“Chinese Fan Spread” Distraction Technique of Laparoscopic Reduction of Intussusception

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ABSTRACT

Objective: The “Chinese Fan Spread” (CFS) distraction technique for laparoscopic reduction of intussusception is herein described and its outcome and benefits are evaluated.

Methods: A retrospective review was performed of all patients who underwent attempts at laparoscopic reduction of intussusception at our center. The CFS distraction technique was consistently applied in all cases.

Results: Fourteen patients were identified. Median age was 2.4 years (range, 4 months to 10.3 years). Indications for surgery included (1) failed pneumatic reduction (n=11), (2) need to evaluate for lead point in a patient with 4 recurrences (n=1), (3) need to biopsy the lead point in a patient with suspected lymphoma (n=1), and (4) diagnostic laparoscopy for evaluation of hematochezia (n=1). Two patients who failed laparoscopic reduction by the CFS distraction technique also failed open manual reduction, requiring right hemicolectomy. Of the 12 (86%) who were successfully reduced laparoscopically, pathologic lead points were identified in 5 (2 acute appendicitis, 1 Meckel’s diverticulum, 1 hamartomatous polyp, and 1 Burkitt’s lymphoma). Lead points were excised laparoscopically or via a vertical transumbilical incision. There were no complications.

Conclusion: Laparoscopic reduction of intussusception by the CFS distraction technique is effective and safe. Lead points may be dealt with together either laparoscopically or via a transumbilical incision.

Key Words: Laparoscopic reduction of intussusception, Children, Chinese fan spread.

INTRODUCTION

Intussusception, a common cause of intestinal obstruction in infants and young children, is successfully treated at our center by air enema reduction in 84.4% of patients.1 However, if reduction of the intussusception is unsuccessful by this method, the traditional approach is to proceed to reduce it manually via a laparotomy. Laparoscopic reduction of intussusception is a new approach, and only a few centers have reported reduction using this technique.2-5 This report describes the “Chinese Fan Spread” (CFS) distraction technique of reducing intussusception laparoscopically, its outcomes, and benefits.

METHODS

We retrospectively reviewed all patients with whom laparoscopic reduction of intussusception was attempted at our Pediatric Surgical Unit between March 2003 and April 2006. All had intussusception confirmed either by imaging studies or at diagnostic laparoscopy. The indications for surgery were (1) failed pneumatic reduction (2), diagnostic laparoscopy was required to evaluate for a lead point (3), diagnostic laparoscopy for another diagnosis when intussusception was not suspected, and (4) diagnostic laparoscopy for evaluation of hematochezia. Failure at pneumatic reduction was defined as 3 attempts using adequate pressure failing to elicit a reflux of air into the small bowel. The decision to use the laparoscopic approach was made based on the attending surgeons’ discretion and ability. The CFS distraction technique of laparoscopic reduction of intussusception was consistently applied in every patient reviewed. Patients’ demographic data, duration of symptoms, diagnostic modalities, attempts at pneumatic reduction, surgical records, and outcome were reviewed.

A 10-mm umbilical port was inserted by using the open Hasson technique. After CO₂ insufflation, a 30-degree laparoscope was first placed and two 5-mm instrument ports were inserted, at the left iliac fossa or suprapubic area. Atraumatic instruments, ie, fenestrated bowel and oviduct graspers, were used to “walk” bowel from the distal ileum until the intussusception was encountered. This was usually found at the infrahepatic area. These
instruments were crossed intraperitoneally and used to gently pull out intussusceptum and pull away the intussusception. This sustained traction-counter traction with crossed instruments gives the appearance of the opening of a Chinese fan, therefore the name Chinese Fan Spread (Figure 1). The fenestrated bowel grasper was preferred in the proximal bowel because it allowed strong traction when applied transversely across the entire bowel diameter. In some instances, 2 fenestrated bowel graspers were used. Once reduced, the bowel was examined for lead point, ischemia, and other intussusceptions. If required, exteriorization and extracorporeal resection and anastomosis of the small bowel were performed via an extended umbilical incision or a minilaparotomy. This technique was performed without any pneumatic or hydrostatic assistance.

