Available online freely at www.isisn.org

Bioscience Research
Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2022 19(4):1858-1863. OPEN ACCESS

Safety and Outcome of Retroperitoneal 3D- Laparoscopic Pyeloplasty in school-going children.

Awais Ayub, Sharjeel Saulat, Jahanzeb Shaikh, DurAmin and Mansoor Ejaz

Urology Department ,Tabba Kidney Institute, Karachi, **Pakistan**

***Correspondence:** seekingawaisemail@yahoo.com **Received 27-08-2022, Revised: 25-10-2022, Accepted: 28-10-2022 e-Published: 30-10-2022**

This study was aimed to assess the safety and clinical effectiveness of Laparoscopic Dismembered Pyeloplasty by Retroperitoneal approach using a 3D imaging system in treating Uretero-pelvic Junction Obstruction (UPJO) in pediatric patients. All patients with the diagnosis of UPJ obstruction below the age of 12 years, who underwent retroperitoneal 3D-Laparoscopic Dismembered Pyeloplasty were included in the study. Prospective data of patients treated from September 2020 to April 2021 was collected. This study included 30 patients in total out of which 24 were male and 6 were female. The mean age of patients was 8.4 ± 3.6 years. Complications were reported in 17 patients (56.6%) which were all limited to Clavien-Dindo grade 1, while no complication > grade-1 was witnessed. There was a peritoneal breach in 3 patients (10%). VAS facial pain score on Postoperative day-1 was graded as Mild in 24 patients (59.9%) while it was Moderate in only 4 patients (26.6%). After 3 months, there was complete resolution of symptoms in all patients. There was a significant reduction in hydronephrosis postoperatively when compared with preoperative imaging (P = 0.04). Mean preoperative APPD was 3.0 ± 0.94mm while mean postoperative APPD was 2.1 ± 0.2mm.The Retroperitoneal Laparoscopic Dismembered Pyeloplasty is an attractive minimally invasive option in children in terms of patient comfort, hospital stay, postoperative pain and recovery period with successful outcomes. A 3D imaging system in our experience helps reduce technical difficulties and complications by providing better orientation of the surgical field.

Keywords: Laparoscopy, Pyeloplasty, Retroperitoneal, Uretero-pelvic junction obstruction

INTRODUCTION

Uretero-Pelvic Junction Obstruction (UPJO) remains one of the most frequent congenital anomaly causing hydronephrosis in children.(Loya MA, 2021 – Okarska-Napierala M, 2017) Previous experience and evidence have declared that dismembered pyeloplasty is the gold standard for correction of UPJ Obstruction in all patients.(Jia J, 2021 - Rehman OF, 2020) Traditional Open Dismembered pyeloplasty has its disadvantages in the form of long incision, more pain, slow recovery, long hospital stay, more requirement for postoperative painkillers and ultimately a large scar. With the advent of the Laparoscopic approach, now it has become possible to avoid these untoward effects and improve patient's comfort and safety.(Ali M, 2016-Pogula VR, 2021-Pérez-Bertólez S, 2021)Laparoscopic Pyeloplasty has been gradually adopted in adult patients and reported as a safe and minimal invasive alternative for the treatment of ureteropelvic junction (UPJ) obstruction when compared to the open procedure. Laparoscopic approach is also feasible in the treatment of recurrent cases.(Chiancone F,2017 - Du T,2022)

Laparoscopic dismembered pyeloplasty can be performed via Transperitoneal or Retroperitoneal routes.(Liu D, 2017 - Zhu H, 2013) Retroperitoneal access is not so popular among surgeons because of the limited working space and poor ergonomics. This approach also has many benefits i.e., it is more direct, exposure of the pelvis is better, peritoneal exposure to blood, urine and carbon dioxide are avoided and last but not the least, it is also feasible in patients with prior abdominal surgeries. In this era of technological advancements, modern imaging systems are being developed that promise to aid surgeons by providing a better quality of imaging and three-dimensional view of the operative field which would reduce technical difficulties faced during difficult steps of the procedure but their role is not well reported in literature yet.(Zwimpfer TA,2021 - Adanur S,2022)

In the present article, we aimed to report Laparoscopic Dismembered Anderson-Hyne's Pyeloplasty via the Retroperitoneal approach in the treatment of Ureteropelvic Junction Obstruction in pediatric patients using a 3D imaging system to assess the safety and clinical effectiveness of the technique. Primary endpoints included blood loss & complications rate. Blood loss was measured in terms of Hemoglobin drop & need for transfusion. Reduction in Hydronephrosis & Antero-posterior Pelvic Diameter at 3 months postoperatively on

Ultrasonography, Operating time, hospital stay, & VAS pain scores on Postoperative day 1 were secondary endpoints of the study.

