Transperitoneal versus Retroperitoneal laparoscopic pyeloplasty for management of Uretropelvic junction obstruction

Thesis
Submitted for fulfilment of MD degree in urology

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2014
ACKNOWLEDGEMENT

First of all, all of gratitude is due to ALLAH Almighty for blessing this work until it has reached its end, as a part of his generous help, throughout my life.

Then I wish to express my great thanks to Prof. DR. Hassan Yassin Ashour of urology, faculty of medicine, Benha University for his great support and encouragement.

I am also deeply grateful to Prof. Dr. Ahmed Mamdouh Shoma, Professor of urology, faculty of medicine, Mansoura university for his great continuous help and kind guidance, advice and encouragement.

Warm gratitude is paid to Prof. Dr. Tarek Mohamed El-Karamany, professor of urology, faculty of medicine – Benha University for his kindly supervision.

I would like to express my greet appreciation to Dr. Ahmed Sebaey Ahmed Mostafa Lecturer of urology, faculty of medicine – Benha university for his continuous assistance and support.

Additionally, I would like to thank my outstanding professors, staff member and my colleagues in Benha urology department and Mansoura urology and nephrology center for their support, encouragement and help.

Finally, my kind wishes for all patients participated in this study to have a healthy and happy life.
Dedication

To my parents

To my small family
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<tr>
<td>AESOP</td>
<td>Automated Endoscopic System for Optimal Positioning</td>
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<tr>
<td>COPD</td>
<td>Chronic obstructive pulmonary disease</td>
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<td>CT</td>
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<td>Computed tomography on urinary tract</td>
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<td>GFR</td>
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<td>LP</td>
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<td>MAG-3</td>
<td>Mercaptoacetyl triglycine</td>
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<td>RALP</td>
<td>Robotically Assisted Laparoscopic Pyeloplasty</td>
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<td>RUS</td>
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<td>SD</td>
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<td>T ½</td>
<td>Time needed for excretion of ½ radioisotope element.</td>
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<td>TRAC</td>
<td>Trocarless rotational access cannula</td>
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<td>UPJ</td>
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<td>USA</td>
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Introduction

Pelvi-ureteric junction obstruction (PUJO) is the most common disease of the ureter, and can lead to progressive hydrenephrosis and renal dysfunction. *(Hani et al., 2011)*

PUJO can be attributed to functional or anatomical abnormalities, or there might even be an association between them. Also, secondary PUJO can occur after endoscopic or open urinary tract procedures. The surgical management of PUJO has changed considerably over the past 20 years. Traditionally, open pyeloplasty was considered to be the standard method for treating PUJO, with success rates of up to 95%. However, the procedure requires a loin incision and so is associated with a prolonged recovery time *(Hani et al., 2011)*

Endopyelotomy became popular in the 1980s as a minimally invasive technique, with a success rate up to 93% in well-selected patients. It has the advantages of a lower rate of complications, relatively short operating times, and quick recovery. Higher success rates have been cited in those patients with a small pelvis and in whom no crossing vessels are present *(Albani et al., 2004)*

Several other procedures were further described: balloon dilatation, retrograde endopyelotomies, and endopyelotomies with the Acucise catheter. The success rate of these minimally invasive procedures has been 15–30% lower than that of open pyeloplasty. *(Tan et al., 2005)*
Laparoscopic pyeloplasty (LP) was initially introduced by Schuessler et al. in 1993. Success rates are reported as 87–100%. The procedure allows the identification of crossing vessels, excision of the diseased PUJ, reduction pyeloplasty and a watertight anastomosis. The analgesic requirements, hospital stay and recovery period are considerably lower than for the open procedure. However, the procedure requires considerable skill and involves longer operating times than with open and minimally invasive techniques. (Moon et al., 2006)

Although technically challenging, the low incidence of failure combined with reduced postoperative morbidity has made this an increasingly popular treatment option at institutions offering this approach. (Sami et al., 2010)

Laparoscopic pyeloplasty can be performed via a retroperitoneal or transperitoneal approach. Equivalent success rates have been quoted in the literature. Perioperative outcomes were comparable in terms of morbidity and success rate. Both techniques were comparable in the postoperative low grade complications which were managed conservatively. No Clavien complications higher than grade II were encountered in either approach. (Sami et al., 2010 and Hani et al., 2011)

Recently, the results of a meta-analysis did not support either approach over the other, both are associated with high success rates and low perioperative complications. Similarly, hospital stay was comparable between both procedures. (Moon et al., 2006, Shoma et al., 2007, Sami et al., 2010, Wu Y et al., 2012)
Aim of the work

To evaluate and compare efficacy and safety of transperitoneal and retroperitoneal laparoscopic pyeloplasty for management of ureteropelvic junction obstruction.
Chapter 1

Applied laparoscopic anatomy

The skin of anterior abdominal wall is capable of enormous stretching and the thinnest part of the anterior abdominal wall is at the inferior crease of the umbilicus in addition the peritoneum is adherent to transversalis fascia at the umbilicus so the incision for pneumoperitoneum is made through this location. (*Winfield, 1992*)

In the infants there is very little subcutaneous adipose tissue and the fascia readily becomes apparent on skin incision however in the adult patients a slightly larger incisions may be required to allow for dissection through the fat to expose the fascia before introduction of the trocars. (*Jordan & Robey, 1991*)

The umbilicus overlies the bifurcation of the aorta and trendelburg's position rotates aorta and common iliac vessels into horizontal plane with consequent reduction in distance from the umbilicus to the bifurcation of the aorta, so the direction of the needle insertion should be towards the hollow of the sacrum which anatomically would corresponds to the level below the bifurcation of the aorta. (*Winfield, 1992*)

The inferior epigastric vessels run upward in the extraperitoneal connective tissue, pass medial to the deep inguinal ring, pierce fascia transversalis at the lateral border of rectus abdomens and enter the rectus sheath by crossing the arcuate line and anastomosing with the superior epigastric vessels superior to the umbilicus. So to avoid injury to the epigastric vessels and their branches, the three safe sites of selection for introduction of trocars are below the umbilicus in the midline or in the right or left lower quadrant at the umbilicus – iliac crest line of the lateral third. (*Winfield, 1992*)
Laparoscopic view through transperitoneal approach

The first landmark should be the ligamentum teres and the falciform ligament. The ligamentum teres is a fibro-adipose cord, represent the obliterated umbilical vein, which extends from above the umbilicus towards the porta-hepatic and is attached to the left branch of the portal vein. It has a fatty appearance with fine vessels. Its continuation above the liver lobes is formed by the falciform ligament is sickle shaped, opaque and sometimes infiltrated with fat and contains few fine vessels. It forms curtain like partition above the anterior surface of the liver. *(Cuschieri, 1975)*

1- Liver lobes:

The normal liver is reddish brown with a smooth, shiny surface. The edges are sharp towards the lateral aspect of both lobes. The medial aspect of each lobe dips towards the falciform ligament. Under normal conditions, the inferior surface of the liver is not visible. In cases of hypertrophy, fibrosis, infiltration by metastasis, the inferior surface is more readily seen. *(Irving et al., 1968)*

2- Gall bladder:

The normal gall bladder in a fasting patient is slightly distended, and the peritoneal surface is shiny greenish-blue in colour. Small tortuous blood vessels are seen on the surface. The pathological gall bladder appears pale, whitish or opaque. *(Berci et al., 1991)*

3- Stomach:

In most cases, the anterior wall including parts of the duodenum antrum and body can be seen below the liver. The greater curvature and the gastroepiploic arcade can be observed *(Berci et al., 1991).*
4- **Spleen:**

The normal spleen is not visible with the patient in the supine position since it is covered with omentum. If the splenic visualization is necessary the patient is turned to the anti-trendlenburg position with the careful attention has to be paid to the spleno-colic ligament, its overstretching may result in tearing of the splenic capsule with severe hemorrhage. The spleen appears bluish brown in colour. There may be few notches seen on its medial margin (*Berci et al., 1991*).

5- **Omentum:**

The appearance and extent of the omentum correlates with the patient's built. Thin or cachectic patients have insignificant filmy omentums whereas in obese patients it is thick, covering most of the intra-abdominal organs, and is difficult to be moved with the palpating probe (*Berci et al., 1991*).

6- **The peritoneum:**

Under normal conditions the peritoneum is pinkish white in colour and has a fine vascular architecture. In the right upper quadrant an indentation of the peritoneum covering the dome of the right lobe of the liver can be encountered at is called Zahn's indentation. As the peritoneal lining over the diaphragm is very thin, the muscular and the tendinous sections of the diaphragm can be well distinguished.
The lumbar retroperitoneal space is bounded anteromedially by the peritoneum, posteriorly and laterally by the paraspinal and flank muscles, and superiorly by the diaphragm, and its inferior extent is continuous with the pelvic extraperitoneal space. Although its posterior and lateral boundaries are composed of anatomically fixed structures, its anterior and anteromedial boundaries are formed by the peritoneum, which is mobile and can be displaced by mechanical means such as balloon dilatation (Gill, 1998).

The retroperitoneal space is only a potential space that contains the great vessels, adrenal gland, kidney and proximal ureter on either side. In addition, variable amounts of perirenal adipose tissue and septated areolar tissue are present. The lateroconal fascia connects Gerota's fascia to the lateral parietal peritoneum (Himpens, 1996).
Review of literature

The space between the lateroconal fascia and the peritoneum is the anterior pararenal space. The space dorsolateral to this fascia is the posterior pararenal space. It is this place that is balloon dilated during retroperitoneoscopy (*Inderbir et al., 2002*).

![Laparoscopic view in retroperitoneoscopy](image)

*Fig. (2) Laparoscopic view in retroperitoneoscopy* (quated from Operative Atlas of Laparoscopic Reconstructive Urology(2009) p. 70)
Chapter 2

Pathophysiology of uretropelvic junction obstruction

The diagnosis of uretropelvic junction obstruction (UPJO) results in a functionally significant impairment of urinary transport from the renal pelvic to the ureter. Although most cases are probably congenital, the problem may not become clinically apparent until much later in life (Jacobs et al., 1979).

Acquired conditions such as stone disease, postoperative or inflammatory stricture, or urothelial neoplasm may also present clinically as symptoms and signs of obstruction at the UPJ level. Similarly, extrinsic obstruction can occur at this level as well. The focus in this section is primarily on the diagnosis and treatment of congenital UPJ obstruction, although these techniques may be applied to the management of certain acquired conditions, in particular urinary stones. (Jacobs et al., 1979)

Pathogenesis:

Congenital UPJ obstruction most often results from intrinsic disease. A frequently found defect is the presence of an apersitaltic segment of the ureter, perhaps similar to that found in primary obstructive megaureter. In these cases, histopathological studies reveal that the spiral musculature normally present has been replaced by abnormal longitudinal muscle bundles or fibrous tissue (Allen, 1970 1978).
UPJO results in failure to develop a normal peristaltic wave for propagation of urine from the renal pelvis to the ureter. Recognition that this type of segmental defect is often responsible for UPJ obstruction is of utmost importance clinically because such ureter may appear grossly normal at the time of surgery, and in fact, may often be calibrated to 14 Fr or greater. Further investigations in the etiology of UPJ obstruction have shown decreased interstitial cells of Cajal at the UPJ in children (Solari et al., 2003).

The cytokine produced in the urothelium has also been proposed to exacerbate UPJ obstruction (Chiou et al., 2005). Other experimental studies have implicated transforming growth factor-β, epidermal growth factor expression, nitric oxide, and neuropeptide Y in UPJ stenosis (Kneer et al., 2001; Yang et al., 2003). A less frequent intrinsic cause of congenital UPJ obstruction is true ureteral stricture. Such congenital ureteral strictures are most frequently found at the UPJ, although they may be located at sites anywhere along the lumbar ureter. Abnormalities of ureteral musculature have been implicated as electron microscopy has demonstrated excessive collagen deposition at the site of the stricture (Hanna et al., 1976).

Intrinsic obstruction at the UPJ may also result from kinks or valves produced by infoldings of the ureteral mucosa and musculature (Maizels and Stephens, 1980). In these cases, the obstruction may actually be at the level of the proximal ureter. This phenomenon appears to result from retention or exaggeration of congenital folds normally found in the ureter of developing fetuses. (Chiou et al., 2005)
In some of these cases, the defects are bridged by ureteral adventitia. Grossly, this can manifest as external bands or adhesions that appear to be causing the obstruction. In fact, Johnston et al., in 1977, reported that lysis of external adhesions can at times reestablish flow without pyeloplasty. In the majority of cases, however, these bands or adhesions are likely to be a secondary phenomenon associated with intrinsic obstruction so that operative pyeloplasty would generally be most effective. (Johnston et al., 1977)

The presence of these kinks, valves, bands, or adhesions may also produce angulation of the ureter at the lower margin of the renal pelvis in such a manner that, as the pelvis dilates anteriorly and inferiorly, the ureteral insertion is carried further proximally. In these cases, the most dependent portion of the pelvis is inadequately drained and the apparent "high insertion" of the ureteral ostium is actually a secondary phenomenon (Kelalis, 1976).

In at least some cases, however, the high insertion itself is likely the primary obstructing lesion, because this phenomenon is found more frequently in the presence of renal ectopia or fusion anomalies. As such, a high insertion can have implications in the subsequent surgical management, particularly endourologic approaches. (Das and Amar, 1984)
Sampaio in 1993 stated that “a precise understanding of the vascular anatomy is of utmost importance when evaluating patients with UPJO.” The incidence of crossing vessels in patients with UPJO varies in the literature from 11% to 87%. Crossing vessels usually cross anteriorly to the UPJ posteriorly crossing vessels are less commonly encountered. (Martin et al., 2001).

Fig. (4): Spiral CT angiography with three-dimensional reconstruction clearly identifies an accessory lower pole crossing vessels at the level of the ureteropelvic junction (UPJ) in a patient with UPJ obstruction. (After CAMPBELL-WALSH Urology, 10th edition P. 1134)

Crossing vessels may be important for two reasons: They are a potential source of hemorrhage following endoscopic incision, and they may play an etiological role in UPJO, and therefore may be a reason for failure of endoscopic techniques. (Mitterberger et al., 2008).
A) Diagnosis

UPJ obstruction, although most often a congenital problem, can present clinically at any time of life. Historically, the most common presentation in neonates and infants was the finding of a palpable flank mass. However, the current widespread use of maternal, prenatal ultrasonography has led to a dramatic increase in the number of asymptomatic newborns being diagnosed with hydronephrosis, many of whom are subsequently found to have UPJ obstruction (Bernstein et al, 1988; Wolpert et al, 1989).

A fraction of cases may also be found during evaluation of chronic renal failure, which may result from bilateral obstruction in a functionally or anatomically solitary kidney. UPJ obstruction may also be incidentally found during studies performed to evaluate unrelated anomalies such as congenital heart disease (Roth and Gonzales, 1983). In older children or adults, intermittent abdominal or flank pain, at times associated with nausea or vomiting, is a frequent presenting symptom. Hematuria, either spontaneous or associated with otherwise relatively minor trauma, may also be an initial symptom. Laboratory findings of microhematuria, pyuria, or frank urinary tract infection might also bring an otherwise asymptomatic patient to the urologist. Rarely, hypertension may be a presenting finding (Riehle and Vaughan, 1981).

