



Routine in-person post-operative follow-up for uncomplicated laparoscopic appendectomy does not change management

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Abstract

Introduction Eliminating points in the continuum of care that do not change management is a safe strategy for cost containment and workflow efficiency in health systems. As a process improvement initiative, we sought to identify whether routine, outpatient follow-up changes management in laparoscopic appendectomy in a military hospital.

Methods We performed a retrospective chart review of adult patients undergoing laparoscopic appendectomy during a one-year period. The primary outcome was identification of a change in management during routine in person follow-up. Secondary outcomes included location of patient presentation with a post-operative event (clinic, emergency department, primary care provider), and if those visits changed management. Events were defined as any deviation from the typical post-operative course within 6 weeks of surgery, including abnormal specimen pathology.

Results One-hundred and seventy-six appendectomies were performed over one year, and 148 patients met inclusion criteria (median age = 27, 66.9% male). Perforation was identified in 10.1% of patients. Seventeen-point-five percent of patients had a post-operative event, of which persistent pain was the most common. Only 2.0% of all patients saw a change in management at their routine in person follow-up appointment. Eighty percent of patients with any post-operative events sought care outside of their routine in person follow up appointments. No variable was independently associated with a change in management.

Conclusion Routine in-person clinical follow-up for laparoscopic appendectomy almost never changes management. Perforated appendicitis may be an indication for in-person follow-up. Considering a telemedicine model for post-operative follow-up of laparoscopic appendectomy patients will provide a safe and effective alternative to in-person clinic visits, while saving patients time and allowing providers the clinic freedom to prioritize more urgent and new patients.

Keywords Appendectomy · Telemedicine · Access to care · Follow up

Perioperative care in the military presents unique challenges to patients and providers alike. Any delay in this care challenges the complex logistics of military activity and can negatively impact a unit's ability to carry out their mission.

Naval Medical Center San Diego (NMCS D) is responsible for the care of tri-service active duty service members, families, and retirees in an area extending as far east as Yuma, Arizona and extending westward to include much of the U.S. Navy Pacific Fleet east of Hawaii. The standard workflow for perioperative care must adapt given this broad catchment area in order to optimize the care received at our Military Treatment Facility (MTF). The current practice pattern at NMCS D after establishment of the diagnosis of acute appendicitis is for the patient to receive laparoscopic appendectomy within 24 h, and if uncomplicated, routinely discharge within 24 h postoperatively. They then return in two weeks for in-person postoperative follow-up. Depending on the distance from the hospital to their duty location, this can result in significant delays to their unit due to travel, and ultimately a delay in the service member's return to full duty status.

This project was presented at the SAGES 2020 Virtual Military Surgical Symposium, where it was awarded the RADM Adam M. Robinson Award for 1st Place General Surgery Presentation. Due to Covid-19 restrictions, the conference was held as an on-line, virtual event.

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Given these delays, we sought to determine if routine, in-person follow-up after uncomplicated laparoscopic appendectomy alters clinical management. We hypothesized there would be no change in post-operative outpatient management as a result of in-person routine postoperative follow-up.

Methods

This study was submitted for review by our institution's Institutional Review Board, and was deemed quality improvement and therefore IRB Exempt. After obtaining IRB exempt status, we performed a retrospective chart review of all adult patients who underwent laparoscopic appendectomy at NMCS D from April 1, 2018 through April 1, 2019 to assess for *post-operative events* (POE) and *changes in management* (CIM). To focus on uncomplicated laparoscopic appendectomy, exclusion criteria included patients younger than age 18, conversion to an open procedure, interval appendectomy, appendectomy performed as part of a larger procedure (example: Ladd's procedure), patients who experienced in-hospital complications, pregnant patients, and patients with inflammatory bowel disease.

In-hospital complications were defined as post-operative abscess formation prior to patient discharge, ileus requiring nasogastric tube placement, and *Clostridium Difficile* infection.

Post-operative events were defined as any deviation from the normal post-operative course within 6 weeks of surgery after discharge (e.g., persistent post-operative pain, surgical site infection, or unexpected pathology). Changes in management were defined as new orders, procedures, referrals, admissions, or extended follow up beyond what is routine after this surgery as a result of these events. The difference between a POE and CIM can be illustrated using pain as an example:

1. *A patient reports pain two weeks post-operatively and is reassured by a provider.* In this case the post-operative event is 'pain', and there is no change in management.
2. *A patient reports pain two weeks post-operatively and is told to follow-up in 1 week and prescribed ibuprofen.* In this case, the post-operative event is still 'pain', but there is a change in management as further follow up is established and unanticipated medication is administered.

