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UROLOGICAL LAPAROSCOPY – MAIN SURGICAL ONCOLOGY PROCEDURES PERFORMED USING LAPAROSCOPY

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Abstract: *Laparoscopy became a very important field within urologic surgery and the development of this type of surgical approach has lead in time to performing of extensive and complicated surgical procedures. Due to the continuous development of this surgical branch, laparoscopic surgery will replace open surgery within the nearest future.*
Laparoscopy developed at a slower rate within the field of urology, due to a wider learning process than for open surgery, as well as due to the increased risk of complications related to this procedure, but as a result of an increased need for surgery and based on the permanent development of laparoscopic instruments and equipment, more and more laparoscopic surgery procedures become possible.
The next century is going to be an era of minimally invasive surgery.

Key words: *Laparoscopy, laparoscopic radical nephrectomy, nephron sparing surgery, radical cystectomy, radical prostatectomy.*

1. Introduction

After being ignored for several decades by urologists, laparoscopy reached the level of becoming known as a secondary special branch within urology, for more than one decade so far. Laparoscopic applications related to urological surgery increased exponentially within past few years and new techniques are being described continuously.

Surgical oncology procedures performed using laparoscopy became first hand procedures for urological affections and these procedures offer several advantages, such as minimal incision, reduced post-operative pain, short recovery period and reduced related costs for patients [18].

The fact that laparoscopic surgical procedures need a learning curve has to be stressed upon. There are technical restrictions, such as a small incision, which permits a small operating field, as well as the bi-dimensional view, which does not offer any depth perception. Unlike to endoscopic surgery, which is performed by a single surgeon, in case of laparoscopy the procedure implies the collaboration between two or three urologists.

2. History

The history of laparoscopy in urology starts in 1806, when Philip Bozzini constructed an instrument through which

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he could see internal organs using a candle as a source of light.

In 1876 Maximilian Nitze creates for the first time an endoscope with a built-in optical system, which uses heated platinum wire loops as a source of light.

The first experimental peritoneoscopy has been performed by Kelling in 1901, who used Nitze's cystoscope, whereas in 1910 Hans Jacobaeus is the one who inspected the human peritoneal cavity using a cystoscope [13].

The first application of laparoscopy within urology has been used in order to locate the testicle with cryptorchis in adult humans, a procedure reported by Cortesi in 1976 [4]. In 1978 the first laparoscopic ureterolithotomy has been performed by Wickham [29]. In 1991 the first laparoscopic radical nephrectomy is performed by Clayman [5], and in 1992 Gaur performs the first laparoscopic nephrectomy by retroperitoneal approach [9], while the same year Rassweiler publishes the first laparoscopic adrenalectomy [22].

3. Advantages

There is a series of advantages for the patient in case of laparoscopic approach, compared to open surgery.

Such advantages are:

- Smaller incisions which lead to a rapid mobilization and shorten the recovery period
- Reduced pain leads to use of less analgesics
- Short hospitalization period
- Reduced loss of blood
- Reduced rate of post-operative immediate and belated complications

4. Access

The concept of laparoscopy is used both for intra-peritoneal laparoscopic procedures, and for retroperitoneal procedures.

Approach in laparoscopic urological surgery can be transperitoneal, retroperitoneal or by means of pelvioscopy.

4.1. Transperitoneal approach

Initial laparoscopic urological techniques exclusively used transperitoneal approach, then, starting with 1992, after performing the first laparoscopic nephrectomy by retroperitoneal approach, the extent of the transperitoneal approach has been reduced.

Transperitoneal approach offers optimal working space and facilitates orientation in order to discover anatomic reference points.

Table 1

Indications for transperitoneal approach

Adrenalectomy for adrenal tumors
Retroperitoneal lymph node dissection
Partial nephrectomy
Radical nephrectomy for renal tumours
Radical prostatectomy
Nephroureterectomy
Radical cystectomy

4.2. Retroperitoneal approach

Within the past few years, retroperitoneal approach became popular among urologists, in order to solve retroperitoneal pathology. Retroperitoneal approach is not recommended for beginners.

When performing retroperitoneal approach, anatomic reference points are less visible than when performing transperitoneal approach, while retroperitoneal fat and limited space make dissection to be difficult.

