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Original Research Article

Laparoscopic versus open pyeloplasty: an experience at a tertiary care centre

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ABSTRACT

Background: Ureteropelvic junction obstruction can lead to symptoms such as hydronephrosis and progressive renal damage. Authors explain present primary experiences about laparoscopic pyeloplasty and open pyeloplasty in the treatment of UPJO.
Methods: A bidirectional non-randomized study from March 2012 to April 2015 was conducted at a tertiary care centre in southern India. A Total 37 cases, 18 patients in laparoscopic pyeloplasty group and 19 patients in open pyeloplasty group were included.
Results: A total of 37 patients were included in the study. 18 patients underwent laparoscopic Anderson-Hyne's pyeloplasty, 19 patients underwent open Anderson-Hyne's pyeloplasty patients. Outcomes were measured in terms of pain, surgery duration, postoperative pain, complications which were significant.
Conclusions: Laparoscopic pyeloplasty was found to be better in terms of postoperative pain, hospital stay and complications.

Keywords: Laparoscopy, Open surgery, Pyeloplasty, Ureteropelvic junction obstruction

INTRODUCTION

Pelviureteric junction obstruction (PUJO) is one of the common cases dealt by a Urologist and has been a challenge since centuries. The etiology of pelviureteric junction obstruction is varied. The various etiologies could be classified broadly into extrinsic and intrinsic causes.[1] Extrinsic causes include compression due to retroperitoneal or intra peritoneal mass, crossing renal vessels. Intrinsic causes include the strictures at pelviureteric junction due to stones, inflammatory causes, dysmotility of the ureteric wall at the pelviureteric junction. Pelviureteric junction obstruction usually leads to hydronephrosis and later progresses to renal impairment. This entails pelviureteric junction to be treated at the earnest. Open pyeloplasty (OP) has been the treatment of choice till lately, among which Anderson-Hynes dismembered pyeloplasty has been the Gold standard.[2] Along the multitude of advances and scientific developments in all fields during the 21st century, there has been advancement in the field of Urology, that too in endourology. The various advances in the management of pelviureteric junction obstruction include laparoscopic pyeloplasty, acucise endopyelotomy and most recently Robotic assisted pyeloplasty. Each method of treatment has been shown to have varied results. The success rate of Open pyeloplasty has been more than 90% in many centres. The success rates are comparable for laparoscopic pyeloplasty and open pyeloplasty.[3] The greatest drawback which was associated with these

treatments was the risk of vascular injury.[4] Many centres have been switching over to laparoscopic/robotic pyeloplasty nowadays.

Open pyeloplasty requires a flank incision which is associated with significant amount of morbidity which is one of the reasons for the main reasons to find a alternative treatment with less/ minimal morbidity and good results. Laparoscopic and Robotic assisted pyeloplasty could be the answer for the present and future.[5].

METHODS

It was a bidirectional non-randomized study conducted from March 2012 to April 2015 at ward and OPD, Department of Urology, Sri Sathya Sai Institute of Higher Medical Sciences, Prasanthigram, Puttaparthy, Andhra Pradesh.

Study population were all cases of primary PUJO of any age, gender. Study sample size was total 37 cases, 18 patients in laparoscopic pyeloplasty group and 19 patients in open pyeloplasty group.

Inclusion criteria

- All patients with primary pelviureteric junction obstruction of any gender, age whether symptomatic or asymptomatic patients with incidentally detected PUJO having decreasing renal function/ parenchymal thickness, complications like stone/ infection.

Exclusion criteria

- Patient not fit for surgery.
- Patient with general contraindications for laparoscopic surgery.

All patients underwent blood and urine investigation preoperatively, which included complete blood counts, renal function test, random blood sugar, urine analysis, urine culture sensitivity. All patients underwent radiological investigations, which included ultrasound abdomen and they either underwent intravenous pyelogram or 99mTc-DTPA renal scan or both. If beyond 40 years of age and associated with comorbidities, preop fitness for surgery obtained from physician.

