



# Intraluminal appendiceal fluid is a predictive factor for recurrent appendicitis after initial successful non-operative management of uncomplicated appendicitis in pediatric patients



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## ABSTRACT

**Background:** The risk factors for recurrent appendicitis in pediatric patients are unclear. This study aimed to identify the predictive factors for recurrent appendicitis in pediatric patients who initially underwent successful non-operative management of uncomplicated appendicitis.

**Methods:** Potential predictive factors for recurrent appendicitis in terms of clinical characteristics, laboratory data, and abdominal ultrasonography and computed tomography findings, were evaluated.

**Results:** This study included 125 patients who underwent initial successful non-operative management of appendicitis. The rate of recurrent appendicitis was 19.2%, and the mean time to recurrence was 12.6 months. Univariate analyses found that rebound tenderness, muscle guarding, appendicoliths, appendiceal diameter >9 mm, and intraluminal appendiceal fluid were associated with recurrent appendicitis.

Multivariate analysis identified only intraluminal appendiceal fluid as an independent predictor of recurrent appendicitis.

**Conclusions:** Intraluminal appendiceal fluid is a predictive factor for recurrent appendicitis after initial non-operative management. The results of this study provide valuable information that may help to determine the appropriate management during the first episode of appendicitis.

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The risk factors for recurrent appendicitis after initial non-operative management in pediatric patients remain unclear. The aim of this study was to identify the predictive factors for recurrent appendicitis after initial successful non-operative management of uncomplicated appendicitis in pediatric patients.

## 1. Methods

### 1.1. Patients

A total of 302 pediatric patients aged 12 months to 15 years were clinically diagnosed with acute appendicitis and managed at the National Mie Hospital between January 2004 and December 2010. The flow of diagnosis and management of these patients is shown in Fig. 1. Patients admitted to the emergency department were suspected of acute appendicitis if they had the following findings: right lower quadrant abdominal pain and elevated white blood cell count (>9000/ $\mu$ l) or C-reactive protein (>0.3 mg/dl). All patients

with suspected acute appendicitis underwent ultrasonography (US). When the diagnosis of acute appendicitis by US was uncertain, additional non-contrast computed tomography (CT) was performed. Appendicitis was suspected if imaging examinations showed an appendiceal diameter (>6 mm), noncompressible appendix, pericecal inflammatory changes, appendicolith, or pericecal abscess. If none of these findings were observed on US or CT, appendicitis was not diagnosed, and other causes of abdominal pain were considered. Patients were excluded from this study if the appendix was not detected on US or CT. The pediatric appendicitis score reported by Samuel [1] was assessed in all patients. This score assigns 2 points for cough/percussion/hopping tenderness in the right lower quadrant of the abdomen, 2 points for tenderness over the right iliac fossa, and 1 point for each of: anorexia, pyrexia, nausea/emesis, leukocytosis, polymorphonuclear neutrophilia, and migration of pain. The maximum total score is 10, and a score of  $\geq 7$  is strongly suspicious of acute appendicitis. All the patients included in this study had a score of  $\geq 7$ . Recurrent appendicitis was diagnosed using the same criteria as for the initial episode. All patients who met the diagnostic criteria and underwent non-operative management with antibiotic therapy or operative management for appendicitis during the study period were included in this study. Appendicitis was classified as complicated or uncomplicated based on the clinical and

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imaging examination findings. Appendicitis was classified as uncomplicated when a large external appendiceal diameter ( $\geq 6$  mm) without abscess formation was observed. Appendicitis was classified as complicated if a periappendiceal or pericecal abscess, or a gangrenous appendix, was observed. In cases of uncomplicated appendicitis, patients and their parents were informed of the potential advantages and disadvantages of both operative and non-operative management, including discussion of the current uncertainty regarding the optimal management of such cases. In cases of uncomplicated appendicitis, after these explanations, we left the final decision to the patient's parents. In cases of complicated appendicitis, emergent appendectomy or interval appendectomy was advised.

Consent for inclusion in the study, which comprised a retrospective chart review, was obtained from the parents of patients with uncomplicated appendicitis who selected initial non-operative management.

