

Replacement of the Ureter Using the Urinary Bladder*

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Summary. The combination of two well established methods - the bladder-psoas-hitch procedure and the Boari flap - succeeded in replacing 2/3 of the lower ureter. After encouraging results on dogs, we performed this method successfully in one patient.

Key words: Replacement of 2/3 of the ureter, mobilisation of the bladder, bladder-psoas-hitch, boari flap, reimplantation of the ureter with submucosal tunnel, preservation of the ureterovesical junction.

This new method of replacing the lower 2/3 of the ureter combines two well established techniques.

1. The bladder-psoas-hitch procedure and
2. The Boari flap, (Fig. 1).

By using these two methods separately, one can replace up to 12 cm of the lower ureter. We thought that a combination of both would bridge a length of at least 24 cm. The points of interest in this procedure are:

1. Blood supply of the mobilized, hitched bladder and the new ureter (Boari flap),
2. reimplantation of the ureter with a submucosal tunnel,
3. the emptying mechanism of the new system.

Material and Methods

We operated on 13 male dogs, weighing 20-25 kg. After intubation anaesthesia we performed a midline incision from sternum to symphysis passing the penis on the right side. After eventration of the intestine, the right ureter was dissected free from the renal pelvis to the bladder, and the bladder totally mobilized down to the insertion point of the other (left) ureter.

The psoas muscle was freed from fatty tissue proximal to the iliac vessels, and the bladder fixed with 2-0 chromic catgut single sutures onto the psoas muscle. After this a 2-3 cm, wide flap from the anterior wall of the bladder was cut and reflected upwards. A submucosal tunnel 2 cm in length was made and the ureter pulled through, severed and anastomosed with 4-0 chromic single catgut sutures to the submucosa of the Boari flap. Then the flap was formed into a tube and the anterior wall of the bladder closed in two layers using continuous 4-0 chromic catgut sutures. No splints for the ureter and no catheter drainage for the bladder were used. The abdomen was closed in layers without drainage. Antibiotics were given for 8 days.

Results

5 out of 13 dogs were sacrificed after six months. One had an ureteric stenosis resulting in hydronephrosis. All the others had excellent results. As we had not seen an ischaemic or necrotic area, either on the bladder or on the new ureter, the blood supply must have been sufficient. The emptying mechanism was undisturbed. No residual urine was seen. 4 dogs died on the 4-5th postoperative day without any obvious reason. We made X-ray studies at weekly and monthly intervals. In the first postoperative weeks we ob-

* Dedicated to Professor Dr. Wilhelm Brosig, on his 60th birthday, November 27th, 1973.

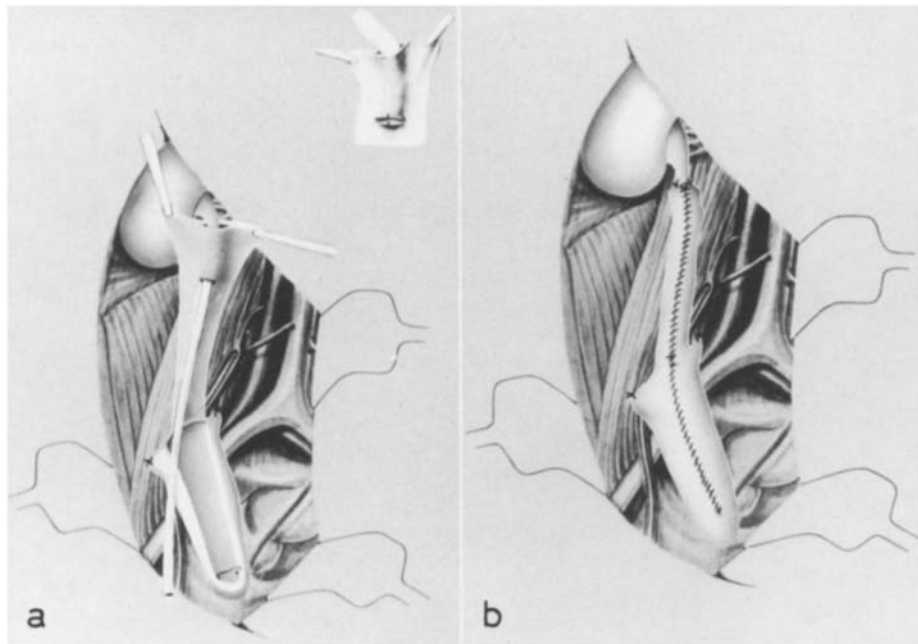


Fig. 1a and b. Replacement of lower 2/3 of the urter: a) Bladder entirely mobilized and hitched onto the psoas muscle. The bladder flap cut from the anterior wall of the bladder and brought up. Submucosal tunnelling of the flap and anastomosis of the ureter (Insert). b) Situation after completion of the anasomosis and closure of the bladder and the Boari flap

