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LAPAROSCOPIC PELVIC LYMPHADENECTOMY IS EQUIVALENT TO TRADITIONAL OPEN SURGICAL LYMPHADENECTOMY IN BLADDER CANCER

By
Sherif I. Maamoun MD , Tarek E. Mostafa MD, Samy R. Shehata MD * and Ahmed M. El-Saied MD***
Ass. Prof. Surgical Oncology, Lecturer, Surgical Oncology* Prof. Surgical Oncology**,
Department of Surgical Oncology, National Cancer Institute, Cairo University, Egypt.

Objective: is to evaluate the efficacy of laparoscopic extended pelvic lymphadenectomy in muscle invasive bladder cancer.

Material and Methods: Twenty five patients with operable muscle invasive bladder cancer were included in the study period between March 2001 and November 2001. There were 19 males and 6 females with a mean age of 55.2 years. Patients underwent laparoscopic pelvic lymphadenectomy followed by completion radical cystectomy and urinary diversion with the traditional open technique. The two procedures were done by two independent surgeons. Evaluation criteria included operative time, adequacy of the lymphadenectomy and presence of any residual lymphatic tissue.

Results: Three patients were found to have metastatic disease on initial laparoscopic exploration. In one patient, uncontrollable bleeding from avulsed obturator vessels prompted urgent laparotomy. Twenty one laparoscopic procedures were available for evaluation. There were 17 males and 4 females with a mean age of 53.1 years. Average operation time was 75 minutes and showed 30% reduction by the end of the study. The average number of lymph nodes resected per patient was 8.2 (range 4-11). Residual fibro-fatty tissue was encountered in three patients early in the study period (first 15 patients) and was mainly due to a learning curve. No residual lymph nodes were detected in the cystectomy specimens.

Conclusion: Laparoscopic pelvic lymphadenectomy is technically feasible and will produce lymphatic yield similar to that of open traditional surgery. It can be used as a staging procedure to allow for neo-adjuvant therapy in muscle invasive bladder cancer. It also can be incorporated with total laparoscopic radical cystectomy and urinary diversion as a single procedure.

Keywords: Laparoscopy, Pelvic lymphadenectomy, Bladder cancer.

INTRODUCTION

Pelvic lymphadenectomy remains an integral step in the management of several pelvic malignancies [1]. The procedure is basically diagnostic and in few conditions therapeutic. There are no investigations that can detect lymph node metastases with an adequate true positive rate such that tissue sampling is required to confirm the presence of lymph node metastases [2]. With the introduction of laparoscopic cholecystectomy in the early 1990, the advantages of minimal access surgery became evident with improved patient s welfare in terms of reduced morbidity in the postoperative period, reduced pain and shorter hospital stay with early return to work. This prompted exploration of laparoscopy in several other disease conditions [3]. Laparoscopic pelvic lymphadenectomy was first described by Schuessler and associates in 1991 for the management of prostate cancer [4] and had thence been widely practiced for the staging of several genital and urologic malignancies [5]. The actual utilization of therapeutic laparoscopic radical procedures in the management of cancer at different sites is currently being evaluated at several clinical trials. It remains paramount to compare these procedures to traditional surgery particularly in terms of oncologic safety. At the National Cancer Institute, Cairo University, bladder cancer remains the second most common malignancy treated following breast cancer. Pelvic lymphadenectomy is the initial step in the radical cystectomy procedure and it plays a crucial therapeutic role particularly for the squamous cell variant of muscle invasive bladder cancer [6]. The procedure is somewhat different from that described for prostate and female genital cancers. The lymph node groups removed include the external iliac, common iliac, obturator and hypogastric nodes and it had been described as the extended pelvic lymphadenectomy to be differentiated form the modified one where only the hypogastric and obturator groups are removed as carried out for prostate and female genital malignancies [7]. The following trial was carried out to test the efficacy of laparoscopic extended pelvic lymphadenectomy compared to the traditional open surgical procedure in bladder cancer.

PATIENTS AND METHODS

Twenty five patients with clinically operable bladder cancer were included in the study period between March 2001 and November 2001. There were 19 males and 6 females with a mean age of 55.2 years. Criteria for patients' exclusion included those with previous abdominal operations (apart from appendectomy) and patients with poor pulmonary reserve who would not withstand a relatively lengthy procedure in the severe Trendelenburg position. Preoperative work up included blood chemistry, renal functions, coagulation profile, chest X-ray, IVP and cystoscopy with biopsy.

