Surgical Resident
Research

April 7, 2010
Minimally Invasive Open Reduction and Internal Fixation (ORIF) for Rib Fractures with Flail Chest

Magdy Giurgius MD Erik Hasenboehler MD
Paul Kearney MD
Acute Care Surgery
Flail chest

- >3 adjacent ribs fractured in two places
- 75 per 50,000 patients per year
  - 1-2 cases per month for each trauma center
- Pulmonary contusion is key problem
  - Decreased compliance
  - Increased shunting
- Mortality: 10-20%
Management of flail chest injury: Internal fixation versus endotracheal intubation and ventilation
- Mortality 8% vs 29%
- VAP 15% vs 50%
- Vent. Days 3.9 vs. 15

Pulmonary function testing after operative stabilisation of the chest wall for Flail chest
- Mortality 11%
- Median time to fixation: 2.8 days
- Extubation within 7 days post-op: 85%

Surgical Stabilization of Internal Pneumatic Stabilization? A Prospective Randomized Study of Management of Severe Flail Chest Patients.
Tanaka et al. Journal of Trauma, 2002
- 37 flail : 18 rib fixation / 19 internal pneumatic
- PNA day 7 : 5% / 16% → day 21; 22% / 90%
- Vent days: 11 / 18.5
# Quality Control “Data”

<table>
<thead>
<tr>
<th>N</th>
<th>Ventilation</th>
<th>Spont TV Pre op</th>
<th>Spont TV Post op</th>
<th>Pain score Pre op</th>
<th>Pain score Post op</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 flail</td>
<td>7 yes</td>
<td>250-690ml M=470 ml</td>
<td>500-900ml M=600 ml</td>
<td>6-10 M=9</td>
<td>2-6 M=4.5</td>
<td>27% TV ↑ 50% ↓ pain</td>
</tr>
<tr>
<td>2 rib series (&gt;7 ribs)</td>
<td>4 no</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Near future

- Prospective study
- All trauma patients with flail chest
- Fixation vs no fixation
- Outcome: respiratory outcome, ventilator length, pulmonary complications, pain, ICU stay, Hospital stay, rehabilitation
Manuscript underway

Minimal Invasive Rib Osteosynthesis
Thank you
Efficacy of Cholecystectomy in Patients with Negative Imaging

Tiffany Wright
Andrew Bernard
Scott Roth
Background

- Biliary colic common general surgical referral
- Patients often present with normal diagnostic imaging
- There is little data regarding efficacy of laparoscopic cholecystectomy in patients with normal imaging
HIDA scan ejection fraction does not predict sphincter of Oddi hypertension or clinical outcome in patients with suspected chronic acalculous cholecystitis.

Young SB, Arregui M, Singh K.
St. Vincent Hospital, 8402 Harcourt Road, Suite 815, Indianapolis, IN 46260, USA.

BACKGROUND: Hepatobiliary iminodiacetic scan with ejection fraction (HIDA EF) is used to evaluate chronic acalculous cholecystitis (CAC). A presumed etiology of CAC is sphincter of Oddi hypertension (SOH). In this study, we evaluated the value of HIDA EF to predict patient response to laparoscopic cholecystectomy and to identify SOH. METHODS: A prospective study of 93 patients with biliary pain but without gallstones (CAC) who underwent preoperative HIDA EF was conducted. At laparoscopic cholecystectomy, transcystic antegrade biliary manometry was performed to determine the SO pressure. Patients were evaluated postoperatively for response to cholecystectomy. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated. The outcomes were compared with the clinical impression. RESULTS: Of the 93 patients with both HIDA EF and SOP measurements, 50 had abnormal EF (< 35%); of these, 29 had SOH (SO pressure > or = 40 mmHg). Of the 43 patients with normal HIDA EF, 30 had SOH. The sensitivity was 49%, specificity 38%, PPV 58%, and NPV 30%. Eighty-six of the 93 patients returned for follow-up evaluation. Follow-up ranged from 0 to 99 months, with a mean of 26.4 months. Overall, 73 patients (85%) improved. Of the 46 with abnormal HIDA EF, 42 (91%) improved. Of the 40 patients with normal HIDA EF, 31 (77.5%) improved. The sensitivity was 57.7%, specificity 69.2%, PPV 91.3%, and NPV 22.5%.

