Delirium Reduced with Intravenous Acetaminophen in Geriatric Hip Fracture Patients

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Significance of Hip Fractures

- **Burden of Disease**
  - 2.6 million/year worldwide by 2025

- **Economic Impact**
  - $209 billion 2006-2015

- **Significant Mortality**
  - 20-33% 1-year mortality:
Challenges of Patient Care

Frail, elderly population

Rapidly deteriorate

Complications
Delirium in Hip Fractures

- **High Incidence**
  - 30-35% meta-analysis

- Increased lengths of stay

- Worse functional outcomes

- Independently increases mortality
Pain Management

Effective Geriatric Pain Management

- Non-narcotics
- Low-dose opioids
- Regional anesthesia
  - Less analgesia
  - Decreased delirium
  - Shorter stays

Under-treated in elderly
Pain Management for Hip Fracture Patients

- **IV acetaminophen (Paracetamol, APAP)**
  - 1g every 8 hours scheduled
    - First 24 hours after surgery
    - Followed by oral (PO) acetaminophen
IV Acetaminophen in Hip Fractures

No studies evaluating delirium or cost effectiveness

Reduced need for narcotics
Study Overview

♦ Retrospective review
  • 1 Jan to 31 Dec, 2016
  • Patients > 60 yo
  • Low energy hip fracture
  • Treated surgically

♦ Excluded patients:
  • Pathologic fracture
  • Injury > 2 weeks prior
  • Previous arthroplasty or fixation
Study Overview

Geriatric Hip Fracture

IV Acetaminophen (IV APAP) <-> Oral Acetaminophen (PO APAP)

Retrospective – protocol compliance

PO and IV narcotics for breakthrough pain
Study Overview

- Primary Outcome: Rate of Delirium

CHART-DEL Instrument:
Chart Abstraction for Delirium During Hospitalization

- Validated tool
Secondary outcomes
Statistics

- **Continuous variables**
  - Student’s T-test

- **Categorical variables**
  - Chi-Square analysis
  - Fisher exact test

- **Statistical significance <0.05**

- **Power analysis**
  - 35% incidence
  - 2015 hip fracture data
  - Power = 0.75
Results

- 123 patients
  - Mean age: 81 years old
  - 73 women
  - 50 men

- 52.8% of patients received IV APAP
  - 65 - IV Group
  - 58 - PO Group

- 18.2 hours - average time to surgery
  - 80% surgery <24 hours
  - Only 1 patient >48 hours to OR - in IV Group
## Results

### Comparison of groups – Pre-Admission Factors

<table>
<thead>
<tr>
<th>Patient Characteristics</th>
<th>IV Acetaminophen N = 65</th>
<th>PO Acetaminophen N = 58</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>81.1</td>
<td>78.9</td>
<td>0.223</td>
</tr>
<tr>
<td>Female</td>
<td>41 (63.1%)</td>
<td>32 (55.2%)</td>
<td>0.373</td>
</tr>
<tr>
<td>Male</td>
<td>24 (36.9%)</td>
<td>26 (44.8%)</td>
<td></td>
</tr>
<tr>
<td><strong>Pertinent Medical History</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline Dementia</td>
<td>12 (18.5%)</td>
<td>15 (25.9%)</td>
<td>0.322</td>
</tr>
<tr>
<td>History of Stroke</td>
<td>12 (18.5%)</td>
<td>12 (20.7%)</td>
<td>0.756</td>
</tr>
<tr>
<td>History of mental illness</td>
<td>11 (16.9%)</td>
<td>10 (17.2%)</td>
<td>1.00</td>
</tr>
<tr>
<td>AMS on presentation</td>
<td>3 (4.6%)</td>
<td>6 (10.3%)</td>
<td>0.223</td>
</tr>
<tr>
<td>Infection at admission</td>
<td>1 (1.5%)</td>
<td>2 (3.4%)</td>
<td>0.493</td>
</tr>
</tbody>
</table>

Non-significant
Results

- Comparison of groups – Pre-Admission Factors

<table>
<thead>
<tr>
<th>ASA Classification</th>
<th>IV Acetaminophen (N = 65)</th>
<th>PO Acetaminophen (N = 58)</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>ASA 1</td>
<td>0</td>
<td>1</td>
<td>0.180</td>
</tr>
<tr>
<td>ASA 2</td>
<td>18</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>ASA 3</td>
<td>39</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>ASA 4</td>
<td>8</td>
<td>9</td>
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</table>

Non-significant

<table>
<thead>
<tr>
<th>Functional Status</th>
<th>IV Acetaminophen (N = 65)</th>
<th>PO Acetaminophen (N = 58)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>31</td>
<td>30</td>
<td>0.694</td>
</tr>
<tr>
<td>Level 2</td>
<td>27</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Level 3</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>
## Results – Delirium Rates

