

Evaluation and Management of the Surgical Patient with Cirrhosis: Understanding and Justifying the Risk

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The Problem

- Increasing number of patients with cirrhosis
- More patients with advanced liver disease will undergo surgery at one point in their lives
- Perioperative mortality are higher in cirrhotics compared to non-cirrhotics

Causes of Perioperative Mortality

- 1:2680 Anesthesia
- 1:420 Surgical error
- 1:95 Underlying medical condition(s)

Outline

- What are the effects of liver disease on surgical outcome?
- Which factors impact on outcomes?
- Are there predictors of operative risk?

Features of Cirrhosis that Raise Surgical Risk

Bleeding	Thrombocytopenia, coagulopathy and splenic sequestration
Hypotension	Decreased systemic vascular resistance aggravated by anesthesia and blood loss
Pulmonary complications	Ascites Hepatopulmonary syndrome
Encephalopathy	Prolonged clearance of anesthetics, sedatives, narcotics

Features of Cirrhosis that Raise Surgical Risk

Wound dehiscence and herniation	Ascites
Renal insufficiency	Ascites, diuretics, hepatorenal syndrome
Infection	Impaired RES

Post-op Hepatic Decompensation

Outline

- Effects of liver disease on surgical outcome
- Factors which impact on outcomes
 - Pre-operative
 - Assessment of functional capacity
 - Screen for risk factors for liver disease
 - Intra-operative
 - Post-operative
- Predictors of operative risk

Pre-Operative Factors: Assessment of Functional Capacity

- Who looks good from the door?
- Who looks too sick?
 - Short life expectancy
 - Complications greater than benefit
 - Delay or cancel surgery
 - Conservative measures only

Assessment of Functional Capacity

- Can be estimated by the ability to perform activities of daily living
 - The inability to climb 2 flights of stairs
 - Run a short distance
- Indicates less than <4 mets
- Poor functional capacity indicates high mortality

American Society of Anesthesiologists (ASA score)

Status 1	Healthy patient
Status 2	Systemic disease without functional limitation
Status 3	Severe systemic disease with definite functional limitation
Status 4	Severe systemic disease that is a constant threat to life
Status 5	Moribund unlikely to survive 24 hours with or without an operation

Absolute No's to Elective Surgery

- Acute liver failure
- Acute renal failure
- Acute viral hepatitis
- Alcoholic hepatitis
- Severe coagulopathy (despite treatment)

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Identify Risk Factors for Liver Disease

- Personal and family history of jaundice and liver disease
- Excessive alcohol use
- High-risk behavior and illicit drug use
- Previous blood transfusions
- Medication review including OTC and herbal supplements

Screen for Liver Disease Pre-Op

- Routine preoperative testing of liver function is not recommended
- Reliance on ALT and AST may be misleading
 - Patients with cirrhosis may have normal results

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 - Surgical
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- Postoperative

Anesthesia Risk

- Cannot be separated from surgical risk
- Sedatives, narcotics and IV induction agents can precipitate encephalopathy with prolonged depression of consciousness
- Short-acting agents such as Propofol, Fentanyl and Lorazepam are preferred
- Long acting narcotics and sedatives should be avoided

Surgical Factors

- Urgency
- Type
- Duration
- Blood loss
- Fluid shifts

Urgency of Surgery

- Lifesaving
 - Emergency procedures
 - Cardiovascular and cancer surgery
- Improve quality of life
 - Orthopedic surgery

Emergency Procedures

- 2 to 5 times the surgical risk independent of CTP or MELD score
- In high risk patients, less invasive alternative therapies are preferred even when these lead to less favorable results
 - Less invasive alternatives tend to be of shorter duration with less blood loss
 - Tube cholecystostomy for acute cholecystitis

Type of Surgery

- Abdominal surgery associated with decreased hepatic arterial blood flow
- Laparoscopy
 - Less tissue trauma with less incisional pain and less post-op fluid shifts
 - Pneumoperitoneum resulting in elevated intra-abdominal pressure and less venous return
- Cardiac surgery associated with mortality risk other than CTP
 - Use of CP bypass
 - Need for pressor support

Table 1. Mortality rates associated with specific types of surgery in patients with cirrhosis [3,7,18,20,44,55,71,98]. Includes emergency and elective procedures. Adapted from: Friedman LS. "Surgery in the patient with liver disease". *Trans Am Clin Climatol Assoc* 2010;121:192-204.

