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Laparoendoscopic Single-Site Upper Urinary Tract Surgery: Assessment of Postoperative Complications and Analysis of Risk Factors

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Abstract

Background: Laparoendoscopic single-site surgery (LESS) has been developed in an attempt to minimise the morbidity and scarring associated with surgical intervention.
Objective: To evaluate the incidence of and the risk factors for complications in patients undergoing LESS upper urinary tract surgery.
Design, setting, and participants: Between September 2007 and February 2011, 192 consecutive patients underwent LESS for upper urinary tract diseases at four institutions.
Measurements: All complications occurring at any time after surgery were captured, including the inpatient stay as well as in the outpatient setting. They were classified as early (onset <30 d), intermediate (onset 31–90 d), or late (onset >90 d) complications, depending on the date of onset. All complications were graded according to the modified Clavien classification.
Results and limitations: The patient population was generally young (mean: 55 ± 18 yr of age), nonobese (mean body mass index [BMI]: 26.5 ± 4.8 kg/m^2), and healthy (mean preoperative American Society of Anaesthesiologists [ASA] score: 2 ± 1). Forty-six patients had had prior abdominal surgery. Mean operative time was 164 ± 63 min, with a mean estimated blood loss (EBL) of 147 ± 221 ml. In 77 cases (40%), the surgeons required additional ports, with a standard laparoscopy conversion rate of 6%. Mean hospital stay was 3.3 ± 2.3 d, and the mean visual analogue scale (VAS) score at discharge was 1.7 ± 1.43. Thirty-three complications were recorded—30 early, 2 intermediate, and 1 late—for an overall complication rate of 17%. Statistically significant associations were noted between the occurrence of a complication and age, ASA score, EBL, length of stay (LOS), and malignant disease at pathology. Univariable and the multivariable analyses showed that a higher ASA score (incidence rate ratio [IRR]: 1.4; 95% confidence interval [CI], 1.0–2.1; $p = 0.034$) and malignant disease at pathology (IRR: 2.5; 95% CI, 1.3–4.7; $p = 0.039$) represented risk factors for complications. Poisson regression analysis over time showed a 23% non-statistically significant reduction in risk of complications every year (IRR: 0.77; 95% CI, 0.5–1.19; $p = 0.242$).
Conclusions: Malignant disease at pathology and high ASA score represent a predictive factor for complication after LESS for upper urinary tract surgery. Thus, surgeons approaching LESS should start with benign diseases in low-surgical-risk patients to minimise the likelihood of postoperative complications.

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1. Introduction

Laparoendoscopic single-site surgery (LESS) has been developed in an attempt to further reduce the morbidity and scarring associated with laparoscopic surgery [1]. Early clinical series have demonstrated the feasibility of a broad range of LESS urologic procedures [2–7]. Few reports have specifically looked at complications after LESS in urology [8]. Irwin et al reported their multi-institutional experience with 125 upper-tract LESS procedures, showing a complication rate of 15.2% [9].

When a new surgical procedure is introduced, there is a need to compare outcomes and complications in a sound and reproducible way. Standardised evaluation tools for outcomes and complications are necessary for achieving this goal. Surgical complications can be reported in a variety of ways, and the means through which data are obtained and reported probably have as much impact on the complication rate as the procedure does [10].

To date, no study has specifically evaluated the risk of complications following LESS. The aim of the present study is to evaluate the incidence of and risk factors for complications in a multi-institutional series of patients who have undergone LESS for upper urinary tract diseases.

2. Materials and methods

2.1. Study design

This was a retrospective analysis of the medical records of consecutive patients who underwent LESS for upper urinary tract diseases at four major institutions between September 2007 and February 2011. All patients gave written informed consent after being informed that the procedure would be attempted via a single incision and counselled that additional incisions could have been necessary.