CONCLUSION: Although the PPV of abnormal HIDA EF is high, it is not much better than the clinical impression. The sensitivity and specificity are marginal. The NPV is poor. Based on the review of these 93 patients, HIDA EF is not reliable for identifying CAC. We recommend that patients with normal HIDA EF have additional testing or consultation before ruling out CAC. HIDA EF does not predict SOH.

n=40 77.5% improved
Hypothesis

Laparoscopic cholecystectomy provides symptomatic relief in patients with biliary colic even with normal imaging.
Study Design

- Retrospective review
- IRB: Expedited review (low risk)
- Inclusion criteria
  - Lap Cholecystectomy from 2006-2008
  - Age ≥18
- Exclusion criteria
  - Gallstone pancreatitis
  - Acute cholecystitis
PATHOLOGY: NO STONES

(+ ) Stones on US
- Excluded

(-) Stones on US
HIDA EF < 35%
- Excluded

(-) Stones on US
HIDA EF > 35%
- Eligible Population
  - Symptomatic Relief
    - Yes
    - No
Results

- Enrollment ongoing
Challenges

- Failure of patients to follow up
- Short duration of follow up
- Poor documentation regarding symptoms
Endoluminal thermal ablation versus stripping of the saphenous vein: Meta-analysis of recurrence of reflux.

Xenos E, Bietz G, Minion D, Abedi N, Sorial E, Karagiorgos SE, Endean E

International Journal of Angiology. Publication Status: Accepted
Endoluminal thermal ablation versus stripping of the saphenous vein: Meta-analysis of recurrence of reflux

• Method: Systematic search of Medline/Pubmed, OVID, EMBASE, CINAHL, Clinicaltrials.gov and Cochrane central register
  – 1966-2009 in all languages
Method

• Randomized prospective clinical trials with > 365 days f/u.
• Analyzed outcomes included recurrence of varicosities and reflux, as documented by duplex ultrasound, and recurrence of signs and symptoms
Results

- 8 randomized controlled trials were included
- 497 patients total
- 226 L/S
- 271 endoluminal thermal ablation
- F/U 584 SD182 days.
Conclusion

• Catheter-based treatments and traditional venous stripping with high ligation have similar long-term results

• Catheter-based treatments have a decreased post op pain, shorter recovery time to work and normal activity.

• Poster Presented at American Venous Form 21st Annual Meeting Phoenix, Arizona Feb 2009
Questions ?
Novel Quantification of the Decay of the Temporal Accuracy of High Quality Axial Imaging for Pancreatic Cancer

Sushanth Reddy, M.D.
Background

• Pancreatic adenocarcinoma is a dynamic disease
  – A lesion can grow over time
  – Neuroendocrine tumors thought to be more indolent

• High quality pancreatic protocol CT scans (PPCT) are now considered the gold standard in evaluating pancreatic cancer

• To date, no study has quantified the accuracy of a PPCT temporally
Methods

- Retrospective review of 2589 PPCT at a single institution 2006-2008
- PPCT findings correlated to operative findings
  - 292 PPCT in 256 patients with adenocarcinoma who underwent exploration
  - 74 PPCT in 63 patients with neuroendocrine cancers who underwent exploration
- Attention was paid to prediction of involvement of porto-mesenteric venous confluence and presence of metastatic disease
## Results

<table>
<thead>
<tr>
<th></th>
<th>Adenocarcinoma</th>
<th></th>
<th>Neuroendocrine Tumor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Metastasis</td>
<td>81.8%</td>
<td></td>
<td>94.9%</td>
<td></td>
</tr>
<tr>
<td>Venous Involvement</td>
<td>82.9%</td>
<td></td>
<td>95.2%</td>
<td></td>
</tr>
</tbody>
</table>
Conclusion