Type of surgery	Mortality				
	Overall (%)	Child-Pugh class			MELD score
		A (%)	B (%)	C (%)	
Appendectomy	9	n.a.	n.a.	n.a.	n.a.
Cardiac	16-17	0-3	42-50	100	n.a.
Cholecystectomy	1-3	0.5	3	n.a.	<8 = 0% ≥8 = 6%
Colorectal cancer surgery	12.5	6	13	27	n.a.
Esophagectomy	17	n.a.	n.a.	n.a.	n.a.
Major abdominal surgery	26-30	10	30-31	76-82	n.a.

n.a., not available.

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 - Intra-operative
 - Anesthesia
 - Surgical
- **Predictors of operative risk**
- Post-operative

Child-Turcotte-Pugh (CTP) Score

- First developed to predict mortality after portocaval shunt surgery
- Now used to predict perioperative morbidity and mortality for hepatic and non-hepatic surgery

Child-Turcotte-Pugh (CTP) Score

CTP	Mortality	
A	10%	Elective surgery well-tolerated
B	30%	Permissible with pre-op preparation (except extensive hepatic resection or cardiac surgery)
C	80%	Contraindicated unless liver transplant

Limitations of the CTP Score

- Inter-observer variability
- Uses subjective parameters
 - Degree of ascites
 - Degree of encephalopathy
- All factors weighted equally

Model for End-stage Liver Disease (MELD)

- Originally developed to assess short-term prognosis of cirrhotics receiving a TIPS
- Subsequently validated as a predictor of mortality in patients with liver disease regardless of etiology
- Presently it is used to prioritize allocation of organs for liver transplantation in the US
- Potential use for predicting mortality in patients with cirrhosis undergoing surgery other than OLT

The MELD Model, UNOS Modification

In the following model, survival probability of a patient with end-stage liver disease is estimated based on the following variables. Please enter data in the corresponding boxes.

What is the INR?

What is the bilirubin?

(mg/dl)

What is the creatinine?

(mg/dl)

Has the patient had dialysis at least twice in the past week?

