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Urological Research

Efficacy of Polyglycolic Acid (PGA) Tubing Stents in Ureteroureterostomies*

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Summary. Polyglycolic acid (PGA) tube stented, silastic stented and non-stented anastomoses were compared in 18 ureteroureterostomies performed in 13 dogs. Urinalysis, urine culture, BUN and serum creatinine and intravenous pyelograms were done periodically from 1 day to 6 months postoperatively and ureteral dynamics were performed at 6 months. Normal intravenous pyelograms were observed following 10 of 11 PGA stented, 3 of 4 silastic stented and 2 of 3 unstented anastomoses. PGA stents prevented extravasation and dissolved within 7 days without stone formation. Urodynamic and histopathologic studies revealed no significant differences among the 3 groups. The data suggest that PGA stents are as effective as silastic stents and do not require additional procedures for removal.

Key words: Polyglycolic acid, Stent, Ureter, Silastic, Intravenous pyelogram, Extravasation.

Introduction

The use of stents in ureteral surgery is controversial [6]; however, a significant number of urologists use them [9]. Stents provide an adequate tubular lumen for reconstitution of the epithelium, minimize urinary extravasation and aid in performance of some anastomoses. Arguments against stented anastomoses are potential foreign body reactions, infections and the additional procedures required for removal.

Polyglycolic acid (PGA), a high molecular weight, linear homopolymer of hydroxyacetic acid with little calculogenic or inflammatory potential, is used as an absorbable suture in urologic surgery [1]. Herein we evaluated the efficacy of hollow PGA stents in canine ipsilateral ureteroureterostomies.

Materials and Methods

Thirteen male and female mongrel dogs underwent ipsilateral ureteroureterostomies through a midline incision under barbiturate anesthesia. The animals received 500 mg of parenteral cefamandole on the day of surgery. The middle ureter was transected transversely and anastomosed with a 6-0 PGA running locked suture. No drains were employed. Eight dogs had unilateral procedures; six with 2 inch long, 1.5 mm outer diameter hollow PGA stents (American Cyanamid Company, Danbury, Connecticut) and two unstented. Five animals had bilateral procedures; four with a 5 French silicone catheter on one side and a PGA stent on the other and one with a PGA and an unstented anastomosis. PGA stents were fixed proximally with 5-0 chromic suture and not removed; silicone catheters were removed at 4 weeks. Urinalysis, urine culture, BUN, serum creatinine and intravenous pyelography were performed in selected animals at 1 day, 2 weeks, 1 month and 4 months with all dogs having at least an early and late x-ray study. Six months postoperatively, ureteral dynamic studies were performed similar to the method of Whitaker [10]. With the dogs under barbiturate anesthesia, the bladders were widely opened to negate any contributing vesicle pressure and a number 20 gauge intravenous catheter was inserted into the upper ureter proximal to the operative site. Water was infused with a Harvard pump at a rate of 10 cc/min for five minutes and pressures were recorded with a Hewlett Packard transducer. The average pressure during two five minute runs was compared to control values obtained from unoperated renal units. Animals were sacrificed 6 months postoperatively and the kidneys, ureters, bladders and urethras were subjected to gross and histologic study.

Results

Four renal units were studied on postoperative day one; two with PGA stents had mild hydroureteronephrosis without extravasation (Fig. 1) while both unstented ureters had moderate hydroureteronephrosis and one had significant anastomotic leakage (Fig. 2). During the first month, mild

