Journal of Pediatric Surgery (2009) **44**, 1206–1211

ELSEVIER

Journal of Pediatric Surgery

www.elsevier.com/locate/jpedsurg

Conflicts in wound classification of neonatal operations

Lan T. Vu, Kerilyn K. Nobuhara, Hanmin Lee, Diana L. Farmer*

Department of Surgery, University of California, San Francisco, CA 94143-0570, USA

Received 15 February 2009; accepted 17 February 2009

Key words:
Pediatrics;
Neonatal surgery;
Wound classification;
Surgical site infections;
Risk assessment;
Antibiotics

Abstract

Background/Purpose: This study sought to determine the reliability of wound classification guidelines when applied to neonatal operations.

Methods: This study is a cross-sectional web-based survey of pediatric surgeons. From a random sample of 22 neonatal operations, participants classified each operation as "clean," "clean-contaminated," "contaminated," or "dirty or infected," and specified duration of perioperative antibiotics as "none," "single preoperative," "24 hours," or ">24 hours." Unweighted κ score was calculated to estimate interrater reliability.

Results: Overall interrater reliability for wound classification was poor (κ = 0.30). The following operations were classified as clean: pyloromyotomy, resection of sequestration, resection of sacrococcygeal teratoma, oophorectomy, and immediate repair of omphalocele; as clean-contaminated: Ladd procedure, bowel resection for midgut volvulus and meconium peritonitis, fistula ligation of tracheoesophageal fistula, primary esophageal anastomosis of esophageal atresia, thoracic lobectomy, staged closure of gastroschisis, delayed repair and primary closure of omphalocele, perineal anoplasty and diverting colostomy for imperforate anus, anal pull-through for Hirschsprung disease, and colostomy closure; and as dirty: perforated necrotizing enterocolitis.

Conclusions: There is poor consensus on how neonatal operations are classified based on contamination. An improved classification system will provide more accurate risk assessment for development of surgical site infections and identify neonates who would benefit from antibiotic prophylaxis.

Surgical wound classification has long been established as an important risk factor of postoperative surgical site infection [1]. In addition, wound classification has been adopted by the National Surgical Quality Improvement Program to help risk stratify adult surgical patients and measure hospital outcomes. Success of this program has lead to the design of a children's National Surgical Quality Improvement Program module [2]. However, the challenges involved in the development of such a program include the different surgical procedures and outcomes of the pediatric population, especially in neonates and infants, compared to adults. The current wound classification system was created based on adult operations [3], and therefore, it remains unclear if these guidelines apply to neonatal operations.

The objectives of this study were to determine the interrater reliability of the wound classification system for common neonatal operations among pediatric surgeons and to examine the current clinical practice of perioperative antibiotics administration for these operations. This is the first study to describe the level of wound contamination for neonatal operations.

* Corresponding author. Division of Pediatric Surgery, University of California, San Francisco, Box 0570, San Francisco, CA 94143-0570, USA. Tel.: +1 415 502 7387; fax: +1 415 476 2314.
E-mail address: diana.farmer@ucsfmedctr.org (D.L. Farmer).

0022-3468/$ – see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1016/j.jpedsurg.2009.02.026

1. Methods

This study is a cross-sectional survey of pediatric surgeons in the United States. In an initial pilot study, we chose a random sample of 200 neonatal operations from a database of operations on neonates and infants from 1997 to 2006 and asked 6 pediatric surgeons from our institution to classify the operations as "clean," "clean-contaminated," "contaminated," or "infected or dirty" based on the Research Council Wound Classification criteria [4]. From this cohort, 22 neonatal operations, which had some degree of disagreement among the 6 local pediatric surgeons on the classification of wound contamination, were included in the final survey (Table 1). Participants were asked to first classify the operations as "clean," "clean-contaminated," contaminated," or "dirty or infected" and then identify the duration of perioperative antibiotics they would prescribe for each operation as "none," "single preoperative," "24 hours," or ">24 hours." In addition, we collected information on how many years each surgeon served as a pediatric surgeon. The web-based survey was created, and data were collected using SurveyMonkey.com. The web link to the survey was emailed to potential participants and the survey remained open for 1 month.