RESULTS

We identified 14 patients who underwent attempts at laparoscopic reduction of intussusceptions. There were 9 boys and 5 girls with a median age of 2.4 years (range, 4 months to 10.3 years). The ethnic distribution was 8 Malays, 5 Chinese, and 1 Indian. These patients had been symptomatic for over 24 hours, median of 3 days (range, 1 to 6). All had undergone ultrasound scans, with 13 patients diagnosed with intussusceptions. Eleven patients failed pneumatic reduction of intussusceptions after adequate attempts. Another patient had 4 recurrences of ileocecocolic intussusception. Despite 3 previous successful pneumatic reductions, surgery was planned at the last recurrence to evaluate for a lead point. One of the patients in whom pneumatic reduction was not attempted was found to have multiple enlarged mesenteric and retroperitoneal masses on ultrasound and CT scans, suspicious of lymphoma. The need for a tissue biopsy prompted us to proceed with the laparoscopic approach rather than an attempt at pneumatic reduction. In another patient, small bowel intussusception was missed on ultrasound scan, and the patient proceeded to diagnostic laparoscopy when she continued to have hematochezia. Ileo-ileal intussusception was identified at laparoscopy.

The intussusceptions identified were ileo-colic (n=11), ileo-ileocolic (n=2), and ileo-ileal (n=1) in locations. The CFS distraction technique allowed us to successfully manipulate and reduce the intussusceptions in 12 (85.7%) of the 14 patients. Two patients in whom the CFS distraction technique failed underwent laparotomy. Both intussusceptions were in the ileo-colic region, had also failed open manual reduction, and required limited right hemicolectomy with ileocolic anastomosis. Histopathology revealed an infarcted 8 cm of ileum with lymphoid hyperplasia in one patient, while the other had Burkitt’s lymphoma.

Of the 12 who successfully underwent laparoscopic reduction of intussusception, pathologic lead points were identified in 5. These included 2 acute appendicitis, 1 Meckel’s diverticulum, 1 hamartomatous polyp (Peutz-Jeghers Syndrome), 1 Burkitt’s lymphoma. Only 4 of the 12 patients underwent laparoscopic reduction without other procedures. Two patients underwent concurrent appendectomies for appendicitis; 1 had transumbilical Meckel’s diverticulectomy; 1 had transumbilical enterotomy, polypectomy, and surveillance enteroscopy in Peutz-Jeghers Syndrome; 2 had transumbilical small bowel biopsies; 1 had intracorporeal excisional biopsy of an enlarged mesenteric lymph node; and 1 underwent transumbilical resection of infarcted small bowel and primary ileo-ileal anastomosis. All the procedures were performed via a vertical transumbilical incision. There was no recurrence of intussusception after that.

Patients who underwent laparoscopic reduction of intussusception without enterotomy or enterectomy established feeds after a median duration of 1 day (range, 1 to

![Figure 1. Representation of the “Chinese Fan Spread” distraction technique of laparoscopic reduction of intussusception.](image-url)
3). Those with resection of bowel or enterotomy established feeds after a median duration of 3 days (range, 3 to 5). They required minimal analgesia. All children remained well and had no recurrence of intussusception or intestinal obstruction.

**DISCUSSION**

Laparotomy has been the traditional approach for manual reduction of intussusception after failed pneumatic or hydrostatic reduction. Although several cases have been reported, laparoscopic reduction remains uncommon in most pediatric surgical centers. Conventional techniques for manual reduction advocate pushing the intussusceptum from the colon backwards, and thus with sustained pressure push the small bowel out; pulling the small bowel out is not recommended. However, it is difficult to squeeze the bowel laparoscopically. Thus, crossing the instruments intracorporeally and using the CFS distraction technique to apply sustained traction-counter traction allowed us to pull the bowel out and to push the intussusceptum away.

