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Bladder Tube Urinary Diversion

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Abstract. The advantages of bladder tube urinary diversion were outweighed by the complications of tube encrustation, ulceration and upper urinary tract dilatation when this operation was performed in dogs. Bowel conduit urinary diversion in dogs did not have these complications to the same extent. The operative procedure rather than the dog model was felt to be responsible for the poor results with bladder tube urinary diversion.

Key words: Urinary diversion, experimental bladder tube

Introduction

The complications following ureteroileocutaneous diversion have prompted the evaluation of other methods of urinary diversion. Trigonal-ileal (1), cutaneous vesicostomy (2) and bladder tube (3) diversions have been reported.

This study evaluates bladder tube urinary diversion performed in dogs.

Method

Fifteen mongrel dogs weighing from 12 to 20 kg were anesthetized by intravenous pentobarbital (1 gr per lb.) and an intravenous pyelogram (IVP), blood urea nitrogen (Bun) and serum creatinine examinations performed. The bladder was exposed by a midline abdominal incision and urine aspirated for culture. The bladder neck was dissected and freed by ligation and division of the proximal urethra. The anterior bladder wall was excised and the posterior bladder wall was fashioned into a tube to include the trigone and mobilized bladder neck. The bladder tube was brought to the right lower quadrant of the dog and a stoma formed from its distal end. The abdominal incision was closed in layers.

Residual urine and urine culture of the bladder tube, Bun and serum creatinine were performed at monthly intervals and at sacrifice (3 months) IVP, conduitogram and cultures were taken of homogenized renal cortex. Histopathological examination was made of the bladder tube, ureters and kidneys.

Results

Six of the 15 dogs died during the course of the study. Autopsy revealed 2 dogs with a normal bladder tube and upper urinary tracts (died at 1 and 2 months postop), 2 with the bladder tube full of encrustation and bilateral hydroureter and hydronephrosis (both died at 2 months postop), 1 with a necrotic bladder tube (died at 2 weeks postop) and 1 with a leak at the base of the tube which contained encrustation (died at 3 weeks postop).

Of the 9 surviving dogs only 2 had normal IVP's (Fig. 1) and normal bladder tubes and upper tracts at autopsy. Five dogs developed thick debris which encrusted the entire length of the bladder tube. Dilatation of the upper urinary tracts was seen on IVP (Fig. 2) and at autopsy in these 5 dogs. The remaining 2 surviving dogs developed stomal stenosis with high residual urine and hydroureter and hydronephrosis.

Conduitograms revealed no reflux in 7 dogs. One dog showed unilateral reflux throughout the study. One dog with a normal appearing bladder tube developed bilateral reflux at 3 months. None of the dogs with encrusted tubes refluxed. (Fig. 3)

Of the 13 bladder tube cultures done at 1 month, 11 demonstrated significant growth (100 000 col/ml). At 2 months 8 of 10 tube cultures revealed significant growth. At 3 months 7 of 9 tubes had significant growth. Of the 9 sets of kidneys homogenized and cultures at autopsy, none of the 18 cultures demonstrated significant growth.

The Bun and serum creatinine were not elevated in any of the 9 dogs during the period of

Fig. 1. (A) Dog 2765. Preoperative IVP showing normal upper tracts. (B) Postoperative IVP at 3 months in Dog 2765 demonstrating normal upper urinary tracts

the study; not even in the 7 dogs with upper tract dilatation.

Histopathological examination revealed normal bladder tubes and upper tracts in only 2 of the 9 surviving dogs.

The remaining 7 dogs showed bladder tube encrustation with necrotic debris and varying degrees of ulceration and underlying inflammatory reaction in the wall of the bladder tube. The upper urinary tracts of these 7 dogs revealed hydroureter and hydronephrosis.

The ureters were grossly and microscopically dilated with varying amounts of submucosal inflammation. The normal stellate configuration was lost to a circular one and the transitional epithelium was generally flattened and occasionally showed ulceration in the lower portions of the ureter. The kidneys demonstrated markedly dilated tubules and some tubular atrophy. Pyelitis was found in those dogs with bladder tube encrustatation. The glomeruli were normal.

