

Stump Appendicitis: A Surgeon's Dilemma

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ABSTRACT

Background: Stump appendicitis is defined by the recurrent inflammation of the residual appendix after the appendix has been only partially removed during an appendectomy for appendicitis. Forty-eight cases of stump appendicitis were identified in the English literature.

Database: The institutional CPT codes were evaluated for multiple hits of the appendectomy code, yielding a total of 3 patients. After appropriate approval from an internal review board, a retrospective chart review was completed and all available data extracted. All 3 patients were diagnosed with stump appendicitis, ranging from 2 months to 20 years after the initial procedure. Two patients underwent a laparoscopic and the one an open completion appendectomy. All patients did well and were discharged home in good condition.

Conclusion: Surgeons need a heightened awareness of the possibility of stump appendicitis. Correct identification and removal of the appendiceal base without leaving an appendiceal stump minimizes the risk of stump appendicitis. If a CT scan has been obtained, it enables exquisite delineation of the surrounding anatomy, including the length of the appendiceal remnant. Thus, we propose that unless there are other mitigating circumstances, the completion appendectomy in cases of stump appendicitis should also be performed laparoscopically guided by the CT findings.

Key Words: Appendicitis, Stump appendicitis, Laparoscopic appendectomy.

INTRODUCTION

Appendectomy is one of the most common surgical procedures performed in the United States with more than 250,000 cases per year.¹ Obstruction of the appendiceal orifice by fecalith, lymphoid hyperplasia, or neoplasm remains the most likely causative factor. Progressive appendiceal luminal distention compromises lymphatic and vascular flow, resulting in appendiceal wall ischemia followed by consequent bacterial invasion, inflammation, and frank perforation if surgical treatment is delayed. Perforation at presentation ranges from 16% to 30%, and it is significantly increased by a delay in diagnosis usually seen at extremes of age or atypical presentation.² Treatment is appendectomy, and postoperative complications include wound infection, bleeding, intraabdominal abscess, small-bowel obstruction, and, rarely, stump appendicitis. Residual appendiceal tissue left at the time of appendectomy may predispose to the rare development of stump appendicitis. Stump appendicitis is defined as the interval repeated inflammation of remaining residual appendiceal tissue after an appendectomy.³ Partially removing an appendix leaves a stump behind, which allows for recurrent appendicitis (**Figure 1**). Today, most clinicians are not aware of the possibility of recurrent appendicitis or, more precisely, stump appendicitis as a differential diagnosis for patients with right lower quadrant (RLQ) pain after previous appendectomy.^{4,5} Therefore, this phenomenon can cause a real diagnostic dilemma, which can lead to delays in treatment and subsequently to an increase in morbidity.⁶ Currently, only 40 reported cases of stump appendicitis are found in the English medical literature. We evaluated a total of 3 cases of stump appendicitis seen at our institution. Our PubMed search on stump appendicitis in January 2009 revealed 4 additional cases including ours, to a prior existing review of the literature reporting 36 cases. Altogether, there are a total of 40 cases of stump appendicitis reported in the English literature (**Table 1**).⁷

Mean age for all 40 patients described in the literature was 37 years (range, 8 to 72). Sixty-two percent of the patients were males (23/40 males and 17/40 females). Sixty-eight percent (27 cases) of the initial appendectomies were performed open, while 32% (13 cases) were performed

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Figure 1. CT scan of recurrent stump appendicitis. Appendix is dilated and fluid filled with evidence of surrounding inflammation (arrow).

laparoscopically. The average interval from the first appendectomy to developing stump appendicitis followed by subsequent appendectomy was 8 years (range, 2 months to 40 years).

Mean white blood cell count on presentation of all reported 40 cases was 13,700 cells/mm³ (range, 8 to 27,000). The most commonly performed radiographic examination used to diagnose stump appendicitis is the abdominal CT scan. It was used in 52% (25 cases). Ultrasound was used in 10% (5 cases). The remaining patients either had Barium enema studies or were taken to the operating room based on the clinical diagnosis of local peritonitis. In 83% (33 cases), an open approach for the definite treatment of the stump appendicitis was chosen. The remaining 17% (7 cases) were performed laparoscopically. Of the initially performed laparoscopic cases (33%, 13 cases), a total of 46% (6 cases) were for laparoscopic reoperation and removal of the stump. The average stump length for all cases was 3.4cm (range, 0.5 to 6.5). Perforation was found in 60% (24/40 cases). Complications included wound infections, bleeding, abscess formation, and postoperative ileus. Mean hospital stay was 8 days (range, 1 to 28).