All patients were explained regarding the procedure of open, laparoscopic pyeloplasty and the need to convert laparoscopic to open procedure if need arises intra operatively. Consent was obtained from patients for both the procedures. All patients underwent retrograde pyelogram, length and position of pelviureteric junction narrowing was noted. Patients underwent laparoscopic or open Anderson- Hyne's pyeloplasty as per preoperative plan.

Patient who were undergoing laparoscopic pyeloplasty were placed in 45-degree lateral decubitus position. The entry to peritoneum was achieved either with a Veress needle or Hassan cannula. After pneumoperitoneum creation with CO_2, generally 3 to 4 ports were inserted. A 10mm port just below umbilicus and two 5mm ports at the lateral border of rectus sheath for adequate triangulation. All ports were shifted laterally, if the patient was obese. The telescope is inserted through the first port in the umbilical region. After inspection of port insertion sites for any bowel or vascular injury, colon was mobilized along the line of Toldt, so as to expose the retroperitoneal structures. A transmesocolic approach to the retroperitoneal structures was done in younger patients with thin mesenteric fat and on the left side. Once the access to the retroperitoneum was obtained, the pelvis and ureter was dissected, the obstructed segment of pelviureteric junction was cut and excised. The ureter was spatulated on the lateral side and redundant renal pelvis was trimmed as much as possible laparoscopically. Anastomosis of the most dependent part of pelvis was done to the spatulated ureter with 4-0 vicryl sutures, in either continuous or interrupted fashion. Double J stents and drainage tubes were placed in all cases. Hemostasis achieved, and port closure done with vicryl no-1 for rectus sheath and skin closure either by silk 2-0 mattress sutures or subcuticular sutures with vicryl 3-0.

Patients undergoing open pyeloplasty were put in kidney position, subcostal approach was utilized. After approaching the retroperitoneum by cutting the muscles, the pelvis and ureter was dissected. Two stay sutures were taken, one on the lateral side of the ureter and other on the lower lateral most part of renal pelvis. The obstructed segment of pelviureteric junction was cut and excised, then ureter was spatulated on the lateral side and redundant renal pelvis was trimmed. Anastomosis of the most dependent part of pelvis was done to the spatulated ureter with 4-0 vicryl sutures, in either continuous or interrupted fashion. Double J stents and drainage tubes were placed in all cases. Hemostasis achieved, muscles approximated with vicryl no-1 in two layers and skin closure done either by silk 2-0 mattress sutures or subcuticular sutures with vicryl 3-0.

The operative time excluding the time required for retrograde pyelogram were noted. On 1st post-operative day (POD 1), pain was gauged with Wong-Baker Pain score. All patients received three doses of tramadol 50mg intravenous injections on 1st post-operative day. Patients who had persistent pain with pain score 3 or more, received additional dosage of diclofenac sodium 50mg intramuscular injections. Per urethral catheter was removed on 3rd post-operative day (POD 3), if drain output was minimal. Drainage tubes were removed next day, if there was no increased drain output after per urethral catheter removal. Total postoperative hospital stay was noted. Complications were noted as per Clavien-Dindo grading system and any complication above grade 1 was considered significant.

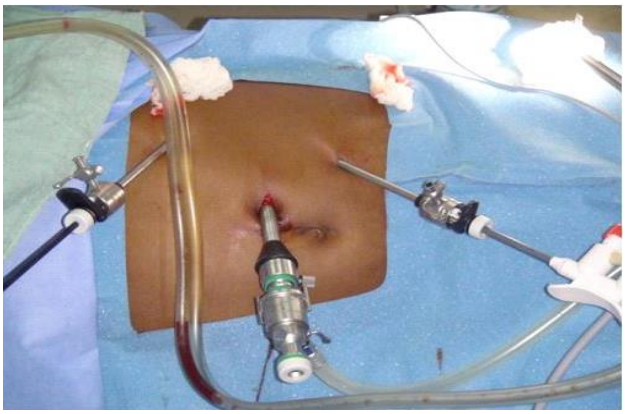

Figure 1: Port positions in laparoscopic left pyeloplasty.

Stent removal was done at 4 weeks under local anesthesia, except in children where short general anesthesia was used. Patients were followed up at 3 months, 6 months and 1 year.

