

Outpatient laparoscopic appendectomy should be the standard of care for uncomplicated appendicitis

Richard C. Frazee, MD, Stephen W. Abernathy, MD, Matthew Davis, MD, John C. Hendricks, MD, Travis V. Isbell, MD, Justin L. Regner, MD, and Randall W. Smith, MD, Temple, Texas

AAST Continuing Medical Education Article

Accreditation Statement

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship of the American College of Surgeons and the American Association for the Surgery of Trauma. The American College of Surgeons is accredited by the ACCME to provide continuing medical education for physicians.

AMA PRA Category 1 Credits™

The American College of Surgeons designates this journal-based CME activity for a maximum of 1 *AMA PRA Category 1 Credit*™. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

Of the *AMA PRA Category 1 Credit*™ listed above, a maximum of 1 credit meets the requirements for self-assessment.

Credits can only be claimed online at this point.



AMERICAN COLLEGE OF SURGEONS
*Inspiring Quality:
Highest Standards, Better Outcomes*

Objectives

After reading the featured articles published in the *Journal of Trauma and Acute Care Surgery*, participants should be able to demonstrate increased understanding of the material specific to the article. Objectives for each article are featured at the beginning of each article and online. Test questions are at the end of the article, with a critique and specific location in the article referencing the question topic.

Claiming Credit

To claim credit, please visit the AAST website at <http://www.aast.org/> and click on the "e-Learning/MOC" tab. You must read the article, successfully complete the post-test and evaluation. Your CME certificate will be available immediately upon receiving a passing score of 75% or higher on the post-test. Post-tests receiving a score of below 75% will require a retake of the test to receive credit.

System Requirements

The system requirements are as follows: Adobe® Reader 7.0 or above installed; Internet Explorer® 7 and above; Firefox® 3.0 and above, Chrome® 8.0 and above, or Safari™ 4.0 and above.

Questions

If you have any questions, please contact AAST at 800-789-4006. Paper test and evaluations will not be accepted.

Disclosure Information

In accordance with the ACCME Accreditation Criteria, the American College of Surgeons, as the accredited provider of this journal activity, must ensure that anyone in a position to control the content of *J Trauma Acute Care Surg* articles selected for CME credit has disclosed all relevant financial relationships with any commercial interest. Disclosure forms are completed by the editorial staff, associate editors, reviewers, and all authors. The ACCME defines a 'commercial interest' as "any entity producing, marketing, re-selling, or distributing health care goods or services consumed by, or used on, patients." "Relevant" financial relationships are those (in any amount) that may create a conflict of interest and occur within the 12 months preceding and during the time that the individual is engaged in writing the article. All reported conflicts are thoroughly managed in order to ensure any potential bias within the content is eliminated. However, if you perceive a bias within the article, please report the circumstances on the evaluation form.

Please note we have advised the authors that it is their responsibility to disclose within the article if they are describing the use of a device, product, or drug that is not FDA approved or the off-label use of an approved device, product, or drug or unapproved usage.

Disclosures of Significant Relationships with Relevant Commercial Companies/Organizations by the Editorial Staff:

Ernest E. Moore, Editor: PI, research support, Haemonetics; PI, research support, TEM Systems, Inc. Ronald V. Maier, Associate editor: consultant, consulting fee, LFB Biotechnologies. Associate editors: David Hoyt and Steven Shackford have nothing to disclose. Editorial staff: Jennifer Crebs, Jo Fields, and Angela Sauaia have nothing to disclose.

Author Disclosures: The authors have nothing to disclose.

Cost

For AAST members and *Journal of Trauma and Acute Care Surgery* subscribers there is no charge to participate in this activity. For those who are not a member or subscriber, the cost for each credit is \$25.

Submitted: July 31, 2013, Revised: September 25, 2013, Accepted: September 25, 2013.

From the Trauma Surgery, Scott & White Healthcare, Texas A&M Health Science Center, Temple, Texas.

This article was presented at the 72nd annual meeting of the American Association for the Surgery of Trauma, September 18–21, 2013, in San Francisco, California.

Address for reprints: Richard C. Frazee, MD, Trauma Surgery, Scott & White Healthcare, Texas A&M Health Science Center, 2401 South 31st St, Temple, Texas 76702; email: RFRAZEE@sw.org.