The diagnosis of a UPJ obstruction requires a functional study to determine the presence of an obstruction in addition to any clinical symptoms. Various imaging modalities have been used to both identify UPJ obstruction and determine its significance. Anatomical studies include renal ultrasound (RUS), and computerized tomography (CT) of the abdomen and pelvis. Magnetic resonance imaging (MRI) urography has been reported, but does not represent a widely available nor cost-effective study. The diuretic renal scan is the standard modality to determine the significance of obstruction and to determine the relative function of the obstructed kidney. (Vipul, 2008)
The Whitaker test had been the gold standard in determining UPJ obstruction, but has been supplanted by diuretic renography as the gold standard due to its invasiveness and its low sensitivity. The Whitaker test is currently used only if other tests are indeterminate or conflicting. *(O’Reilly, 1986).*

**Intravenous urography** is a useful test to delineate both anatomy and function in UPJ obstruction. This is an appropriate test for patients with normal renal function, with no intravenous (IV) contrast allergy, and who are not pregnant. Obstruction is visualized as delayed filling of a dilated proximal collecting system with a distinct transition point between the renal pelvis and the proximal ureter. Oftentimes, a crossing vessel may be implied by a kink at the transition point or an unexpected curve in the proximal ureter.

However, if the UPJ obstruction is severe, then no contrast will be seen on the affected side during the duration of the imaging. *(Nesbit et al., 1956)*

**Renal ultrasound** is a good anatomical study, but is unable to reveal any functional information. It is commonly used first in the pediatric population, in pregnant patients, in azotemic patients, and in patients with contrast-induced allergies. Besides evaluation of the renal parenchyma, ultrasound is capable of determining the presence of hydronephrosis. Hydronephrosis appears on ultrasound as an anechoic mass separating the central echo complex of the renal hilum. Ultrasound is inaccurate, however, in determining whether or not obstruction exists. *(King et al., 1984)*
Unenhanced helical CT scan is widely accepted method of diagnosis. It provides excellent anatomic detail and easily reveals hydrenephrosis, but does not show functional significance of the hydrenephrosis unless contrast-enhanced images are taken and compared with delayed images.

Unenhanced helical CT is the gold standard for the detection of renal calculi, and oftentimes is the study initially performed for flank pain. UPJ obstruction can be diagnosed with a hydrenephrosis leading to a normal proximal ureter. Besides identification of a transition point, CT scan may reveal perinephric stranding, periureteral edema, renal swelling, and a crossing vessel. (Vieweg et al., 1998)
Diuretic renal scan is a non-invasive measure of renal function and allows washout of the collecting system to determine functional significance of an obstruction. Those unable to void completely must have a catheter placed. (Roarke et al., 1998)

Normal renal function is important in determining the response of the kidneys to the diuretic. A sufficient flow rate must be induced by the diuretic in order to detect obstruction. (Roarke et al., 1998)

![Image](image-url)

Fig. (8): MAG-3 diuretic renography revealing ureteropelvic junction obstruction of the left kidney, with a T1/2 greater than 35 minutes. (After CAMPBELL-WALSH Urology, 10th edition P. 1129)

In cases of decreased creatinine clearance, increased diuretic amounts may be used to decrease the possibility of a false negative result. The timing of the administration of the diuretic is key. The diuretic is given 20 min after the radionuclide is administered. This has been called the F-20 technique. If there is prompt washout, then no obstruction exists. If the t1/2 of the clearance of the radionuclide in the collecting system is greater or equal to 20 min, then the collecting system is obstructed. (Roarke et al., 1998)
Partial obstruction may exist or renal impairment may cause indeterminate clearance curves. If this is the case, the diuretic may be given 15 min prior to radionuclide administration, to achieve a normal washout curve. This is called the F-15 technique. *(Roarke et al., 1998)*
• **Treatment**

The currently accepted indications for the treatment of UPJ obstruction include symptomatic obstruction, formation of stones or infection, decrease in overall renal function or worsening ipsilateral renal function, and rarely, hypertension. *(Hanna, 2000)*

The goal of treatment is a restoration of urine flow and improvement or return of renal function. If the patient presents with physiologically indeterminate obstruction, then the option of observation with serial imaging studies may be appropriate. The patient whose overall renal function is decreased in a solitary kidney or bilaterally involved disease mandates a pyeloplasty be performed. In children with UPJ obstruction, similar criteria are used to determine when a pyeloplasty is indicated. However, controversy still remains as to the optimal timing of repair in the neonate *(Shokeir and Nijman, 2000)*.

For those with suspected UPJO, debate is ongoing regarding the optimal management. Historically, most patients with high-grade hydronephrosis were treated surgically. Before the arrival of the endourological era Surgical management with open pyeloplasty is safe, with a high success rate of 90%-95%. Studies have indicated that conservative management is appropriate for those who might not have complete UPJO *(Koff & Campell 1994)*.

• **Open pyeloplasty**

The first reported open surgical reconstruction of the UPJ was in 1886 by Trendelenburg, followed by an initial description of flap techniques in 1916 by Schwyzer. The often quoted Anderson- Hynes dismembered pyeloplasty was described in 1949 and has withstood the test of time with reported success rates in excess of 90%. Even today this procedure continues to be held as the gold standard against which other surgical options must be compared *(Howard, 2006)*.
The endourological approaches (antegrade and retrograde) which began surfacing in the 1980s have reasonably high success rates (70% to 90%), but as they are less invasive than the open surgical counterpart, provide for a more comfortable postoperative course (Albani and Yost, 2004).

However, Van Cangh et al. elegantly demonstrated that patient selection is critically important to the success of any endourological approach. Patients with crossing and potentially extrinsically constricting anterior lower pole renal vessels, a significantly dilated renal pelvis, nuclear scan split renal function of the affected kidney (less than 25%) and/or UPJ obstruction greater than 2 cm, are less likely to have a successful outcome (less than 50%) after endopyelotomy. The role of the anterior crossing renal vessel as a culprit in UPJ obstruction continues to generate considerable controversy but clinical and research data accumulate to suggest it is real (DiMarco et al., 2006).

**Endopyelotomy**

In 1983, Wickham and Kellett described the technique of full-thickness incision of the obstructing UPJ with a cold knife inserted through a dilated percutaneous nephrostomy track, which they named percutaneous pyelolysis. Postoperatively, a ureteral stent was left in situ for 4 weeks to act as a scaffold for ureteric healing, according to the principles of the intubated ureterotomy. This technique is now better known as endopyelotomy (Christopher G. Eden, 2007).

Although diathermy and laser energy have been used as alternatives to old knife incision of the UPJ with similar success rates, there is a concern that diathermy might produce more tissue necrosis and fibrosis, which may lead to a higher stricture rate, but this is currently unproven. (Christopher G. Eden 2007).


**Balloon disruption:**

Balloon disruption of the UPJ (inflation of the balloon until the ‘waist’ disappears, extravasation of contrast from that site, and ureteric stent insertion) has the appeal of being technically less demanding than endopyelotomy. When performed retrogradely, it can be performed with no skin incision as a day case. (*Osther et al, 1998*)

**Acucise device:**

A modification of the balloon catheter is the addition of a 100 mm electrocautery cutting wire, which bowstrings across it (Acucise, Applied Medical Systems, Laguna Hills, CA, USA). When a diathermy current is applied to the wire with the balloon inflated across a stenosed UPJ, it simultaneously incises and dilates the stricture. (*Eden, 2007*)
• **Laparoscopic pyeloplasty**

Laparoscopic approaches to UPJ obstruction offer perhaps the best of both worlds. They provide a balance between a highly successful technique in all patients (as with open pyeloplasty) and improved postoperative recovery (better than the open approach, although longer than endopyelotomy). *(Howard, 2006).*

With a laparoscopic approach, whether transperitoneal, retroperitoneal or even robotically assisted, the urologist now can accurately access the anatomy of the UPJ and determine if a dismembered approach might be best or whether a Foley Y-V plasty or Scardino-Prince vertical flap may lead to better results. Should tailoring of the renal pelvis be considered? Such options are possible with the laparoscopic as well as the open surgical route, but not with the endoscopic approach. *(Howard, 2006).*
Chapter 4

Laparoscopic pyeloplasty

Laparoscopic pyeloplasty (LP) aims to combine the same excellent results of open pyeloplasty with avoidance of a substantial wound. Since the initial report of LP by Schuessler et al in 1993, the popularity of LP has increased at only a very modest rate because of its perceived difficulty. The initial series of LPs were associated with very long operating times of up to 7 h due mainly to the difficulty of laparoscopic suturing but also exacerbated by the poorer laparoscopic vision available at that time and by surgical inexperience. (Eden, 2007)

The use of alternatives to suturing, such as the Laparaty clip and Endostitch devices, tissue glues laser welding and even the endoGIA linear stapler-cutter, which delivers metal staples have all been described but have not assumed popularity. The reason for this is probably that laparoscopic suturing is readily taught and mastered. Better optics, greater experience, and more familiarity with laparoscopic suturing have reduced operating times to those similar to open surgery. (Araki et al., 2005)
PREOPERATIVE PATIENT MANAGEMENT

Patient selection and contraindications:

Careful patient selection and identification of possible relative and absolute contraindications are vital to a successful outcome of laparoscopic procedures. To this end, a meticulous past history and physical examination are the initial steps in patient evaluation for possible laparoscopic surgery. Age, health based laboratory studies, electrocardiogram and a chest radiograph should be obtained, following the same criteria established for any other significant open surgical procedure that is undertaken with general anaesthesia. *(Gaurav and Leonard, 2010).*

Especially in patients presenting with severe chronic obstructive pulmonary disease (COPD), further studies (i.e., arterial blood gases and pulmonary function tests) are required. In severe COPD, helium as an alternative insufflant should be considered. Severe cardiac arrhythmias have to be evaluated and treated accordingly because hypercarbia and the resulting acidosis may have adverse effects on the myocardium *(Gaurav and Leonard, 2010).*

- **Absolute contraindications:**

1- **Abdominal wall sepsis:** This is an absolute contraindication because of the risk of peritoneal infection.

2- **General peritonitis:** This is increased risk of dissemination of infection. *(Elspeth et al, 2005)*

3- **Bowel obstruction:** There is increased risk of bowel injury in patient with distended abdomen due to air-fluid filled intestinal loops
4- **Uncorrected coagulopathy:** Correctable coagulation disorders do not constitute a contraindication, but they require prior replacement therapy. If the abnormal coagulation state proves refractory, laparoscopy should be avoided.

5- **Massive hemoperitoneum.**

6- **Suspected malignant ascites.** *(Elspeth et al, 2005)*

**Relative contraindications:**

Relative contraindications to laparoscopic surgery necessitates careful risk-benefit analysis and extensive informed consent, the following conditions should alert the surgeon to potential difficulties with a laparoscopic approach.

1- **Morbid Obesity:**

Laparoscopic procedures in morbidly obese patients are technically challenging. Difficulties include inadequate length of instruments, decreased range of motion of instruments, need for higher pneumoperitoneum pressures to elevate the abdominal wall, and poor anatomic orientation owing to excessive amounts of adipose tissue. The difficulties translate into a higher rate of associated complications *(Brown et al., 2008)*.

2- **Extensive prior abdominal or pelvic surgery:**

When extensive intra-abdominal or pelvic adhesions are suspected, close attention must be given to the possible site of veress needle insertion as well as to the possibility of obtaining open access with a Hasson- style cannula. Alternatively in these patients, a retroperitoneal approach, or the procedure can be initiated retroperitoneally and the peritoneum then entered. *(Elspeth et al, 2005)*

3- **Pelvic fibrosis:**

Patients with a history of pelvic or intra- abdominal infection (i.e. peritonitis, ruptured appendix or disrupted colonic diverticulum) results in significant scaring and a large amount of adhesion, are poor candidates for laparoscopy. In these
patients the veress needle must be placed as far as possible from the site of the affected organ or the surgical site (Cadeddu et al., 1999)

4- Ascites:

Patients with severe ascites are under increased risk of injury to the bowel, owing to closer proximity of bowel loops to the anterior peritoneum. In addition, a watertight closure is required, and firm wound dressing should be applied to prevent prolonged post-operative leakage. An open-cannula approach to achieve the pneumoperitoneum in these patients is recommended (Gaurav et al., 2010).

5- Pregnancy:

Initial access to the abdomen must be obtained at a safe distance from the fundus of the gravid uterus. As such, trocar placement is usually performed more cephalad on the abdominal wall, depending on the fundus of the uterus. The left upper quadrant is often the preferred site of access. As pregnancy progress beyond the 20th week, the technical possibility of performing laparoscopic procedures decreases significantly, correlating with the increasing size of the gravid uterus (Sainsbury et al., 2004).

6- Organomegaly:

Known or preoperatively diagnosed organomegaly necessitates a cautious approach when obtaining the pneumoperitoneum. The site of verses needle insertion must be chosen at a safe distance from any enlarged organ. Alternatively, open access is recommended in cases of marked hepatomegaly or splenomegaly (Gaurav et al., 2010).

7- Hiatal hernia:

Large hiatus hernia results in pneumo-mediastinum after laparoscopy and is usually considered a contraindication (See, 1993).

8- Irreducible abdominal or inguinal hernia:

There is a risk of ischemia of the content of an external hernia when the intra-
peritoneal pressure is increased by artificial pneumoperitoneum (See, 1993).

9- Umbilical abnormalities:

Evidence of an umbilical hernia, presence of urachal remenant or history of an umbilical herniorrhaphy precludes the use of the umbilicus as the primary site for placement of the veress needle. This problem can be overcomed by choosing a lateral site on the abdomen for insufflation (See, 1993).

10- Iliac or aortic aneurysm:

This condition needs to be evaluated by the vascular surgeon. If the aneurysm does not warrant immediate surgical correction, insertion of the veress needle should be performed in the left upper quadrant to stay well away from the area of the aneurysm. Alternatively, open access with the Hasson technique can be employed. Insertion of accessory trocars must be done under strict endoscopic control to avoid the area of the aneurysm. Alternatively, the retroperitoneal laparoscopic approach can be employed (Elspeth et al, 2005)
Bowel preparation:

The need for an regimen of bowel preparation have changed markedly. For retroperitoneoscopy, no bowel preparation is needed. For transperitoneal laparoscopic procedures, a light mechanical bowel preparation can be given in an effort to decompress the bowels. Usually, a clear liquid diet and a Dulcolax suppository or two Dulcolax tablets the day before the procedure are sufficient (Breda et al., 2007).

Preparation of blood products:

laparoscopic pyeloplasty should be managed like any other major open surgical procedure, with two units of packed red blood cells available before surgery. The patient should also be provided with the option of donating two units of autologous blood. This is most important during one's initial major laparoscopic cases (Ahlering et al., 2004).
OBTAINING MAXIMUM VISUALIZATION DURING LAPAROSCOPY

Decreasing the "Fogging Condition": Fogging of the telescope usually occurs because of a difference of temperature between the ambient intraabdominal temperature and the temperature of the telescope. There are several measures to decrease it:

1. Immersing the telescope pre-operatively into warm saline for at least 15 minutes.
2. Do not use the trocar-telescope for insufflation. The insufflated CO2 will cool the telescope and prompt fog accumulation.
3. Use a defogging agent.
4. Intra-abdominal wiping of the telescope: The tip of the telescope can be frequently wiped over intra-abdominal organs for better visualization. It is best done on bowel surface. Omentum or fatty structures should be avoided.
5. Intra-abdominal irrigation of the tip of the telescope: Some telescopes have built-in irrigation apparatus. The tip of the telescope can also be irrigated while working with a irrigation-suction device using normal saline. If the irrigated saline is cold this increased visualization will only be temporary.