During follow up, ultrasound abdomen was done and decrease or increase in hydronephrosis as compared to the preoperative ultrasound was noted.

Following that all patients underwent 99m Tc-DTPA Renal scan±intravenous urography depending on the preoperative functional study so as to have a comparative data. Glomerular filtration rate (GFR), drainage curve on renal scan and contrast excretion, drainage on IVU were noted.

Any failure during the entire period of 1 year follow up was noted. If recurrent pelviureteric junction obstruction develops, they were to be proposed for redo pyeloplasty. Nephrectomy was considered, if the differential function on affected side was less than 15%.

Statistical analysis

The demographic, clinical, intra operative and post-operative data were analyzed using Pearson's Chi-squared test, Student t-test, Fischer's Exact F test and SPSS software 19.0. Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

A total of 37 patients were included in the study. 18 patients underwent laparoscopic Anderson-Hyne's pyeloplasty, 19 patients underwent open Anderson-Hyne's pyeloplasty patients.

One patient underwent sequential bilateral open pyeloplasty, so the total number of open pyeloplasties became 20. None of the patients in the study in whom laparoscopic pyeloplasty was attempted, had to be converted into open procedure.

Age

Though the mean age of patients undergoing LP is about 3.5 years more than the patients undergoing OP, this difference is not statistically significant. Thus, authors can assume that the ages of the patients are pretty much same in both the treatment groups (Table 1).

Table 1: Age of patients in the two groups.

	Laparoscopic pyeloplasty	Open pyeloplasty	Total
Number of patients (n)	18	20	38
Min	13	4	4
Mean	29.33	25.8	27.47
Median	27.5	24.5	25.20
Max	53	58	58
Standard error	2.46	3.95	2.37
95% CI	24.15, 34.52	17.54, 34.06	22.68, 32.27

Operative time

The operative time in laparoscopic pyeloplasty group ranged from 90 to 240 minutes with an average operating time of 155minutes. Whereas in the open pyeloplasty group, the operating time ranged from 60 to 180 minutes with an average operating time of 121 minutes.

Additional requirement of analgesic

Only 2 patients (11%) in the laparoscopic pyeloplasty group required additional doses of analgesics as against 7 patients (36%) in the open pyeloplasty group was much more as compared to laparoscopic pyeloplasty group.

These data suggest a significant decrease in morbidity in the laparoscopic pyeloplasty group.

Even though none of the patients had any chest related complications in this study, unrelieved operative site pain is a major cause for reduced breath efforts leading to pulmonary lower lobe collapse or consolidation (Table 2, 3 and 4).

Table 2: Distribution of pain score on 1st POD in the two groups.

Pain score	Laparoscopic pyeloplasty n (%)	Open pyeloplasty n (%)	Total n (%)
1	0 (0.00)	2 (10.00)	2 (5.26)
2	16 (88.89)	11 (55.00)	27 (71.05)
3	2 (11.11)	6 (30.00)	8 (21.06)
4	0 (0.00)	0 (0.00)	0 (0.00)
5	0 (0.00)	1 (5.00)	1 (2.63)
Total patients	18 (100.00)	20 (100.00)	38 (100.00)

Table 3: Distribution of pain score on 1st POD in the two groups.

	Laparoscopic pyeloplasty	Open pyeloplasty	Total
Number of patients (n)	18	20	38
Min	2	2	1
Mean	2.11	2.35	2.24
Median	2	2	2
Max	3	5	5
Standard error	0.08	0.2	0.11
95% CI	1.95, 2.27	1.94, 2.76	2.01, 2.46
t-test	Null: Two surgery procedures induce similar pain in patients Alternative: LP induce lesser pain in patients than OP t = -1.1376, df = 24.571, p-value = 0.1331		

Table 4: Additional requirement of analgesic by the two-surgery procedure.