DOI: 10.1097/TA.0b013e3182ab0d42

J Trauma Acute Care Surg
Volume 76, Number 1

BACKGROUND:	In 2012, a protocol for routine outpatient laparoscopic appendectomy for uncomplicated appendicitis was published reflecting high success, low morbidity, and significant cost savings. Despite this, national data reflect that the majority of laparoscopic appendectomies are performed with overnight admission. This study updates our experience with outpatient appendectomy since our initial report, confirming the efficacy of this approach.
METHODS:	In July 2010, a prospective protocol for outpatient laparoscopic appendectomy was adopted at our institution. Patients were dismissed from the postanesthesia recovery room or day surgery if they met predefined criteria for dismissal. Patients admitted to a hospital room as either full admission or observation status were considered failures of outpatient management. An institutional review board–approved retrospective review of patients undergoing laparoscopic appendectomy for uncomplicated appendicitis from July 2010 through December 2012 was performed to analyze success of outpatient management, postoperative morbidity and mortality, as well as readmission rates.
RESULTS:	Three hundred forty-five patients underwent laparoscopic appendectomy for uncomplicated appendicitis during this time frame. There were 166 men and 179 women, with a mean age of 35 years. Three hundred five patients were managed as outpatients, with a success rate of 88%. Forty patients (12%) were admitted for preexisting comorbidities (15 patients), postoperative morbidity (6 patients), or lack of transportation or home support (19 patients). Twenty-three patients (6.6%) experienced postoperative morbidity. There were no mortalities. Four patients (1%) were readmitted for transient fever, nausea/vomiting, partial small bowel obstruction, and deep venous thrombosis.
CONCLUSION:	Outpatient laparoscopic appendectomy can be performed with a high rate of success, a low morbidity, and a low readmission rate. This study reaffirms our original pilot study and should serve as the basis for a change in the standard of care for appendicitis. (<i>J Trauma Acute Care Surg.</i> 2014;76: 79–83. Copyright © 2014 by Lippincott Williams & Wilkins)
LEVEL OF EVIDENCE:	Therapeutic study, level V.
KEY WORDS:	Outpatient; laparoscopic appendectomy.

Laparoscopic surgery has many well-recognized advantages over open surgery including less pain, shorter hospitalization, and quicker return to full activities. As laparoscopy has been applied to a number of operations, an increasing number of these operations have transitioned from inpatient to outpatient procedures. This includes laparoscopic cholecystectomy, gastric banding, fundoplication, hernia repair, and even gastric bypass.^{1–3} An exception to this trend has been laparoscopic appendectomy. Guller et al.⁴ found that the average length of stay after laparoscopic appendectomy was 2.06 days.

Appendicitis can present as a spectrum of disease severity ranging from acute uncomplicated inflammation to perforation with significant intraperitoneal contamination. The choice of treatment and risk of complications are largely based on the presenting severity of disease. Our focus on outpatient appendectomy has been limited to patients with uncomplicated acute inflammation in the adult population. In 2012, we published data reporting our initial experience with an outpatient care protocol for laparoscopic appendectomy for uncomplicated appendicitis.⁵ One hundred sixteen patients managed with the protocol were compared with 119 historic controls. Outpatient management increased from 35% to 85% with the initiation of the protocol. Postoperative morbidity was not significantly different with outpatient management, and during this initial analysis, there were no readmissions. Since completion of that study, outpatient laparoscopic appendectomy has become the standard of care for uncomplicated appendicitis at our institution. This report updates our previous experience and further validates that this approach should have wider application nationally in the treatment of patients with uncomplicated appendicitis.

PATIENTS AND METHODS

An institutional review board–approved retrospective review of patients who underwent laparoscopic appendectomy for uncomplicated appendicitis from July 2010 through

December 2012 was performed. Patients were analyzed for demographics, success of outpatient management, reason for admission, postoperative morbidity, and need for readmission. The protocol was applied to all nonpregnant patients age 17 years and older who were scheduled for laparoscopic appendectomy. Patients who were found intraoperatively to have necrotizing or perforated appendicitis were excluded from the protocol and are not included in the analysis.

