

Laparoscopic appendectomy using a clip applier

Bernard G. Cristalli, Vincent Izard, Denis Jacob, and Michel Levardon

Department of Gynecologic Surgery and Obstetrics, Hôpital Beaujon, 100, Boulevard General Leclerc, F-92118 Clichy Cedex, France

Summary. The diagnostic worth and therapeutic value of laparoscopic surgery are known for ovarian cysts and ectopic pregnancies. Diagnosis of appendicitis is difficult, and laparoscopy is useful in these cases. The present study was done to assess the feasibility, efficacy, and advantages of a new laparoscopic appendectomy technique. Between August 1, 1989, and July 31, 1990, patients exhibiting right pelvic pain associated with fever were divided into three groups according to the pre-operative diagnosis: appendicitis, pelvic inflammatory disease (PID), and diagnostic doubt between appendicitis and PID. An intra-peritoneal appendectomy was performed if the diagnosis was not PID. Via three suprasymphyseal trocars, the appendix was exposed and the mesoappendix was coagulated. The appendix stump was closed using a clip applier (Ethnor T1300). In all, 20 patients underwent laparoscopic appendectomies. The mean duration of the procedure was 36.5 min; in no case was laparotomy necessary. There were no post-operative complications, and digestive transit returned on the 2nd day post-surgery. Both patients and nurses appreciated the technique. The subjects experienced comfortable post-operative periods and gained aesthetic advantages. The operative procedure could be completed on each attempt. We conclude that this technique is sure, quick, and easily reproducible in young patients presenting with right pelvic pain associated with fever.

Key words: Laparoscopy – Laparoscopic surgery – Laparoscopic appendectomy – Pelvic inflammatory disease

The diagnostic value of laparoscopy has been proven for pelvic inflammatory disease (PID) [1], ovarian cysts and their complications [2], and ectopic pregnancies [2]. The therapeutic value of laparoscopic surgery has been proven for these conditions and their sequelae [2]. Appendicitis is a frequent cause of pelvic pain and is often difficult to diagnose either by clinical examination or by biological tests [1]. Laparoscopy is useful for confirmation of the diagnosis [1, 3, 8]. However, even laparoscopic diagnosis may be difficult in patients exhibiting an apparently normal pelvis or in the case of diagnostic doubt between primary

appendicitis and that arising from adjacency to PID, thus making an open appendectomy necessary [3]. Laparoscopic appendectomy has previously been performed [4, 6, 9, 11]. This prospective study was carried out to appraise the feasibility, efficacy, advantages, and disadvantages of a new laparoscopic appendectomy technique.

Patients and methods

From August 1, 1989, until July 31, 1990, patients seen in our department for right pelvic pain associated with fever were divided into three groups according to the pre-operative diagnosis (group 1, appendicitis; group 2, PID; group 3, doubt between appendicitis and PID). The eligibility and exclusion criteria are shown in Table 1. Written informed consent was obtained from each patient and the study was carried out with the approval of our institution's ethics committee.

Distribution into the three pre-operative diagnosis groups was determined following the criteria presented in Table 2. Diagnostic laparoscopy was systematically carried out using the criteria shown in Table 3. The macroscopic state of the appendix determined its stage (0, normal; 1, mild inflammation; 2, severe inflammation associated with edema). In cases of PID there was no surgery. An appendectomy was performed if the laparoscopic diagnosis was appendicitis or a normal pelvis. The appendectomy was done by laparoscopy if the appendix was staged as 0 or 1 and by laparotomy if the appendix was staged as 2.

Laparoscopic appendectomy (LA) was carried out according to the following operative procedure. Three suprasymphyseal trocars were placed on an imaginary Pfannenstiel incision: two 5-mm trocars (Microfrance CM 105) were situated at the ends for the introduction of laparoscopic forceps and scissors (Microfrance CM 115 and 104), and one 11-mm trocar (Storz 26 020AA) was located on the median line for the introduction of the clip applier (Ethnor LC3010 and TI 300). The appendix was grasped with a grip forceps (Microfrance CM 111), which was introduced through the right trocar to expose the appendix and mesoappendix (Fig. 1), and adhesiolysis was performed if necessary. Hemosta-