A prospective purpose-built datasheet was constructed for this study. The following information was collected: age, gender, ethnicity, body mass index (BMI), preoperative conditions (ie, smoking status, diabetes, renal insufficiency, hypertension), pre- and postoperative renal function, prior abdominal surgery, specific comorbidities, American Society of Anaesthesiologists (ASA) score, tumour stage and grade, surgical margin status, specimen weight, operative time, and estimated blood loss (EBL). Additional collected data included intraoperative variables (eg, kind of trocar, placement of trocar, number of additional ports, use of prebent or articulating instruments), preoperative and postoperative serum haemoglobin levels, transfusion data, conversion to open surgery or standard laparoscopy, length of stay (LOS), postoperative pain evaluation based on a visual analogue scale (VAS) score at discharge, incision length, and subjective scar satisfaction. Procedures were categorised as "extirpative/ablative" or "reconstructive." Moreover, they were scored based on a Likert-type scale from 1 (slightly difficult) to 5 (extremely difficult) according to a previously reported scoring system for laparoscopic surgery [11].

Conversion to open surgery was considered a complication, whereas conversion to standard laparoscopy through the use of more than one additional trocar was not. Both medical and surgical complications occurring at any time after surgery were captured, including inpatient stay as well as in the outpatient setting. They were classified as early (onset <30 d), intermediate (onset 31–90 d), or late (onset >90 d) complications, depending on the date of onset. For late complications, those deemed to be related or possibly related to LESS were captured, regardless of how long after surgery onset occurred.

All complications were recorded with a grade (1, 2, 3a, 3b, 4a, 4b, or 5) assigned according to the modified Clavien-Dindo classification [12]. Specifically, grade 0 identified the absence of any complication; grade 1 identified the presence of any deviation from the normal postoperative course, including the need for pharmacologic treatment other than antiemetics, antipyretics, analgesics, diuretics, electrolytes, or physiotherapy; grade 2 identified complications requiring the use of intravenous medications, total parenteral nutrition, enteral nutrition, or blood transfusion; grade 3 identified complications requiring surgical, endoscopic, or radiologic intervention; grade 4 identified life-threatening complications requiring intensive care or intensive care unit management; and grade 5 identified complications resulting in the death of the patient.

2.2. Statistical analysis

For the whole sample, patients' baseline characteristics were reported as frequency (percentage) and mean plus or minus standard deviation (SD) for categorical and continuous variables, respectively. Moreover, patient characteristics according to the presence of a complication were recorded and compared with Pearson χ^2 test or Fisher exact test for categorical variables and the Mann-Whitney U test for continuous variables.

To identify independent characteristics associated with complications, Poisson regression models with robust error variance were used [13]. Variables with a univariate p value <0.05 were entered into the final model—specifically, gender, age, smoking, presence of comorbidity, BMI, ASA score, malignant disease at pathology, use of an additional port, kind of surgery, and complexity score. Results were expressed as incidence rate ratio (IRR) and 95% confidence interval (CI).

To estimate the probability of complications, cumulative incidence was calculated using the Kaplan-Meier approach. All statistical tests were two-sided, and p values <0.05 were considered significant. All the analyses were performed using SAS v.9.2 (SAS Institute, Cary, NC, USA).

3. Results

3.1. Study population

Our population consisted of 192 patients who underwent LESS for upper urinary tract diseases (Table 1). The patient population was generally young (mean: 55 ± 18 yr of age), nonobese (mean BMI: 26.5 ± 4.8 kg/m^2), and healthy (mean preoperative ASA score: 2 ± 1). Forty-six patients had had prior abdominal surgery. The procedures were mostly for extirpative surgery (85.4% of cases), including radical nephrectomy (RN; 25.6%), partial nephrectomy (PN; 12.5%), simple nephrectomy (10.9%), and living-donor nephrectomy (14.1%). Reconstructive surgery (14.6% of cases) included pyeloplasty, ureterolithotomy, and nephropexy cases. In 68 cases, the final pathologic evaluation confirmed the presence of malignant disease.

3.2. Intraoperative and postoperative characteristics

Mean operative time was 164 ± 63 min, with a mean EBL of 147 ± 221 ml. In 77 cases (40%), the surgeons required additional ports, with a standard laparoscopy conversion rate of 6% (12 of 192). The reasons for the conversion to standard laparoscopy were difficulties during dissection and exposure (four cases) and demanding suture (eight cases). Mean