Protocol

All patients were identified and diagnosed with acute appendicitis with standard diagnostic methods including clinical impression and radiographic imaging. Patients were extensively counseled preoperatively on the plans for dismissal from the postanesthesia care unit (PACU) after surgery. Arrangements were made for laparoscopic appendectomy at the next available operating time regardless of the time of presentation to the hospital. No patient was delayed until the next morning. A single dose of parenteral antibiotic was administered perioperatively. Antibiotics were not continued postoperatively without a separate clinical indication. All patients underwent laparoscopic appendectomy with a 3-trocar technique. Conversion to open appendectomy was left to the discretion of the attending surgeon. All operations were performed by the surgical resident staff with the attending surgeon's direct supervision. Trocar sites were injected with 10 mL of 0.25% bupivacane hydrochloride with epinephrine. Patients were given 30 mg of ketorolac intravenously at the end of the procedure unless they had a clinical contraindication to administration. Anesthetic care was not standardized, but the expectation of outpatient management influenced anesthetic management to maximize rapid reversal of paralytics. Postoperatively, patients recovered in the PACU. They were given a full-liquid diet in the PACU and instructed to advance their diet at home as tolerated. Counseling on postoperative care and restrictions was given preoperatively with a preprinted instruction sheet that also included contact information and follow-up appointments. Prescriptions for postoperative analgesia were given

to family members, and directions to the closest 24-hour pharmacy were provided for patients having surgery during the night. They were monitored until the following discharge criteria were met:

1. Ability to tolerate liquid intake
2. Ability to ambulate
3. Pain controlled with oral analgesics using a visual analog scale
4. Hemodynamic stability
5. Adequate respiratory effort
6. No alteration in mental status from baseline
7. Ability to urinate
8. Nausea and vomiting controlled
9. Physician approval
10. Appropriate supervision and assistance at home.

Any patient with comorbidities that precluded the option of dismissal was admitted as deemed clinically necessary. In addition, select operative interventions or complications could result in admission at the discretion of the attending surgeon and were considered failures of outpatient management. All patients were given appointments for follow-up 2 weeks postoperatively.

RESULTS

From July 2010 through December 2012, 345 patients had a laparoscopic appendectomy for uncomplicated appendicitis. There were 166 men and 179 women, with a mean age of 35 years (range, 17–83 years). The mean body mass index was 31 (median 29) and ranged from 19 to 50. Approximately one third of the patients had undergone previous abdominal surgery. Preexisting comorbidities included hypertension (29%), diabetes mellitus (11%), coronary artery disease (4%), and chronic obstructive pulmonary disease (1%). The mean (SD) time from presentation to surgery was 305 (205) minutes. Three hundred five patients (88%) met outpatient management criteria and were dismissed from the PACU. Dismissal occurred between 6:00 AM and 12:00 noon in 30%, between 12:00 noon and 6:00 PM in 15%, between 6:00 PM and 12:00 midnight in 25%, and between 12: midnight and 6:00 AM in 30% of the patients. The time from completion of the surgery to dismissal averaged 171 minutes (range, 50–711 minutes). Forty patients (12%) required admission. The reasons for admission included the following: preexisting comorbidities in 15 patients, postoperative morbidity in 6 patients, and lack of transportation in 19 patients. Overall, 23 patients (6.6%) experienced postoperative morbidity including urinary retention, wound infection/seroma/hematoma, enterotomy, cecal serosal injury, chronic obstructive pulmonary disease exacerbation, and deep venous thrombosis in a patient with factor V Leiden deficiency. There was one conversion from laparoscopic to an open procedure in the patient with the operative enterotomy that occurred during lysis of adhesions. There were no mortalities. Only 4 (1%) of 305 patients discharged home required readmission for transient fever, postoperative nausea and vomiting, partial small bowel obstruction, and deep venous thrombosis. Counting the four readmissions, the overall success of outpatient management was 87%. Outpatient follow-up was scheduled at 2 weeks

postoperative, and 86% of the patients had follow-up clinic visits or telephone follow-up.