Choosing the proper telescope: We favor the use of a zero degree straight forward telescope for most procedures. A 30 Degree angle telescope can be used to have a good view of certain structures. (Elspeth et al, 2005)
Operating Room Setup

The operating room has to provide enough space to accommodate all necessary personnel and the technologic equipment required by both the laparoscopist and the anaesthesiologist. Positioning of equipment, surgeon, assistants, nurses, anaesthesiologist, and other support staff should be clearly defined and established for each standard laparoscopic procedure. A separate tray with open laparotomy instruments must be ready for immediate use in the event of complications or problems necessitating open incisional surgery. *(Elspeth et al., 2005)*

Patient positioning and Draping

Positioning of the patient depends primarily on the laparoscopic procedure to be performed. Most laparoscopic procedures start with the patient in a supine position with the arms secured at the sides of the body. In the Trendelenburg or lateral position, tape and security belts applied across the chest and thighs provide safe and stable positioning of the patient. *(Elspeth et al., 2005)*

In the lateral position, all bony prominences must be carefully padded; likewise, the point of contact between any of the positioning straps and the hip or shoulder should be padded. In the lateral position, the bottom leg is flexed approximately 45° while the upper leg is kept straight; a pillow is placed between the legs as a cushion and also to elevate the upper leg so that it lies level with the flank, thereby obviating any undue stretch on the sciatic nerve. *(Elspeth et al., 2005)*
Application of active warming system may prevent hypothermia should a lengthy laparoscopic procedure be anticipated. The full extent of the abdominal wall should be prepared and draped from nipples to pubis. In some procedures, it is advantageous to extended the preparation to the knees and to drape the external genitalia into the surgical field. For example, gently pulling on the testicle may help identify the intrapelvic location of the vas deferens and spermatic vessels, insertion of the surgeon's index finger into the vagina certainly facilitates laparoscopic bladder neck suspension, and free access to the urethral meatus enables the performance of auxiliary procedures such as flexible cystoscopy or manipulation of ureteral catheters during a laparoscopic pyeloplasty. (*Elspeth et al., 2005*)

Before major laparoscopic procedures, placement of a nasogastric tube and a Foley catheter is usually performed to decompress stomach and bladder, respectively, thereby decreasing the chance of injury of abdominal contents during insertion of the Veress needle and the initial trocar. Pneumatic compression stockings are applied as anti-embolic prophylaxis. (*Elspeth et al., 2005*)

**Placement of Operative Team and Equipment**

If only one monitor is used, it is typically placed at the foot of the table. If two monitors are used, they are positioned on either side of the table opposite the primary surgeon and the assisting surgeon, respectively, to allow an unobstructed view. (*Elspeth et al., 2005*)

The cart with the monitor for the primary surgeon should also contain the insufflator, placed at the surgeon's eye level, to allow continuous monitoring of the CO2 pressure. The light source, camera controls, and any recording device are also on this cart. The surgeon usually stands opposite the area of surgical interest and the assistant stands on the ipsilateral side of the table. (*Elspeth et al., 2005*)
The second assistant stands on the contralateral side of the table. With two monitors in use, the instrument table and the scrub nurse are on the side of the surgeon toward the end of the table.

Incoming lines form insufflator, suction/irrigation, and electrosurgical devices enter from the contralateral side. Optional technology (e.g., harmonic scalpel argon beam coagulator) must be arranged in an orderly fashion using either pre-existing or improvised pockets of the surgical drape. These lines ideally should enter the field from the contralateral side of the table or form the ipsilateral head of the table. Robotic devices for electronically controlled or voice controlled camera manipulation should be brought into the operative area from the contralateral side of the table to prevent any limitation of the surgeon's maneuver ability during the procedure.

Additional technology (e.g., high-speed electrical tissue morcellator,) may be moved to the operating table depending on the surgeon's needs as well as on the availability of spacinmin (Claymen et al., 1993).
A checklist ensuring that all essential equipment is present and operation should be completed just before initiating the pneumoperitoneum. Specifically, this list should include:-
1. Light cable on the table, connected to the light source.
2. Laparoscope connected to the light cable and to the camera, with an image that is whit balanced and focused on a gauzae sponge.
3. Operational suction and irrigation functions of the irrigator/ aspirator.
4. Insufflator tubing connected to the insufflator, which is turned on to allow the surgeon to see that there is proper flow of CO2, through the tubing; kinking of the tubing should result in an immediate increase in the pressure recorded by the insufflator, concomitant cessation of CO2 flow.
5. An extra tank of CO2 in the operating room.
6. A Veress needle, checked to ensure that its tip retracts properly.

(Claymen et al., 1993)
Port placement in laparoscopic pyeloplasty

I- Transperitoneal pyeloplasty

- Closed method:

  After Peritoneal access is gained using a Veress needle, the abdomen is insufflated with carbon dioxide. The first port (10 mm) is placed midway between the umbilicus and the anterior superior iliac spine, at the level of the umbilicus. The second port (5 mm) is placed at the angle between the costal margin and the lateral border of the ipsilateral rectus muscle. The third port (10/12 mm) is placed between these two ports, closer to the upper port than the lower one, so as to allow a direct vision of the renal hilum. This port, which houses the 30° laparoscope, may alternatively be placed in the umbilicus (Ramani et al 2003)

  ![Port placement in transperitoneal laparoscopic pyeloplasty](after Novick, 2006)

- Open technique:

  The first port (Hasson) is placed by an open technique in the region of the umbilicus and secured with a skin suture. The gas flow is set at 2 L/min to 4 L/min and the abdominal pressure at 10 mmHg to 12 mmHg. Two working ports are inserted under direct vision: one under the costal margin and the other in the ipsilateral iliac fossa. The position of this latter port, which is used for the needle holder, is crucial, as it has to be in line with the anastomosis to facilitate suturing (Pedro-José Lopez, et al 2005)
Fig (12): Another ports configuration in lap. Pyeloplasty; note that the 1st trocar is at the umbilicus
(after Rosenblatt, Bollens and Espinoza Cohen, 2008)

**Ports placement for retroperitoneoscopic pyeloplasty**

The first 10-12-mm trocar is inserted just below the tip of the 12th rib. The second 5- or 12-mm trocar (depends if right- or left-sided operation) is inserted under vision control just 2–3 cm away from the spina iliaca anterior superior in the anterior axillary line. The third 5-mm trocar is placed at the middle or one third between the connection line of both already inserted trocars. The fourth trocar is optional and can be placed at the tip of the 10th or 11th. (*Ramani et al 2003*)

Fig. (13): Port placement in retroperitoneal laparoscopic pyeloplasty
(*After Campbell, Wein and Kavoussi, 2007 P. 218*)
Placement of A Ureteral Stent Prior to Pyeloplasty

There are several suggestions for stent/ureteral catheter placement prior to performing laparoscopic pyeloplasty. It is generally agreed that the presence of a stent at the time of the ureteral dissection makes it easier to identify the ureter. However, the presence of a stent for prolonged period of days or weeks prior to the pyeloplasty can result in inflammation and edema of the ureter, making suturing difficult. Therefore, it is routinely recommend that removal of any previously placed ureteral stent should be several days before the surgery, unless there are overriding reasons not to do so. *(Kumar and Gill, 2007)*

Prior to the pyeloplasty, a flexible cystoscopy is done in the supine position and place a guidewire under fluoroscopic guidance. An open ended ureteric catheter is then passed over the guidewire after removal of the cystoscope, a retrograde ureterogram performed, and the catheter is positioned with its tip a few centimetres. A urethral Foley catheter is placed, and the ureteric catheter is secured to the foley catheter. The patient is then repositioned for the laparoscopic pyeloplasty in a 60-degree lateral position. The ureteric catheter is included in the sterile preparation of the abdomen and kept in the field for access during surgery. During dissection of the retroperitoneum, the ureteric catheter may be manipulated to help identify the ureter. *(Kumar and Gill, 2007)*

Absence of a stent across the UPJ also makes it easier to divide the UPJ for pyeloplasty. Once one is ready to have the stent placed across the repair, a guidewire, passed through the ureteral catheter in a retrograde fashion, is brought out through one of the ports, the ureteral catheter is removed, and the ureteral stent is then passed antegrade ly.
and positioned in the pelvis prior to completion of the anastomosis. (Kumar and Gill, 2007)

On the other hand (Rosette 2005) declared that, Initially the patients were stented during the surgery, either retrograde or using laparoscopic guidance, but that caused a lot of difficulties and problems. So the decision is to insert a stent on the day prior to surgery. First of all, you are not pressed for time; and secondly, by having a very nice retrograde study, any other abnormalities are detected. So you can avoid problems during the surgery. So pre-stenting with a double-J stent facilitates the surgery in all respects. (Rosette 2005)
Chapter 5

Laparoscopic reconstruction of pelviuretral junction

1- Anderson–Hynes Dismembered Pyeloplasty

The stenotic UPJ is divided obliquely, taking care not to cut the stent. The ureter is spatulated laterally for an adequate length. The stenotic UPJ area may be excised only if excess tissue is available.

The renal pelvis is spatulated medially in a generous manner, with or without excision of redundant pelvis. Any excision of pelvic or ureteral tissue should be performed only after careful planning so as not to cause any shortening. The apex of the spatulated ureter is sutured to the inferior edge of the pylotomy with 4-0 Vicryl. The knot is kept extraluminal.

Pyeloplasty is performed using two running 4-0 Vicryl sutures, one dyed and the other undyed, on RB-1 needle(suture length 6–8 cm). The anterior wall of the anastomosis is approximated initially across 80% of its length. Anterior traction is placed on this stitch, thus bringing the posterior wall of the anastomosis into view. The second stitch is employed to suture the posterior wall. The cephalad end of the J-stent is reinserted into the renal pelvis. The remainder of the anterior wall is sutured, the two stitches tied, and pelvic suturing completed to secure a watertight anastomosis (fig. 14). (Novick, 2006)
- Aberrant Vasculature

When an aberrant lower pole vessel is present, a dismembered pyeloplasty allows proper repositioning of the vessel as necessary (fig. 15). We do not routinely transpose the crossing vessel, performing this maneuver only as dictated by the individual anatomical situation. (Novick, 2006)

Fig. 15

Large redundant pelvis:

For a patient with a redundant pelvis, a reductive pyeloplasty avoids stasis and recurrence of obstruction. To perform a reduction pyeloplasty, the entire renal pelvis is mobilized completely. After dividing the UPJ, the excess, redundant pelvis is excised. (fig. 16)

Virtually the entire reduction is performed along the medial side of the renal pelvis; the lateral (lower) lip of the pelvis is maintained intact to facilitate adequate funneling of the pelvis. The ureteropelvic junction anastomosis is performed initially as described above. Closure of the large pelvic defect is performed subsequently by running one of the sutures cephalad. (Novick, 2006)

Fig. 16
2- LAPAROSCOPIC FENDER-PLASTY (HEINEKE-MIKULICZ TYPE)

Laparoscopic endoshears are used to vertically incise the site of the UPJO. A vertical incision is made on the renal pelvis, starting cephalad to the UPJ and continuing across the junction onto the ureter. The upper and the lower angles of the incision are approximated in the midline with 4-0 Vicryl sutures to convert the vertical incision into a horizontal one. Interrupted sutures are now taken to horizontally approximate the rest of the incision. Indigo carmine dye is administered intravenously to confirm no leak from the anastomosis. Drain is inserted, hemostasis confirmed, and laparoscopic exit performed. (Novick, 2006)
3- LAPAROSCOPIC DISMEMBERED TUBULARIZED FLAP PYELOPLASTY

Infrequently employed, this technique is indicated for a large, extrarenal pelvis, with dependent, long-segment UPJ or upper ureteral narrowing. Laparoscopic endoscopic shears are used to excise the strictured area. The renal pelvis is completely transected at the ureteropelvic junction and then closed with a figure-of-eight suture. The strictured upper ureter is excised until healthy ureter is visualized. The cut end of the ureter is spatulated posteriorly. The renal pelvis is completely mobilized and an adequate 3x2 cm pelvic flap on a wide inferolaterally directed base is outlined with stay sutures.

The flap is created with endoshears and rotated downward to meet the spatulated ureter. Using 4-0 polyglactin suture, the most dependent part of the renal pelvis is sutured to the corresponding part of the ureter. Posterior anastomosis is formed in a running manner and the J curl of the ureteral stent positioned in the renal pelvis. The anterior wall of the anastomosis is completed over the stent. Subsequently, the renal pelvis is tabularized by closing it longitudinally in a watertight manner. Indigo carmine dye is administered intravenously to confirm a watertight anastomosis. Drain is inserted, hemostasis confirmed, and laparoscopic exit performed. (Novick, 2006)
Chapter 6

Complications of laparoscopic pyeloplasty

In the last decade, the popularity of laparoscopic surgery has exploded, as evidenced by the dramatic increase in the number of laparoscopically performed urologic procedures. This has been driven by the potential of laparoscopic surgery to achieve the same goals as a standard open approach while offering the patient distinct advantages with regard to perioperative morbidity, length of hospital stay, and convalescence. *(Hohenfellner and Santucci, 2007)*

However, there are also disadvantages to the endoscopic approach. Typically the learning curves for laparoscopic operations are long and there are a number of pitfalls that potentially complicate these procedures.

Even for very experienced open surgeons, it is difficult to translate skills and knowledge directly to the endoscopic technique. Although in laparoscopic surgery the approach is minimally invasive, the complexity of the procedure is at least equal to its traditional open counterpart.

This is also reflected in the scope of possible complications, which characteristically encompasses all the complications known from open surgery and in addition to that a number of complications that are specific to the endoscopic approach. Knowledge about these complications is essential for their prevention. Additionally, this understanding helps the laparoscopic surgeon to identify possible complications intraoperatively. *(Hohenfellner and Santucci, 2007)*
Intraoperative Complications

1) Complications Related to Access:

Establishing a pneumoperitoneum and gaining entry access to the abdomen are prerequisites for laparoscopic surgery. These initial steps of the procedure can be challenging and harbour a unique range of complications. The overall incidence of access-related injuries is relatively small.

Intraoperative Complications:

Reported incidences below 1% (Champault et al., 1996; Deziel et al., 1993). With increasing experience over the last decade, complications related to the laparoscopic access seem to have become less frequent also in urologic procedures (Gettman, 2005). Recent large series showed incidence rates around 0.2% (Fahlenkamp et al., 1999; Soulie et al., 2001). However, the mortality rate reported from these complications is as high as 13% (Chandler et al., 2001).

Recognition

Injury to major blood vessels is probably the most feared complication of gaining laparoscopic access. In those cases, recognition of the complication usually is not a problem. However, in many of the less spectacular complications of trocar placement, the intraoperative recognition of the injury, which is crucial for an optimal management of the situation, is the main difficulty. Chandler and colleagues found that nearly 50% of both large- and small-bowel injuries remained unrecognized for at least 24 h. Also, this delayed recognition was found to be an independent, significant predictor of death (Chandler et al. 2001).

If the pneumoperitoneum is established via a Veress needle, correct positioning of the needle should be verified prior to CO2 insufflation. An irregular finding on aspiration, irrigation, reaspiration, or drop test indicates malpositioning of the needle and may lead to the diagnosis or the suspicion of an injury to an intraabdominal organ. Any sudden change in the hemodynamics of the patient or end tidal CO2 reading should lead to cessation of insufflation (Porter 2004).
Also, embolization of CO\textsubscript{2} to the right heart, a very rare but potentially catastrophic situation that typically results from inadvertent insufflation of gas into the bloodstream, leads within minutes to a low-output heart failure \cite{Lantz and Smith 1994; Wolf and Stoller 1994}.

Once the camera is introduced, a cursory inspection of the peritoneal cavity should be performed in every procedure. In case an access injury is suspected, a very meticulous inspection is mandatory to verify or rule out any intraabdominal lesion.

**Management**

The optimal management of entry access-related complications obviously varies widely with the severity and acuteness of the problem. If a complication from the insertion of the Veress needle is suspected, the needle should be withdrawn and the pneumoperitoneum should either be established by introducing the Veress needle at a different site or by open insertion of a Hasson cannula \cite{Hasson, 1971}.

Puncture injuries of the liver and the spleen can be managed in the same way or they can be cauterized with the argon beam coagulator. Simple punctures of the bowel or the bladder by the Veress needle do not require any treatment \cite{Bateman et al. 1996; Gill et al. 2002}.

