Operating on the Cirrhotic Patient

University of Kentucky
Department of General Surgery
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Grand Rounds
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Objectives

• Define cirrhosis and discuss current classification systems
• Discuss risks associated with operating on cirrhotic patients
• Discuss current literature regarding general surgical procedures in cirrhotic patients
B&B LIQUORS
Party Store/Beer & Wine

THE LIVER IS EVIL
IT MUST BE PUNISHED
Cirrhosis

- Histologic term: Parenchymal necrosis, fibrosis, nodular regeneration, vascular distortion leading to portal hypertension.
- Gross appearance: micronodular, macronodular or mixed
- Decompensated cirrhosis: ascites, hepatic encephalopathy, varices, HRS, synthetic dysfunction
Healthy

Cirrhosis
Imaging findings of cirrhosis

- Right lobe atrophy
- Ascites
- Caudate lobe hypertrophy
- Recanalization of umbilical vein
- Enlargement of portal vein and splenomegaly
What happens when we operate on cirrhotic patients?
Effects of anesthesia on the liver

- Hepatic ischemia $\rightarrow$ elevated transaminases
- Cirrhosis
  - Hyperdynamic circulation with decreased blood flow to liver
  - More susceptible to hypoxemia and hypotension
- Surgical factors contributing to hepatic ischemia:
  - Hypotension, hemorrhage, vasoactive medications
  - Positive pressure ventilation
  - Pneumoperitoneum during laparoscopic cases
  - Traction on abdominal viscera
Metabolism of medications

• Volume of distribution of medications is increased in cirrhotic patients.

• Inhaled anesthetic choice
  – Halothane can cause hepatotoxicity
  – Isoflurane has less effect on hepatic blood flow than other agents
Metabolism of medications

• Neuromuscular blocking agents
  – Atracurium/cisatracurium preferred—not excreted by liver or kidney

• Sedatives and narcotics can precipitate hepatic encephalopathy and prolong periods of depressed consciousness.
What are the postoperative concerns?
Coagulopathy

- Decreased production of clotting factors
- Depletion of vitamin K stores
- Increased fibrinolytic activity
- Thrombocytopenia
Ascites

- Hepatic hydrothorax—respiratory complications
- Wound complications
- Hernia
- Optimize volume status
Renal dysfunction

• Potential causes:
  – Intravascular volume depletion
  – Nephrotoxicity
  – ATN
  – Hepatorenal syndrome (HRS)
    • Cr>1.5 in absence of iatrogenic causes, bleeding or intrinsic renal disease that is not improved by fluid or colloids.

• Hyperdynamic circulation activates sympathetic circulation and RAAS. When compensatory mechanisms fail, HRS may develop.

• Optimize volume status, monitor urine output and systemic perfusion.
Hepatic encephalopathy

- A state of disordered central nervous system function characterized by disturbances in consciousness, behavior and personality.
- Late stages: confusion, stupor, coma
- Precipitating factors in post operative period
  - Volume contraction
  - Hypokalemia
  - Infection
  - Bleeding
  - Medications
Pulmonary complications

- Ascites and hepatic hydrothorax
- Increased risk of aspiration
- Pneumonia
- ARDS
- Ventilation dependence
- Hepatopulmonary syndrome: triad of liver disease, increased AA gradient and intrapulmonary shunting
  - Platypnea
  - Orthodeoxia
Miscellaneous

• Optimize nutritional status
  – Protein rich diet
  – Enteral feeds
• Minimize hypoglycemia
How can we estimate the operative risk in patients with liver disease?
The obvious

• Surgical risk depends on the degree of hepatic dysfunction, nature of the procedure and comorbid conditions.
• Preoperative assessment
• Preoperative optimization
• There is no level I data
Preoperative evaluation

Millwala, et al. Outcomes of patients with cirrhosis undergoing non-hepatic surgery: Risk assessment and
Contraindications for elective surgery

