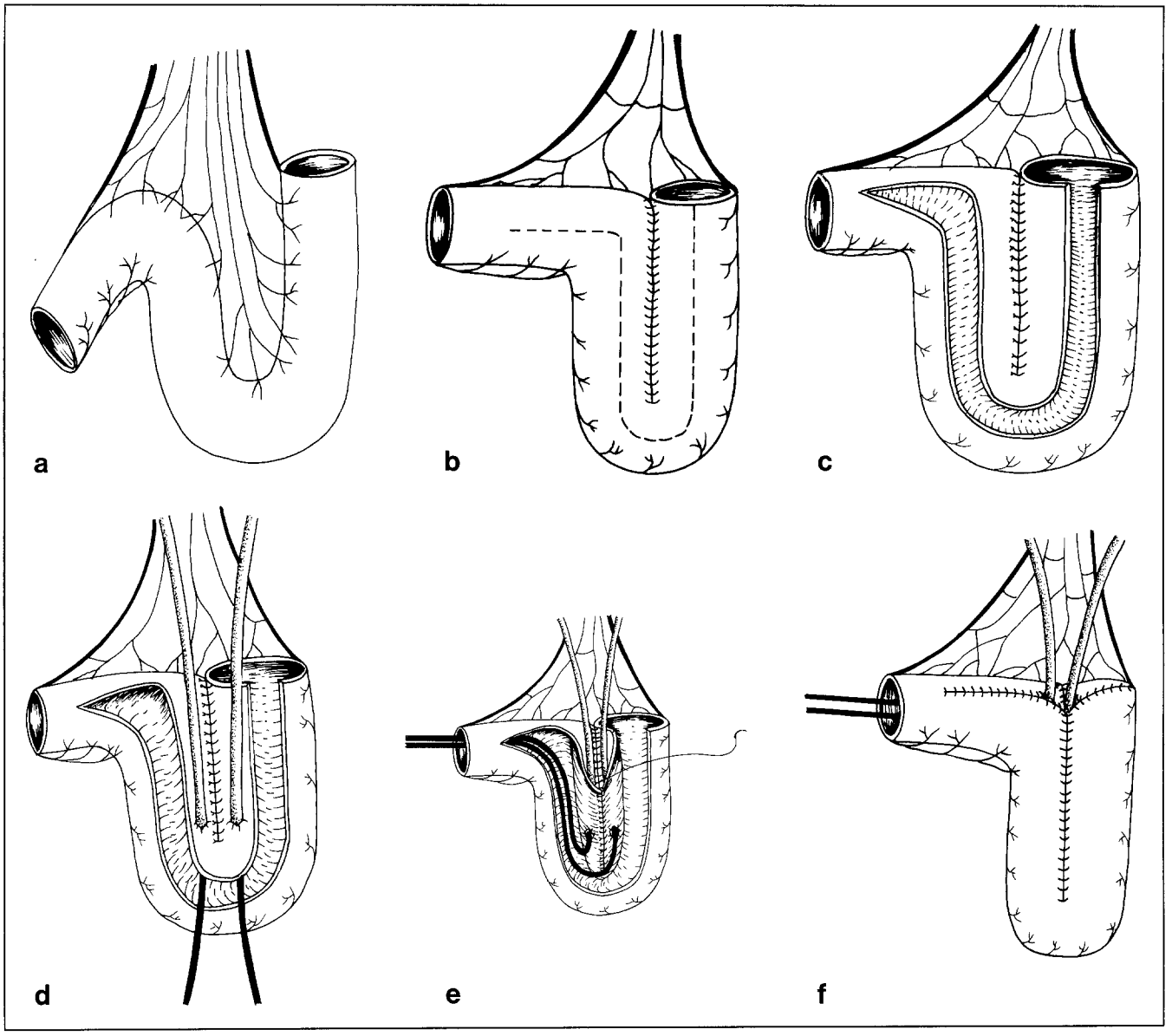


Fig. 1a. An ileal segment 30 cm long is isolated. The proximal two thirds are turned into a U configuration. **b** A continuous seromuscular suture is applied to approximate the two limbs of U, close to the mesenteric border. **c** The antimesenteric border is incised to create two intestinal flaps joined at their base. **d** Mucosa-to-mucosa reimplantation of the ureters through two "button-holes" created in the distal end of the trough thus fashioned. **e** Closure of the intestinal flaps in front of the implanted ureters creates a serous-lined extramural tunnel. **f** The reservoir is closed keeping two ureteral stents. The intact distal end was brought out as a cutaneous stoma

Results

All the reimplanted renal units showed perfect radiographic configuration without evidence of reflux (Fig. 2). Gross examination of the necropsy specimens revealed a normal upper tract (Fig. 3) and an adequate serous-lined extramural ileal tunnel enclosing intact ureters (Fig. 4).