	Laparoscopic pyeloplasty n (%)	Open Pyeloplasty n (%)	Total n (%)
Additional requirement of analgesic -yes	2 (11.11)	7 (35.00)	9 (23.68)
Additional requirement of analgesic -no	16 (88.89)	13 (65.00)	29 (76.32)
Total	18 (100.00)	20 (100.00)	38 (100.00)

Null hypothesis

There is no association between the type of surgery and additional requirement of analgesic. Alternative Hypothesis: There is association. Pearson's Chi-squared test with Yates' continuity correction

Chi-squared = 1.8155, df = 1, p-value = 0.1779

Post-operative hospital stay

Mean hospital stay was 4.44 days in the laparoscopic pyeloplasty group and 4.35 days in the open pyeloplasty group. But the point to be noted is that, none in both groups required prolonged hospitalization. (Table 5 and 6).

In Table 7, authors see that the distribution of number of days spent in post-operative hospital stay is slightly heavier towards smaller number of days for LP compared to OP, while heavier towards larger number of days for OP compared to LP. However, when authors do a t-test authors see that the difference is not statistically significant.

Table 5: Comparison of mean post-operative hospital stay between present study and Bansal et al.

	Laparoscopic pyeloplasty group	Open pyeloplasty group
Bansal et al	3.14 days	8.29 days
Present study	4.44 days	4.35 days

Table 6: Distribution of no. of days of post OP hospital stay in two groups.

	Laparoscopic pyeloplasty n (%)	Open pyeloplasty n (%)	Total n (%)
3	2 (11.11)	3 (15.00)	5 (13.16)
4	8 (44.44)	12 (60.00)	20 (52.63)
5	6 (33.33)	2 (10.00)	8 (21.06)
6	2 (11.11)	1 (5.00)	3 (7.89)
7	0 (0.00)	2 (10.00)	2 (5.26)
Total	18 (100.00)	20 (100.00)	38 (100.00)

Table 7: Distribution of no. of days of post OP hospital stay in two groups.

	Laparoscopic pyeloplasty	Open pyeloplasty	Total
Number of patients (n)	18	20	38
Min	3	3	3
Mean	4.44	4.35	4.395
Median	4	4	4
Max	6	7	7
Standard Error	0.2	0.25	0.16
95% CI	4.02, 4.87	3.82, 4.88	4.07, 4.72
t-test	Null: Two surgery procedures involve same number of post-operative hospital stay Alternative: LP involves lesser post-operative hospital stay than OP t = 0.2911, df = 34.965, p-value = 0.6136		

Complication

There was no significant (Clavien-Dindo grading 2 or more) immediate post-operative complications in both groups, except for mild ileus in 1 patient which was managed conservatively. In the study by Singhania et al, one patient had urinary peritonitis, while 2 patients had suture granuloma. There was one major complication in laparoscopic group as noted by Bansal et al, that patient had prolonged drainage of urine (six days) through the drain which subsided with prolonged catheterisation. He had recurrence of symptoms at three months and an obstructive DTPA curve. This was probably secondary to fibrosis caused by leakage of urine that occurred earlier. The patient was managed with endopyelotomy after six months. No patient in open group had recurrence. In

present study, none of the patients in either group had any leak in the post-operative period, which is considered one of major determinant for long term failure (Table 8). Here authors see that only 1 patient in OP had post-operative complication which settled conservatively. Though no statistical test is possible in this case, authors see that both the procedures are relatively safer.

Table 8: Post-operative complications in two groups.

	Laparoscopic pyeloplasty n (%)	Open pyeloplasty n (%)	Total n (%)
Complications-yes	0 (0.00)	1 (5.00)	1 (2.63)
Complications-no	18 (100.00)	19 (95.00)	37 (97.37)
Total	18 (100.00)	20 (100.00)	38 (100.0)

Follow up

All patients were followed up for a period of 5 years in present department. But for the purpose of this study, the follow up and results upto 1 year has been included. There were no failures in the open pyeloplasty group, whereas in the laparoscopic pyeloplasty group, 2 patients failed (Table 9). Fischer's F Exact test done provided a p value of 0.229. So even though 2 patients in the laparoscopic pyeloplasty group failed, the difference was not statistically significant. Both these patients were adults and had poorly functioning kidney to begin with. Both of them underwent nephrectomy in the follow up period.

Table 9: Failure at 1 year in two groups.

