International Journal of Surgery 35 (2016) 51–57

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original Research

Total laparoscopic hysterectomy: Analysis of the surgical learning curve in benign conditions

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HIGHLIGHTS

- Hysterectomy is the most common gynaecological surgery around the world.
- The learning curve for laparoscopic hysterectomy is necessary for guiding the implementation of this surgery in the education of gynaecologists.
- Education and training reduce complications.
- The learning curve is correlated with a decrease in operating time for total laparoscopic hysterectomy.

ARTICLE INFO

Article history:
Received 1 August 2016
Received in revised form
6 September 2016
Accepted 10 September 2016
Available online 12 September 2016

Keywords:
Laparoscopic hysterectomy
Total laparoscopic hysterectomy
Learning curve

ABSTRACT

Objective: To assess the learning curve for total laparoscopic hysterectomy.
Methods: This study was a retrospective analysis of the learning curve for two surgeons during their first 257 consecutive cases of total laparoscopic hysterectomy at a teaching hospital. Patients were divided sequentially into groups comprising the first 75 patients, the next 75, and the final 107 patients. Age, body mass index, gestational parity, indications for laparoscopic hysterectomy, previous pelvic surgery, operating time, haemoglobin decline, complications, need for transfusion, and length of hospital stay were evaluated.
Results: The mean operating time for total laparoscopic hysterectomy reduced significantly from 76.2 min to 68.9 min ($p = 0.001$) between the first and second 75-patient groups. Linear regression analysis showed a plateau was reached on the learning curve after 71–80 cases. The rate of all complications started at 8% in the first group of 75 patients, reduced to 6.7% in the next group, and decreased further in the final group to 4.7%. The decline was not statistically significant ($p = 0.6$).
The difference in the need for transfusion was statistically significant between the first 75 patients and the second group of 75 ($p = 0.04$). Conversion from laparoscopy to laparotomy was required in five patients, four in the early group and one in the final group. Age, body mass index, parity, previous pelvic surgery, decline in haemoglobin, and length of hospital stay were similar among the three groups.
Conclusions: A plateau in the learning curve for TLH was reached after the first 75 cases. We can infer that there is a learning curve for TLH as confirmed by the decrease in operating time (accompanied by no change in complications) correlated to gain in experience. On the other hand, one should not disregard the fact that laparoscopy is not a complication-free surgery and achievement of the learning curve does not exclude complications. Gynaecological surgeons can perform TLH securely during the learning curve.

1. Introduction

Hysterectomy is the most common gynaecological surgery around the world, especially for benign conditions such as

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http://dx.doi.org/10.1016/j.ijsu.2016.09.010
1743-9191/

menorrhagia, fibroids, pelvic pain and uterine prolapse [1,2]. The surgical approach includes abdominal, vaginal or laparoscopic routes. The first laparoscopic hysterectomy (LH) was performed in 1989 by Reich et al. [3]. In subsequent years, the first series of laparoscopy-assisted vaginal hysterectomies (LAVH) and laparoscopic subtotal hysterectomies (LASH) were described by Mage et al. [4], Donnez and Nisolle [5], and Lyons [6]. Laparoscopy has several important advantages compared to laparotomy, including less pain, shorter hospitalisation, faster recovery time and fewer infections [7]. The magnification provided by laparoscopic instruments enables easy access to the uterine vessels, ureter, rectum and vagina [8]. During the past 30 years, laparoscopy has advanced rapidly, following improvements in video camera and electrical surgery technology. Conventional laparoscopy, with three or four small incisions, has become the gold standard for many gynaecological diseases, from benign conditions to endometrial cancer [9,10]. Recently, total laparoscopic hysterectomy (TLH) has received wider acceptance in Turkey, as the surgeons have gained experience.

Injury to the urinary tract remains the primary concern in TLH. Johnson et al. [11] showed the rate of urinary tract injuries was higher in LH than it was during abdominal-incision hysterectomy (AH), in a 2006 meta-analysis that covered 3643 patients in 27 trials, but found no significant difference in the rate of the injury when LH was compared to vaginal hysterectomy (VH). The meta-analysis concluded that VH was preferable to AH, and suggested LH as an alternative when VH was not possible, for example, in cases of enlarged uterus or narrow pelvic arch. Garry et al. [12] encountered ureter and bladder damage as high as 11.1% during LH. However, other researchers reported that LH was not associated with high rates of major complications, especially in experienced hands [7,8,13,14].

