

A Role for Abdominal Ultrasound in Evaluating Bowel Ischemia in Congenital Heart Disease Patients with Suspected Necrotizing Enterocolitis

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Objectives

- Necrotizing enterocolitis (NEC) is most commonly a disease of the preterm neonate. However, NEC is also seen less frequently in full-term neonates with complex congenital heart disease (CHD), who have lower rates of surgical disease.
- We evaluated the diagnostic utility of abdominal ultrasound (AUS), an emerging adjunct to abdominal x-ray (AXR), for suspected NEC specifically in patients with CHD.

Methods

- A multicenter retrospective review of 86 patients with suspected NEC from 2009-2018 was performed. Patients were classified as with CHD (n=18) if they required cardiac intervention versus without CHD (n=68). Patients with isolated PDA requiring ligation were considered without CHD.
- Clinical and radiological data during the admission at the time of NEC evaluation were compared between CHD and non-CHD patients. Concordance between first paired AXR and AUS studies was compared between CHD and non-CHD patients.
- Wilcoxon rank-sum test and Fisher's exact test were performed, as appropriate.

Results

CHD Diagnoses (n=18):

- Hypoplastic left heart syndrome (n=5; 27.8%)
- Cardiomyopathy with heart failure (n=3; 16.7%)
- Tetralogy of Fallot (n=3; 16.7%)
- AV canal defect (n=2; 11.1%)
- Double outlet right ventricle (n=2; 11.1%)
- Other (ASD/VSD, PAPVR, PAIVS) (n=1 each; 5.6%)

Results

Demographic and Clinical Comparisons:

- CHD patients had higher birth weights (p<0.001) and gestational ages (p<0.001), and presented more frequently with hypotension (p=0.041) and less frequently with bilious emesis (p<0.001).

Demographic and Clinical Comparison of Patients with and without CHD			
	CHD Patients (n=18) [N, %]	Non-CHD Patients (n=68) [N, %]	p-value
Median birth weight (kg; IQR)	2.4 (2.1, 3.7)	1.0 (0.7, 1.4)	<0.001
Median gestational age at birth (weeks; IQR)	37.0 (36.3, 38.6)	27.6 (25.5, 30.3)	<0.001
Presentation with hypotension	12 (66.7)	27 (39.7)	0.041
Presentation with bilious emesis	2 (11.1)	39 (57.4)	<0.001

Radiological Comparisons:

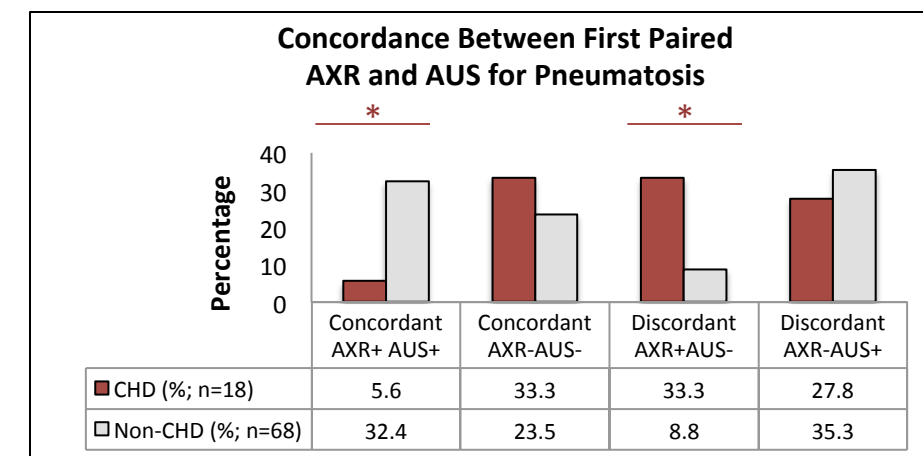
- CHD patients had significantly decreased likelihood of having AXR findings of pneumatosis (p=0.005) and AUS findings of decreased bowel mural flow (p=0.035) compared to non-CHD patients.

Abdominal X-ray and Ultrasound Findings in Patients with and without CHD			
	CHD Patients (n=18) [N, %]	Non-CHD Patients (n=68) [N, %]	p-value
Pneumatosis (AXR)	12 (66.7)	54 (79.4)	0.346
Pneumatosis (AUS)	6 (33.3)	49 (72.1)	0.005
Portal venous gas (AXR)	7 (38.9)	15 (22.1)	0.222
Portal venous gas (AUS)	4 (22.2)	19 (27.9)	0.769
Pneumoperitoneum (AXR)	2 (11.1)	8 (11.8)	0.999
Pneumoperitoneum (AUS)	0 (0)	7 (10.3)	0.337
Bowel wall thickening (AUS)	5 (27.8)	18 (26.5)	0.999
Bowel wall thinning (AUS)	0 (0)	11 (16.2)	0.11
Decreased mural flow (AUS)	0 (0)	14 (20.6)	0.035
Echogenic free fluid (AUS)	2 (11.1)	12 (17.6)	0.724
Focal fluid collection (AUS)	0 (0)	7 (10.3)	0.337

Results

Concordance Analysis for Pneumatosis:

- CHD patients had 3.8-fold more discordant study pairs with pneumatosis on AXR but not on AUS (33.3% vs. 8.8%; p=0.016).
- Non-CHD patients had 5.8-fold more concordant study pairs with pneumatosis on both AXR and AUS (32.4% vs. 5.6%; p=0.033).



*p<0.05

Clinical Outcome Comparisons:

- Urgent surgical intervention for suspected NEC was required in 5.6% of CHD patients versus 16.2% of non-CHD patients. NEC-related mortality was 0% in CHD patients versus 5.9% in non-CHD patients.

Conclusions

- Congenital heart disease patients with suspected necrotizing enterocolitis may represent a distinct clinical population.
- Abdominal ultrasound may have utility in helping to rule out bowel ischemia in congenital heart disease patients with a lower suspicion for surgical disease.