Surgical Approach, Risks, and Outcomes Of Paraesophageal Hiatal Hernia Repair: An Analysis Of The National Inpatient Sample Database

Surgical Section of the National Medical Association

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Disclosures

- Consultant
  - Ethicon Endosurgery, Inc.
  - WL Gore, Inc.
- National Faculty
  - Ethicon Endosurgery, Inc.
Epidemiology and Anatomy

- **Incidence of hiatal hernias: 5 per 1000**
  - 95% are small type I
  - 2-5% are incarcerated paraesophageal hernias
    - At least 1/3 of stomach herniated into the thorax
    - Elderly
Symptoms

- **Type 1 Sliding hiatal hernia**
  - Asymptomatic
  - Reflux

- **Paraesophageal hiatal hernia (PHH:types 2-4)**
  - Asymptomatic
  - Obstruction
    - Diaphragmatic impingement on the stomach
    - Gastric volvulus
    - Compression of the esophagus by the intrathoracic stomach
  - Bleeding (33%)
    - Hematemesis or bleeding caused by ulceration of the stomach
  - Respiratory complications
    - Associated with a large paraesophageal hernia
      - Recurrent aspiration, pneumonia, and chronic cough
Diagnosis
Treatment of PHH

- **Surgical Repair**
  - Reduction of incarcerated organs
  - Reduction +/- excision of the hernia sac
  - Repair of the diaphragmatic defect
- **Laparoscopic approach**
  - Successful in 90% of cases
  - Decreased postop pain, shortened recovery time
  - Decreased morbidity
  - Transabdominal preferred over transthoracic
    - More precise reduction of the volvulus
    - More accurate reconstruction of the hiatus
- **Areas of non-consensus**
  - Watchful waiting vs urgent repair of asymptomatic PHH
  - Routine anti-reflux operation
  - Esophageal lengthening procedure
  - Routine use of prosthetic mesh with the repair of the diaphragmatic defect

- Cloyd, DW. Surg Endosc, 1994
Watchful Waiting if Asymptomatic

- Emergency intervention for symptoms
- Most patients have symptoms if properly interviewed
  - Minimal symptoms are associated with complications
  - Uncomplicated repair: 1-2% mortality
  - Benefits of the laparoscopic approach
- 45% of asymptomatic patients will progress if left untreated
- Major complications include torsion, gangrene, perforation, and massive hemorrhage
  - Surgical death rate: 16-50%
    - Gastric volvulus death rates approach 100%
  - Most patients are elderly and will not tolerate a complicated course

Questions for Outcomes Research

- What are the definitive risk factors that can predict poor outcomes in PHH repair?
- To what extent do these risk factors influence outcomes in PHH repair?
Hypothesis

- Laparoscopic PHH repair affords better outcomes than open abdominal or thoracic repair.
- Uncomplicated cases afford better outcomes than complicated cases regardless of approach.
  - “Watchful waiting” increases mortality.
Methods

- 9-year (1998-2006) retrospective analysis of the Nationwide Inpatient Sample (NIS) database
  - approximately 7 million records per year
- ICD-9 diagnoses and Procedure codes
  - Complicated (incarcerated, obstructed, strangulated) vs uncomplicated PHH repair
    - Complicated is our surrogate for watchful waiting
  - Laparoscopic, open abdominal, or open thoracic approach
- Outcome variables were in-hospital mortality and length of stay (LOS)
- Univariate, Bivariate and Multivariate analyses
  - Controlling for demographics (age, gender, ethnicity) and co-morbidities (obesity, Charlson Co-morbidity Index) while looking for independent risk factors for mortality in PHH repair.
### Results: Univariate Analysis

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Patients</td>
<td>23,514</td>
<td></td>
</tr>
<tr>
<td><strong>In Hospital Mortality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>15,119</td>
<td>64</td>
</tr>
<tr>
<td>Uncomplicated</td>
<td>19,921</td>
<td>84.72</td>
</tr>
<tr>
<td>Complicated</td>
<td>3,593</td>
<td>15.28</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>3,891</td>
<td>16.55</td>
</tr>
</tbody>
</table>
Results: Univariate Analysis

PHH Repair By Surgical Approach

- Open Abdominal: 56%
- Lap: 35%
- Open Thoracic: 9%
Bivariate Analysis (p≤0.05)

- Mean Age 56.1 years

**Bivariate Analysis: Mean Age by Approach and Hernia Status**

- **Surgical Approach**:
  - Lap
  - Open Abdominal
  - Open Thoracic

- **Hernia Status**:
  - Uncomplicated
  - Complicated
Bivariate Analysis (p≤0.05)

