Urol. Res. 9, 181-185 (1981)

Urological Research

Ureteric Displacement into a Silicone Cover as Protection from an Induced Retroperitoneal Fibrosis: A Preliminary Report of Experiments in Rats

L. V. Wagenknecht, H. M. Langendorff and H. Schäfer

Departments of Urology, Traumatology and Pathology, University of Hamburg, Hamburg, Federal Republic of Germany

Accepted: November 13, 1980

Summary. At present, the "therapy of choice" for patients presenting retroperitoneal fibrosis is ureterolysis with intraperitoneal transposition. This procedure, however, leaves the upper and lower part of the ureter vulnerable to recurrent fibrotic stricture since these portions still remain within the retroperitoneal space. In order to protect the ureter in its entire length from aggressive fibrosis an alloplastic cover might offer a better alternative. Following experimental induction of retroperitoneal fibrosis by phenol-mandelic acid in rats the entire ureter was displaced into a silicone envelope. Under the operating microscope the silicone sheath was closed around the renal pedicle by separate sutures of 8-0 prolene. The upper and lateral sealing of this pouch was done by continuous sutres and the lower opening of this silicone envelope was fixed to the bladder wall.

Progressive retroperitoneal fibrosis caused anterior displacement of the silicone pouch but neither a fibrotic infiltration into this cover nor ureteral stenosis was noted.

Histological investigation of these animals in comparison with the control group showed effective protection by the silicone cover. Long-term results of experiments in larger animals will show whether this procedure might be applied clinically.

Key words: Experimental urology, Renal insufficiency, Retroperitoneal fibrosis, Silicone.

INTRODUCTION

Retroperitoneal fibrosis (RPF) is an uncommon disease, the aetiology of which is variable. It leads to medial and anterior displacement and stricture of the ureters mainly between L4 and S1, which in turn results in hydronephrosis and eventually renal insufficiency (3). At present, the "therapy of choice" for these patients is ureterolysis with intraperitoneal transposition of the ureters. This procedure, however, leaves the upper and lower part of the ureter vulnerable to recurrent fibrotic stricture of the ureter since these portions still remain within the retroperitoneal space (Fig. 1). In a retrospective analysis of 430 cases from west Europe a recurrence rate of 22% was found following ureterolysis and laterocolic ureteric displacement (3). Other surgical techniques have a higher recurrence rate (3). In order to protect the ureters from an aggressive retroperitoneal fibrosis, transposition of the entire urinary tract into a silicone envelope might offer an effective alternative.

MATERIAL AND METHODS

A total of 45 mature Wistar rats weighing 250 to 300 g were used. In a first group of 30 rats retroperitoneal fibrosis was induced by 5 mg phenol-mandelic acid contained in pellets of paraffin (1 mg). Under an operating microscope (OP-Mi 7, Zeiss Comp. / FRG) the pellets were placed retroperitoneally next to the left ureter while the right side remained intact. IVPs were done 4 weeks to 6 months after surgery. In a second group of 15 rats the left ureter and kidney were mobilised under an operating microscope. The ureter may be completely enveloped without circulatory disturbance because of the nutritional vessels arising from the kidney and bladder. A silicone sheath of 0.1 mm thickness was used to completely envelop the left side of the urinary tract. A hood was formed before the operation and slid over the kidney. The silicone sheath was wrapped around the ureter and closed off laterally

