



APSA papers

Matched analysis of nonoperative management vs immediate appendectomy for perforated appendicitis[☆]

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Abstract

Background: The role of nonoperative therapy vs immediate appendectomy in the management of children with perforated appendicitis remains undefined. The objective of this study was to rigorously compare these management options in groups of patients with matched clinical characteristics.

Methods: Multicenter case-control study was conducted from 1998 to 2003. We compared patients treated nonoperatively vs those undergoing appendectomy to identify differences in 12 clinical parameters. We then generated a second control group of patients matched for these variables and compared the following outcomes in these clinically similar groups: complication rate, abscess rate, and length of stay (LOS). Analysis was performed according to intention-to-treat principles, using χ^2 , Fisher exact, and Student *t* tests.

Results: The only significant difference between patients treated nonoperatively and those treated by appendectomy was the duration of pain on presentation (6.8 vs 3.1 days of pain). We created a second control group of patients undergoing immediate appendectomy matched on duration of pain on presentation to patients treated nonoperatively. These groups continued to be clinically comparable for the other 11 parameters. Compared to this matched control group, the nonoperative group had fewer complications (19% vs 43%, $P < .01$), fewer abscesses (4% vs 24%, $P < .01$), and a trend for shorter LOS (6.5 ± 5.7 vs 8.8 ± 6.7 days, $P = .08$).

Conclusions: When nonoperative management for perforated appendicitis was studied using appropriately matched clinical controls, we found that it resulted in a lower complication rate and shorter LOS in the subset of patients presenting with a long duration of pain. Our data suggest that nonoperative management should be prospectively evaluated in children with perforated appendicitis presenting with a history of pain exceeding 5 days.

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There is no consensus among pediatric surgeons regarding the optimal treatment for children with complicated appendicitis [1]. With the development of broad-spectrum antibiotics, some surgeons have advocated nonoperative management for these children [2-10]. However, there is little evidence to determine which children are most likely to benefit from this approach. Prior attempts to determine the effectiveness of nonoperative management for perforated appendicitis often have not controlled for inherent differences in the clinical status of patients treated nonoperatively vs those treated with immediate appendectomy. The objective of this study was to compare these management options in clinically similar patients.

1. Methods

A multicenter case control study was designed and conducted at 4 geographically diverse, academic, tertiary care children's medical centers. Institutional review board approval was received from all institutions before study initiation.

Data were collected for all children ages 1 to 18 who presented to these four hospitals between May 1998 and June 2003 with a diagnosis of perforated appendicitis. For the purposes of this study, perforated appendicitis was defined as evidence on preoperative abdominal ultrasound or computed tomography (CT) scan of perforated appendicitis; evidence of perforated appendicitis in the operating room (OR); or perforation confirmed on pathology report. Cases of gangrenous appendicitis without evidence of perforation were not included in the analysis.

The case group for this study consisted of all children who were treated with nonoperative management. The initial control group consisted of 4 computer-generated, site-matched controls treated with immediate appendectomy for each case. The cases and controls were examined on

Table 1 Clinical characteristics of patients who were successfully vs unsuccessfully managed nonoperatively

Variable	Successful NO group (N = 43) (Mean \pm SD or n [%])	Unsuccessful NO group (n = 5) (mean \pm SD or n [%])	<i>P</i>
Age (y)	8.5 \pm 4.8	10.3 \pm 2.9	.43
Male sex	26 (54.2)	2 (40)	.16
Medicaid	17 (35.4)	2 (40)	.36
Pain duration	7.3 \pm 5.6 d	4.4 \pm 2.2 d	.06
WBC at admission	17.3 \pm 6.4	17.4 \pm 6.3	.97
Bands at admission	17.8 \pm 15.0	18.0 \pm 13.1	.85
Temperature at admission	37.9 \pm 1.0 °C	37.9 \pm 0.7 °C	.90
Fecalith in OR	4 (11.5)	0 (0)	.57

NO indicates nonoperative management; WBC, white blood cell.

Table 2 Clinical characteristics of patients treated by nonoperative management vs immediate appendectomy for perforated appendicitis

Variable	NO group (n = 48) (mean \pm SD or n [%])	AP group (n = 192) (mean \pm SD or n [%])	<i>P</i>
Age	8.5 \pm 3.8 y	9.8 \pm 3.8 y	.08
Male sex	31 (64.6)	122 (63.5)	.89
Insurance = Medicaid	21 (43.8)	64 (36.7)	.37
Pain duration	6.8 \pm 5.2 d	3.1 \pm 2.4 d	<.001
Temperature at admission	38.0 \pm 0.9 °C	38.1 \pm 0.9 °C	.65
Focal RLQ peritonitis	19 (42)	99 (56)	.11
Nausea	32 (66.7)	145 (91.2)	.46
Vomiting	35 (72.9)	160 (89.9)	.25
Diarrhea	21 (43.8)	70 (36.5)	.65
WBC at admission	17.7 \pm 6.0	17.3 \pm 6.2	.73
Percent bands	19.7 \pm 15.3	16.3 \pm 14.4	.36
Fecalith in OR	4 (8.7)	27 (17.8)	.17

AP indicates appendectomy; RLQ, right lower quadrant.

12 clinical parameters to determine the comparability of these groups. A second control group was then generated based on the differences found between these 2 groups. The case group and the clinically matched group were compared for 3 main outcomes: complication rate, abscess rate, and length of stay (LOS). Length of stay in the nonoperative group included the total length of the acute hospitalization(s) until the patient returned to full activity and diet. Interval appendectomies (IA) were performed in delayed fashion in some of these patients. While hospital stays for IA were routinely 1 to 2 days, these data were not available for all patients and were therefore not included in the LOS analysis. Statistical analysis was completed using SAS 8.01 for Windows (SAS Institute, Cary, NC). Analysis was performed according to intention-to-treat principles, using χ^2 , Fisher exact, and Student *t* tests for comparative analysis.

2. Results

Data were collected for 313 patients. Forty-eight were treated by nonoperative management. Five (10.4%) patients failed nonoperative management and required appendectomy within 3 weeks. These patients "failed" because of persistent fevers despite antibiotic treatment, abscess development believed to require operation, or ongoing and worsening symptoms. These 5 children subsequently had long hospitalizations, with a mean stay of 17.6 \pm 12.4 days (range, 6-32 days). There were no significant detectable clinical differences between these 5 children and those who did well with nonoperative management (Table 1). Of the

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