If there is any pronounced change in hemodynamics or end tidal CO\textsubscript{2} level at the beginning of the CO2 insufflation, the gas flow must be stopped and trouble shooting with the anaesthesiologist should identify the cause of the problem. If a CO\textsubscript{2} embolization is suspected or diagnosed, the pneumoperitoneum has to be desufflated immediately.

The patient should be placed in the Trendelenburg position and a left lateral decubitus position to prevent the gas from entering the pulmonary circulation and to minimize the airlock effect of the embolus within the right ventricle. Additionally, an aspiration of the gas via a central venous catheter can be attempted \cite{See et al., 1993}.

Unlike lesions caused by the Veress needle, injuries resulting from initial
trocar placement often cannot be managed laparoscopically. Therefore, it is advisable to convert the case to an open procedure once a trocar lesion of an intraabdominal structure is suspected. (Green et al. 1992).

**Prevention**

The keys to the prevention of access-related injuries are knowledge of the scope of possible complications as well as the surgeon's skills. Obviously, this comes with experience and Peters reported in a survey of complications in pediatric urological laparoscopy that the surgeon's experience was the best predictor of access-related complications (Peters 1996).

However, Cadeddu et al. (2001) showed that intensive laparoscopic training prior to commencing clinical practice decreased the impact of the learning curve (Cadeddu et al., 2001).

Proper knowledge of the vascular anatomy of the abdominal wall as well as understanding of the intraabdominal anatomy is necessary to minimize the risk of access-related injuries. Previous abdominal surgery significantly increases the risk of intraabdominal adhesions and access-related bowel injury (Brill et al. 1995; Lecuru et al. 2001).

Careful surgical technique and adequate equipment are prerequisites for a safe laparoscopic access. If a cutting trocar is used, it is important that the cutting edges be very sharp in order to minimize the amount of axial force that has to be applied for trocar insertion. Less force allows for more control during trocar insertion (Kelty et al. 2000).

Expandable access systems convert axial into radial force (Schulam et al., 1999) and the trocarless rotational access cannula (TRAC) is a threaded, blunt-tip cannula that is radially advanced into the peritoneal cavity (Ternamian 1997). Other technical advances such as springloaded safety shields that flip over the trocar blade once cutting resistance is no longer detected or visual obturators that permit trocar placement under direct visual control (String et al. 2001) have been brought into use to reduce the number of access-related complications.
To decrease the risk of port-site hernias, all fascial defects greater than 10 mm (5 mm in children) need to be closed at the end of the procedure (Colegrove and Ramakumar 2005). If a trocar less than 10mm in diameter is extensively manipulated during the operation, widening of the respective fascial defect may occur and primary closure should also be considered. During closure of the port sites, care must be taken not to entrap bowel or injure other intraabdominal structures. Fascial closure devices such as the Carter-Thompson device allow for easy fascial reapproximation under direct vision (Kulacoglu, 2000).
(2) Complications in Laparoscopic Surgery

- **Vascular Injury**

  With incidence rates between 1% and 2%, vascular injuries are not common; however, they represent the most frequently encountered and probably the most feared specific complication in urologic laparoscopic surgery. The majority of these injuries are not access related but occur during dissection *(Fahlenkamp et al. 1999; Gill et al. 1995; Meraney et al. 2002; Thiel et al., 1996)*.

  Most commonly, this results from inadequate exposure of the vascular structures, leading to either sharp or thermal injury to the vessel *(Porter, 2004)*.

  Not surprisingly, the incidence of vascular injuries increases with the complexity of the procedure and decreases with the surgeon’s experience *(Guillonneau et al., 2002; Meraney et al., 2002; Peters 1996; Thiel et al., 1996)*.

**Recognition**

  High level of suspicion has to be maintained throughout the entire laparoscopic procedure to recognize these injuries intraoperatively. Especially venous lesions can be missed intraoperatively because the pressure created from CO2 insufflation may compress the injured vein and prevent it from oozing blood.

  Since most vascular lesions occur during dissection, the injured vessel typically is not yet fully exposed at the time of laceration. Locating the source of the bleeding can be a very challenging laparoscopic task. In minor bleeding complications, suction and irrigation may be all that is needed to find the injured
vessel, as a trail of blood within the puddle of irrigation fluid will lead directly to the target when the fluid is aspirated.

However, if the bleeding is more pronounced, local compression of the respective area is advisable. Through an assistant port, pooled blood in the operating field is constantly aspirated, and as soon as the bleeding discontinues one is sure that the compression is applied to the appropriate site. Under constant aspiration, the tamponade is then gradually removed to reveal the exact location of the bleeding source.

If exposure is insufficient, the dissection of the field is carefully continued while pressure remains applied to the lesion. When the lacerated vessel cannot be identified and exposed satisfactorily despite these measures, no further time should be lost and conversion to an open procedure should be performed.

Management

Whereas in access-related vascular injuries it is recommended to convert to open surgery in order to control the bleeding, vascular injuries that occur during dissection after all the ports have been placed may be dealt laparoscopically. As in open surgery, the first step is the application of pressure to the source of the bleeding. Whereas in open surgery manual compression can be applied very quickly, in a laparoscopic case an effective tamponade requires a small laparotomy pad or at least a sponge gauze to be pressed onto the bleeding site via a laparoscopic instrument (e.g., a grasper).

As an alternative, Yurkanin suggested the use of a Foley catheter that is inserted through one of the ports. The inflated catheter balloon can be pressed onto
the bleeding site with a catheter guide (Yurkanin et al. 2005). Moreover, the intraabdominal pressure can be increased up to 25 mmHg temporarily to diminish venous bleeding.

**In a minor vascular injury**, application of pressure for a couple of minutes alone may solve the problem. In addition, hemostyptic agents such as oxidized regenerated cellulose and fibrin glue may be applied alone or in combination. If there is adequate exposure of the injured vessel, electrocautery or application of clips can be enough to control the bleeding.

However, **in a major vascular lesion**, these measures are insufficient and are likely to result merely in a loss of time and blood. Here a decision must be made: whether the respective blood vessel has to be repaired or not. If a repair is not necessary, an open or a laparoscopic suture ligation is most likely to stop the bleeding.

In case the injured vessel is nicely exposed, the application of a stapling device might also be considered. Clearly, endoscopic management is more likely to be feasible if a repair does not have to be attempted. However, in the patient’s best interest, this decision should not be biased by the desire to complete the procedure laparoscopically. If the vessel needs to be repaired, endoscopic suturing of the laceration may be possible but should only be attempted by the highly experienced laparoscopic surgeon (Kavoussi 2000).

The placement of additional ports can be helpful in such a situation, as it creates an opportunity to optimize distance and angle of the instruments toward the
site of the lesion. In most cases of major vascular injury, however, it is advisable to convert to an open procedure and consider the consultation of a vascular surgeon.

To minimize blood loss and to facilitate locating the injury, it is important to leave the instrument and the tamponade in place until the conversion is finished. For the conversion itself, a midline port can be used like a handle to pull the abdominal wall upwards. The incision is then made down to the shaft of this port. Once the peritoneal cavity is open the respective laparoscopic instrument is followed to the injured vessel. *(Gill et al. 2002).*

**prevention**

Vascular injuries are potentially catastrophic complications of laparoscopic surgery and they can at least jeopardize the successful outcome of the specific procedure. Therefore, prevention of these injuries is of utmost importance. Key to this prevention is a solid understanding of vascular anatomy in general as well as the vascular anatomy of the specific patient. In this regard, all available radiologic examinations should be carefully studied preoperatively. Especially prior to laparoscopic procedures that involve dissection of major vessels. *(Hohenfellner 2007)*

The surgeon angles and pulls a midline trocar to the abdominal all while cutting down on the shaft of this trocar with the other hand to gain open access to the abdomen. At the same time, the bleeding is controlled by compression via a laparoscopic instrument (e.g., grasper holding a small laparotomy pad or a sponge gauze) that has been introduced through another trocar. View from midline toward the left abdominal wall (e.g., renal surgery, retroperitoneal lymph node dissection) a radiologic examination, which shows the vascular anatomy in the region of interest should be obtained. *(Hohenfellner 2007)*
Bowel Injury

Overall, bowel injury is a rare complication of laparoscopic surgery. The most commonly injured part of the intestine is the small bowel followed by the colon and the rarely injured stomach. Injuries of the duodenum are the most serious bowel complications of laparoscopic surgery as they are associated with the highest morbidity and mortality rates (El-Banna et al. 2000).

Recognition

Early recognition is very important for all types of laparoscopic complications, for bowel injuries, however, it is probably most crucial. In this case, a time delay can turn a minor intraoperative problem into a life-threatening condition. The bowel can basically be harmed by any kind of sharp or blunt instrument. Given the limited field of view inherent to laparoscopic surgery, such an injury can easily go unnoticed.

Manipulation with instruments outside this field (e.g., during instrument changes) is prone to inadvertent violation of bowel and other intraabdominal structures. If a lesion cannot be seen directly, free intestinal contents are proof of a bowel laceration. Additionally, the escape of a fecal smell through an opened port valve must lead to a search for a bowel injury. If such a lesion is strongly suspected, the whole bowel has to be inspected meticulously, Even the spontaneous temporary closure of such defects has been reported (Schafer et al. 2001).

Electrocautery-induced thermal damage is the single most frequent origin of bowel injury during laparoscopic surgery. Typically, this injury is missed intraoperatively because of the delayed breakdown of the intestinal wall. So again it is the surgeon’s knowledge of possible mechanisms of electrosurgical injury combined with a high index of suspicion throughout the entire procedure that can lead to the detection of as yet invisible bowel lesions. (Philips and Bishoff 2005)

The four mechanisms of electrocautery-induced thermal damage during laparoscopic surgery are inappropriate direct activation of the electrocautery, coupling to another instrument, insulation failure, and capacitive coupling (Gill et al., 2002).
Management

Once an intestinal injury is recognized intraoperatively, it can be safely managed laparoscopically in most cases (Nezhat et al. 1993; Reich 1992). However, if there is any question as to the integrity of the repair or if the patient had prior radiation therapy, open repair and consultation of a general surgeon should be considered (Porter 2004).

The laceration should be over sewn in one or two layers if small bowel is involved. Lesions of the colon and the rectum should always be closed in two layers. In simple lesions, it is usually not necessary to resect the injured bowel segment. It is advisable to over sew also small serosal abrasions, since these minor lesions can cause major postoperative complications if they are left unattended during the initial laparoscopic procedure (Bishoff et al. 1999).

Immediate repair of a bowel injury does not require intestinal diversion even if the rectum is involved (Guillonneau et al. 2003b; Reich 1992), and it usually does not have a significant impact on the postoperative course and the length of hospital stay.

The management of electrothermal injuries of the bowel differs to some extent from the management of simple lacerations. If a thermal injury is caused by bipolar electrocautery, it may be excised and the bowel wall defect may be simply closed as long as the lesion is small in diameter. If more than half of the circumference of the bowel segment is involved, the respective segment needs to be resected and an end-to-end anastomosis should be performed (Abdel-Meguid and Gomella 1996).

In injuries that are caused by monopolar electrocautery, on the other hand, the extension of the tissue damage is typically underestimated. Therefore, any monopolar electrothermal lesion necessitates resection and end-to-end anastomosis of the involved bowel segment. Additionally, a safety margin of several centimeters on either side of the injury should be resected before the completion of the end-to-end anastomosis (Gill et al. 2002).

Again, all these steps may be performed laparoscopically by the highly experienced endoscopic surgeon. Considering the high morbidity of postoperative
intestinal complications, a surgeon who does not feel absolutely confident with advanced laparoscopic bowel surgery is strongly advised to convert to an open procedure or consult a general surgeon.

**Prevention**

Prevention of bowel injuries during urologic laparoscopic surgery seems to be difficult since experienced laparoscopic surgeons are reported to cause an equal rate of intraoperative bowel lesions as inexperienced surgeons (*El-Banna et al., 2000*). Routine use of a nasogastric tube to empty the stomach reduces the risk of injury to the stomach. Also, preoperative bowel preparation may reduce inadvertent intestinal trauma by increasing intraperitoneal free space and by facilitating operative maneuvers (*Li et al. 1997*).

To avoid electrothermal trauma, all laparoscopic instruments must be checked for insulation damage prior to their use. Bipolar electrosurgery should be used whenever possible and all diathermy must be avoided close to the bowel. Monopolar electrocautery should not be used to take down bowel adhesions. The lowest possible power setting should be used at all times (*Saye et al. 1991*).

Innovative instruments such as Ligasure (*Valleylab, Boulder, CO, USA*), which uses a high-current low-voltage output, or the Harmonic Scalpel (*Johnson & Johnson, Brunswick, NJ, USA*), which uses ultrasonic energy for both cutting and coagulation, minimize the spread of thermal energy and thereby may reduce the risk of inadvertent bowel injury.

In patients who are at risk of bowel injury (i.e., patients with a history of abdominal surgery), an adequate means of prevention may be not to offer the patient laparoscopic surgery in the first place. Extensive adhesiolysis must be considered an advanced laparoscopic procedure and it should therefore remain in the hands of the experienced endoscopic surgeon.
Injuries to Other Intraabdominal Structures:

❖ **Bladder Injury**

Bladder injuries during laparoscopic surgery are most commonly associated with gynecological procedures *(Hasson and Parker 1998)*. Incidence rates in the respective literature range from 0.02% to 8.3%. The bladder dome was found to be the most frequent site of bladder injury. If a bladder lesion is not obvious or not immediately recognized, the finding of gas and/or blood in the urethral catheter bag should cause the laparoscopic surgeon to look for any laceration in the bladder. *(Ostrzenski and Ostrzenska 1998)*

Irrigation of the bladder via the urethral catheter can help to locate the lesion. Once detected, any defect in the bladder wall can be closed with an absorbable single-layer running suture, which most endourological surgeons will be able to complete laparoscopically. *(Gill et al. 2002)*

Depending on the size of the lesion, the Foley catheter should be left to continuously drain the repaired bladder for up to 10 days postoperatively. An easy and effective measure to prevent intraoperative bladder injuries is the routine preoperative placement of a Foley catheter in all patients undergoing laparoscopic procedures.

❖ **Ureteral Injury**

In a recent review of laparoscopic pelvic surgery, incidences of ureteral injury between 0.03% and 2% were reported *(Ostrzenski et al. 2003)*. The
mechanisms of injury include transection, ligation, electrothermal injury, and interruption of the ureteral blood supply (Chow 2005). Unfortunately, the majority of these lesions are not recognized intraoperatively (Ostrzenski et al. 2003), which means that a high level of suspicion needs to be maintained throughout a pelvic or retroperitoneal laparoscopic procedure in order to detect a ureteral injury during the initial surgery.

If a ureteral injury is suspected, intraoperative diagnosis can be facilitated by the intravenous administration of methylene blue or indigo carmine. Additionally, a retrograde or an antegrade pyelography can help identify the exact location of the lesion. When recognized intraoperatively, laparoscopic repair can be attempted depending on the surgeon’s level of expertise. As in open surgery, the optimal management is conditional on the location and the extent of the ureteral lesion.

Ureteroureterostomy, ureteroneocystostomy, psoas hitch, or a Boari flap can be performed laparoscopically by the skilled surgeon. It is important to understand that also nonperforating mechanical (e.g., clamping of the ureter) or thermoelectrical ureteral lesions should be addressed immediately. The respective ureteral segment needs to be excised and the appropriate repair done laparoscopically or in an open procedure. (Chow 2005)

In every case of repair, a ureteral stent should be inserted and left in place for 2–6 weeks. To prevent ureteral injuries, the laparoscopic surgeon needs a thorough understanding of the intraoperative pelvic and retroperitoneal anatomy. If a surgical procedure involves dissection close to a ureter, this ureter should be identified beforehand. When dissecting a ureter, great care must be taken not to interrupt its
Review of literature

blood supply. To avoid electrothermal injury, monopolar current should never be used close to the ureter.

