Objectives
- Identify the types of bariatric surgeries
- State the indications of IV acetaminophen and its use in bariatric surgery
- Analyze results regarding literature on IV acetaminophen in bariatric surgery

Survey
- How often do you see an order for IV acetaminophen for bariatric surgery patients in your institution?
  - Frequently
  - Rarely
  - I've never seen this order

Bariatric Surgery
- Operation that results in weight loss by restricting the amount of food the stomach can hold, causing malabsorption of nutrients, or by a combination of both gastric restriction and malabsorption
- Indications
  - BMI ≥ 40, or more than 100 pounds overweight
  - BMI ≥ 35 and at least two obesity-related co-morbidities such as:
    - Type II diabetes, hypertension, sleep apnea and other respiratory disorders, non-alcoholic fatty liver disease, osteoarthritis, lipid abnormalities, gastrointestinal disorders, or heart disease
  - Inability to achieve a healthy weight loss sustained for a period of time with prior weight loss efforts

Bariatric Surgery Procedures
- Gastric Band
- Gastric Sleeve
- Gastric Bypass

Estimate of Bariatric Surgery Numbers

<table>
<thead>
<tr>
<th>Year</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>158,000</td>
</tr>
<tr>
<td>2012</td>
<td>173,000</td>
</tr>
<tr>
<td>2013</td>
<td>176,000</td>
</tr>
<tr>
<td>2014</td>
<td>188,000</td>
</tr>
<tr>
<td>2015</td>
<td>196,000</td>
</tr>
</tbody>
</table>
Postoperative Priorities
- Pain management
- Leakage from surgical site
- Nausea and vomiting
- Intravenous fluid management
- Pulmonary hygiene
- Ambulation

2016 Guidelines: American Pain Society
- Management of Postoperative Pain
- Multimodal analgesia
- Variety of analgesics medications
- Techniques combined with non pharmacological interventions

2016 Guidelines: American Pain Society
- Pain management
- Leakage from surgical site
- Nausea and vomiting
- Intravenous fluid management
- Pulmonary hygiene
- Ambulation

Acetaminophen Injection (Ofirmev)
- Approved by the FDA November 2010 for management of postoperative pain
- Indications
  - Management of mild to moderate pain
  - Management of moderate to severe pain with adjunctive opioid analgesics
  - Reduction of fever
- Generic formulation not available

Dosing IV Acetaminophen

<table>
<thead>
<tr>
<th>Age group</th>
<th>Dose given every 4 hours</th>
<th>Dose given every 6 hours</th>
<th>Maximum single dose</th>
<th>Maximum total daily dose of acetaminophen (by all routes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults and adolescents (13 years and older)</td>
<td>650 mg</td>
<td>1000 mg</td>
<td>1000 mg</td>
<td>4000 mg in 24 hours</td>
</tr>
<tr>
<td>weighing &gt; 50 kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adults and adolescents (13 years and older)</td>
<td>12.5 mg/Kg</td>
<td>15 mg/Kg</td>
<td>15 mg/Kg</td>
<td>75mg/Kg in 24 hours (up to 3750mg)</td>
</tr>
<tr>
<td>weighing &lt; 50 kg</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Children 2 to 12 years of age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

IV vs PO

<table>
<thead>
<tr>
<th></th>
<th>IV acetaminophen</th>
<th>PO acetaminophen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset of action</td>
<td>5 - 10 minutes</td>
<td>&lt;1 hour</td>
</tr>
<tr>
<td>Bioavailability</td>
<td>100%</td>
<td>85-98%</td>
</tr>
<tr>
<td>Peak plasma concentration</td>
<td>15 minutes</td>
<td>30 - 60 minutes</td>
</tr>
<tr>
<td>Duration</td>
<td>4 – 6 hours</td>
<td>4 – 6 hours</td>
</tr>
</tbody>
</table>
2016 Guidelines: American Pain Society

- No clear differences between IV versus oral administration of acetaminophen in reducing postoperative pain
- Studies have found IV administration leads to a quicker increase in plasma levels
- Does not have a statistical significance in reducing postoperative pain