Fig. 2. Postoperative IVP at 2 months showing dilation of the upper urinary tracts

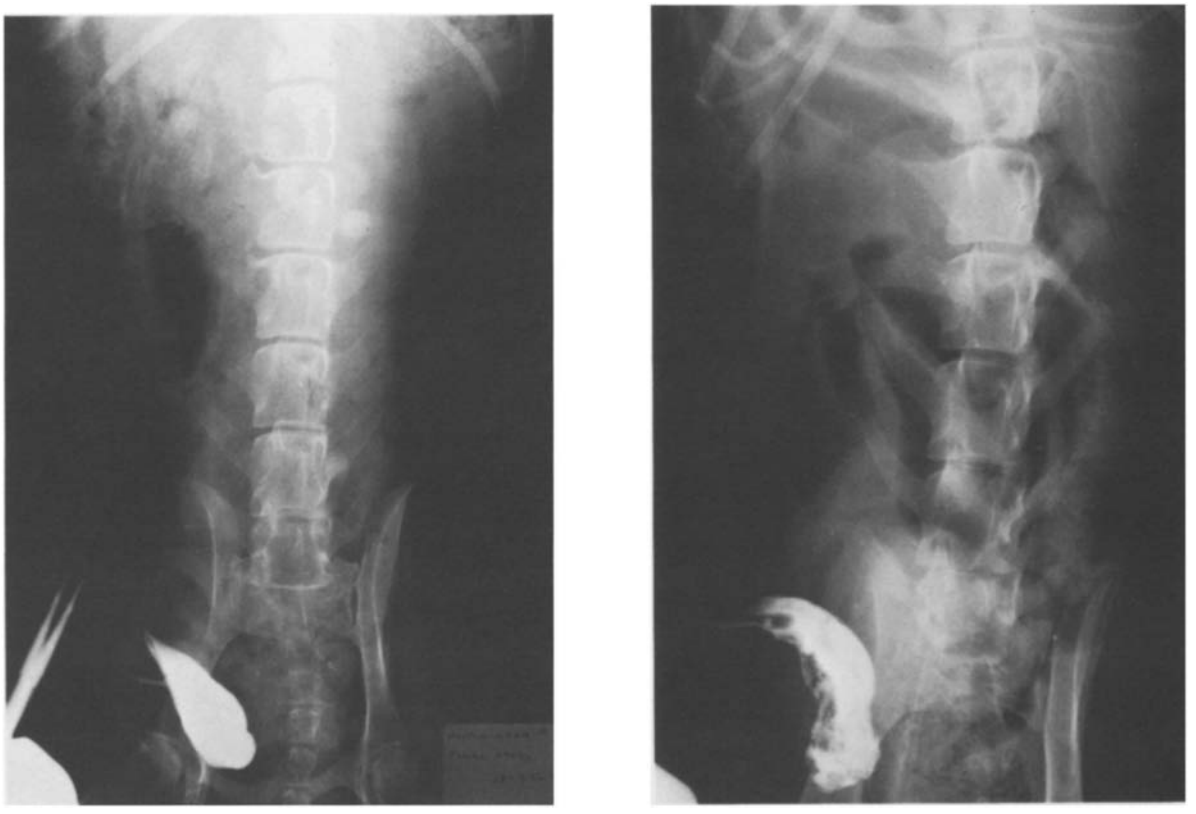

Fig. 3. (A) Conduitogram at 3 months post surgery in Dog 2765 showing a normal bladder tube with no ureteral reflux. (B) Conduitogram in Dog 2922 at 3 months post surgery revealing encrustation in bladder tube with no ureteral reflux

Discussion

The advantages of using a bladder tube which included the intact trigone as a method of urinary diversion are the preservation of the ureterovesical valve and the use of the bladder wall for the conduit and stoma. Preservation of the ureterovesical valve should prevent reflux of conduit urine, which is usually infected, into the upper urinary tracts. Bladder mucosa does not allow the absorption of urinary constituents and thus is ideally suited for a urinary conduit.

However, bladder tube urinary diversions in dogs did not give satisfactory results. Nine (69%) of the 13 dogs surviving more than 1 month developed bladder tube encrustation with ulceration and dilation of the upper urinary tracts. Ureteral reflux was present in only 3 of the 18 renal units indicating that the ureterovesical valve was intact in most of the dogs. The obstructive effect of the tube encrustations and the ulcerations and inflammatory reaction in the bladder wall was thought to be responsible for the upper tract dilatation.

A similar type of experiment in dogs using a bowel segment as the conduit gave opposite results (4). In 17 dogs 8 small bowel conduits and 9 large bowel conduits were performed and followed for 3 months.

No encrustation of the conduit occurred during this period and generally normal small or large bowel histology was seen at autopsy at the end of the 3 months. Subsequent dilatation of the upper urinary tracts was seen at 3 months in only 31% of small bowel conduits and 33% of the large bowel conduits.

A bladder tube urinary diversion has been performed in man (3). Schlegel fashioned a tube from the trigone to the bladder neck area with excision of any excessive bladder. After the tube was constructed, a dacron aortic graft was placed over the tube for support in preventing dilatation of the tube. Long term results have shown four of the five cases needed to be revised because of stone formation around the dacron graft. Schlegel no longer used the graft for support and only performs the procedure in patients with hypertonic bladders (5).

The bladder tube urinary diversion in man and in dogs has not been satisfactory, whereas the intestinal loop urinary diversions in dogs were satisfactory. It appears that it was the operative procedure rather than the dog model which was responsible for the poor results with this type of urinary diversion.

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