💧 Injuries of the Liver and the Gallbladder

Non-access-related injury of the liver during urologic laparoscopic surgery is rare. It may complicate right-sided renal or adrenal procedures and it is usually caused by inappropriate retraction of the liver (Ogan and Cadeddu 2005).

In a large single-center experience, these injuries complicated only 0.28% of all laparoscopic procedures performed on the upper urinary tract (Varkarakis et al., 2005).

Minor hepatic injuries may be managed expectantly. If the bleeding is too pronounced or does not stop spontaneously, hemostasis may be achieved with an argon beam coagulator. Additionally, oxidized regenerated cellulose can be sealed onto the laceration using the argon beam coagulator, and fibrin glue can be applied to the lesion. More extensive injuries, which do not respond to these measures, should prompt a general surgical consult and they will typically result in a conversion to an open procedure.

Nonperforating injuries of the gallbladder such as electrothermal lesions can be managed expectantly with placement of a closed suction drain in the gallbladder fossa and observation (Varkarakis et al. 2005).

Perforating injuries, on the other hand, should result in cholecystectomy right away with a general surgical consult as needed. A simple, save and very effective way to retract the liver during laparoscopic renal or adrenal surgery is illustrated in that a locking grasper is placed under the edge of the liver from medial to lateral.
The liver is then retracted upward and held in place by locking the grasper to the lateral abdominal wall.

To prevent liver injuries during laparoscopic procedures, all adhesions to the liver must be taken down carefully at the beginning of the dissection. If the liver has to be retracted during the procedure the surgeon has to make sure that this is done in a safe and non-traumatic way. There are a number of different commercially available retractors for this purpose.

**Splenic Injury**

The mechanisms leading to splenic injuries during laparoscopic surgery are the same as described for laparoscopic liver injuries. Splenic capsular lesions most commonly occur during the exposure of the retroperitoneum in left-sided renal or adrenal procedures. In recent reviews, iatrogenic lesions of the spleen complicated 0.5%–2.5% of laparoscopic and hand-assisted laparoscopic nephrectomies ([Hedican 2004](#)).

Intraoperative recognition usually is not a difficulty in splenic lesions but as in other parenchymatous bleedings, reduction of the intra-abdominal pressure can help to identify the injury. The majority of splenic injuries during urologic laparoscopic surgery are minor capsular lesions, which usually can be managed laparoscopically ([Hedican 2004](#)). Measures to control these injuries include pressure and the application of oxidized regenerated cellulose, absorbable gelatin sponges, and fibrin glue as well as coagulation with the argon beam coagulator ([Hedican 2004](#)).
The key to preventing intraoperative lesions of the spleen is to avoid traction on the splenic capsule. Therefore any adhesions to the spleen as well as the splenocolic ligaments have to be taken down or incised very carefully during the exposure of the retroperitoneum. If practicable and appropriate, a retroperitoneoscopic approach may reduce the risk of iatrogenic injury to the spleen.

**Pleural Injury**

Because of the high intraabdominal pressure associated with laparoscopy, insufflated gas can enter the thorax through a diaphragmatic lesion and lead to ipsilateral pneumothorax and pneumomediastinum. Recently a large multicenter series reported an incidence of pleural injury during laparoscopic renal surgery of 0.6%. In this series, two out of ten pleural injuries were access related and 80% occurred during dissection. *(Del Pizzo et al., 2003).*

**Recognition**

Typically a lesion in the diaphragm occurs during the dissection of the renal upper pole. A tear in the diaphragm is not necessarily visible, as electrocautery-induced thermal damage can also injure the pleura. If an injury to the pleura is not directly observed, there are signs of pneumothorax that can be recognized intraoperatively. *(Potter et al. 2001).*

**Voyles and Madden** described the floppy diaphragm sign, which refers to the billowing of the diaphragm into the abdomen with every reduction of intraabdominal pressure *(Voyles and Madden 1998).* This sign reflects a loss of the negative pressure in the pleural space and should prompt a search for a diaphragmatic injury. Additionally, the anesthesiologist may notice a decrease in oxygen saturation, an increase in airway pressures and end-tidal CO2 as well as reduced breath sounds over the respective hemithorax and hemodynamic instability as a result of the pneumothorax *(Potter et al. 2001).*

**Management**
Diaphragmatic and pleural injuries that occur during urologic laparoscopic procedures can usually be managed endoscopically and in general an insertion of a thoracostomy tube is not needed. Basically, the diaphragmatic lesion needs to be oversewn and the air or gas needs to be evacuated from the pleural cavity. If the ventilation and the hemodynamic situation of the patient allow it, the procedure may be continued with a lower intraabdominal pressure as needed; the pleural injury may be addressed only at the end of the operation.

The diaphragmatic lesion should be sutured with interrupted stitches. This way, the suction device can be passed into the pleural cavity between the sutures and the gas can be evacuated from the thorax before those stitches are tied. Also, the patient can be given a large inspiratory breath before securing the sutures (Del Pizzo 2005).

Alternatively, a 6-F central line can be modified by cutting extra side holes and introduced anteriorly through the fifth or sixth intercostal space to evacuate the gas. In case sufficient repair of the diaphragmatic injury cannot be achieved, the placement of a thoracostomy tube must be considered. (Del Pizzo et al. 2003)

**Prevention**

Diaphragmatic and pleural injuries rarely occur during urologic laparoscopic surgery, but they also happen to the highly experienced laparoscopist. There are no specific preventive measures that can be taken to avoid this type of complication. Probably the best prevention is the awareness of the possibility of this injury, especially during the difficult cases of renal upper pole dissection.
Postoperative Complications

In laparoscopic surgery with its limited field of view, an intraoperative injury of an abdominal organ is more likely to go unnoticed during the initial procedure than in open surgery. The respective lesions may cause delayed complications and they can lead to an early secondary intervention. Two large series reported reintervention rates after urologic laparoscopic surgery of 0.7%–1% (Yaycioglu et al. 2002) and a recent overview of the urologic literature found 1.5% repeat explorations in a total of more than 4,000 laparoscopic cases (Yaycioglu 2005).

Vascular Complications

Vascular complications contribute to a substantial share of the early postoperative complications after urologic laparoscopic procedures. In a recent report, the majority of hemorrhagic complications of laparoscopic partial nephrectomies occurred postoperatively or after the patient’s discharge from the hospital. (Yaycioglu 2005)

Different reasons lead to a delayed manifestation of vascular injuries. An injured vessel can remain undetected during the procedure because of the compression caused by the pneumoperitoneum, due to a vasospasm or a partial ligation. A splenic tear can typically manifest itself only in the postoperative period. (Ramani et al. 2005).

Recognition:

As the overall incidence of these complications is low and symptoms may be unspecific. A high index of suspicion is needed in the postoperative period to recognize and treat these potentially dangerous lesions in time. Possible symptoms
of late vascular complications include but are not limited to general malaise, abdominal or flank pain, dizziness or syncope, hypotension, tachycardia, decreasing haemoglobin and hematocrit, gross hematuria, bloody drainage from a surgical drain in the operative field, nausea, vomiting, absent pulses, fever, and renal insufficiency. In patients with clinically significant findings and non diagnostic routine examinations, a CT scan is the examination of choice.

A CT scan reliably identify the site of postoperative bleeding (Cadeddu et al., 1997). Angiography is a second-line investigation that may provide important additional information if persistent active bleeding is suspected. Angiography also offers the possibility of a concomitant therapeutic intervention (i.e., embolization of a bleeding vessel).

**Management**

If a postoperative CT scan reveals a hematoma, conservative treatment with transfusion of red blood cells if necessary and observation are often sufficient. With persistent hemodynamic instability, however, active management is needed. If the situation allows it, angiography and possibly embolization of the bleeding vessel is the least invasive intervention. Angiographic embolization is also the treatment of choice for renal artery pseudoaneurysms and arteriovenous malformations.

If an angiographic procedure is unsuitable or not successful, surgical exploration is necessary. A laparoscopic approach may be attempted, but most cases of significant postoperative bleeding complications ultimately have to be managed by an open approach. With patient safety as the ultimate priority, the surgeon must
make sure that no time is wasted with a pointless attempt to treat the complication laparoscopically.

**Bowel Complications**

In laparoscopic surgery, bowel injuries account for 76% of all complications with a delay in diagnosis of more than 24 h (Chandler et al. 2001). Approximately 50% of all bowel injuries are caused by electrocautery (Bishoff et al. 1999), and thermal injuries typically present later than nonthermal injuries as a result of delayed breakdown of the intestinal wall at the injury site (Philips and Bishoff 2005).

Early diagnosis and immediate repair of unrecognized bowel injuries are of utmost importance since longer delays are associated with a significantly higher mortality (Chandler et al. 2001).

**Recognition**

For unrecognized bowel lesions, the time from surgery to presentation is approximately 5 days on average, and some lesions become clinically apparent more than 4 weeks after the initial procedure depending upon the mechanism of injury as well as the bowel segment involved (Bishoff et al. 1999).

Confounding factors such as pain medication and antibiotics can render the postoperative diagnosis of a bowel complication difficult. In addition, delayed bowel complications of laparoscopic surgery have been reported to often present in an atypical way with low-grade temperature, low to normal white blood count, no ileus, and no signs of peritonitis (Philips and Bishoff 2005).

If an unrecognized bowel injury is clinically suspected, an abdominal CT scan with oral contrast medium should be obtained. This examination reliably
identifies bowel perforations as well as other abdominal pathology in the early postoperative period and can help to plan appropriate therapeutic interventions *(Cadde
du et al. 1997).*

**Management**

Once a previously unrecognized bowel injury is diagnosed, immediate repair is indicated. Whereas in intraoperatively recognized bowel lesions a laparoscopic repair is usually feasible and bowel diversion is generally not necessary, almost all bowel lesions with delayed recognition will need an open repair. Bowel diversion may be necessary depending on the individual case and it may be advisable to obtain a general surgery consultation. *(Bishoff et al. 1999)*
Chapter 7

Laparoscopic single site surgery and Robotic surgery

To further optimize minimally invasive surgery, Laparoscopic single site surgery (LESS) has been reported lately. Transumbilical single port laparoscopy, using a single-port device that allow simultaneous introduction of a laparoscope and two curved or flexible instruments. (Kaouk et al., 2008)

Natural orifice translumenal endoscopic surgery (NOTES) using vaginal or gastric access has been investigated in the laboratory with limited clinical applications. Free-hand suturing using NOTES is challenging in the absence of port triangulation. (Desai et al., 2008)

The da Vinci system (Intuitive Surgical, Sunnyvale, CA) offers articulated laparoscopic instruments with wrist motion that assists particularly during suturing and knot tying. The da Vinci robot system was used to perform NOTES surgery, with a main focus on evaluating robotic intracorporeal suturing and knot tying during pyeloplasty and partial nephrectomy. (Lima et al, 2007)

Dismembered Pyeloplasty

The first single-port transumbilical pyeloplasty was reported by Desai et al in 2007. For dismembered pyeloplasty, a monopolar curved scissors and a grasper were placed on the right and left robotic arm, respectively. The ureter was transected at the ureteropelvic junction and spatulated. Using EndoWrist needle drivers (Intuitive Surgical, Inc., Sunnyvale, CA), the anastomosis was performed with two 5-0 synthetic absorbable monofilament running sutures introduced through the vaginal port. (Desai et al., 2008)
Robotic Surgery: is Microsurgery in which the surgeon performs surgery by manipulating the hands of a robot.

The robot was initially looked upon as a tool to transition from surgeons from open to laparoscopic surgery. However, studies soon showed that the robot was not just a transition tool, but in many ways showed improvement and a broader application compared to standard laparoscopy. (Patel, 2007)

The first robotic-assisted pyeloplasty was described by Sung and colleagues. Their porcine model compared only the pyeloureteric anastomosis time and tightness of the anastomosis between traditional intracorporeal laparoscopic suturing and robotic assisted suturing. The robot had increased anastomosis times, but the tightness of the anastomosis was equal between the two groups of pigs on visual inspection with indigo carmine and ex vivo retrograde ureteropyelogram.
The robot in this case was the Zeus® robot (Computer Motion, Santa Barbara, CA) with an Automated Endoscopic System for Optimal Positioning (AESOP) attachment. Soon afterward, this same group compared the Zeus® to the da Vinci® robotic system (Intuitive Surgical Inc., Sunnyvale, CA) in performing various laparoscopic procedures on the porcine model (Patel, 2007)

They were able to perform the anastomosis faster and secure it with more bites by using the da Vinci® system. The comparison between the two systems revealed that the da Vinci® robot was more technically intuitive to use, thereby decreasing the learning curve (Patel, 2007)

- **Advantages**

  The robot provides magnified three-dimensional vision, motion scaling, tremor reduction, a full range motion of the surgical arms, and increased articulation with six degrees of freedom. These features render robotic surgery ideal for complex reconstructive or ablative surgery. Therefore, the number of robotic systems in the USA has increased over the recent years (Schwentner et al., 2007)

  Initial studies on Robotically Assisted Laparoscopic Pyeloplasty (RALP) and partial nephrectomy have also shown favorable results (Siddiq et al, 2005)
Fig. 20: Operating room in Robotic surgery (equipments and personnel) (After Patel, 2007)

Technique

At first cystoscopy is used and a retrograde JJ placed before RALP, whereas in other cases it may be placed antegradely during laparoscopy. RALP is done with the patient in a modified lateral decubitus position with a 45° tilt of the operating table. The robot is set up at the side of the affected kidney. The surgeon control the camera and the two robotic arms from the remote unit. One assistant exchanging the robotic instruments, and use conventional instruments for suction, retraction and suture introduction. (Patel, 2007)

Four transperitoneal ports is used ,Pneumoperitoneum was created using a Veress needle followed by placing a 12-mm reusable camera port (Intuitive Surgical) umbilically for the laparoscope (30° lens). Two reusable working ports (8 mm, Intuitive Surgical) is inserted in the midline below the xiphoid and in the ipsilateral lower abdominal quadrant in the mid-clavicular line. A 10-mm assistant port is then introduced in the midline between the xiphoid and the umbilicus. (Gettman et al., 2002)
In patients with a right PUJO, the line of Told was incised and the hepatic flexure was retracted medially to identify Gerota fascia. For left-sided cases the peritoneum was incised similarly to mobilize the colon where as in slim patients an alternative transmesocolic approach was used. Gerota fascia was then incised to expose the PUJ and anterior crossing vessels that were not routinely repositioned. The PUJ was subsequently transected, the ureter spatulated on the lateral side, and the redundant renal pelvis excised. A needle driver was inserted and three 4–0 polyglactin sutures were used for anastomotic repair. The first suture secured the spatulated ureter to the renal pelvis and two additional running sutures were used for the anterior and posterior wall of the anastomosis, as well as for pelvic closure. *(Schwentner et al., 2007)*

After completing the posterior anastomosis a 7 F JJ stent was inserted antegradeley over a guidewire and by using a portable u/s it can detect its tip in the bladder. The bowel was repositioned and secured with one 4–0 polyglactin suture. The JJ stent was left indwelling for 6 weeks while the Foley catheter was removed 2 days after surgery. *(Schwentner et al., 2007)*
Disadvantages of Robotic Surgery

In comparison to robots used in the industrial sector, medical robots present designers with much more complicated safety problems. Some of the most important factors which lead to such complexity are described:

- **Human presence:**

  In the medical sector, robots are required to assist rather than to replace humans. In that respect, they must be able to work in close proximity to humans and perform well in a chaotic, time-varying environment. This requires medical robots to have rich sensory and reasoning capabilities concerning their environment, something that both pushes the current technology to the limits and presents robot designers with insurmountable obstacles.