0300-5623/81/0009/0181/$ 01.00

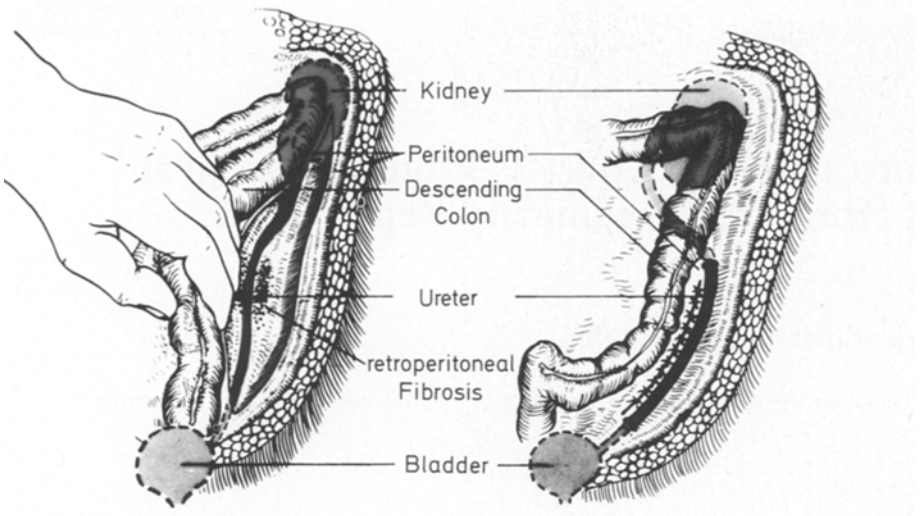

Fig. 1. Ureterolysis and lateral ureteric displacement for retroperitoneal fibrosis

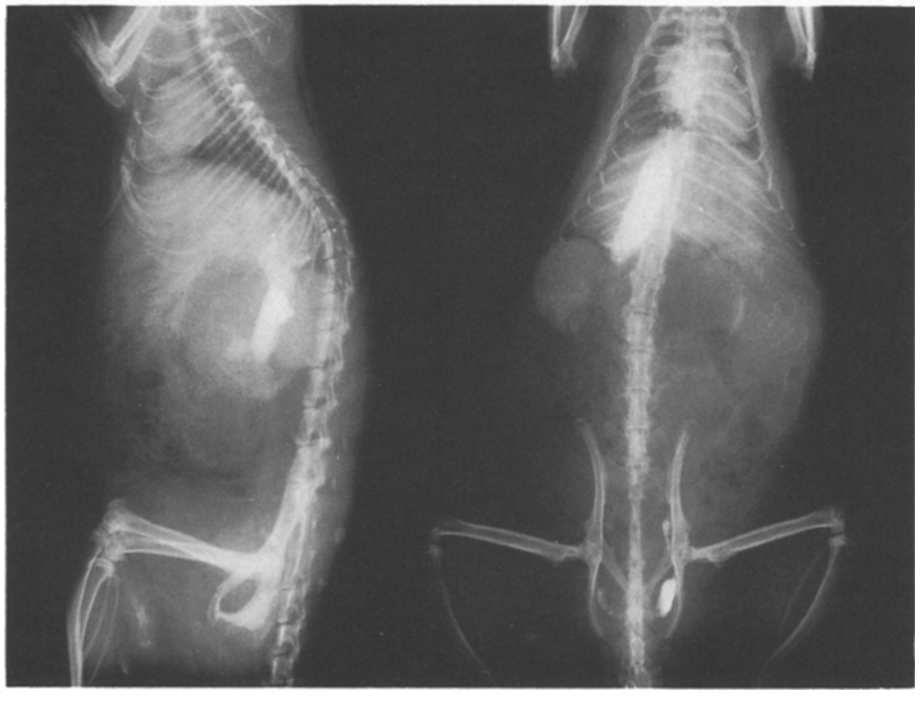

Fig. 2. IVP of a rat 4 month after left-sided induction of retroperitoneal fibrosis shows hydronephrosis on the left and normal renal function on the right side (lateral view on the left; a-p projection on the right side)

by separate sutures 8-0 prolene. Care was taken to ensure that the renal pedicle was not constricted. The silicone sack was sutured to the bladder around the insertion of the left ureter with 8-0 prolene. The phenol pellet was then placed behind the silicone pouch. IVPs were done 4 weeks to 6 months after the operation. All 45 animals were sacrificed 5 to 6 months after surgery.