Scheduled Intravenous Acetaminophen Reduces Postoperative Narcotic Analgesic Demand and Requirement After Laparoscopic Roux-en-Y Gastric Bypass

Saurabh, et al. (2014)

Methods

- Objective: Determine whether use of IV acetaminophen reduces postoperative narcotic demand and requirement during the first 24 hours in patients undergoing laparoscopic Roux-en-Y gastric bypass (LRYGB) surgery
- Retrospective electronic medical record (EMR) review of laparoscopic Roux-en-Y gastric bypasses performed for severe obesity between 2011 and 2013
- Compared groups based on 24-hour narcotic analgesic demand and requirements

Results

<table>
<thead>
<tr>
<th></th>
<th>Control group Morphine PCA only (n=229)</th>
<th>Study group Morphine PCA and IV acetaminophen (n=189)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yr)</strong></td>
<td>43 ± 0.7 (18-68)</td>
<td>44 ± 0.8 (23-68)</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>23%</td>
<td>16%</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>77%</td>
<td>84%</td>
</tr>
<tr>
<td><strong>BMI</strong></td>
<td>45.8 ± 0.4 (36-82.3)</td>
<td>46 ± 0.5 (35.3-77.4)</td>
</tr>
<tr>
<td><strong>Type 2 Diabetes</strong></td>
<td>29%</td>
<td>35%</td>
</tr>
</tbody>
</table>

Saurabh, et al. (2014)

Methods

- Evaluate the effect of adding scheduled IV acetaminophen on postoperative morphine sulfate patient-controlled analgesia (PCA) usage
- Complications that occurred during the 24-hour postoperative period
- 30-day postoperative complications between groups

Results: Total PCA pushes

<table>
<thead>
<tr>
<th></th>
<th>Control group Morphine PCA only (n=229)</th>
<th>Study group Morphine PCA and IV acetaminophen (n=189)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Narcotic demand</strong></td>
<td>40.5 ± 3.1 (20-206)</td>
<td>30.9 ± 8 (0-174)</td>
</tr>
<tr>
<td><strong>P value</strong></td>
<td>0.0017</td>
<td></td>
</tr>
<tr>
<td><strong>Narcotic requirement</strong></td>
<td>20.9 ± 1.0 (0-111)</td>
<td>24.1 ± 13 (0-177)</td>
</tr>
<tr>
<td><strong>P value</strong></td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td><strong>Total IV acetaminophen in first 24h</strong></td>
<td>0 mg</td>
<td>361.7 mg</td>
</tr>
</tbody>
</table>
Saurabh, et al. (2014)

**Conclusion**

- IV acetaminophen reduces the demand for and requirements of narcotic analgesia after Roux-en-Y gastric bypass in the first 24 hours
- IV acetaminophen can be safely used for post operative analgesia in morbidly obese patients when used for 24 hours with compliance and dosage requirements

**Critical Appraisal**

- **Strengths**
  - Researchers do not have a conflict of interest to the study
  - Looked at a specific subset of bariatric surgeries
  - Utilized an order set for pain management
- **Limitations**
  - Retrospective in nature
  - Lacks objective pain assessment on patients
  - Monitoring acetaminophen induced side effects and effect on liver enzymes


**Methods**

- **Objective**: To determine whether IV acetaminophen reduces opioid requirements after bariatric surgery
- Retrospective chart review analysis of bariatric surgery patients who
  - Received only opioids for postoperative pain from January 2012 to June 2012
  - Received at least four doses of IV acetaminophen plus opioids from October 2012 to March 2013

**Data Analysis**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>All Patients (n=44)</th>
<th>IV acenaminophen (g)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>41.85 ± 10.35</td>
<td>43.73 ± 11</td>
<td>0.089</td>
</tr>
<tr>
<td>Gender, n (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>20 (45.5)</td>
<td>18 (41.3)</td>
<td>1.000</td>
</tr>
<tr>
<td>Female</td>
<td>24 (54.5)</td>
<td>26 (58.6)</td>
<td></td>
</tr>
<tr>
<td>Mean BMI (kg/m²)</td>
<td>45.03 ± 6.3</td>
<td>46.38 ± 6.26</td>
<td>0.043</td>
</tr>
</tbody>
</table>

