

Laparoscopic Reduction of Intussusception: an Evolving Therapeutic Option

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ABSTRACT

Introduction: Intussusception (IS) is a common cause of bowel obstruction in the pediatric population. Traditionally, unsuccessful hydrostatic reduction has been followed by laparotomy. With the advent of minimally invasive surgery, centers have adopted laparoscopic reduction as a surgical option. We reviewed our experience with IS and investigated whether there were any advantages to performing laparoscopy over conventional laparotomy in unsuccessful air enema reduction (AE).

Methods: All the records of patients admitted from January 2001 to August 2004 with a diagnosis of IS (diagnosis code 560.0) were reviewed. Parameters investigated included age, sex, weight, radiological intervention, operative procedure, length of stay (LOS), and days to oral intake (PO). Statistical analysis was performed with the 2-tailed *t* test to compare outcomes and Fisher's exact test to assess differences in nominal frequencies.

Results: Seventeen males and 9 females diagnosed with IS were identified. The mean age was 2.5 years (range, 1 month to 14 years), and the average weight was 5.65 kg (range, 4.65 to 95). Twenty-three of the 26 patients (88.5%) underwent AE reduction, with success in 13 (57%). One recurred after initial successful AE, 9 failed multiple attempts at AE, and 2 attempted reductions were complicated by perforations. Fifteen patients underwent surgical reduction for unsuccessful AE or to address a pathological lead point. The success rate of laparoscopic reduction was 85%. The average time to resumption of PO intake for patients with successful AE was 0.5 days, and after laparoscopic reduction, the average time to PO intake was 1.5 days, while it was 4 days after laparotomy ($P=0.05$). After laparoscopic reduction, the average LOS was 6 days, but LOS was 7 days after laparotomy ($P=0.66$).

Conclusion: Many children who present with IS can be treated by AE. In patients who fail AE, laparoscopy offers a safe, effective alternative to laparotomy.

Key Words: Laparoscopy, Laparotomy, Intussusception, Air enema reduction.

INTRODUCTION

Hirschsprung in 1876 popularized the enema technique as an alternative to surgery in the reduction of intussusception.¹ Currently, universal use of hydrostatic and air enemas for diagnosis and treatment makes childhood intussusception a nonsurgical condition in at least 50% of cases.² However, a wide variation exists in the reported success rates of nonsurgical reduction.^{3,4} Predictors of unsuccessful nonoperative reduction are symptoms longer than 48 hours, rectal bleeding, small bowel obstruction, ileoileocolic intussusception, and prior failure of reduction with barium. Some children with intussusception may need surgical intervention either due to failure of nonoperative treatment, a complication of nonoperative treatment, recurrences after nonoperative treatment, or a pathological lead point. Traditionally, the surgical approach to intussusception has involved laparotomy; however, recently minimally invasive techniques have been applied not only to aid nonoperative reduction, but also to primarily reduce the intussusception and in some cases to resect a pathological lead point or damaged segment of bowel.⁵ We investigated whether increased application of minimally invasive techniques had altered outcomes of children admitted with the diagnosis of intussusception over a 4-year period from January 2001 to August 2004.

METHODS

We retrospectively reviewed the records of patients admitted with a diagnosis of intussusception (diagnosis code 560.0). Parameters investigated included age, sex, weight, radiological intervention, operative procedure, length of stay (LOS), and days to oral intake (PO). The success of nonoperative treatment was evaluated. Demographic data and postoperative morbidity data were compared be-

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tween minimally invasive and traditional surgery to determine whether there were any benefits associated with the application of laparoscopy to treat intussusception. Surgeon preference and not patient characteristics determined whether a patient received the conventional operation or a laparoscopic procedure. This study looked at the potential of minimal access surgery as a safe therapeutic option in dealing with childhood intussusception (IS) and does not attempt to delve into selection criteria for open or laparoscopic surgery.

Statistical analysis was performed with Fischer's exact test to assess differences in nominal frequencies of small groups and the Student *t* test to compare outcomes. A value of $P < 0.05$ was considered to represent a statistically significant difference. Approval for collection and publication of data was obtained from the hospital institutional review board.

RESULTS

Twenty-six patients were admitted to our institution with the diagnosis of intussusception over the study period (**Table 1**). There were 17 males and 9 females with a mean age of 2.5 years (range, 1 month to 9 years). The average weight of the patients in the study was 5.65 kg (range, 4.65 to 95). Computed tomography (CT) or ultrasonography was used to initially aid the diagnosis in 4 and 6 patients, respectively. Twenty-three of the 26 patients (nearly 90%) underwent air contrast enema with an attempt at nonsurgical reduction. An experienced pediatric radiologist performed or supervised all air enemas with the surgery team on standby in the event of a complication. Thirteen of the 23 subjects (60%) who underwent enema reduction (AE) had a reduction of IS. One patient in this group had a recurrent IS after an initially successful air enema. Ten patients failed nonsurgical reduction with

an air enema, and this included 2 attempted reductions, which were complicated by perforations.