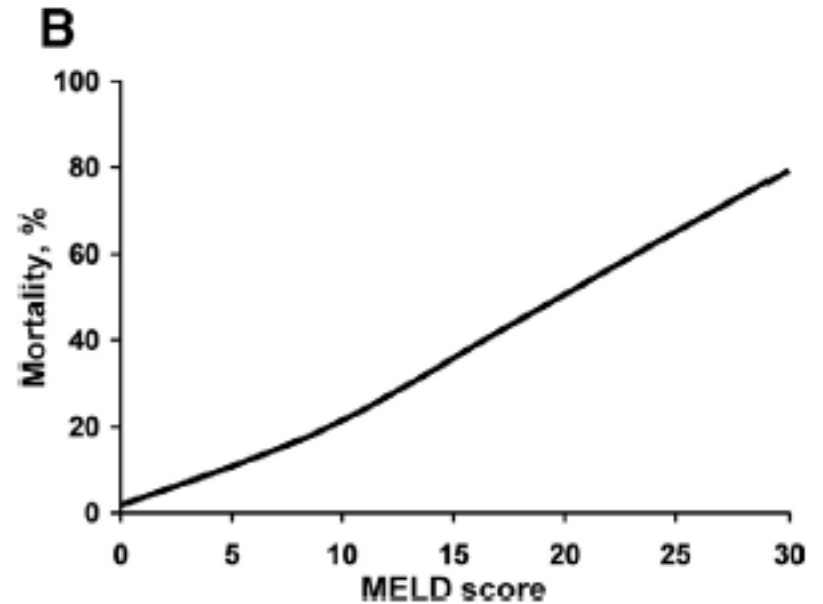
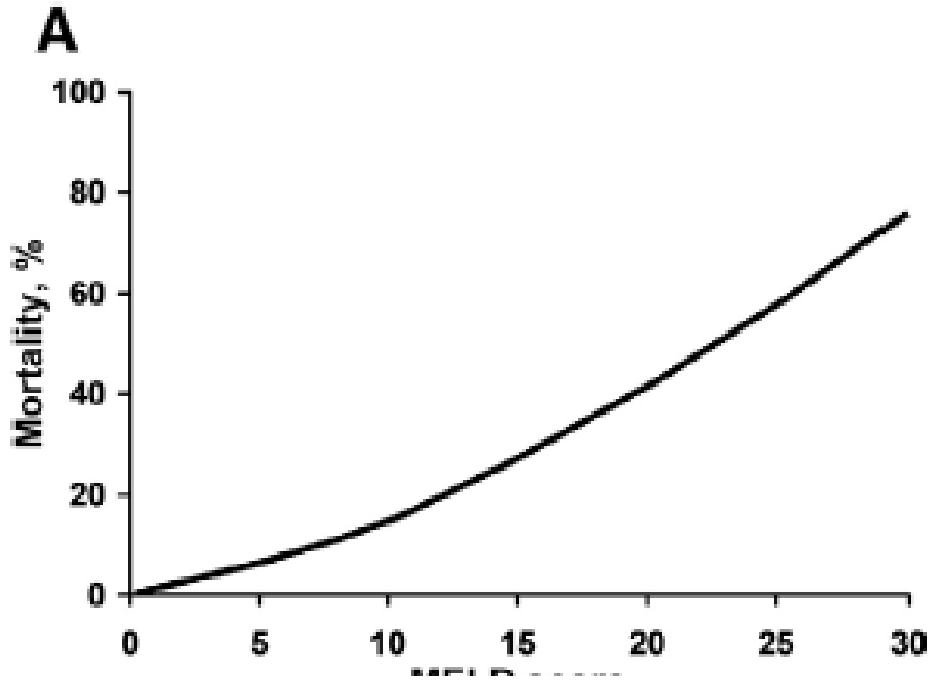
No

Yes

Compute

MELD score:

Operative Mortality and MELD Score



Teh SH et al Gastroenterology 2007

MELD is better than the CTP

- Includes key components of the CTP score
- Includes a measure of renal function
- Uses objective variables
- Not subject to “floor” or “ceiling” effects
- Wider range of scores between 6 and 40
- Allows finer calibration of risk
- Like the CTP, it has been validated extensively in different patient groups

CTP and MELD: Is there a direct correlation?

CTP	MELD	
A	<10	Perioperative mortality is low
B	10-14	Increased perioperative risk and indication for surgery carefully assessed
C	>14	Avoid surgeries other than liver transplantation

Risk Factors for Mortality After Surgery

- Retrospective study (n= 772 cirrhotics)
- Major GI surgery, orthopedic or cardiovascular
- Conclusion
 - ASA class is the strongest predictor of 7-day postop mortality
 - MELD score is the strongest predictor of mortality beyond 7 days and long-term