Histopathological examination of the reimplantation sites showed intact no ureters with normal overlying intestinal wall. There was evidence of an inflammatory reaction or scarring (Fig. 5).

Discussion

The importance of incorporating an antirefluxing ureteroileal anastomosis when a bladder substitute is created does not need emphasis. These systems are frequently infected and regurgitation of their contents could be deleterious to renal function in the long term. In addition, the absence of reflux induces progressive dilatation and "maturation" of the pouch, which otherwise remains small in size with a limited volume/capacity [5]. Several operative techniques can be used for reflux prevention. In our hands, the best functional results were obtained following creation of an intussuscepted nipple valve [3, 7]. Nevertheless, this method involves the utilization of an extra 15 cm of bowel.

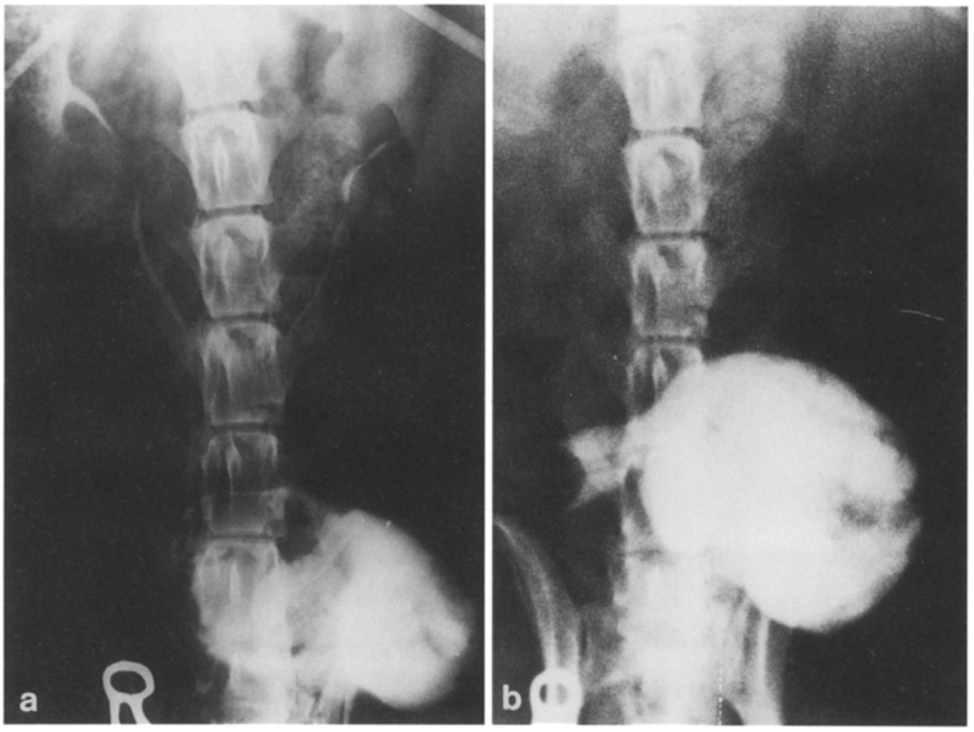
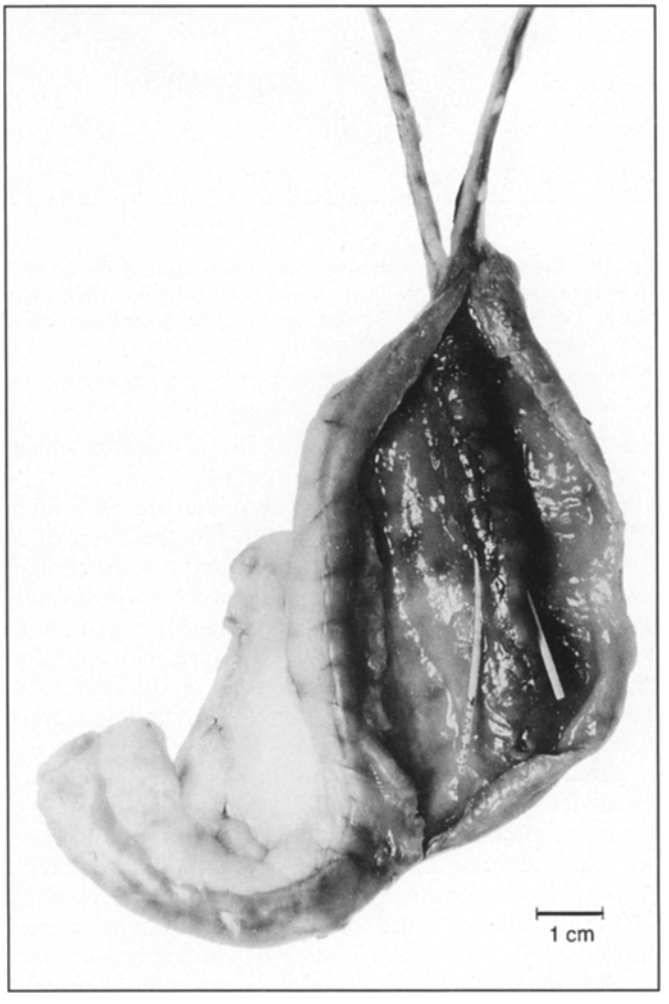