Fifteen patients underwent surgery to relieve the intussusception or deal with a pathological lead point. In this group, 6 had laparoscopic reduction and resection of bowel or pathological lead point, while 8 underwent laparotomy. One laparoscopic procedure had to be converted to open surgery because of a perforation in the intussusciens and has been included in the conventional group for statistical analysis. One patient had a successful laparoscopic reduction and had commenced oral intake but developed a recurrence just before discharge. This was dealt with by conventional surgery. In 2 of the laparoscopic cases, complex bowel resections were also performed. In one case, laparoscopic colotomy and resection of a polyp, which was a pathological lead point of a colocolic intussusception, was performed. In the second, a laparoscopic-assisted colectomy was performed for ischemic compromise of the bowel.

The demographic data and outcomes in the 2 surgical groups are illustrated in **Table 2**. The children in the laparoscopic arm were on average heavier and older than the children in the conventional surgery arm. No statistically significant differences existed between the 2 groups with regards to either age or sex. The white cell counts were not statistically different between the groups that underwent laparoscopy (mean, 14.2; range, 5.6 to 31.6) and laparotomy (mean, 13.4; range, 7.7 to 16.3). While children after laparoscopic reduction commenced oral intake on an average of 1.5 days after surgery, it took an average of 4 days for children after conventional surgery

Table 1.

Clinical and Therapeutic Characteristics of Patients Admitted With Intussusception (N=26)	
Sex (M:F)	17:9
Age (Mean)	2.5 years
Weight (Mean)	5.65 kg
Initial NSR (Nonsurgical reduction)	23 (12 successful; 1 recurrence and 10 failed)
Surgery	15
Laparoscopy	6
Laparotomy	9 (1 conversion)

Table 2.

Comparison of Demographic Data and Outcomes in Patients Who Underwent Laparoscopy and Conventional Surgery

Demographics	Laparoscopy (n=6)	Laparotomy* (n=9)	P†
Age (y)	4.66 (1.5–9)	2.3 (0.1–14)	NS (0.28)
Sex (M:F)	3:3	6:3	NS (0.67)
Weight (kg)	23 (11.7–43.7)	17.7 (4.65–95)	NS (0.70)
White blood cell count	14.2 (5.6–31.6)	13.4 (7.7–16.3)	NS (0.81)
Oral intake (d)	1.5 (0–4)	4.2 (2–11)	S (0.05)
Length of stay (d)	6.16 (3–10)	7.1 (3–15)	NS (0.66)

*One patient in the laparotomy group had initial attempted laparoscopy and subsequent conversion due to perforation.

†NS=not significant; S=significant.

to resume oral intake ($P=0.05$). The length of stay after a laparoscopic procedure was not significantly different than the length of stay for those who underwent conventional surgery ($P=0.66$).

DISCUSSION

Minimal access surgery is rapidly becoming the surgical approach of choice for a variety of surgical disorders in children. However as pointed out by Lobe and associates,⁶ most surgeons still harbor justifiable concerns about the morbidity of this modality. Proponents of laparoscopy cite faster recovery time, less pain, and better cosmetic results. Opponents remain skeptical because of lack of proven long-term benefits, the higher cost, and the question of increased complications.

Six of the 7 children who underwent a laparoscopic approach had successful reduction, and 2 also underwent complex laparoscopic procedures to deal with a lead point and ischemic bowel. This is a success rate of 85%. As noted earlier, although most children in this group were on average larger and older than the group that underwent conventional surgery, the difference was bit significant. This suggests that better instrumentation and surgeon expertise has enabled a higher success rate in performing laparoscopic reduction of intussusception. In 2001, Van der Laan et al⁷ concluded that laparoscopy be reserved for cases of recurrent intussusception or doubtful reduction and further suggested that children older than 3 years would not likely benefit from a laparoscopic approach because of a high incidence of a pathological lead point. We have been able to deal with pathological lead points laparoscopically and do not hesitate to use it as the first therapeutic option, reserving conventional surgery as the gold standard in case of difficulty with laparoscopy or complications of minimal access surgery.

Most children were able to resume oral intake on an average of 1.5 days after surgery. This was significantly lower than the 4.2 days after conventional surgery ($P=0.05$). Although children who underwent laparoscopy

went home an average of a day earlier than those after conventional surgery, the difference was not statistically significant ($P=0.66$). Complex laparoscopic procedures performed in 2 of our patients prolonged their stay.

CONCLUSION

The cosmetic benefits of minimal access surgery are well known; however, this is of secondary importance to the safe performance of the procedure. Our success rate of 85% suggests that laparoscopy can be performed safely with no significant increase in complications. Larger randomized studies will however be needed to further elucidate the indications and contraindications for laparoscopic surgery in the pediatric age group as compared with the gold standard of exploratory laparotomy.

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