- **Fault consequences:**

  This is closely related not only to the presence of humans near the robot, but also to the nature of the task of the robot, which typically involves a human patient. In the industrial sector, a fault can mean at most some loss of physical equipment. In the medical sector, where lives are at stake, the implications are of profound importance.

- **Non-generic task:**

  In the industrial sector, the robot is required to perform a series of movements in some pre-defined order. The object it is operating on, be it as simple as a metal pipe or as complex as a car, is not distinguished in any way, that is, the robot is not
Review of literature

required to take account of differences on an object-by-object basis, but treats them all as being equal. When dealing with patients, however, this is not possible. Each patient has their own distinguishing characteristics, making a uniform approach inappropriate. In safety terms, this requires testing, or at least reasoning about infinitely many scenarios.

- Cost

Robots that perform the surgeries cost around $750,000 to over $1 million. This is because they use extremely sensitive and experimental equipment that costs a lot of money. In addition to the cost of the machines the training that is needed for surgeons to learn how to use the systems is also very expensive. Because of the extreme cost of the machines at this point in time the procedures are slightly more expensive than a regular operation, but it does have its advantages. (Singh, 2011)
Patients and methods

A prospective comparative non randomized study was conducted on 50 patients whom were selected and admitted to urology department, Benha University hospital during the period of the study from May 2012 to August 2014.

These patients were divided into two groups,

- **Group I (G I)** which included patients underwent transperitoneal laparoscopic pyeloplasty (25 patients).

- **Group II (G II)** which included patients underwent retroperitoneal laparoscopic pyeloplasty (25 patients).

**Inclusion criteria:**

Patients with primary pelvi-uretric junction obstruction confirmed by diuretic renogram and characterised by one or more of the following:

- Symptomatic such as (pain, infection, hematuria or palpable Mass).
- Worsing hydronephrosis.

**Selection criteria:**

We performed transperitoneal laparscopic pyeloplasty for patients with large renal pelvis whereas retroperitoneal pyeloplasty was done in cases with relatively small renal pelvis due to small working place in retroperitoneoscopy.
Exclusion criteria:
We excluded patients with uncorrected bleeding disorders; severe cardiopulmonary diseases, a history of peritonitis, bowel obstruction or multiple abdominal operations, abdominal wall infection, hemoperitoneum and previous upper urinary tract surgery.
We also excluded patients with poorly functioning kidneys (split GFR<15%)

All those patients were subjected to the following scheme:

[1] Complete history taking including:
  a- Age of the patient.
  b- Complaint: Right or Left flak pain or hematuria
  c- History of previous Abdominal or pelvic surgery. Peritonitis either generalized or localized, pelvic inflammatory diseases chronic urinary tract infection. Chronic systemic disease and / or blood dyscryiasis.

[2] Examination:
  • General examination: as regard body mass index, bony deformity, chest and heart etc.
  • Local examination: as regard, scars of previous abdominal surgery, abdominal wall sepsis, external hernia abdominal swelling, ascites and organomegally.
[3] **Investigations:**

The patients were subjected to routine laboratory and radiological investigations including:

**(A) Laboratory investigations:**
1) Complete urine analysis with culture and sensitivity test when needed.
2) Blood urea and serum creatinine level.
3) Complete Blood picture.
4) Bleeding and coagulation time.
5) Liver function tests (Bilirubin, prothrombin time and activity, SGPT & SGOT).
6) Fasting blood sugar.

**(B) Radiological investigation ..**

1. Pelvi-Abdominal U/S; to assess the degree of hydronephrosis, Antroposterior diameter of renal pelvis, parenchymal thickness, echogenicity and corticomedullary differentiation.
2. Intravenous urography (IVU): to assess degree of hydonephrosis, excretion of the kidneys, ballooning of renal pelvis and visualization of the ureter
3. Spiral CTUT with coronal reformatting was done in cases with renal stones, non-secreting kidneys in IVP study. CT angiography may be used is patients with suspicious crossing vessels.
4. Diuretic isotope renography (DTPA or MAG3): to assess $T\frac{1}{2}$, differential and split renal function and GFR.
5. Viioding cytourethrogram was done in children with UPJO to exclude the presence of vesico-uretral reflux.
**Patients and methods**

**[4] Laparoscopic procedure:**

**A- Transperitoneal laparoscopic pyeloplasty**

(1) Informed consent

It was written by all our patients in which they were informed that all of the internal risks of open surgery are present with the laparoscopic surgery. In addition, the patients were informed that there was a possibility that an open laparotomy may be necessary if needed when the procedure cannot properly or safely completed or if significant complications occurred during the procedure.

(2) Patients preparation:

- The patients were admitted to the hospital the day before the surgery for bowel preparation. Enema was done once at night and once at the morning.
- Fasting started at the midnight before surgery. All patients received antibiotic prophylaxis with single preoperative dose of I.V 2nd generation cephalosporin.
- Blood grouping with cross matching and reservation of 2 units of blood.
Patients and methods

(3) Instrumentations and equipment specific to the procedure: 

Instruments

- Camera – video system:
  0 ° 10 mm laparoscopic lens (three-chip Carl Storz lens) attached to Stryker 888 Camera.

![Three-chip Carl Storz lens and Stryker 888 Camera](image)

- Laparoscopic instrument set which contain:
  (1) 10 mm Hasson port.
  (2) Instrument ports (5mm and 10mm)

![5 and 10 mm instrumental ports (vesiports) and Hasson port](image)
Patients and methods

(3) Endoclinch
(4) Grasper.

Fig. 24: endoclinch and grasper

(5) Diathermy hook.

Fig. 25

(6) Ligasure handles (5mm and 10mm)

Fig. 26

(7) Needle holder

Fig. 27

(8) Suction irrigation device.

Fig. 28

(9) Balloon dilator for retroperitoneoscopy.

Fig. 29
(11) Fan retractor for liver retraction in Rt. Pyeloplasty

![Fig. 30](image)

(10) Puncture needle for antegrade insertion of JJ stent.
- Tube drain.
- Long-term JJ stent and guide wire.

**Equipment:**
- Light cable on the table, connected to a xenon light source.
- An Extra-tank of CO2 in the room.
- Monitor and recording system.
- Ligasure vessel sealing system

![Fig. 31: Ligasure device](image)

(4) **Position of operating room Equipment:**
The surgical cart containing the monitor (below which was the insufflator, DVD recording system) was positioned behind the patient so that it was in direct view of the surgeon.

All the laparoscopic instruments were placed on the nurse's table which was behind the patient. (Fig. 23) Likewise the equipment for irrigation aspiration, insufflation and camera were positioned behind the patient. Only the electrosurgical unit with its cord was placed in front of the patient.
(5) **Position of operating room personnel:**
The surgeon operates from the abdominal side of the patient. The first assistant stood caudally to the surgeon and at a higher position than the surgeon to prevent instruments from conflicting and the scrub nurse at the feet on the opposite side (Fig. 23).

![Diagram](image)

(6) **Anaesthesia:**

**Fig. 32:** Position of operating room personnel in transperitoneal laparoscopic pyeloplasty

(7) **Nasogastric tube.**

A nasogastric tube was placed and the stomach decompressed to avoid puncture during trocar placement and to allow additional space during abdominal insufflation.

(8) **Urethral catheter:**

An Foley catheter was introduced for decompression of the Bladder.
Access and port placement:

As previously described by Davenport et al., Four ports were generally enough to perform the procedure, although a fifth port was used for liver retraction in those cases with long length of proximal ureter stenosis where the right kidney could be fully mobilized (Davenport et al., 2005). Before the introduction of the trocar the abdomen was insufflated using a Veress needle (35 patients) or open technique (15 patients).

Technique for Creation of the Pneumoperitoneum using Veress needle:

A cutaneous incision was made two finger breadth below the costal margin arch in the midclavicular line, lateral to ipsilateral rectus muscle. The needle was introduced through the incision. The skin incision was 50% larger than the diameter of 11 mm trocar. (Fig. 33)

**Fig. 33:** Technique for Creation of the Pneumoperitoneum using Veress needle

Technique for Creation of the Pneumoperitoneum using Hasson Technique:

A skin incision was made at the level of the umbilicus. Using two retractors, the incision was deepened down to the level of the fascia. A Vicryl suture was placed on both edges of the fascia and the fascia was then cut. Using great care, the peritoneal cavity was entered. (Fig. 34)
Patients and methods

First port (11 mm. 0° Optic)

Once pneumoperitoneum was established (intra-abdominal pressure 14 mmHg). The Veress needle was removed, and 11 mm trocar was introduced through the same incision, perpendicularly to the abdominal wall. The optic was introduced through the device, and the abdomen is then inspected for any injury due to insertion of the Veress needle or the trocar, and to identify adhesions in areas where the secondary port was placed. The insufflator line is then connected to the Trocar. (Fig. 35)
Patients and methods

Second port:
The triangulation rule was followed for the placement of the trocars as the body habitus is different for each patient. The second port was placed at the angle between the costal margin and the lateral border of the ipsilateral rectus muscle. Four finger breadth was kept between the optic trocar and the working trocars and five finger breadth was kept between the working trocars. *(Fig. 36)*

![Fig.36: Insertion of 2nd port in transperitoneal pyeloplasty](image)

Third port (11 mm, bipolar grasper)
The triangulation rule was followed as above.

Fourth port (5 mm, suction device)
A cutaneous incision was made approximately midline between the umbilicus trocar and the anterior superior iliac spine on the side of the procedure for the introduction of the 5 mm trocar.
Surgical technique in transperitoneal laparoscopic pyeloplasty:

As previously described by Gaurav et al, by introducing the optical system parallel to the inner layer of the abdominal wall, the peritoneal reflection was easy identified. The peritoneum was gently dissected medio-ventrally using the tip of the camera this is important in order to central the position of camera tip. It is also help to prevent injury to the peritoneum. (Gaurav et al. 2010)

Fig.37: initial transperitoneal laparoscopic view of Rt. PUJO

Mobilization of the colon:

Frequently the hydronephrotic kidney could be identified posterior and lateral to the colon. The posterior peritoneum overlying the kidney was divided from the upper pole to a distance approximately 3 cm below the lower pole. Care was taken so as to not divide the lateral attachment of Gerota's fascia allowing the kidney to "flop" medially. The renocolic ligaments were divided allowing the colon to passively move medially and provide good exposure to the UPJ. (Fig.37)
Patients and methods

Identification of the ureter:

The ureter was identified by following the psoas muscle to a point just medial to the lower pole of the kidney. The ureter was distinguished from the gonadal vessels by peristalsis. Care was taken to not strip the peri-uretral tissues (and blood supply). Psoas muscle appeared horizontally on video screen except at the level of UPJ. Once the ureter has been identified, it is freed in a cephalic direction toward the UPJ. (Fig.38)

Some patients had a crossing vessel identified at PUJ. (Fig.39) which was preserved and repositioned posterior to the newly reconstructed PUJ.

Surrounding fatty and connective tissue was dissected carefully using the tip of suction device, bipolar forceps and scissors. Care was taken at this point to avoid injury to a smaller lower pole artery.

Fig.39 Crossing vessel in ureteroperlveic junction obstruction
Patients and methods

After dissection and clear visualization of the UPJO, the anteriorly visible pelvic well was incised by using endoscopic Pott's scissors. Starting 1.0 – 1.5 cm above visible stenosis of the pelvic wall, the entire UPJO was longitudinally incised (opened) and extended toward the healthy proximal ureter.

![Fig. 40: Incision of the renal pelvis with subsequent ureteral spatulation](image)

Spatulation of the proximal ureter was performed before the ureter was completely separated from the pelvis (Fig. 40). At this point we did Aderson – Hynes dismemberd pyeloplasty.

Some Manovers were used to help decrease the distance between the UPJ and the ureter:

1) Freeing the kidney outside the capsule so that it could be mobilized caudally.

2) A nephropexy can be performed by suturing the renal capsule at the lower pole to the psoas muscle before the repair.
Anderson Hynes Repair:-

The pelvis was transected 1 cm proximal to the UPJ, the ureter was spatulated 1 cm distal to the narrowed segment on its lateral aspect. A reduction pyeloplasty was performed in 10 patients. The first suture was placed using a free-hand technique with 4-0 Vicryl between the most dependent point of the renal pelvis and the distal corner of the ureteral spatulation to stabilize the suture line. (fig. 41)

Fig. 41: The 1\textsuperscript{st} suture of the Pyeloplasty at the apex with continuous posterior

The anastomosis was performed using a freehand running suture. The posterior wall was anastomosed first.

**Antegrade placement of JJ:** After insertion of a guide wire through a 5 mm trocar or a puncture needle, the JJ stent was connected with a pusher and the stent was pushed antegrade into the ureter. The proximal end of the indwelling stent was positioned inside the renal pelvis. (Fig. 42)

N.B: Cystoscopy was done after completion of laparoscopic procedure to confirm the position of the lower coil of DJ stent.
Patients and methods

After that, the anterior wall was anastomosed in a similar fashion.

(Fig. 43)

Fig. 42: Insertion of antegrade JJ stent

After the end of the procedure, a 16 fr. tube drain was placed near the UPJ anastomosis then fascial and skin closure of the trocar sites was done.

Fig. 43: Anterior wall anastomosis with subsequent closure of the pyelotomy
Surgical technique in retroperitoneal laparoscopic pyeloplasty

As previously described by Chuanyu et al. General anaesthesia was used for all patients. Patients were positioned in the classic lateral decubitus position with Hyperextension.

A 2-cm incision was first made using the open technique over the iliac crest. Hemostatic forceps was then used to divide the fascia lumbodorsalis. The retroperitoneal fat and the retroperitoneal space were separated by digital dissection (Fig. 44). A working space was created in the retroperitoneum by balloon dilation for 5 minutes. Three ports were guided by index finger and placed at the subcostal anterior axillary line, the posterior axillary line, and the anterior axillary line at the level of iliac crest. (Chuanyu et al., 2009)

Fig. 44: Open technique for placement of 1st port in retroperitoneal laparoscopic pyeloplasty with 3 ports placement.
Patients and methods

Trocars were then inserted and CO2 insufflation was performed until pressure reached 14 mm Hg. The kidney was initially identified in the area anterior to the psoas major muscle. After opening the Gerota’s fascia (Fig. 45), lower pole of the kidney was mobilized using Harmonic shears.

![Image](image1.png)

**Fig.45:** Initial laparoscopic view in RLP with identification of the kidney and ureter

The location of UPJO could be identified after the pelvis and upper 5-cm part of the ureter had been fully exposed. After dissection and clear visualization of the UPJO, the anteriorly visible renal pelvis was incised using an endoscopic scissor. The renal pelvis was partly divided from the most dependent part, cephalad toward the renal pelvis and keeping the most lateral extent of the renal pelvis undismembered; it would be incised to the appropriate size in a bell-mouth shape (Fig. 46)

![Image](image2.png)

**Fig.46:** Incision of the renal pelvis and spatulation of the ureter
The transection of the ureter was made about 0.5 cm distal to the obstructed position. The proximal ureter was spatulated with a 1.0-cm longitudinal incision on its lateral wall. Then, a double-J stent was positioned from the renal pelvis to bladder and the stenotic segment of the UPJ with the redundant renal pelvis was removed. The posterior pelvis-ureter running anastomosis was performed using 4-0 Vicryl absorbable suture. (Fig. 47)

The first suture was placed from the most inferior point of the ureteral spatulation to the most dependent portion of the pelvis. The suture was tied by the intracorporeal technique, with the knots placed outside the lumen. After the posterior anastomosis was completed, the same suture was used on the anterior wall of the anastomosis. If a crossing vessel was encountered during the dissection of the ureter, it was preserved and the ureter was transposed anterior to the vessel.
Patients and methods

After hemostasis was confirmed, the drain tube was placed in the retroperitoneum before the closure of incision.