Table 2

Indications for retroperitoneal approach

Exploration of the kidney for diagnosis purposes
Renal biopsy
Radical or partial nephrectomy
Nephroureterectomy
Retroperitoneal lymphadenectomy

These laparoscopic techniques can be performed either by retroperitoneal approach or by transperitoneal approach.

5. Renal Cancer

5.1. Radical nephrectomy

Laparoscopic surgery at kidney level was initially limited to benign pathology, but along with gathering experience and development of laparoscopic equipment, a step ahead was done, from laparoscopic solving of benign urological surgery procedures to malignant urological procedures.

Laparoscopic radical nephrectomy can be performed through peritoneal cavity or through retroperitoneal cavity [1], [2], [7], [19],[20].

Laparoscopic radical nephrectomy (LRN) is the "gold standard" treatment in current guidelines in cases where nephron sparing surgery is not feasible, with equivalent oncological and functional outcomes [15], [17], [21].

5.2. Transperitoneal radical nephrectomy

Laparoscopic radical nephrectomy is considered to be the standard treatment for the majority of patients with renal tumors, who are not eligible for nephron-sparing surgery.

Generally speaking, patients with tumors less than 8 cm, without affecting renal vein or vena cava, are eligible for performing laparoscopic nephrectomy.

For experienced surgeons, laparoscopic technique is equivalent to open surgery for tumors stage T1-T3NoMo, up to 12 cm.

Transperitoneal approach permits a comfortable working space, which allows good orientation and easy identification of anatomic reference points.

5.3. Nephrectomy by means of retroperitoneal approach

Is limited, especially due to reduced working space, and should be avoided in case of large kidneys, in case of obese patients or in case of retroperitoneal fibrosis. Nevertheless, retroperitoneal approach offers advantages, such as rapid access to renal pedicle for rapid ligature, extrafascial mobilization of the kidney and block excision, together with the adrenal gland.

5.4. Hand-assisted radical nephrectomy

Is an alternative proposed by Schmeller, by means of an approx. 7 cm incision, concomitant with 2 or 3 trocars, introduced by means of transperitoneal approach.

This type of surgery shortens surgery time, it offers an extended intra-operative security, without sacrificing the benefits of a minimum invasive surgery. It is therefore recommended especially to less experienced urologists within the field of urological laparoscopy [10].

5.5. Partial laparoscopic nephrectomy

Partial nephrectomy was reported for the first time by Winfield and his colleagues in 1993, for a patient with caliceal

diverticulum ate the level of inferior renal pole, and which contained a calculus.

Holding initial indications only for patients with increased risk of subsequent development of renal insufficiency, for patients with bilateral renal tumors or tumor mass located on the only one left kidney, nephron sparing approach has been accepted worldwide, with the increased availability of long term data concerning oncological outcomes [16]. Nephron sparing surgery is herewith exclusively limited by the patient or by the tumor's characteristics (size, location) [26].

Development of new laparoscopic techniques within nephron sparing surgery can be split into two categories: hilar control with warm ischemia versus no hilar clamping.

The combination of partial laparoscopic nephrectomy and ablative techniques lead to successful excision of renal tumor masses with adequate hemostasis, without hilar clamping.

Partial laparoscopic nephrectomy delivers quality histopathological results, but also confirmation of excision edges.

Partial laparoscopic nephrectomy is a safe procedure, which respects all oncological principles.

6. Adrenal Cancer-Adrenalectomy

The surgical pathology of the adrenal gland was tardy approached by laparoscopic means, in 1992, Rassweiler publishes the first laparoscopic adrenalectomy.

Laparoscopic approach became the “gold standard” for the benign surgical pathology of the adrenal gland, in affections such as Cushing disease, aldosteronoma and pheochromocytoma, whereas there are few laparoscopic procedures performed for malign pathology of the adrenal gland.

The role of laparoscopic surgery with regard to malign adrenal tumors is disputed, as the profile literature describes a small series of patients, for a rare pathology. There are also concerns regarding possible local recurrence, subsequent to curative surgery [23]. Three cases of intraperitoneal metastatic dissemination and death subsequent to laparoscopy for adrenal gland cancers are described [25].

Surgery can be performed by transperitoneal or retroperitoneal means, depending on surgeon's experience and preference, whereas cases exist where transthoracic or transdiaphragmatic approach has been used.