DISCUSSION

In the early 1990s, surgeons debated over the merits of the laparoscopic appendectomy compared with the traditional open technique. Several studies showed a significant decrease in length of stay, favoring laparoscopic over open appendectomy.^{5–8} Similar studies demonstrated the same effect in other laparoscopic operations. In 1992, outpatient laparoscopic cholecystectomy was introduced and has now become the standard of care for this procedure.⁹ Despite the growing evidence of the success of outpatient management for many laparoscopic procedures, surgeons were resistant to the concept of outpatient laparoscopic appendectomy.

Jain et al.¹⁰ reported success with selective use of outpatient management in 35 of 75 patients having laparoscopic appendectomy. The outpatient group had no complications, and the authors concluded that outpatient appendectomy was safe for acute nonperforated appendicitis. Dubois et al.¹¹ developed a protocol for outpatient appendectomy and found that 45% of the patients were able to be dismissed at a median of 4.7 hours postoperatively. A review from the Armed Forces Health Surveillance Center reported that between 2002 and 2011, hospitalization averaged 1.6 days following laparoscopic appendectomy for nonperforated acute appendicitis. During this time frame, outpatient management increased fourfold to 33% in 2011.¹² Before the adoption of our protocol, we performed outpatient laparoscopic appendectomy on a selective basis.¹³ With this selective approach, 35% of the patients were managed as outpatients, and 65% were admitted for 1 day to 5 days postoperatively. There was no difference in morbidity between patients admitted and those treated as outpatients. Upon further analysis of our patients who were admitted, it was difficult to determine retrospectively a medical indication for the admission in the majority of patients. It seemed that admission was based on the surgeon's previous practice experience rather than medical necessity.

This interval review caused us to question the value of routine inpatient admission for laparoscopic appendectomy for uncomplicated appendicitis. In July 2010, we adopted a protocol for outpatient management of this specific group of patients. We reported our initial results after adoption of the outpatient protocol in 2012. In that study, 116 protocol patients were compared with 119 historic controls. Outpatient management increased from 35% to 85% with the initiation of the protocol, with no increase in postoperative morbidity, mortality, or readmissions.

As with all new treatment options, our approach was greeted with an appropriate degree of skepticism from many in the surgical community. Since its publication however, a current literature review did not reveal any new publications that confirmed or refuted our approach. We therefore undertook the current review to update and add to our experience with outpatient management. We have now managed 345 patients with this protocol, with an overall success of outpatient care in 87% of the patients. Postoperative morbidity has remained low as expected in this relatively young and otherwise healthy patient

population. The reasons for admission included lack of transportation, preexisting comorbidities, and postoperative morbidities. The readmission rate of 1% and no mortalities speak well for this approach.

The success with this approach should challenge the current “standard of care” of admission for uncomplicated appendicitis. Certainly from an economic standpoint, an argument could be made for this transition. Length of stay following laparoscopic appendectomy for uncomplicated appendicitis ranges from 1.6 days to 2.1 days.¹⁴ The average cost for a day of hospitalization is estimated at \$1,900.¹⁵ The 2008 Healthcare Cost and Utilization data revealed that 357,000 appendectomies are performed in the United States each year.¹⁶ If an outpatient protocol were applied universally, it would result in annual health care savings of \$921,500,000. In addition, several studies show improved patient outcomes with early operative intervention for acute appendicitis. They demonstrated lower infectious complications and readmissions with a policy of immediate rather than delayed operative intervention.^{17,18} Finally, the development of acute care services that provide around the clock emergency/urgent care facilitates the ability of hospitals to provide laparoscopic appendectomy as an outpatient at any time of the day. In our experience, there was a relatively even distribution of dismissal times throughout the 24-hour day.

It has been questioned whether outpatient management produces the same degree of patient satisfaction as admission. Although we did not survey our patients postoperatively, they were generally pleased to learn that they would not have to stay in the hospital following their surgery. This is, however, a valid question that was not directly addressed. Since completion of this study, a follow-up questionnaire was initiated, which will address patient satisfaction with outpatient laparoscopic appendectomy. Alkhoury et al.¹⁹ looked at patient and family satisfaction in outpatient laparoscopic appendectomy in the pediatric population and found good parent satisfaction with same-day dismissal. With appropriate preoperative counseling and instruction, high patient satisfaction can be maintained.