Effect of Intravenous Acetaminophen on Postoperative Opioid Use in Bariatric Surgery Patients

Data Analysis

- Distribution of patients among narcotic classes
- Seven of the 88 patients received no narcotic

\[ \begin{array}{ccc}
\text{IV Opioid} & \text{Median (mg)} & \text{IV Opioid} \\
\text{Hydromorphone} & 4.5 & \text{Hydromorphone} \\
\text{Morphine} & 8 & \text{Morphine} \\
\text{Oxycodone, oral} & 12 & \text{Oxycodone, oral} \\
\end{array} \]

Results: Comparison of Opioid consumption

<table>
<thead>
<tr>
<th>Opioid use</th>
<th>N</th>
<th>Median (mg)</th>
<th>N</th>
<th>Median (mg)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OME</td>
<td>44</td>
<td>93.5</td>
<td>44</td>
<td>63</td>
<td>0.017</td>
</tr>
<tr>
<td>Hydromorphone, IV</td>
<td>34</td>
<td>4.5</td>
<td>6</td>
<td>7.75</td>
<td>0.348</td>
</tr>
<tr>
<td>Morphine, IV</td>
<td>8</td>
<td>8</td>
<td>37</td>
<td>16</td>
<td>0.049</td>
</tr>
<tr>
<td>Oxycodone, oral</td>
<td>12</td>
<td>25</td>
<td>20</td>
<td>20</td>
<td>0.626</td>
</tr>
</tbody>
</table>

Results: Comparison of Pain scores

<table>
<thead>
<tr>
<th>Variables</th>
<th>All patients (n = 88)</th>
<th>IV Acetaminophen (n = 44)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline pain score (0 to 10)</td>
<td>6 (6-8)</td>
<td>6 (6-8)</td>
<td>6 (6-8)</td>
</tr>
<tr>
<td>Pain score after analgesic use</td>
<td>3 (1-3)</td>
<td>3 (1-3)</td>
<td>3 (1-3)</td>
</tr>
<tr>
<td>Change in pain score</td>
<td>4 (3-5)</td>
<td>4 (3-5)</td>
<td>4 (3-4)</td>
</tr>
</tbody>
</table>

Conclusion

- The study found the acetaminophen/opiate group required significantly more opiates compared to the opiates alone group.
- Study arms did not alter average length of stay contributory to conclusion
- Authors conclude IV acetaminophen does not reduce opioid use for postoperative pain management in bariatric surgery patients

Critical Appraisal

- Objective pain scores were monitored and analyzed
- Included postoperative length of stay
- Looked at different opioids and compared by oral morphine equivalents

- Retrospective in nature
- Small sample size
- Prescriber discretion in choosing IV narcotic for pain management

IV Acetaminophen Results in Lower Hospital Costs and Emergency Room Visits Following Bariatric Surgery: Double-Blind, Prospective, Randomized Trial in a Single Accredited Bariatric Center

Chaar, et al. (2016)
Chaar, et al. (2016)

Methods

- Objective: Investigate the economic impact of IV Acetaminophen in bariatric surgery and its effect on patient’s pain, satisfaction, and hospital length of stay
- Double-blind, prospective, randomized controlled trial in patients that underwent Roux-en-Y (LRYGB) gastric bypass or laparoscopic sleeve gastrectomy (LSG)

Chaar, et al. (2016)

Results

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Race</th>
<th>Type of surgery</th>
<th>IV acetaminophen</th>
<th>Normal saline</th>
</tr>
</thead>
<tbody>
<tr>
<td>43.2 ± 15.8</td>
<td>36 female (72%)</td>
<td>36 White (72%)</td>
<td>LRYGB 40 (80%)</td>
<td>$3089.18 ± 1366.27</td>
<td>$2991.62 ± 1169.58</td>
</tr>
<tr>
<td>41.1 ± 13.9</td>
<td>39 female (78%)</td>
<td>44 White (88%)</td>
<td>LRYGB 52 (64%)</td>
<td>$3051.40 ± 1253.39</td>
<td>$3030.80 ± 1037.88</td>
</tr>
</tbody>
</table>

Chaar, et al. (2016)