DATABASE CASES

Case One

Patient 1 was a 33-year-old female who presented with a 1-day history of acute unrelenting abdominal pain in April 2006. She had undergone an open appendectomy in Africa in 1986. Her workup in the emergency department at our institution revealed a white blood cell count of 10,000 cells/mm³ (reference Normal <11,000 cells/mm³). A CT scan of her abdomen/pelvis revealed an appendiceal remnant that was dilated, fluid filled, and measuring 8mm in diameter. There was pericecal/periappendiceal stranding suggestive of acute appendicitis. An uncomplicated laparoscopic appendectomy was performed. The pathology revealed acute appendicitis and periappendicitis with abscess formation. The appendix measured 5cm in length. Our patient had no postoperative complications and was discharged home on postoperative day (POD) 5.

Case Two

Patient 2 was a 48-year-old male who originally presented to our emergency department with acute right lower quadrant (RLQ) abdominal pain in December 2006. At that time, a CT scan of the abdomen/pelvis was consistent with acute appendicitis. Therefore, he underwent an uncomplicated laparoscopic appendectomy. The pathology revealed acute appendicitis and an appendix measuring 4.2cm in length. No complications were observed, and the patient was discharged home on POD 2.

Three and 1/2 months later, the patient re-presented to our emergency department with complaints of abdominal cramps and pain, localized in the RLQ for 1 day. He denied febrile episodes at home and had a white blood cell count of 8,000 cells/mm³. Nonetheless, he underwent a CT scan of the abdomen/pelvis, which revealed a 3-cm tubular structure adjacent to the cecum with significant inflammatory changes suggestive of stump appendicitis. Based on the CT and subsequent laparoscopic evaluation, the removal of the remaining inflamed appendiceal stump was performed without difficulties. Pathology revealed patchy acute and chronic mural inflammation and serositis of the appendix. The appendix measured 2cm in length. No intra- or postoperative complications were encountered. The patient was discharged home on POD 3.

Case Three

The third patient was a 52-year-old male who presented to our institution originally in July of 2008 with acute RLQ

Table 1.
Review of the English Medical Literature for Reported Stump Appendicitis

Author	Age	Sex	Primary Surgery ^a	Interval	Pain ^a	Dx Mode ^a	Repeat Surgery	Stump Length ^a	Perforated ^a
Harris ⁴	26	M	Open	10yr	RLQ	CT	Open	NA	Y
Devereaux ⁵	49	M	Lap	2 mo	RLQ	NA	Open	2cm	Y
Walsh ⁶	72	F	Lap	5mo	ABD	Xray	Open	2.5cm	Y
Liang ⁷	32	F	Lap	5 mo	RLQ	CT	Lap	4 cm	Y
Rose ⁸	23	M	Open	1yr	NA	NA	Open	5.1cm	NA
	40	M	Open	2yr	NA	NA	Open	5.1cm	NA
Greenberg ¹¹	31	M	Lap	4mo ^a	RLQ	CT	Open	3.5cm	N
Milne ¹⁵	25	M	Lap	18mo	ABD	NA	Open	3.2cm	N
Rao ²¹	39	F	Open	34yr	ABD	CT	Open	NA	Y
Aschkenasy ²²	27	M	Open	25yr	RLQ	CT	Open	NA	N
Roche-Nagle ²³	35	M	NA	NA	RLQ	CT	Open	3-4cm	Y
Shin ²⁴	41	M	Lap	NA	RLQ	CT	Lap	6.5cm	N
Watkins ²⁵	63	F	Lap	9mo	RLQ	CT	Lap	5.5cm	Y
Nahon ²⁶	33	M	Open	18yr	RLQ	Colonoscopy	Open	NA	Y
Mangi ²⁷	43	F	Open	40yr	Ni	CT	Open	0.5cm	Y
	64	F	Open	NA	Ni	BE	Open	0.6cm	Y
Baldisserotto ²⁸	13	F	Open	2mo	RLQ	US	Lap	2cm	N
Gupta ²⁹	11	M	Open	1yr	RLQ	CT	Open	4.5cm	Y
Erzurum ³⁰	11	F	Open	8mo	RLQ	CT	Open	3.5cm	Y
Thomas ³¹	53	F	Open	21yr	RLQ	CT	Open	NA	NA
Wright ³²	35	M	Lap	2mo	RLQ	BE	Open	4.5cm	NA
	48	M	Lap	8mo	RLQ	CT	Open	4.0cm	NA
Feigin ³³	26	M	Open	1yr	ABD	NA	Open	NA	Y
Greene ³⁴	27	F	Open	12yr	RLQ	BE	Open	NA	N
	42	F	Open	16yr	ABD	NA	Open	NA	Y
	53	F	Open	20yr	RLQ	BE	Open	NA	Y
Siegel ³⁵	51	F	Open	23yr	RLQ	NA	Open	1.5cm	Y
Baumgardner ³⁶	55	M	Open	3mo	RLQ	NA	Open	NA	Y
Uludag ³⁷	47	M	Open	20yr	RLQ	CT	Open	2cm	Y
De ³⁸	26	F	Open	1yr	RLQ	NA	Open	NA	NA
Durgun ³⁹	68	F	Open	8mo	ABD	NA	Open	3cm	Y
Tang ⁴⁰	14	M	Open	5yr	ABD	CT	Open	3cm	N
	11	M	Open	2mo	NA	CT	Open	NA	Y
	13	F	Open	10mo	ABD	CT	Open	4cm	N
Leff ⁴¹	33	F	Lap	2weeks	RLQ	CT	NA	NA	N
	24	M	Lap	7mo	ABD	CT	Lap	NA	Y
Chikamori ⁴²	24	M	Lap	4days	ABD	US	Lap	7mm	Y
Burt ⁴³	27	M	Open	NA	RLQ	CT	Open	NA	Y
Waseem ⁴⁴	15	M	Lap	2yr	ABD	CT	Open	6mm	N
O'Leary ⁴⁵	43	M	Open	10yr	RLQ	US	Open	2.5cm	N