• PPCT is a highly accurate way to predict resectability of pancreatic cancers

• For adenocarcinoma, there is a depreciation of accuracy of PPCT to determine the presence of metastatic disease but not venous involvement
  – The same trend does not occur for neuroendocrine tumors

• Every patient should undergo PPCT within 4 weeks of planned operative intervention
UK and NSQIP

☆ General Surgical Operative Duration Is Associated with Increased Risk-Adjusted Infectious Complication Rates and Length of Hospital Stay; Journal of the American College of Surgeons, Volume 210, Issue 1, Pages 60-65.e2; L. Procter, D. Davenport, A. Bernard, J. Zwischenberger


☆ Blood transfusion is associated with increased morbidity and mortality after lower extremity revascularization; Journal of Vascular Surgery, Volume 51, Issue 3, Pages 616-621.e3; S. O’Keeffe, D. Davenport, D. Minion, E. Sorial, E. Endeant, E. Xenos


☆ Dan Davenport and the NSQIP Dataset: A Sweet Way to Earn a Trip to a Major Meeting; Surgical Resident Quarterly, Volume 2, Pages 112-113; W. Mustain, L. Proctor, P. McHugh, S. O’Keeffe
Abstract

Introduction
- Impact of obesity not clearly defined
- Various authors with different conclusions
- Mostly small, single-institution series

Methods
- NSQIP 2005-2008, by CPT code
- Intraoperative and 30-day outcomes by BMI-based obesity class
- Multivariable regression to adjust for comorbidities where significant differences were found
Results

 Patients

- 11,056 cases; 106 missing height or weight
- 10,950 analyzed;
  - 3,206 (29%) obese
  - 48.2% male
  - Mean age 60 ±15

 Outcomes

- Operative time and wound occurrence correlate with BMI
- Multivariable regression shows obesity as independent risk factor
## Results

<table>
<thead>
<tr>
<th>30-day Outcome n (%)</th>
<th>BMI ≤ 18.50 UnderWt. n=281</th>
<th>BMI 18.51-25.00 Normal n=3473</th>
<th>BMI 25.01-30.00 OverWt. n=3990</th>
<th>BMI 30.01-35.00 Obese I n=2043</th>
<th>BMI 35.01-40.00 Obese II n=752</th>
<th>BMI &gt; 40.00 Obese III n=411</th>
<th>Chi-sq. P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Op. Duration min. ± s.d.</td>
<td>161±83</td>
<td>156±74</td>
<td>163±72</td>
<td>168±72</td>
<td>174±67</td>
<td>185±84</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Intraoperative Transfusion n (%)</td>
<td>10 (3.6)</td>
<td>80 (2.3)</td>
<td>78 (2.0)</td>
<td>42 (2.1)</td>
<td>14 (1.9)</td>
<td>8 (2.0)</td>
<td>0.52</td>
</tr>
<tr>
<td>Surgical site infection or dehiscence</td>
<td>22 (7.8)</td>
<td>254 (7.3)</td>
<td>363 (9.1)</td>
<td>231 (11.3)</td>
<td>94 (12.5)</td>
<td>77 (18.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Reoperation w/in 30 days</td>
<td>21 (7.5)</td>
<td>146 (4.2)</td>
<td>184 (4.6)</td>
<td>88 (4.3)</td>
<td>34 (4.5)</td>
<td>22 (5.4)</td>
<td>0.19</td>
</tr>
<tr>
<td>Pulmonary Occurrence</td>
<td>7 (2.5)</td>
<td>86 (2.5)</td>
<td>102 (2.6)</td>
<td>44 (2.2)</td>
<td>23 (3.1)</td>
<td>11 (2.7)</td>
<td>0.84</td>
</tr>
<tr>
<td>Renal Insuff./ Failure</td>
<td>1 (0.4)</td>
<td>13 (0.4)</td>
<td>26 (0.7)</td>
<td>18 (0.9)</td>
<td>9 (1.2)</td>
<td>4 (1.0)</td>
<td>0.07</td>
</tr>
<tr>
<td>Sepsis/Shock</td>
<td>17 (6.0)</td>
<td>112 (3.2)</td>
<td>158 (4.0)</td>
<td>74 (3.6)</td>
<td>22 (2.9)</td>
<td>20 (4.9)</td>
<td>0.07</td>
</tr>
<tr>
<td>DVT / Pulm. Embolism</td>
<td>3 (1.1)</td>
<td>28 (0.8)</td>
<td>42 (1.1)</td>
<td>28 (1.4)</td>
<td>9 (1.2)</td>
<td>7 (1.7)</td>
<td>0.34</td>
</tr>
<tr>
<td>Mortality</td>
<td>2 (0.7)</td>
<td>31 (0.9)</td>
<td>36 (0.9)</td>
<td>12 (0.6)</td>
<td>7 (0.9)</td>
<td>2 (0.5)</td>
<td>0.76</td>
</tr>
</tbody>
</table>
Multivariable Regression

