Journal of Pediatric Surgery 52 (2017) 1751–1754

Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jpedsurg

Does timing of gastroschisis repair matter? A comparison using the ACS NSQIP pediatric database☆,☆☆

Lori A. Gurien [a,*], Melvin S. Dassinger [a], Jeffrey M. Burford [a], Marie E. Saylors [b], Samuel D. Smith [a]

[a] Department of Pediatric Surgery, Arkansas Children's Hospital, 1 Children's Way, Slot 837, Little Rock, AR 72202, USA
[b] Department of Biostatistics, Arkansas Children's Hospital Research Institute, 13 Children's Way, Little Rock, AR 72202, USA

ARTICLE INFO

Article history:
Received 24 October 2016
Received in revised form 10 February 2017
Accepted 11 February 2017

Key words:
Gastroschisis
NSQIP
Outcomes
Repair
Technique
Timing

ABSTRACT

Background: There is no consensus on optimal timing of gastroschisis repair. The 2012–2014 ACS NSQIP Pediatric Participant Use Data File was used to compare outcomes of primary versus staged gastroschisis repair.
Methods: Cases were divided into primary repair (0–1 day) and staged repair (4–14 days). Baseline characteristics and outcomes were compared for primary versus staged closure using Fisher's exact tests for categorical variables and Wilcoxon rank-sum tests for continuous variables. Length of stay was compared after controlling for prematurity.
Results: There were 627 subjects included, with 364 neonates in the primary group and 263 in the staged group. The primary group demonstrated shorter hospital length of stay (LOS) (5.1 days; $p < 0.001$) and had less surgical site infections (OR = 0.27; $p = 0.003$), but had longer ventilator days (1.9 days; $p < 0.001$). Neonates in the primary repair group were less likely to be discharged home versus transferred to another hospital (OR = 0.24; $p = 0.006$) and more likely to require nutritional support at discharge (OR = 1.74; $p = 0.034$). No significant differences were identified for mortality, readmissions, postoperative LOS, sepsis or other outcomes.
Conclusion: Staged repair of gastroschisis has longer LOS attributed to preoperative timing, but less ventilator days. Outcomes for these closure techniques are equivocal and support surgeons performing the closure technique they are most experienced with.
Level of Evidence: III (Treatment: retrospective comparative study).

Although gastroschisis is the most common congenital defect of the abdominal wall, surgical management of this condition is variable, based on preference of the institution or surgeon [1,2]. No consensus has been reached on optimal timing of gastroschisis repair, with some neonates undergoing primary closure while others are managed with silo placement followed by staged reduction and delayed closure. Results of studies comparing outcomes of these two approaches have been mixed and limited by their small sample sizes [3–7]. Additionally, management of neonates with gastroschisis is institution dependent, making it difficult to compare outcomes of different repair strategies based on reports from facilities that favor a specific closure approach.

The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) provides risk-adjusted data of perioperative adverse events [8]. Since 2012, the Pediatric Participant Use Data File (PUF) has been available to institutions that participate in ACS NSQIP Pediatric [9]. In 2014, the PUF collected data from 64 hospitals comprising almost 70,000 cases. While many of the previous studies examining timing of gastroschisis repair have been limited to single institution chart reviews with small sample sizes, accessing the Pediatric PUF allows larger volumes of data from multiple sites to be collected on rare conditions and procedures, such as gastroschisis closures. We accessed years 2012–2014 of the ACS NSQIP Pediatric PUF to compare outcomes of primary versus staged gastroschisis repair.

1. Methods

After IRB approval, the Pediatric PUF was searched for Current Procedural Terminology codes indicating repair of gastroschisis (49605 or 49606) and a postoperative International Statistical Classification of Diseases (ICD) 9 code confirming a diagnosis of gastroschisis (756.73). Subjects with an ICD 9 code for omphalocele (756.72) were excluded. Neonates who underwent abdominal wall closure on day of life 0 or 1 were classified as primarily repaired, while those that underwent closure on day of life 4 through 14 were classified as staged repair. Subjects were excluded if they were closed on day of life 2 or 3, as type of closure (primary versus staged) could not be accurately determined. Infants with comorbidities of intestinal atresia, volvulus or major/severe cardiac history were also excluded. Subjects were considered to have minor cardiac conditions and were included in the study if surgical repair was not

Abbreviations: ACS NSQIP, American College of Surgeons National Surgical Quality Improvement Program; ASA, American Society of Anesthesiologists; ICD, International Statistical Classification of Diseases; PUF, Participant Use Data File.

☆ Conflicts of Interest: none.

☆☆ Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

* Corresponding author at: Department of Pediatric Surgery, Arkansas Children's Hospital, 1 Children's Way, Slot 837, Little Rock, AR 72202, USA.
E-mail address: lgurien@gmail.com (L.A. Gurien).

http://dx.doi.org/10.1016/j.jpedsurg.2017.02.008
0022-3468/

required or if they had undergone operative repair of a congenital condition and had subsequent normal cardiovascular function without need for medications [9]. Surgical site infections were defined as superficial incision, deep incision, and organ/space infections. Subjects were considered transferred to another hospital as their final disposition if their discharge destination included facilities such as skilled care (ie, transitional care unit or skilled nursing home), separate acute care, or rehabilitation center [9]. Nutritional support at time of discharge referred to subjects that required intravenous total parenteral nutrition or enteral feeding support via gastrostomy, nasogastric, or jejunal feedings devices [9].

