

Retrospective comparison of outcomes of laparoscopic pyeloplasty using barbed suture versus nonbarbed suture: A single-center experience

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Abstract

Introduction: laparoscopic pyeloplasty is an important tool in urology armamentarium. The most important & also the difficult part of this surgery is intracorporal suturing and knotting. There are only a few reports of knotless Barbed sutures for upper tract reconstruction. We report the comparative outcomes of Laparoscopic Pyeloplasty with barbed suture vs non barbed sutures used for uretero-pelvic anastomosis.

Materials and Methods: We retrospectively reviewed patients' records that underwent Laparoscopic pyeloplasty at our Institution from January 2013 to May 2014. Total 37 patients were underwent LP in this period. Whole of the procedure was same as conventional LP except suture material. 3-0 barbed suture was used in 21 patients and 3-0 vicryl used in 16 patients for uretero-pelvic anastomosis and continuous suturing technique was employed. Patients' demographics, total operative time, intracorporal suturing time, post operative complications, symptoms & renal isotope scan were recorded.

Results: Average total operative time was significantly less in barbed suture group vs vicryl group (162 vs 208 minutes) ($p=0.0811$). Average time taken for intracorporal suturing was 31.2 minutes vs 70 minutes ($p=0.0576$). 1 patient developed post operative urine leak which persisted for 5 days in barbed group (4.76 %) vs no leak in vicryl group. Most common complication was UTI presented in 2 patients (9.5 %) vs 2 in vicryl (12.5%). JJ stent was removed at 4 weeks. Median follow up was 3 months with 7 patients lost to follow up. None of the patients found to have obstructive drainage or deterioration of split function on follow up isotope renogram at 3 months.

Conclusions: In this study, Laparoscopic pyeloplasty with barbed suture has acceptable outcome when compared to conventional non barbed suture on short term basis. Laparoscopic Pyeloplasty with barbed suture can potentially become the standard approach in near future.

Keywords: Barbed suture, laparoscopic pyeloplasty, self-retaining suture

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INTRODUCTION

Laparoscopic pyeloplasty (LP) has become an important tool in urology armamentarium. The first LP was reported in 1993. The LP has proven to have equal long-term results

compared with the open technique, with the advantages of rapid patient recovery, less pain, and optimal cosmetic results.^[1-4]

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The most important, time-intensive, and also the most difficult part of LP is intracorporeal suturing and knotting for ureteropelvic anastomosis.^[5-8] In conventional LP, ureteropelvic anastomosis is done using polyglactin (vicryl) or polydioxanone in continuous or interrupted manner. Ureteropelvic anastomosis using the continuous suturing technique has a comparable success rate with that using interrupted suturing. Various methods have been invented in the past to simplify the process of suturing and knot tying such as knot pushers, suture clips, and pretied sutures.^[5-8]

The knotless self-retaining barbed suture is one such method devised for intracorporeal suturing to ease the process. They are successfully being applied in lower tract reconstruction, whereas there are only few reports of their evaluation for upper tract reconstruction.^[9-13]

We report comparison of outcomes of LP with barbed suture with outcomes of nonbarbed sutures used for ureteropelvic anastomosis.

MATERIALS AND METHODS

We retrospectively reviewed patient's records that underwent LP from January 2013 to May 2014. All the procedures were performed by three experienced surgeons. Preoperative diagnosis was established in all cases with intravenous excretory urography (computed tomography [CT] or X-ray). All LPs included in the study were done by transperitoneal approach using dismembered technique. Whole of the procedure was same as conventional LP except suture material.

After excision of pelvic-ureteric junction and spatulation of the ureter, 4-0 absorbable barbed suture was used in 21 patients and 4-0 vicryl (nonbarbed braided) used in 16 patients for ureteropelvic anastomosis, and continuous suturing technique was also employed. A double J-stent, abdominal drain, and Foley catheter were placed in all cases.

Total operative time (from start to the end of anesthesia), intracorporeal suturing time, postoperative complications,

symptoms, and findings renal isotope scan were recorded [Table 1].

Additional characteristics of barbed sutures

The suture has tiny unidirectional barbs (20 barbs/cm) on its surface. Barbs are evenly spaced, distributed in a helical pattern pointed in direction opposite to the needle end of the suture. Once passed through the tissue, these barbs anchor and retain the tissue in place throughout its length, thus eliminating the need to place a knot. The first 1 inch from the suture is smooth and devoid of barbs to help facilitate the removal of the suture in case of such need. Suture has a preformed loop at the end of suture to secure the first pass of the suture in place without need of a knot.

RESULTS

A total of 37 patients underwent LP from January 2013 to May 2014. LPs were performed with barbed suture in 21 cases and with nonbarbed suture in 16 cases. Average total operative time was significantly less in barbed suture group (162 min) compared to nonbarbed group (208.5 min). The average time for intracorporeal suturing was significantly less – 31.2 min (barbed) compared to 70 min (nonbarbed). One factor appearing to contribute to the total suturing time in both groups is size of renal pelvis. It appears that larger and more redundant pelvis takes more time for suturing and closure.

One patient (barbed group) developed postoperative urine leak, which persisted for 5 days (4.76%). The most common complication was fever (urinary tract infection), 2 patients in each group developed fever in post operative period. Abdominal drain was removed in all cases on the 3rd day, except one patient, in whom, it was removed on the 5th day. Foley catheter was removed in all patients on the postoperative day 2, except one patient, in whom, it was done on the 4th day). Double J-stent was removed at 4 weeks in all cases. Median follow-up was 3 months. Three patients in barbed group and four patients in nonbarbed group were lost to follow-up. The median length of stay in both the groups was 4 days (4–7 days).