Table 1. Eligibility and exclusion criteria. PID, Pelvic inflammatory disease

Eligibility	Exclusion
Women	Contra-indication for laparoscopy
Informed consent	Previous appendectomy
Pelvic pain associated with fever	Severe appendicitis, peritonitis
Clinical diagnosis of PID or appendicitis	Pelvic pain due to another affliction ^a

^a Preoperative or operative diagnosis of ectopic pregnancy, ovarian cyst, or other pathological findings

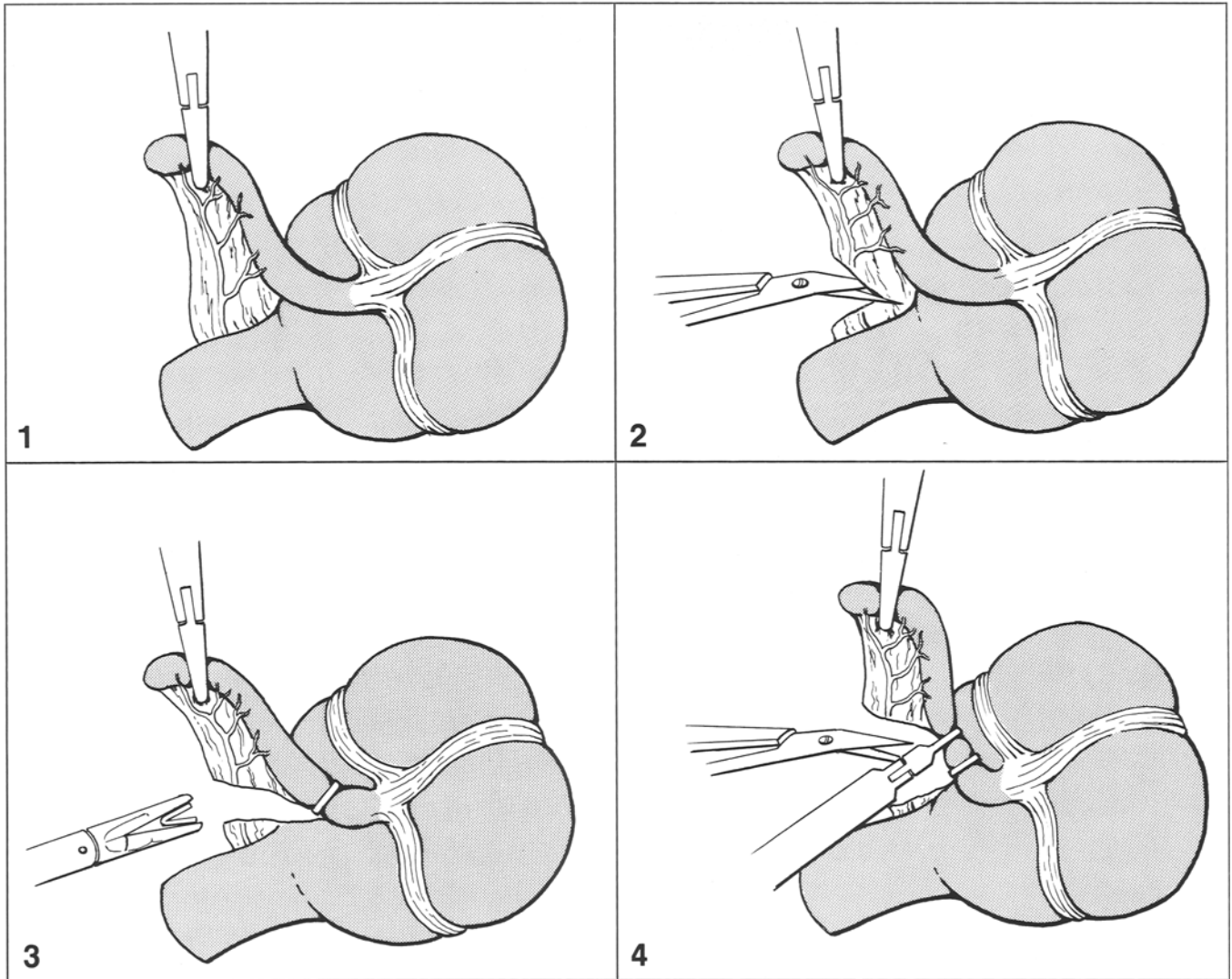


Fig. 1. Exposure of the mesoappendix. The extremity of the appendix is grasped with the forceps on the right side to expose the mesoappendix

