Journal of Pediatric Surgery (2011) 46, 1126–1130

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Journal of Pediatric Surgery

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Is it necessary to drain all postoperative fluid collections after appendectomy for perforated appendicitis?

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Received 8 March 2011; accepted 26 March 2011

Key words:
Perforated appendicitis;
Postoperative fluid;
Percutaneous drainage

Abstract

Purpose: Children treated for perforated appendicitis can have significant morbidity. Management often includes looking for and draining postoperative fluid collections. We sought to determine if drainage hastens recovery.

Methods: Children with perforated appendicitis treated with appendectomy from 2006 to 2009 were reviewed. Patients with postoperative fluid that was drained were compared with patients with undrained fluid with regard to preoperative features and postoperative outcomes. Statistical analyses included paired Student's *t* tests, Mann-Whitney *U* test, and linear regression.

Results: Five hundred ninety-one patients were reviewed. Seventy-one patients had postoperative fluid, of whom 36 had a drainage procedure and 35 did not. There was no significant difference in white blood cell count at the time of assessment for drainage (16.4 ± 4.0 vs 14.6 ± 4.9, $P = .14$), days with fever (3.5 ± 3.0 vs 2.9 ± 2.5, $P = .35$), or readmission rate (19% vs 31%, $P = .28$). After multivariate linear regression, larger fluid volumes were associated with prolonged length of stay (LOS) ($P = .03$). For fluid collections between 30-100 mL, there was no significant difference in LOS between the drain and no-drain groups (9.8 ± 3.5 vs 10.9 ± 5.2 days, $P = .51$).

Conclusion: After appendectomy for perforated appendicitis, larger postoperative fluid collections are associated with prolonged LOS. Drainage of collections less than 100 mL may not hasten recovery.

Appendicitis remains the most common indication for abdominal surgery in the pediatric population, with the annual incidence in the United States estimated to be 25 per 10,000 children between the ages of 10 ands 17 years and 1.5 per 10,000 children younger than of 4 years [1]. Most of these patients have simple appendicitis with a brief hospital stay. However, approximately 20% to 35% of patients will have perforated appendicitis [2,3] that sometimes dictates a prolonged hospitalization and further interventions. Children with persistent fever, leukocytosis, and/or anorexia in the postoperative period will often undergo imaging such as ultrasound or computed tomography (CT) to identify an intraperitoneal abscess thought to be the source of the ongoing inflammatory response. However, with increased imaging availability and sophistication, there is a higher likelihood of detecting nonpurulent fluid collections that

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doi:10.1016/j.jpedsurg.2011.03.043

may or may not be causing any symptoms [4,5]. One of the recent challenges in the management of complicated appendicitis is deciding whether percutaneously draining these fluid collections will have clinical benefit beyond treatment with antibiotics alone. There have been several recent studies suggesting that children will recover fully with only antibiotics in most cases [6-9]. The purpose of this study is to determine whether drainage of postoperative fluid collections hastens recovery in children after surgery for perforated appendicitis and whether drains should be placed routinely, in select cases or not at all.

1. Methods

All patients younger than 19 years with appendicitis treated with appendectomy between March 2006 and March 2009 at the Children's Medical Center, Dallas, TX, were retrospectively reviewed after evaluation and approval by the University of Texas Southwestern Medical Center Institutional Review Board. Only children with perforated appendicitis based on both pathologic diagnosis and the surgeon's diagnosis at the time of operation were included in the analysis. Children who presented with perforated appendicitis with associated abscess who did not undergo appendectomy on the initial admission were excluded. Patients with perforated appendicitis who then had postoperative imaging (CT scan) owing to clinical factors including leukocytosis, fever, diarrhea, poor oral intake, or ongoing abdominal pain and in whom a fluid collection was identified on CT were specifically reviewed. Within this group, children who had a percutaneous drain placed by radiology were compared with those children who did not. If a drain was placed, it was left in situ until the drainage was minimal (<10 mL/d). None of the children were sent home with a drain. All of the patients were treated with intravenous ampicillin/sulbactam or gentamicin (if penicillin allergic) and metronidazole from the time of surgery until discharge. Some patients were continued on oral amoxicillin/clavulanate and metronidazole after discharge, depending on surgeon preference. The drain and no-drain groups were compared in several variables including age, sex, findings on preoperative and postoperative imaging, number of days with fever, white blood cell count (WBC) on the day of postoperative CT, days to regular diet, length of stay (LOS), duration of treatment with antibiotics, and any postoperative complications. The volume of all fluid collections was measured on CT with a Vitrea work station (Vital Images, Minnetonka, MN) by isolating regions of interest in each slice and multiplying the area by the thickness for the entire collection. Statistical analyses were performed with the paired Student's t test for normally distributed data and the Mann-Whitney U test for nonparametric comparisons. Analysis of variance and Kruskal-Wallis tests were used for comparisons of more than 2 variables. Univariate and multivariate linear regressions were also performed. $P < .05$ was considered statistically significant. All analyses were performed with the SPSS Statistical Package version 17.0 (SPSS Inc, Chicago, IL).

2. Results

Between March 2006 and March 2009, a total of 1844 appendectomies were performed at the Children's Medical Center, Dallas, TX. Among this group, 591 children (32%) had perforated appendicitis. Seventy-six of the patients (13%) with perforated appendicitis went on to have a postoperative CT scan. The decision to obtain a CT scan was made by the patient's surgeon based on persistent fever, leukocytosis, inability to tolerate diet, or other symptoms including ongoing abdominal pain or diarrhea. If fluid was seen on the CT, the patient was then evaluated for possible percutaneous drain placement. Thirty-six of the 76 patients evaluated had fluid collections that were drained percutaneously (drain), 35 patients had fluid collections that were not

Table 1 Patient characteristics (N = 71)

	Drain (36)	No drain (35)	*P*
Age (y)	8.4 (±3.4)	9.5 (±4.4)	.27
Male:female (%)	54:36	53:37	.93
Preoperative CT scan obtained (%)	64	55	.57
Postoperative day CT performed (d)	6 (±1)	7 (±2)	.15
WBC on the day of CT ($\times 10^3$)	16.4 (±4.0)	14.6 (±4.9)	.14
Postoperative days with fever (>38.0) (d)	3.5 (± 3.0)	2.9 (±2.5)	.35
Time to regular diet (d)	6.3 (±4.1)	5.0 (±2.7)	.11
Volume of postoperative fluid collection (mL)	148.7 (±133.3)	45.2 (±76.6)	.00016
LOS (d)	12.1 (±5.7)	8.5 (±4.5)	.004
Duration of antibiotics (d)	18.9 (±3.8)	15.3 (±5.6)	.002
No. of readmissions	7 (19%)	11 (31%)	.28
No. of postoperative bowel obstructions	4 (11%)	2 (6%)	.42

Values reported as mean with SD.