

Research Article

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The Safety and Clinical Results of Pyeloplasty Using Mini-Laparoscopic Instruments: A Comparison with Conventional Laparoscopic Pyeloplasty

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Abstract

Background: To evaluate safety, clinical efficacy, and cosmetic results after pyeloplasty using Mini-Laparoscopic Instruments (MLP) compared with standard laparoscopic pyeloplasty (SLP) in patients with Ureteropelvic Junction Obstruction (UPJO).

Methods: From September 2009 to September 2014, 29 extroperitoneal MLPs were performed, and in the corresponding period, 22 extroperitoneal SLPs were conducted in patients with UPJO in our hospitals. The data from two groups were reviewed and studied.

Results: Baseline characteristics were similar between the groups. There were no conversions to open procedures in groups. There were no differences in operative duration, blood loss, day of catheter removal, time for backing to normal diet, and perioperative complications in two groups ($P>0.05$). The average postoperative hospital stays, postoperative analgesics required and the pain Numerical Rating Scale (NRS) scores at first postoperative day were less or lower for group MLP than that for the group SL ($P<0.05$). Mean follow-up time was 23(6-36)months. The values of anteroposterior pelvic diameter on Ultrasound within each group were decreased significantly ($P<0.05$), but were similar between the two groups at 1 year after surgery ($P>0.05$). The GRFs of impaired split renal function in both group were significantly elevated, whereas there was no significant difference in mean values of GRF between the two groups at 1 postoperative year (GRF, MLP:45±18ml/min vs SLP:47±16 ml/min, $P>0.05$). The questionnaires showed that patients in group MLP were significantly more satisfied with their cosmetic result.

Conclusions: Our initial experiences suggest that pyeloplasty using mini-laparoscopic instruments appears to be safe, feasible and effective in the treatment of PUJOs. Cosmetically, it is better than standard laparoscopic pyeloplasty.

Keywords: Mini-Laparoscopy; Operation Instruments; Pyeloplasty; Ureteropelvic Junction Obstruction

Abbreviations

MLP	:	Mini-Laparoscopic Instruments
SLP	:	Standard Laparoscopic Pyeloplasty
UPJO	:	Ureteropelvic Junction Obstruction
NRS	:	Numerical Rating Scale
ECT	:	Emission Computed Tomography

Background

With the continuous innovation and development of the laparoscopic instruments, there are more and more tiny instruments being invented, which leads the pyeloplasty less invasive. Tan, et al. reported that the needle-scope (or we call mini-laparoscopic) with 2.0mm diameter was used for children Ureteropelvic Junction Obstruction (UPJO) [1]. Here we improved the mini-laparoscopic: 5.5mm trocar on the observation lens, 3.0mm trocar on the reflective lens, and 2.8mm operation instruments. We performed series of Urology surgery using the improved min-laparoscopic, and it demonstrated an ideal clinical efficacy. All surgeries were

taking place from September of 2011 to September of 2014. Among them, 29 cases of UPJO were conducted by the mini-laparoscopic mentioned above, while 22 were by conventional ones. We compared the results and got this report.

Methods

Clinical Data

The sample contains 51 patients of UPJO. One group of 29 patients were treated with mini-laparoscopic (MLP group) while the other group of 22 treated by standard laparoscopic (SLP group). In MLP group there were 18 males and 11 females. Their age ranged from 9 to 64 with an average age of 27.5. Correspondingly, SLP group contains 14 males and 8 females. The age ranged from 9 to 65 with an average of 29.5. The comparative data of two groups' age, gender composition, BMI and left & right distribution of UPJO. There is no statistical significance in terms of two groups index difference. Two groups patients were diagnosed with UPJO and the diagnosis was confirmed by Urography, CT and Urinary system imaging. Emission Computed Tomography (ECT) and/or Diuretic kidney diagram were used to judge the level of Urinary tract infarction. Two groups applied the same inclusion criteria

and exclusion criteria. Inclusion criteria: (1) Patients with obvious expansion of Renal Pelvis and Calendula, or the diameter of Renal Pelvis is larger than 3.0cm, or those whose bad kidney was still functional despite of badness with an GRF>10%; (2) Renal Pelvis and Calendula expanded progressively; (3) Patients with symptoms of bellyache and urinary tract infection but not caused by gastrointestinal diseases. Exclusion criteria: (1) Patients with the multiple surgical history at side of waist abdomens before the pyeloplasty and those whom we think would be difficult to be established retroperitoneal cavity, separation and adhesion; (2) Patients with severe cardiopulmonary disease, arrhythmia, heart failure, pulmonary ventilation disorders and those who cannot or do not accept the laparoscopic [2-4].