The primary outcome was the percentage of patients in whom a CIM occurred during routine, post-operative follow-up. Secondary outcomes were location of presentation for POEs (surgery clinic, emergency department, or primary care provider) and when POEs presented (before, during, or after their follow-up appointment, out to six weeks post-operatively). Demographic, operative and clinical variables

were collected, including age, sex, race, comorbidities, tobacco use, prior abdominal surgery, and perforated appendicitis (identified intraoperatively as annotated in the operative record). These variables were entered into two step-wise multiple logistic regression models with POE and CIM as the dependent variables.

Data sources were the local inpatient and outpatient electronic medical records and the surgical scheduling system. Demographic data, past medical comorbidities, and medication use were abstracted for all patients.

Results

During the study period, 178 laparoscopic appendectomies were performed, of which 148 met inclusion criteria (Fig. 1). Median age was 27, and of these, 66.9% were male, 57.6% were white, 6.3% were black, 5.6% were Asian, and 29.9% were identified as 'other' or unknown. Only 7.4% had more than one comorbidity and 16.3% had prior abdominal surgery. Additionally, 21.8% were current tobacco users (Table 1).

Perforated appendicitis (identified intraoperatively) accounted for 10.1% of patients. Median operative time was 57 min. No malignancy was identified on final pathology of any specimen analyzed. Four patients (2.7%) were found to have non-cancerous polyps, fibrous obliteration of the appendix, or normal appendix on final pathology. In-person post-operative follow up clinic visits were completed in 91.2% of patients.

Table 2 summarizes primary and secondary outcome findings. Twenty-six total POEs were identified in 24 patients (16.3%). Persistent pain was the most-commonly reported event (53.8%). Median time to presentation was 13.5 days. Eleven patients (7.4%) had a CIM, of which 3 (2.0%) were identified during in-person post-operative follow-up visit. For these 3 patients, their CIM was as follows:

1. *Event:* sessile polyp noted on pathology; *Management:* referral for colonoscopy.
2. *Event:* persistent, nonfocal abdominal pain; *Management:* cross-sectional imaging (normal), gynecology and gastroenterology referrals (no pathology found).
3. *Event:* persistent, port-site pain; *Management:* ibuprofen prescribed, heating pad given.

Of the 24 patients with a POE, 80% presented outside of their routine follow-up appointment (48.0% before and 32.0% after), 42.3% of these patients presented to the emergency department, and 15.4% presented to their primary care provider. Eight (5.4%) patients were identified to have a CIM either before or after their routine,

Fig. 1 CONSORT Diagram depicting all inclusions/exclusions for our patient population

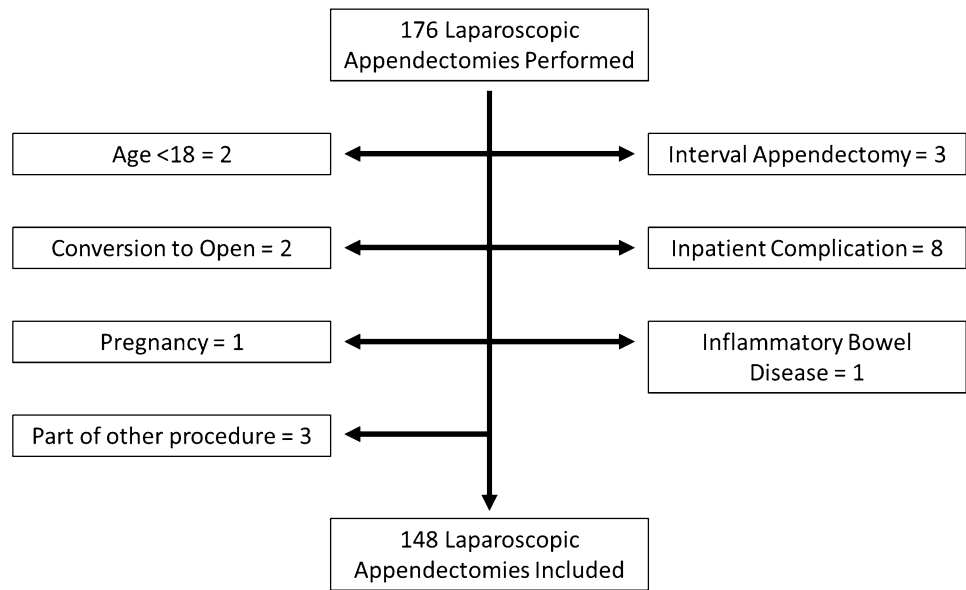


Table 1 Demographic data and variables for patient cohort

	Total (n)	Percent or range
Age	27	18–81
Sex		
Male	99	66.9
Female	49	33.1
Race		
White	83	57.6
Black	9	6.3
Asian	8	5.6
Other/unknown	44	29.9
Comorbidities		
Hypertension	10	6.8
Diabetes	5	3.4
Hyperlipidemia	8	5.4
Coronary artery disease	1	0.7
Chronic kidney disease	1	0.7
Psychiatric diagnosis	9	6.1
Autoimmune disease	5	3.4
Cancer history	4	2.7
Obstructive lung disease	4	2.7
Prior abdominal surgery	24	16.3
Tobacco use		
Current	31	21.8
Former	9	6.3
Never	102	71.8