Technique:

The procedure was divided into two stages each being carried out by a different surgeon. The first stage consisted of laparoscopic pelvic lymphadenectomy. In the second stage and following the completion of the laparoscopic procedure, a standard open radical cystectomy with urinary diversion was done.

Laparoscopic procedure:

The procedure had been described in detail elsewhere [3] (Fig. 1– 6).

After the induction of general anesthesia, a nasogastric tube was placed to decompress the stomach. Attention should be paid to the pressure points which were padded to avoid pressure injury with prolonged procedure. The arms were placed at the patient's side and secured. A sterile scrub was performed from the xiphoid process to the pubis and from the right to the left anterior axillary lines. The penis and scrotum were wrapped and draped into the sterile field to prevent carbon dioxide accumulation in the loose areolar tissue, and a bladder catheter was placed.

The patient was placed in the supine position, and the operating room table was moved to approximately 10° in the Trendelenburg position for initial Veress needle placement and insufflation. The operating surgeon stood on the contralateral side of the node dissection, with the first assistant positioned on the ipsilateral side. A video screen was placed at the foot of the table to allow visualization of both sides of the procedure by all members of the surgical team.

Insufflation:

A Veress needle was introduced into the abdominal cavity through the supraumbilical point. This site was chosen for initial insufflation because all fascial layers fuse into one single layer. A relatively low-flow, low-pressure carbon dioxide state (<8 mm Hg, <1 L/min) was used until the entire abdominal wall was elevated with loss of liver dullness, indicating proper placement of the Veress needle. Additional ports were placed at a pressure of 20 mm Hg, which was then decreased to 12 mm Hg during the node dissection.

Once the pneumoperitoneum was established, the Veress needle was removed and a 10-mm curvilinear incision was placed along the superior aspect of the umbilicus for initial trocar placement. Using a 0° lens scope the first trocar was introduced into the peritoneal cavity through the umbilical incision. Subsequent port placement was accomplished under direct vision with the aid of the laparoscope which was used to shine through the abdominal wall to visualize the blood vessels avoiding their injury. Once the trocars were placed, each entry site was inspected carefully for any unsuspected intra-abdominal injury.

Trocar placement:

A diamond configuration of the trocars was used in which four ports were used: two 10-mm ports, 1 at the umbilicus and 1 approximately 4-6 cm above the symphysis pubis in the mid line and two 5-mm ports were placed near the McBurney point in the midclavicular line on both sides.

Additional trocars were used based on the patient's configuration and if intra-operative maneuvers necessitated additional ports. Immediately following insertion of the trocars, the CO_2 connection was placed in any of the ports other than the one used for the camera. This step minimized condensation and fogging of the lens as result of the cold temperature of the insufflation gas.

Exploration:

Careful exploration of the entire abdominal cavity was carried out with frequent change of the operating table position to allow proper visualization of the peritoneal surfaces and subphrenic spaces. The node dissection was performed with a 30° laparoscope.

The patient was rotated approximately 30° towards the surgeon, elevating the side of initial dissection, and the operating room table was placed in a 25-30° Trendelenburg position, allowing the bowel to fall away from the side of lymphadenectomy. The medial umbilical ligament, iliac vessels, internal inguinal ring, vas deferens, and cord structures were identified. The line of peritoneal incision was then determined.

Exposure of external iliac artery and vein:

Using electrocautery through the laparoscopic scissors and a curved grasper for counter traction, the peritoneal incision extended from the pubis (starting lateral to the medial umbilical ligament) and continued cranially along the line of Toldt. The vas deferens was observed over the medial umbilical ligament as it entered the internal inguinal ring. After the vas deferens had been divided, the medial umbilical ligament was traced back to the internal iliac artery and the ureter was identified at its crossing over the common iliac vessels. In the latter half of the study and in order to avoid missing any tissue at that region, the ureters were divided between clips to facilitate traction on the nodal tissue with proper exposure of the common iliac region.

The lateral border of the dissection was developed from the pubis and the circumflex iliac vein to the level of the common iliac artery and medial to the genitofemoral nerve and external and internal iliac vessels. The dissection proceeded along the anterior border of the common iliac artery removing all the lymphatic tissue. The cephalad extent of the packet was secured with hemoclips and was rolled away from the iliac artery. Any psoas branches from the common iliac artery were clipped and divided. The common iliac and external iliac arteries were displaced medially, exposing the bifurcation of the common iliac vein and nodal tissue. The obturator nerve was observed passing below this bifurcation. The external iliac vein was then identified, and lymphatic tissue was cleared from the pubis to the bifurcation of the common iliac vessels.