Failure at 1 year	Laparoscopic pyeloplasty n(%)	Open pyeloplasty n (%)
Yes	2 (11)	0 (0)
No	16 (89)	19 (100)

DISCUSSION

Operative time of laparoscopic pyeloplasty was significantly more, with an average of around 30 minutes more as compared to open pyeloplasty. The maximum time taken in the laparoscopic pyeloplasty is also more, 240 minutes as against 180 minutes in the open pyeloplasty group. Bansal et al reported operative time of 244.2 min (188-300 min) in laparoscopic pyeloplasty group as compared to 122 min (100-140 min) in open pyeloplasty group.[6] Singhania et al reported an average operating time of 3.75 hrs for laparoscopic pyeloplasty.[7] Baldwin et al noted that there was no difference in operative time between laparoscopic and open pyeloplasty.[8,9] Whereas Zhang et al reported less operative time with laparoscopic pyeloplasty as compared to open pyeloplasty.[10] In present study, the operating time for laparoscopic pyeloplasty was much less as compared to the other mentioned studies. Probably because of then better skills of the operating surgeon in terms of intracorporal suturing and Knotting, which are considered a major hurdle in any laparoscopic procedures (Table 10 and 11).

Table 10: Comparison of mean operative time between present study and Bansal et al study.

	Laparoscopic pyeloplasty group	Open pyeloplasty group
Bansal et al	244 minutes	122 minutes
Our study	155 minutes	121 minutes

Table 11: Operative time (in minutes) in two groups.

	Laparoscopic pyeloplasty	Open pyeloplasty	Total
Number of patients (n)	18	20	38
Min	90	60	60
Mean	155	121.25	137.24
Median	150	120	137.5
Max	240	180	240
Standard error	8.27	8.94	6.65
95% CI	137.54, 172.46	102.55, 139.95	123.77, 150.70
t-test	Null: Two surgery procedures take the same operative time Alternative: LP takes greater operative time than OP t = 2.7713, df = 35.984, p-value = 0.004391		

Of the 18 patients undergoing LP, 16 (88.89%) of them had a pain score of grade 2, while the remaining 2 (11.11%) of them has a pain score of 3. While the 20 patients undergoing OP, procedure are spread over almost all the grades of pain duration. Though the average pain score (2.11) for LP is less than that of OP (2.35), it is not statistically significant. Though authors see that relatively more number of patients undergoing OP requires analgesic compared to patients undergoing LP and relatively less of them does not require them compared to OP, a Chi-square test for measure of association gives a p-value of 0.1779.

The average operative time for patients undergoing LP is 155 minutes compared to 121.25 minutes of the patients undergoing OP. This is statistically significantly greater (level of significance=0.05).

Baldwin et al noted lower analgesic requirements in laparoscopic pyeloplasty group i.e., 27.2 *v* 124.2 mg of morphine sulphate for open pyeloplasty. Bansal et al

found the postoperative diclofenac requirement was significantly less in laparoscopic pyeloplasty group (mean- 107.14 mg) compared to open pyeloplasty group in which then mean diclofenac requirement was 682.35 mg. In present study, the additional requirement of analgesics. Based on this current sample there is yet no statistically significant evidence of requirement or non-requirement of analgesic based on the type of surgery. Bansal et al reported a mean postoperative hospital stay of 3.14 Days (2-7 days) in laparoscopic pyeloplasty group as compared to 8.29 days in open pyeloplasty group. The mean post-operative hospital stay was 5.5 days as reported by Singhania et al. Whereas in present study, there is no significant difference in between the groups because of present policy of drain insertion in all patients which were removed on 4th post-operative day in absence of any leak. However no statistically significance was noted in post-operative stay in hospital.

Both procedures are safe as per present study, as there were very less postoperative complications. The results of laparoscopic pyeloplasty were similar to open Pyeloplasty, Hence, Laparoscopic pyeloplasty cannot be considered inferior. Results of the study were comparable and at par with Singhania et al, Bansal et al and Baldwin et al.[6-9]

CONCLUSION

Laparoscopic pyeloplasty is a safe option in terms of perioperative complications and results nearly equaling open pyeloplasty. Laparoscopic pyeloplasty is preferable to open pyeloplasty, considering cosmesis and decreased morbidity.

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