CONCLUSION

Outpatient laparoscopic appendectomy for uncomplicated appendicitis is now our routine practice, with selective admission based on preexisting patient comorbidities, lack of home support or transportation, and postoperative morbidity. This approach has led to successful outpatient management in greater than 85% of the patients with minimal morbidity and low readmission rates. We propose that this approach should have wider application nationally, especially at hospitals with dedicated acute care services. This approach will translate into significant cost savings and potential improvements in patient care.

AUTHORSHIP

R.C.F. and S.W.A. designed this study, conducted the literature search, and collected data. All authors contributed to data analysis and interpretation. R.C.F. wrote the manuscript, which all authors critically revised.

ACKNOWLEDGMENT

We thank the contributions of Gina Du Par in editing and formatting.

DISCLOSURE

The authors declare no conflicts of interest.

REFERENCES

- Smith R, Kolyn D, Pace R. Outpatient laparoscopic cholecystectomy. *HPB Surg*. 1994;7:261–264.
- Symanski J, Voitk A, Joffe J, Alvarez C, Rosenthal G. Technique and early results of outpatient laparoscopic onlay mesh repair of ventral hernias. *Surg Endosc*. 2000;14:582–584.
- McCarty TM, Arnold DT, Lamont JP, Fisher TL, Kuhn JA. Optimizing outcomes in bariatric surgery: outpatient laparoscopic gastric bypass. *Ann Surg*. 2005;242:494–498.
- Guller U, Hervey S, Purves H, Muhlbaier HL, Peterson ED, Eubanks S, Pietrobon R. Laparoscopic versus open appendectomy outcomes comparison based on a large administrative database. *Ann Surg*. 2004;239:43–52.
- Cash CL, Frazee RC, Abernathy SW, Childs EW, Davis ML, Hendricks JC, Smith RW. A prospective treatment protocol for outpatient laparoscopic appendectomy for acute appendicitis. *J Am Coll Surg*. 2012;215:101–105.
- Richards W, Watson D, Lynch G, Reed GW, Olsen D, Spaw A, Holcomb W, Frexes-Steed M, Goldstein R, Sharp K. A review of the results of laparoscopic versus open appendectomy. *Surg Gynecol Obstet*. 1993;177:473–480.
- Attwood SE, Hill AD, Murphy PG, Thornton J, Stephens RB. A prospective randomized trial of laparoscopic versus open appendectomy. *Surgery*. 1992;112:497–501.
- Frazee RC, Roberts JW, Symmonds RE, Snyder SK, Hendricks JC, Smith RW, Custer MD 3rd, Harrison JB. A prospective randomized trial comparing open versus laparoscopic appendectomy. *Ann Surg*. 1994;219:725–728; discussion 728–731.
- Reddick EJ. Laparoscopic cholecystectomy in freestanding outpatient centers. *J Laparoendosc Surg*. 1992;2:65–67.
- Jain A, Mercado PD, Grafton KP, Dorazio RA. Outpatient laparoscopic appendectomy. *Surg Endosc*. 1995;9:424–425.
- Dubois L, Vogt KN, Davies W, Schlachta CM. Impact of an outpatient appendectomy protocol on clinical outcomes and cost: a case-control study. *J Am Coll Surg*. 2010;211:731–737.
- Appendicitis and Appendectomies, Active and Reserve Components, U.S. Armed Forces, 2002–2011. Medical Surveillance Monthly Report 2012;19:7 Available at: <http://www.dtic.mil/dtic/tr/fulltext/u2/a570998.pdf>. Accessed February 20, 2013.
- Cash CL, Frazee RC, Smith RW, Davis ML, Hendricks JC, Childs EW, Abernathy SW. Outpatient laparoscopic appendectomy for acute appendicitis. *Am Surg*. 2012;78:213–215.
- Worni M, Østbye T, Gandhi M, Rajgor D, Shah J, Shah A, Pietrobon R, Jacobs DO, Guller U. Laparoscopic appendectomy outcomes on the weekend and during the week are no different: a national study of 151,774 patients. *World J Surg*. 2012;36:1527–1533.
- HCUP Databases: Healthcare Cost and Utilization Project, 2009 National Statistics. Available at: www.hcup-us.ahrq.gov/. Accessed February 20, 2012.
- HCUP Databases: Healthcare Cost and Utilization Project, 2008 National Inpatient Sample (NIS). Available at: www.hcup-us.ahrq.gov/. Accessed February 20, 2012.
- DiTillo MF, Dziura JD, Rabinovici R. Is it safe to delay appendectomy in adults with acute appendicitis? *Ann Surg*. 2006;244:656–660.
- Udgiri N, Curras E, Kella VK, Nagpal K, Cosgrove J. Appendicitis, is it an emergency? *Am Surg*. 2011;77:898–901.
- Alkhoury F, Burnweit C, Malvezzi L, Knight C, Diana J, Pasaron R, Mora J, Nazarey P, Aserlind A, Stylianios S. A prospective study of safety and satisfaction with same-day discharge after laparoscopic appendectomy for acute appendicitis. *J Pediatr Surg*. 2012;47:313–316.