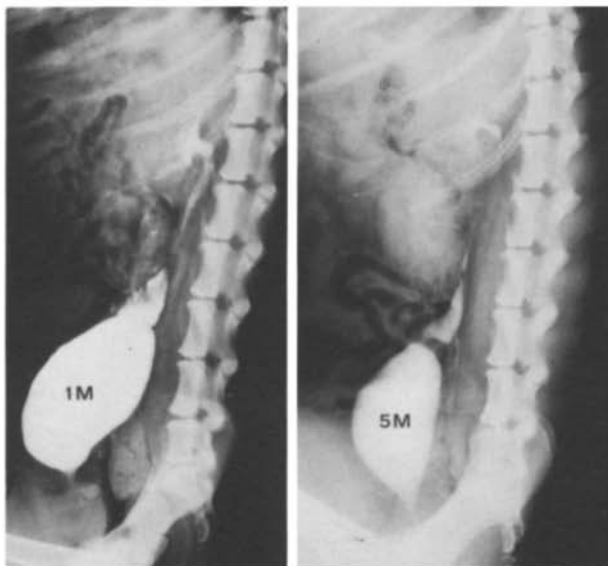


Fig. 2. Excretory urograms on a dog after 1 month and 5 months. A slight dilatation of the operated site in the first weeks subsequently disappears entirely.

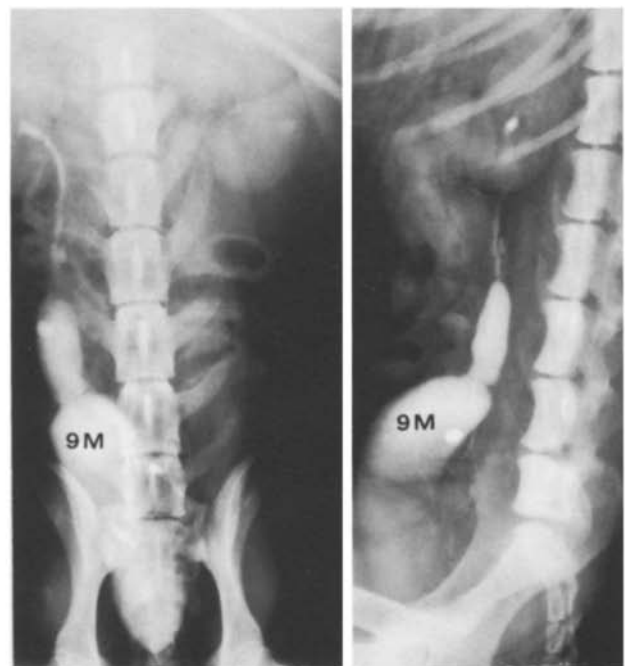


Fig. 3. Excretory urogram 9 months after surgery. Almost equal sized ureters on both sides. One can easily see how much ureter has been replaced

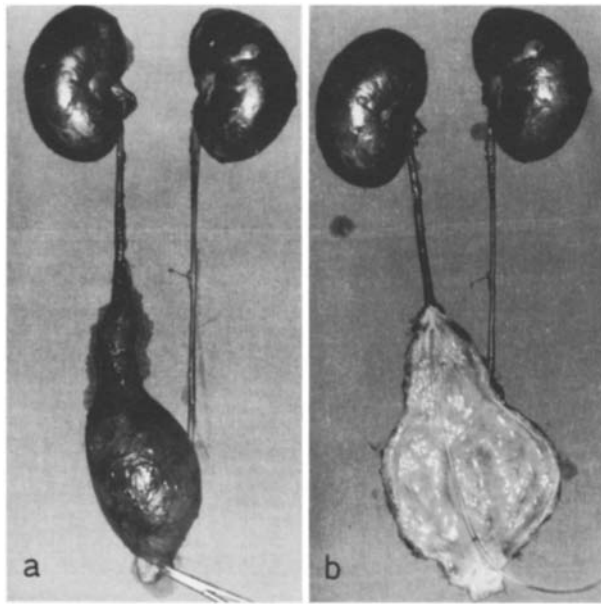


Fig. 4a and b. Gross specimen 6 months after surgery: a) Bladder and Boari flap in closed condition, b) Bladder and Boari flap opened, splint inserted into the new orifice. One can see the submucosal path of the distal ureter clearly

served a moderate dilatation which disappeared entirely after a few months (Fig. 2). No reflux was seen. In Fig. 4, one can see a specimen 6 months after surgery, the distal end of the ureter is seen in the submucosal tunnel of the Boari tube.

