Journal of Pediatric Surgery (2010) **45**, 876–879

ELSEVIER

Journal of Pediatric Surgery

www.elsevier.com/locate/jpedsurg

Is routine preoperative 2-dimensional echocardiography necessary for infants with esophageal atresia, omphalocele, or anorectal malformations?

Ahmed Nasr[a], Patrick J. McNamara[b], Luc Mertens[b], David Levin[a], Andrew James[b], Helen Holtby[c], Jacob C. Langer[a,*]

[a]*Department of Surgery, Hospital for Sick Children, Toronto, Ontario, Canada M5G1X8*
[b]*Department of Pediatrics, Hospital for Sick Children, Toronto, Ontario, Canada M5G1X8*
[c]*Department of Anaesthesia, Hospital for Sick Children, Toronto, Ontario, Canada M5G1X8*

Received 23 January 2010; accepted 2 February 2010

Key words:
Esophageal atresia;
Anorectal malformation;
Omphalocele;
Echocardiography;
Imperforate anus;
Tracheoesophageal fistula;
Abdominal wall defect

Abstract

Background: Infants with esophageal atresia (EA), omphalocele, and anorectal malformation (ARM) often have associated congenital heart disease. Recognition of significant cardiac defects, which compromise patient well-being in the perioperative period, is essential before going to the operating room. However, urgent echocardiography may be unavailable, and surgery may therefore be delayed in some cases. We wished to determine if routine echocardiography is necessary for neonates with these diagnoses, or if appropriate patients could be selected.

Methods: Retrospective review of all infants admitted to the neonatal intensive care unit with EA, omphalocele, or ARM for 5 years (2003-2008). Clinically relevant findings in the cardiovascular examination (murmur, tachycardia, abnormal 4 limb blood pressure, cyanosis, shock), abnormalities in respiratory examination (intubation, tachypnea, desaturations), or abnormal chest x-ray (cardiomegaly, abnormal pulmonary vasculature) were documented. Cardiac defects were categorized according to their clinical impact as major or minor to differentiate those disorders which may influence timing of surgical intervention.

Results: Eighty-six infants were identified (33 EA, 21 omphalocele, 32 ARM). Thirty-seven (42.9%) patients had congenital heart disease on echocardiography evaluation, of which 11 (12.7%) were classified as major and 26 (30.2%) were minor. The sensitivity, specificity, positive predictive value, and negative predictive value of abnormal clinical and radiologic combined assessment for a major cardiac defect were 100% (95% confidence interval [CI], 0.76-1), 64% (95% CI, 0.61-0.64), 28% (95% CI, 0.22-0.29), and 100% (95% CI, 0.94-1.00), respectively.

Conclusions: Normal clinical and radiologic examination predicted absence of a significant cardiac abnormality on echocardiography in 100% of cases. We conclude that routine echocardiography before embarking on surgical intervention may not always be necessary but should be reserved for infants with abnormal clinical and/or radiologic findings.

Presented at the 41st Annual Meeting of the Canadian Association of Paediatric Surgeons, Halifax, Nova Scotia, Canada, October 1-3, 2009.

* Corresponding author. Division of General and Thoracic Surgery, The Hospital for Sick Children, Roy Hill Wing, Toronto, Ontario, Canada, M5G1X8.
E-mail address: jacob.langer@sickkids.ca (J.C. Langer).

0022-3468/$ – see front matter © 2010 Elsevier Inc. All rights reserved.
doi:10.1016/j.jpedsurg.2010.02.002

Infants with esophageal atresia (EA), omphalocele, and anorectal malformations (ARMs) frequently have other associated congenital anomalies which can have a significant impact on their anesthetic care and survival to discharge. One of the most important is congenital heart disease (CHD), which has been reported to occur in approximately one third of patients [1-3]. Recognition of CHD among these infants is essential before any surgical intervention, because of the potential impact of the underlying cardiac defect on the management of the anesthetic and the associated risk. In most centers, it is routine practice in the neonatal intensive care unit (NICU) to perform a 2-dimensional (2D) echocardiogram in all infants with these anomalies even if the clinical examination of the cardiovascular system is normal. Arranging routine echocardiography may be difficult in many centers, especially outside of normal working hours, leading to delays in urgent surgical intervention. The goal of this study was to determine whether neonates with CHD that posed an increased risk to the surgical intervention, or where the surgical care has to be adapted, could be identified a priori on the basis of a comprehensive clinical evaluation.

1. Methods

1.1. Design

A retrospective cohort study at a quaternary NICU was conducted.

1.2. Study population

All infants admitted to the NICU with diagnoses of EA, omphalocele, and ARM for 5 years (July 1, 2003, through June 30, 2008) were identified from a surgical database. The NICU at the Hospital for Sick Children, Toronto, is one of the largest surgical referral centers in Canada. Institutional research ethics board approval was obtained, and informed patient consent was waived.

1.3. Study objective

The primary aim of this study was to determine the clinical utility of routine preoperative 2D echocardiography for infants with EA, omphalocele, and/or ARM.

1.4. Data collection and categorization process

Neonatal demographics, relevant maternal history and details of the delivery, resuscitation, and transport stabilization process were obtained from the electronic patient health record. Clinical history, clinical findings (eg, cyanosis, heart murmur, abnormal pulses, or 4-limb blood pressure), laboratory testing (eg, arterial blood gas, hyperoxia test, plasma lactate), or abnormalities on chest radiograph (eg, cardiomegaly [cardiothoracic ratio of >60%], lung parenchymal findings), consistent with a diagnosis of CHD, were recorded. Details regarding the amount of cardiorespiratory support (eg, crystalloid, cardiotropic agents, ventilation, and inhaled nitric oxide) needed during the stabilization were recorded. Any abnormal findings in the cardiovascular examination (murmur, tachycardia , abnormal 4 limb blood pressure, cyanosis , shock), respiratory examination (tachypnea, intercostal recession, desaturations), or abnormal chest x-ray (cardiomegaly, abnormal pulmonary vasculature) were considered to be positive clinical and/or radiologic findings. The documentation of abnormal clinical findings was made by an investigator (A.N.) who remained blind to the echocardiography results and defect classification.

1.5. Echocardiography evaluation process

The process for obtaining a structural echocardiogram at our institution during normal weekday working hours is via an online Web-based program. The online recquisition is completed by a member of the medical or surgical team. It does not require a cardiology consultation, but all cases are triaged and prioritized by staff in the echocardiography laboratory. All daytime echocardiography evaluations are performed by dedicated technicians and later reviewed by a staff cardiologist, after which a report is obtained. A cardiology consult is required, however, for all after-hour and weekend requests. The echocardiographic evaluation is performed by a cardiology trainee and subsequently reviewed remotely and reported by a staff cardiologist.

1.6. Categorization of cardiac defects

Cardiac defects were categorized by an investigator (P.M.) who was blinded to the patient's clinical information. Defects were categorized according to their clinical impact as major if they were likely to impact on patient well-being or change the surgical course. These would include defects where the likelihood of cardiovascular surgical intervention was high, defects requiring treatment with prostaglandins, or defects where the anesthetic risk was greatly increased. Minor cardiac defects were defined as those that were not likely to alter the surgical course, or required no cardiovascular intervention.

1.7. Analysis

Descriptive statistics were used for neonatal demographics, surgical characteristics, and details of the specific cardiac defects. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) with confidence interval (CI) of the clinical examination of the cardiovascular system, the chest x-ray, and 2D echocardiogram for preoperative detection of CHD in these infants were calculated. *P* value was considered significant at 0.05 level. In an attempt to minimize bias, the individuals collecting the