1.2. Interventions and data collection

A total of 134 patients with uncomplicated appendicitis underwent initial non-operative management and received intravenous antibiotic therapy (cefoperazone, 60 mg/kg/day divided into 8-hourly doses) for at least 48 hours. As no appropriate protocols for the non-operative management of uncomplicated appendicitis in pediatric patients were identified in previously reported studies, we developed our own protocol, as follows. On the first day of admission, antibiotic therapy was initiated, and patients were fasted and received intravenous fluid therapy. Eating was allowed from the second day of admission. Patients were discharged when they had no abdominal pain, body temperature  $<37.0$  °C, and no increase in the levels of inflammatory markers compared with admission or the time of resumption of oral intake. If the C-reactive protein level was  $>1.0$  mg/dL at discharge, oral antibiotic therapy (cefcapene pivoxil) was prescribed for 3 days.

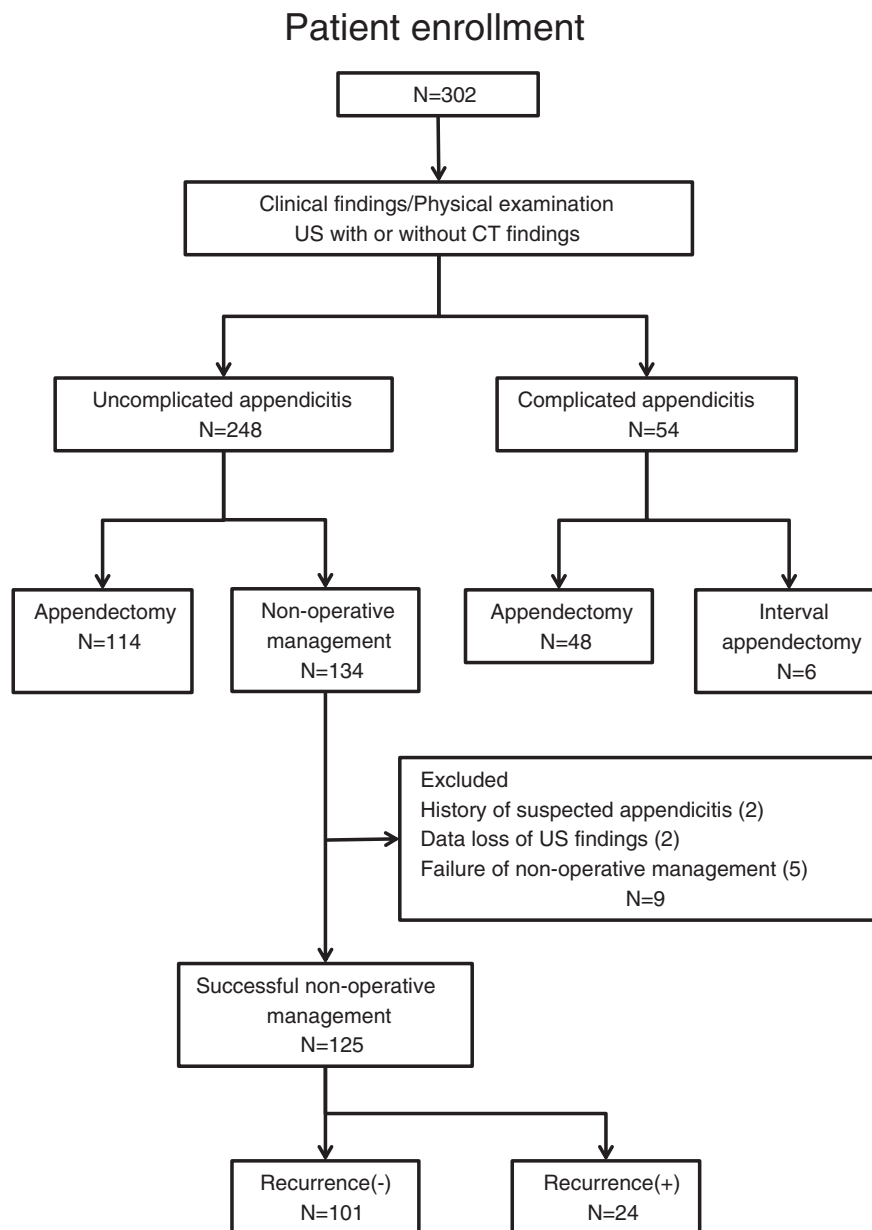


Fig. 1. Patient enrollment. A total of 125 patients who underwent successful initial non-operative management were analyzed in this study.

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