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Laparoscopic Appendectomy: A Beginner's Operation?

Duri Gianom, Othmar Schöb, Rolf Schlumpf

Department of Surgery, University of Zürich Hospital, Zürich, Switzerland

Since propagation of laparoscopy for the management of patients with appendicitis by Götz et al. [1], numerous studies have verified that laparoscopic appendectomy may be performed as safely as the traditional open technique [2–4]. However, its superiority to the open technique continues to be debated, and although recently considered as the new 'gold standard' [5], laparoscopic appendectomy is far from becoming as popular as laparoscopic cholecystectomy.

In several studies on open versus laparoscopic appendectomy, only selected and experienced surgeons were allowed to perform the laparoscopic procedure [6, 7]. In our institution, laparoscopic appendectomy was introduced as the standard procedure in November 1990. From the beginning, surgical residents were allowed to perform the operation either in own responsibility or under supervision of a staff surgeon. Our hospital is a teaching hospital with a great number of surgical residents. There will therefore always be a pool of young surgeons, inexperienced in laparoscopic appendectomy, who are at the beginning of the so-called learning curve and one could argue that results of laparoscopic appendectomy will be worse than in studies with only a small number of experienced surgeons [8]. Since there is only little information about this question, the presented analysis was initiated.

Material and Methods

Hospital charts of 434 consecutive laparoscopies in 430 patients, performed for clinically suspected appendicitis at the University of Zürich Hospital in the years 1990–1996, were analyzed retrospectively. We have included in the study a few cases of diagnostic laparoscopies in patients with chronic lower abdominal pain, in whom an incidental laparoscopic appendectomy has been performed. Results were subdivided according to the surgeon in group 1, resident, and group 2, staff surgeon.

All patients received a prophylactic thromboembolic dose of a low-molecular-weight heparin. In the majority of cases a prophylactic antibiotic dose consisting of netilmicin sulfate 150 mg and ornidazole 500 mg was administered. In cases of a perforated appendicitis a systemic antibiotic treatment was administered. Operative technique was the 3-point technique, previously described by Götz et al. [1] (fig. 1). After set-up of the pneumoperitoneum with the Veress needle, the laparoscope



was inserted through a 10-mm trocar at the umbilicus. The instruments were then inserted through a 5-mm trocar in the left middle abdomen and a 10-mm trocar in the right middle abdomen. The appendix was prepared with bipolar coagulation to the base and then resected after ligation with a Roeder slipknot. The base of the appendix had to be identified with certainty to avoid leaving an appendiceal remnant, as recurrent appendicitis has been reported to occur after laparoscopic appendectomy when a significant remnant was left [9]. At the beginning of our laparoscopic series we used three loop ligatures and coagulated the appendix in the area where it was transected. In the meantime we have modified our technique and we use only two Roeder slipknots and cut the appendix without coagulation (fig. 2). A linear stapler has been used in 7% of the cases only. Stump inversion has been performed only in a few cases but was soon abandoned, being too time-consuming [10]. To remove the resected appendix, the port in the right middle abdomen was dilated to 20 mm. After disinfection of the appendiceal stump with a povidone-iodine solution, the operation site was carefully rinsed. A drainage was routinely used in perforated appendices. In cases with perityphlitic abscesses and difficulty to identify the appendix, it is our policy to do a drainage of the abscess only, followed by interval appendectomy 2–3 months later. Wound closure included a fascial suture at the umbilicus and in the right middle abdomen.

Results

Between 20.11.90 and 28.12.96, we performed 434 laparoscopic appendectomies in 430 patients with clinically suspected appendicitis ($n = 408$; 94%), chronic lower abdominal pain ($n = 17$; 3.9%) or interval appendectomy ($n = 9$; 2.1%) after former drainage of a perityphlitic abscess. Table 1 summarizes our results.

The median age of the patients was 33.6 (16–84) years. 48.9% were women and 51.1% men. Our series represents a cross-section of the normal adults appendectomy population. The operations were done by 49 surgeons (30 residents (group 1), 19 staff surgeons (group 2)) around the clock, 56.7% of them after hours. 91.2% were emergency interventions. 266 (61.3%) operations have been performed by residents either in own responsibility or under supervision of a staff surgeon, 168 (38.7%) operations by staff surgeons. Mean number of operations performed by 1 surgeon was 8.8 (1–37) operations.

We were forced to abandon the laparoscopic procedure in 56 (12.9%) cases due to perforation ($n = 19$), extensive adhesions ($n = 10$), perityphlitic abscess ($n = 9$), technical problems ($n = 8$), bleeding ($n = 4$), retrocecal vermiform position ($n = 3$) and anesthesiological problems of pneumoperitoneum ($n = 3$). Conversion rate was slightly higher in group 1 ($n = 37$; 14%) than in group 2 ($n = 19$; 11.3%).