Baseline characteristics and outcomes were compared for primary versus staged closure using Fisher's exact tests for categorical variables and Wilcoxon rank-sum tests for continuous variables. Length of stay was compared after controlling for prematurity. All statistical analyses were performed using SAS 9.4 (SAS Institute, Cary NC) [10]. P-values less than 0.05 were considered significant.

2. Results

Of the 183,233 subjects entered in the 2012–2014 ACS NSQIP Pediatric PUF, 627 patients met inclusion criteria for this study (Fig. 1). Seventeen patients were excluded who had intestinal atresia, with 15 closed primarily and 2 closed in a delayed fashion. Three other subjects with a diagnosis of volvulus were excluded, all repaired primarily. The primary group included 364 neonates with a mean age of closure of 0.2 day old, while 263 neonates underwent staged repair with a mean age of closure of 6.4 days old.

Baseline characteristics demonstrated that neonates in the staged group were more likely to have minor cardiac risk factors and an American Society of Anesthesiologists (ASA) classification greater than 2, while those closed primarily were more likely to be premature, have a lower gestational age, and be born via cesarean section (Table 1). No differences were seen for other demographic characteristics such as gender, birth weight, location of birth, and Apgar scores.

Overall survival was 99.0% for all subjects (Table 2). The primary repair group had significantly shorter hospital length of stay (difference of 5 days; $p < 0.001$), although there was no difference in time from operation to discharge ($p = 0.91$). When we controlled for prematurity, we found no difference in length of stay between the two groups for premature infants (Table 3, $p = 0.10$). However, for term infants, those who underwent delayed closure had a significantly longer hospital length of stay of approximately 7.5 days compared to those who underwent primary closure ($p = 0.006$).

Infants in the primary repair group also had lower rates of surgical site infections compared to the delayed closure group (Table 2). However, neonates in the staged repair group had less ventilator days (difference of 2 days; $p < 0.001$), were more likely to be discharged home versus transferred to another hospital, and were less likely to require nutritional support at time of discharge compared to infants in the primary repair group. No significant differences were found for other outcomes analyzed.

3. Discussion

Low incidence of congenital anomalies makes it difficult for a single institution to evaluate optimal management strategies of these conditions. Although gastroschisis is the most common congenital abdominal wall deformity, incidence in the United States is still only 2 to 4.9 per

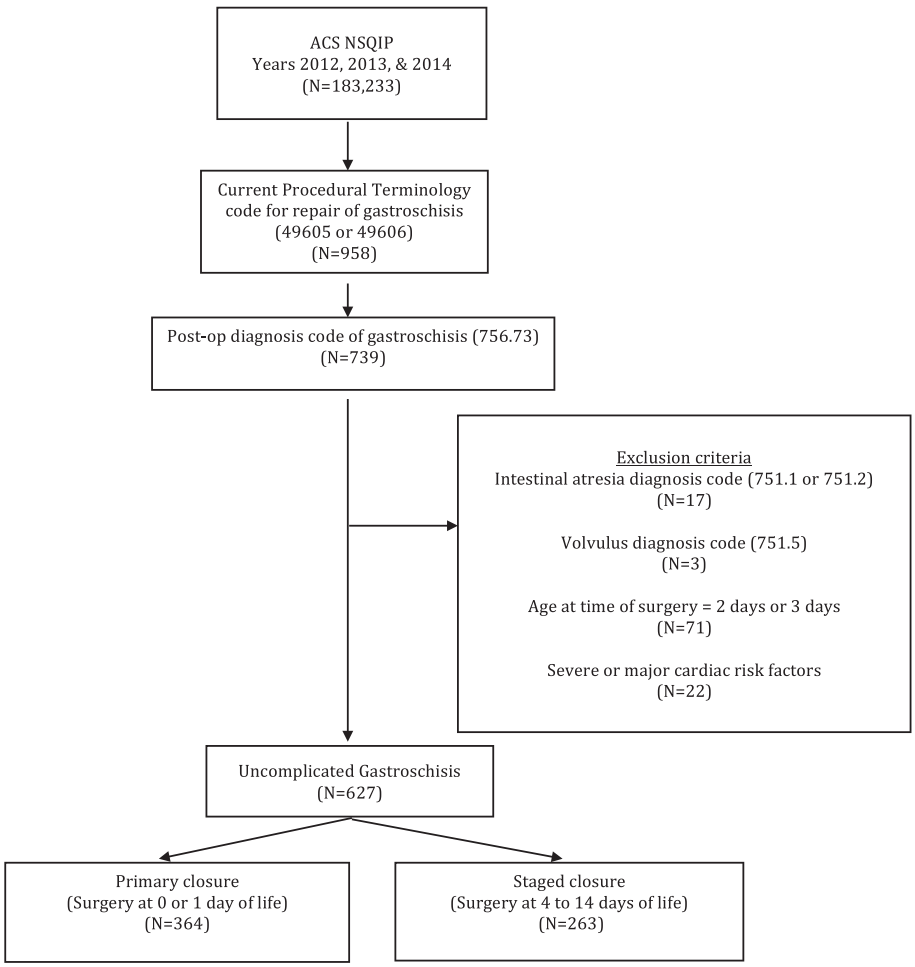

Fig. 1. Flow chart of patients included in study.