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ORIGINAL ARTICLE

Stepwise introduction of laparoscopic liver surgery: validation of guideline recommendations

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Abstract

Background: Uncontrolled introduction of laparoscopic liver surgery (LLS) could compromise post-operative outcomes. A stepwise introduction of LLS combined with structured training is advised. This study aimed to evaluate the impact of such a stepwise introduction.

Methods: A retrospective, single-center case series assessing short term outcomes of all consecutive LLS in the period November 2006-January 2017. The technique was implemented in a stepwise fashion. To evaluate the impact of this stepwise approach combined with structured training, outcomes of LLS before and after a laparoscopic HPB fellowship were compared.

Results: A total of 135 laparoscopic resections were performed. Overall conversion rate was 4% (n = 5), clinically relevant complication rate 13% (n = 18) and mortality 0.7% (n = 1). A significant increase in patients with major LLS, multiple liver resections, previous abdominal surgery, malignancies and lesions located in posterior segments was observed after the fellowship as well as a decrease in the use of hand-assistance. Increasing complexity in the post fellowship period was reflected by an increase in operating times, but without comprising other surgical outcomes.

Conclusion: A stepwise introduction of LLS combined with structured training reduced the clinical impact of the learning curve, thereby confirming guideline recommendations.

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Introduction

Laparoscopic liver surgery (LLS) had a relatively slow start due to initial concerns about bleeding, gas embolism, increased complications during the early phases of the learning curve and the ability to perform adequate radical oncological resections. Through the pioneering work of high-volume, expert centers, an increasing body of evidence has emerged in recent years confirming the possible advantages of LLS.[1–9] Benefits of LLS include less intra-operative blood loss, less postoperative complications, decreased need for analgesics, faster functional recovery, shorter post-operative stay, and a cosmetic benefit.[1–9] In addition, some studies have demonstrated the cost-effectiveness of LLS,[10–12] thus resulting in benefits for both individual patients and healthcare institutions. These promising results have promptly increased the interest in LLS worldwide[1,2] and the first randomized controlled trials of laparoscopic vs. open liver surgery have been performed.[13,14]

Despite these promising results, LLS remains challenging and should not be started without appropriate training and acquired surgical skills. During the 2015 Morioka consensus meeting[15] and more recently during the 2017 European guideline meeting on LLS in Southampton (EGMLLS) the importance of structured implementation plans, providing education and a stepwise introduction of LLS, was stressed. Starting with minor resections and gaining experience along the way, surgeons can

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eventually begin to take on more difficult procedures such as hemihepactectomies. The results of such an approach and its effect on the learning curve have not been specifically addressed before and could further encourage surgeons to implement LLS into their center.

The aim of this study was to present the results of a single center that followed a stepwise approach in setting up a LLS practice, including structured training, with assessment of a potential learning curve effect on short-term postoperative outcomes.

Methods

Patients

In a retrospective case series, all consecutive patients undergoing LLS for any indication between November 2006 and January 2017 in the Academic Medical Center (AMC) in Amsterdam were evaluated. No LLS was performed prior to November 2006. All primary LLS or combined laparoscopic colorectal and liver resections were included.

Prior to surgery, all patients were discussed in a multidisciplinary team (MDT) meeting with HPB surgeons, radiologists, gastroenterologists, hepatologists, medical oncologists and pathologists. The surgical indication was established independently of the decision regarding the surgical approach, which was made later considering a number of factors including the available experience and skill. Initially, only minor resections, defined according to the Louisville consensus meeting in 2008,[16] were considered candidates for the laparoscopic approach whilst major LLS procedures were only considered after experience and skills were obtained by performing minor LLS and one surgeon (MB) had completed an eight month fellowship in laparoscopic HPB surgery in 2013.

In addition, complex resections such as those of large lesions or lesions in close proximity to major vascular structures were not considered during the early stages. Attention was paid during the MDT meetings to patient- and tumor characteristics (e.g. tumor location, obesity) that could increase the difficulty of the operation, in order to select the patients most suitable for LLS, especially during the early stages.

Outcomes

Baseline patient- and procedure characteristics included patient demographics, body mass index (BMI, kg/m^2), American Society of Anaesthesiology (ASA) classification, liver cirrhosis, previous abdominal surgery, previous liver resection, simultaneous colorectal resection, tumor pathology (benign/malignant), extent of resection (minor/major/technically major[17]), type of resection, hand-assistance, multiple simultaneous liver resections and approach to liver resection (one-stage only, one-stage + radio frequency ablation (RFA), two-stage without portal vein embolization (PVE) and two-stage with PVE). Intra- and postoperative outcomes included operative time (mins), intraoperative blood loss (ml), blood transfusion, conversion, resection margins (margin negative (R0) or margin involved (R1)), length of postoperative hospital stay (days), clinically relevant complication rate (defined as Clavien-Dindo score 3 or higher)[18] and mortality (defined as death related to liver and/or colorectal complications within 90 days after surgery or within hospital stay).

Surgical experience

All resections were performed or supervised by one or two out of three liver surgeons (OB, PT and MB), all of whom had completed a fellowship in open liver surgery, had experience in advanced laparoscopic gastrointestinal surgery (defined here as anything beyond laparoscopic cholecystectomy, appendectomy or hernia repair surgery) and had taken at least two hands-on courses on minor LLR. OB had ten years of experience in open liver surgery and advanced laparoscopic gastrointestinal procedures after his fellowship. PT and MB each had two years of experience after their fellowship including advanced laparoscopic gastrointestinal procedures. OB started with LLS in 2006, PT in 2010 and MB in 2012. MB completed a fellowship in laparoscopic HPB surgery (Jan–Aug 2013; University Hospital Southampton NHS Foundation Trust).

Surgical technique

A standardized approach was used. Patients were placed in a supine position with legs apart and if required on a beanbag. After placement of 3–5 trocars, parenchymal dissection was performed with ultrasonic shears (Harmonic Ace®; Ethicon Endo-Surgery, Cincinnati, OH, USA) and, for larger/posterior lesions or resections, laparoscopic cavitron ultrasonic surgical aspirator (CUSA) (Valleylab, Boulder, CO, USA). For left lateral sectionectomy, only ultrasonic shears and endostaplers were used. Rarely, for posterior lesions, a handport was used (n = 4). Specimens were extracted in a plastic endoscopic bag (Endocatch; Ethicon Endo-Surgery, Cincinnati, OH, USA) via a Pfannenstiel incision or, in case of lesions <3 cm, through a widened trocar incision. Pringle maneuver was applied for laparoscopic major procedures, including posterior metastasectomies and larger, atypical metastasectomies. For metastasectomies the 'diamond technique' was preferred.[19] All laparoscopic hemihepatectomies and laparoscopic resections involving segment 7 were performed by a team of two surgeons (MB, PT).

Statistical analysis

Data analysis was performed using IBM SPSS Statistics for Windows version 23.0 (IBM corp., Armonk, NY, USA). To evaluate the stepwise approach and its impact on the learning curve, the cohort was divided into two groups: before (group A) and after (group B) a dedicated fellowship in major laparoscopic HPB surgery. Continuous non-parametric variables were reported as median with interquartile range (IQR). A Mann Whitney *U* test was used to compare continuous variables

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