

Laparoscopic vs. open appendicectomies: results obtained by junior surgeons at a british University Hospital

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Abstract. – Background: The laparoscopic approach for appendicectomies remains a frequent topic of debate. In this study we report the experience with laparoscopic (LA) and open appendicectomies (OA) achieved in a british University Hospital over one year where most of these operations have been conducted by junior trainees.

Methods: Retrospective review of LA and OA performed at the Whipps Cross University Hospital of London (U.K.). Outcomes measured were the operating time, length of hospital stay and post-operative complications.

Results: Between January and December 2008 205 appendicectomies have been performed on adult patients. Eighty-eight per cent of the procedures were conducted by junior surgeons. The operating time was significantly shorter for the OA vs. LA patients (55 ± 26.8 vs. 83 ± 26.9 min, $p < 0.01$). The hospital stay confirmed a significant advantage for LA (2.2 vs. 3.7 days, $p = 0.02$). No significant differences were present among techniques for the overall morbidity, post-operative intra-abdominal abscesses and rate of readmissions.

Conclusions: Under adequate supervision LA can be safely performed by junior surgeons and reduces the hospital stay.

Key Words:

Laparoscopic appendicectomy, Open appendicectomy, Surgical training, Complications.

Introduction

Since the introduction of laparoscopic appendicectomy (LA) in 1983, the debate about its superiority compared to the open approach is still open. Numerous studies¹⁻¹⁰ and four metanalyses¹¹⁻¹⁴ have showed that LA had longer operation times than open appendicectomy (OA)¹¹⁻¹⁴, decreased postoperative pain^{11,14}, a reduced fre-

quency of postoperative ileus¹² and wound infections¹¹⁻¹⁴, as well as an earlier return to normal activities^{11,13,14}. However, the operation costs¹¹ and the incidence of intra-abdominal abscesses¹¹⁻¹⁴ are significantly higher compared to OA and no significant benefits are present for the overall hospital costs or the readmission rates¹³. Furthermore, although the hospital stays seemed shorter for LA, results are contrasting¹¹⁻¹⁴. For all these reasons, one meta-analysis concluded that a more selective approach (suspicion of appendicitis, fertile women) would probably be more beneficial¹¹.

The advent of LA has impacted not only on the surgical results but also on the training of junior surgeons. Recent studies¹⁵⁻¹⁷ have showed that most appendicectomies are now performed laparoscopically by senior surgeons than in the past when the open approach was used. This trend is not present in our University Hospital where most LA cases are conducted by junior surgeons during their training (Registrars and Senior House Officers) under adequate supervision. In the present study we aimed to describe the results and experience achieved over one year of activity.

Materials and Methods

A retrospective analysis was conducted for all patients who underwent LA and OA at the Whipps Cross University Hospital between January and December 2008. Charts of adult patients undergoing appendicectomy were reviewed and data collected for age, sex, operative procedure, operation time (from skin incision to skin closure), type of pathology, length of hospitalization and complications. Pregnant females, patients with American Society of Anesthesiologists (ASA) greater than 3, patients with psychiatric disorder, incidental appendicectomies and pa-

tients under 16 years of age were excluded to guarantee a more homogenous population for the analysis of results.

Clinical Protocol

The diagnosis of appendicitis was made in the Emergency Department and was based on the presence of right lower quadrant pain, nausea/vomiting, and abdominal guarding on physical examination. In patients where a clinical diagnosis could not be established imaging investigations were performed (abdominal Ultrasound or Computed Tomography scan). The individual senior surgeon preference dictated the type of approach (open vs. laparoscopic).

Operative Technique

OA were performed following the well-established Mc Burney technique with a 5 cm muscle splitting incision in the right lower quadrant. The LA was conducted with a three-port technique: two 5 mm trocars (sovrappubic and left inguinal fossa) and one 10 to 12 mm umbilical trocar. LA was generally performed by a Registrar supervised by a Consultant up to when the Registrar was judged able to perform independently the LA. In some cases the appendectomy was conducted by a Senior House Officer always supervised by a Consultant.