RESULTS

1. Induction of Retroperitoneal Fibrosis

IVP controls of the first 30 rats 4 weeks to 6 months after surgery showed progressive displacement of the left ureter and hydronephrosis while the right side functioned normally in 26 out of 30 rats (Fig. 2). In 4 animals the fibrosis had crossed the midline and involved the right ureter also; these rats showed massive eventration on the left flanc caused by the hydronephrosis and a fibrotic mass (Fig. 3).

Autopsy confirmed the radiological finding. Microscopic examination demonstrated an irregularly structured scar. The retroperitoneal fat was transformed into granulation tissue containing foreign body cells and an inflammatory infiltrate. The paraffin carrier substance of the pellet was split up and appeared microscopically as swiss cheese-like vacuoles (Fig. 4).

Granulocytes and lymphocytes were found within the sclerotic mass. This inflammatory

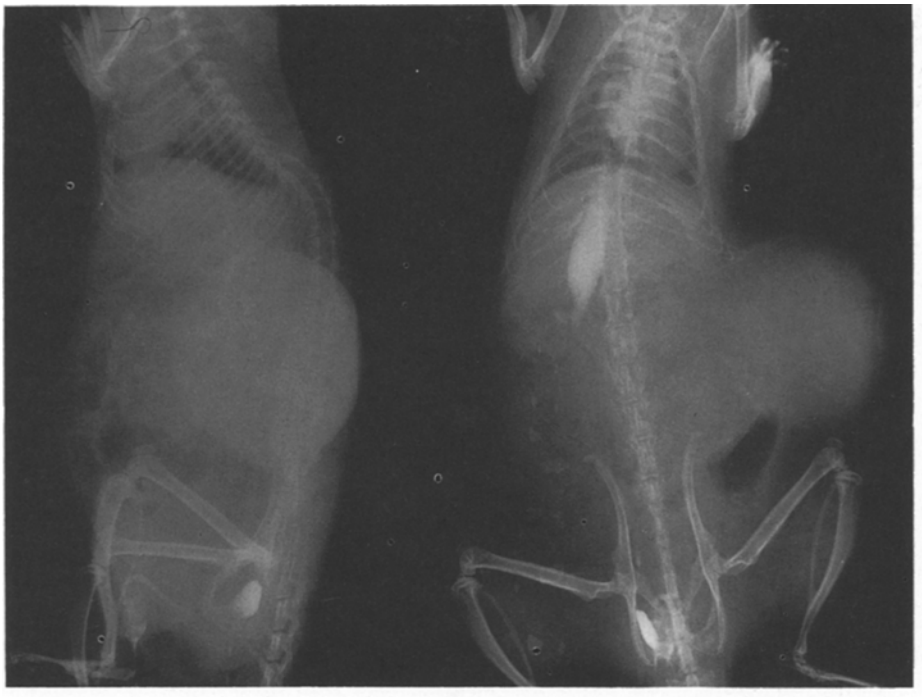

Fig. 3. IVP 6 months after left-sides induction of RPF showing an eventrated hydronephrosis on the left and a moderately dilated kidney on the right side (see text)