Table II: Multivariable regression corrected for age, gender, ASA class, work RVU, and wound class.
Table III: Multivariable regression corrected for age, gender, ASA class, work RVU, wound class, and operative duration.

<table>
<thead>
<tr>
<th>30-day Outcome</th>
<th>BMI (\leq 18.50)</th>
<th>BMI 18.51-25.00</th>
<th>BMI 25.01-30.00</th>
<th>BMI 30.01-35.00</th>
<th>BMI 35.01-40.00</th>
<th>BMI &gt; 40.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical site infection or dehiscence</td>
<td>1.0 (0.6-1.6)</td>
<td>1.0 Ref.</td>
<td>1.2* (1.0-1.4)</td>
<td>1.5*** (1.2-1.8)</td>
<td>1.6*** (1.2-2.0)</td>
<td>2.4*** (1.8-3.2)</td>
</tr>
<tr>
<td>Odds ratio (CI)</td>
<td>UnderWt. n=281</td>
<td>Normal n=3473</td>
<td>OverWt. n=3990</td>
<td>Obese I n=2043</td>
<td>Obese II n=752</td>
<td>Obese III n=411</td>
</tr>
</tbody>
</table>

* p<.01
Conclusions

- Laparoscopic colectomy is performed in a large number of obese and morbidly obese patients with no difference in mortality or six different morbidities compared to non-obese patients.

- Operative time is increased with obesity, reflecting technical challenges associated with larger body habitus.

- Obesity is an independent risk factor for development of surgical site infection or wound dehiscence, with rates approaching 20% in morbidly obese patients.
Operative versus Non-operative Treatment for Clavicle Fracture in The Polytrauma Patient with Associated Chest Injury. A Prospective Randomized Clinical Trial.

Erik Hasenboehler MD, Andrew Bernard MD
Raymond Wright MD, Eric Moghadamian MD
General Surgery Trauma/ Orthopaedic Trauma

University of Kentucky
Saint Anthony Central Hospital Denver CO
Background

- Associated with chest trauma / upper rib fx.
- Past treatment: conservative with poor outcome
- Current treatment: changing towards surgery
- Current data: improved functional outcome, patient satisfaction, improved rehabilitation, earlier return to function and decreased nonunion and malunion
- No data on chest injury outcome available
Methods

- Open, prospective, randomized, dual arm, parallel clinical study of open reduction and internal fixation (ORIF) or intramedullary nail (IMN) versus non operative treatment for clavicle fracture

- Randomized according to algorithm for two level 1 trauma centers
Closed Midshaft Clavicle Fracture

No

Associated Chest Injury? (Pneumo- Hemathotorax, Rib Fracture, Sternal Fracture)

Yes

Exclusion Criterion
1. Severe and moderate brain Injury (GCS ≤ 13)
2. Intubated patients
3. Injury precluding operative fixation within 7 days of admission
4. Open clavicle fractures
5. Spinal Cord Injuries
6. Pregnant females
7. Age < 18 - ≥ 80
8. Spanish peaking only

Ineligible

Informed Consent?