The lymphatic tissue was pulled from the pelvic sidewall using traction and suction from the irrigator aspirator. Large lymphatic channels were clipped and divided. The caudal limit of the extended dissection was the pubic bone. Immediately medial to the external iliac vein, the lymph node of Cloquet was identified and with traction a clip was placed at lymphatic tissue passing through the deep inguinal ring to allow division and traction of all lymphatic tissue at this region. Care was taken to not injure the superficial epigastric vein running medially and superiorly into the femoral vein. An unnamed branch originating from the medial aspect of the external iliac vein could be encountered here particularly on the left side and it should be carefully exposed, ligated and divided.

Posteriorly, the border of dissection was the obturator nerve and internal iliac vessels. Using the irrigator aspirator tip, the lymph node packet was dissected gently from the pubic ramus, and the obturator nerve was identified. Suction and dissection was applied parallel to the nerve to prevent avulsion injury. The obturator artery and vein usually are found medial to the nerve. Clipping and dividing the obturator vessels usually was not necessary except in presence of enlarged nodes surrounding the vessels. The packet was dissected along the obturator nerve until the nerve disappeared posterior to the iliac vein, where the lateral dissection was performed. Multiple small vessels and lymphatic channels were usually identified in the packet under the obturator nerve, which could be clipped and divided. Application of electrocautery in this area could result in powerful adduction of the thigh, leading to inadvertent vascular injury.

The cephalad margin was the common iliac artery. The node dissection continued along the medial surface of the internal iliac artery to the origin of the medial umbilical ligament, and the entire nodal packet was freed living it attached at the region of the lateral ligaments of the urinary bladder around the superior and inferior vesical vessels, and clips were used to secure the pedicle.

Radical Cystectomy:

Following completion of the laparoscopic procedure, the lymphatic tissue was left at the obturator fossa. No attempt at specimen extraction was carried out since laparotomy would be performed. All laparoscopic equipment were taken out from the room, the patient was repositioned with the arms being stretched and new sterile scrubing was carried out. The second surgeon started the procedure with midline laparotomy extending from the symphysis pubis to midway between the umbilicus and xiphoid process. The first step began with removal of the laparoscopic specimens for separate histopathologic examination. The surgeon would now carefully inspect the lymphadenectomy field for any missed tissues after the laparoscopy and if any tissue was found it was submitted separately for pathologic examination. Radical cystectomy was then completed as planned. At the end of the procedure the pelvis was drained via suction catheters brought out through the 5 mm ports at the midclavicular line.

RESULTS

Of the twenty five patients included in this report, three were inoperable at the initial laparoscopic exploration (peritoneal nodules in two patients and liver metastases in one patient). Those patients were thus spared unnecessary laparotomy. In one patient the laparoscopic procedure was aborted due to uncontrolled bleeding from injury to the obturator vessels. The patient was rapidly explored to control the bleeding and the procedure was completed and the further course was uneventful. Accordingly, twenty-one patients were candidates for evaluation of the laparoscopic procedure. There were 17 males and 4 females with a mean age of 53.1 years. The average operation time of the laparoscopy phase was 75 minutes (range: 45 minutes three hours).

Table (1): ***Patients and tumor characteristics of the laparoscopically completed procedures***

Data		*Number of patients*
Sex		
	Male	17
	Female	4
Age (mean)		53.1 years
Pathological data		
	Tumor	
	T3	14
	T4	7
Nodal Status		
	Negative	13
	Positive	8

Three patients were inoperable, and in one patient procedure was aborted due to uncontrollable bleeding

There was a definite reduction in the operation time by the end of the study with increased experience denoting a learning curve (105 minutes in the first 15 cases vs. 65 minutes in the last six patients). Laparoscopy related complications included only minor surgical emphysema in 10 patients. The emphysema was detected at the inguinal region and it subsided spontaneously without further intervention. Demographic data and pathological staging of the resected specimens are shown in (Table 1). In three patients gross fibro-fatty tissue was detected on laparotomy. The tissue left was mainly located lateral to the region of ureteric crossing over the common iliac artery. However, pathologic examination did not show any lymph nodes in these tissues. Those residual tissues were encountered early in the study and the reason for missing them was attributed to failure to mobilize the ureter during the laparoscopy phase which would have exposed these tissues. Such a step was neglected since laparotomy was contemplated in all cases. This, however was corrected during the last ten cases where the ureters were mobilized, clipped and divided to allow removal of all tissues at that region.