Histological examination of those animals which died 4 or 5 days after surgery showed hyperaemia, leukocytic infiltration and early granulation tissue in the Boari flap. Specimens 6 months after surgery showed excellent healing of the ureter in the well vascularized Boari-tube (Fig. 5). We regularly observed metaplastic bone tissue which was localized in the submucosa of the Boari-tube.

4 dogs are living 12 months after surgery and are in good clinical and - as the X-rays show, (Fig. 3) - in good functional condition.

Discussion

The results show that this new method is certainly a simple and effective way to replace the lower 2/3 of the ureter. All different methods - auto- or alloplastic - which have been described previously are more or less complicated and most of them ineffective. Our method uses neither alloplastic material nor intestine. The entire opera-

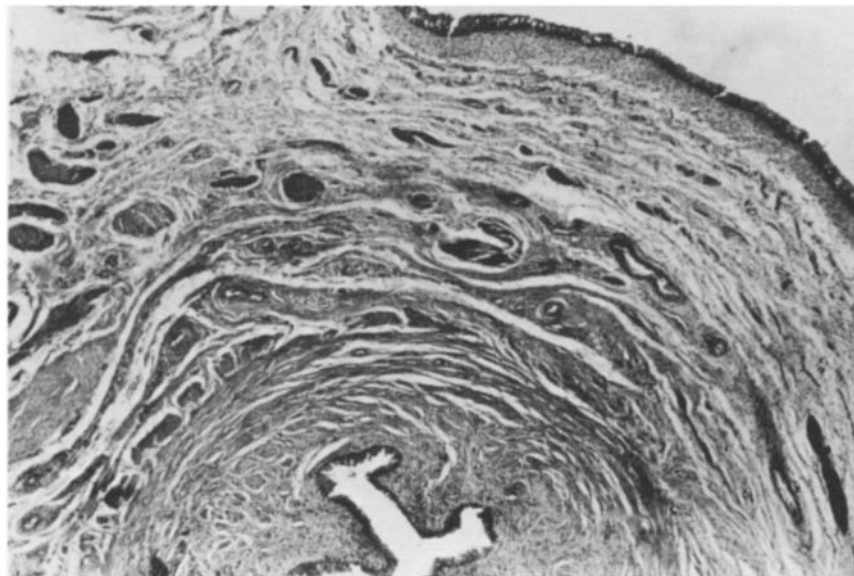


Fig. 5. HE. 2.5X. 6 months postoperative. Cross section of the ureter in the submucosal tunnel of the Boari-tube. Below middle: ureter. Above right: mucosa of the Boari-tube

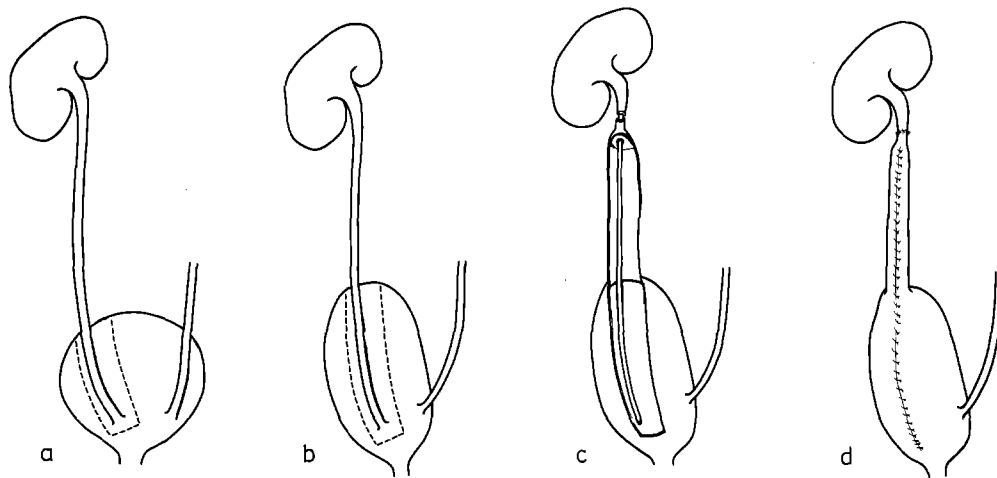


Fig. 6a-d. Replacement of upper 2/3 of the ureter with preservation of uretero-vesical junction: a) Posterior view of non-mobilized bladder with incision line. b) Mobilized and hitched bladder. Note the prolongation of the incision line. c) Bladder flap cut off under preservation of the orifice. d) Bladder flap formed to a tube and bladder closed. Anastomosis of the ureter