Data are reported as median and interquantile range, and percentage. Unweighted κ was calculated to determine the interrater reliability of wound classification among participants who completed the survey. All analyses were performed using STATA (version 9.2) software (StataCorp, College Station, Tex). Because this study involved no patients or review of patient health information, no institutional approval was necessary.

Table 1 Neonatal operations included in survey

Neonatal operation
Lobectomy
Gastroschisis: primary closure
Gastroschisis: staged closure
Gastroschisis with necrotic bowel: bowel resection
Omphalocele: immediate repair
Omphalocele: delayed repair
Ruptured omphalocele: primary closure
Gastric perforation of premature newborn (<24 h of life)
Perforated necrotizing enterocolitis: >24 h of life
Imperforate anus: perineal anoplasty (<48 h of life)
Imperforate anus: diverting colostomy
Hirschsprung disease: primary anal pull-through
Pyloric stenosis: pyloromyotomy
Tracheoesophageal fistula: fistula ligation
Tracheoesophageal fistula: primary esophageal anastomosis
Resection of sacrococcygeal teratoma: no intraabdominal component
Meconium peritonitis: bowel resection
Resection of extralobular sequestration
Ovarian torsion: oophorectomy
Colostomy takedown and closure
Malrotation: Ladd procedure
Midgut volvulus: open Ladd and bowel resection

2. Results

Among the 144 participants, the median number of years as a pediatric surgeon was 15 years (interquantile range, 9.25-25 years). The interrater reliability for wound classification was poor (unweighted overall κ = 0.30). In addition, we stratified the responses based on years served as pediatric surgeon (<15 or ≥15 years), and there was no difference in the κ score for wound classification between the 2 groups.

The following 5 operations were classified as "clean" by most of the respondents: pyloromyotomy for pyloric stenosis (97%), resection of extralobular sequestration (78%), resection of sacrococcygeal teratoma (79%), oophorectomy for ovarian torsion (85%), and immediate repair of omphalocele (72%). However, for primary closure of gastroschisis, 46% of respondents classified the operation as clean, whereas 42% of the respondents classified it as clean-contaminated. The duration of perioperative antibiotics selected for these clean operations varied greatly; 47% and 54% of respondents selected only preoperative antibiotics for pyloromyotomy, oophorectomy, and resection of extralobular sequestration; 41% and 52% of respondents selected 24 hours of antibiotics for resection of sacrococcygeal teratoma and immediate repair of omphalocele; and 37% of respondents selected greater than 24 hours of antibiotics for primary closure of gastroschisis (Fig. 1).

The following operations were classified as clean-contaminated: Ladd procedure for malrotation (72%), bowel resection for midgut volvulus (55%), fistula ligation of tracheoesophageal fistula (63%), primary esophageal anastomosis of esophageal atresia (89%), lobectomy for chest mass (63%), primary closure of ruptured omphalocele (57%), staged closure of gastroschisis (60%), delayed repair of omphalocele (51%), perineal anoplasty (76%) and diverting colostomy (78%) for imperforate anus, primary anal pull-through for Hirschsprung disease (81%), and colostomy takedown and closure (74%). However, as with the clean operations, there was disagreement on the duration of perioperative antibiotics needed for these clean-contaminated operations (Figs. 2-4).

Most respondents agreed on treating the following operations with greater than 24 hours of antibiotics: bowel resection and repair of gastroschisis with necrotic bowel (87%), closure of gastric perforation in premature newborn (70%), bowel resection of perforated necrotizing enterocolitis (99%), and bowel resection in meconium peritonitis (58%). However, the respondents disagreed on the wound classification for these 4 operations: whether they were clean-contaminated, contaminated, or dirty operations (Fig. 5).