Fig. 2. Coagulation and section of the mesoappendix. The electrocoagulation is done with the forceps and the mesoappendix is cut with scissors. The base of the appendix is stripped in preparation for clip application

Fig. 3. Clip application. The clip applicator is passed through the median-line trocar, the first clip is applied to the base, and the second one is applied to the distal portion

Fig. 4. Section of the appendix. The appendix is grasped with the clip applicator held at the level of the distal clip and is cut between the two clips and then extracted directly through the trocar for the clip applicator

sis was achieved by monopolar electrocoagulation using “atraumatic” forceps (Microfrance CM 115) prior to sectioning of the appendix with scissors (Fig. 2). The clip applicator was passed through the median-line 11-mm trocar. The appendix stump was closed with clips, first proximally at 5 mm from the caecum, then distally (Fig. 3). After prehension of the appendix at the level of the distal clip using the clip applicator, the appendix was cut with scissors and pulled out through the trocar without being dropped (Fig. 4). The procedure was completed by electrocoagulation of the appendix stump followed by the verification of hemostasis prior to a hydrochloride serum wash using the Tritonet (Microfrance CM 101).

The minimal hospital stay following appendectomy was 5 days. A clinical control was carried out at 1 month after the operation. Results were evaluated according to (1) post-operative complications, (2) the duration of the procedure from the creation of pneumoperitoneum until skin closure, (3) the return of digestive transit, and (4) subjective appreciation of the technique by nurses and patients.

Results

A total of 31 patients were included in this study, of whom 6 exhibited PID and were treated with antibiotics; 25 subjects underwent appendectomies, 20 by laparoscopy and 5 by laparotomy. The laparotomies were performed because of severe inflammation of the appendix. Among the 20 LAs, the pre-operative diagnoses involved appendicitis in 13 cases, PID in 2, and doubt in 5. Laparoscopy confirmed the clinical diagnosis in 29% of cases (9/31). Histology revealed appendicitis in each of the 20 appendices that were removed by LA (6 acute, 7 sub-acute, and 7 chronic cases); 1 of the appendices that were extracted by laparotomy was inflamed due to its adjacency to PID.

A laparoscopic diagnosis of appendicitis showed a 62.5% sensitivity and a 93.7% positive predictive value;

Table 2. Pre-operative criteria for a diagnosis of appendicitis or PID. A clinical diagnosis of appendicitis or PID was assessed when three or more criteria were met for one affliction; there was clinical doubt when less than three criteria were filled for one affliction or when three or more criteria were met for each affliction. RIF, Right iliac fossa

Appendicitis	PID
History of RIF pain	History of PID
Digestive transit troubles	Intra-uterine device
Temperature of $\geq 37.5^\circ\text{C}$	Temperature of $\geq 38^\circ\text{C}$
Spontaneous and induced RIF pain	Increased pelvic pain during walking
RIF parietal defence	Pain at uterine mobilization
Pain on the right side at pelvic examination	Cul-de-sac tenderness

Table 3. Laparoscopic diagnostic criteria for appendicitis and PID. The pelvis was considered to be normal if none of these criteria was filled. The appendix was staged as 1 if only the first two criteria were met. The appendix was staged as 2 if three or four criteria were met

Appendicitis	PID
Erythema	Erythema
Edema of the appendix	Edema of the fallopian tube
Outpouring, appendicular false membranes	Outpouring, fallopian false membranes
Appendicular abscess	Pyosalpinx

the specificity and the negative predictive value were 0. The same operative procedure was applied in every case, and the mean duration of the operation was 36.5 min. On no occasion did it become necessary to perform a laparotomy after an LA had been initiated. Digestive transit returned on the 2nd day post-surgery in most cases, on day 4 in one case, and on day 1 in six cases (30%). There were no post-operative complications: all patients were discharged on the 5th day following surgery. Subjective appreciation of this procedure by patients and nurses was excellent.