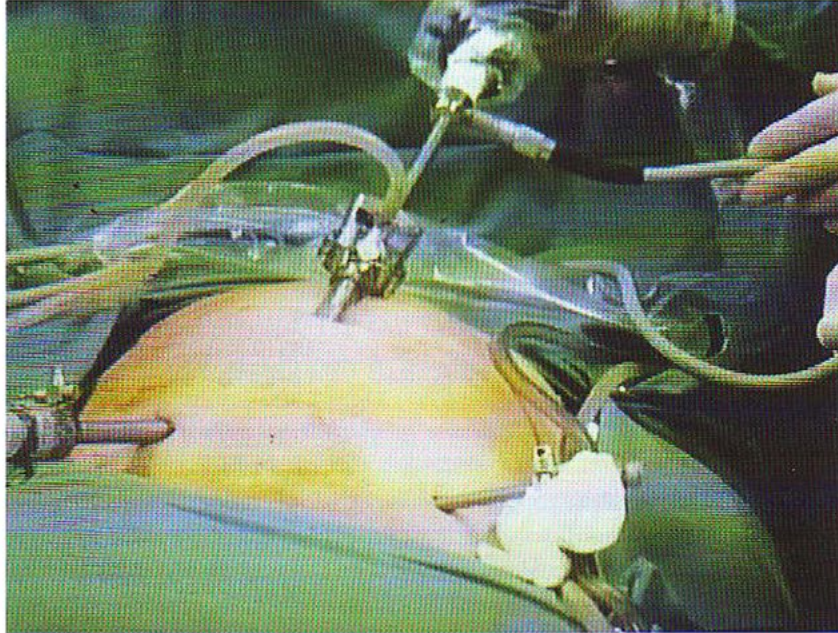
Median operation time including the converted cases was 82.0 (30–205) min. Operation time was longer in group 1 (85.6 min) than in group 2 (76.7 min). Hospital stay, excluding the converted cases, but including prolonged or recurrent hospitalization for complications, was 5.4 (2–24) days. Mortality rate was zero.

All specimens were classified histopathologically. 64.6% showed ulcerophlegmonous and 13.2% perforated appendicitis, 21.1% were judged normal or chronic, whereas in 0.9% a carcinoid and in 0.2% Crohn's disease was found. If one neglects the 17 cases of incidental appendectomy in the diagnostic laparoscopies for chronic lower abdominal pain, the 9 cases with interval appendectomy and the 4 cases of carcinoid and Crohn's disease, there is a negative appendectomy rate of 11.8% in our series.

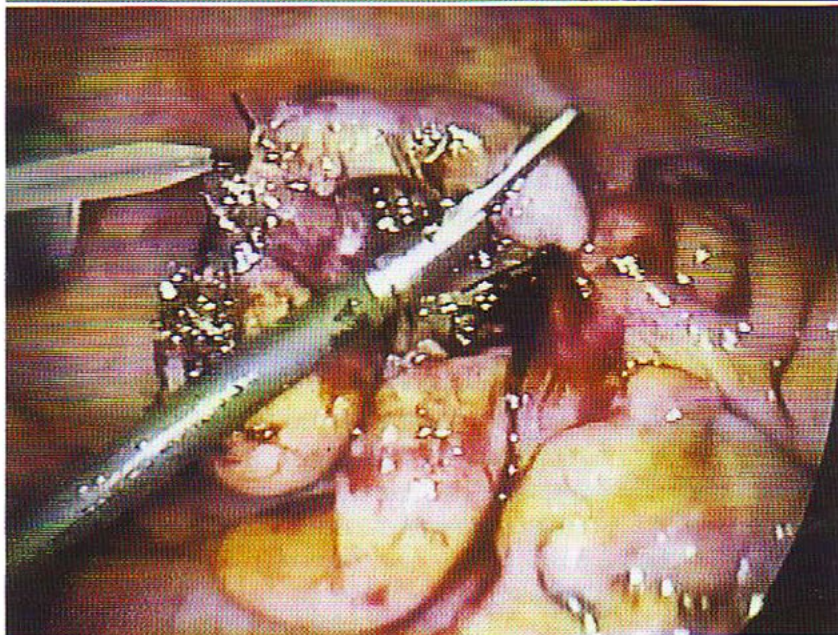
Overall postoperative complications rate was 11.5% ($n = 50$). As general complication we saw 9 patients with pulmonary atelectasis or fever without any sign for local complications. One patient with coronary heart disease, operated for ulcerophlegmonous appendicitis a few days after coronary angiography and coronary stenting, underwent emergency angiog-



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Fig. 1. Trocar arrangement for laparoscopic appendectomy.

Fig. 2. Resection of the appendix after ligature with a Roeder slipknot.