Pathological examination of the laparoscopic specimens revealed an average number of lymph nodes of 8.2/patient (range: 5-11). Eight patients had pathologically positive nodes that were located at the obturator and hypogastric regions. There were no positive lymph nodes detected at the external or common iliac regions. Careful examination of the cystectomy specimens showed no residual lymphatic tissue.

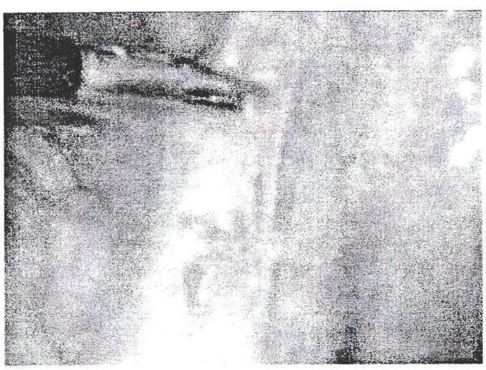

Fig.(1): Initial peritoneal incision is made over the external iliac artery

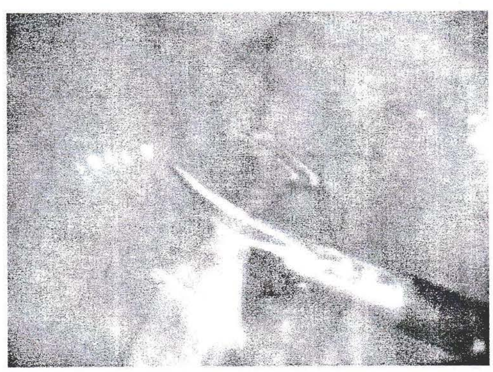

Fig. (2): The vas deferens is clipped and divided

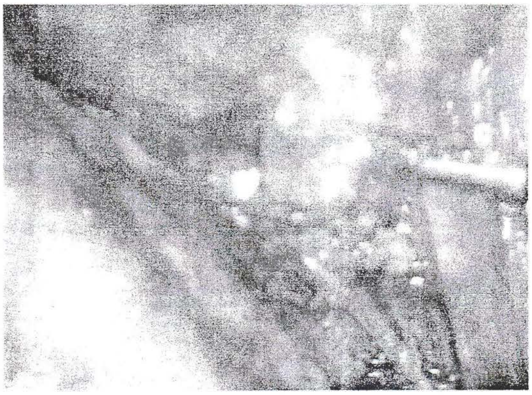

Fig. (3): The Gland of Cloquet is carefully dissected from the deep inguinal ring

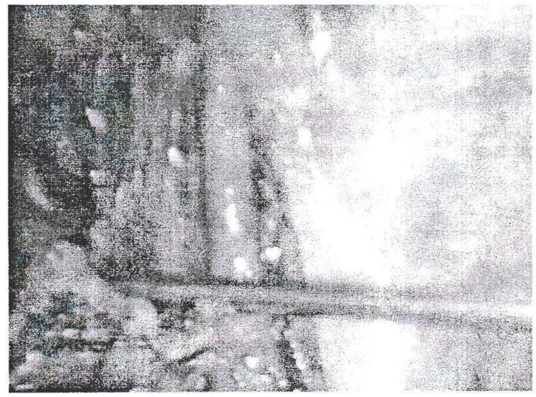

Fig. (4): The lymphatic pack is dissected off the iliac vessels

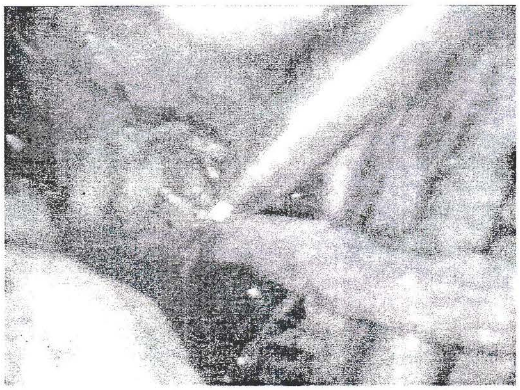

Fig. (5): The ureter is grasped and pulled upwards exposing the lymphatic tissue around the common iliac vessels