Surgery Instruments

MLP group: 5.00 mm high definition mini-laparoscopic (Olympus Company produces two types: 0° and 30°), 5.5mm and 3.0mm trocar (Made by Hangzhou Kangji Medical Device Company), 2.8mm separation clamp, needle holders, hook electrodes, scissors, and irrigation aspirators and other reusable equipment (Figure 1).



Figure 1: Result of follow-up during after surgeries.

SLP group: 10mm high definition laparoscopic (Made by Olympus Company), 10.5mm and 5.5mm trocar (Made by Hangzhou Kangji Medical Device Company), 2.8mm separation clamp, needle holders, hook electrodes, scissors, and irrigation aspirators and other reusable equipment (Image 1).

Surgical Methods

Surgeries were operated in abdominal cavity while patients were fully anesthetized. Two groups' patients were treated with the same operator. The establishment of retroperitoneal space: Abdominal wall puncture was made by piercing cone with trocar. Through observation lens, we used direct separation method to establish it. Patients were in lateral position and raised their waist

with their shoulder leaning forward around 10°-15°. Then we cut and left a 2cm incision above axillary line skeleton (Make sure it reaches subcutaneous fascia). The direction of puncture was vertical with the skin surface. Stop piercing at the moment when you felt a sudden drop. Normally the depth is 3-5cm. then removing the piercing cone, inserting observation lens, adjust to just below the back fascia (with visible yellow fat) and finally swing the lens to produce the gap. Under straight look when the lens was closely stuck to outer fat we proved that once CO₂ enters in retroperitoneal space, keep swinging the lens will push forward peritoneum to axillary line and push backward peritoneum to separate it from abdominal wall and psoas muscle. If we press the abdomen from outside, there would be a safer and better effect because the gap

will grow bigger and bigger. All methods mentioned above were used in both groups. The only difference is that the cut depth in MLP group was 3-4mm using 5.5mm trocar and mini-laparoscopic while in SLP group the depth was 7-8mm using 10.5mm trocar and traditional laparoscopic.

Under the direction of observation lens, in MLP group we pierced two 3.0mm trocars blow 2-3cm of 12th flange front and backside of auxiliary line respectively (Figure 2a).



Figure 2a: The Position of MLP.

In SLP group we did pierced 5.5mm and 10.5mm trocar respectively. Post-cavity pressure maintained between 12-14mmHg in both groups and so as the junction obstruction. Cut the perirenal fascia vertically using electrodes to expose the underneath of the back side of kidney, separate upper side of pelvis and ureter exposed in air then we identify the proposition of obstruction and figured out the reason. We cut the pelvis parentetically in accordance with its feature to prevent inner part from being separated with ureter. There was 1 patient of pelvis stones in each group and we tried to take it out. We cut ureter vertically below the obstruction around 0.1-1.0cm first. In MLP group we use 5-0 absorbable line to stitch the lowest part which was cut before (In SLP group 4-0 or 5-0 absorbable line was used). Then we cut the ureter at remote end of obstruction. Continuous suture method was used at one side, leaving sewing length around 0.8-1.0cm. If pelvis was cut deeper than the stated lengths, stitch longer until the pylon opening. Patients without putting double J tube by Cystoscope should be put the tube through cutting point and then suture the other end (Figures 2b-2f).

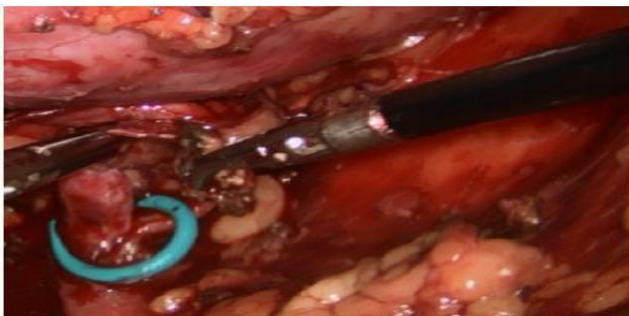


Figure 2b: Take out the kidney stone.