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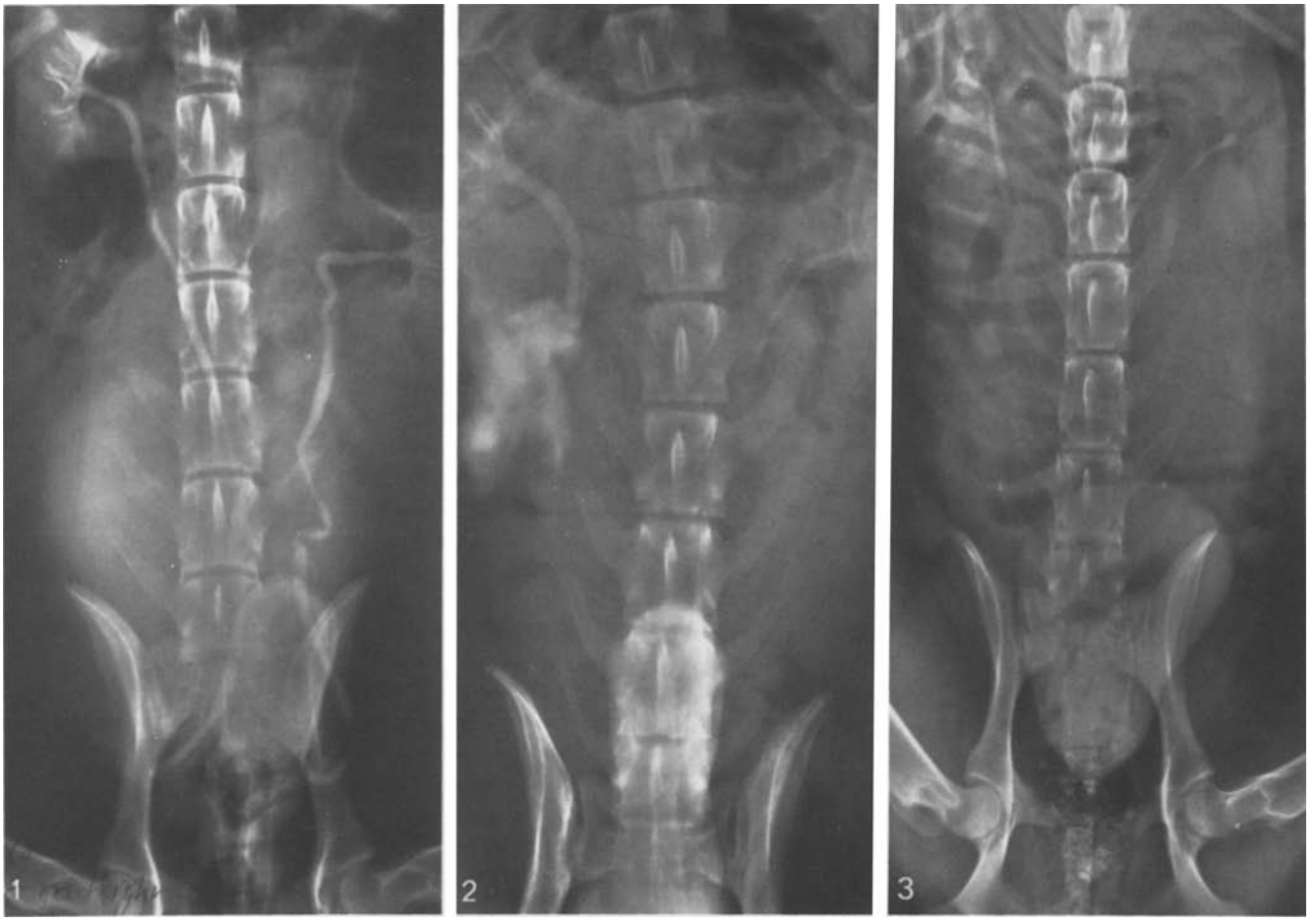

Fig. 1. Intravenous urogram one day after PGA stented bilateral ureteroureterostomies

Fig. 2. Intravenous urogram one day after unstented right ureteroureterostomy (Notice extravasation)

Fig. 3. Intravenous urogram four months after bilateral PGA stented ureteroureterostomies

to moderate hydronephrosis with occasional distal ureteral dilatation was observed. Within four months delicate collecting systems were observed in ten of eleven (91%) PGA stented (Fig. 3), three of four (75%) silastic stented and two of three (67%) unstented renal units. Mild hydronephrosis persisted in the remaining units for up to six months. Mortality occurred in one dog with pyonephrosis associated with distal migration of the silastic catheter and contralateral hydronephrosis of a PGA stented renal unit and one dog with a pyonephrotic unstented anastomosis.