• Acute hepatitis

• Alcoholic hepatitis
  – Abstinence from alcohol for at least 12 weeks improves hepatic inflammation and hyperbilirubinemia
  – Reassess after 12 weeks

• Acute liver failure
Risk stratification

- Child-Turcotte-Pugh scoring system
  - Child and Turcotte—University of Michigan, 1964
  - Modified by Pugh, 1972
  - For assessing perioperative morbidity and mortality in patients with cirrhosis
  - Class correlates with the frequency of postoperative complications: liver failure, worsening encephalopathy, bleeding, infection, renal failure, hypoxia, intractable ascites.
Child-Turcotte-Pugh score

<table>
<thead>
<tr>
<th>Clinical and Lab Criteria</th>
<th>Points*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Encephalopathy</td>
<td>None</td>
</tr>
<tr>
<td>Ascites</td>
<td>None</td>
</tr>
<tr>
<td>Bilirubin (mg/dL)</td>
<td>&lt; 2</td>
</tr>
<tr>
<td>Albumin (g/dL)</td>
<td>&gt; 3.5</td>
</tr>
<tr>
<td>Prothrombin time</td>
<td></td>
</tr>
<tr>
<td>Seconds prolonged</td>
<td>&lt;4</td>
</tr>
<tr>
<td>International normalized ratio</td>
<td>&lt;1.7</td>
</tr>
</tbody>
</table>

Child-Turcotte-Pugh Class obtained by adding score for each parameter (total points)
Class A = 5 to 6 points (least severe liver disease)
Class B = 7 to 9 points (moderately severe liver disease)
Class C = 10 to 15 points (most severe liver disease)
Child-Turcotte-Pugh

• Operative Mortality
  – Class A: 10%
  – Class B: 30%
  – Class C: 76-82%

• Emergency surgery is associated with a higher mortality than elective surgery

• General consensus:
  – Class A: elective surgery well tolerated
  – Class B: permissible with preoperative preparation
  – Class C: contraindicated

Model for End-Stage Liver Disease

- Linear regression model
- Objective scoring system with weighted variables

\[ \text{MELD} = 3.78 \times \log_e \text{serum bilirubin (mg/dL)} + 11.20 \times \log_e \text{INR} + 9.57 \times \log_e \text{serum creatinine (mg/dL)} + 6.43 \text{ (constant for liver disease etiology)} \]

**NOTES:**
If the patient has been dialyzed twice within the last 7 days, then the value for serum creatinine used should be 4.0.

Any value less than one is given a value of 1 (i.e., if bilirubin is 0.8, a value of 1.0 is used) to prevent the occurrence of scores below 0 (the natural logarithm of 1 is 0, and any value below 1 would yield a negative result).
MELD

• Teh, et al. Mayo Clinic, Rochester, MN
• 772 patients with cirrhosis undergoing abdominal, orthopedic and cardiovascular operations.
• MELD, ASA and age can quantify mortality risk in cirrhotic patients postoperatively.
• Increased risk of mortality up to 90 days postoperatively
• Mortality rates
  – MELD <7: 5.7%
  – MELD 8-11: 10.3%
  – MELD 12-15: 25.4%
• ASA class IV adds 5.5 MELD points. ASA class V = 100% mortality
## ASA classification

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>Normal, healthy patient</td>
</tr>
<tr>
<td>Class II</td>
<td>Patient with mild systemic disease—a mild to moderate systemic disorder related to the condition to be treated or to some other, unrelated process</td>
</tr>
<tr>
<td>Class III</td>
<td>Patient with severe systemic disease that limits activity but is not incapacitating</td>
</tr>
<tr>
<td>Class IV</td>
<td>Patient with incapacitating systemic disease that is life threatening</td>
</tr>
<tr>
<td>Class V</td>
<td>Moribund patient not expected to survive 24 hr without an operation</td>
</tr>
</tbody>
</table>
Post-operative Mortality Risk in Patients with Cirrhosis

To determine the risk of post-operative mortality for all types of major surgery, especially gastro-intestinal, orthopedic and cardiac surgery (includes open-heart procedures), please enter the following variables:

What is the age?  