Intraoperative inflammation of the appendix was graded as absent (normal appendix), inflamed (phlegmonous), gangrenous or perforated. If an inflamed appendix was found in the laparoscopic technique, this was removed through the 10-12 mm trocar site with an endoscopic specimen retrieval device (bag). When macroscopically normal the appendix was not removed if another cause of abdominal pain was present¹¹. Saline irrigation was used depending on the degree of peritoneal contamination in cases of perforation, gangrenous appendix or gross intra-abdominal contamination. No routine drains, urinary catheters or nasogastric tubes were used in both laparoscopic and open procedures.

Postoperative Course

The antibiotic regimen depended on the degree of inflammation of the appendix: patients with a phlegmonous appendix received only a perioperative intravenous dose of amoxicillin and metronidazole; intravenous administration continued for 24-36 hours if the appendix was gangrenous, and antibiotics were given intravenously for 48 hours followed by oral administration for 3-5 days after removal of a perforated appendix.

The following criteria were used to determine discharge: patient afebrile, able to tolerate a diet and pain controlled with oral analgesics.

The presence of an erythematous, painful wound with purulent discharge was considered diagnostic for a wound infection. Fever, raised white cells count, ileus and an imaging showing a fluid collection with the characteristics of an abscess was considered diagnostic for an intra-abdominal abscess. After discharge a follow-up visit was performed in the Outpatient Department (OPD) clinics at six months to detect any late post-operative complication or problem.

Statistical Analysis

Data analysis was performed using the Statistical Package for the Social Sciences Windows version 17.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics for quantitative variables were the mean and standard deviation (mean \pm SD) for parametric variables, median and range for non-parametric variables. Normality assumptions were demonstrated with histograms, Kolmogorov-Smirnov and Shapiro Wilk testings. Descriptive statistics for qualitative variables was performed with occurrences and described with relative frequencies or median and range (minimum and maximum).

Comparison for groups' homogeneity was performed with the Student's t test for continuous parametric variables, Mann-Whitney test for non-parametric variables and with the Chi-Square test for categorical variables. All *p* values were considered significant if less than 0.05.

Results

A total of 205 patients were operated in the time-frame of analysis. Of these, 113 (55%) patients underwent complete LA, 75 (37%) patients underwent OA, and 17 (8%) patients had a LA converted to OA. The indications for conversion were anesthetic problems (*n*=2), unclear anatomy or difficult dissection and bleeding (*n*=15). These patients were included in the LA group for statistical purposes on an intention to treat basis. Most procedures (*n*=181, 88%) were performed by a junior surgeon in training: 166 (81%) appendectomies by a Registrar and 15 (7%) by a Senior House Officer.

The postoperative course was uneventful for 173 patients (84.4%), whereas complications arose in 32 patients (15.6%). Two patients developed a large haematoma, three patients an intra-

abdominal haemorrhage that required a new operation with hemostasis and wash out procedure. Ten patients developed a wound infection, six a wound dehiscence and 11 an intra-abdominal abscess. Among the 32 complications developed, seven needed a surgical treatment (reoperation rate: 3.4%, 7/205): four intra-abdominal collections, two hemoperitoneum, one for the post-operative development of an ileo-colic intussusception. Nine patients needed to be readmitted after discharge (readmission rate: 4.4%, 9/205) for the treatment of wound infections, intra-abdominal collections or haemorrhages, paralytic ileus and for a hernia of the port site.

Groups' characteristics are presented in Table I. A larger proportion of women underwent LA when compared to OA (72 % vs. 38 %, $p < 0.01$). Operating times were longer for LA than OA. No significant differences were observed for the intraoperative macroscopic appearance of the appendix, intra-abdominal collections, complications, readmission rates. There was no mortality in either group. The length of hospitalization was shorter for LA than OA (2.2 ± 2.2 vs. 3.7 ± 5.9 days) (Table I).