Education and training reduce complications. Studies have pointed out the importance of the learning curve for LH [15–17]. Generally, the handling of a particular number of cases is accepted as indicating that a surgeon is competent in pelvic laparoscopic procedures. The threshold number may be influenced by the previous education of the surgeon or local factors, such as medico-legal issues and the cost of the operations. The pattern and slope of the learning curve may vary by country and institution.

Defining the learning curve for LH is necessary for guiding the implementation of this surgery in the standard education of gynaecologists. For that purpose, we analysed our learning of TLH. Our primary purpose was to determine the number of cases that would express a surgeon's proficiency in TLH. The secondary aim was to investigate the parameters (e.g., operation time and complications) of consecutive cases and compare them against the increasing experience of the surgeon.

2. Materials and methods

This was a retrospective review of demographic data, operating times and complications from TLH for 257 patients between December 2011 and April 2014 at the Derince Training and Research Hospital in Kocaeli, Turkey.

2.1. Patients

The informed consent of patients was obtained.

We retrieved clinical charts, pathology reports, preoperative history, and physical examination findings from the hospital's electronic medical records. Patient demographic data included age, gravidity, gestational parity, body mass index (weight in kilograms divided by the square of the height in meters), type of delivery, and previous pelvic surgeries. Perioperative information included indications for surgery (myoma uteri, abnormal uterine bleeding refractory to treatment, adnexal mass, chronic pelvic pain or abnormal cervical cytology), type of procedure, conversion to laparotomy, total operating time, uterine weight, estimated blood loss, duration of hospital stay and immediate intraoperative and postoperative complications, such as bowel, bladder, or ureter injury and blood transfusion, port site infection, bleeding or hernia. Total operating time began with the first skin incision and ended with the last closure of an incision. The duration of hospital stay was measured from admission to discharge.

2.2. Surgical technique

The two surgeons (A.K. and H.T.) had not received fellowship training and were not previously experienced with TLH, but had previously performed level-two laparoscopic procedures, for example, ectopic pregnancy and cystectomy [18]. The operating room staff had five to six years of experience with laparoscopy, but were new to gynaecological laparoscopic surgery.

All patients received standard prophylactic cephalosporin. General anaesthesia was administered via endotracheal intubation.

The patients were placed in a modified lithotomy position with the hips extended at 180° and the knees flexed at nearly 90°. The table was tilted nearly 45° in the Trendelenburg position. Both of the arms were tucked along the patient's side. The surgeon was located at the left side of the patient and the assistant was positioned on the opposite side.

A 10 mm trocar was inserted through the umbilicus. Pneumoperitoneum was generated until the intra-abdominal pressure was 14 mmHg. Three additional 5 mm ports were inserted. One of these was placed 5 cm left of the umbilicus, and the other two were placed 2 cm medial and superior to the anterior superior iliac crests. If the uterus was larger than the size of 21 cm in any direction, the Lee Huang point (3 cm above the umbilicus) was used for the trocar and the optic camera port [19].

A RUMI© uterine manipulator with a Koh Cup™ colpotomizer (Cooper Surgical; Trumbull, Connecticut, US) was introduced vaginally at the beginning of the procedure. The hysterectomy was performed using a Ligasure™ Blunt Tip grasping and dissection instrument (Covidien; Dublin, Ireland) and monopolar and bipolar energy modalities. All vascular pedicles were ligated by bipolar coagulation and sectioned with the scissors or were ligated and cut by using the Ligasure™. A circular vaginal incision was performed with monopolar coagulation.

The uterus was removed from the abdomen through the vaginal cuff. If uterine morcellation was necessary, it was carried out vaginally by circular wedge resection with a scalpel. The vaginal apex was closed intracorporeally with interrupted single stitches, using absorbable suture (VICRYL® suture #1 [JK-10]; Ethicon). We did not perform routine cystoscopy. The weight of the uterus without ovaries was measured in the operating room, and then the specimen was sent for pathological investigation.

2.3. Calculation of the learning curve and statistical analysis

Patients were divided sequentially into three groups. Group 1 comprised the first 75 patients. Group 2 included the subsequent 75 patients, and Group 3 included the following 107 patients, who we called ‘others’.

The average operating time was determined for each group. Outcome measures, such as estimated blood loss, postoperative hospital stay and conversion to laparotomy were recorded and evaluated for statistical significance.

Student's t-test was used for continuous data, and a p value of less than 0.05 was considered statistically significant. Continuous