Bivariate Analysis: Overall Mortality By Approach and Hernia Status,

<table>
<thead>
<tr>
<th>Approach</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lap</td>
<td>0.74%</td>
</tr>
<tr>
<td>Open Abdominal</td>
<td>2.27%</td>
</tr>
<tr>
<td>Open Thoracic</td>
<td>1.67%</td>
</tr>
<tr>
<td>Uncomplicated</td>
<td>1.02%</td>
</tr>
<tr>
<td>Complicated</td>
<td>5.26%</td>
</tr>
</tbody>
</table>
Bivariate Analysis (p≤0.05)

Bivariate Analysis: Mortality By Approach and Hernia Status

Mortality

- Lap: 3.79% (Uncomplicated: 0.57%, Complicated: 3.22%)
- Open Abdominal: 5.75% (Uncomplicated: 1.34%, Complicated: 4.41%)
- Open Thoracic: 3.60% (Uncomplicated: 1.22%, Complicated: 2.38%)
Length of Stay (p≤0.05)

Bivariate Analysis: LOS By Surgical Approach for PHHR, p=0.000

Length of Stay (Days)

- Lap: 3.81
- Open Abdominal: 6.91
- Open Thoracic: 8.75

Surgical Approach
Bivariate Analysis (p≤0.05)

**Bivariate Analysis: LOS by Approach and Hernia Status**

![Graph showing LOS in days for different approaches and hernia status]
# Multivariate Analysis: Likelihood of Death

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>ODDS RATIO</th>
<th>p-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Approach</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laparoscopic</td>
<td>0.53</td>
<td>0.000</td>
<td>0.38-0.74</td>
</tr>
<tr>
<td>Open Thoracic</td>
<td>1.04</td>
<td>0.864</td>
<td>0.69-1.57</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>2.03</td>
<td>0.009</td>
<td>1.19-3.47</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2.34</td>
<td>0.001</td>
<td>1.42-3.83</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;=60 - &lt;70</td>
<td>3.25</td>
<td>0.011</td>
<td>1.31-8.03</td>
</tr>
<tr>
<td>&gt;=70 - &lt;80</td>
<td>6.48</td>
<td>0.000</td>
<td>2.72-15.4</td>
</tr>
<tr>
<td>&gt;=80 - &lt;90</td>
<td>18.06</td>
<td>0.000</td>
<td>7.61-42.84</td>
</tr>
<tr>
<td>&gt;90</td>
<td>34.25</td>
<td>0.000</td>
<td>13.65-85.89</td>
</tr>
<tr>
<td><strong>Hernia Status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complicated</td>
<td>2.01</td>
<td>0.000</td>
<td>1.51-2.67</td>
</tr>
</tbody>
</table>
Multivariate Analysis: Likelihood Of Death For PHH Repair (PHHR),
1.0=Comparison group

Approach  Ethnicity  Age  Hernia Status
Lap  Open  Abdominal  Open Thoracic  White  African American  Hispanic  0-40  60-70  70-80  80-90  >90  Uncomplicated  Complicated
0.53  1.00  1.04  1.00  2.03  2.34  1.00  3.25  6.48  18.06  34.25  1.00  2.01

Odds Ratio
## Multivariate Analysis: Likelihood of Death

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>ODDS RATIO</th>
<th>p-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Male</em></td>
<td>1.10</td>
<td>0.454</td>
<td>0.85-1.40</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Obese</em></td>
<td>0.51</td>
<td>0.077</td>
<td>0.24-1.07</td>
</tr>
</tbody>
</table>
Results: Summary

- Independent risk factors for mortality
  - Surgical Approach
    - Open abdominal and open thoracic
  - Age > 60 years
  - Complicated Hernia Status
  - Ethnicity
    - African American or Hispanic
Study Limitations

- In-Hospital Mortality Assessment
  - Readmissions are not captured in data
- Retrospective Study
- Uncomplicated with symptoms not captured
- Assume that if you’re complicated you have symptoms
  - Surrogate for watchful waiting
Conclusions

- Surgical approach, age, complicated hernia status and ethnicity are independent risk factors for mortality in patients undergoing PHH repair.
- Waiting until the patient develops symptoms (which may be associated with complications) may predispose patients already at high risk (age) to unnecessary mortality.
Conclusion

- Laparoscopic approach in the uncomplicated group affords a 0.57% mortality regardless of age.
- Watchful waiting increases mortality at least two-fold once complications/symptoms occur.
Thank you