SCIENTIFIC PAPER

# Laparoscopic Appendectomy in Women Without Identifiable Pathology Undergoing Laparoscopy for Chronic Pelvic Pain

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## ABSTRACT

**Objectives:** To assess the effectiveness of appendectomy in women undergoing laparoscopy for chronic pelvic pain without identifiable pathology.

**Methods:** This retrospective cohort study included women aged 15 to 50 years who underwent laparoscopic surgery for chronic pelvic pain without identifiable pathology. The cohort was divided into 2 groups: women who underwent appendectomy and women who had not undergone appendectomy at laparoscopic surgery. Postoperative pain was assessed at 6-week follow-up and by subsequent mailed questionnaire.

**Results:** Women who underwent appendectomy (n = 19) were significantly more likely to report improvement in pain at 6-week follow-up than women who did not undergo appendectomy (n = 76) (93% vs 16%; $P < .001$). Thirty-six patients (38%) responded to the questionnaire at a median of 4.2 years after surgery, when the median change (improvement) in reported pain was greater in the appendectomy group than in the nonappendectomy group.

**Conclusion:** Appendectomy is effective therapy for patients with chronic pelvic pain of unknown etiology who are undergoing laparoscopy.

**Key Words:** Appendectomy, Laparoscopy, Pelvic pain, Chronic.

## INTRODUCTION

Chronic pelvic pain is generally defined as pelvic pain that persists for at least 6 months. It causes considerable functional impairment to patients and represents a clinical challenge for gynecologists. Although chronic pelvic pain is a common presentation in clinical gynecologic practice, its prevalence is difficult to determine because its definition is ambiguous. Of randomly selected women aged 18 to 50 years, 15% have been reported to visit a gynecologist because of pelvic pain,[1,2] and approximately 10% of all visits to a gynecologist are related to pelvic pain.[3] The pathophysiology underlying chronic pelvic pain is complex and may involve many organ systems, including the gynecologic, gastrointestinal, genitourinary, musculoskeletal, neurologic, and psychiatric systems. Laparoscopic surgery can reveal certain diagnoses, such as endometriosis, adhesions, uterine anomalies, or adnexal pathology. However, a cause for pelvic pain may not be found in as many as 61% of patients who undergo laparoscopy.[1] Furthermore, the presence of visible pathology does not necessarily correlate with the severity of the patient's pain or the histology.[4]

Incidental appendectomy at the time of laparoscopic surgery has been reported as a good treatment option for women with chronic pelvic pain, with improvement in pain in as many as 97% of patients.[5] This is not surprising because histologic examination has revealed pathologies in as many as 66% of grossly normal appendices.[6]

Although several studies have shown a beneficial effect of laparoscopic appendectomy in the absence of gross pelvic disease, these studies had major flaws in their design or methodology.[5–7] These flaws include the use of single-arm, uncontrolled studies[5–7]; inconsistent definitions of chronic pelvic pain[5–7]; inclusion of children and men[6]; lack of adjustment for confounders such as concomitant surgery for endometriosis or other pelvic pathology[5–7]; and inconsistent use of a validated pain scale.[5–7] Thus, questions remain about the internal and external validity of these studies. The objective of this study was to assess the effectiveness of laparoscopic appendectomy in women undergoing laparoscopy for chronic pelvic pain for which no identifiable pathology was encountered.

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## MATERIALS AND METHODS

This study was approved by the Mayo Clinic Institutional Review Board. Study subjects were identified through retrospective medical record review for all women aged 15 to 50 years who underwent diagnostic laparoscopic surgery from January 1, 2001 to April 30, 2009 with a surgical indication of chronic pelvic pain or pelvic pain lasting 6 months or longer before surgery. Specific exclusion criteria were prior hysterectomy or bilateral oophorectomy, prior appendectomy, lack of documentation of the presence or absence of the appendix during surgery, grossly visible pathology (eg, endometriosis, adnexal masses, uterine leiomyomas), and abnormal histology. The remaining patients composed the laparoscopy cohort of patients who had no visible or histologic evidence of pelvic pathology. From this cohort, 2 groups were identified: women who underwent appendectomy and women who did not undergo appendectomy or any additional surgical procedures beyond visual inspection.

In the first phase of this study, baseline demographic information, including age, parity, location of pain, and history of endometriosis, was abstracted from the preoperative visit notes in each patient's medical record. The operative note and pathology report from the surgery were reviewed. The preoperative pain assessment was accessed through surgical consultation notes, as documented in the electronic medical record. The patient's postoperative pain assessment was taken from the first postoperative visit at 6 weeks or at the last episode of care that also included a documented pelvic pain rating.