Table 1. Laparoscopic appendectomy: summary of the results

	Total	Group 1 (residents)	Group 2 (staff surgeons)
Number of operations	434 (100%)	266 (61.3%)	168 (38.7%)
Number of surgeons	49 (100%)	30 (61.2%)	19 (38.8%)
Number of operations/surgeon	8.8 (1–37)		
Hospital stay, days	5.4 (2–24)		
Operation time, min	82 (30–205)	85.6	76.7
Conversion	56 (12.9%)	37 (14%)	19 (11.3%)
Complication	50 (11.5%)	32 (12%)	18 (10.7%)
Reintervention	29 (6.7%)	18 (6.7%)	11 (6.5%)

raphy because of stent occlusion and postoperative myocardial infarction. Another patient unfortunately showed an intra-abdominal dislocation of the drainage. She needed a relaparoscopy for extraction of the drain. As local complications we saw 19 (4.4%) intra-abdominal abscesses, 11 (2.5%) trocar site infections, 4 (0.9%) intra-abdominal bleeding, 3 (0.7%) early intestinal occlusions, 1 (0.2%) chronic fistula at a trocar site and 1 (0.2%) trocar site hernia. 32 (12%) of all complications occurred in group 1 and 18 (10.7%) in group 2. 78% of the atelectasis and 84% of the intra-abdominal abscesses occurred in group 1, whereas the other complications were equal in both groups. In 29 cases (6.7% of all interventions), a reintervention was necessary, 18 times (6.7%) in group 1 and 11 times (6.5%) in group 2. Herein are included laparoscopy or laparotomy for intra-abdominal abscess, for bleeding or for extraction of a drainage tube, ultrasound-guided abscess drainage, subcutaneous abscess incision, fistulectomy and hernia repair.

Discussion

Open appendectomy, first performed by Rudolf Krönlein in Zürich in 1884, is still the gold standard in the treatment of acute appendicitis. Appendectomy through McBurney's laparotomy is a classical beginner's operation and traditionally, for almost any surgical resident, it is the first abdominal operation performed alone or under supervision.

Unlike laparoscopic cholecystectomy, there is still little acceptance of laparoscopic appendectomy in general surgery and it seems that in future for the routine patient it will not replace open appendectomy [2]. However, there are indications in which laparoscopy should be considered: for example young women with lower abdominal pain, people with uncertain diagnosis or obese patients and patients with a perforated appendicitis [11]. Beside medical factors, patient's individual preference, cosmetic aspects, economical factors and at least availability and feasibility of laparoscopy on an emergency basis will decide upon the future of laparoscopic appendectomy.

We are convinced that modern abdominal surgery also requires competent handling of laparoscopic technology. Therefore, we introduced laparoscopic appendectomy in November 1990. Soon after, laparoscopic appendectomy became the standard procedure at our institution. To guarantee appropriate education, surgical residents were allowed to perform the laparoscopic operation from the beginning, according to their education, either alone or with the assistance of a staff surgeon.



The question, whether laparoscopic appendectomy can be performed in the daily clinical practice as safe as under study design, remains unclear. Pier and Götz [1], the pioneers in the field of endoscopic techniques, published excellent results using laparoscopic appendectomy as the standard procedure. They consider appendectomy as the least challenging laparoscopic operation and recommend therefore that any surgeon inexperienced in laparoscopy should start with laparoscopic appendectomy. Some authors do agree and consider laparoscopic appendectomy suitable for education [4, 7, 8, 12, 13]. However, others, either based on personal negative experience or based on the critical literature reports, consider laparoscopic appendectomy too pretentious and therefore not suitable for education [14, 15]. Our herein reported overall results are comparable with the one obtained in prospective studies on open versus laparoscopic appendectomy [2, 16]. Furthermore, our results are comparable with a former analysis, in which 204 open appendectomies performed at our institution between 1987 and 1989 have been retrospectively reviewed. In this collective with a number and distribution of operators comparable to our series, there was a mean operation time of 64 min, a mean hospital stay of 7.6 days and an overall complication rate, which was equal to our series with 11%. We are convinced that laparoscopic appendectomy can be performed as an educational operation in daily clinical practice, including the emergency situation, as safe as open appendectomy. In the residents' group there was a longer operation time, a higher conversion and higher overall complication rate, whereas the reintervention rate was equal in both groups (table 1). The most striking difference in both groups was the fact that 84% of the intra-abdominal abscesses occurred in the residents' group. For this we have no explanation, since in the majority of these interventions a staff surgeon experienced in laparoscopic technology assisted the operation. We suggest that the differences between the two groups are the consequence of the learning curve, since the number of operations performed by each surgeon in this study was only 8.8. Our impression of the appendectomies performed in 1997 is, that with increasing experience, major septic complications are getting rarer. However, depending on the inflammation status, laparoscopic appendectomy can be a very pretentious operation. Nevertheless, we believe that the somewhat worse results in the residents' group should not hinder the introduction and development of this new 'patient-friendly' technique. As future generations need to master open as well as laparoscopic appendectomy, there is a need for continuing instruction of residents by experienced staff surgeons, until they are competent to operate on their own, even when surgery has to be performed after hours.

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Dr. Duri Gianom, Department of Surgery, University of Zürich Hospital,
Rämistrasse 100, CH-8091 Zürich (Switzerland)
Tel. +41 1 2551111, Fax +41 1 2554449