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Ann Ital Chir, 2019 90, 1: 72-77
pii: S0003469X18029408
Epub Ahead of Print - November 19
free reading: www.annitalchir.com

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Postoperative outcomes in laparoscopic appendicectomies with histopathologically normal appendix

AIM: Although still debatable, appendectomy during laparoscopy in patients with abdominal pain is often performed even if the appendix seems normal. The study's aim is to compare the postoperative outcomes of laparoscopic appendicectomies with appendix proven to be histologically normal to those with proven appendicitis, adding evidence on whether a normal appendix should be removed.

METHODS: All consecutive patients who underwent laparoscopic appendectomy in a one-year period in a single centre were retrospectively studied. Comparison was attempted between patients with negative and positive histology with regards to their postoperative outcomes (length of stay and postoperative complications).

RESULTS: Out of 134 patients included in the study, ten patients developed postoperative complications (7.5%), 42 patients had negative histology (31.3%), 92 patients had positive histology (68.7%) and six (4.3%) and four patients (4.3%) respectively from each group developed post-operative complications. No statistically significant difference was found regarding morbidity, length of stay and Clavien-Dindo grading of complications between the two groups.

DISCUSSION: Morbidity and length of stay in laparoscopic appendectomy with normal appendix are not inferior to those with histologically confirmed appendicitis and thus should not be disregarded when considering a routine appendectomy.

CONCLUSION: The final decision to remove a normal appendix in laparoscopy for abdominal pain should be based on the individual clinical scenario and surgeon's experience.

KEY WORDS: Acute appendicitis, Histology, Length of Stay, Morbidity

Introduction

Appendicitis is the most common acute surgical diagnosis worldwide, with a lifetime risk of 9% in women and 7% in men ¹. Since the late 1960s, considerable effort has been devoted to increase diagnostic accuracy

and reduce negative appendectomy (NA) rates in patients with acute abdominal pain. Various techniques and technologies have been assessed, including diagnostic laparoscopy where the clinical diagnosis remains equivocal ², frequently followed by laparoscopic appendectomy (LA). It has been suggested that with the introduction of laparoscopy, a normal-looking appendix could be left in place reducing the risk of development of procedure-related morbidity and the NA rate could be significantly decreased to <10% ^{1,3}. However, various studies have reported that the normal appendix tends to be removed in laparoscopy and that the total NA rate has increased with rates reported in literature from 5.5% to 37.2% ³⁻⁸. While the removal of a macroscopically nor-

Pervenuto in Redazione Agosto 2018. Accettati per la pubblicazione Ottobre 2018

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mal appendix is routine in open appendectomy⁹, a vigorous debate has been generated as to whether it should be removed routinely at a diagnostic laparoscopy. Various publications appear to favour the removal of the appendix if there is no other pathology identified^{5,8,10,11} as there is an assumption that it is unlikely to increase the morbidity of the procedure. On the other hand, other authors believe that there is little evidence to substantiate this³ and advocate that it should not be performed^{10,12-15}. NA has shown to be associated with a morbidity rate of approximately 6%, including reoperations, an extended hospital length of stay^{4,6,16} and higher hospital costs^{1,4,17}. Finally, it can be argued that performing appendectomy irrespective of the appearance of the appendix, would theoretically limit the diagnostic value of laparoscopy.

Aim of this study is to evaluate the postoperative outcomes of patients that underwent laparoscopic appendectomy with appendix proven eventually to be histologically normal compared to those with proven appendicitis, adding evidence on whether a normal appendix should be removed, in absence of other explanatory pathology.

Material and Method

The electronic records of all consecutive patients who had appendicectomies in a one-year period in a single institution were reviewed retrospectively. All the cases in which an open appendectomy was performed or a laparoscopic procedure was converted to an open were excluded from the study. The cases in which complicated ovarian cysts or other pathologies were identified during laparoscopy or in which an appendectomy was performed during other primary procedure were also excluded. The demographics of the patients were documented. The main outcome parameters studied were morbidity and length of stay in the hospital. Morbidity was defined as any postoperative complication leading to deviation from the standard postoperative recovery, including readmissions to the hospital or pain of such amount to require postoperative scans or re-attendances to Accident and Emergency department. Morbidity also included readmissions for any other reason related to the initial operation, including cases in which a reoperation was needed. A stratification of the complications was also performed following the Clavien-Dindo Classification of Surgical Complications (C-D)¹⁸.