In the second phase of the study, a questionnaire was mailed to all patients in the cohort during January 2010. The questionnaire asked patients to recall their pain both preoperatively and postoperatively using a validated 11-point numeric scale and the Pain Disability Index.[8,9] They were asked to rate their pain on a scale of 0 to 10, with 0 being "no pain" and 10 being "the worst pain imaginable." The Pain Disability Index asked patients to rate their preoperative and postoperative disability in 5 categories—family/home responsibilities, recreation, social activity, occupation, and sexual behavior—on a scale of 0 (meaning no disability) to 10 (meaning the worst disability). In addition, the survey included questions regarding any additional procedures they had undergone for chronic pelvic pain or any new medications they had been prescribed for chronic pelvic pain since their initial laparoscopic surgery.

The Survey Research Center at the Mayo Clinic administered the questionnaires. The initial contact included a letter detailing the study, a Health Insurance Portability and Accountability Act (HIPAA) form, and the questionnaire. Questionnaires were mailed with the expectation of a response within 6 weeks. Nonresponders were sent a second mailing after those 6 weeks, and nonresponders after the second mailing were then contacted by telephone.

Comparisons between 2 groups (ie, appendectomy vs nonappendectomy, responders vs nonresponders) were evaluated using the 2-sample $t$ test or Wilcoxon rank sum test for continuous or ordinal variables and the $\chi^2$ test or Fisher exact test, as appropriate, for categorical variables. Comparisons of preoperative versus postoperative pain ratings within a group were evaluated using the Wilcoxon signed rank test. All statistical analyses were 2-sided, and $P$ values $< .05$ were considered statistically significant. Statistical analyses were performed using SAS version 9.2 software (SAS Institute Inc, Cary, NC).

Previous outcome studies have suggested that pelvic pain improved in 80% to 97% of patients who underwent appendectomy at the time of laparoscopy.[5–7] Using a 2-tailed $\chi^2$ test with 2 groups of patients—16 in the appendectomy group and 110 in the nonappendectomy group—to detect improved pelvic pain from 90% in the appendectomy group to 30% in the laparoscopy group, gives a power 90%. Logistic regression modeling was used to adjust for age, body mass index, and other known confounders.

## RESULTS

### Medical Record Review

We identified 200 patients who underwent laparoscopy for chronic pelvic pain during the study period. After extensive review of the medical records, we found that 95 patients met the inclusion criteria and included them in the analyses—76 in the nonappendectomy group and 19 in the appendectomy group. There was no statistical difference between the 2 groups in age, parity, and history of endometriosis. There was, however, a statistically significant difference in the preoperative location of the pain, with women in the appendectomy group more likely to report right-sided pain than women in the nonappendectomy group (58% [11/19] vs 22% [17/76]; $P = .002$). Review of surgical pathology revealed abnormal pathology in 2 (11%) of the 19 patients in the appendectomy group (ie, mild acute appendicitis and chronic appendicitis).

The 6-week postoperative follow-up assessment was available for 14 of 19 patients (74%) in the appendectomy

group and 51 of 76 patients (67%) in the nonappendectomy group. Improvement in pain was reported in 13 of 14 patients (93%) in the appendectomy group and 8 of 51 patients (16%) in the nonappendectomy group ($P < .001$) **(Table 1)**. Women who underwent appendectomy were 70 times more likely to report improvement in pain compared with women who did not have appendectomy (odds ratio, 69.9; 95% confidence interval, 8.0–611.6; $P < .001$).

### Survey Results

In the second phase of the study, a questionnaire was mailed to all 95 patients. Of these, 36 (38%) completed both the questionnaire and the HIPAA form, and their responses were included in the data analysis. The median duration from the initial laparoscopic surgery to the questionnaire response was 4.2 years (range, 0.9–9.3). An additional 10 patients who completed the questionnaire but did not return the HIPAA form were categorized as nonresponders and were excluded from the analysis. In the appendectomy group, 8 of 19 patients (42%) responded, and in the nonappendectomy group, 28 of 76 (37%) responded. There were no significant differences in baseline demographics between responders and nonresponders (data not shown).

For all 6 pain and disability measures, preoperative pain and disability data were not significantly different between the 2 groups. In the nonappendectomy group, the range in median values for the 6 measures was 4.5 to 8.0 before surgery and 1.5 to 3.0 after surgery, with a range in the median change of 1.0 to 4.0 **(Table 2)**. In the appendectomy group, the range in median values was 6.0 to 8.0 before surgery and 0 to 2.0 after surgery, with a range in the median change of 4.0 to 5.0 **(Table 3)**. Although the median (and mean) change was greater in the appendectomy group than in the nonappendectomy group, the difference was not statistically significant.