MATERIALS AND METHODS

Prospective data of all patients with the diagnosis of UPJ obstruction below the age of 12 years, who underwent Laparoscopic Retroperitoneal Dismembered Pyeloplasty using 3D imaging system at Tabba Kidney Institute from August 2020 to February 2021, was collected after the approval of Ethical Review Committee (Form # TKI-HEC010). Patients who had other urinary anomalies, renal insufficiency, Recurrent UPJO, Blood Coagulation Disorder or history of ipsilateral renal surgery were excluded. Preoperative baseline investigations and ultrasonography were done in all patients. CT Urogram was also done in some patients to assess other complications such as renal calculi. A renal scan was also done to assess the degree of obstruction and split renal function.

Technique:

After the induction of General Anasthesia, a Foley's catheter was inserted. The patient was secured in a standard flank position with table flexed, a rolled towel was placed to maximize the space between the twelfth rib and the iliac crest (lumbar triangle). Balloon dilatation was performed to create retroperitoneal space after insertion of first port. If needed, a fourth port was placed lateral to the lumbosacral muscles. 4 ports were needed in 4 patients while in all other patients 3 ports were used. Insufflation with CO^2 was done at 8-10 mm Hg. Ports placement is shown in Figure 1.

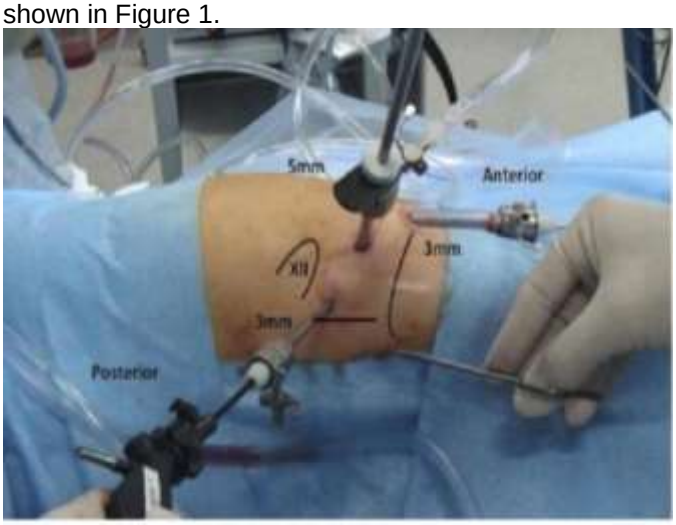

Figure 1: Landmarks for ports placement for right side. The first (5mm) port is made 1 cm from the tip of the 12th rib (XII). A second (3 mm) port is made posteriorly at the costovertebral angle. The third (3 mm) trocar is made 1 cm above the iliac crest.

The renal pelvis or ureter was first identified and then dissection was done around the UPJ. Dissection around the anterior surface of the UPJ was carried out to look for the presence of crossing vessels. UPJ dismembered and the ureter was spatulated. Anderson-Hyne's pyeloplasty was carried out using 5-0 polydiaxanone tension-free, running sutures. If crossing vessels were encountered, they were dissected free of the UPJ and ureteric transposition was carried out. Reduction of the redundant renal pelvis was carried out if needed. The renal stones, if present, were removed using laparoscopic graspers, a flush irrigation method or a flexible nephroscope. JJ Ureteral Stent was placed in all cases in an antegrade fashion. The presence of lower end of the stent in the bladder was confirmed on C-Arm. Perinephric Drain was placed in one patient only which was removed on 1st postoperative day. Oral intake was commenced after 6 hours. After 4 weeks, JJ stents were removed. Foley's catheter was removed on the 2nd postoperative day in most patients. Blood loss during surgery, duration of surgery, Intraoperative complications, hospital stay, total analgesic requirement, need for blood transfusion, and Postoperative pain using VAS pain score at 24 hours were recorded.

All patients were followed up with fresh postoperative ultrasonography after 3 months. Success was considered an improvement in the radiography and ultrasonography findings, improvement on renal scan, and resolution of symptoms. Package of social sciences version 20 was used to enter and analyze the data.

RESULTS

This study included 30 patients in total out of which 24 were male and 6 were female. Demographic details along with Pre-Operative & Intra-operative details are shown in Table 1 & Figure 2.