Fig. 2a. Postoperative intravenous urogram showing the perfect radiographic configuration of the upper tract. **b** Ascending pouchgram showing the absence of reflux



▲ **Fig. 3.** Necropsy specimen showing the normal upper tract

◀ **Fig. 4.** Necropsy specimen showing the adequate serous-lined extramural ileal tunnel. Note that the ureteral catheter can pass easily

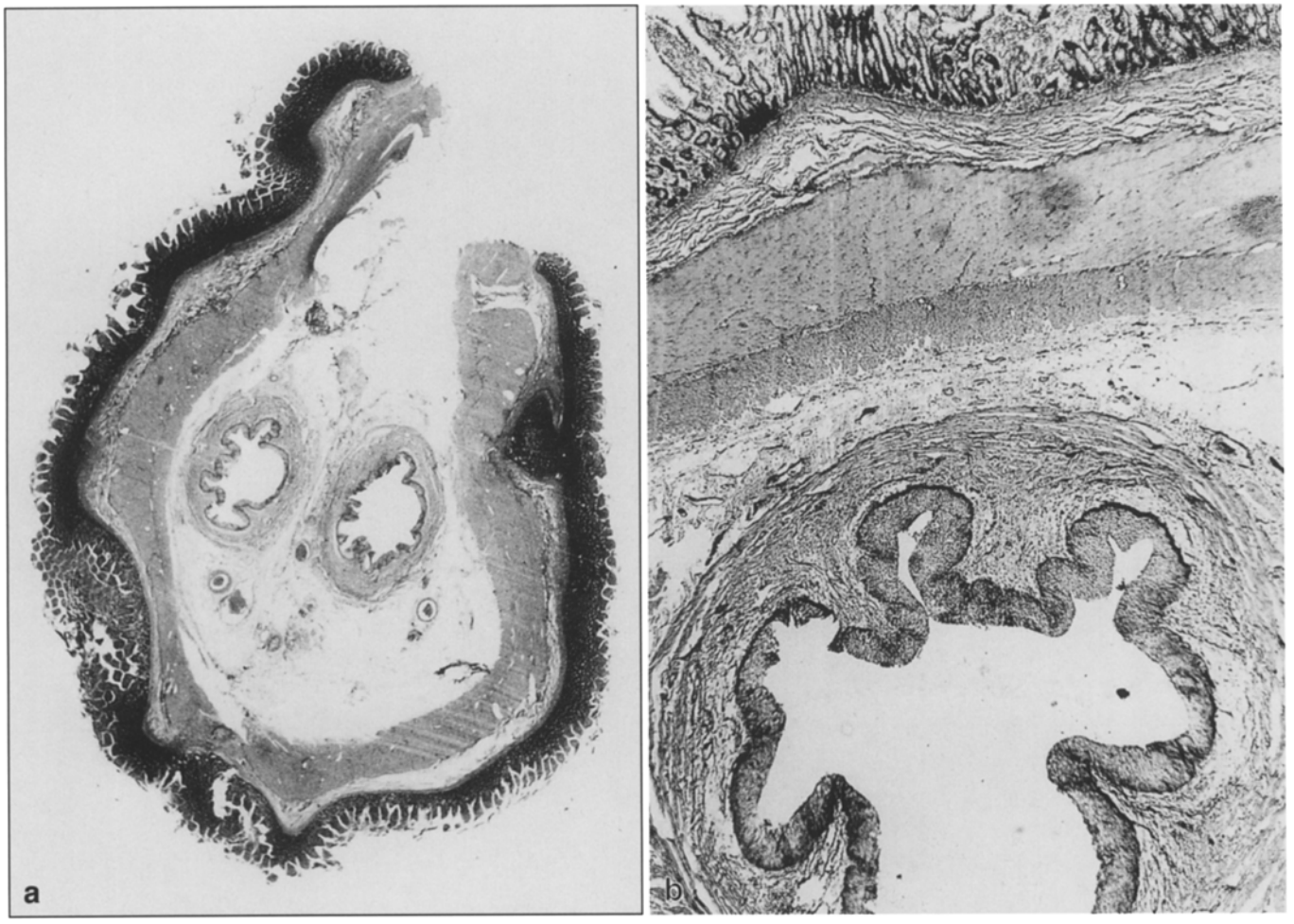


Fig. 5a. Histological examination of a cross section of the tunnel. Note the intact ureteral wall with normal overlying intestinal wall. H&E, ×10. **b** Micrograph of the implantation site. Note the absence of an inflammatory reaction or fibrosis. H&E, ×100

Also, metallic staples are necessary for its stability, which could be a nidus for stone formation [4].

Studer and co-workers proposed the use of a long afferent loop for reflux prevention. On the basis of a controlled study, they maintained that the functional results are comparable to those of an intussuscepted valve [9]. Again, this technique uses an extra 20 cm of bowel. The fate of this segment in the long term is uncertain. Previous experience with replacement of the ureter by ileum indicates that such segments may undergo dilatation and become non-propulsive [8–10].

Creation of mucosal sulcus in which the ureter is embedded as described by Le Duc and associates [6] is an attractive alternative. It is technically simple, staples are not required and a 15–20 cm segment of bowel is spared. However, our clinical experience [7] and experimental data [1] revealed that the complication rate (stenosis and/or reflux) following this procedure is high. Exposure of the ureteral adventitia to urine leads to a periureteral inflammatory response. The creeping of intestinal mucosa to cover the bare ureter is irregular and delayed [2].