Surgical histology was defined as negative when no evidence of appendicitis or other pathology was identified in the specimen and as positive when the specimen demonstrated evidence of appendicitis or other pathologic findings that could explain the symptoms that lead to a laparoscopy. Findings such as *Enterobius Vermicularis*, meso-appendiceal abscess and carcinoid tumors of the appendix were accounted as positive histology. A com-

parison was performed between the group of patients who had laparoscopic appendectomy presenting negative histology and the group of patients who had appendectomy presenting positive histology, with regards to their morbidity, length of stay (LOS) and C-D. Median length of follow up was 19 months (range 13-24). Bivariate correlations between scale and binomial variables were assessed using Mann-Whitney U test. Correlations of categorical variables in 4-fold tables were assessed using Fisher's exact test (2-tailed) and in >4-fold table using chi-square test (2-tailed). A p value of less than 0.05 was considered statistically significant. Statistical processing of data was conducted using SPSS v20 software (IBM Corporation, Chicago, IL, USA). Conduction of this work is in full compliance with local Ethical Regulations and Anonymization standards. Approval from local ethical committee was not required as this was not an interventional study, involving only retrospective analysis of clinical data associated with diagnostic and therapeutic techniques performed without any deviation from institute's local guidelines. The study analysed data retrospectively thus informed consent from the patients prior to their inclusion in the study was not required according to local policy. All patients have signed an informed consent form prior to their operations.

Results

A total of 311 patients underwent an appendectomy in a one-year period in a single centre. One hundred and thirty four patients who underwent LA were included in the study after following the set criteria, 52 male (38.8%) and 82 female (61.2%). Median age at the time of surgery was 28 years. The median LOS in hospital was three days. Ten patients developed postoperative morbidity (7.5%) (Table I). The distribution of the specific types of complications is shown in Table II. One

TABLE I - Demographic data of patients included in the study, results of final histology and main outcomes.

Gender ^a	
Female	82 (61.2)
Age at time of surgery (years) ^b	28 (14-67)
Length of hospital stay (days) ^b	3 (1-14)
Clavien-Dindo Complication Grade ^a	
I	2 (20)
II	6 (60)
III	2 (20)
Postoperative complications ^a	
Yes	10 (7.5)
Final histology ^a	
Positive	92 (68.7)

^a n (%), ^b Median (range)

TABLE II - Number of patients with specific types of complications in laparoscopic appendicectomy

Complications (type)	Number of patients
Pain	8
Wound infection	2
Bilateral lung consolidations	1
Right iliac fossa abscess	1
Intraabdominal collection	1
Acute Kidney Injury	2
Ileus	1
Reoperation	1

TABLE III - Comparison between the two groups with regards to post-operative complications, C-D grade of complications and LOS

	Negative Histology	Positive Histology	p value
Postoperative complications ^a			
Yes	6(14.3)	4(4.3)	0.071
No	36(85.7)	88(95.7)	
Clavien-Dindo Grade of complications ^a			
I	1(16.7)	1(25.0)	0.435
II	3(50)	3(75.0)	
III	2(33.3)	0	
Length of Stay (days) ^b	4(1-10)	3(1-14)	0.109

^a n (%), ^b median (range)

patient developed an intra-abdominal collection treated with ultrasound guided drainage and another patient underwent a re-operation for persistent abdominal pain (appendiceal stump excision). Table I shows the severity of the complications based on the C-D. There were no patients classified as grade IV or grade V. Out of the 134 patients, 42 patients had negative histology and 92 patients had positive histology (Table I). Six of the patients with negative histology (14.3%) and four of the patients with positive histology (4.3%) developed post-operative complications with no statistically significant difference between the two groups ($p=0.071$). This was further confirmed by the absence of statistically significant difference regarding the severity of complications based on the C-D ($p=0.435$). Median LOS was four days and three days respectively with again no statistically significant difference between the two groups ($p=0.109$) (Table III).