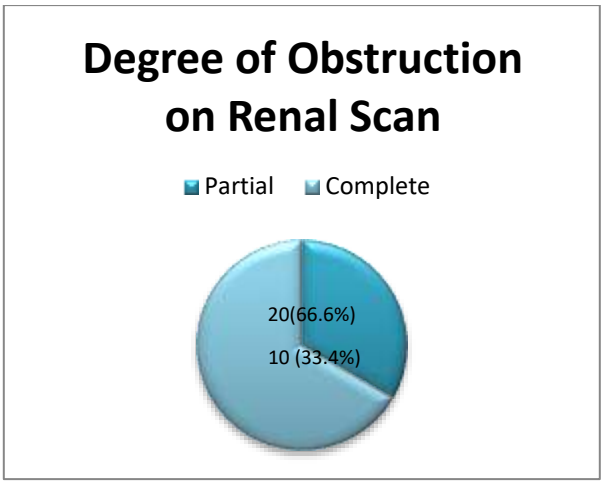

Figure 2: Degree of obstruction on renal scan (n=30)

Table 1: Demographic & operative details (n=30)

Demographic & Operative Details		
Variables		**Values (%)**
Gender	Male	24 (80%)
	Female	6 (20%)
BMI	Underweight	4 (13.3%)
	Normal weight	24 (80%)
	Overweight	2 (6.7%)
Age		8.4 ± 3.6 years
Split renal function		40.0 ± 10.6 %
T Half max		14.0 ± 11.7 mins
Blood loss		63.7 ± 32.8 ml
Total Operative time		144.2 ± 42.6 mins
Co-existing renal calculi	Yes	5 (16.7%)
	No	25 (83.3%)
UPJ obstruction	Intrinsic	23 (76.7%)
	extrinsic	5 (16.7%)
Retrograde Pyelography	Yes	6 (20%)
	No	21 (70%)
DJ insertion	Antegrade	25 (83.3%)
	Retrograde	2 (6.7%)
Ports	3	24 (80%)
	4	4 (13.3%)
Excision Redundant pelvis	Yes	12 (40%)
	No	18 (60%)
Peritoneal breach	Yes	3 (10%)
	No	27 (90%)
Drain Placement	Yes	1 (3.3%)
	No	29 (96.6%)

In 4 patients, preoperative antibiotics were employed for 1 week before intervention according to their culture & sensitivity reports. 5 patients (16.7%) had co-existing renal calculi, 3 of them were involving lower calyces, while in 2 patients they were present in both mid & lower calyces. Renal calculi were successfully removed by flush & irrigation method in 2 patients, while laparoscopic grasper was used in 2 patients and flexible nephroscope had to be used in one patient. 4 patients (13.3%) had crossing vessels while 1 patient had Retrocaval ureter. Excision of the redundant pelvis was carried out in 12 patients (40%).

Complications were reported in 17 patients (56.6%) which were all limited to Clavien-Dindo grade 1, while no complication > grade-1 was witnessed (Table 2). There was a peritoneal breach in 3 patients (10%). Comparison of pre & post-operative laboratory values is given in Table 3. Graphic representation of VAS Pain scores grading on 1st POD is shown in Figure 3.

Table 2: Post-operative details (n=30)

Post-operative details		
Variables		**Values**
Post OP NPO Duration (hours)		7 ± 5.0 hours
Hospital stay		1.9 ± 0.1 days
Claviendindo classification	G 0	13 (43.3%)
	G 1	17 (56.6%)
Foley catheter removed	2nd day	19 (63.3%)
	4th day	5 (16.7%)
	5th day	2 (6.7%)

Table 3: Pre & post-operative APPD and laboratory test values for comparison (n=30)

Variables (n=30)	Pre OP Results	Post OP Results	P-value
HB	12.35 ± 1.6	11.9 ± 1.6	0.05
Hematocrit	37.6 ± 5.1	33.9 ± 5.5	0.05
TLC	11.6 ± 7.2	11.6 ± 2.9	0.73
PLT	356.7 ± 180.4	294.8 ± 161.4	0.01
Urea	24.7 ± 7.5	19.1 ± 6.3	0.81
Creatinine	0.5 ± 0.2	0.5 ± 0.31	0.005
APPD	3.0± 0.94	2.1 ± 0.2	0.25