Results

<table>
<thead>
<tr>
<th>Direct Costs</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV acetaminophen (n =50)</td>
<td>$3089.18 ± 1366.27</td>
</tr>
<tr>
<td>Normal Saline (n=50)</td>
<td>$2991.62 ± 1169.58</td>
</tr>
<tr>
<td>LRYGB (n=72)</td>
<td>$3036.13 ± 1311.53</td>
</tr>
<tr>
<td>SG (n=28)</td>
<td>$3051.40 ± 1253.39</td>
</tr>
</tbody>
</table>

Chaar, et al. (2016)

Results

<table>
<thead>
<tr>
<th>Patient satisfaction score</th>
<th>Median (range)</th>
<th>P value</th>
<th>Patient pain rating score</th>
<th>Median (range)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV acetaminophen (n=50)</td>
<td>4 (1-5)</td>
<td>0.23</td>
<td>6.19 ± 2.40</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Normal saline (n=50)</td>
<td>5 (1-5)</td>
<td>0.94</td>
<td>6.48 ± 2.29</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>LRYGB (n=72)</td>
<td>5 (1-5)</td>
<td>0.44</td>
<td>6.87 ± 1.74</td>
<td>0.23</td>
<td></td>
</tr>
<tr>
<td>SG (n=28)</td>
<td>5 (1-5)</td>
<td>0.44</td>
<td>6.87 ± 1.74</td>
<td>0.23</td>
<td></td>
</tr>
</tbody>
</table>
Chaar, et al. (2016)  
Conclusion  
- IV acetaminophen results in significant indirect cost savings and reduced the number of ED visits in the first 30 days  
- IV Acetaminophen found to be safe and effective for the obese population  
- Use of IV Acetaminophen for pain control following bariatric surgery should be seriously considered  

Chaar, et al. (2016)  
Critical Appraisal  
Strengths  
- Randomized controlled trial  
- Patient pain scores  
- Patient satisfaction scores  
Limitations  
- ED readmission rates not significant  
- Direct cost savings not significant  
- Three of the researchers received study funding from Mallinckrodt Pharmaceuticals  

Saurabh, et al.  
- Retrospective EMR review  
- Evaluate effect of IV acetaminophen on postoperative morphine PCA usage  
- Reduction in the demand and requirements of narcotic analgesia in the first 24 hours  

Wang, et al.  
- Retrospective chart review  
- Determine whether IV acetaminophen reduces opioid requirements postop  
- Acetaminophen/opiate group required significantly more opiates compared to opiates alone  

Chaar, et al.  
- Double-blind, prospective, randomized controlled trial  
- Investigate economic impact of IV acetaminophen on patient's pain and satisfaction scores and hospital length of stay  
- Indirect cost savings and reduction in ED visits in first 30 days  

Saurabh, et al.  
- Retrospective EMR review  
- Evaluate effect of IV acetaminophen on postoperative morphine PCA usage  
- Reduction in the demand and requirements of narcotic analgesia in the first 24 hours  

Wang, et al.  
- Retrospective chart review  
- Determine whether IV acetaminophen reduces opioid requirements postop  
- Acetaminophen/opiate group required significantly more opiates compared to opiates alone  

Chaar, et al. (2016)  
Conclusion  
- Data is not conclusive and randomized controlled trials are warranted  
- Patient's should be assessed based on their clinical assessment before deciding IV acetaminophen would be beneficial  
- American Pain Society guidelines state there is not a clear difference between IV and PO acetaminophen  
- Would not recommend routine use of IV acetaminophen  

Acknowledgements  
Evaluator: Lane Farrell, Pharm.D  
Preceptors  
- Merry Daniel, Pharm.D  
- Josiah Smith, Pharm.D  
- Jennifer Frawley, Pharm.D, BCPS, BCCCP  
- Danh Dinh, Pharm.D  

Questions??
IV Acetaminophen (Ofirmev) in Bariatric Surgery

Jennifer Shin, PharmD
PGY-1 Pharmacy Practice Resident, St. David's South Austin Medical Center
The University of Texas at Austin College of Pharmacy
Pharmacotherapy Rounds
January 20th, 2017