The new technique proposed here is simple. Staples are not required. The implanted part of the ureter is covered and protected from exposure to urine. The whole length of the resected ileum is utilized for the creation of the urinary reservoir. Furthermore, the length and cross-sectional diameter of the serous-lined tunnel can be tailored according to the size of the implanted ureter. Thus it is suitable for normal as well as dilated ureters. In view of the excellent functional outcome obtained in our experiments, a clinical trial utilizing this new approach is currently under way.

References

1. Abol-Enein H, El-Baz M, Ghoneim MA (1993) Optimization of uretero-intestinal anastomosis in dogs. I. Evaluation of the Le Duc technique. Urol Res 21:125
2. Abol-Enein H, El-Baz M, Ghoneim MA (1993) Optimization of uretero-intestinal anastomosis in urinary diversion: an experimental study in dogs. II. Influence of exposure to urine on the healing of the ureter and ileum. Urol Res 21:131
3. Ghoneim MA, Shaaban AA, Maharan MR, Kock NG (1992) Further experience with the urethral Kock pouch. J Urol 147:361
4. Ginsberg D, Huffman JL, Lieskouvsky G, Boyd S, Skinner DG (1991) Urinary tract stones: a complication of the Kock pouch continent urinary diversion. J Urol 145:956

5. Kock NG, Ghoneim MA, Lycke KG, Maharan MR (1989) Replacement of the bladder by the urethral Kock pouch: functional results, urodynamic and radiological features. J Urol 141:1111
6. Le Duc A, Camey M, Teillac P (1987) An original anti-reflux uretero-ileal implantation technique: long-term follow up. J Urol 137:1156
7. Shaaban AA, Gaballah MM, El-Diasty TA, Ghoneim MA (1992) Urethral controlled bladder substitution: a comparison between the intussuscepted nipple valve and the technique of Le Duc as anti-reflux procedures. J Urol 148:1156
8. Shokeir AA, Gaballah MA, Ashamallah AA, Ghoneim MA (1991) Optimization of replacement of the ureter by ileum. J Urol 146:306
9. Studer UE, Ackmann D, Casanova GAA, Zingg EJ (1989) Three years' experience with an ileal low pressure bladder substitute. Br J Urol 63:43
10. Tanagho EA (1975) A case against incorporation of bowel segments into the closed urinary system. J Urol 113:796