^aNA=not available; ABD=abdomen; RLQ=right lower quadrant; CT=computed tomography; US=ultrasound; BE=barium enema.

pain and was found to have acute appendicitis. The CT scan of the abdomen showed acute appendicitis with microperforation. Subsequently, he underwent an uncomplicated laparoscopic appendectomy. The pathology revealed acute appendicitis with focally suppurative and organizing periappendicitis. The appendix measured 3cm in length. The patient was discharged home on POD 3.

Two months later, he re-presented with persistent abdominal discomfort in the RLQ, which was unrelenting despite removal of an inflamed appendix. He was found to have a low-grade temperature and a white blood cell count of 14,000 cells/mm³. A repeat CT scan of his abdomen/pelvis demonstrated further progression of his previously documented appendicitis compared to his previous CT scan. He was taken to the OR for an open uncomplicated appendectomy. The pathology revealed purulent appendicitis with periappendicitis. The appendix measured 6.1cm in length. The patient had no postoperative complications and was discharged home on POD 4.

DISCUSSION

Claudius Amyand is credited with performing the first appendectomy in 1735, and Reginald Fitz was the first to describe the clinical features and pathologic abnormalities of appendicitis in 1886. In 1945, Rose was the first to describe stump appendicitis in patients who had previously undergone an appendectomy for appendicitis.⁸ Today, one of the dilemmas of diagnosing stump appendicitis is that surgeons or physicians in the emergency room need to be more aware that stump appendicitis exists and needs to be kept in the differential diagnosis for patients with right lower quadrant pain after prior appendectomy. The presenting symptoms of stump appendicitis are basically indistinguishable from those of primary appendicitis. They include pain that starts periumbilically and wanders to the right lower quadrant and is associated with anorexia, nausea, and vomiting.

The laparoscopic appendectomy has been well studied and has been found to be equivalent to the more traditional open technique in overall ability to adequately remove the inflamed appendix.^{9,10} There is the notion that stump appendicitis is a new phenomenon that mainly occurs in laparoscopically performed appendectomies.^{11,12} At least theoretically, there is the potential for an increased incidence of stump appendicitis in laparoscopic surgery due to the lack of a 3-dimensional perspective, and the absence of tactile feedback. Subsequently, a longer stump might be left behind. However, in sharp contrast to this theoretical assumption

stands the fact that 66% of the reported cases occurred after open appendectomies.⁷ However, laparoscopic appendectomies are a relatively new procedure compared to the more proven and historic open technique and therefore, there may be some merit to the above assertion.

