

## Successful Long-Term Implantation of Plastic Prosthesis in the Pelvis of a Transplanted Kidney

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**Summary.** Complications affecting the healing of the ureters of transplanted kidneys may lead to extensive scarring. Since further ureterostomy is rarely practicable, in many cases removal of the graft becomes necessary.

**Methods:** A pyelo-cysto-neostomy was performed around a plastic endoprosthesis.

**Results:** Despite reflux, the hydronephrosis disappeared. After seven months, the endoprosthesis was still in place and was not encrusted. The urine was sterile.

**Conclusion:** The use of modern plastic materials, a low urinary calcium level and low urinary osmolality have made a simple technique feasible for rescuing transplanted kidneys in cases of ureteric scarring.

**Key words:** Kidney-transplantation, urological complications.

Despite better control of the rejection of transplanted kidneys, urological complications are still serious events in these patients. In his comprehensive series, Andersson et al. (1) found that they occurred in 22 - 24% of cases; and in statistics from 10 centres and 1108 transplants, Tallent (2) noted them in 14% with a mortality of 30%.

The urological complications commonly arise in the ureter. Acute lesions are usually treatable to some extent, at least if they can be operated on at an early stage. However, if there is immunological rejection of the ureter combined with extravasation of urine for a long period and secondary infection, in most cases intense scar tissue will take place. The mass of scar tissue situated between the transplanted kidney and the bladder is generally so dense and extensive that dissection of the ureter and its reimplantation into the bladder is successful only in exceptional cases. If, in addition, the upper part of the ureter has become obstructed, nothing else can be done but to remove the graft, which is still functioning well. The following case history describes a possible alternative treatment in such a difficult and serious situation.

On 23rd June 1970 a cadaver kidney was transplanted into the right iliac fossa of a 26 year old man with terminal renal insufficiency. Under immunosuppressive therapy the transplant began to function and the initial post-operative course was

untroubled. Three weeks after the transplantation his daily urine output was 4 200 ml and the serum-creatinine 1.75 mg %. The IVP showed free flow of urine (Fig. 1). Four months later a further IVP demonstrated increasing hydronephrosis and, on tomography, the ureteric outline looked like a string of pearls (Fig. 2).

After a further three months there was an episode of rejection which was controlled by immunosuppressive therapy. However, the strictures in the ureter became increasingly serious, and even-

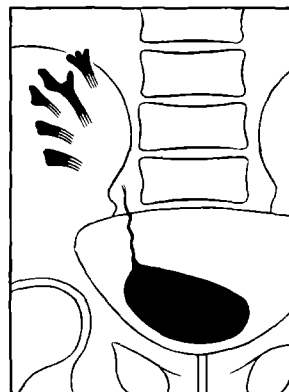


Fig. 1. IVP, 3 weeks after transplantation. (Because of the method of reproduction the most important parts of the X-rays are shown as sketches)

tually the transplanted kidney could be palpated in the right lower abdomen as a tensor mass. Besides the hydronephrosis a large cyst with early calcification of its wall was found in the upper part of the kidney by X-ray examination.

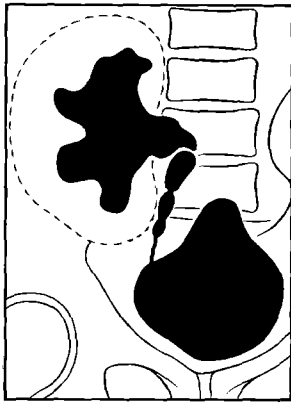


Fig. 2. Pyelographic tomogram 4 months after transplantation. Multiple stenoses affect the ureter: hydronephrosis is commencing

By 24th April 1971 an operation had become essential because the urinary obstruction had become complete. At surgery, an extensive mass of scar tissue was found between the kidney and bladder wall incorporating the renal and iliac vessels and the distal part of the renal pelvis. The ureter was entirely obliterated except for a short proximal segment.

