



## Small Bowel Obstruction after Laparoscopic Appendectomy in Children

Belén Aneiros Castro<sup>1\*</sup>, Indalecio Cano Novillo<sup>1</sup>, Araceli García Vázquez<sup>1</sup>, Pedro Yuste García<sup>2</sup>, Eduardo Ferrero Herrero<sup>2</sup> and Andrés Gómez Fraile<sup>1</sup>

<sup>1</sup>Department of Pediatric Surgery, Hospital 12 de Octubre, Madrid, Spain

<sup>2</sup>Department of General Surgery, Hospital 12 de Octubre, Madrid, Spain

### Abstract

**Introduction:** The aim of this study is to determine the characteristics and the treatments of the patients with bowel obstruction after laparoscopic appendectomy.

**Material and Methods:** A retrospective study was conducted to analyze laparoscopic appendectomy performed in our center between 2000 and 2013. Bowel obstruction was diagnosed by physical examination and radiographic. Stata software was used to analyze all the statistical data.

**Results:** There were 1,734 patients, of which 17 patients developed bowel obstruction (1%). The mean age of the patients was 8.0 years. Overall, 70.6% were male and 29.4% were female. Bowel obstruction occurred in 12 patients in the immediate post-operative period, in 8 patients in the delayed post-operative period and in 3 patients in both periods. All the patients with bowel obstruction in the immediate post-operative period underwent operative intervention; 50% were completed by the laparoscopic approach and 50% by open approach. Intra-abdominal abscess occurred in 66.6% of the patients. In the delayed post-operative period, 7 patients were managed conservatively and 1 patient was managed by open surgical approach. The patients that developed bowel obstruction in both periods were managed by open surgical approach in the immediate post-operative period.

**Conclusion:** Bowel obstruction after laparoscopic appendectomy is an uncommon complication. Like the most recent studies, our results support that laparoscopic appendectomy reduces the incidence of bowel obstruction. In addition, this approach can be used to treat this complication in determinate cases.

**Keywords:** Bowel obstruction; Appendectomy; Laparoscopy

### Introduction

In the last decades, minimally invasive surgery has increasingly been acknowledged in different surgical specialties. At present, it is the gold standard approach for the management of several pathologies. The adaptation of laparoscopic instruments for pediatric patients has allowed us to perform minimally invasive techniques in children [1]. Several studies have demonstrated that laparoscopic approach for appendectomies has advantages over open technique such as decreased rate of wound infection and small bowel obstruction, shorter hospital stay, better cosmesis and less postoperative pain. Furthermore, it has also been observed diagnostic and therapeutic advantages with regard to the open technique, especially in fertile women [2].

The development of intestinal adhesions after an Intra-abdominal surgery is generally inevitable. They can have serious consequences for patients such as infertility, chronic abdominal pain or bowel obstruction. The management of intestinal adhesions depends on the symptoms and physical signs of the patients. Laparoscopic approach allows an effective treatment in selected patients, which reduces the morbidity associated with open procedures [3]. The aim of this study is analyze the characteristics of the patients with small bowel obstruction after laparoscopic appendectomy. Furthermore, we want to investigate which is the best therapeutic management for these patients.

### Material and Methods

The data of the patients who underwent laparoscopic appendectomy in our department between January 2000 and December 2013 were retrospectively analyzed. A total of 1,734 pediatric patients were included in this study. Demographic parameters, clinical records, surgical interventions

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#### \*Correspondence:

Belén Aneiros Castro, Department of Pediatric Surgery, Hospital 12 de Octubre, Madrid, Spain, Tel: +34630668108;

E-mail: belenaneiroscastro@gmail.com

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**Table 1:** Macroscopic characteristics of the appendix during the surgical intervention.

|             | Cases | Percentage |
|-------------|-------|------------|
| Phlegmonous | 1     | 5,8%       |
| Gangrenous  | 5     | 29,5%      |
| Perforated  | 11    | 64,7%      |

**Table 2:** Treatment of postoperative small bowel obstruction.

|           | Conservative treatment | Laparoscopic surgery | Open surgery |
|-----------|------------------------|----------------------|--------------|
| Immediate | 0                      | 6 (50%)              | 6 (50%)      |
| Delayed   | 7 (87,5%)              | 0                    | 1 (12,5%)    |

and postoperative results were evaluated. Diagnosis of small bowel obstruction was made according to the physical examination and symptoms (abdominal pain, vomiting or lack of abdominal sounds) and radiological findings (dilated intestinal loops, lack of distal gas or hydro-aerial levels).