Discussion and Commentary

According to an international survey the vast majority of surgeons would remove a macroscopically normal

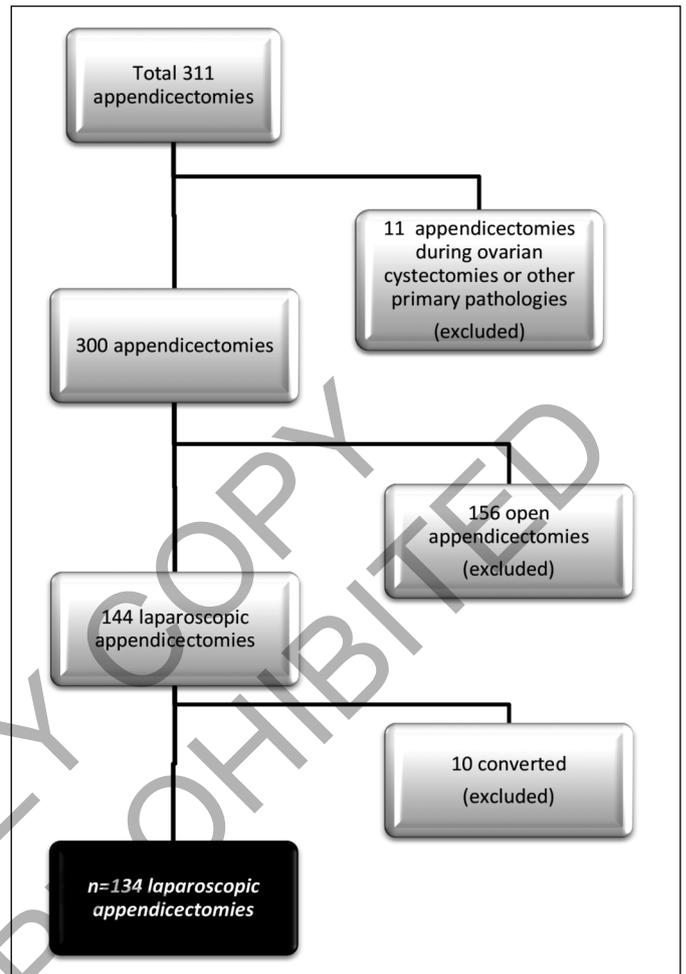


Fig. 1

appendix in absence of other pathology, but current literature fails to provide clear guidance^{1, 19} and in a different survey performed, 68% of surgeons responded that there are no sufficient guidelines on the topic²⁰. In literature, the rate of NA in laparoscopy ranges from 3.3% to 37.2%^{1,3,8,10,21-23}, which could reflect the lack of clear guidance. However, negative appendectomy has been considered as better than a situation of misdiagnosis of appendicitis with resultant potential for adverse outcomes^{8, 23} and a recent multicenter study demonstrated that negative LA reduced the need for further surgical or radiological intervention in 30 days²¹. Moreover, studies support that removal of a normal looking appendix confers no disadvantage with respect to morbidity, mortality or length of the operation and therefore support LA^{2,11,24,25}, although on the other hand several authors have found that removal of a normal appendix was associated with considerable morbidity^{2,4,6,7,12,24}. In the current study, the relatively high rate of NA in laparoscopy (31.3%) is within the literature range and could be explained by the local practice followed by most surgeons to remove the appendix if no other pathology

is identified. In LA with negative histology the rate of morbidity is again within the range of rates reported (6%-14.8%)^{3,6,7,21}, although still relatively high and not significantly different than the morbidity in cases of removal of pathologic appendices, a finding in agreement with other studies^{3,7,21}. Similarly the severity of complications based on the C-D is not statistically significantly different between the two groups, in line with other authors³. No significant difference was found in the median LOS comparing negative with positive histology cases in laparoscopy (four and three days respectively) and this may represent the consequence of additional testing and observations to identify the source of the patient's symptoms. The median LOS reported by other authors was in favour of NA²³, but it is difficult to compare studies because of the variability in defining length of stay in literature.

In the present study, in accordance with other authors, patients that underwent appendectomy as additional part to another procedure were excluded^{1,6,8,9,16,23}, as were cases of laparoscopic converted to open surgery, considered as being open according to potential complications and postoperative course⁸. The database includes only in-hospital recorded events. However, this would reflect equally in the two groups. Main limitation of the study is that it was performed retrospectively and that it was based on the histopathology findings. This is because no objective intra-operative macroscopic criteria exist for defining a normal appendix, the intra-operative assessment is not always clearly recorded and the intra-operative image is not always available to compare¹. An investigation on other factors that may influence the decision to remove a normal appendix, including the level of experience of the surgeons was not assessed. Some surgeons perform an appendectomy to prevent future appendicitis and diagnostic confusion^{14,19}. Moreover, surgeon's decision is often based on the possibility of microscopic inflammation in a macroscopically normal appendix and on reports of discrepancies between surgical and histopathological assessments with varying proportions of false negative rates^{1,10,20}. On the other hand, it is argued that these microscopic pathologic changes can be insignificant and that the subsequent pathological fate of these appendices, had they not been removed, is impossible to predict⁹. Several authors have described the safety of leaving a normal appendix in situ^{9,13-15}.