Tumor dimension does not represent a contraindication for surgery, but laparoscopic surgery is generally performed on tumor formations up to 10 cm.

Laparoscopic adrenalectomy is possible from a technical point of view and involves reduced incidents and complications, compared to classical surgical approach. It reduces hospitalization, it implies a reduced amount of post-operative analgesics, it offers an excellent cosmetic result, recovery is rapid and eventrations are exceptions.

7. Bladder Cancer - Radical cystectomy

From a historical point of view, the first cystectomy was performed by Bernhard Bardenheuer (1839-1913) in January, 1887, in Köln, Germany. In 1949 Marshall and Whitmore deliver the first detailed description of a radical cystectomy [24].

The first laparoscopic simple cystectomy was reported in 1992 by Parra et al. describing the removal of a benign retained bladder

Radical laparoscopic cystectomy represents a modern and elaborate alternative, from a technical point of view, for classic radical cystectomy, and it preserves same indications as open surgery.

Radical cystectomy with lymphodisection is the "gold standard" treatment for confirmed muscle-invasive bladder cancer, or for high-grade bladder cancer [6].

Within the past few years, laparoscopic cystectomy progressed rapidly. However, there are few studies which compare laparoscopic cystectomy with open cystectomy, and many series of patients within these studies are small. The results of these studies highlight some advantages of laparoscopic cystectomy, which imply a reduced morbidity compared to open surgery, a better view of pelvian structures, a reduced loss of blood, compared to open approach, shorter post-operative ileus and shorter period of hospitalization, as well as a superior cosmetic result. Limits consist of an extended learning period, an extended surgery period, higher costs, as well as a yet unassessed risk of metastasis at the level of the approach points

Even if progress was made, both with regard to surgery techniques and with regard to post-operative care, even if oncological treatment techniques have developed and limits of pelvic lymph node dissection have extended, a percentage of 35-50% of patients is estimated to die due to progression of neoplasia.

Urinary diversion can be performed both intracorporeal or by means of a mini-laparotomy incision, of 5-7 cm. On a series of 37 patients who were submitted to radical laparoscopic cystectomy, with an average follow-up period of 31 months, a global survival rate after 5 years of 58% was relieved [12].

8. Prostate Cancer - Radical prostatectomy

The first radical laparoscopic prostatectomy was performed by Schuessler et al. [11], in 1991, then a initial series of nine cases was published in 1997. Afterwards Guillonneau and Valencien improved the technique, obtaining similar results as for open surgery, but, due to the extended learning curve, radical laparoscopic prostatectomy became popular quite difficult.

Nowadays laparoscopic prostatectomy is spread all over the world. Initially transperitoneal approach was used, afterwards retroperitoneal approach gained momentum.

Open radical prostatectomy is defined as the standard within being surgical management of localized prostate cancer (cT1-cT2) with a life expectancy of > 10 years, but laparoscopic radical prostatectomies became therapeutical standard in many excellency centers all over the world.

Laparoscopic approach offers the advantage of a large working field, allowing a clear working field with an enhanced view during dissection of neurovascular bundles and of urethrovesical anastomosis.

From a technical point of view, laparoscopic surgery becomes even more difficult by significant reduction of working space and by possible closeness of approach points. The technical element with the highest degree of difficulty within laparoscopic approach remains the urethrovesical anastomosis.

9. Conclusions

Surgical procedures which in the past were considered "gold standards" were

replaced by procedures with equivalent rate of success, but with obvious benefits.

Laparoscopic surgery became recently popular, due to benefits, such as rapid mobilization, reduced hospitalization period, reduced rate of immediate and belated complications and rapid post-operative recovery [8], [14], [26], [27], [28].

Laparoscopic surgery with regard to malign urological tumor pathology leads to a reduction of peri-operative morbidity, it reduces hospitalization period and it offers oncological results similar to open surgery procedures.

Practicing this procedure implies adequate training, patience, devotion and a frequently difficult and long learning curve.

Laparoscopy has the potential of becoming the new standard within oncological urology pathology and even of replacing open surgery procedures, within the nearest future. With the skills of endoscopic surgery and experience of endovision camera, there is no reason why urologists cannot take up laparoscopic surgery.

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