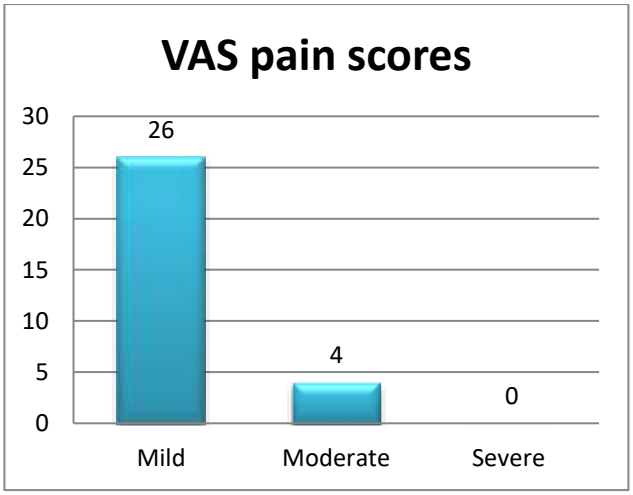

Figure 3: Graphic representation of VAS Pain scores grading on 1st POD (n=30)

All patients had a follow-up ultrasonography and APPD measurement at 3 months. There was complete resolution of clinical symptoms and improvement in hydronephrosis and APPD on ultrasonography in all patients. In two patients the JJ stents had migrated, and ureteroscopy had to be used (Figure 4).

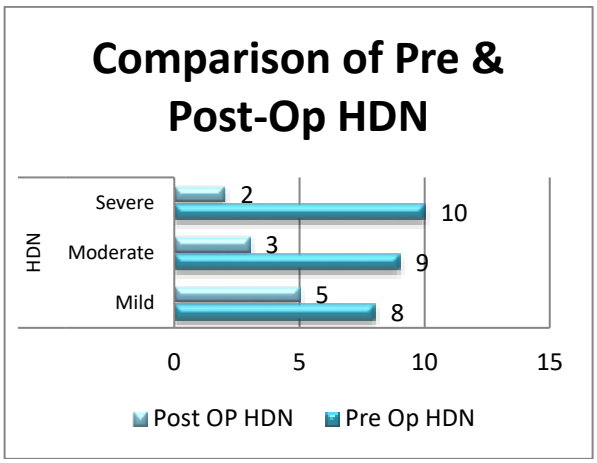

Figure 4: Graphical representation of Pre & Post-operative Hydronephrosis for comparison (n=30) (P=0.04)