Finally, the survey data did not show any significant differences in the need for narcotic pain medications, surgical procedures for pain, and chiropractic or physical therapy services after the initial laparoscopic procedure **(Table 4)**.

## DISCUSSION

This retrospective cohort study was performed to assess the effectiveness of laparoscopic appendectomy on pelvic pain improvement in patients with no identifiable pelvic pathology. At a 6-week postoperative follow-up visit, 93% of patients who underwent appendectomy had an improvement in pain. In addition, in a survey completed after surgery, the patients in the appendectomy group reported a greater mean decrease in pain than did the nonappendectomy group. The pain improvements that we found were similar to those of other studies assessing the effectiveness of appendectomy, including a prospective study by AlSalilli and Vilos,[5] who found a 97% improvement in pain after appendectomy. These numbers are consistent with the results of previous studies and show promise in the treatment of pelvic pain.

Previous studies have assessed appendectomy as a possible treatment for patients with chronic pelvic pain and have shown improvement in pain, with rates from 89% to 97%.[5,6,10] Despite undergoing extensive medical and radiologic evaluation, 97% of patients with recurrent right lower quadrant pain reported immediate relief of pain and

**Table 1.**
Results from the First Phase of the Study: Pain Improvement at 6 Weeks after Laparoscopic Surgery[a]

| Characteristic | Appendectomy Group (N = 19) | | Nonappendectomy Group (N = 76) | | *P* Value Comparing the 2 Groups with Follow-up |
|---|---|---|---|---|---|
| | Follow-up (n = 14) | No Follow-up (n = 5) | Follow-up (n = 51) | No Follow-up (n = 25) | |
| Age (y), mean (SD) | 26.3 (8.3) | 23 (4.1) | 29.6 (8.5) | 27.3 (7.8) | .21 |
| Parity ≥1 | 3 (21) | 2 (40) | 24 (47) | 9 (36) | .08 |
| History of endometriosis | 5 (36) | 0 | 13 (25) | 4 (16) | .45 |
| Right-sided pain (documented locations) | 10/12 (83) | 1/4 (25) | 11/29 (38) | 6/13 (46) | .008 |
| Improvement in pain at 6-week follow-up assessment | 13 (93) | — | 8 (16) | — | < .001 |

[a]Values are expressed as number (%) unless indicated otherwise.

**Table 2.**
Results from Survey Data: Pain Disability Index Scores Before and After Surgery for Patients in the Nonappendectomy Group[a]

| Life Activity and Pain Categories | Patients Without Concurrent Appendectomy (n = 28) | | |
|---|---|---|---|
| | Before Surgery Mean (SD) Median | After Surgery Mean (SD) Median | Before–After Difference Mean (SD) Median |
| Family/home responsibilities | 5.1 (2.8) | 2.8 (2.9) | 2.3 (2.8) |
| | 5 | 2 | 1.5 |
| Recreation | 5.8 (3) | 3 (2.9) | 2.8 (3.4) |
| | 5.5 | 3 | 1.5 |
| Social activity | 5.1 (3.2) | 2.9 (3.2) | 2.2 (2.7) |
| | 5.5 | 1.5 | 1 |
| Occupation | 5 (3.5) | 2.8 (3.3) | 2.2 (3) |
| | 4.5 | 2 | 1 |
| Sexual behavior | 6.2 (2.9) | 3.1 (3.2) | 3.2 (3.4) |
| | 6.0 | 2.5 | 2.5 |
| Pain | 7.2 (2) | 3.6 (3) | 3.6 (3.2) |
| | 8 | 3 | 4 |

[a]Mean changes were 1.0 to 4.0 for all categories assessed.