Discussion

LA was feasible on each attempt. The proposed operative procedure was efficient, quick, and reproducible. Post-operative periods were comfortable, and all of the patients could have been discharged prior to the 5th post-operative day. The aesthetic advantage of the absence of an abdominal wall incision, even of a very small one, was strongly felt in this group of young subjects. Some studies have reported a reduction in post-operative peritoneal adhesions following LA [6], but this has yet to be thoroughly assessed.

Laparoscopy enables a complete exploration of the entire pelvis and a good view of the rest of the abdominal cavity. For appendicitis, the positive value of laparoscopy is good, but its negative predictive value is worthless [7, 8], which renders it unsuitable for the exclusion of a diagnosis of appendicitis. The removal of a macroscopically healthy

appendix is justified when a patient suffers from right lower quadrant pain associated with fever [3]. In the present study, 96% (24/25) of the appendices removed showed histological signs of inflammation, regardless of their macroscopic state, as compared with either the 50% value previously reported for appendices following incidental appendectomy during gynecological operations [12] or the 11% value found for patients aged <25 years [7].

The use of laparoscopy avoids the need for appendectomy in some cases [1, 5]; this elimination of useless laparotomies is more important among young patients [3]. Exploration increases the duration of the procedure but can locate the appendix, thus making the appendectomy easier. Stump closure with clips is quicker and more simple than that using intra-peritoneal sutures [9–11] and seems to be more secure than that using sterilization rings or clips [4, 6]. The small size of the clips complicates their use in cases of severe inflammation, but this technique can provide an alternative means of using the Roeder loop. Stump burying through laparoscopy is practised by some surgeons; however, as it requires a high degree of technical skill, it renders appendectomy a very difficult procedure that is limited to specially trained practitioners [10]. The absence of hemorrhagic complications after simple coagulation of the mesoappendix confirms the efficacy previously reported for thermocoagulation [2]. These findings strongly support the use of laparoscopy in the global (diagnostic and therapeutic) management of right pelvic pain associated with fever.

References

1. Body G, Lansac J, Magnin G, Quentin R (1985) Les salpingites aiguës non tuberculeuses. *Encycl Med Chir Gynécol (Paris)* 470A10: 11
2. Bruhat MA, Dubuisson JB, Pouly JL, et al (1989) La coeliochirurgie. *Encycl Med Chir Tech Chir Urol Gynecol (Paris)* 41 515: 6
3. Deutsch AA, Zelikovsky A (1982) Laparoscopy in the prevention of unnecessary appendectomy. *Br J Surg* 69: 336–337
4. Gangal HT, Gangal MH (1987) Laparoscopic appendectomy. *Endoscopy* 19: 3–5
5. Lau WY, Fan ST, Yiu TF, Chu KW, Suen HC, Wong KK (1986) The clinical significance of routine histopathologic study of the resected appendix and safety of appendiceal inversion. *Surg Gynecol Obstet* 162: 256–258
6. Leahy PS (1989) Technique of laparoscopic appendectomy. *Br J Surg* 76: 616
7. Mulvihill S, Goldthorn J, Woolley MM (1983) Incidental appendectomy in infants and children. Risk vs rationale. *Arch Surg* 118: 714–716
8. Ragland J, Garza J de la, McKenney J (1988) Peritoneoscopy for the diagnosis of acute appendicitis in females of reproductive age. *Surg Endosc* 2: 36–38
9. Schreiber JH (1987) Early experience with laparoscopic appendectomy in women. *Surg Endosc* 1: 211–216
10. Semm K (1982) Advances in pelviscopic surgery. (Current problems in obstetrics and gynecology, vol 5). Year Book Medical Publishers, Chicago London
11. Semm K (1988) Die pelviskopische Appendektomie. *Dtsch Med Wochenschr* 113: 3–5
12. Von Rechenberg KN (1983) Die histopathologischen Befunde bei Gelegenheits-Appendektomien im Rahmen gynäkologischer Laparotomien und ihre Bedeutung für die Patientin. *Geburtshilfe Frauenheilkd* 43: 273–280