DISCUSSION

Open pyeloplasty used to be the only standard treatment for adults and children during 1980s for the treatment of Uretero-Pelvic junction (UPJ) obstruction. (Adanur S, 2022 - Alzweri LM, 2022) But this procedure required a longer incision and hence, longer recovery period. In order to avoid this morbidity, surgeons were pushed to explore minimally invasive approaches. During the 1990s, the endourological management started gaining popularity for the treatment of UPJ obstruction in adults. (Alzweri LM, 2022) The success rate of endourological procedures was not convincing and it was < 80%. (Brooks JD, 1995) Schuessler et al. introduced the Laparoscopic approach via transperitoneal route for adult patients in 1993 and the procedure has been gaining popularity since then and is also feasible in recurrent cases. Schuessler WW, 1993) While, the retroperitoneal route of pyeloplasty was first employed by Janetschek et al in 1996. (Janetschek G, 1996) In pediatric population, Peter was the first to report experience of laparoscopic pyeloplasty in a 7 years old child.(Peters CA, 1995) The success rates of this approach are reported to be between 87 and 100% depending upon what series is reviewed. Minimal invasive surgery has brought a paradigm shift in the surgical management of Uretero-Pelvic junction (UPJ) obstruction since the beginning of the 21st century. Tan et al used transperitoneal route in 18 children with mean (range) age of children was 1.4 (0.25–15) yrs and no patient was converted to open.(Tan HL, 1999) Two patients needed a repeat procedure due to recurrent obstruction Yeung et al. reported successful outcomes of laparoscopic dismembered pyeloplasty in 13 patients using retroperitoneal access route. One patient needed conversion to open surgery.(Yeung CK, 2001) Soulie et al. compared Laparoscopic approach by retroperitoneal route and open approach using a minimal incision in 53 adults. (Soulié M, 2001) The return to painless activity was in favor of the laparoscopic arm in younger patients while other variables were comparable. In a study by Zhu et al., they retrospectively compared transperitoneal and retroperitoneal approaches in 50 patients to select out the easier approach during beginner phase of the learning curve of a laparoscopic surgeon.Several steps of the procedure were recorded individually, e.g. Patient positioning, Access to operating field, Dissection around UPJ, Suturing of UPJ. Apart from the total duration of surgery, the time consumed during each individual step was also measured and recorded. In this study, both approaches were comparable in terms of success rate, complications rate and hospital stay. One patient in the retroperitoneal was converted to open. Moreover, Total duration of procedure and time consumed during UPJ Suturing was significantly shorter in transperitoneal route (p=0.002). Transperitoneal route was more convenient regarding patient positioning. While, retroperitoneal group had significantly shorter time taken to access the operating field and UPJ & Resumption of oral intake after surgery (p=0.05). They suggested that young surgeons during their beginner phase of the learning curve should start to perform laparoscopy using a transperitoneal approach.(Zhu H, 2013) It has been observed that with increasing expertise, the complications rate and operative duration tend to decrease Trocar placement is the key step because difficulties with orientation and limited space would be multiplied in case of suboptimal trocar placement, especially in children. Frede et al., showed that by standardizing the technique, the operative duration would be reduced by as much as 75%. .(Frede T, 2000) Retroperitoneal space is far more familiar to the urologist and has the advantage of being a home ground. But narrow working space during laparoscopy causes problems, especially in pediatric patients.(El-Ghoneimi A, 2003) When crossing vessels are encountered, suturing becomes even more cumbersome but in our study, duration of procedure was no longer in such cases. All of children included in the study were able to resume their full school activities within a week after the procedure. This study is one of a kind as we incorporated modern technology to report its effects on operative outcomes and we suggest that more advanced technologies should be incorporated in future studies such as the 4k imaging system, on which we are already working. Main limitation is that comparison of this technique with other laparoscopic techniques and open approach was not done in this study. Moreover, 3D system was not compared with existing 2D or other modern 4K systems. Hence, More randomized controlled studies are mandatory to confirm these findings. The Laparoscopic Retroperitoneal Pyeloplasty is an attractive alternative to traditional open surgery or transperitoneal route but technically challenging. The use of a 3D imaging system helps in this regard as it provides very good depth perception & HD

view which is very helpful especially during suturing.

CONCLUSION

The laparoscopic approach is as effective as the open approach in the treatment of UPJ Obstruction. Reconstruction of the UPJ and Excision of the diseased UPJ and redundant pelvis can be easily performed laparoscopically via the retroperitoneal route. The Laparoscopic Retroperitoneal Pyeloplasty is an attractive option in children in terms of patient comfort, hospital stay, postoperative pain and recovery period with successful outcomes. A 3D imaging system in our experience helps reduce technical difficulties and complications by providing an HD view and 3D orientation of the surgical field. Further improvements in technique and instruments would be required in future to reduce technical difficulties and operative duration.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

ACKNOWLEDGEMENT

I would like to acknowledge my Supervisor, Dr. Sharjeel Saulat (HoD Urology) and all Urology Faculty of Tabba Kidney institute, Karachi.

AUTHOR CONTRIBUTIONS

AA: Objective, Data Collection, Write up
SS: Surgeries, Final Approval
JS: Statistical Analysis
DA: Data Collection, Surgery
ME: Write-up

REFERENCES

Adanur S, Demirdogen SO, Altay MS, Polat O. Comparing the Effects of 2D and 3D Imaging Systems on Laparoscopic Pyeloplasty Outcomes in the Treatment of Adult Ureteropelvic Junction Obstruction [published online ahead of print, 2022 Mar 28]. J Laparoendosc Adv Surg Tech A. 2022;10.1089/lap.2022.0072. doi:10.1089/lap.2022.0072

Alzweri LM, Thomas R. Adult Robotic Pyeloplasty. InTechniques of Robotic Urinary Tract Reconstruction 2022 (pp. 37-51). Springer, Cham.

Ali M, Raziuddin Biyabani S, Ghirano RA, Aziz W, Siddiqui KM. Is laparoscopic pyeloplasty a comparable option to treat ureteropelvic junction obstruction (UPJO)? a comparative study. JPMA: Journal of the Pakistan Medical Association. 2016;66(3):224.

Brooks JD, Kavoussi LR, Preminger GM, Schuessler WW, Moore RG. Comparison of open and endourologic approaches to the obstructed ureteropelvic junction. Urology. 1995 Dec 1;46(6):791-5.