In this difficult situation, the distal part of the renal pelvis was freed from the vessels by sharp dissection and the urinary bladder (Fig. 3) was mobilized. A fresh pyelo-cystostomy could then be

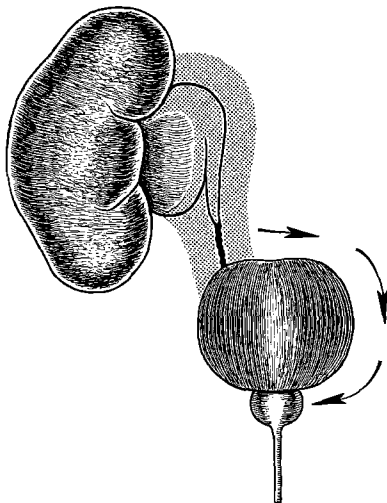


Fig. 3. Anatomical sketch showing the preoperative situation of hydronephrosis and obliteration of the distal ureter. The extent of the scar tissue is indicated by shading. Mobilisation of the urinary bladder

formed without tension. The procedure which followed the method of Turner-Warwick is shown in Fig. 4. The anastomosis was splinted with a disposable catheter 10 Fr (Fig. 5). The urinary bladder was drained by a further catheter for one week.

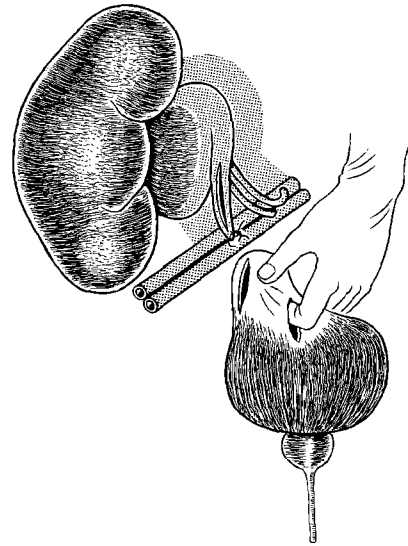


Fig. 4. Technique of pyelo-cystostomy

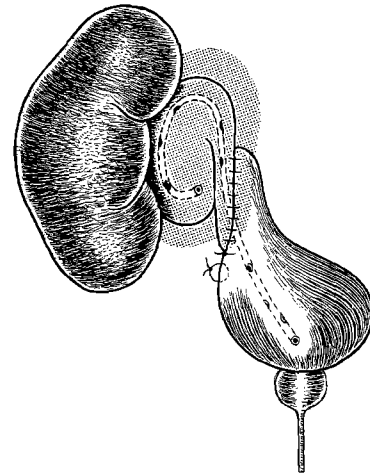


Fig. 5. Completion of anastomosis with splint in situ

### Results

The anastomosis healed slowly because of the poor blood supply to the edges of the incision which were already scarred. Fourteen days after the operation an IVP showed diminution of the hydronephrosis and the pararenal uriniferous cyst (Fig. 6). The anastomosis finally healed since the splint guaranteed good urinary flow.

Subsequently, several attempts were made to remove the splint, but this was always followed by

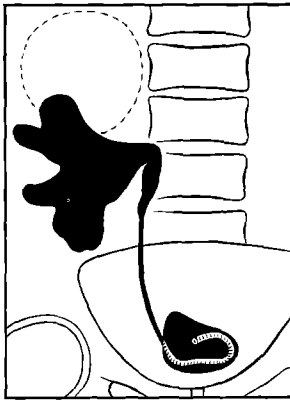


Fig. 6. IVP, 2 weeks after reoperation. Hydronephrosis is diminishing. There is a pararenal urinary cyst with calcified walls (---), and incomplete filling of the bladder with contrast medium

oedema, an increase in the BUN and serum creatinine and finally in oliguria. These episodes were considered to be due to a valve mechanism. The anatomical difficulties made it impossible to risk another operation, so the only remaining possibility was to leave the catheter in situ as an endoprosthesis for as long as possible.

Further healing was surprisingly good. Except for micro-haematuria which occurred after long walks, the patient had no subjective complaints, his urine remained sterile and kidney function was good. Despite the vesico-pelvic reflux caused by the splint both the pyelectasia and the pararenal urinary cyst continued to shrink.

