

Laparoscopic versus Open Appendectomy: Is There a Difference?

Long KH, Bannon MP, Zietlow SP, et al. A prospective randomized comparison of laparoscopic appendectomy with open appendectomy: clinical and economic analyses. *Surgery* 2001;129:390-400.

Study Overview

Objective. To determine whether there are differences in clinical or economic outcomes for patients with suspected appendicitis undergoing open versus laparoscopic appendectomy.

Design. Randomized trial with both clinical and economic data collection. Analyses were by intention to treat. Economic analysis took a societal perspective and used standardized cost data.

Setting and participants. Consecutive patients presenting to the emergency department in a single U.S. center were enrolled if they had a clinical diagnosis of uncomplicated appendicitis. Patients were excluded who had a palpable right lower quadrant mass (known phlegmon or abscess), diffuse peritonitis, or septic shock; were pregnant; were younger than 15 years; or experienced pain onset after arrival at the hospital. Baseline characteristics of 198 randomized subjects were not presented in the article.

Intervention. Patients underwent either a standardized open appendectomy or a nonstandardized laparoscopic appendectomy. Before surgery, all patients received 1 g of cefoxitin intravenously or, if they were allergic to penicillin, 600 mg of clindamycin and 1 g of aztreonam intravenously. Antibiotics were continued postoperatively only in patients with gangrenous or perforative appendicitis and only if temperature had remained less than 38°C for 24 hours and white blood cell count was less than 10,000 cells/mm³. Postoperative analgesia was standardized as were criteria for discharge.

Main outcome measures. The primary clinical outcome was not clearly stated, although the sample size was calculated to detect a reduction in hospital length of stay (LOS). Other clinical endpoints evaluated how quickly patients recovered (eg, number of days to return to full activity), need for analgesics, and satisfaction. Cost data were also broken down into a number of categories and summary values. Presumably, total costs (direct plus indirect) were of main concern.

Main results. 84% of patients in both groups had histopathologically confirmed appendicitis. No significant differences between groups were seen in appendicitis type (simple, 44% in the laparoscopic group versus 47% in the open group; suppurative, 28% versus 26%; perforative, 10% in both groups; gangrenous, 3% versus 4%). Two patients in the laparoscopic group and 8 in the open group required other procedures ($P = 0.11$), and 15 patients underwent a conversion from laparoscopic to open technique (8 because of perforative appendicitis, the remainder for a variety of reasons). Laparoscopic patients required less parenteral analgesia than open-surgery patients (1.6 versus 2.2 days' worth; 33.3 mg versus 53.5 mg of morphine or equivalent; $P < 0.001$ for both measures) and were able to return to a regular diet faster (1.6 versus 2.3 days, $P = 0.002$). However, no significant differences were found with regard to total hospital days, time to return to work or school or to full activity, postoperative complications, or total costs (\$11,577 for laparoscopic versus \$13,965 for open appendectomy; 95% confidence interval for difference, -\$5156 to \$380).

Conclusion. Laparoscopic and open appendectomy appear to be roughly equivalent in terms of clinical and economic outcomes.

Commentary

This was a generally well-designed study with a very well-done economic analysis. It would have been helpful if Long and colleagues had reported baseline patient characteristics in order to determine the generalizability of their findings. Of note, the study was powered to detect an LOS reduction from an estimated 4.2 days to 2.9 days. Actual mean LOS was 2.9 days and 3.5 days, respectively, in the laparoscopic versus open-procedure groups. To demonstrate a significant effect, the laparoscopic group would have had to show a mean LOS of 2.2 days. It seems unlikely that this could have been achieved, as the median LOS was 2 days in both groups; reducing LOS further would probably require discharging patients within 24 hours of surgery.

Unfortunately, this study was underpowered to detect economically significant savings. In the intention-to-treat analysis, there was a 17% reduction in total costs (not charges) from a societal perspective. Saving more than \$2000 per patient seems like a good reason to favor laparoscopic appendectomy for as many patients as possible, but not unless the finding is statistically significant. Long and colleagues also did a “pure analysis” based on the procedure that patients actually received and found a highly significant \$4830 savings. This analysis, however, is not valid for making conclusions. Such analyses remove the effects of

randomization, and in the real world it is the general strategy used (ie, all patients will have laparoscopic appendectomies if there is no clinical indication otherwise), and not what care individual patients receive, that accounts for overall costs.

Applications for Clinical Practice

At this time, neither laparoscopic nor open procedures show a clearly documented advantage, clinical or economic, for patients with uncomplicated appendicitis. Either procedure should be considered acceptable.

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