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

7 days

30 days

90 days

1 year

5 years

%

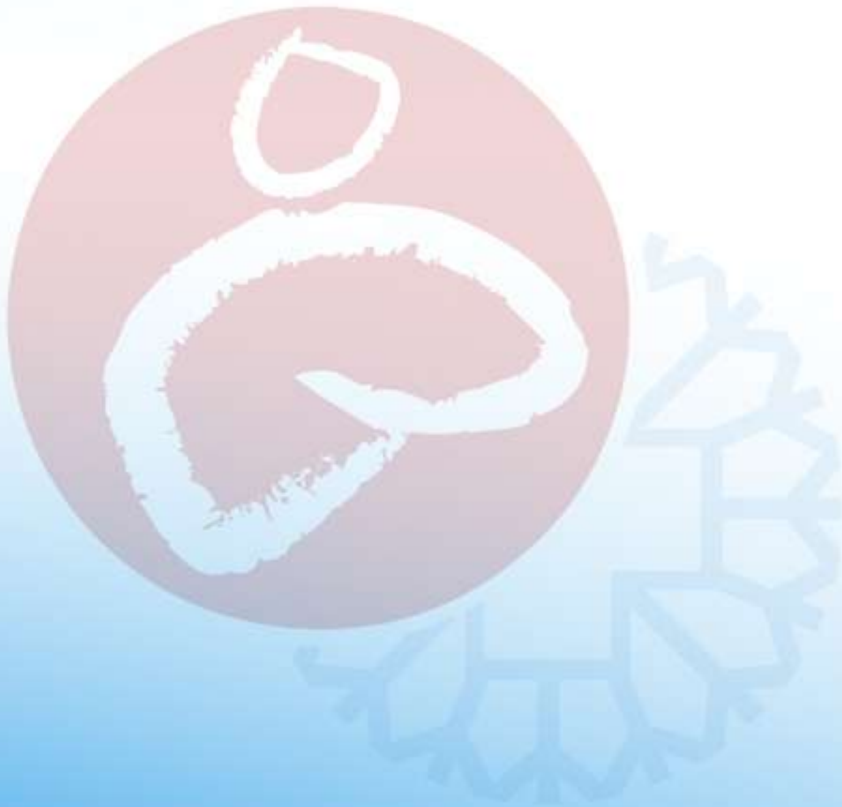
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Practical Tips



Correct Coagulopathy

- Vitamin K and FFP to achieve PT within 3 seconds of normal
- Vitamin K 10mg/day for 1 to 3 days will correct coagulopathy due to nutritional or bile salt deficiency but not due to hepatic synthetic dysfunction
- Use of cryoprecipitate and recombinant factor VIIa

Tips on Transfusion

- Keep platelet above 60,000
- Avoid aggressive transfusion to achieve hemoglobin above 10g/dL
 - Increase in portal pressure can increase risk of variceal bleeding
 - Can do screening EGD for varices if big spleen and low platelet

Monitor for Renal Dysfunction

- Abnormal hemodynamics , fluid shifts and third-space losses
- “Normal” level creatinine may represent impaired renal function
 - Serum creatinine overestimates true GFR due to muscle wasting and decrease urea synthesis
- Cautious use of diuretics and NSAIDs
- Control bleeding and infection

Not all Renal Dysfunction is HRS

- Cirrhotics appear “fluid overloaded” because they have extravascular volume overload
- Prone to intravascular volume depletion leading to ATN (stop diuretics and do a fluid challenge)
- Infusion of too much crystalloid can lead to increased venous oozing, pulmonary and peripheral edema, post-op ascites and wound dehiscence
- Use IV albumin or terlipressin to prevent circulatory dysfunction

Manage Ascites Before Surgery

- Start diuretics or perform paracentesis pre-op
- Restrict salt to 2g/day
- Wound dehiscence, abdominal wall herniation and respiratory compromise due to reduced lung expansion
- Administer IV albumin when large volumes of ascites is removed pre-op and intra-op to prevent PICD

WOF Encephalopathy Triggers

- Infection
- Volume depletion from diuretics
- Hypokalemia
- Metabolic alkalosis
- Constipation
- Narcotics and sedatives
- Hypoxia
- Azotemia
- GI Bleeding

Postoperative Monitoring

- Admit to the ICU
 - Prolonged surgery, intraoperative hypotension, excessive blood loss or cardiopulmonary surgery
- Monitor for signs of hepatic decompensation
 - Worsening jaundice, coagulopathy, encephalopathy and ascites
 - Prothrombin time is the single best indicator of hepatic synthetic function
 - Elevated bilirubin can be non-specific
- Monitor renal function

Postoperative Monitoring

- Titrate sedatives and pain medications
 - Cirrhotics are more sensitive to standard doses
- Manage constipation due to post-op ileus, narcotics or immobility
- Prolonged INR in CLD seem to be not protective from hospital acquired DVT or PE

Summary

- Targeted interventions before surgery help prevent complications and improve outcomes
- Risk stratification using the CTP score, the MELD score and the ASA physical status help weigh risks and benefits of surgery
- Monitor, monitor and monitor

Thank You