The catheter, which was not fixed, developed a slightly rolled end in the renal pelvis, but it did not move despite the normal physical activities of the patient. The catheter was left in place for increasingly long periods since it did not become encrusted with urinary salts and its material remained

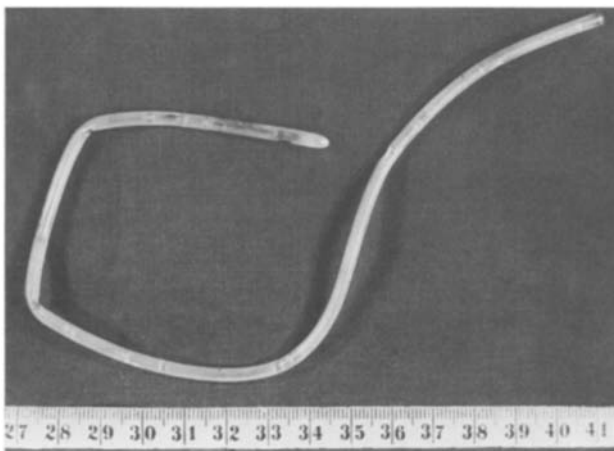


Fig. 7. Endoprosthesis (disposable catheter) after 7 months in the urinary tract. No encrustation has occurred

flexible. Although the splint was changed every 4 weeks at first, by Young's forceps, technical difficulties made it necessary to leave it for longer periods. The last endoprosthesis was finally removed after it had been in place for more than 7 months. It was changed then only so that the catheter could be examined. Even after this long period, the material had retained its elasticity and was free from encrustations (Fig. 7).

Clinically, the patient feels so well that he has become a truck driver. His blood chemistry is normal, except for a small increase in serum creatinine to 2.1 mg%. An IVP done on 14th March 1972 i.e. 21 months after transplantation showed only slight dilatation of the renal pelvis and calices (Fig. 8). The urine was sterile.

When his bladder was filled with 350 ml of contrast medium, which produced a strong urge to micturate, no reflux was observed (Fig. 9). During micturition, too, there was only a moderate reflux of contrast medium into renal pelvis (Fig. 10).

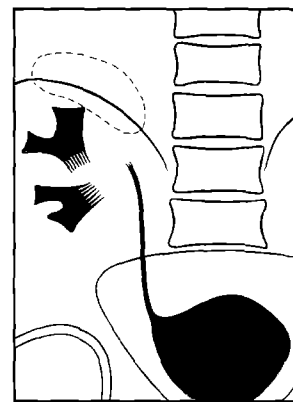


Fig. 8. IVP, 11 months after reoperation, i.e. 21 months after renal transplantation. The hydronephrosis has almost disappeared, and so has the pararenal urinary cyst. Incomplete filling of the bladder with contrast medium. The splint is simulating a ureter

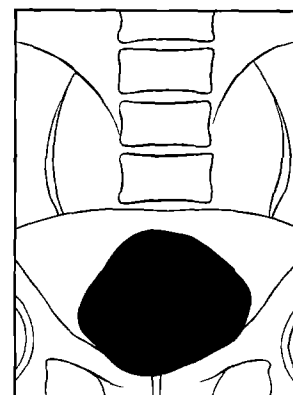


Fig. 9. No reflux via the splint despite complete filling of the bladder

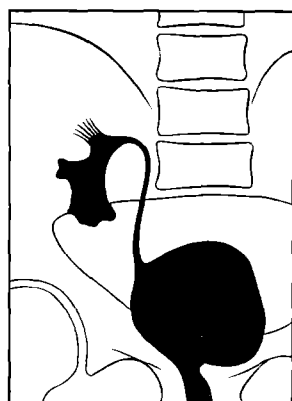


Fig. 10. Reflux during micturition

### Discussion

As shown in Fig. 2 the causes of the urological complications in this case were not an unsatisfactory initial operation but rather an isolated rejection of the ureter, which already had an inadequate blood supply.

