

Incidence and treatment of adhesive bowel obstruction after gastroschisis closure

Claudia Mueller^a and Sarah Bouchard^b

Background Children with gastroschisis, especially when it is complicated by atresia or perforation, often suffer from severe long-term sequelae such as short-bowel syndrome and chronic dysmotility. These children are also susceptible to adhesive bowel obstruction later in life, which can alter their nutritional intake and may require repeated visits to the hospital. However, few long-term studies have attempted to determine the rate of occurrence of intestinal occlusion after gastroschisis. In this study we measured the incidence and management of adhesive bowel obstruction in children with gastroschisis at one academic pediatric hospital.

Methods A retrospective chart review was carried out on patients with gastroschisis born between January 2000 and December 2007. A total of 74 patients who underwent closure of their gastroschisis during this period were identified.

Results Twelve of these 74 (16%) patients were readmitted to the hospital with at least one episode of adhesive bowel obstruction. Three of the 12 patients had gastroschisis complicated by atresia. Eight patients underwent immediate primary closure of their defect on the first day of life. Silos were installed on the remaining four (36%) and were kept in place for an average of 6.25 (range: 4–9) days. Five of the 12 children resolved their

obstruction with nasogastric tube decompression alone. The remaining seven (58%) required lysis of adhesions after failure of decompression. The seven children who underwent surgical lysis of adhesions did not have additional episodes of occlusion after laparotomy.

Conclusion In this study, 16% of the patients born with gastroschisis within a 7-year period presented with a adhesive obstruction. Occurrence of obstruction was unrelated to the method of closure or the severity of the defect. Although conservative management with nasogastric tube decompression may be effective initially, over half of patients with occlusion will need eventual surgery for lysis of adhesions. *Ann Pediatr Surg* 13:14–16
© 2017 Annals of Pediatric Surgery.

Annals of Pediatric Surgery 2017, 13:14–16

Keywords: bowel obstruction, gastroschisis, lysis of adhesions

^aDivision of Pediatric Surgery, Department of Surgery, Stanford University, Palo Alto, California, USA and ^bDepartment of Pediatric Surgery, University of Montreal, Quebec, Canada

Correspondence to Claudia Mueller, PhD, MD, Division of Pediatric Surgery, Stanford University, 300 Pasteur Drive, Alway M116, Palo Alto, CA 94305, USA
Tel: +1 650 723 6439; fax: +1 650 725 5577;
e-mail: clmueller@stanfordchildrens.org

Received 20 June 2016 accepted 19 July 2016

Introduction

Bowel obstruction caused by postoperative adhesions is a frequent complication in children who have undergone abdominal surgery. Reports of the incidence of postoperative adhesive bowel occlusion range rather widely depending on the type of surgery performed: SBO has been noted to occur in from one to three percent of patients after open appendectomy [1] and up to 15% after Ladd's procedures [2]. Children born with abdominal wall defects may also be at relatively high risk for intestinal adhesions, but the actual incidence has not been conclusively demonstrated as reports of obstruction vary from seven to 30% of cases [3–7].

To better understand the nature of bowel obstruction in children with gastroschisis, we reviewed all patients that were born with this abdominal wall defect at our institution during a period of 7 years. We were particularly interested in the incidence and timing of adhesive obstruction in patients with gastroschisis, whose nutrition may already be compromised by chronic dysmotility or short-bowel syndrome [8–10]. Furthermore, we examined whether closure type or the presence of a defect complicated by atresia or necrosis predicts the occurrence of an obstruction and whether the timing of obstruction is related to the need for surgical intervention.

Methods

A retrospective chart review was carried out on all patients born with gastroschisis at an urban children's hospital between January 2000 and December 2007. Infants born with omphalocele or any other type of abdominal wall defect were not included in this review. Maternal and neonatal demographic data were gathered. In addition, closure technique and presence of atresia or necrosis were noted. Finally, patient charts were reviewed for any hospital admission for bowel obstruction. Treatment strategies for each episode of bowel obstruction were recorded. Descriptive analyses as well as comparisons by using *t*-tests were carried out to examine our data.