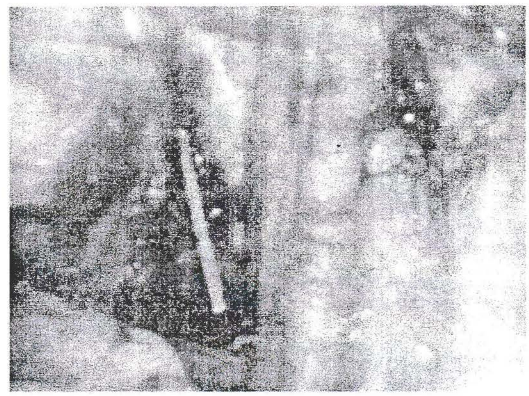

Fig. (6): Final dissection with clearance of the iliac, hypogastric and obturator nodes

DISCUSSION

The benefits of minimal access surgery are well established. In addition to the better patient's outcome, enhanced systemic immune response and more favorable oncologic impact are among the different variables that are currently investigated with initial results demonstrating clear advantages to laparoscopic surgery [8,9]. From the surgical point of view, magnified view and better visualization of the anatomy are additional benefits. An essential feature of video assisted surgery which is usually understated is the fact that, it remains the only method that will allow auditing of the different surgical procedures. This in turn will reflect greatly on outcome comparison among different treatment protocols [10]. It remains a challenge, however, to develop enough skills with laparoscopic procedures to mimic the traditional open counterparts. Laparoscopic pelvic lymphadenectomy had acquired a definite role in the management of several pelvic malignancies particularly as a staging procedure in prostate cancer and female genital malignancies [3]. The extended pelvic lymphadenectomy as practiced in the treatment of bladder cancer is different from the modified procedure as described for the aforementioned lesions. It is more radical removing the external iliac and common iliac nodes and it plays an important therapeutic role rather than being a staging procedure. The latter fact is attributed to the lack of effective adjuvant therapy in the management of muscle invasive bladder cancer particularly the squamous variant [11]. Reports of extended pelvic lymphadenectomy, are scarce in the literature, that had been largely attributed to technical inability to perform urinary diversion laparoscopically. Recently, there have been several reports of the possibility of performing such procedure via the laparoscope [12, 13,14]. This prompted exploration of the technical validity of the procedure with the major concern being the oncologic safety of the technique. Our report here is the initial step in the procedure verification algorithm with the aim of developing experience with the technique and compare the results to those of the open technique. A learning curve is perhaps the most noticeable aspect of laparoscopic surgery and since there is no simple laparoscopic procedures such a curve is usually steep. This is usually reflected on the operation time and field orientation [15]. Most series report an average reduction of the operation time by 40-50% following the first fifteen laparoscopic procedures [16]. We had a 30% reduction in the operation time in our series after fifteen cases. The reported incidence of respectability in muscle invasive bladder cancer is in the range of 60-75% [17]. Three patients (14.3%) in our trial were spared unnecessary laparotomy, which is an important additional asset to this procedure. The lymphatic tissue removed was similar to that of open traditional surgery except in three patients where residual fibro-fatty tissue was left, and although it did not contain any lymph nodes the technique was later on modified to remove this tissue in the last ten patients. The mean number of lymph nodes removed was slightly higher than the open surgical technique which is usually in the range of 5-6 nodes/patient [17,18], and this difference could be attributed to pathologist's diligence to look for lymph nodes in the context of the trial. We encountered only one complication that prompted urgent laparotomy (uncontrollable bleeding), yet the small number of patients and since laparotomy was performed in all cases does not allow for conclusions concerning laparoscopy related complications.

In conclusion, laparoscopic pelvic lymphadenectomy for muscle invasive bladder cancer is technically feasible with lymphatic yield similar to that of open surgery. The validity of laparoscopic lymphadenectomy in muscle invasive bladder cancer opens up an avenue for several questions and options that could not have been addressed before; which include:

- Patients with advanced disease could be spared unnecessary laparotomy
- The possibility of staging of the disease and use of neo-adjuvant therapy especially in patients with enlarged lymph nodes.
- For early non-invasive bladder cancer, it remains paramount to evaluate the pelvic lymph nodes in the subset of patients with high grade lesions and multiple recurrences.
- Finally, laparoscopic pelvic lymphadenectomy is the first step in the ultimate goal of total laparoscopic radical cystectomy and urinary diversion.

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