For the 5 patients with renal calculi, Calculi in the renal pelvis were removed with right angle forceps under direct laparoscopic vision. Calyceal stones were also directly picked up with the help of a laparoscope and angled forceps if the renal pelvis and calyces were grossly dilated. Then, a suction cannula was placed in the pelvis and all calyces were flushed with saline through the cannula, and the remnant fragments were flushed out. It was successful in removing stones in all cases.

Fig. 48: Extraction of renal stones and performing dismembered pyeloplasty
Patients and methods

Follow up

Oral fluids and diet were introduced postoperatively as tolerated. The urethral catheter was removed on day 1 unless the drain tube output was excessive. The drain was removed when the drainage was less than 30 mL within 12 hours. Patients were discharged when comfortable.

Removal of the ureteral stents was undertaken 6 weeks postoperatively. Diuresis renography was obtained 6 and 12 months after surgery.

Success was defined by the presence of each of three criteria:
A decreasing renographic excretion curve or proven anastomotic patency according to the methods described, improved differential renal function, and the absence of pain.

Data analysis:

- Patients demographics (age, sex, side of PUJO, indications for PUJO treatment including symptoms, preoperative renal scan parameters (T1/2 for drainage, differential and split renal functions)
- Perioperative parameters including use of accessory ports, operative time (from the first incision to the last wound closure), estimated blood loss, conversion, presence of crossing vessels, complications, length of hospital stay, time to Foley’s catheter removal, time to drain removal were prospectively collected and recorded.
Patients and methods

- Postoperative followup: included postoperative complications and functional outcome of UPJO repair. Complications were graded according to Clavien - Dindo grading system (Dindo et al., 2004). Functional outcome parameters included assessment of symptoms improvement and change in the T1/2 of drainage in diuretic renal scan and estimated GFR.

Statistical analysis:

The clinical data were recorded on a report form. These data were tabulated and analyzed using the computer program SPSS (Statistical package for social science) version 16.

Descriptive statistics were calculated for the data in the form of: Mean and standard deviation for quantitative data, Frequency and distribution for qualitative data.

Analytical statistics were used for statistical comparison between the different groups, the significance of difference was tested using one of the following tests:-

1- Student t test:- Used to compare mean of two groups of quantitative parametric data.

2- FET (fisher exact test):- used to compare categorical data when one cell is less than five.

3- Inter-group comparison of categorical data was performed by using chi square test (X2-value),

P value <0.05 was considered statistically significant (S) while >0.05 statistically insignificant Pvalue <0.01 was considered highly significant (HS) in all analyses.
### RESULTS

Table 1: Baseline Age, sex, BMI, side of PUJO for patients underwent TLP and RLP groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>TLP (n=25)</th>
<th>RLP (n=25)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age/years (mean±SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(range)</td>
<td>29.48±9.9</td>
<td>27.52±10.25</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>(16-50)</td>
<td>(15-50)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>20 (80%)</td>
<td>20 (80%)</td>
<td>0.9</td>
</tr>
<tr>
<td>Female</td>
<td>5 (20%)</td>
<td>5 (20%)</td>
<td>0.9</td>
</tr>
<tr>
<td>BMI (mean±SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(range)</td>
<td>24.2±7.2</td>
<td>24±6.9</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>(19-33.5)</td>
<td>(19-32)</td>
<td></td>
</tr>
<tr>
<td>Side of PUJO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>13 (52%)</td>
<td>12 (48%)</td>
<td>0.9</td>
</tr>
<tr>
<td>Right</td>
<td>12 (48%)</td>
<td>13% (52%)</td>
<td>0.9</td>
</tr>
</tbody>
</table>

TLP = Transperitoneal Pyeloplasty, RLP = Retroperitoneal Pyeloplasty, BMI = Body mass index, No = Number, SD = Standard Deviation, p-value < 0.05 was considered significant (*)

In total 50 patients underwent laparoscopic pyeloplasty, of whom 25 patients underwent transperitoneal laparoscopic pyeloplasty (TLP) and 25 patients underwent retroperitoneal laparoscopic pyeloplasty (RLP). The mean age of patients underwent TLP and RLP was (29.48±9.9 and 27.52±10.32 years; p=0.5), respectively. Eighty per cent of patients were males in each group with comparable left-sided pyeloplasty [13 (52%) vs. 12 (48%), p=0.9] in TLP and RLP groups, respectively. Body mass index was also comparable (24.2± 7.2 and 24± 6.9 ) in both TLP and RLP groups. (Table 1).
Table 2: Clinical presentation of patients underwent TLP and RLP

<table>
<thead>
<tr>
<th>Variable</th>
<th>TLP (n=25) No (%)</th>
<th>RLP (n=25) No (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed presentation</td>
<td>8 (32 %)</td>
<td>4 (16 %)</td>
<td>0.3</td>
</tr>
<tr>
<td>Renal colic</td>
<td>6 (24 %)</td>
<td>7 (28 %)</td>
<td>0.9</td>
</tr>
<tr>
<td>Recurrent UTI</td>
<td>5 (20 %)</td>
<td>6 (24 %)</td>
<td>0.9</td>
</tr>
<tr>
<td>Haematuria</td>
<td>2 (8 %)</td>
<td>1 (4 %)</td>
<td>0.9</td>
</tr>
<tr>
<td>Incidentally discovered</td>
<td>2 (8 %)</td>
<td>4 (16 %)</td>
<td>0.7</td>
</tr>
<tr>
<td>Secondary stone</td>
<td>2 (8 %)</td>
<td>3 (12 %)</td>
<td>0.9</td>
</tr>
<tr>
<td>Total</td>
<td>25 (100%)</td>
<td>25 (100%)</td>
<td></td>
</tr>
</tbody>
</table>

In the TLP group, two patients (8%) presented with hematuria, 6 (24%) had renal colic, 5 (20%) had recurrent urinary tract infection (UTI) and 2 patients (8%) presented with secondary renal stones, while 8 patients (32%) presented with mixed presentation and 2 patients (8%) were incidentally discovered.

In the RLP group, one patient (4%) presented with hematuria, 7 (28%) had renal colic, 6 (24%) had recurrent urinary tract infection (UTI) and 3 patients (12%) presented with secondary renal stones, while 4 patients (16%) presented with mixed presentation and 4 patients (16%) were incidentally discovered. (Table 2)
Fig. 49: Clinical Presentation of patients in both groups
Table 3: Intraoperative data for patients undergoing TLP and RLP

<table>
<thead>
<tr>
<th>Variable</th>
<th>TLP (n=25)</th>
<th>RLP (n=25)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operative time (min)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean± SD (range)</td>
<td>190.8±53.85(140-350)</td>
<td>223.4±55.38(160-350)</td>
<td>0.04*</td>
</tr>
<tr>
<td><strong>Crossing vessels</strong> (No, %)</td>
<td>7 (28%)</td>
<td>4 (16.7%)</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Concomitant pyelolithotomy (No., %)</strong></td>
<td>2 (8%)</td>
<td>3 (12%)</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Estimated Blood loss (mL)</strong></td>
<td>249.6±69</td>
<td>223.2±60</td>
<td>0.2</td>
</tr>
<tr>
<td>mean± SD (range)</td>
<td>(180-400)</td>
<td>(120-300)</td>
<td></td>
</tr>
<tr>
<td><strong>Conversion (%)</strong></td>
<td>8%</td>
<td>12%</td>
<td>0.9</td>
</tr>
</tbody>
</table>

The mean operative time (excluding the time for anaesthesia and time for recovery) was significantly shorter in TLP group (190.8±53.85 vs. 223.4±55.38 min, p=0.04) (Figure 50).

Crossing vessels were encountered in 7 cases (28%) during the TLP versus 4 cases (16%) during RLP. Pyelolithotomy was done in cases with stones, 2 patients in TLP group and 4 patients in RLP group, and it was successful in all cases.

The mean blood loss was comparable between TLP and RLP (249.6±69.07 vs. 223.2±60.93 mL, p=0.20), respectively. Similarly, both groups had a comparable rate of conversion to open surgery (8% vs. 12%, p= 0.90), respectively (Table 3).
**Results**

**Fig. (50): Mean operative time**

<table>
<thead>
<tr>
<th></th>
<th>TLP</th>
<th>RLP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>191 (min)</td>
<td>223 (min)</td>
</tr>
</tbody>
</table>

**Fig. (51): conversion rate in TLP and RLP**

<table>
<thead>
<tr>
<th>Conversion (%)</th>
<th>TLP</th>
<th>RLP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Results

### Table 4: Postoperative data for patients underwent TLP and RLP

<table>
<thead>
<tr>
<th>Variable</th>
<th>TLP (n=25)</th>
<th>RLP (n=25)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter removal (days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean± SD (range)</td>
<td>4.76±2.5</td>
<td>4.76±2.5</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>(3-12)</td>
<td>(3-10)</td>
<td></td>
</tr>
<tr>
<td>Drain removal (days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean± SD (range)</td>
<td>6.6±2.6</td>
<td>6.12±2.4</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>(4-14)</td>
<td>(4-12)</td>
<td></td>
</tr>
<tr>
<td>Visual analog pain scale at discharge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean± SD (range)</td>
<td>2.2±1.2</td>
<td>2.0±1.1</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>(2-5)</td>
<td>(2-3.5)</td>
<td></td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>mean± SD (range)</td>
<td>6.24±2.8</td>
<td>6.12±2.6</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>(3-14)</td>
<td>(3-14)</td>
<td></td>
</tr>
</tbody>
</table>

Catheter were removed after a mean period of 4.76±2.5 and 4.76±2.5 in TLP and RLP groups respectively. While drain was removed after 6.6±2.6 and 6.12±2.4 in both groups. Patients were discharged after a mean hospital stay which was comparable in TLP and RLP groups (6.24±2.8 and 6.12±2.6).

Postoperative pain was not severe in both groups, and Visual analog pain scale was applied to all patients with mean of 2.2±1.2 and 2.0±1.1 in TLP and RLP groups respectively.
Table 5: Postoperative complications for patients underwent TLP and RLP

<table>
<thead>
<tr>
<th>Variable</th>
<th>TLP (n=25) No (%)</th>
<th>RLP (n=25) No (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>High grade fever</td>
<td>2 (8 %)</td>
<td>1 (4 %)</td>
<td>0.9</td>
</tr>
<tr>
<td>Urinary leakage</td>
<td>4 (16 %)</td>
<td>3 (12 %)</td>
<td>0.9</td>
</tr>
<tr>
<td>Clot retention</td>
<td>0 (0 %)</td>
<td>1 (4 %)</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Six patients (24%) who underwent TLP had low-grade postoperative complications (Clavien I and II), including 2 patients (8%) had high grade fever and 4(16%) had leakage from the drain sites. On the other hand, Clavien I and II postoperative complications were detected in 5 patients (20%) who underwent RLP including one patient (4%) had high grade fever, 3 (12%) had leakage and one patient (4%) had clot retention (Table 4).

All postoperative complications were managed conservatively. No high grade complications (Clavien>II) were detected in either group. The mean catheter and drain times and hospital stay were comparable between TLP and RLP procedures.

Patients with prolonged leakage were advised to decrease water intake. X-ray was performed to check the position of JJ stent and drain. Drain was withdrawn for a few centimetres in those patients as it could compress the suture line. We didn’t need to exchange or remove the JJ stents and drain was kept till leakage decreased under cover of antibiotic.

Patients with high grade fever were managed by antibiotic therapy according to urine culture and sensitivity together with i.v fluids and
antipyretics in form of acetaminophen and diclofenac sodium. Clot retention that occurred in one patients in the RLP group was managed by bladder lavage by normal saline and antibleeding measures.

**Table 6: Complications in the studied groups according to Clavien - Dindo grading system**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
<th>TLP (n=25)</th>
<th>RLP (n=25)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions. Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgetics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside.</td>
<td>4 (16%)</td>
<td>4 (16%)</td>
<td>0.9</td>
</tr>
<tr>
<td>II</td>
<td>Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included.</td>
<td>2 (8%)</td>
<td>1 (4%)</td>
<td>0.5</td>
</tr>
<tr>
<td>III</td>
<td>Requiring surgical, endoscopic or radiological intervention not under general anaesthesia.</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Requiring surgical, endoscopic or radiological intervention under general anaesthesia.</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Life-threatening complication (including CNS complications) requiring IC/ICU management with Single organ dysfunction (including dialysis).</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life-threatening complication (including CNS complications)* requiring IC/ICU management with multiple organ dysfunction.</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Death of a patient</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
</tbody>
</table>

Suffix “d” the suffix “d” (for “disability”) is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication.

*(Dindo et al., 2004)*
**Results**

**Fig. (52):** Post-operative complications in TLP and RLP

**Table 7:** Follow up data and success rate for patients underwent TLP and RLP

<table>
<thead>
<tr>
<th>Variable</th>
<th>TLP (n=25) No. (%)</th>
<th>RLP (n=25) No. (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean follow-up ( months)</td>
<td>18.44±3.48 (12-24)</td>
<td>19.92±3.83 (13-24)</td>
<td>0.2</td>
</tr>
<tr>
<td>Resolution of patients symptoms</td>
<td>22 (88%)</td>
<td>21 (84%)</td>
<td>0.7</td>
</tr>
<tr>
<td>Radiologic resolution of obstruction</td>
<td>23 (92%)</td>
<td>22 (88%)</td>
<td>0.7</td>
</tr>
<tr>
<td>Renogram features</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes in T ½</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved</td>
<td>23 (92%)</td>
<td>22 (88%)</td>
<td>0.7</td>
</tr>
<tr>
<td>Worsened</td>
<td>0 (0%)</td>
<td>1 (4%)</td>
<td>0.1</td>
</tr>
<tr>
<td>No changes</td>
<td>2 (8%)</td>
<td>2 (8%)</td>
<td>0.9</td>
</tr>
<tr>
<td>GFR before pyeloplasty (ml/min)</td>
<td>39.7 ±11.4 (18.2-43.1)</td>
<td>36.7 ±10.7 (17.2-41.9)</td>
<td>0.6</td>
</tr>
<tr>
<td>GFR after 12 months (ml/min)</td>
<td>45.2 ±10.7 (39.8-55.2)</td>
<td>44.3 ±9.2 (38.3-52.1)</td>
<td>0.7</td>
</tr>
<tr>
<td>Overall success rate</td>
<td>23 (92%)</td>
<td>22 (88%)</td>
<td>0.7</td>
</tr>
</tbody>
</table>
Results

Resolution of symptoms occurred in the majority of cases; 88% and 84% in TLP and RLP groups. This improvement was also associated with improvement of obstruction assessed by radiological investigations in both groups; 92% in TLP and 88% in RLP.

Renogram features showed significant improvement in both groups with decrease of $T\frac{1}{2}$ [92% (23 patients) in TLP and 88% (22 patients) in RLP], while it remained stationary in 2 patients (8%) in each group, and one patient in RLP group showed prolonged $T\frac{1}{2}$.

Postoperative GFR (45.2 ±10.7 and 44.3 ±9.2 in TLP and RLP groups respectively) improved in the both groups compared to the preoperative one (39.7 ±11.4 and 36.7 ±10.7 in TLP and RLP groups respectively).

