Anesthesia Considerations for the Patient with Liver Failure

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• Background
• Physiological changes
• Outcomes
• Management
Background

- 2% US adults liver disease
- Cirrhosis 0.3% population
  - 69% unknown
- Mortality 26%/2yr (vs 8% matched controls)
- Associated conditions
  - Viral hepatitis (HCV)
  - Diabetes (NASH)
  - Alcohol

CDC 2016. Scaglione J Clin Gastroenterol. 2015;49(8):690
Physiologic Changes

- Decreased liver metabolic function
- Portal hypertension
Drug metabolism

• Any drug with liver metabolism/excretion

• Low albumin
  – Altered drug binding

• Many, many drugs
Coagulation

- Decreased synthesis coagulation factors
  - Procoagulants (except VIII)
- Thrombocytopenia
  - hypersplenism
Coagulation

- Decreased synthesis coagulation factors
  - Classical procoagulants (except VIII)
- Decreased synthesis anticoagulant factors
  - Protein C, S
- Decrease in fibrinolytic factors
- Result is “rebalanced” coagulation system
  - Limited reserve
  - May bleed or thrombose

Lisman T. Blood 2010; 116:878-85
Balanced, stable

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Balanced, unstable
Portal Hypertension

- Disordered liver architecture
- Resistance to portal flow
- Porto-systemic anastomoses
  - Variceal vessels
Variceal vessels


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Cardiovascular

• Hyperdynamic circulation
  – High cardiac output
  – Low SVR

• Activation of Renin-Angiotensin System, sympathetic system
  – Fluid retention
  – Relative renal hypoperfusion
    • Renal dysfunction

• Cirrhotic cardiomyopathy
  – Decrease cardiac reserve
Pulmonary

• Restrictive disease
  – Ascites, pleural effusion
• Hepatopulmonary syndrome
• Portopulmonary hypertension
Hepatolpulmonary Syndrome (HPS)

- Pulmonary vascular dilation
- Hyperdynamic circulation
- Hypoxemia
Portopulmonary Hypertension

- Pulmonary hypertension with cirrhosis
- Poor survival
Outcomes

• Risk of surgery – liver decompensation in the perioperative period
• Altered hepatic perfusion
  – Degree of liver failure
  – Surgical insult
  – Site of surgery
Stratifying Liver Failure
MELD Score

MELD =
3.78[Ln serum *bilirubin* (mg/dL)] +
11.2[Ln INR] +
9.57[Ln serum *creatinine* (mg/dL)] + 6.43

• Values from 6 – 60 (40)
• Predicts 3mo outcome
Stratifying Liver Failure

Child-Turcotte-Pugh Score

<table>
<thead>
<tr>
<th>Measure</th>
<th>1 point</th>
<th>2 points</th>
<th>3 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total bilirubin, μmol/l (mg/dl)</td>
<td>&lt;34 (1&lt;=2)</td>
<td>34-50 (2-3)</td>
<td>&gt;50 (&gt;3)</td>
</tr>
<tr>
<td>Serum albumin, g/l</td>
<td>&gt;35</td>
<td>28-35</td>
<td>&lt;28</td>
</tr>
<tr>
<td>PT INR</td>
<td>&lt;1.7</td>
<td>1.71-2.30</td>
<td>&gt; 2.30</td>
</tr>
<tr>
<td>Ascites</td>
<td>None</td>
<td>Mild</td>
<td>Moderate to Severe</td>
</tr>
<tr>
<td>Hepatic encephalopathy</td>
<td>None</td>
<td>Grade I-II (or suppressed with medication)</td>
<td>Grade III-IV (or refractory)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Points</th>
<th>Class</th>
<th>One year survival</th>
<th>Two year survival</th>
</tr>
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<tbody>
<tr>
<td>5-6</td>
<td>A</td>
<td>100%</td>
<td>85%</td>
</tr>
<tr>
<td>7-9</td>
<td>B</td>
<td>81%</td>
<td>57%</td>
</tr>
<tr>
<td>10-15</td>
<td>C</td>
<td>45%</td>
<td>35%</td>
</tr>
</tbody>
</table>
MELD and Surgical Outcome

- 772 patients for major surgery
- Independent predictors of mortality
  - MELD
  - Age
  - ASA

The *Gastroent* 2007;132:1261
30d mortality and MELD

Online calculators available

The Gastroent 2007;132:1261
Cirrhosis and Cardiac surgery

• CTP class related to outcome
• Mortality
  - A 5%
  - B 35%
  - C 70%
Approach to the patient with liver failure for surgery

- Planning
- Evaluation
- Perioperative management
Planning/Evaluation

• Complexity of surgery
  – Minor
  – Major
    • Abdominal or thoracic
    • Potential blood loss

• Emergency vs elective

• Severity of liver failure
  – MELD score (?15 cutoff for elective)
  – ALF, alcoholic hepatitis

• Necessity/wisdom of procedure

Planning /Evaluation

• Necessity/wisdom of procedure
  – Discuss risk with patient, surgical team

• Surgery at an institution with liver failure expertise
  – Transplant potential
Planning/Evaluation

• Evaluate for comorbidities
  – Cardiac/cardiopulmonary
    • Echo
    • Note NASH CAD association
  – Pulmonary
    • oximetry
  – Renal
Perioperative Management

• Maintain liver perfusion
  – No useful measure
  – Goal baseline BP
  – Maintain CO
Anesthesia
Regional/neuraxial

- Neuraxial blockade decreases hepatic blood flow
- Contradictory reports of vasopressor effects
- Coagulopathy concerns limit utility

Anesthesia
General

• Avoid halothane
  – Greatest effect on hepatic blood flow
  – Greatest metabolism/risk of hepatotoxicity

• Isoflurane, sevoflurane, desflurane
  – Some decrease in hepatic blood flow

• IV agents
  – Propofol may increase hepatic blood flow

• non-liver failure patients.

Meierhenrich Anaesthesia. 2010 Nov;65(11):1085-93
Anesthesia Adjuvants

• Consider drugs not reliant on liver metabolism/excretion
  – e.g cisatracurium

• Monitor effects
Coagulation Management

• No indication for preoperative INR correction
• INR poorly correlated with bleeding
• Viscoelastic testing based therapy
  – TEG or ROTEM
• Suggested goals
  – Platelets > 50 000
  – Fibrinogen > 150 mg/dL
• Avoid volume overload
Postoperative Management

• Close monitoring
• Follow markers of liver function
  – If deterioration early specialist referral
Summary

- Liver failure associated with multi-system co-morbidities
- Liver failure associated with risk of deterioration post-surgery
- Evaluate risk/benefit
- Discuss with medical/surgical team, patient
thank you

https://youtu.be/hYu_J3mDVBI