No

Yes

Randomize

Surgery

IM Nail
(Simple Midshaft Fx)

ORIF
(Medial/Lateral/Comminuted midshaft Fx.)

No Surgery
Inclusion

- Patients with a unilateral/bilateral midshaft clavicle fractures ≥ 2cm displaced, ≥ 2cm shortened, significantly comminuted, or tenting the skin

- Patient has associated chest injury: i.e. pneumothorax, hemathotorax, rib fx, sternal fx, chest contusion with lung contusion visible on x-ray, with or without additional injuries to the abdomen, pelvis or extremities
Objective

- Determine the hospital length of stay
- Intensive care unit length of stay
- Respiratory rehabilitation
- Functional outcome
- Subjective mobility, morbidity and mortality in polytrauma patients with chest injury and clavicle fracture treated operatively versus nonoperatively
Patient population: N=88 (44 each group)

Approximate study duration 24 months

Follow up for 12 months (pre- postop, 2/6/12 wks and 12 m.)

FU evaluation:

- X-Ray
- shoulder ROM (Constant Murley Score)
- rehabilitation satisfaction SF-36 and DASH Score
- Lung function capacity (TV) with Spyrometer
Thank you
Short-term Outcomes of Rectal Prolapse Repair by Perineal Approach versus Abdominal Approach: A Report Using the ACS-NSQIP Database

Grand Rounds
University of Kentucky
Department of Surgery
April 7, 2010
Rectal Prolapse: Background

- Protrusion of the rectum through the anus, due to an intussusception of the rectum.
- Can have fecal incontinence secondary to pudendal nerve stretch injuries.
- Can be severely limiting for patients in their daily activities.
- Operative management plays a significant role in treatment.
Operative Approach

- Transabdominal: Thought to have better long-term outcomes, but it generally represents a larger operation.

- Perineal: Thought to be safer for patients with a more frail state of health.
Perineal approach is an appropriate choice for patients in a poorer overall state of health.
Our Study: Methods

- Retrospective analysis using the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database.
- Patients had a diagnosis of rectal prolapse (ICD-9 code 569.1)
- Transabdominal approach: laparoscopic rectopexy (CPT 45400), laparoscopic resection and rectopexy (CPT 45402), open rectopexy (CPT 45540), and open resection and rectopexy (CPT 45550).
- Perineal approach: perineal resection (Altemeier Procedure) (CPT 45130) and perineal rectopexy (CPT 45541).
- Outcome measures: 30 day mortality, ASA class, mean age, operative duration, Intraoperative transfusion, length of stay, Pneumonia or other respiratory complications, surgical site infections (SSIs), sepsis/shock, UTIs, and return to OR within 30 days.
Our Study: Results

- Older patients were more likely to receive a perineal approach (mean age of 74.2 vs 57.1) as were those with a higher ASA class (61.4% had an ASA class of 3 or 4 vs only 28% in abdominal approach).
- Perineal approach is a shorter operative duration (87 min vs 140 min).
- Patients who received a perineal approach left the hospital on average one day earlier (3d vs 4d).
- Lower rates of SSI in perineal approach (0.7% vs 6.5% for deep/superficial SSI and 1.3% vs 2.8% for organ space SSI)
- Perineal approach did shower higher rate of pulmonary events (2.5% vs 0.5%) and a higher mortality rate, but this was not statistically significant.
Conclusion

- Even though perineal approach for rectal prolapse has inferior long-term results when compared to abdominal approach, it still remains a viable option for patients who would be considered poorer operative candidates.
Aortic injury from posterior rib fracture after blunt trauma

Authors: Robert R Carter, Nathan T Orr, David J Minion, Eleftherios S Xenos


Presented by: Nathan Orr
Case Summary:

- 43 y/o F unrestrained driver in MVC resulting in rollover and ejection

- On arrival to ER, patient was hypotensive, tachycardic, and had left neck subq emphysema

- CXR: multiple bilateral rib fxs, widened mediastinum, left pneumothorax

- Left tube thoracostomy had 150ml of blood return
CT scan:
- Left 2-10 contiguous and segmental ribs fractures
- Right 4-7 rib fractures

CT aorta:
- Dislocation of the left fifth rib at the costovertebral junction.
- Fracture fragment appearing to contact and displace the posterior wall of the descending thoracic aorta
Sagittal View
Reconstruction:
Case Summary Cont.

