Necrotizing Enterocolitis: Anatomic Distribution Correlates with Gestational Age and Presence of Congenital Heart Disease

Martha-Conley E Ingram MD MPH1, Yazan Rizeq BS2, Timothy Lautz MD1, Mehul V Raval MD MS1

1Division of Pediatric Surgery, Department of Surgery, Northwestern University Feinberg School of Medicine, Ann & Robert H. Lurie Children’s Hospital of Chicago, Chicago, Illinois 2Department of Surgery, Rush University, Chicago, IL

Background

- Necrotizing enterocolitis (NEC) is a disease of infancy1,2
  - Among top causes of mortality within NICU1
  - Largely affects pre-term (<37 weeks Gestational Age (GA)) and low-birthweight infants1,4

- NEC in term infants
  - Rare event (~10%)3,4
  - Risk of development has been found to increase in presence of: CHD, Hypotension, Polycythemia2,4

- Retrospective review, association not causation
- No access to operative report to confirm pathologic SIP vs surgical NEC

- Dataset limitation:
  - Transfer care
  - Comorbidities

Research Objectives

- Examine whether NEC in term infants involves different anatomic regions than in early and moderate pre-term infants
- Examine possible effect of CHD on locations of anatomic involvement in infants with NEC

Methods

Cohort Development

- PHIS database query
- 2004-2018
- All cases of surgical NEC
- Categorize infants by:
  - Gestational Age
  - Presence of absence of CHD

Statistical Methods

- Chi-square test proportions of colonic intestinal involvement
- Anatomic heat maps created based on GA, CHD

Results

- 13,494 infants with NEC from 2004-2018
  - 2900 infants with Surgical NEC (21.4%):
    - Early Preterm: 1911 (65.9%)
    - Late Preterm: 609 (21%)
    - Term: 380 (13.1%)

Distributions of Resection vary by GA

Example Anatomic Heat Map of Resections

<table>
<thead>
<tr>
<th>Characteristics of Necrotizing Enterocolitis affecting intestine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Preterm CHD Infants: majority of resections on the small intestine, some ascending colon</td>
</tr>
<tr>
<td>Late Preterm CHD Infants: majority of resections on the ileum, neonatal valve, ascending colon</td>
</tr>
<tr>
<td>Full-term Infants have more resections in colon (descending, ascending, transverse)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Colon Involvement Increases with GA and CHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Preterm CHD Infants: majority of resections on the small intestine, some ascending colon</td>
</tr>
<tr>
<td>Late Preterm CHD Infants: majority of resections on the ileum, neonatal valve, ascending colon</td>
</tr>
<tr>
<td>Greater involvement of all areas of the colon for Term CHD + patients than all other cohorts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 1: Proportion of Colonic Involvement for Surgical NEC by Age and presence of CHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Preterm</td>
</tr>
<tr>
<td>All Surgical Infants (all gestational ages)</td>
</tr>
<tr>
<td>Other Resections</td>
</tr>
<tr>
<td>83.2%</td>
</tr>
<tr>
<td>CHD sub-group (all gestational ages)</td>
</tr>
<tr>
<td>78.2%</td>
</tr>
</tbody>
</table>

* Indicates p<0.05

Limitations

- Retrospective review, association not causation
- No access to operative report to confirm pathologic SIP vs surgical NEC
- Dataset limitation:
  - Transfer care
  - Comorbidities

Conclusions

- Necrotizing Enterocolitis in full term infants is uncommon
  - Surgical NEC rate of 13.1 % in this cohort
- Surgical NEC of the colon affects term infants more often, and is greatest among term infants with CHD

References

1RM Patel, S Kandefer, MC Walsh, EF Bell, WA Carlo, AR Laptook et al, NEJM (2015)
2RD Christensen, DK Lambert, VL Baer, PV Gordon, Clin Perinatal (2013)
4RE Overman Jr, CN Criss, SK Gadeppali, JPS (2019)