DISCUSSION

Dr. Andrew B. Peitzman (Pittsburgh, Pennsylvania): This is a well-written paper which continues a series of contributions from the authors addressing management of acute appendicitis.

A 1994 paper from the authors prospectively compared laparoscopic to open appendectomy. As mentioned in the presentation, in 2012 the authors reported and described their protocol for outpatient management of laparoscopic appendectomy, comparing 116 patients to a matched historical cohort group. This paper is an update of the 2012 paper and now includes 345 patients.

I have two questions or areas where I need expansion from the authors.

First, you assume that your patients are home, happy and doing well after discharge. They may not be. Your conclusions would be more valid if the patients had completed a questionnaire that stated that they were home and doing well, as other authors have done in studying this disease.

Second, you provided mean times from the ED to the operating room and from completion of surgery to discharge. Can you provide median times?

Again, I congratulate you on a well-presented and well-written paper.

Dr. Michael T. White (Detroit, Michigan): What did you do to set this up postoperatively for your staff that got the patient discharged? Half the challenge in setting up something like this is to make sure the patient is well-informed in terms of what they're to expect when you get into discharge planning and set up.

What did you do to do that? Did you make any changes for these patients to try to ensure that they would have a successful outcome when they went home?

Dr. Norris Childs (Walnut Creek, California): How did you and, more importantly, how does your hospital define a one-day admission?

Dr. David P. Blake (Norfolk, Virginia): Great paper. My question alludes to what my predecessor just commented on. Just because we can discharge somebody at three o'clock in the morning, most 24-hour stays allow you up to 24 hours. Why not keep them a few hours in a holding area to ensure that they, in fact, are doing well?

Dr. Richard Frazee (Temple, Texas): I'd like to thank Dr. Peitzman and the other discussants for their questions. In answering the median time, there was a fairly even distribution of times. Median time was 188 minutes. There wasn't a

huge difference between our mean and median. That's why we reported the mean.

Patient satisfaction is certainly something that needs to be looked and, admittedly, is a deficiency in our current study. We are in the process of doing a follow-up study where we are doing just what Dr. Peitzman suggested and sending questionnaires to our patients.

We have an interim analysis on 27 patients. And our average satisfaction score on a scale of 1 to 5 is 4.3. So we will be doing a completion of that study to further analyze patient satisfaction in greater detail.

I am puzzled though, by the concept that a night in the hospital is a great patient satisfaction quality indicator. Somehow a night in an unfamiliar bed; with hospital food; and nurses, medical students and residents waking you up through the night doesn't seem like it is something that is going to help our H-CAP scores.

And as far as preparing our staff for outpatient management, we did go through an educational process when we implemented the protocol.

A lot of this has to do with preoperative education of our patients, so we spend a considerable amount of time in that preoperative period explaining to the patients that this will be done as an outpatient.

We provide them with a preprinted instruction sheet that has our contact numbers, their follow-up appointments, and their instructions for after the operation.

Their expectation is that they are having a minimally-invasive operation and, as a result of that, the recovery is going to be quick and they can go home. The patients' expectations are set, and their acceptance of it is quite good.

The main logistical change we had was related to nighttime dismissal from the post-anesthetic care unit. Typically patients would go to the day surgery unit during the day so we did have to do some education of our PACU nurses.

The question regarding the one-day admission, we considered any admission into a hospital bed, whether it be a full admission or observation status, a failure of outpatient management. These patients were counted as admissions in our analysis.

And I guess the last one was also about the 24-hour stay so thank you.