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Early versus late surgical management of complicated appendicitis in children: A statewide database analysis with one-year follow-up☆

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ABSTRACT

Background: Complicated appendicitis is common in children, yet the timing of surgical management remains controversial. Some support initial antibiotics with delayed operation whereas others support immediate operation. While a few randomized trials have evaluated this question, they have been small, single-center trials with limited follow-up. We present a database analysis of outcomes in early versus late surgical management of complicated appendicitis with one-year follow-up.
Methods: We conducted a retrospective review of children with complicated appendicitis presenting between 2000 and 2013, utilizing a New York State database. We compare children undergoing later versus early appendectomy with a primary outcome measure of any complication within one year as determined from ICD-9 codes.
Results: 8840 children were included in the analysis, 7708 of whom underwent early appendectomy. Patients with late appendectomy were significantly more likely to have at least one complication when compared to those undergoing early appendectomy (34.6% vs 26.7%, $p < 0.01$).
Conclusions: We present the first population-level study evaluating early versus late appendectomy in children with complicated appendicitis with a one-year follow-up period. Children undergoing late appendectomy were more likely to have a complication than those undergoing early appendectomy. These data corroborated previous studies supporting early operative management.
Level of evidence: This study provides level III evidence of a treatment study.

Appendicitis is the most common disease requiring surgical treatment in children [1,2] and up to 30% of children with appendicitis present with appendiceal rupture [3]. Yet, the treatment of such complicated appendicitis – i.e. appendicitis resulting in abscess or generalized peritonitis – is varied. Traditionally it is managed with immediate surgery. However, in the 1980s treatment with initial antibiotics followed by "interval appendectomy" after a period of four to sixteen weeks was described [4] and this approach in management became increasingly popular. In this time period, several retrospective studies, including a meta-analysis, suggested reduced morbidity with late appendectomy [5–7].

In recent years, however, new data have questioned this practice. One study found that a substantial percentage of patients with suspected acute perforated appendicitis and a plan for interval appendectomy require unplanned readmission [8]. Additionally, a randomized control trial demonstrated that patients undergoing immediate appendectomy had quicker return to normal activity, fewer adverse events, and lower cost to the system when compared to those with late appendectomy [9,10]. A separate randomized trial looking only at children with an appendiceal abscess had mixed findings in terms of clinical parameters when comparing early to late appendectomy [11], but demonstrated that children experienced better quality of life and parents suffered less stress when undergoing early appendectomy [12].

1. Purpose

Despite the emerging data favoring early appendectomy, no consensus exists on the optimal management of complicated appendicitis in children, and practice patterns continue to vary dramatically. This may in part be because of the fact that the majority of studies on the topic – both in favor of and against early appendectomy – were

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single-center studies, with small sample sizes, and limited follow-up periods. Thus, the purpose of our study was to compare surgical outcomes for early versus late surgical management of complicated appendicitis using a large state-level all payer database.

2. Material and methods

2.1. Data source

We utilized the New York State Department of Health Statewide Planning and Research Cooperative (SPARCS) database for analysis. This database, established in 1979, collects patient, treatment, and provider information for every hospital discharge, ambulatory surgery, emergency department visit, and outpatient service. The database includes demographic information including race and ethnicity as classified and defined by SPARCS, ICD-9 codes pertaining to primary and secondary diagnoses, procedure, length of stay, and charges. A unique identifier is assigned to every patient allowing for longitudinal analysis.

2.2. Study population

We included all children less than age 18 admitted between 2000 and 2013 with a primary diagnosis of appendicitis with generalized peritonitis (ICD-9-CM 540.0) or any diagnosis of acute appendicitis with peritoneal abscess (ICD-9-CM 540.1). Procedure codes of open and laparoscopic appendectomy (ICD-9-CM 47.01, 47.09) were used to determine the timing of surgery. Patients were excluded if they never underwent an appendectomy as we were unable to distinguish between patients being treated without surgery, patients lost to follow-up, or patients receiving further care outside of New York State. We additionally excluded children who had prior hospitalization for uncomplicated appendicitis. A detailed patient selection process is described in Fig. 1.

