**Prevention and Management of Intra and Perioperative Complications During Laparoscopic Urological Surgery**

Panagiotis Mourmouris¹, Christos Papachristou², Titos Markopoulos¹, I Kyriazis¹, M Lardas¹, Omer Burak Argun⁴, Andreas Skolarikos¹

¹2nd Department of Urology, University of Athens, Sismanoglio General Hospital, Athens Greece
²EL. AS Department of Urology, Athens, Greece
³Department of Urology, University of Patras, Rio General Hospital, Patra, Greece
⁴Department of Urology, Acibadem University, Acibadem Maslak Hospital, Istanbul, Turkey

**Abstract**

Laparoscopy is the gold standard for many urological surgeries and the experience of the surgeons has significantly increased the last two decades. Inevitable surgeons are confronted with complications, some of them can be potentially life-threatening. Since the best way to deal with complications is to prevent them, we review the literature for the most frequent intra or perioperative complications during laparoscopic urological surgeries and we propose measures to prevent them before happening and to manage them after they occur.

**Introduction**

Laparoscopic surgery was introduced in Urology in early 90s. The milestone in the development of urological laparoscopy include the diagnosis of impalpable testes reported in 1976 by Cortesi et al¹ but it took almost a decade for the first laparoscopic nephrectomy reported by Clayman et al. [2]. The main reasons for this delay included resistance to innovation, lack of certified training centers capable of releasing the first highly trained generation of urologic laparoscopists who in turn, would be responsible for the training of the younger trainees, steep surgical learning curve, the advent of new complications and the rising difficulty for a mainly open surgeon to deal with them [3]. Despite the aforementioned difficulties pure laparoscopy clinical and training programs still run all over the world and so surgeons are inevitably confronted with complications. The best way to deal with complications is to prevent them from occurring. However,

**Key words**

non metastatic; castrate resistant; prostate cancer; management

**Citation**


**Corresponding author:**
Mourmouris Panagiotis, E-mail: thodoros13@yahoo.com
Prevention and Management of Intra and Perioperative Complications During Laparoscopic Urological Surgery, p. 09-13

when they occur it is crucial to recognize them early, ideally intraoperative, and repair them immediately. We review the literature for the most frequent complications and we propose the most appropriate ways to confront them.

First things first
Proper training during residency and a dedicated postgraduate fellowship are of paramount importance to reduce complication rate. Even after proper training, mentoring during the first cases is also very important. In addition, the surgeon should be responsible to create a dedicated constant operating team including the anesthesiologist and the specially trained nursing staff [3]. Furthermore, the surgeon should be responsible for the proper operating room set up which again is crucial for the success of the operation [3].

As in every type of surgery, the laparoscopic urologist needs to follow a checklist before starting an operation (Table 1). Before starting the operation, the surgeon must check the operating room set up and the instrument availability and well performance. Proper patient positioning is crucial. The surgical team must provide adequate padding and avoid extreme bending and/or stretching while fixing the patient over the operating table. Selecting and preparing in advance the appropriate suture is also wise. The team nurse must be well trained to prepare the suture to the length of a trocar as this is a simple but mandatory rule, fitting to the majority of reconstructive necessities. To avoid anesthetic complications, intra-abdominal pressures must be kept below 15 mmHg, creation of subcutaneous emphysema must be avoided, and operation time must be reduced as much as possible. Very rarely a carbon dioxide gas embolism occurs. The surgeon and the anesthetist should suspect it when there is a decrease in end-tidal CO₂ and end-tidal O₂ along with a decrease in patient’s blood pressure intra-operatively [4]. Immediate desufflation is mandatory. The anesthetist should be fully trained in order to immediately place the patient in Durant’s position and make the appropriate ventilator adjustments [4]. Aspiration of CO₂ through the superior vena cava may be needed in severe cases.

Port site placement
Access to the peritoneal cavity or to the retroperitoneal space can be performed either by the Veress needle (closed technique), the Hasson technique (open technique) and the optical port technique. The site of insertion depends of the procedure and whether the site is approached trans or retro-peritoneally. Several factors may predispose to access related complications (Table 2).

The results of a recent meta-analysis of all open and closed laparoscopy conclude that open laparoscopy eliminates the risk of major vascular injury and reduces the rate of major visceral injury [5]. Other technique includes transillumination of the abdominal wall, use of hand held Doppler device, minimizing port insertion force and inserting ports under direct vision [6-7]. For visceral injuries, although there are no data concerning urological procedures, there are sufficient data from gynecological and general surgical literature that stress the importance of the insertion of the primary port, mainly in the presence of adhesions [8]. Again, the use of the Hasson technique and placement of the access away from area of previous surgery, if possible, could minimize the risk of this complication [8-9].