Discussion

Although a large British study described the prevalence of LA as only 6.3% of the total performed⁶ this rate has progressively increased and

nowadays LA constitutes in our institution more than a half of the total appendicectomies. Similar to previous reports, our LA operating times are longer compared to OA¹¹⁻¹⁴, hospital stays shorter and the overall complication rate is of 12.3%^{2,11-14}. The studies of Katkhouda et al¹⁰ and Faiz et al⁶ described a higher readmission rate after LA than OA (around 10%) due to the post-operative pain and late onset of intra-abdominal abscess, while Brummer et al also found a greater risk of developing an intra-abdominal abscess after LA than OA¹⁸. Our overall reoperation (3.4%) and readmission rates (4.4%) positively matched those presented in the literature including only eleven cases of intra-abdominal abscesses. We also recorded a wound infection rate of 3.1% for LA and 8% for OA, well within the limits described by the literature (between 0 and 13%). Finally, a macroscopic "negative" appendix was found in 22.3% of our LA cases and 18.7% of OA. This rate is higher than the overall prevalence presented by the british study (15.4%)⁶, but it refers to the intraoperative, macroscopic assessment of the appendix and not to the final pathologic analysis of the specimen. Additionally, the same study also presented higher negative appendectomy rates in women (21.7%) between 15 and 50 years of age (24.1%)⁶.

The sub-analysis conducted according to the surgeon's experience showed that the twenty-four appendicectomies performed by Senior Consultants manifested a high rate of complica-

Table I. Group characteristics. LA = Laparoscopic appendicectomy. OA = Open appendicectomy.

	LA (n = 130)	OA (n = 75)	p
Age (years)	32 ± 13	32 ± 13	NS
Sex	42 M 88 F	57 M 18 F	NS
Operative time (min.)	83 ± 26	55 ± 26	< 0.01
Intraoperative appearance of the appendix:			
• Normal	29 (22.3%)	14 (18.7%)	NS
• Gangrenous	31 (23.8%)	26 (35.7)	NS
• Perforated	15 (11.5%)	12 (16%)	NS
Intraoperative intra-abdominal collection	18 (13.8%)	14 (18.7%)	NS
Length of hospitalization (days)	2.2 (0.5-15.8)	3.7 (0.3-47.1)	< 0.05
Complications:	16 (12.3%)	16 (21.3%)	NS
• Hemorrhage	2 (1.5%)	1 (1.3%)	NS
• Hematoma	2 (1.5%)	0	NS
• Wound infection	4 (3.1%)	6 (8%)	NS
• Wound dehiscence	3 (2.3%)	3 (4%)	NS
• Intra-abdominal abscess	5 (3.8%)	6 (8%)	NS
Reoperation	4 (1.95%)	3 (1.46%)	NS
Mortality	0	0	NS
Re-admission	5 (3.8%)	4 (5.3%)	NS

Ns: not statistically significant.

tions (13% of wound infections and dehiscences, 5% of intra-abdominal collection and readmissions) probably because Senior Surgeons are actively involved in more difficult and complicated operations than junior ones. On the contrary, fifteen appendicectomies (6 OA and 9 LA) have been performed safely by Senior House Officers. This confirms that LA and OA, in selected cases and when accurately supervised, can be a very useful moment of surgical formation (19, 20) and the first step to familiarize with the core skills necessary for laparoscopic procedures^{15,17,20}.

Conclusions

Our study describes the experience of a british University Hospital where junior surgeons perform most of LA. Overall results are similar to those already presented in the literature, confirming that LA can be performed safely and effectively even by junior surgeons with adequate supervision. Although the study is a retrospective review and conclusions cannot be definitive, it still represents a good example of the results and experience achieved over one year by junior surgical during their training.

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