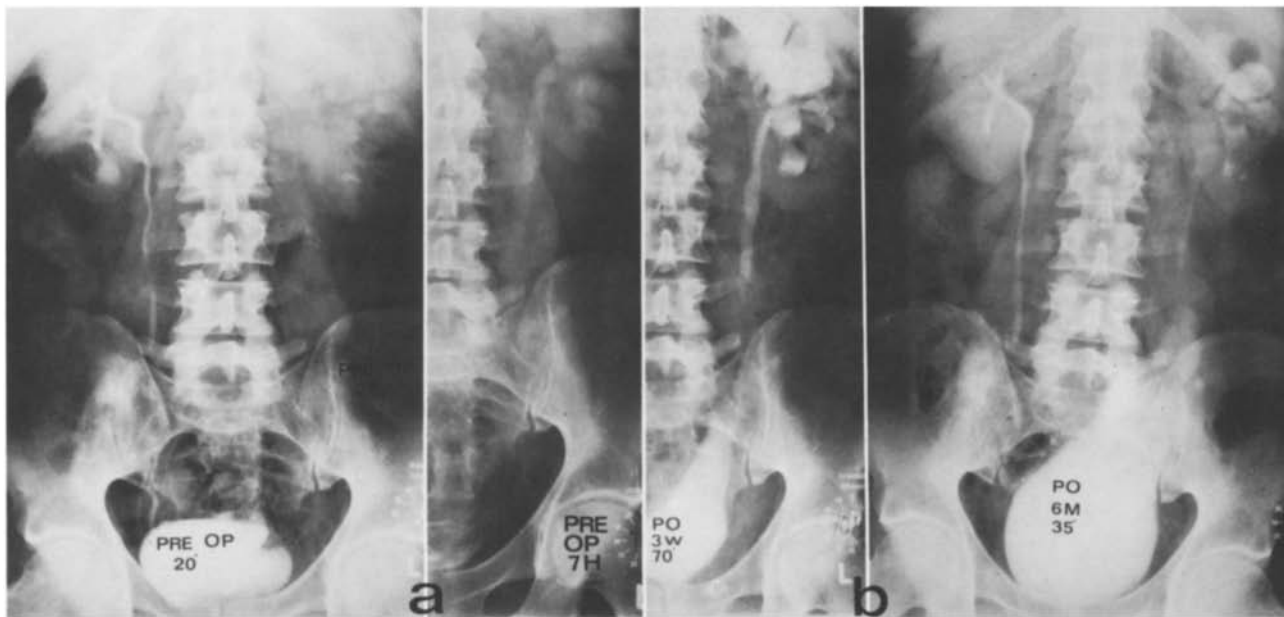


Fig. 7a and b. Case report: a) 36 years old male patient with a ureteric stricture due to genito-urinary tuberculosis. Preoperative urogram shows 20' after injection of contrast medium a delayed secretion on the left side. After 7h one can see the dilated ureter and renal pelvis. The patient had a ureteral stenosis 18 cm in length, at the level of the 4th left vertebra. b) A combined bladder-psoas-hitch and Boari-flap prodedure was performed. Urogram 3 weeks and 6 months after surgery. One can easily see the totally mobilized and hitched bladder (notice the new shape). The slight dilatation after 3 weeks subsequently disappeared entirely

tion can be performed retro-peritoneally in which we see a great advantage. The only organ required is the urinary bladder which should be normal and should have at least a normal capacity. A bladder with supranormal capacity would provide a few more centimetres in length of the Boari tube. Another possibility to gain length is to mobilize the kidney and/or omit the submucosal tunnel.

We have started a new series of experiments in which we are trying to replace the upper 2/3 of the ureter with preservation of the uretero-vesical junction. It also is a combination of two methods:

1. The bladder-psoas-hitch procedure and
2. a bladder flap on the posterior wall including the uretero-vesical junction (2, 3) (Fig. 6).

The early results are encouraging; we will report on these on a later occasion.

Case Report

A 36 year old male patient had a ureteric stenosis on the left side, approximately 18 cm in length, due to tuberculosis. An excretory urogram showed only slight secretion after 7 h. A retrograde ureterogram did not succeed because we could not enter the orifice. Since he was a young man, we decided to try our new method. The operation was performed as described above. X-rays (Fig. 7)

after 6 months showed excellent function after 15 min, thus proving that the replacement of the lower 2/3 of the ureter with our new method was successful.

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