post-operative visit including two port-site infections requiring antibiotics or surgical drainage, three intra-abdominal abscesses requiring admission for further care, a urinary tract infection requiring antibiotics, persistent

pain requiring medication, and a delayed allergic reaction to surgical prep requiring Benadryl.

Perforated appendicitis was significantly associated with occurrence of a POE (OR 5.4, $p=0.006$), however, no demographic, comorbid, or operative variables were independently associated with CIM according to our logistic regression modeling.

Discussion

We sought to determine if routine, in-person, post-operative follow-up clinic visits changed management for patients after routine laparoscopic appendectomy. We found three total management changes were made during routine follow-up appointments, but that most patients with a POE sought care outside of these appointments. No variable was found to be independently associated with CIM, and perforated appendicitis was the sole variable significantly associated with POE. This implies that, while perforated appendicitis led to POE such as persistent post-operative pain, these POE did not result in a CIM.

Our findings are in agreement with those of prior studies on similar populations. Chen, et al. retrospectively reviewed 219 appendectomies and 200 cholecystectomies and found that only 14% required intervention in clinic. Among laparoscopic appendectomy alone, 13% had a CIM during clinic follow-up. Our rate was much lower (2%), and may be explained by our study's strict selection criteria, exclusion of in-hospital complications (i.e. no drains were placed requiring removal), and relatively young, healthy active-duty population. Ignoring suture, staple, and drain removal, pain would be the most common presenting complaint to the

Table 2 Primary and secondary outcomes for patient cohort

	Total or median (n=148)	Percent or range
Patients with post-operative events	24	16.3
Total # of events	26	
Time to event (days)	13.5	1–35
Event type		
Abscess	3	11.5
Surgical site infection	2	7.7
Serous leakage from port site	1	3.8
Persistent pain	14	53.8
Imaging or pathology requiring follow up	2	7.7
Other	4	15.4
Time period patient presented for event		
Before follow up	12	46.2
During follow up	5	19.2
After follow up	9	34.6
Events leading to change in management		
During follow up	3	*2.0/11.5
Other (before or after)	8	*5.4/23.1
Location patient presented for event		
Clinic	11	42.3
Emergency department	11	42.3
Primary care provider	4	15.4
Treatment		
Medication	5	20.0
Admission	3	12.0
Imaging	2	8.0
Referral	1	4.0
Clinic/ED procedure	1	4.0
Reassurance	13	52.0

ED Emergency Department

*% out of: total patients/total events

ED among appendectomies in their cohort (5%), and pain medication would be the most common intervention aside from further follow-up (12%). This is similar to our cohort, in which pain was the most common post-operative event among all patients (9%) [6].

Sada, et al. reviewed the rate of post-operative complications identified during routine follow-up after bariatric surgery. They found that only 2 patients with complications (6%) were identified during their follow-up visit. The rest presented either to the emergency department (47%) or by seeking care from providers outside of their visit (47%) [7]. This is similar to our findings, in which 80% of patients presenting with a post-operative event did so outside of their routine, follow up appointments. One reason

for this could be because a scheduled follow up may or may not capture the time a complication becomes clinically evident.

Telemedicine modalities (including videoconferencing, the internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications [8]) present an interesting alternative for surgical follow-up for patients similar to our cohort, and have been associated with improved cost savings [1] and patient satisfaction [1–4], without affecting outcomes [2–5]. This has become a particularly attractive alternative in light of the recent COVID-19 pandemic and emphasis on limiting unnecessary patient and provider in person interactions. Furthermore, access to care may be increased by freeing up clinic appointments to convert routine clinic visits to telemedicine visits where feasible.

Previously, Broman, et al. analyzed clinic utilization for follow-up of low acuity general surgery patients after implementing optional telephone calls for follow-up. They found clinic utilization decreased by one half without an increase in emergency department utilization or readmission rates. They also found complication rates were not different between those who elected to undergo telephone follow up and those who presented to clinic for follow-up (6% vs. 8%, respectively, $p=0.31$) [4].