![Fig. 53: Changes in $T\frac{1}{2}$ in both groups](image)
All patients underwent follow up with mean follow up period of 18.44±3.48 and 19.92±3.83 in TLP and RLP groups respectively. The overall success rate was 92% and 88% in the TLP and RLP procedures, respectively (p=0.70) (Table 7).
The Anderson–Hynes open pyeloplasty remains the standard treatment for UPJO, with a success rate of >90%. Endoscopic incisions of the UPJ can be made in different ways; an antegrade or retrograde approach have been used as a minimally invasive treatment alternative, with the success rate being lower than for open pyeloplasty. (Hani, et al., 2011)

Despite being slightly more invasive than endopyelotomy, LP reproduces open surgery for its results and positive outcomes. However, it also carries the well-known advantages of laparoscopic surgery (less pain, shorter hospital stay, shorter convalescence and less scarring) and it allows patients to resume their daily activities earlier. Several studies have shown a success rate of >90% for LP, similar to that of traditional open dismembered pyeloplasty. It could replace open surgery as the standard treatment for UPJO. (Lopez-Pujals, Leveillee and Wong, 2004)

The laparoscopic approach has become the access of choice for pyeloplasty. The associated reduction in morbidity, the rapid postoperative recovery, and the superior results of laparoscopy are some of the advantages of this technique when compared with traditional open surgery. Increased experience not only decreases the incidence of complications but also changes
the approach to the management of complications and reduces the incidence of conversion to laparotomy. *(Hani, et al., 2011)*

The advantages of the retroperitoneal approach may be direct access to the target structures, minimized risk of injury to intraperitoneal organs, and allowance for a conservative treatment in urinary fistula cases or anastomotic leakage because urine does not come into contact with the peritoneal cavity and organs. Furthermore, it may be used successfully in morbidly obese patients with body mass index >30 because the full flank position and the flexion of the surgical table allow for an anterior passage through both the subcutaneous and abdominal fat. This facilitates the surgical procedure compared with the transperitoneal approach. *(Cestari et al., 2010)*

Nevertheless, retroperitoneoscopy has some disadvantages; the proper recognition of anatomic landmarks can be more difficult. Especially at the beginning of the retroperitoneoscopic experience. The surgical field may become reduced compared with the transperitoneal approach and subsequently with the potential closeness of the operative ports. *(Cestari et al., 2010)*

Finally, with the retroperitoneal approach it can be more difficult to properly judge the role of a crossing vessel in the obstruction and whether the vessel must be decrossed or not, especially at the beginning of the experience. Therefore, the
choice depends on the surgeon experience with both approach and the balance between the advantage and disadvantage of each technique. *(Cestari et al., 2010)*

In the present study, the demographic date including age of patients, gender, BMI and side of PUJO was comparable in both TLP and RLP groups and the differences were statistically insignificant. The mean age of patients underwent TLP and RLP was \(29.48 \pm 9.9\) and \(27.52 \pm 10.32\) years; \(p=0.5\), respectively. Eighty per cent of patients were males in each group with comparable left-sided pyeloplasty \([13 (52\%) \text{ vs. } 12 (48\%), p=0.9]\) in TLP and RLP groups, respectively This data was similar in the previous studies. Between October 1999 and October 2008, *Sami and his colleagues* performed laparoscopic transperitoneal pyeloplasty in 34 cases \((52\%)\), 15 male and 19 female, and the retroperitoneoscopic in 31 cases \((48\%)\), 12 male and 19 female. The procedures were performed in the right side in 35 \((54\%)\) patients and in left side in 30 \((46\%)\) patients *(Sami et al., 2010)*

The clinical presentation for patients in both groups was either pain, UTI, hematuria, secondary stone, while some patients presented with mixed presentations others were incidentally discovered during radiological assessment for another health problem with comparable number of cases in both groups. This findings was similar in other studies *(Shoma et al., 2007, Sami et al., 2010 and Wu Y et al., 2012)*
Crossing vessels identified during TLP were transposed anteriorly from the UPJ, to reduce tension on the anastomosis, during the RLP. Transposition of UPJ in the presence of the anterior crossing vessels was performed by Shoma and colleagues during both approaches, \textit{(Shoma et al., 2007)} they aimed at sticking to the Anderson Hynes technique. Other cohorts see that transposition add to the prolongation of the operative time in the RLP and prefer rather to translocate the crossing vessel cephalad from the UPJ during RLP. \textit{(Janetschek et al., 2000)}

However; transposition of UPJ had no impact on the outcome of either procedure. \textit{(Sami et al., 2010)}

In the present study, Blood loss was not severe and no patient required blood transfusion with was comparable between TLP and RLP (249.6±69.07 vs. 223.2±60.93 mL). This data was in agreement with other studies \textit{(Davenport et al., 2005 and Cestari et al., 2010)}

Conversion to open surgery was done in cases where there was failure to progress due to dissection difficulties, especially in cases with preoperative recurrent UTI and complex crossing vessels. This was statistically insignificant (12\% in RLP vs. 8\% in TLP). Review of literature reported significant higher conversion rate in RLP compared to TLP. \textit{(Sami et al., 2010 and Wu Y et al., 2012)} This may be an advantage of the experience based approaching that may neutralize the significant higher conversion
in RLP. If both approaches performed by a single surgeon, he may be proficient in one approach rather than the other and can deal with crossing vessels and dissection difficulties in a better way in one approach rather than the other, as most of laparoscopic urologists started their learning using the transperitoneal approach, they are more familiar with it and can deal better with difficulties during the transperitoneal rather than the retroperitoneal approach, this may explain the higher conversion in RLP and why this was neutralized when the approach was performed by retroperitoneal laparoscopist.

Unfortunately, the operative time in this study was still significantly longer in the RLP, this was consistent with that previously reported. *(Shoma et al., 2007, Sami et al., 2010 and Wu Y et al., 2012)* We hypothesized that the experience based approach may neutralize the time gap between both approaches. It seems that there is something in the retroperitoneal approach that prolongs the operative time and could not be overcome even whenever the procedure was performed by retroperitoneal laparoscopist. This may be due to the narrow working space which makes the anastomosis more difficult and takes longer time. *(Shoma et al., 2007, Sami et al., 2010).*

Visual analog pain score was applied to all patients postoperatively and showed low values in both groups and this finding reflected the relative decrease in pain and analgesic intake.
in laparoscopic pyeloplasty. This is in agreement with other series that compared the pain scores in both laparoscopic and open pyeloplasty. *(Bauer et al., 1999)*

The short term follow-up did not represent a limitation of our results as post LP failures often occur within the first postoperative year. The followup date included objective and subjective parameters reflecting improvement of patient’s symptoms either pain, UTI,...etc., improvement of radiological followup by ultrasonography and IVP. Renogram features were assessed also pre and postoperative and showed significant improvement in term of decrease T ½ and improvement of GFR of the operated kidney. Postoperative GFR in our study after 12 months followup (45.2 ±10.7 and 44.3 ±9.2 in TLP and RLP groups respectively) improved in the both groups compared to the preoperative one(39.7 ±11.4 and 36.7 ±10.7 in TLP and RLP groups respectively) This was also observed in the previous studies. *(Rais-Bahrami et al., 2013)*

The current success rates were 92% for TLP and 88% for RLP, which are consistent with that previously reported. *(Davenport et al., 2005, Soulie et al., 2001 and Shoma et al., 2007)* However, Sami and colleagues had reported a success rate of 87% for TLP and 82% for TLP, which are slightly lower than our results. *(Sami et al., 2010)*
Due to the limited working field offered by the retroperitoneal route, our experience shows that the anterograde stent positioning appears easier with the transperitoneal approach compared with the anterograde stent positioning in the retroperitoneal approach. This finding was observed also during previous trials. (Cestari et al., 2010) Moreover, the typical cranial position of the assistant port in the transperitoneal approach (although this port positioning may create some conflicts during the dissection phase of the procedure on the right side for a right-handed surgeon) eases the anterograde stent positioning compared with the more posterior and caudal position of the assistant port in the retroperitoneal approach.

Perioperative outcomes were comparable in terms of morbidity. Both techniques were comparable in the postoperative low grade complications which were managed conservatively. No Clavien complications higher than grade II were encountered in either approach. Complications reported ranged from high grade fever due to postoperative pyelonephritis, prolonged leakage via the drain and one case with clot retention. This is consistent with that previously reported series. (Chapron et al., 1998 and Sami et al., 2010)

Recently, the results of a meta-analysis did not support either approach over the other, both are associated with high success rates and low perioperative complications. (Wu Y et al.,
Similarly, hospital stay was comparable between both procedures and go in line with the reported data. *(Shoma et al., 2007, Sami et al., 2010, Wu Y et al., 2012, Moon et al., 2006)*

Results obtained with patients undergoing laparoscopic pyeloplasty demonstrate that morbidity and complications are significantly decreased with laparoscopy. In addition, short-term results of complete dismembering laparoscopic pyeloplasty are similar to those obtained with open technique. This suggests that complete dismembering laparoscopic pyeloplasty the potential to replace open dismembered surgery as the gold standard for treatment of UPJ obstruction. *(Klingler et al., 2003)*

Despite being an experience-based prospective trial, the limitations of the current cohort could be addressed in its relatively small sample size and the patients were not randomized between both procedures e.g. patients with large redundant renal pelvis were preferred to do pyeloplasty via transperitoneal approach.
### Table 8: Main series of laparoscopic pyeloplasty

<table>
<thead>
<tr>
<th>Series</th>
<th>n.</th>
<th>Approach</th>
<th>Open conversion %</th>
<th>Mean operative time (min.)</th>
<th>Mean hospital stay (day)</th>
<th>Follow up (months)</th>
<th>Success rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jarrett et al (2002)</td>
<td>100</td>
<td>Trans</td>
<td>0</td>
<td>252</td>
<td>3.3</td>
<td>26</td>
<td>98</td>
</tr>
<tr>
<td>Zhang et al (2009)</td>
<td>50</td>
<td>Retro</td>
<td>0</td>
<td>81</td>
<td>7.6</td>
<td>22</td>
<td>98</td>
</tr>
<tr>
<td>Davenport et al (2005)</td>
<td>83</td>
<td>Transperitoneal</td>
<td>0</td>
<td>224</td>
<td>3.6</td>
<td>15</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retroperitoneal</td>
<td>11.7</td>
<td>209</td>
<td>3.6</td>
<td>30</td>
<td>67</td>
</tr>
<tr>
<td>Shoma et al (2007)</td>
<td>40</td>
<td>Transperitoneal</td>
<td>0</td>
<td>139</td>
<td>3.6</td>
<td>23</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retroperitoneal</td>
<td>0</td>
<td>189</td>
<td>3.8</td>
<td>20</td>
<td>90</td>
</tr>
<tr>
<td>Sami et al (2010)</td>
<td>62</td>
<td>Transperitoneal</td>
<td>2.9</td>
<td>194</td>
<td>4.4</td>
<td>45</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retroperitoneal</td>
<td>19.3</td>
<td>231</td>
<td>4.4</td>
<td>51</td>
<td>87</td>
</tr>
<tr>
<td>Present series (2014)</td>
<td>50</td>
<td>Transperitoneal</td>
<td>8%</td>
<td>191</td>
<td>6.2</td>
<td>18.4</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retroperitoneal</td>
<td>12%</td>
<td>223</td>
<td>6.1</td>
<td>19.9</td>
<td>82</td>
</tr>
</tbody>
</table>
Summary and conclusion

Laparoscopic pyeloplasty has now been consistently shown to offer the advantages of minimally invasive techniques with the success rate comparable to open surgery. It can become a standard of care for the treatment of UPJO as it is applicable to both primary and secondary UPJ obstruction, with or without obstructing crossing vessels.

Laparoscopic pyeloplasty either done by transperitoneal or retroperitoneal approach has comparable outcome in terms of hospital stay, blood loss and postoperative complications.

The experience-based approach of laparoscopic pyeloplasty has neutralized the higher conversion rate. However, retroperitoneal approach was still associated with longer operative time.

In the next few years we can expect a significant increase in laparoscopic urologic procedures for the reconstructive intervention. The ability to perform a safe laparoscopic sewn anastomosis in a reasonable time will determine the success of the laparoscopic surgeon and will expand the use of laparoscopic techniques in reconstructive procedures.

As UPJO is not frequently diagnosed, we recommend a multicenter randomized study with appropriate sample size to address this finding.
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A


B


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المتخصّص العربي

بعد تصليح الجراحي لضيق حوض الكلى اساسا لتصليح هذا المرض منذ فترة بعيدة. وقد بدأ ذلك المفهوم يتغير تدريجيا منذ أن دخل تصليح حوض الكلى باستخدام منظار البطن الجراحي إلى حيز الوجود وذلك بنتائج تقارب تلك التي يحققها التصليح الجراحي لهذه المشكلة.

ويحمل استخدام منظار البطن الجراحي لتصليح ضيق حوض الكلى مزايا متعددة سواء من خلال خلف الغشاء البريتوني. وذلك من خلال إمكانية تكبير مجال الرؤية ومن خلال تقليل عدد أيام الإقامة بعد العملية والعودة لممارسة الحياة الطبيعية بعد فترة وجيزة مع تقليل الحاجة لاستخدام مسكنات لفترات طويلة بعد العملية بالإضافة إلى تقليل المضاعفات بعد العملية.

وتهدف الدراسة إلى تقييم ومقارنة استخدام منظار البطن الجراحي لتصليح ضيق حوض الكلى سواء من خلال أو خلف الغشاء البريتوني.

خضع لهذه الدراسة 50 مريضا يعانون من ضيق حوض الكلى وقد تم تقسيمهم إلى مجموعتين:


وقد استبعد من الدراسة المرضى الذين يعانون من أمراض تجلط الدم، وجود عدوى نشطة بالمسالك البولية، انسداد معوي، السمنة المفرطة، وجود عدوي بجدار البطن الخارجي، الحوامل الذين يعانون من وجود تجمع بالغشاء البريتيوني وكذلك المرضى الذين خضعوا لجراحات بالكلية أو جراحات متقدمة بالبطن أو الحوض.

وقد خضع المرضى قبل أجراء العملية إلى الفحوصات الأتية:

- تحليل بول كامل
- التحاليل الروتينية قبل إجراء العمليات الجراحية
- موجات فوق صوتية على البطن والحوض
- أشعة بالصبغة على المسالك البولية بالإضافة إلى أشعة مقطعية حزازنية على المسالك البولية "عند الحاجة إليها"
- أشعة مسح ذري على الكلي

تم إجراء العمليات عن طريق منظار البطن الجراحي من خلال أو خلف الغشاء البريتيوني بطريقة الفصل الكلي للحاصل عن حوض الكلي وإعادة تشخيصها مع تركيب دعامة داخلية بالحقل يتم رفعها بعد مرور ستة أسابيع من العملية.

قد تم حصر بيانات المرضى قبل أثناء العمليات وبعد العمليات في كلتا المجموعتين وكذلك المضاعفات أثناء العملية وبعدها.

تمت متابعة الحالات بعد العملية ومناظرتها مع عمل متابعت وفحوصات بعد العملية تشمل اشعة مسح ذري وفحوصات عملية للتأكد من نجاح العملية وعدم حدوث مضاعفات على المدى البعيد. وقد تم إجراء تحليل إحصائي للمعطيات السابقة بغرض الحصول على نتائج.
وقد خلصت الدراسة إلى تقارب نتائج منظر البطن الجراحي لتصليح ضيق حوض الكلى من خلال الغشاء البريتوني أو من خلفه سواء من جانب المضاعفات أثناء العملية أو الحاجة إلى التحول للتصليح الجراحي وأيضاً من جانب حدوث مضاعفات بعد العملية وكذلك نجاح العملية. ولكن استخدام منظر البطن من خلف الغشاء البريتوني كان مصحوبا بطول نسبى في وقت العملية وذلك خصوصاً في الحالات الأولى للدراسة.

وتوصى الدراسة بإجراء دراسات موسعه على عدد أكبر من الحالات وفترات متابعة أطول لتقييم دور منظر البطن في تصليح ضيق حوض الكلى. مع توصية باستخدام منطار البطن بشكل أكبر في علاج مرضى المسالك البولية.

Alaa El Shaer
دراسة مقارنة استخدام منظار البطن الجراحي لتصليح ضيق حوض الكلى من خلال الغشاء البريتوني أو من خلفه

توظف للحصول على درجة الدكتوراه في جراحة المسالك البولية والتناسلية

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2014