If a minor vascular injury, which results in a significant bleeding, does occur, then it must be controlled under direct vision. Suture ligation is preferable over extensive

---

**TABLE 1** Check list prior to a Laparoscopic Operation

<table>
<thead>
<tr>
<th>The Laparoscopic Urologist Should:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoroughly inform and give ample time to the patient and close family</td>
</tr>
<tr>
<td>Provide details regarding the nature of the disease, the procedure, the laparoscopic approach, the existing alternatives, the risks and the likelihood of conversion</td>
</tr>
<tr>
<td>Give reassurance that the patient safety comes first</td>
</tr>
<tr>
<td>Fill confident with the selected approach</td>
</tr>
<tr>
<td>Know the patient and its surgical problem</td>
</tr>
<tr>
<td>Think in advance about the advent of a complication related to the procedure</td>
</tr>
<tr>
<td>Wonder whether he knows how to handle a complication</td>
</tr>
</tbody>
</table>

**TABLE 2** Factors predisposing to access-related complications

<table>
<thead>
<tr>
<th>Patient parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obesity</td>
</tr>
<tr>
<td>Previous Surgery</td>
</tr>
<tr>
<td>Surgeon Experience</td>
</tr>
<tr>
<td>Port design</td>
</tr>
<tr>
<td>Port size</td>
</tr>
<tr>
<td>Blunt/cutting/radially expanding edges</td>
</tr>
</tbody>
</table>
Prevention and Management of Intra and Perioperative Complications During Laparoscopic Urological Surgery, p. 09-13

Diathermy and can be accomplished via a figure of eight suture or via the use of a port closure device [10]. If the injury has occurred during port introducing, after controlling the bleeding, the port can be replaced through the same site. On the event of a major vascular injury during port placement, conversion is typically required even though major venous injuries hold a greater potential for laparoscopic repair. If the latter is decided the steps must include: increasing intra-abdominal pressure to 15mm Hg, holding both edges of vessel incision with atraumatic graspers during closure and continuous suturing of the opening. Nevertheless, it must be stressed that these maneuvers require not only a skilled surgeon but also an equally skilled assistant.

Even though the incidence of visceral injuries during port placement in laparoscopic urological procedures is not known, reports from other specialties place it between 0.06 and 0.08% [8]. Although, open placement seems to reduce the rate of visceral injury, it does not eliminate it [11]. As for the anatomical position of the injury, a recent literature review of bowel injury in laparoscopy reports a 58% small bowel injury, 32% colon injury and 7% stomach injury [9].

And from the latter depends the management of this complication. Since small bowel is the most frequent site of injury it should be noted that it requires meticulous repair that we can be performed laparoscopic if it is recognized early. If the diagnosis is delayed, then almost require laparotomy [9].

Intraoperative Complications

Vascular injuries

Major vascular injury can happen in 1-3% of the cases during laparoscopic urologic surgery with 0.5-3% uncontrollable bleeding [12-16]. Prevention and high level of vigilance are of paramount importance.

The general surgical principles must be followed with reverence: familiarization and respect to the anatomy, careful mobilization, retraction and dissection of the tissues and knowledge of physiology. If the bleeding is minimal, compression is adequate, and the procedure can continue. Otherwise, thermal (bipolar, ultrasonic, argon beam) or non-thermal (intracorporeal suturing and bolsters) measures might prove useful on controlling bleeding. Preventive sutures (par example on dorsal plexus during radical prostatectomy), increasing pneumoperitoneum to 20-25 mmHg, hemostatic figure of eight stitch, even the use of a metallic (Benique) urethral probe, all are measures that can be utilized to prevent or control bleeding during ligation of dorsal vein plexus [17]. Small vena cava lacerations are controlled with adequate pressure in 80-90% of the cases. Endoscopic clipping of arterial branches and vascular suturing of the vena cava may be mandatory to control the bleeding [13]. As a rule of thumb if the patient needs transfusion (more than 2 units) by the time you would be able to repair the vessel injury open conversion and a vascular surgeon consultation may be needed. Either way the urologist must know the basic principles of vascular reconstruction as shown in Table 3.