Hwa et al., reported on a pilot program of scheduling all open hernia and laparoscopic cholecystectomy patients for 3-week in-person follow-up, but calling at 2 weeks to assess the need and desire for completion of a scheduled in-person appointment. There were 3 complications identified and triaged over the phone among open hernia repair patients. No complications were identified in any other group [2]. This aligns with our study findings of three changes in management which could have been reasonably triaged via telephone. Similarly, Eisenberg, et al., trialed an opt-in telemedicine follow-up among laparoscopic hernia repair patients, of which 100% of eligible participants (n=62) agreed to telephone follow up with 5 patients ultimately presenting following identification of complications over the phone [3].

Similar outcomes for post-operative follow-up using other telemedicine modalities have been identified across other surgical disciplines, including in orthopedic [9] and transplant surgery [10] using commercially available video conferencing applications, as well as in otolaryngology [11] and urology [12] where remote patients used clinics close to their homes that were staffed by nurses who facilitated follow-up using video conferencing with a physician.

Further evidence suggests patients may prefer telemedicine follow-up in some cases. Round-trip travel distances for post-operative patients greater than 100 miles have been reported in multiple studies [2, 3, 11]. In one retrospective review of post-operative urologic patients, Canon, et al., found that for every 37 km increase in distance to their hospital, there was a 111% increase in the

odds of receiving telemedicine compared to receiving on-site care (OR 2.1, 95% CI 1.0, 4.4) [12].

This study was performed a few months before the emergence of the COVID-19 global pandemic. Out of necessity, to minimize potential COVID-19 exposure to our beneficiaries and staff and to maintain social distancing, our institution's follow-up policies for routine surgical procedures have changed. At the time of this writing, post-operative virtual health appointments are being conducted via telephone for all patients who underwent uncomplicated elective or emergent operations, as defined by the operating surgeon. Anecdotally, both patients and providers are satisfied with these virtual follow-up visits, and most changes in management if required can be performed over the phone. Further study is needed to delineate both patient and provider satisfaction with this new practice pattern.

A strength of our study was the fidelity with which we were able to collect follow-up data (91.2%), due largely to the mandatory nature of clinic appointments for active duty patients. This limits our translation to a civilian healthcare system, however, where some patients may be lost to follow-up, and makes another case for consideration of telemedicine for these patients. Among the cohort that Broman, et al. assessed, 6% of telephone patients were unable to be reached for follow-up [4]. This is similar to the findings of Ma, et al., where 7% of patients randomized to telephone follow up could not be reached. This was, however, much lower than the rate of non-attendance for in-person follow-up (24%, $p = 0.002$) [5]. Eisenberg et al., found that the completion rate for telephone calls was 88.7% among patients who opted in for remote follow-up [3]. One can reasonably infer from these findings that rates of follow-up with a telemedicine modality would either be improved or unchanged.

Our study is limited by its retrospective nature, single site and focus on a single procedure. It is further limited by the strict selection criteria which focused on uncomplicated operations for laparoscopic appendectomy, and its relatively homogenous young, healthy population (the latter likely being why no malignancies were identified on final pathology in our patient cohort). This was in an effort to provide conservative recommendations for patients who could reasonably be transitioned to telemedicine follow-up in lieu of routine post-operative in-person appointments. Second, our military population is unique compared to civilian populations in that all members have access to multiple levels of care should they need it, whereas civilian access to care may not be as uniform. Finally, given the study's retrospective nature, no data could be collected on patient preference for or against in-person, routine, post-operative follow-up.

Conclusion

In assessing whether in-person, routine, post-operative follow-up for laparoscopic appendectomy changes management, we found three patients who (2%) had a CIM occur during their follow-up appointment. Most patients with POE sought care outside of their appointment. Using a telemedicine model for post-operative follow-up of laparoscopic appendectomy patients would likely provide a safe and effective alternative to in-person clinic visits, while saving both patients and providers time allowing providers to prioritize more acute or new patients, improving access to care. Further study into other low and medium acuity surgeries may open new areas for the safe implementation of telemedicine follow-up modalities for routine surgical patients.

Declarations

Disclosures The views expressed in this article reflect the results of research conducted by the authors Daniel Baldor MD, Paul R. Lewis DO, Matthew D. Tadlock MD and do not necessarily reflect the official policy or position of the Naval Medical Center San Diego, the Department of the Navy, Department of Defense, nor the United States Government. The authors have no other conflicts of interest or financial ties to disclose. We are military service members or federal/contracted employees of the United States government. This work was prepared as part of our official duties. Title 17 U.S.C. 105 provides that 'copyright protection under this title is not available for any work of the United States Government.' Title 17 U.S.C. 101 defines a U.S. Government work as work prepared by a military service member or employee of the U.S. Government as part of that person's official duties.

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