Of the patients presented for follow-up, all of the patients reported resolution of symptoms. None of the patients found to have obstructive drainage on isotope renogram at 3 months [Table 2].

DISCUSSION

Dr. John Alcamo, a general surgeon, was granted a US patent for barbed sutures in 1964. The first reported use of barbed in urology was by Tewari *et al.* Many researchers have

Table 1: Characteristics of sutures used

Characteristics	Barbed (V-loc 90™)	Nonbarbed 90 (Vicryl™)
Composition	Glycolide, dioxanone, and trimethylene	Polyglactin (90% glycolide and 10% L-lactide)
Color	Violet	Violet
Construction	Monofilament	Braided
Absorption time (days)	90-110	56-70
Size used	4-0	4-0
BSR	1 week 90% 2 weeks 75%	2 weeks 75% 3 weeks 50% 4 weeks 25%

BSR: Break strength retention

reported successful use of barbed sutures in laparoscopic lower urinary tract reconstruction.^[9-13]

Weld *et al.* first confirmed the safety and efficacy of the barbed sutures in LP in porcine mode. Barbed suture is capable of producing a watertight anastomosis without significant tissue disruption.^[9] Biomechanical testing compared with nonbarbed material *in vitro* in porcine model revealed immediate tissue adaptation with reduced suture line shortening,^[7] equal tightness,^[7] and less time consuming.^[7]

Shah *et al.*^[14] reported the first human use of barbed sutures for ureteropelvic anastomosis in robotic-assisted LP in nine patients. They reported successful outcome in seven patients who completed 6 months follow-up with no evidence of obstruction. They emphasized the need of careful tightening of this suture just to achieve a watertight anastomosis and avoid over tightening.

Liatsikos *et al.*^[15] reported unfavorable outcome with the use of barbed suture for LP. They performed six LP with barbed suture (Quill™). The mean follow-up was 3 months, and retrograde ureteropyelography and MAG-3 renography were performed. Of them, five patients developed obstruction at the site of anastomosis in follow-up for which additional intervention was needed.

Garcia *et al.*^[16] reported the use of barbed sutures in many urologic reconstructive procedures including one LP. Re-obstruction was not reported by them [Table 3].

Dowson *et al.*^[17] compared their outcomes of LP using barbed suture (13 patients) with nonbarbed sutures (16 patients).

They reported significantly reduced operative time in barbed suture group compared to nonbarbed group. The median follow-up was 10.8 months in the barbed group. One patient in the barbed group and two patients in the nonbarbed group developed re-obstruction which was found to be statistically nonsignificant.

Su *et al.*^[18] reported, reported use of barbed suture for pediatric robotic pyeloplasty. They performed three cases with barbed suture and reported reduced hydronephrosis on 2 weeks follow-up ultrasonography.

In our study, we applied barbed sutures successfully for ureteropelvic anastomosis, with acceptable complication rate. No evidence of recurrence of obstruction was found in any of the patients at 3 months. We found these sutures very easy to use, with minimal difficulty in handling of suture. We emphasize on precise placement and careful tightening of the suture to avoid need of removal of suture, over-tightening, and purse-stringing.

Advantages of barbed sutures over conventional sutures include:

- No need of knotting
- No need to follow the suture during continuous suturing, thus eliminating assistant's role and one extra port to follow the suture
- Operative time is less, leading to decreased surgeon fatigue and decreased anesthesia time and probably decreased overall cost of the procedure. More surgeries can be planned on same day due to time benefit
- It distributes tension across the whole wound length instead of at knot

Table 2: Results

Parameters	Results barbed group	Results nonbarbed group	P
n	21	16	
Total operative time (mean), min	161.95	208.5	<0.0001
Time taken for intracorporeal suturing (mean)	31.19	69.81	<0.0001
Postoperative complications	3 patients	2 patients	0.875
Duration of urinary catheter (median)	2 days	2 days	
Duration of abdominal drain (median)	3 days	3 days	
Clavien-Dindo grading (median)	0	0	
Double J-stent removal	At 4 weeks	At 4 weeks	
Median follow-up	3 months	3 months	
Tc-DTPA diuretic renogram at 3 months	Nonobstructive drainage pattern in all	Nonobstructive drainage pattern in all	

DTPA: Diethylene triamine pentaacetic acid

Table 3: Pyeloplasty with barbed suture (laparoscopic or robotic) Past series

	Shah <i>et al.</i> (laparoscopic)	Liatsikos <i>et al.</i> (laparoscopic)	Garcia <i>et al.</i> (laparoscopic)	Dowson <i>et al.</i> (laparoscopic)	Su <i>et al.</i> (robotic)
Total number of patients	9	6	1	13	3
Average operative time	Not mentioned	112 min	Not mentioned	169 min	167 min
Follow-up (average)	6 months	3 months	Not mentioned	10.8 months	2 weeks
Re-obstruction	None found	5 patients	None found	None found	Not mentioned

- It is easy to master with little technical expertise needed; learning curve of LP can also decrease with barbed sutures.

Disadvantages include:

- Cost of the suture compared to nonbarbed suture
- It is difficult to remove back once placed through the tissue, if needed. Sawing action due to the presence of barbs in reverse direction while pulling back can damage the tissue.

There are some limitations of our study such as retrospective study, small sample size, short follow-up, and single-center study.

CONCLUSION

In this study, LP with barbed suture has similar and acceptable outcome when compared to conventional nonbarbed suture on short-term basis. Further larger-scale studies with longer follow-up are needed for more evidence. LP with barbed suture can potentially become the standard approach in the near future.

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Conflicts of interest

There are no conflicts of interest.

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