- Left thoracotomy performed:
  - Left 5th rib fractured posteriorly with sharp anterior fragment in direct contact with the thoracic aorta
  - Superficial aortic injury, with no indication of aortic dissection or intramural hematoma
  - 5cm of the rib was resected and a pledgeted suture was placed to repair the intimal tear of the aorta
References:


Prospective, Controlled Evaluation of ABRA Abdominal Wall Closure System

David Hamilton

UK College of Medicine
Class of 2011

Mentor:
Phillip Chang, M.D.
Background

Damage control laparotomy and decompressive laparotomy increasing
  - Complex abdominal trauma
  - Critically ill patients
  - Abdominal compartment syndrome

Increased incidence open abdominal cavities has resulted in:
  - Method to protect viscera; encourage fascial closure
  - Various management methods
  - No well designed comparison study available
  - Best results require returning to OR every 3-5 days
Background – ABRA System

• ABRA by CANICA introduced
  - FDA Listed System

• Full-thickness, transfascial method
• Uses button anchors and elastomers
• Tension can be set and adjusted
  - Stabilize retracted wound
  - Prevent loss of domain
  - Reduce wound
  - Close wound
Hypothesis

ABRA increases fascial closure rate and decreases OR resource utilization.
Methods

• Prospective, Randomized Study
• Canica ABRA system + KCI VAC system vs. KCI VAC system alone
• 30 patients.
• To date: 5 control, 5 study
• Vac change every 2-3 days for KCI alone (in OR)
• Vac change/ABRA tighten every 2-3 days in ICU
  • OR for fascial closure only

Endpoints:

• Rate of primary fascial closure
• Operating room resource utilization
Primary Fascial Closure
References


Open Versus Endoluminal Repair of Ruptured Abdominal Aortic Aneurysms: 30-Day ACS NSQIP Database Outcomes

S.D. O`Keeffe, D.L. Davenport, D.J. Minion, E.E. Sorial
E.D. Endean, E.S. Xenos
University of Kentucky Medical Center
Lexington, Kentucky
Endovascular aneurysm repair versus open repair in patients with abdominal aortic aneurysm (EVAR trial 1): randomised controlled trial

DREAM, NEJM, 2005

Two-Year Outcomes after Conventional or Endovascular Repair of Abdominal Aortic Aneurysms

EVAR-1, Lancet, 2005
Question

- Does EVAR confer a benefit in terms of early morbidity and mortality in rAAA?
Methods

- NSQIP database queried for rAAA based on CPT codes:
  - OPEN - 35082/35103
  - EVAR - 34800-34805

- Preoperative risk factors, intra-operative variables, and 30-day outcome measures compared using student T-test and Chi tests

- NSQIP risk factors entered into the logistic regression model
NSQIP

- Prospective, systematic sample of major vascular surgery cases at 173 medical centers

- Data obtained from the medical records by clinical nurses is uniform and reproducible and thus comparable.
## Results

### Graph

<table>
<thead>
<tr>
<th>Year</th>
<th>Open Repair</th>
<th>EVAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>90.3%</td>
<td>9.7%</td>
</tr>
<tr>
<td>2006</td>
<td>75.0%</td>
<td>25.0%</td>
</tr>
<tr>
<td>2007</td>
<td>76.8%</td>
<td>23.2%</td>
</tr>
</tbody>
</table>

### Table

<table>
<thead>
<tr>
<th>Year</th>
<th>Open Repair</th>
<th>EVAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>39</td>
<td>4</td>
</tr>
<tr>
<td>2006</td>
<td>100</td>
<td>32</td>
</tr>
<tr>
<td>2007</td>
<td>189</td>
<td>63</td>
</tr>
</tbody>
</table>

*Note: Open Repair and EVAR percentages represent percentages of total cases for each year.*
## Results