A previous attempt to overcome ureteric obstruction by an endoprosthesis had already been made by Truss<sup>1</sup> several years ago when, in uraemic patients with ureteric obstruction and a single kidney, he inserted a plastic (PVC)-bypass from the dilated ureter to the bladder. By the means the disadvantage of temporary nephrostomy could be avoided. The PVC-tubes used became hard and brittle, however, and were obstructed by four weeks after the operation by encrustation with urinary salts. Therefore, despite its theoretical advantages this procedure had to be abandoned.

The dynamics of the urinary tract and ureteric peristalsis are further reasons against long term insertion of an endoprosthesis. If the ureter still exhibits peristalsis it will try to expel the foreign body, and, a rigid tube fixed between the ureter and the bladder affects urinary dynamics in such an unfavourable manner, that hydronephrosis and hydronephrosis will develop sooner or later.

In the present case of a transplanted kidney, other and more favourable conditions must have ensued after the pyelo-cystostomy. The importance of the physico-chemical form of the foreign material for the prosthesis used cannot be underestimated. The disposable catheters used on this occasion were also made of polyvinylchloride, but this time with a plasticiser based on olefine. The olefine base contained no heavy metal ions which would tend to promote the deposition of urinary salts. A certain sediment-repelling effect was obtained by a slight admixture of chlorophyll dyes.

It was not only the nature of the plastic catheter used that kept it free from encrustation for seven months. Another most important factor was control of urinary osmolarity. The patient was urged to take a large amount of liquid every day, and his urine output was never less than 2 l/24h. Further, as transplantation itself usually causes some residual renal damage, the average 24h urinary excretion of electrolytes was significantly reduced (Table 1), most notably of calcium. Urine osmolarity

Table 1. 24 h urinary electrolyte excretion of the graft compared with normal values

	Normal values	Patient mEq/l
Na	180	84
K	100	45
Ca	10	1.4

ty was also reduced. During a normal day the values were 190 mosm/l (specific gravity about 1005).

After a 12 h nocturnal period of thirst it only increased to 495 mosm/l (spec. grav. 1015) (Table 2). Thus, the conditions were not favourable for encrustation of a foreign body with urinary salts.

Table 2. Comparison of urinary osmolarity and specific gravity

mosm/l	Specific gravity
200	1006
400	1012
600	1018
800	1024
1000	1030
1200	1036

From this case it appears that an endoprosthesis may not be dislodged by peristalsis if the ureter is absent. In addition, retention of the prosthesis is favoured by thickening of the wall of the dilated renal pelvis as it no longer possesses much motility.

Three additional observations seem noteworthy. First, that the urine remained sterile despite the chronic irritation and mechanical injury to the mucosa caused by the foreign body as well as the immunosuppressive therapy. Second, the mechanically immobile connection between the urinary

<sup>1</sup> unpublished

bladder and renal pelvis did not disturb the urodynamics. Lastly, the hydronephrotic dilatation of the renal pelvis did not increase but actually decreased even though some urinary reflux persisted.

The first observation emphasizes the well-known fact that high urinary flow and low urinary osmolality are most effective in preventing urinary tract infections.

The second point stresses the important part that any remaining segments of the ureter play in cases of alloplastic substitution of this organ.

The third observation, i.e. the regression of hydronephrosis despite persistent reflux, illustrates some of the relationships which exist between the mechanisms of reflux and the development of hydronephrosis. The important observation is that urine can return from renal pelvis to the urinary bladder immediately after micturition. It shows how correct urological surgeons are when they refuse to operate on cases of reflux unless the urine is retained in the renal pelvis for 3 minutes. The results of cystography make it likely that the splint enters the bladder wall in such a way that neither low-pressure nor high-pressure reflux were able to occur. Only during micturition was there a transitory vesico-pelvic reflux.

In conclusion, both final state of the patient as well as theoretical considerations imply that the good clinical results achieved can not be regarded as accidental. The purpose of this report is to draw attention to a method of treatment which is simpler and more promising than anything described previously in the literature.

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