Results

In total, 74 patients were treated for gastroschisis at our center during the 7-year period. All were delivered at our children's hospital. The infants (37 boys) had a mean gestational age of 36.5 (range: 31.3–39.6) weeks at birth. Of the 74, 15 (20%) had gastroschisis complicated by atresia (six patients), necrosis (four patients), or both (five patients). A total of 52 (70%) patients underwent immediate primary closure on the first day of life. The remaining 22 had spring-loaded silos placed at birth and

Table 1 Patients with adhesive bowel obstruction after gastroschisis repair

| Patients | Closure type | Atresia | Time interval to first obstruction (months) | Treatment |
|-----------------|--------------|---------|---|----------------------|
| 1 ^a | Primary | Absent | 0.75 | Strictureplasty, LOA |
| 2 ^a | Silo | Present | 0.75 | Lysis of adhesions |
| 3 | Primary | Absent | 1 | NGT decompression |
| 4 | Primary | Absent | 1.3 | Lysis of adhesions |
| 5 | Primary | Absent | 1.5 | NGT decompression |
| 6 | Primary | Present | 2 | Resection, LOA |
| 7 | Silo | Absent | 2.3 | Lysis of adhesions |
| 8 | Silo | Absent | 3 | Lysis of adhesions |
| 9 ^a | Primary | Absent | 6.5 | NGT decompression |
| 10 ^a | Primary | Absent | 9 | NGT decompression |
| 11 | Silo | Present | 9.5 | NGT decompression |
| 12 | Primary | Absent | 12.5 | Strictureplasty, LOA |

LOA, level of activity; NGT, nasogastric.

^aThese patients had multiple episodes of obstruction which occurred up to 41 months after gastroschisis closure.

underwent staged closure. Silos were kept in place for a mean of 5.8 (range: 2–9) days.

Twelve of the 74 (16%) patients born with gastroschisis during this time period were readmitted to the hospital with at least one episode of bowel obstruction caused by adhesions (Table 1). Eight patients presented with obstruction only once. Four had multiple episodes: two patients presented twice, and the remaining two patients each had three admissions for obstruction. First episodes of obstruction occurred an average of 4 months after gastroschisis closure (range: 3 weeks to 1 year). However, additional episodes of obstruction were noted up to 41 months after gastroschisis repair. Patients presented to the hospital with classic obstructive symptoms of abdominal pain, distention, nausea, and vomiting. Three of these 12 (25%) patients had intestinal atresia associated with their gastroschisis for which they underwent subsequent laparotomies before they presented with adhesive occlusions. Seven of the 12 patients had immediate primary closure of their defect on the first day of life. The remaining five had silos placed and underwent closure an average of 6.3 (range: 4–9) days later.

Five of the 12 children who presented with adhesive bowel obstruction resolved their occlusion with nasogastric tube decompression. These included three of the patients who had multiple episodes of obstruction. The remaining seven (58%) children failed conservative management and underwent laparotomy with lysis of adhesions. These seven children had no additional episodes of obstruction after surgical adhesiolysis. Three of the patients had incidentally noted strictures: two were treated with stricturoplasty, one with resection.

Whether children had their gastroschisis reduced primarily or via a silo made no significant difference to their likelihood to present with obstruction ($t = 0.29$, NS) or to require surgery if they did obstruct ($t = 0.89$, NS). Rather surprisingly, there was also no difference in the likelihood of obstruction based on the presence of a gastroschisis complicated by either atresia or necrosis ($t = 0.42$, NS). However, we did note a trend for children who presented with a first episode of obstruction early in life to require surgical correction. Specifically, children whose first episode of obstruction occurred within the first 3 months after gastroschisis closure seemed more likely to require

lysis of adhesions than children whose obstructions presented later ($t = 1.89$, $P < 0.10$).