### Table 3: Management of artery

<table>
<thead>
<tr>
<th>Complication</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain Normal Caliber</td>
<td></td>
</tr>
<tr>
<td>Sutures</td>
<td>Direction of blood flow</td>
</tr>
<tr>
<td>Lacerations</td>
<td>Monofilament polypropylene</td>
</tr>
<tr>
<td>&gt;30% Circumference</td>
<td>Vein of Gore-Tex patch grafts</td>
</tr>
<tr>
<td>Complete transection</td>
<td>End-to-End anastomosis</td>
</tr>
<tr>
<td>Flash the vessel injury</td>
<td>Heparin</td>
</tr>
</tbody>
</table>

### Bowel Injury

With a rate of 0.8% non-access related bowel injury during urologic laparoscopy is considered a rare complication [9]. However, the main problem is that more than 2/3 of these complications are not diagnosed intraoperatively. Nearly half of the cases are due to inappropriate electrocautery use [18]. For that reason, monopolar and bipolar instruments should always be checked for proper insulation before the procedure.

Other preventive measures that can be applied to minimize the risk for thermal injury is the use of low dissipation thermal energy, refraction rather than grasping the bowel and using monopolar electrocautery in close proximity [19]. As far as rectum is concerned, its injury is a relatively rare but serious complication and so every measure must be taken to avoid it. Proper dissection of the Denonvillier’s fascia, careful retraction of the seminal vesicles and vas deference anteriorly and sigmoid colon posteriorly, recognition of the correct plane by visualization of the yellow perirectal fat are all important steps to accomplish the above mentioned goal [20, 21].

In the unlikely event of a bowel injury most authors agree that intraoperative repair provides significantly bet-
Prevention and Management of Intra and Perioperative Complications During Laparoscopic Urological Surgery, p. 09-13

Preoperative outcomes than conservative observation in hospital, even for superficial ones [22]. It is also well documented that thermal injuries result in a more extensive damage than expected and that laparoscopy results in a low metabolic and immune response that allows a quick progression into sepsis [23-24]. For these reasons foul smelling gas exiting trocar or greenish fluid that emerges in the operating field should prompt an immediate bowel exploration and if needed a wide excision should be performed with removal of all affected tissue and adequately draining of the injured area [21]. An experienced surgeon can safely perform a laparoscopic repair or the large bowel with intracorporeal suturing without colostomy (which must be reserved for patients unprepared preoperatively with colonic injuries that require segmental bowel resection).

On the other hand, if clinical indications for bowel injury occur post operatively (sepsis, acute abdominal pain, nausea, fever, chills or trocar site pain), a CT scan should confirm the diagnosis (free air in the abdomen, extraluminal feces, contrast agent in the peritoneal cavity) and immediate laparotomy must be carried out [21]. If rectum is the anatomical site of the injury and it is diagnosed intraoperatively, the surgery field should be irrigated with saline after removing the prostate, and a rectal examination should follow identifying the rectal wall and the muscular layers of the defect. Rectal wall can be then closed laparoscopically or open (depends on surgeon’s experience) in two layers (inner mucosa and outer seromuscular layer) with continuous 3-0 polyglactin sutures. The final step is to check the integrity of the repair (by filling the rectum with saline via a catheter) and if no leakage is identified two drains are placed [25].

Adjacent structures injuries
The organs that can potentially be injured in a laparoscopic urological procedure are liver, spleen, stomach, duodenum and pancreas. From these the most catastrophic one is the duodenum due to the high morbidity associated with duodenal leakage. It is usually a complication of a right renal surgery or retroperitoneal lymphadenectomy. Conversion, general surgery consultation and repair of the injury site are mandatory [21]. Liver or spleen injuries can be avoided by careful insertion of the initial trocars and by careful retraction and mobilization of these two organs. If injury does occur compression alone can be enough to manage minor injuries whereas lacerations can be dealt with electro cautery or argon beam diathermy (120-150 Watts) and/or hemostatic agents [26]. In case of more severe bleeding suturing of the liver parenchyma or conversion to hand assisted laparoscopy to proceed with partial or radical splenectomy may be required.

Diaphragmatic injuries may occur at initial trocar placement, when a large upper pole renal/adrenal tumor abutting the diaphragm is treated, or when dissecting renal hilum, as the crura may stop there. High level of suspicion along with observing paradoxical movements of the diaphragm should set the diagnosis. If the patient is stable from the ventilation standpoint defer repairing intraoperative pneumothorax until the end of the primary laparoscopic procedure. A small/moderate rent can be repaired by a 2/0 Vicryl figure-8 stich on a CT-1 needle whereas larger defects tailor the position of a Dacron graft. When the pneumothorax is realized postoperatively, it occupies <30% of the pleural cavity and the patient is stable, the CO₂ will be absorbed spontaneously without requiring any treatment. When the pneumothorax is >30% or the patient is unstable a chest tube is necessary.

Conclusion
Most of the complications in laparoscopic urological surgery can be anticipated and potentially avoided. Basic principles, high level of suspicion, surgical experience and knowledge of the potential complication and their management are the keys for the success.

Conflicts of interest
The author declared no conflict of interest.
References