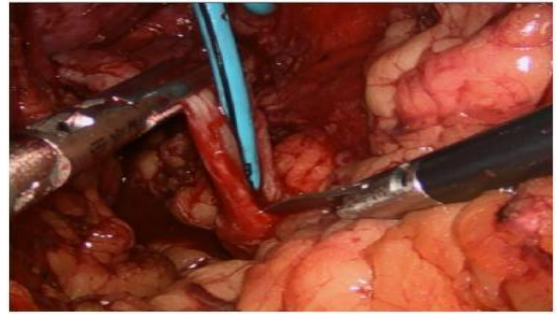


Figure 2c: Cut ureter vertically until reach 0.5-1cm of obstruction.



Figure 2d: Stitch pelvis together with the bottom part of the cut.

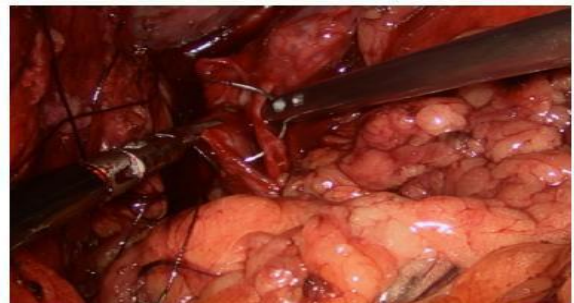


Figure 2e: Use 5-0 absorbable line to sew the ureter.



Figure 2f: The position of the surgical wound and drainage tube.

Put 1 same drainage tube through ridge by trocar for both groups. In SLP group we used 10.5mm trocar to insert the tube and stitched 1-2 needles at all cuts. In MLP group we used 2.8mm

champ insert the tube through 3mm trocar after going through 5.5mm trocar. After this, remove 5.5mm trocar. There is no need to sew the 3.0mm wound because of its short diameter and less repairing needles (Figure 2f). Double J tube will be removed after 4 weeks of the surgery.

Evaluation Factors for Efficacy

We marked down surgery duration, complications, open transfer rate, estimated bleeding, duration of in-hospital stay, pain level, urine wilt, the possibilities wound infection, and satisfaction of body recovery. Continuous observation on diameter before and after separation, the change of GRE, evaluation on obstruction improvement is required by ultrasound (or water Image on urinary tract when necessary), MRU and Diuretic reprogram examination after 3 months, 6months, 1 year and 2 years. NRS methods was adopted to evaluate the pain level. Survey was used to evaluate patients satisfactory level.

Statistical Analysis

SPSS17.0 was utilized for helping analyse. The data difference was compared by**, measurement difference was compared by Mann-Whitney level. $P < 0.05$ is statistically significant.

Results

Two groups' surgeries were operated successfully without any Interim open surgery patients, intestinal damage or organ damage cases. There is no statistical significance ($P > 0.5$) in surgical blood loss, duration of drainage tube, postoperative recovery time, urinary atrophy and wound infection rate. Though the operation duration in MLP was longer than that of SLP, there is no statistical significance neither. However, in-hospital time and demand of medicine after the surgery in MLP group is significantly less than those of SLP group. One case in MLP group: we took out two kidney stones from a female patient after smashing them and transferred another one (1.0cm*0.8cm*0.5cm) into Retroperitoneal cavity. The patient doesn't fell any discomfort until now. One case in SLP group as demonstrated: we took out one kidney stone from one male patient with obesity by means of Choledochoscope and remained the other 3 in the body. There is no severe complication, neither no death rate. 51 patients were investigated for a continuous period of time (average 23 months). We found one patient from each group diagnosed with Anastomotic obstruction and we conducted Ureteral balloon dilation for them after 6 and 9 months respectively under full anaesthesia. They were cured after 3-month double J tube in the body. All patients had no more Urinary tract infection and feelings of back pain. Ultrasound Image suggested that there is no increasingly separation of pelvis and that AP value decreased dramatically. 1 year later, the average AP value of two groups has no more statistical significance (MLP: 2.4+/-0.8cm vs SLP: 2.5+/-0.9cm) but the value is lower than before. The average

GRE in Diuretic kidney diagram (14 from MLP and 9 from SLP) show the result of 45+/-18ml/min vs 47+/-16ml/min. Compared with before, there was a significant increase in GRE ($P < 0.5$). The survey we conducted suggested that MLP patients are more satisfied with the results that that of SLP group.