Serial urine cultures revealed no infections related directly to PGA stenting. The only infections occurred in the previously mentioned mortalities and were not attributable to PGA stenting. Microscopic urine examinations demonstrated no casts or crystalluria. BUN and serum creatinine values were not altered significantly.

Gross and microscopic examination of the kidneys, ureters, bladders and urethras revealed no calculi or unusual tissue reactions in the PGA group. Similar results were obtained in the preserved renal units of the other two groups. An autopsy performed on a postoperative day seven fatality demonstrated total dissolution of the PGA stent.

Ureteral dynamic studies revealed statistically significant increased intraureteral pressure in operated compared to unoperated groups ($P < 0.05$ by one way analysis of variance) (Fig. 4) [8]. Among operated groups, there was no statistically significant difference.

Discussion

The results of this pilot study suggest that PGA stents are as effective as silastic stents for ipsilateral ureteroureterostomies. Although ureteral surgery can be accomplished without intubation [5], stenting facilitates accurate placement of sutures and provides an adequate lumen for organized regeneration of the epithelium; a process which is accomplished within seven days [3]. Extravasation of urine with resultant periureteral fibrosis and infections is less likely to occur in a stented compared to an unstented

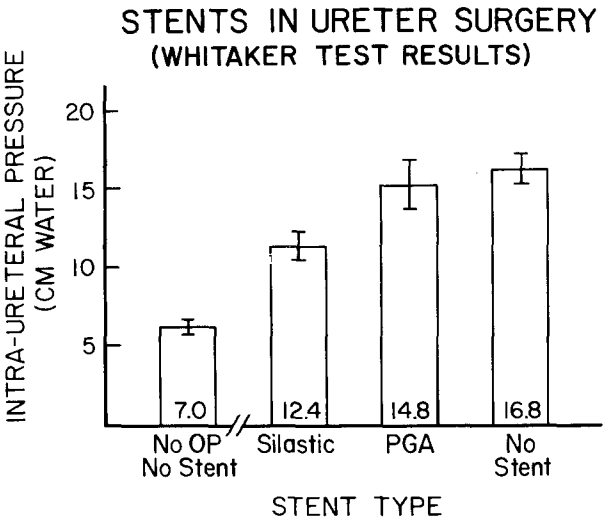

Fig. 4. Intra-ureteral pressure in unoperated ureter and 6 months after silastic, PGA, or non stented ureteroureterostomy

anastomosis, particularly if the urothelium has been compromised by infection, stone or radiation.

The PGA stents were absorbed within 7 days; therefore an additional surgical procedure was not required as was the case for silastic stent removal. None of the PGA stented units became infected since the stent was not exposed to external bacterial contamination. A disadvantage of PGA stents was their lack of pliability. The occasional early distal ureterectasis that was demonstrated radiographically might represent distal obstruction secondary to PGA particles; this warrants further investigation.

When used in the urinary tract, PGA suture material is absorbed by hydrolysis in approximately 7 days, promotes very little tissue reactivity and is not significantly calculogenic [2, 4, 7]. The results of our gross and histologic studies suggest that the PGA stent has similar properties. According to the manufacturer, the composition of the PGA stent can be altered to retard dissolution, an important consideration if the stent is used in the infected urinary tract, since PGA suture breakdown is increased in the presence of bacteriuria [7].

This preliminary study suggests that polyglycolic acid stents are a non-reactive, non-calculogenic, absorbable adjunct for ureteroureterostomy. Further studies are warranted to assess the efficacy and safety of PGA stents in ureteral, urethral and vasal surgery.

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