Journal of Pediatric Surgery (2010) **45**, 507–512

ELSEVIER

Journal of Pediatric Surgery

www.elsevier.com/locate/jpedsurg

Incidence of septicemia immediately after elective gastrointestinal contrast procedures in infants: a cohort study

Ziad Abu-Sharar[a,c], Ashley Robinson[b], Pascal M. Lavoie[a,c,d,*]

[a]*Children's and Women's Health Center of British Columbia, Vancouver, British Columbia, Canada V6H 3V4*
[b]*Department of Radiology, Children's and Women's Health Center of British Columbia, Vancouver, British Columbia, Canada V6H 3V4*
[c]*Department of Pediatrics, University of British Columbia, Vancouver, British Columbia, Canada*
[d]*Child and Family Research Institute, Vancouver, British Columbia, Canada V5Z 4H4*

Received 1 April 2009; revised 20 June 2009; accepted 6 July 2009

Key words:
Neonates;
Gastrointestinal surgery;
Radiologic contrast procedure;
Sepsis

Abstract

Background: Sepsis is a documented complication of gastrointestinal contrast procedures in neonates. However, the identification of preventive measures is hampered by a lack of data on its incidence and risk factors.

Methods: The study used a retrospective cohort analysis of infants with selected surgical gastrointestinal conditions admitted to a tertiary neonatal center. Risk factors were identified by logistic regression and matched case-control analyses. Contrast procedure-related bacteremia or sepsis were defined by clinical signs with or without a positive blood culture, respectively, within 48 hours after an intervention.

Results: The apparent incidence of contrast procedure-related sepsis was 2.7 per 100 infant procedures. Infants with contrast procedure-related sepsis were also generally of lower gestational age and birth weight and generally sicker (ie, higher incidence of hepatic cholestatic disease, and poorer weight gain). Notably, all infants with contrast procedure-related sepsis previously had necrotizing enterocolitis. Although the number of cases of sepsis directly attributable to the procedures may be lower, as suggested by a comparison with the baseline time prevalence of bacteremia in this cohort, significant associated morbidities and mortality were observed.

Conclusions: This is the first study reporting the incidence of contrast procedure-related sepsis in high-risk infants with surgical gastrointestinal conditions. Based on our observations, the routine use of prophylactic antibiotics to prevent this complication in this population does not seem warranted.

Elective radiologic contrast procedures are commonly performed in infants for various indications, including the evaluation of the integrity and patency of intestinal segments in individuals with surgical gastrointestinal conditions [1,2].

* Corresponding author. Children's and Women's Health Center of British Columbia, Vancouver, British Columbia, Canada V6H 3V4. Tel.: +1 604 875 2135; fax: +1 604 875 3106.
E-mail address: plavoie@cw.bc.ca (P.M. Lavoie).

0022-3468/$ – see front matter © 2010 Elsevier Inc. All rights reserved.
doi:10.1016/j.jpedsurg.2009.07.023

Contrast procedure-related bacteremia has been reported in up to 23% of patients undergoing elective gastrointestinal contrast procedures [3,4]. In adults, episodes are usually transient and self-limited, and sepsis is exceedingly rare [5]. Prematurely born infants are particularly susceptible to sepsis in part because of immaturity of their immune system [6]. In those patients, sepsis can result from relatively minor interventions potentially compromising mucosal integrity such as nasogastric tube insertion or tracheal suctioning [7,8]. Other comorbid conditions often encountered in preterm infants with gastrointestinal disease requiring prolonged parenteral nutrition, including nutritional deficiencies, cholestatic hepatic disease, and bacterial overgrowth, may further increase the risk of sepsis [9]. Because of the high mortality and serious long-term neurodevelopmental morbidities associated with infections in infants born prematurely; additional preventive measures need to be considered [10,11].

Brand et al [12] described a small case series of 9 infants with previous necrotizing enterocolitis (NEC) who clinically deteriorated after an elective contrast enema, including two who demonstrated cardiorespiratory collapse with blood cultures positive for gram-negative enteric pathogens. Their study raised important considerations for use of prophylaxis antibiotics, especially in select high-risk situations, to prevent this potentially serious complication. Antibiotics are not routinely recommended to prevent gastrointestinal procedure-related sepsis in adults, but evidence from endoscopic interventions suggests it may be beneficial in select high-risk groups, including in patients at high risk of bacterial endocarditis because of underlying cardiac disease, in situations where endoscopic procedures may be associated with increased rates of transient bacteremia (eg, dilatation of an esophageal stricture) or in immunocompromised patients [13]. Although prematurely born infants might be at highest risk, to the best of our knowledge, there are no previous reports of the general risks or factors associated with contrast procedure-related bacteremia in this potentially highest risk group, including neonates or infants more generally.

In this study, we determined the overall incidence of gastrointestinal contrast procedure-related sepsis in a large cohort of infants. We aimed to test whether the risk of sepsis is increased after gastrointestinal radiologic contrast procedures in preterm infants with previous surgical gastrointestinal pathologic conditions. Also, we examined the risk factors and short-term outcomes associated with this potential complication.

1. Methods

1.1. Study population

Retrospective cohort study of all infants admitted to our neonatal intensive care unit at Children's and Women's Health Center of British Columbia (Vancouver, British Columbia, Canada), between January 1999 and December 2007 (inclusive). The study center is the main tertiary care neonatal center of the province of British Columbia, admitting about 600 infants per year, including most infants requiring gastrointestinal surgery in the province. Clinical data were collected prospectively by trained database coordinators. Infants were included in the study if they underwent an elective radiologic upper or lower gastrointestinal contrast study after a gastrointestinal complication (eg, infants with previous intestinal perforation/NEC, bowel obstruction, gastroschisis, malrotation/volvulus, Hirschprung's disease) mainly with the purpose to evaluate the anatomical integrity of the bowel (eg, not including contrast studies for gastrointestinal tube placement). For infants with contrast procedure-related sepsis as well as for matched controls, additional clinical data were collated through review of medical records. Our study was approved by the University of British Columbia Clinical Research Ethics Board.

1.2. Definitions

Upper or lower bowel contrast studies also included procedures where contrast was injected through an enterocutaneous fistula involving only segments of bowel (ie, often referred to as *fistul-o-gram* or *loop-o-grams*). Infants with contrast procedure-related sepsis were identified by manually reviewing all cases of infants who had a blood culture sampled within 48 hours after a contrast procedure. Contrast procedure-related sepsis was defined when infants presented with a clinical deterioration (eg, temperature instability, cardiovascular collapse, pathologic abdominal distension, acute respiratory failure, and others), as per the attending neonatologist, within this period and prompting administration of parenteral antibiotics for at least 5 days. Contrast procedure-related bacteremia was considered in the presence of a positive blood culture result, regardless of the microorganism involved. Necrotizing enterocolitis was defined, as per the attending neonatologist, by the presence of both clinical and radiologic criteria (pneumatosis, persistent intestinal loop distension, free air, and others). Furthermore, diagnosis of NEC was either suspected (clinical diagnosis) or confirmed (surgical diagnosis) by laparotomy. Exacerbation of an underlying hepatic cholestasis was defined as an acute rise in conjugated bilirubin of more than 20 μmol/L (1.2 g/dL) during the septic episode.

1.3. Statistical analysis

Descriptive statistics were used to report basic demographic and clinical characteristics of patients. Time prevalence of bacteremia was determined by dividing the number of infants with bacteremia within each 48-hour period over the number of infants still hospitalized at that age (days). To investigate risk factors for contrast procedure-related sepsis, cases were compared either against the