Segmental replacement of the left ureter using a pedicled and tapered gastric flap in dogs

Preliminary report

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Abstract. Segmental replacement of the left ureter was done using a pedicled and tapered gastric flap in ten dogs. All were followed up for 12 weeks. The results of the operation were good. Serum electrolyte imbalance was not observed in any dog. Intravenous pyelograms were normal except in one animal that had mild calyceal dilatation. Postoperative values of blood urea nitrogen (BUN) and creatinine were normal when compared with preoperative values. Pathologic examinations of the left kidney, left ureter, and gastric ureter of the dogs were normal. We believe that incorporating a pedicled and tapered gastric flap into the urinary tract to bridge a ureteral defect is a new, safe, and effective clinical alternative.

Key words: Ureteral replacement- Ureter- Flap- Stomach

Introduction

Frequently pediatric surgeons or urologists are confronted with the problem of effective ureteral continuity after trauma, chronic inflammation, neoplasia, primary neuromuscular disorders, retroperitoneal fibrosis, and radiation [2, 7]. Continuity of the urinary tract can be re-established by a variety of techniques including ureteroureteral anastomosis, reimplantation of the ureter into the bladder, psoas bladder hitch, Boari bladder flap, transureteroureterostomy, or autotransplantation of the kidney into the groin [1, 2, 4, 5]. Additionally, vein grafts, synthetic grafts, collagen sponge tube grafts, peritoneum, omentum, small intestine, colon, appendix, fallopian tube, dura mater, renal capsule, and tunica vaginalis have been used for ureteral replacement [9, 12, 13]. Each of these techniques has advantages and disadvantages [10–14] that have been discussed elsewhere [5, 6, 13].

We describe a new technique for segmental ureteral replacement using a pedicled and tapered gastric flap in dogs and report here the short-term results of our study.

Materials and methods

Ten dogs weighing 2 to 30 kg were used for this study. All animals were denied food for 8 h prior to operation. Anesthesia was induced and continued with ketamine 3–5 mg/kg. Ampicillin 1 g/day was given intramuscularly during the procedure and continued for 5 days postoperatively. All animals received 300 to 1000 ml 5% dextrose in normal saline for 2 days postoperatively.

The abdomen was prepared and draped using sterile technique. A midline incision from the xiphoid to the pubis was made. The abdomen was explored. By careful dissection of the right gastroepiploic arcade along the greater curvature from the pyloroduodenal junction to the midpoint of the gastric corpus with interruption of the short gastric vessels close to the stomach, leaving this arcade attached to the greater omentum, it was possible to isolate a vascularized segment 6 × 0.4 cm in diameter including the corpus of the stomach. Closure of the gastric wound was accomplished with one continuous layer of 2/0atraumatic chronic catgut sutures and a second layer of interrupted 2/0 atraumatic silk sutures using Lambert-type serosa-to-serosa sutures.

A vascular bulldog clamp was placed on the pedicle of the gastric flap and released every 10 min to provide a relatively bloodless field. The gastric segment was irrigated with normal saline and was tapered over the no. 2.5 feeding tube with two-layer 4/0 chronic catgut sutures, the first layer comprising full-thickness running, locked sutures and the second interrupted Lambert-type serosa-to-serosa sutures. The bulldog clamp was then removed. The parietal peritoneum was incised lateral to the ascending colon and the retroperitoneum was dissected. A 6-cm segment was excised from the midpoint of the left ureter. A no. 2.5 feeding tube was passed, from the distal ureter through the tapered gastric flap 1−2 cm from the renal pelvis and distally the catheter was pushed into the bladder. Distal and proximal isoperistaltic anastomoses were established between the ureter and gastric flap by four interrupted Lambert-type serosa-to-serosa sutures. The retroperitoneum was closed with drainage (Fig. 1). The abdomen was closed, using 2/0 silk sutures. All animals were allowed to feed 1 or 2 days after the operation. The ureteral catheters were removed from the bladder via a second operation 1 week after the procedure. Before and 12 weeks after the procedure a urine analysis and culture was obtained and blood urea nitrogen (BUN), creatinine, Na, K, and CI levels were measured. Intravenous pyelograms (IVP) were obtained 12 weeks after the procedure. The left kidneys and ureters were removed en bloc. Macroscopic and microscopic sections were examined.
Fig. 1. Diagrammatic representation of the surgical procedure

Table 1. Laboratory findings before and 12 weeks after ureteral replacement

<table>
<thead>
<tr>
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<th>Preoperative</th>
<th>Postoperative</th>
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<tbody>
<tr>
<td>Na (mEq/l)</td>
<td>138.9 ± 1.91</td>
<td>139.2 ± 1.69</td>
</tr>
<tr>
<td>K (mEq/l)</td>
<td>3.96±0.26</td>
<td>4.10±0.3</td>
</tr>
<tr>
<td>Cl (mEq/l)</td>
<td>101.9 ± 1.66</td>
<td>100.7 ± 2.06</td>
</tr>
<tr>
<td>Ca (mg/dl)</td>
<td>9.67±0.28</td>
<td>9.77±0.30</td>
</tr>
<tr>
<td>Urea nitrogen (mg/dl)</td>
<td>27.0 ± 4.90</td>
<td>28.4 ± 2.41</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>0.98±0.15</td>
<td>0.93±0.16</td>
</tr>
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for evidence of renal scarring, pyelonephritis, stenosis of the anastomosis lines, mucus production, concretions, and peptic ulcers in the gastric flaps.

Results

Table 1 shows pre- and postoperative values of serum electrolytes, BUN, and creatinine. There were no differences between pre- and postoperative values 12 weeks after the procedure. Urinalyses and results of the urine cultures were normal. The IVPs done 12 weeks after the procedure were normal except in one animal that had mild calyceal dilatation. The left ureters immediately above and below the gastric ureter were slightly dilated (Fig. 2).

Macroscopic examination of the ureters and renal pelves above and below the gastric ureter revealed slight dilatations except in one case. Diameters of the kidneys were within normal ranges in all dogs. No concretions were found. Mucus production was not observed in any dog. Histologic examinations of the kidneys, ureters, and gastric ureters were normal.

Discussion

Experimental ureteral substitutes that use a variety of free grafts, pedicle grafts, and synthetic prostheses other than normal ileum have consistently failed [14]. The variable results reported after ureteral replacement by an isolated bowel segment suggest that the procedure is hazardous [1, 2, 14]. The causes of failure include dilatation of the bowel segment, residual urine, persistent bacteriuria, deterioration of the upper urinary tract, mucus production, stone formation, and electrolyte imbalance [2, 7, 11, 13]. The ideal nonsynthetic ureteral substitute should be mobile, have peristalsis, have a reliable blood supply, and serve as a conduit, not a reservoir, for urine [14]. For these reasons, we used a pedicled and tapered gastric flap and anastomosed the flaps and ureters isoperistaltically to prevent possible absorption of electrolytes from the gastric mucosa [14]. Electrolyte imbalance was not present in any dog. Cummings et al. [3] reported that isolated gastric segments substituted for orthotopic bladder replacement have the advantage of acid production with attendant chloride secretion as opposed to chloride reabsorption. Our data support their results. Values of BUN creatinine in the dogs were normal 12 weeks after the procedure when compared with preoperative values.