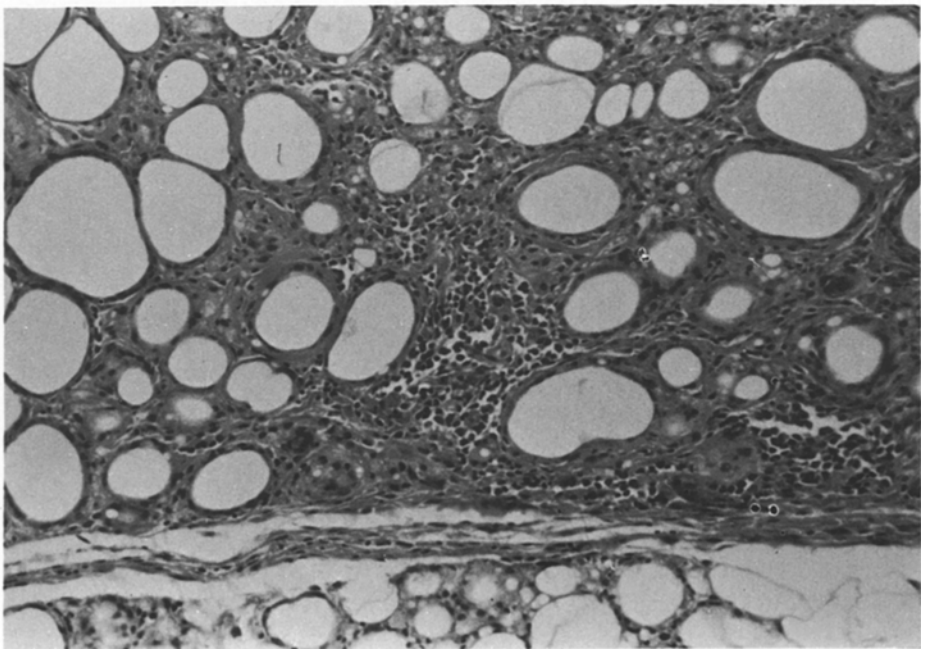

Fig. 4. Inflammatory scar tissue around fractions of paraffin (white vacuoles)

reaction extended into the wall of the ureter and lead to its thickening, fibrosis and to obliteration of its lumen. Marked hydronephrosis was confirmed microscopically by finding a distended pyelo-caliceal system and by a severe reduction of the functioning renal parenchyma. The tubules became obstructed or showed cystic enlargement.

2. Protection of the Urinary System

Following transposition of the left urinary tract into a silicone envelope, X-ray controls showed lateralisation of the renal axis on the left but otherwise normal excretion. On lateral X-ray exposures an anterior displacement of the left

ureter was noted (Fig. 5). In 2 out of 15 animals the bladder fixation of the silicone pouch was torn and showed some fibrous tissue infiltration. Microscopic examination of the content of this silicone envelope showed normal retroperitoneal fat with a minor inflammatory reaction and a normal ureter. The renal parenchyma was entirely normal. Behind the silicone sheath induction of fibrosis and inflammatory granulation was seen as in the first group of animals.

DISCUSSION

In a pilot study in rats prior to this investigation various percentages of phenol-mandelic acid and ethoxysclerole, contained in carrier substances of yeast or paraffin were tried out. In addition Alpha-Chemotrypsin was added to increase diffusion of the sclerosing substances. Five mg of phenol-mandelic acid contained in 1 mg pellets of paraffin and placed into the retroperitoneum proved to be the most reliable inductor of fibrosis. Yeast pellets (with and without Alpha-Chymotrypsin), were too quickly dissolved leading to intestinal necrosis by the sclerosing substance. Retroperitoneal placement of paraffin pellets containing 10 mg phenol-mandelic acid induced phenol poisoning and early death within days, or extensive granulation tissue around both ureters and the intestine causing death from uraemia within some weeks.

An induction of local fibrosis with phenol-mandelic acid or ethoxysclerole is used clinically for obliteration of haemorrhoids or varicose veins. "Vaso-active" substances like Serotonin were injected in animals to induce retroperitoneal fibrosis. These experiments were only successful when the substance was directly injected into the retroperitoneal space (3). Following subcutaneous and intraperitoneal application of methysergide in rats and rabbits, Alberti and coworkers (1, 2) induced histological changes similar to those seen in RPF from ergot-derivates in man. After 110 days IVPs showed typical medial displacement of the lumbar ureters and extensive pyelorenal dilation. These results were never reproducible, although higher doses of methysergide were given for longer periods in many other animals. It was assumed that a possible direct retroperitoneal injection of methysergide might explain the results of Alberti as an expression of a non-specific foreign-body granulation (3).