Chiancone F, Fedelini M, Pucci L et al: Laparoscopic management of recurrent ureteropelvic junction obstruction following pyeloplasty: A single surgical team experience with 38 cases. Int Braz J Urol, 2017; 43(3): 512–17

Du T, Qi P, He L, Yang S, Zhang B, Shang P. Comparison of Secondary and Primary Minimally Invasive Pyeloplasty in the Treatment of Ureteropelvic Junction Obstruction: A Systematic Review and Meta-Analysis. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2022 Mar 18

El-Ghoneimi A, Farhat W, Bolduc S, Bagli D, McLorie G, Aigrain Y, Khoury A. Laparoscopic dismembered pyeloplasty by a retroperitoneal approach in children. BJU international. 2003 Jul;92(1):104-8

Frede T, Stock C, Rassweiler JJ, Alken P. Retroperitoneoscopic and laparoscopic suturing: tips and strategies for improving efficiency. Journal of endourology. 2000 Dec;14(10):905-14.

Jia J, Meng Q, Zhang M, Qi J, Wang D. A comparative study on the Efficacy of Retroperitoneoscopic Pyeloplasty and Open Surgery for Ureteropelvic Junction Obstruction in Children. Pakistan Journal of Medical Sciences. 2021 Nov;37(7):1768.

Loya MA, Zalce HL, López OR. Ureteropelvic junction (UPJ) obstruction. Acta Médica Grupo Angeles. 2021 Dec 17;19(4):544-6.

Liu D, Zhou H, Ma L et al: Comparison of laparoscopic approaches for dismembered pyeloplasty in children with ureteropelvic junction obstruction: Critical analysis of 11-year experiences in a single surgeon. Urology, 2017; 101: 50–55

Okarska-Napierała M, Wasilewska A, Kuchar E. Urinary tract infection in children: Diagnosis, treatment, imaging – comparison of current guidelines J Pediatr Urol. 2017 Dec;13(6):567-573. Doi: 10.1016/j.jpurol.2017.07.018

Pogula VR, Galeti EH, Omkaram K, Nalubolu MR. Evaluation of Open vs Laparoscopic Pyeloplasty in Children: An Institutional Experience. World. 2021 Sep;14(3):174.

Pérez-Bertólez S, Martín-Solé O, García-Aparicio L. Comparison between mini-laparoscopy, conventional laparoscopy and open approach for ureteropelvic junction obstruction treatment in children. Scandinavian Journal of Urology. 2021 Jul 4;55(4):307-12.

Peters CA, Schlussel RN, Retik AB. Pediatric laparoscopic

dismembered pyeloplasty. The Journal of urology. 1995 Jun;153(6):1962-5.

Rehman OF, Umair M, Hussain AK, Faraz A, Iqbal M, Waqar M, Tahir M, Khan AR. Laparoscopic Versus Open Pyeloplasty for Primary Pelvic Ureteric Junction Obstruction: A Prospective Single Centre Study. Cureus. 2020 Oct 22;12(10).

Schuessler WW, Grune MT, Tecuanhuey LV, Preminger GM. Laparoscopic dismembered pyeloplasty. The Journal of urology. 1993 Dec 1;150(6):1795-9.

Soulié M, Thoulouzan M, Seguin P, Mouly P, Vazzoler N, Pontonnier F, Plante P. Retroperitoneal laparoscopic versus open pyeloplasty with a minimal incision: comparison of two surgical approaches. Urology. 2001 Mar 1;57(3):443-7.

Tan HL. Laparoscopic Anderson-Hynes dismembered pyeloplasty in children. The Journal of urology. 1999 Sep;162(3 Part 2):1045-7.

Yeung CK, Tam YH, Sihoe JD, Lee KH, Liu KW. Retroperitoneoscopic dismembered pyeloplasty for pelvi-ureteric junction obstruction in infants and children. BJU international. 2001 Apr;87(6):509-13.

Zhu H, Shen C, Li X et al: Laparoscopic pyeloplasty: A comparison between the transperitoneal and retroperitoneal approach during the learning curve. Urol Int, 2013;90(2): 130–35

Zwimpfer TA, Wismer C, Fellmann-Fischer B, Geiger J, Schötzau A, Heinzelmann-Schwarz V. Comparison of 2D 4K vs. 3D HD laparoscopic imaging systems using a pelvitrainer model: a randomized controlled study [published online ahead of print, 2021 Oct 26]. Updates Surg.2021;10.1007/s13304-021-01195-0. Doi:10.1007/s13304-021-01195-0