What is the ASA score?  (use 1-5)

What is the bilirubin?  (mg/dl)

What is the creatinine?  (mg/dl)

What is the INR?

What is the etiology of cirrhosis?  
- Alcoholic or Cholestatic
- Viral/Other

Compute  Reset form

Probability of Mortality

Post-operative Interval
7 days  30 days  90 days  1 year  5 years

%  %  %  %  %
The literature

- There is no level I evidence
- Studies are mostly retrospective
- Small cohorts of patients
- Biased patient selection
Cirrhosis and trauma

- Retrospective study
- Trauma registry over 10-year period
- 468 cirrhotics (1.3%), 35,570 without cirrhosis
- Analyzed complication rates and evaluated subgroup of those undergoing laparotomy

Cirrhosis and trauma

Table 2: Adjusted odds ratio of outcome between cirrhotic and noncirrhotic trauma patients

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Cirrhotic patients</th>
<th>Noncirrhotic patients</th>
<th>Adjusted odds ratio (95% CI)</th>
<th>Adjusted p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>11.5% (54/468)</td>
<td>5.7% (2054/35,565)</td>
<td>5.65 (3.72, 8.41)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Any complication</td>
<td>10.2% (48/468)</td>
<td>4.1% (1469/35,570)</td>
<td>2.05 (1.45, 2.84)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>ARDS</td>
<td>5.8% (27/468)</td>
<td>1.2% (434/35,570)</td>
<td>3.81 (2.41, 5.79)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Trauma-associated coagulopathy</td>
<td>4.9% (23/468)</td>
<td>0.5% (190/35,570)</td>
<td>9.32 (5.61, 14.8)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>3.8% (18/468)</td>
<td>2.0% (711/35,570)</td>
<td>1.28 (0.72, 2.11)</td>
<td>0.37</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>1.3% (6/468)</td>
<td>0.8% (290/35,570)</td>
<td>1.07 (0.42, 2.26)</td>
<td>0.87</td>
</tr>
<tr>
<td>Sepsis</td>
<td>1.7% (8/468)</td>
<td>0.5% (166/35,570)</td>
<td>2.81 (1.24, 5.54)</td>
<td>0.01</td>
</tr>
<tr>
<td>Intra-abdominal abscess</td>
<td>0.2% (1/468)</td>
<td>0.2% (61/35,570)</td>
<td>1.25 (0.07, 5.82)</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Variables in the model: gender, age ≥ 55 years, ISS ≥ 16, Head AIS ≥ 3, Chest AIS ≥ 3, Extremity AIS ≥ 3, mechanism of injury (blunt vs. penetrating), laparotomy

CI confidence interval, ARDS acute respiratory distress syndrome

Cirrhosis and trauma laparotomy

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Cirrhotic patients who had laparotomy (N = 45)</th>
<th>Noncirrhotic patients who had laparotomy (N = 2039)</th>
<th>p valuea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any complication</td>
<td>26.7% (12)</td>
<td>12.5% (255)</td>
<td>0.01</td>
</tr>
<tr>
<td>ARDS</td>
<td>13.3% (6)</td>
<td>4.7% (95)</td>
<td>0.02</td>
</tr>
<tr>
<td>Intra-abdominal abscess</td>
<td>0.0% (0)</td>
<td>0.7% (14)</td>
<td>1.00</td>
</tr>
<tr>
<td>Trauma-associated coagulopathy</td>
<td>15.6% (7)</td>
<td>2.2% (45)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>11.1% (5)</td>
<td>5.6% (114)</td>
<td>0.18</td>
</tr>
<tr>
<td>Acute renal failure</td>
<td>6.7% (3)</td>
<td>2.8% (57)</td>
<td>0.14</td>
</tr>
<tr>
<td>Sepsis</td>
<td>0.0% (0)</td>
<td>2.5% (50)</td>
<td>0.63</td>
</tr>
<tr>
<td>Died</td>
<td>40.0% (18)</td>
<td>15.0% (306)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>ICU LOS median [range] (n)</td>
<td>8 [1,106] (30)</td>
<td>6 [1,134] (963)</td>
<td>0.69</td>
</tr>
<tr>
<td>Hospital LOS median [range] (n)</td>
<td>9 [1,116] (45)</td>
<td>8 [1,725] (2039)</td>
<td>0.82</td>
</tr>
</tbody>
</table>