Several factors influence the occurrence of stump appendicitis. One very common problem is the correct identification of the base of the appendix, ie, the cecal appendiceal junction. Misidentification of the cecal appendiceal junction seems to occur more often with extensive inflammation of the appendix, which can, but does not necessarily, extend to the cecum. Additionally, a complete or partial retrocecal lying appendix, ie, the base is retrocecal or a part of the appendiceal shaft lies retrocecal and the tip turns back and is easily visualized intraperitoneally and therefore the part of the appendix that disappears in the retrocecal area is misidentified as the base and falsely transected leaving a stump behind.

Moreover, careful consideration should be given to the length of the resected appendix. In 7 of the 48 cases reported above, the pathology revealed that the mean length of the removed appendices was 4.4cm (7/48 cases, range, 3 to 6.5).⁷ Therefore, while the normal length of the appendix is variable, we recommend inspecting and verifying that, whenever the resected appendix is ≤ 6.5 cm in length, there is no appendiceal stump longer than 3mm left behind.

Besides the possibility of stump appendicitis, there is another possible explanation for appendicitis after previous appendectomy: a duplicated appendix. This is a very rare developmental abnormality, which can be seen in about 0.004% in appendectomy patients. Three types have been described by Cave and Wallbridge.^{13,14} Type A has incomplete duplication with both appendices having a common base; type B has complete duplication with the first appendix arising from its usual location at the confluence of the tenia coli, and the second appendix is located at various sites along the colon; and type C has complete duplication of the cecum, with each part having its own appendix.

General recommendations for the resection of the acutely inflamed appendix in either open or laparoscopic surgery include the proper identification and visualization of the base of the appendix or cecal appendiceal junction.^{15,16} This can be accomplished by following the convergence of the tenia coli to the appendix. It is also important to resect the appendix completely or, if leaving a stump, it should be < 3 mm in length. Guidance in determining the length of the appendix may also be obtained from the CT

scan if one has been obtained. Also, the answer to the question of what to do with an incidental finding of an appendiceal stump seen on CT seems to be observation rather than surgical removal.

Nevertheless, completion appendectomy is the treatment of stump appendicitis.¹⁷ An additional ileocecostomy was necessary in 18% of the cases (9/48). This more extensive operation should generally not be required as long as the appendiceal stump can be readily identified and the cecum itself does not show evidence of a significant amount of inflammation. The completion appendectomy has been done as an open procedure for the majority of the cases reported in the literature. A great debate has been waged over the inversion of the remaining stump versus simple ligation.^{18–20} Not only is the diagnosis of stump appendicitis being increasingly made by CT scan,²¹ but CT scan also enables exquisite delineation of the anatomy including the length of the remnant. Thus, we propose that unless there are other mitigating reasons, the completion appendectomy should also be performed laparoscopically guided by the CT findings as in our case 2.

CONCLUSION

Stump appendicitis is a real and likely underreported disease process in gastrointestinal surgery. Although a rare complication after appendectomy, it can and does occur after both laparoscopic and open appendectomies. It is yet to be definitely determined whether the incidence of this is indeed increasing with laparoscopic appendectomies as claimed by some. Stump appendicitis can certainly represent a diagnostic dilemma if the treating physician is unaware of this uncommon phenomenon. During surgery, a severely inflamed completely or partially lying retrocecal appendix might be one of the contributing factors leading to the misidentification of the cecal appendiceal junction. Also a stump longer than 3mm left behind during the initial surgery can lead to appendicitis after appendectomy. Surgeons therefore must fall back on their training of anatomy, especially in difficult cases where severe inflammation is present. A thorough exploration and meticulous dissection with the critical view of the appendiceal-cecal junction is imperative to prevent this potentially devastating complication. This may be facilitated through elevation of the appendix, toward the abdominal wall, providing mild tension, which will aid in the dissection of the significantly inflamed tissue planes. Once a diagnosis of stump appendicitis has been made, the rules of appendectomy remain consistent between the traditional and laparoscopic techniques in that removal of

the entire affected structure must be completed with appropriate visualization of the anatomical landmarks.

Therefore, surgeons need to have a heightened awareness of the possibility of stump appendicitis, identify the appendiceal base correctly and remove the appendix without leaving a stump to minimize the risk of stump appendicitis. If a CT scan has been obtained, it enables exquisite delineation of the anatomy including the length of the remnant. Thus, we propose that unless there are other mitigating reasons, the completion appendectomy should also be performed laparoscopically guided by the CT findings rather than by the open route in cases of stump appendicitis.

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