<table>
<thead>
<tr>
<th>Outcome</th>
<th>IV Acetaminophen N = 65</th>
<th>PO Acetaminophen N = 58</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delirium</td>
<td>10 (15.4%)</td>
<td>19 (32.8%)</td>
<td>0.024</td>
</tr>
<tr>
<td>Definitive</td>
<td>5</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Probable</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Possible</td>
<td>1</td>
<td>0</td>
<td></td>
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</tbody>
</table>

The p-value of 0.024 indicates a statistically significant difference between IV and PO acetaminophen regarding delirium rates.
Results – IV Opioid Consumption

Post-Operative IV Opioid Doses

Number of Doses

PO APAP

p = 0.008

IV APAP

p = 0.106

p = 0.158

POD #1

POD #2

POD #3
Results - Pain Scores

Post-Operative Pain Scores

<table>
<thead>
<tr>
<th>POD #1</th>
<th>POD #2</th>
<th>POD #3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>2.00</td>
<td>4.00</td>
</tr>
</tbody>
</table>

Mean VAS Pain Score

PO APAP: p = 0.410
IV APAP: p = 0.500
PO APAP: p = 0.295
## Results

### Secondary Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Group 1 (IV APAP) N = 65</th>
<th>Group 2 (PO APAP) N = 58</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required One-to-One Supervision</td>
<td>6</td>
<td>14</td>
<td>0.025</td>
</tr>
<tr>
<td>Readmission</td>
<td>12</td>
<td>16</td>
<td>0.228</td>
</tr>
<tr>
<td>Length of Stay (days)</td>
<td>6.37</td>
<td>8.47</td>
<td>0.037</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discharge Disposition</th>
<th>Group 1 (IV APAP) N = 65</th>
<th>Group 2 (PO APAP) N = 58</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>7</td>
<td>6</td>
<td>0.645</td>
</tr>
<tr>
<td>Rehab</td>
<td>11</td>
<td>10</td>
<td>0.645</td>
</tr>
<tr>
<td>SNF</td>
<td>46</td>
<td>38</td>
<td>0.645</td>
</tr>
<tr>
<td>Hospice</td>
<td>1</td>
<td>3</td>
<td>0.645</td>
</tr>
<tr>
<td>Expired during admission</td>
<td>0</td>
<td>1</td>
<td>0.645</td>
</tr>
</tbody>
</table>
Discussion

- Similar baseline patient groups

- Populations treated during same time period with analogous care algorithms

- Low compliance (52.8%) with ordering IV acetaminophen
Effect of Delirium

**Length of Stay (days)**

- No Delirium: 5.6 days
- Delirium: 13.2 days

**Readmission Rates**

- No Delirium: 21.3%
- Delirium: 27.6%

*p < 0.001, p = 0.048*
Cost Implications of IV APAP

Length of Stay

- Oral APAP patients with delirium → longer ICU stays

<table>
<thead>
<tr>
<th></th>
<th>No Delirium</th>
<th>Delirium</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO APAP</td>
<td><img src="image" alt="PO APAP No Delirium" /></td>
<td><img src="image" alt="PO APAP Delirium" /></td>
</tr>
<tr>
<td>IV APAP</td>
<td><img src="image" alt="IV APAP No Delirium" /></td>
<td><img src="image" alt="IV APAP Delirium" /></td>
</tr>
<tr>
<td>PO APAP</td>
<td><img src="image" alt="PO APAP No Delirium" /></td>
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<tr>
<td>IV APAP</td>
<td><img src="image" alt="IV APAP No Delirium" /></td>
<td><img src="image" alt="IV APAP Delirium" /></td>
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</tbody>
</table>
Cost Implications of IV APAP

Direct Room & Board Costs

- ICU
- Med-Surg Floor

- Increased ICU utilization drives **higher costs**
Cost Analysis

Direct Room & Board Costs

Reduced delirium rate days
($102,717)

Reduced ICU utilization
($60,169)

$421,457

$162,886 cost savings

PO APAP

Cost Savings

$584,343
# Cost Analysis

## Direct Medication Costs

<table>
<thead>
<tr>
<th></th>
<th>APAP</th>
<th>Opioids</th>
<th>Average Total Direct Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO APAP</td>
<td>$11.52</td>
<td>$25.18</td>
<td>$36.70</td>
</tr>
<tr>
<td>IV APAP</td>
<td>$40.94</td>
<td>$16.56</td>
<td>$57.50</td>
</tr>
<tr>
<td>Difference</td>
<td>$29.42</td>
<td>$(8.62)</td>
<td>$20.80 per patient (N=65)</td>
</tr>
</tbody>
</table>

**IV APAP cost $1207 more for all 65 patients**
Cost Savings using IV APAP

- Medication Cost: $162,886
- R&B Savings: $1,207

Total Savings: $161,679
Discussion

- Weakness of this study
  - Retrospective, observational
    - Patients not systematically randomized
    - Delirium not evaluated in real time
    - Mortality not reported
Conclusions
Questions and Comments
References