Based on the results of the present study, the removal of normal appendices in laparoscopy presents similar outcomes in terms of morbidity and LOS with the removal of pathologic appendices. The extrapolated risk of postoperative complications can be justified in the case of appendicitis, but is quite difficult to do so in cases of normal appendix, particularly from a medical ethics point of view. This finding, in combination with the absence of sufficient clear evidence in literature may contribute to the suggestion that the removal of a normal appendix during diagnostic laparoscopy for right iliac fossa pain

in the absence of other pathology should not probably be performed routinely, although other factors need to be considered too. In line with the guidelines of the Society of American Gastrointestinal and Endoscopic Surgeons, if no other pathology is identified, the decision to remove the appendix should be individually considered, based on the individual clinical scenario²⁶.

Conclusion

The complication rate of diagnostic laparoscopy has been reported to be 1-5% for minor and 0.3-2.3% for major complications²⁷. However, to the authors' knowledge there is no direct comparison in literature between the morbidity of diagnostic laparoscopy alone and laparoscopy with removal of normal appendix. In this context, ideally a randomized prospective multicenter study would be needed to directly compare laparoscopic appendectomy versus laparoscopy with normal appendix left in situ, including a long term follow up of these cases. Response of symptoms, need for further treatment, patient-reported outcomes and cost-analysis are required to provide a definite answer. Until then, if no other pathology is identified, the decision will need to be based on surgeon's experience and preference, following correlation with the clinical course and clear pre-operative informative discussion with the patient.

Riassunto

Durante gli ultimi anni, sono state sviluppate molte diverse indagini diagnostiche per la diagnosi di appendicite acuta tra cui quella di laparoscopia diagnostica. Nonostante sia ancora discutibile, spesso durante la laparoscopia diagnostica per fare la diagnosi di un dolore addominale acuto, l'appendice viene rimossa in assenza di altra patologia, anche se essa appare normale. Alcuni Autori credono che la rimozione di una appendice normale non conferisce un incremento della morbilità postoperatoria, mentre altri invece dimostrano un suo incremento, allungamento della degenza in ospedale e aumento dei costi. Lo scopo di questo studio era di confrontare i risultati tra i casi di appendicectomia laparoscopica dove l'appendice si era dimostrata istologicamente normale, con quelli in cui l'appendicite acuta era confermata istologicamente, cercando di rispondere al quesito: se rimuovere o meno una appendice apparentemente normale durante una laparoscopia.

Sono stati studiati retrospettivamente tutti i pazienti appendicectomizzati nell'arco di un anno in un singolo centro. Sono stati inclusi nello studio tutti i pazienti appendicectomizzati per via laparoscopica senza presenza di altra patologia. Sono stati confrontati i risultati dei pazienti con istologia negativa con quelli con istologia

positiva, per quanto riguarda le complicazioni postoperatorie e la durata della degenza in ospedale.

Sono stati inclusi nello studio 134 pazienti, 42 con istologia negativa e 92 con istologia positiva. Dieci pazienti hanno avuto complicanze postoperatorie: 6 con istologia negativa e 4 con istologia positiva. Non è stata rilevata nessuna differenza statisticamente significativa tra i due gruppi di pazienti per quanto riguarda la lunghezza di degenza in ospedale ($p=0.109$) o per quanto riguarda le complicanze ($p=0.071$). Inoltre, non è stata notata neanche qualche differenza statisticamente significativa tra i due gruppi per quanto riguarda la classificazione delle complicanze secondo la classifica Clavien-Dindo ($p=0.435$).

I motivi per cui diversi chirurghi rimuovono una appendice normale sono diversi, per altro verso però molti altri considerano abbastanza sicuro di lasciare una appendice normale in situ.

Questo studio dimostra che la morbilità e la lunghezza della degenza ospedaliera in caso di appendicectomia laparoscopica con istologia negativa non è inferiore a quella con istologia positiva. Questo, in combinazione con la assenza di chiare prove in letteratura suggerisce che la rimozione di una appendice normale in assenza di altra patologia durante laparoscopia per dolore addominale non deve essere sempre effettuata, ma anche altri fattori devono essere presi in considerazione. La decisione deve essere basata sul caso individuale specifico e sulla esperienza del chirurgo.

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