The principle of this technique was that the creation of an intracorporeal fulcrum allowed an increase in the range of movement of the graspers, hence, magnification of the forces of distraction. In general, the predominant use of the wrist movements in laparoscopic surgery reduced the strain on the surgeon’s shoulders. It also restricted the range of movement of the instruments. Ergonomically, it was easier to apply sustained force (pull or push) with the wrist flexed than to do so with the wrist extended. The point where the graspers crossed each other intracorporeally acted as a fulcrum. Together, they worked to magnify the movement of each wrist flexion, allowing wider movement with no strain in the application of the sustained pull-push pressure. Slight abduction of the shoulders then added to the angle as well, making the CFS movement more comfortable.

The use of a fenestrated bowel grasper in the proximal bowel has significantly reduced the incidence of bowel tears during laparoscopic reduction. When applied transversely across the entire bowel diameter, it evenly distributed the pull-away force. In contradistinction, the use of a smaller instrument would have led to concentration of forces on one area of the bowel thereby resulting in a tear. In several instances, we used a similar grasper and technique on the distal bowel as well.

The versatility of the laparoscopic approach not only provided an accurate diagnosis of intussusception and its lead point, other adjunct procedures may also be performed with minimal access. Once the intussusception was reduced, the bowel was examined for lead point, ischemia, and other intussusceptions. Pathologic lead points may be dealt with effectively simultaneously. If required, exteriorization and extracorporeal resection and anastomosis of the small bowel were performed via an extended umbilical incision or a minilaparotomy, or even a surveillance enteroscopy was performed via the transumbilical approach as was done in the patient with Peutz-Jeghers syndrome. Laparoscopic intracorporeal lymph node biopsies and appendectomies can also be done at the same time.

Even though laparoscopic reduction of intussusception remains uncommon after a failed gas enema, success rates in laparoscopic reduction of intussusceptions in children have increased as reported in recent reports. Schier reported a success rate of 57% in his series of patients in 1997, whilst Kia et al. reported a success rate of 87.5% in 16 patients. However, in another series of 72 patients, the laparoscopic approach was attempted in 14 children, but in only 3 was reduction successful; all 3 patients were >3 years of age. We were able to reduce the intussusception in 12 of 14 patients (85.7%), or 10 of 11 patients (90.9%) if we considered only those who failed the pneumatic reduction trial. We believe that our technique of CFS distraction allowed us to reduce the intussusception safely and effectively. The only 2 patients with failed laparoscopic reduction could not be reduced manually either.

The application of concurrent pneumatic assistance during laparoscopic reduction has brought about better success rates in some centers. The CFS distraction technique, however, allowed laparoscopic reduction without the need for per rectal pneumatic or hydrostatic insufflation with no complications. Our technique obviates the problem of uncontrolled insufflation pressures, bowel distension making visibility and manipulation in the abdominal cavity difficult, pericatheter leakage of gas and soiling that occurs during per rectal pneumatic insufflation.

Laparoscopic reduction of intussusception, apart from conferring the benefits of less postoperative pain and better cosmesis, also allows excision of the pathologic lead points and bowel resection via a small incision. Using instruments to handle gut helps in early return of intestinal movement, shorter hospital stay, and is expected to decrease the incidence of adhesive obstruction. We have managed to successfully reduce intussusception laparoscopically in 86% of our patients by using the CFS distraction technique without the need for simultaneous pneumatic insufflation and without complications.
CONCLUSION

Laparoscopic reduction of intussusception by the CFS distraction technique is effective and safe. Lead points may be dealt with together either laparoscopically or via a transumbilical incision. We recommend the use of this technique of laparoscopic CFS reduction of intussusception in those patients with failed pneumatic or hydrostatic reduction or when diagnosed incidentally at laparoscopy.

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