The progressive retroperitoneal fibrosis in the present experiments was also induced locally by phenol-mandelic acid pellets. In this experimental model and in the human disease the basic pathogenetic process is fibrosis, which primarily occurs in the paraureteric tissue and which only secondarily involves the ureter itself producing fatal ureteric stenosis.

The present investigation revealed that during experimental retroperitoneal fibrosis a simple

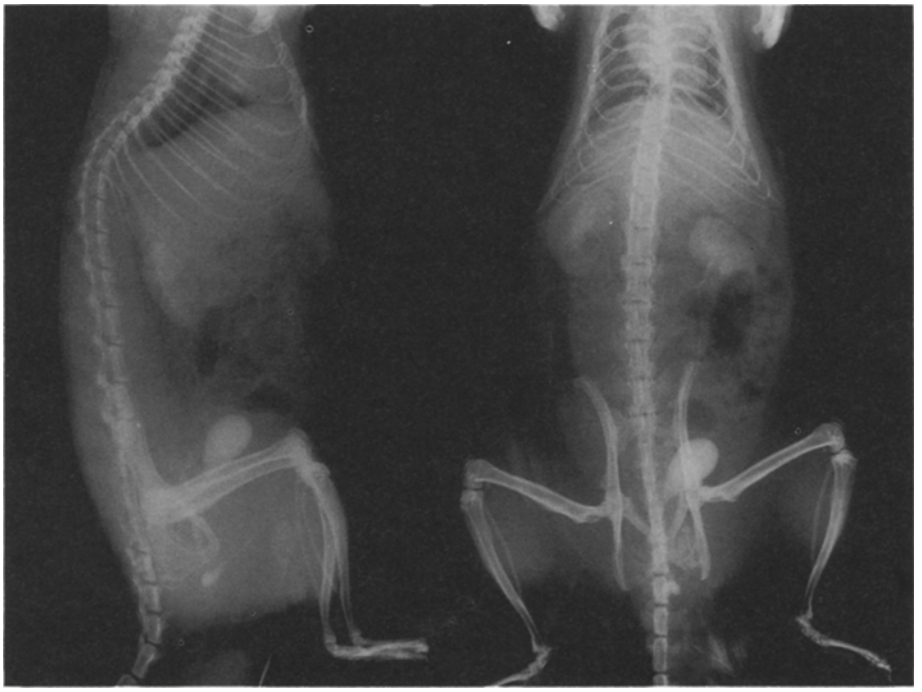

Fig. 5. IVP of a rat 6 months after ureteric displacement on the left side into a silicone envelope and subsequent induction of retroperitoneal fibrosis showing protection of the urinary tract from stenosis and hydronephrosis

silicone envolope around the urinary system prevented the fibrotic infiltration and protected the ureter from fibrosis and resulting ureteric stenosis. Although displacement of the ureters persisted, this had no functional relevance. Recurrent fibrotic stricture of the ureter after operation is a difficult clinical problem in the treatment of retroperitoneal fibrosis. Our findings suggest that the enveloping technique may represent a new therapeutic approach. Long-term studies in larger animals, however, have first to confirm that the procedure might be of clinical value.

REFERENCES

1. Alberti, C., Macaluso, G., Bocchi, R., Potenzoni, D.: Contributo sperimentale allo studio delle periureteriti da farmaci (nota preliminare). Ateneo parmense. Sezione 1. Acta Bio-Medica 39, 343 (1968)
2. Alberti, C., Piacentini, L., Cortellini, P.: In tema di patologia pieloureterale da medicamenti, Elaborazione statistica dei resultati delle nostre ricerche sperimentali. Rass. Urol. Nephrol 6, 133 (1968)
3. Wagenknecht, L.V., Hardy, J.C.: Retroperitoneale Fibrosen. Stuttgart: Thieme 1978

Prof. L.V. Wagenknecht
Department of Urology
University of Hamburg
Martinistraße 52
D-2000 Hamburg 20
Federal Republic of Germany