**Table 3.**
Results from Survey Data: Pain Disability Index Scores Before and After Surgery for Patients in the Appendectomy Group

| Life Activity and Pain Categories | Patients with Concurrent Appendectomy (n=8) | | |
|---|---|---|---|
| | Before Surgery Mean (SD) Median | After Surgery Mean (SD) Median | Before–After Difference Mean (SD) Median |
| Family/home responsibilities | 5.5 (3.7) | 1.1 (1.4) | 4.4 (3.3) |
| | 6.5 | 0.5 | 4.5 |
| Recreation | 6 (4.1) | 1.4 (1.8) | 4.6 (3.5) |
| | 7 | 0.5 | 4.5 |
| Social activity | 4.9 (3.5) | 1 (1.4) | 3.9 (2.8) |
| | 6 | 0 | 4.5 |
| Occupation | 5.1 (3.6) | 1 (1.1) | 4.1 (3.5) |
| | 6 | 1 | 4 |
| Sexual behavior | 6.6 (3.1) | 2.3 (2.6) | 4.4 (3.3) |
| | 7 | 1.5 | 5 |
| Pain | 7.3 (2.5) | 2.5 (2.2) | 4.8 (3.2) |
| | 8 | 2 | 5 |

89% reported no recurrence, with a median follow-up of 19 months.[6] In 1 study, with an appendectomy rate of 60% in patients with right-sided chronic pelvic pain, the pain was relieved in 97%.[5]

Studies have evaluated the operative complication rate and mortality rate and have found no increase in groups of patients in whom appendectomy was performed.[11,12] In one study assessing laparoscopic appendectomy for sus-

**Table 4.**
Results from Survey Data: Secondary Outcomes[a]

| Outcome | Nonappendectomy Group (n = 28) | Appendectomy Group (n = 8) | *P* Value[b] |
|---|---|---|---|
| Additional surgery[c] | | | .30 |
| No | 25 (89) | 6 (75) | |
| Yes | 3 (11) | 2 (25) | |
| Additional procedures[d] | | | .56 |
| Missing | 0 (0) | 1 (13) | |
| No | 23 (82) | 7 (100) | |
| Yes | 5 (18) | 0 (0) | |
| Narcotic pain medications | | | > .99 |
| No | 25 (89) | 8 (100) | |
| Yes | 3 (11) | 0 (0) | |

[a]Values are expressed as number (%) unless indicated otherwise.

[b]Fisher exact test.

[c]Additional surgical procedures for pelvic pain.

[d]Chiropractic or physical therapy services for pelvic pain.

pected acute appendicitis, the overall mortality rate was 0% and the general morbidity rate was 1%.[13] In a study of 100 patients undergoing incidental appendectomy at the time of pelvic laparoscopic surgery, no increase in morbidity associated with the additional procedure was found.[14] Similarly, our study found no complications in the negative laparoscopy cohort. Because total complications with laparoscopy are low, a larger sample size is needed to better assess whether appendectomy performed at the time of laparoscopic surgery contributes to an increase in complications of gynecologic laparoscopic surgery.

In our study, 2 of 19 patients had abnormal appendix at the time of surgery (ie, mild acute appendicitis and chronic appendicitis). Similarly, Drozgyik et al[15] found chronic appendicitis in 3.8% of their patients. Other studies have shown a higher percentage of abnormal histologic or gross appendices. One study of 356 patients undergoing laparoscopic surgery found that 30.2% of the appendix specimens had abnormal histology, including lymphoid hyperplasia, endometriosis, and chronic and acute appendicitis.[11] Wie et al[16] reported similar findings in 34.9% of histologic abnormalities. In a study of 231 women with endometriosis, 115 women had pathologic abnormalities in their appendix when it was removed at the time of their surgery for chronic pelvic pain.[17] These abnormal histologic findings may contribute to chronic pelvic pain, specifically right lower quadrant pain. Other studies have shown long-term improvement of pain in patients who underwent appendectomy, regardless of whether abnormal pathology was present at the time the appendix was removed.[12]

Our study serves to better elucidate the relationship between appendectomy and improvement of chronic pelvic pain. Compared with prior studies, our study has several strengths. First, it is a cohort study with specifically defined exclusion criteria. It is also a single-institution study, providing a more consistent definition of chronic pelvic pain and more standardized surgical practices and postoperative follow-up. We also used a validated assessment of pain, with the 11-point numeric pain scale and the Pain Disability Index.

One of the main limitations of our study is its retrospective nature. In addition, we had a poor response rate in the second phase of the study. Only 38% of the cohort responded to the survey, although there were no demographic or clinical differences between responders and nonresponders. The inadequate response undermined efforts to quantify any differences between the groups in the need for additional analgesic use and surgical interventions. Also, recall bias may have been a factor because the survey was sent during a defined period, regardless of when the patient's surgery was performed. Although we believe a well-designed, randomized controlled trial can

address the design limitations of this study, enrollment could be challenging.

This study has demonstrated in the short term the effectiveness of appendectomy in patients with chronic pelvic pain, especially right-sided pelvic pain that has no obvious pelvic pathology. Long-term outcomes data from randomized clinical trials are needed to validate these findings.

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