• Retrospective review of trauma registry to evaluate risk of death or serious complications in trauma patients undergoing laparotomy
• 40 cirrhotics matched with 80 non-cirrhotic controls
• Mortality: 45% v 24% (p=0.021)
Laparoscopic cholecystectomy

- Cirrhosis increases risk of gallstone formation and associated complications.

- 1992 NIH consensus
  - Most patients with symptomatic gallstones are candidates for laparoscopic cholecystectomy, if they are able to tolerate general anesthesia and have no serious cardiopulmonary diseases or other comorbid conditions that preclude operation. Patients who are usually not candidates for laparoscopic cholecystectomy include... end stage cirrhosis of the liver with portal hypertension...
• Analyzed 17 publications; 351 patients with cirrhosis undergoing LC from 1993-2001
• Laparoscopic cholecystectomy is the preferred method of management of symptomatic cholelithiasis in patients with CTP class A or B cirrhosis.
• Cannot draw adequate conclusion about CTP class C

A Metaanalysis of Laparoscopic Cholecystectomy in Patients with Cirrhosis

Alessandra Puggioni, MD, Linda L Wong, MD, FACS

<p>| Table 3. Comparison Between Cirrhotic and Noncirrhotic Patients Undergoing Laparoscopic Cholecystectomy |</p>
<table>
<thead>
<tr>
<th>Operative details and postoperative course</th>
<th>Cirrhotic patients</th>
<th>Noncirrhotic patients</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute cholecystitis (%)</td>
<td>47</td>
<td>15</td>
<td>&lt;0.001</td>
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<tr>
<td>Conversion rate (%)</td>
<td>7.06</td>
<td>3.64</td>
<td>0.0237</td>
</tr>
<tr>
<td>Operative time (min)</td>
<td>98.2</td>
<td>70</td>
<td>0.00467</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>0.59</td>
<td>0.13</td>
<td>0.133*</td>
</tr>
<tr>
<td>Morbidity (%)</td>
<td>20.86</td>
<td>7.99</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Wound infection (%)</td>
<td>1.6</td>
<td>1.5</td>
<td>0.9288*</td>
</tr>
<tr>
<td>Intraoperative bleeding (%)</td>
<td>26.4</td>
<td>3.1</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Not statistically significant (p > 0.05).

# Cirrhosis is not a contraindication to laparoscopic surgery

W. S. Cobb, B. T. Heniford, J. M. Burns, A. M. Carbonell, B. D. Matthews, K. W. Kercher

Department of Surgery, Carolinas Laparoscopic and Advanced Surgery Program, Carolinas Medical Center, 1000 Blythe Boulevard, MEB 601, Charlotte, NC 28203, USA