Discussion

We reviewed the incidence of postoperative adhesive bowel obstruction in 74 patients who were born with gastroschisis at our hospital center over a 7-year period. Twelve (16%) of these patients were admitted to the hospital at least once with adhesive bowel obstruction. Our findings are consistent with those reported by Wilkins and Spitz [3], who noted an obstruction rate of 15.4% in children after gastroschisis closure. Most of the episodes we identified occurred within children's first postoperative year, which is also consistent with some previous reports [6,7].

We found no significant differences in the occurrence of bowel obstruction based on whether closure was facilitated by spring-loaded silos or primary. Furthermore, children with gastroschisis complicated by atresia were no more likely to present with bowel obstruction than those with simple gastroschisis. This is in contrast to what has been described by Freidmacher *et al.* [7] in their series, but may be the result of our relatively small sample size. Of course, obstructions in the complicated cases of atresia might be multifactorial rather than caused by simple adhesive disease, and thus may not be comparable with the obstructions seen in our patients.

In our experience, more than half of the patients who presented with adhesive bowel obstruction failed the trials of conservative management and required surgical lysis of their adhesions. This is higher than the rate of surgical adhesiolysis documented in reviews of bowel obstruction after interventions for causes such as atresia or appendectomy. This finding suggests that adhesions caused during closure of gastroschisis may be less susceptible to conservative treatments than those incurred during other surgeries.

We acknowledge that our review of the incidence of adhesive bowel obstruction after gastroschisis may be incomplete because it encompasses only episodes of occlusion that required hospital admission. As our hospital serves as the preferred admitting center for French-speaking children within the province of Quebec, we are confident of our follow-up for these patients.

However, 1-day emergency room visits and intervals of vomiting noted by parents at home were not included. Thus, the actual incidence of adhesive bowel obstruction after gastroschisis closure in our population actually may be higher than we report.

Children born with gastroschisis may have a fragile nutritional balance, which may be easily destabilized by prolonged dehydration or intolerance of oral intake. We thus strongly suggest that parents should be alerted to the possibility of postoperative obstruction as a consequence of gastroschisis management to avoid dangerous delays in treatment. Moreover, given the relatively high need for surgical adhesiolysis in our patients, physicians are encouraged to consider early surgical intervention if conservative management appears ineffective.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

References

- 1 Festen C. Postoperative small bowel obstruction in infants and children. *Ann Surg* 1983; **196**:580–583.
- 2 Janik JS, Ein SH, Filler RM, Shandling B, Simpson JS, Stephens CA. An assessment of the surgical treatment of adhesive small bowel obstruction in infants and children. *J Pediatr Surg* 1981; **16**:225–235.
- 3 Wilkins BM, Spitz L. Incidence of postoperative adhesion obstruction following neonatal laparotomy. *Br J Surg* 1986; **73**:762–764.
- 4 Koivusalo A, Lindahl H, Rintala RJ. Morbidity and quality of life in adult patients with a congenital abdominal wall defect: a questionnaire survey. *J Pediatr Surg* 2002; **37**:1594–1601.
- 5 Snyder CL. Outcome analysis for gastroschisis. *J Pediatr Surg* 1999; **34**:1253–1256.
- 6 Van Eijck FC, Wijnen RM, van Goor H. The incidence and morbidity of adhesions after treatment of neonates with gastroschisis and omphalocele: a 30-year review. *J Pediatr Surg* 2008; **43**:479–483.
- 7 Friedmacher F, Hock A, Castellani C, Avian A, Höllwarth ME. Gastroschisis-related complications requiring further surgical interventions. *Pediatr Surg Int* 2014; **30**:615–620.
- 8 Swartz KR, Harrison MW, Campbell JR, Campbell TJ. Long-term follow-up of patients with gastroschisis. *Am J Surg* 1986; **151**:546–549.
- 9 Davies BW, Stringer MD. The survivors of gastroschisis. *Arch Dis Child* 1997; **77**:158–160.
- 10 Driver CP, Bruce J, Bianchi A, Doig CM, Dickson AP, Bowen J. The contemporary outcome of gastroschisis. *J Pediatr Surg* 2000; **35**: 1719–1723.