Immediate bowel obstruction was established when this complication appears during the length of stay while delayed bowel obstruction was determined when the patient was discharged from the hospital. The minimum follow-up was at least 4 years. Statistical analyses were checked by STATA software. Continuous variables were analyzed with the Wilcoxon test. Discrete variables were compared using the chi-square test. A p value of less than 0.05 was considered statistically significant.

## Results and Discussion

Small bowel obstruction was observed in 17 of the 1,734 patients (1%) included in this study. There were 12 boys and 5 girls. The mean of age was 8.0 years and the mean weight was 33.9 kg. Vomiting was present in 14 patients (82.4%) and fever in 15 (88.2%). The mean time from the onset of symptoms to the diagnosis of appendicitis was 2.62 days.

The macroscopic aspect of the appendix (Table 1) during the surgical intervention was phlegmonous in 1 case (5.9%), gangrenous in 5 cases (29.4%) and perforated in 11 cases (64.7%). There was an inflammatory phlegmon in 9 patients (52.9%) and generalized peritonitis in 14 patients (82.4%). One patient (5.9%) required conversion to open appendectomy. Abdominal drainage was placed in 11 cases (64.7%). There were 3 intraoperative complications: 2 rupture of the appendix and 1 bleeding. The mean surgical time was 74.4 min.

There were 12 small bowel obstructions (Table 2) in the immediate postoperative period (70.6%) and 8 in the delayed period (47%). Three patients presented small bowel obstruction in both periods. All the children with small bowel obstruction during the immediate postoperative period were treated by surgical intervention (6 laparoscopic approaches and 6 open techniques). Intra-abdominal abscess were found in 8 of these patients (66.6%) and they were simultaneously treated. The mean onset of enteral feeding was 10.3 days and the mean of length of stay was 16.9 days.

Patients with small bowel obstruction in delayed postoperative period (n=8) were managed by conservative treatment in 7 cases (87.5%) and by open surgical intervention in 1 case (12.5%). The mean onset of enteral feeding was 1.4 days and the mean of length of stay was 5.3 days. This complication was observed in a range of time intervals from 10 days to 9 years after the first surgical intervention.

Small bowel obstruction in both periods was found in three patients (17.6%). All of them were treated by open surgery in the immediate period. In the delayed period, one of them underwent open surgical intervention and the other two patients underwent laparoscopic intervention.

Small bowel obstruction is a relevant clinical condition that can happen after an Intra-abdominal surgical intervention due to the development of peritoneal adhesions between abdominal tissues and organs. These adhesions are also called “flanges” by surgeons. Although studies are limited in pediatric patients, it has been estimated that small bowel obstruction after an Intra-abdominal surgery can occur in 1% to 6% of patients [3,4]. The incidence of postoperative adhesions varies according to the type of surgery and the age of the patient. The formation and the closure of ileostomy have the highest rate of postoperative bowel obstruction in pediatric patients (up to 25%); while appendectomy has the lowest rate (up to 0.3%) [5].

There are several studies comparing the outcomes of open or laparoscopic appendectomy in the literature. The rate of bowel obstruction after laparoscopic appendectomy is statistically lower than after open surgery. It occurs in approximately 0.89% of patients who underwent laparoscopic appendectomy and in 3.21% after open appendectomy. These percentages vary according to the type of appendicitis (phlegmonous, gangrenous or perforated). Perforated appendicitis has the highest rate of postoperative bowel obstruction [6-8].

Initial therapeutic management of postoperative small bowel obstructions in adults is conservative when there are not clinical signs of ischemia. However, it has been not demonstrated that this management is safe for children. The rate of patients with postoperative obstruction who respond to conservative treatment varies from 16% to 63%. Therefore, many pediatric patients are treated by surgical intervention [9]. Some authors have defended initial conservative management during the first 48 hrs due to the majority of responder patients tend to improve at this time. In addition, the risk of intestinal ischemia is lower during this period [10].

Minimally invasive surgery also plays an important role in the treatment of postoperative bowel obstruction. It has been demonstrated that laparoscopic adhesion removal has a lower rate of complications, shorter length of stay and less risk of recurrence. However, this technique has high rate of conversion and requires advanced laparoscopic skills [11].

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