<table>
<thead>
<tr>
<th>Reference</th>
<th>Year</th>
<th>No. of Patients</th>
<th>A(^a)</th>
<th>B(^b)</th>
<th>C(^c)</th>
<th>Conversion</th>
<th>Morbidity</th>
<th>Mortality</th>
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<td>D’Albuquerque [7]</td>
<td>1995</td>
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<td>0</td>
<td>0</td>
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<td>Lacy [16]</td>
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<td>7</td>
<td>3</td>
<td>1</td>
<td>1</td>
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<td>Gugenheim [10]</td>
<td>1996</td>
<td>9</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Yerde [32]</td>
<td>1997</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Jan [14]</td>
<td>1997</td>
<td>21</td>
<td>18</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
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<tr>
<td>Angrisani [1]</td>
<td>1997</td>
<td>31</td>
<td>20</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>8</td>
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<tr>
<td>Saeki [24]</td>
<td>1997</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
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<td>Sleeman [26]</td>
<td>1998</td>
<td>25</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>0</td>
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<td>Morino [20]</td>
<td>2000</td>
<td>33</td>
<td>27</td>
<td>4</td>
<td>2</td>
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<td>Fernandes [9]</td>
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<td>48</td>
<td>38</td>
<td>10</td>
<td>0</td>
<td>4</td>
<td>6</td>
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<td>Clark [5]</td>
<td>2001</td>
<td>25</td>
<td>14</td>
<td>9</td>
<td>2</td>
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<td>Poggio [21]</td>
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<td>26</td>
<td>22</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>0</td>
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<td>Yeh [31]</td>
<td>2002</td>
<td>226</td>
<td>193</td>
<td>33</td>
<td>0</td>
<td>10</td>
<td>15</td>
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<td>Tuech [29]</td>
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<td>26</td>
<td>22</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>7</td>
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<td>Cucinotta [6]</td>
<td>2003</td>
<td>22</td>
<td>12</td>
<td>10</td>
<td>0</td>
<td>2</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>528</strong></td>
<td><strong>427</strong></td>
<td><strong>95</strong></td>
<td><strong>6</strong></td>
<td><strong>25</strong></td>
<td><strong>85</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

\(^a\) Child-Pugh classification A  
\(^b\) Child-Pugh classification B  
\(^c\) Child-Pugh classification C
Abdominal Wall Hernias

- Abdominal wall defects occur due to increased intra-abdominal pressure caused by ascites.
- Carbonell, et al. looked at cirrhotic vs non-cirrhotic inpatient hernia repairs over 5 year period at 129 academic centers.
  - Abdominal wall hernia repair
  - Repair of umbilical hernia
  - Incisional hernia repair
  - 32,033 inpatient ventral hernia repairs evaluated
    - Cirrhotic group: 1,197
    - Non-cirrhotic group: 30,836
Cirrhotics had higher rates of ICU admission

Complications in cirrhotics with highest mortality: Aspiration pneumonia, Pulmonary compromise, MI, pneumonia, metabolic derangements
Elective hernia repair in cirrhotics is relatively safe but emergent surgery has poor outcomes.
Umbilical hernias

- Operative v. conservative management
- 20% risk of developing umbilical hernia with ascites
- McKay, et al. reviewed literature from 1983-2005
  - Elective umbilical hernia repairs in cirrhotics
  - 183 patients, 4 deaths (2.7%)
  - No mention of CTP class or MELD

Umbilical hernias

• Marsman, et al.
  – Evaluated elective repair v non-operative management
  – 34 patients total with cirrhosis and ascites
    • Elective repair: n=17. complication rate: 18%
    • Non-operative management: n=13. complication rate 77%, mortality in 15%
  – Ascites with an umbilical hernia should prompt surgical correction.
  – Non-operative management carries high risk of incarcerations.

N=30 (7 CTP A, 18 CTP B, 5 CTP C)

After 10 months: 2 deaths (7%)

After 25 months: 2 recurrences (7%)

No significant correlations between MELD or CTP and complications or recurrences.

Elective hernia repair is safe and seems preferable over conservative treatment in selected cirrhotic patients.
Summary

• Patients with cirrhosis have a higher risk of perioperative complications and require optimization prior to elective surgical intervention.

• Perioperative risk can be estimated using the CTP and MELD scoring system.

• Patients with well compensated cirrhosis should be considered for operative intervention when they have symptoms that may be treated surgically.
References