Discussion

Currently, MLP gets recognised by the filed to conduct surgery for UPJO patients and is chosen as the first choice and highest standard. However, the medical professions are still finding a better substitute. With the invention of mini-Laparoscopy, we are entering a boom period of mini-equipment. Previously Tan reported that 2.0mm laparoscopy was used to cure a child patient, resulting a lower definition/contrast and less wide scope of the Image than conventional one [1]. Besides, it was only available for Acupuncture without 2mm Set folder, hook electrode and needle holder. 2mm is not proper to hold the equipment and the attractor flow is not high. When some device stuck in the tube, smoke caused by electrode cannot be discharged out of body. That's why Acupuncture is limited. Our study shows that improved laparoscopy works better and provides the same quality Image as the conventional laparoscopy. Besides, it has two types to choose (0 and 30 degree). Therefore, 2.8mm tube is safer together with Set folder, hook electrode and needle holder. Cheng, etc, [5] reported that infant UPJO patients can also be treated with mini-laparoscopy as long as make them lie down. Puncture at 11-4 umbilicus point, insert observation lens, then put the tube(3mm/5mm) at 5-7 umbilicus point. Doing this make it easy insert Single-hole laparoscopy. Simforoosh etc, [6] proved that MLP for infants is safer than SLP with less trauma and more satisfying efficacy. In Fiori etc, 's [7] study, they treated 12 adult patients with 3mm laparoscopy. Compared with 24 patients cured by CLP, they concluded that those 12 had less in-hospital days and were more satisfied. One difference from our study is that all references mentioned above the patients lied down while we required patients lied at one side but all puncture point are the same.

Ureteropelvic angioplasty through multiple entries of umbilical hole caused less trauma. It only requires one cut which hides secretly below the umbel can minimises the width of the wound. Therefore, it appears a better Postoperative cosmetic result and leads a less painful effect. Ureteropelvic angioplasty cannot work perfectly with Single-hole laparoscopy because the laparoscopy is easy to be bent and cause crash with another device in the tube, which increases risks. Curvable needle is distinct from traditional laparoscopy during the operation. Compared with Single-hole laparoscopy, we chose a more convenient one, which leads less trauma. Three cuts we made are 5.5mm, 3mm, and 3mm respectively while the former one made a cut within 20-30mm. Our study suggested that MLP has a less trauma than SLP, less than half in terms of the length despite of the same operation

manner. Duration of operation, blood loss during the surgery, duration of drainage tube and time required of recovery of normal diet have no statistical significance. MLP appears a less pain effect, a shorter in-hospital duration and more satisfying efficacy. In long term run, we conclude that there will be no significantly medical difference for UPJO patients' improved kidney function between MLP and SLP. MLP turns out to be a more operation accuracy oriented medical equipment especially when it comes to ureter cut and suture compared with SLP and Single-hole laparoscopy with multi channels. 2.8mm needle holder can hold the 5-0 absorbable line better. However, if it is used to hold 5-0 needle tube, it will lead to the structure change of the needle and stuck in the tube. That is not recommendable for us. Our key study point is to find how to insert trocar and to establish Retroperitoneal with 5.5mm trocar. There have already been reference books talking about direct puncture method to establish Retroperitoneal. They did it like this: first cut 1.0-1.5cm in length under skin with a lean of 0-30 degree and 5-7cm in depth; then swing the laparoscopy to establish it under straight sight. On the contrast, we only cut 3-4 mm and used 5.5mm trocar to do the same work, which minimised the trauma of celiac wall. Trocar normally was fixed by the skin tension, so we do not need to fix it ourselves. Puncture depth is around 3-5cm, reaching the boarder of Extramembranous fat and abdominal fascia. At this moment we swing the laparoscopy. To realize this project, we strong recommend that the puncture depth shall not exceed our limit because once we puncture too deep, the sight will be blocked by yellow fat due to inflatable expansion. In SLP group study we also used the same method (cut 7-8mm) to establish Retroperitoneal. The duration to establish it in two groups has no statistical significance. Nowadays there is no MLP 2.8mm set folder and ultrasound knife, in order to stop blood loss, we must use Electrocoagulation. Leaving trocar open (one air-in and two air-out) can accelerate emission of smoke caused by Electrocoagulation when necessary [8-11].

Conclusions

Our clinical research suggests that mini-laparoscopy is safe for UPJO surgeries and that can get the same clinical efficacy compared with those conducted by conventional laparoscopy but a minimal trauma and painful feelings and a faster recovery and better satisfaction for patients.

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