<table>
<thead>
<tr>
<th>Preoperative Risk Factor</th>
<th>EVAR N=99</th>
<th>Open repair N=328</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age mean years ± S.D.</td>
<td>72.1 ± 10.5</td>
<td>73.6 ± 9.3</td>
<td>0.167</td>
</tr>
<tr>
<td>Male (%)</td>
<td>79.8</td>
<td>76.5</td>
<td>0.497</td>
</tr>
<tr>
<td>Smoking (%)</td>
<td>39.4</td>
<td>30.8</td>
<td>0.111</td>
</tr>
<tr>
<td>COPD (%)</td>
<td>19.2</td>
<td>13.4</td>
<td>0.156</td>
</tr>
<tr>
<td>Hematocrit &lt; 38% (%)</td>
<td>44.4</td>
<td>59.5</td>
<td>0.008*</td>
</tr>
<tr>
<td>Preop. Renal Failure</td>
<td>1.0</td>
<td>1.8</td>
<td>0.575</td>
</tr>
<tr>
<td>Hematocrit &gt; 45% (%)</td>
<td>7.1</td>
<td>5.8</td>
<td>0.641</td>
</tr>
<tr>
<td>Preop Albumin g/dL mean ± S.D.</td>
<td>3.56 ± 0.78</td>
<td>3.30 ± 0.73</td>
<td>0.017*</td>
</tr>
<tr>
<td>Hx. of Angina, MI or CHF (%)</td>
<td>9.1</td>
<td>5.8</td>
<td>0.246</td>
</tr>
<tr>
<td>Prior Cardiac Operation or PCI (%)</td>
<td>27.3</td>
<td>21.3</td>
<td>0.218</td>
</tr>
<tr>
<td>Treated Hypertension (%)</td>
<td>64.6</td>
<td>66.8</td>
<td>0.696</td>
</tr>
<tr>
<td>Preop. Transfusion &gt;4 u PRBCs (%)</td>
<td>2.0</td>
<td>6.1</td>
<td>0.108</td>
</tr>
</tbody>
</table>
## Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>EVAR (n=99)</th>
<th>Open Repair (n=328)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-Day Mortality</td>
<td>22.2%</td>
<td>37.2%*</td>
</tr>
<tr>
<td>Composite Morbidity</td>
<td></td>
<td>45.5%</td>
</tr>
<tr>
<td>Pulmonary Event</td>
<td></td>
<td>50.0%*</td>
</tr>
<tr>
<td>Sepsis/Shock</td>
<td>19.2%</td>
<td>29.9%*</td>
</tr>
<tr>
<td>Renal Insuff/Fail.</td>
<td>18.2%</td>
<td>20.4%</td>
</tr>
<tr>
<td>Surg. Site Infection</td>
<td>5.1%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Card. Arrest/Infarct</td>
<td>4.0%</td>
<td>8.2%</td>
</tr>
<tr>
<td>CNS Event</td>
<td>2.0%</td>
<td>5.2%</td>
</tr>
</tbody>
</table>

* Chi² P < .05
Results

- Independent Preoperative Risk factors for M/M in rAAA Pts. included:
  - ASA Class
  - Age
  - COPD
  - Functional Status
  - Elevated WBC
  - Mechanical Ventilation
  - Renal Failure
Risk-adjusted Odds Ratios (95% CI) for Outcomes
Open Repair vs. EVAR

- Mortality: 1.67
- Morbidity: 1.82
- Pulmonary AEs: 1.99
- Sepsis/Shock: 1.60
- Renal insuff/fail: 1.26
- SSI: 2.01
- Card arrest/infarct: 2.56
- CNS AEs: 2.40
Conclusion

- Our data shows that \( \frac{3}{4} \) of rAAA repairs are open.

- EVAR confers lower risk of 30-day mortality and morbidity.

- Our results imply an under-utilization of EVAR in rAAA.
Open Versus Endoluminal Repair of Ruptured Abdominal Aortic Aneurysms: 30-Day ACS NSQIP Database Outcomes