The independent variable was early versus late appendectomy. Early appendectomy was defined as surgery within 2 days of admission during index hospitalization as it has previously been shown that there are minimal differences in outcome between 12, 24 and 48-h delay from diagnosis to surgery [13]. Late appendectomy was defined as having

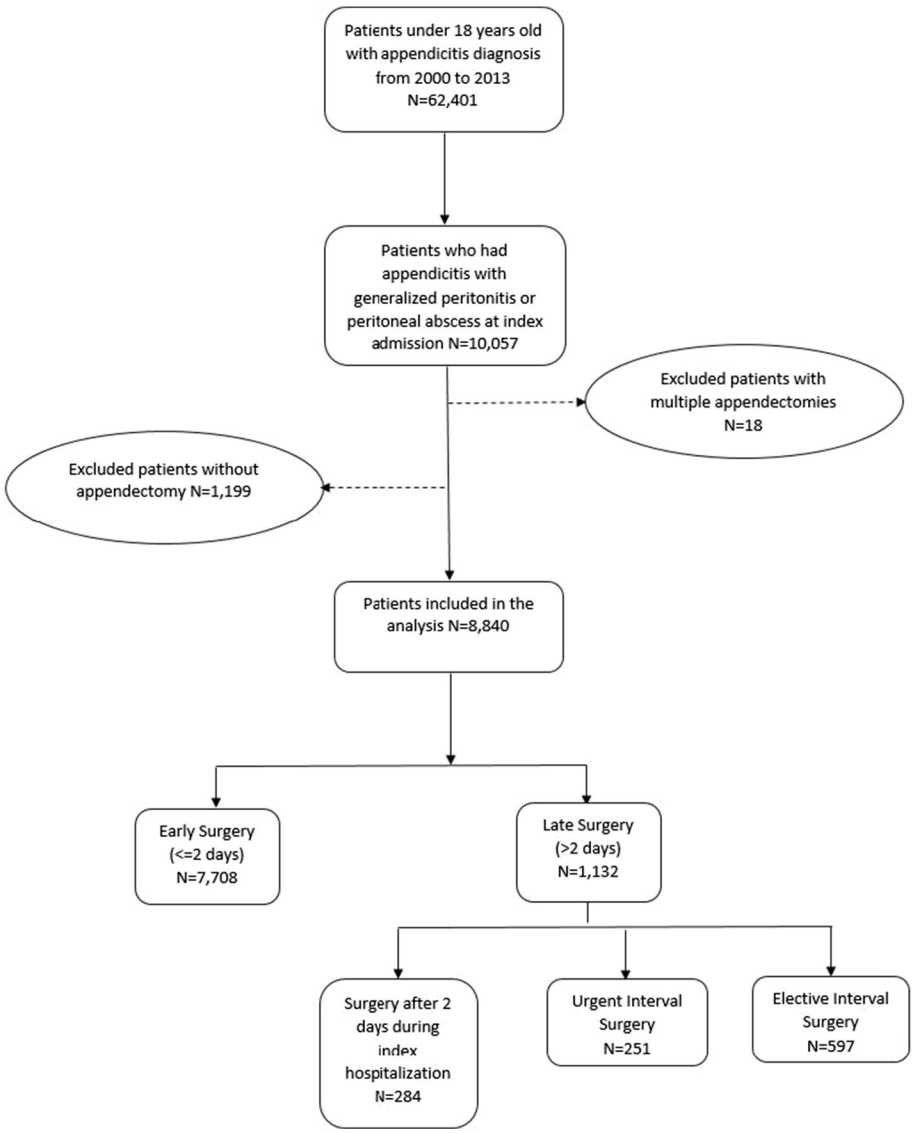

Fig. 1. Patient selection process.