



Risk assessment of cirrhotic patients prior to non-hepatic surgery

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Surgery in cirrhotic patients

- **10%** of patients with cirrhosis will undergo surgery during their last two years of life
- Number predicted to rise significantly in the next decade
- Mortality rate **8.3–25%** compared with **1.1%** in matched controls

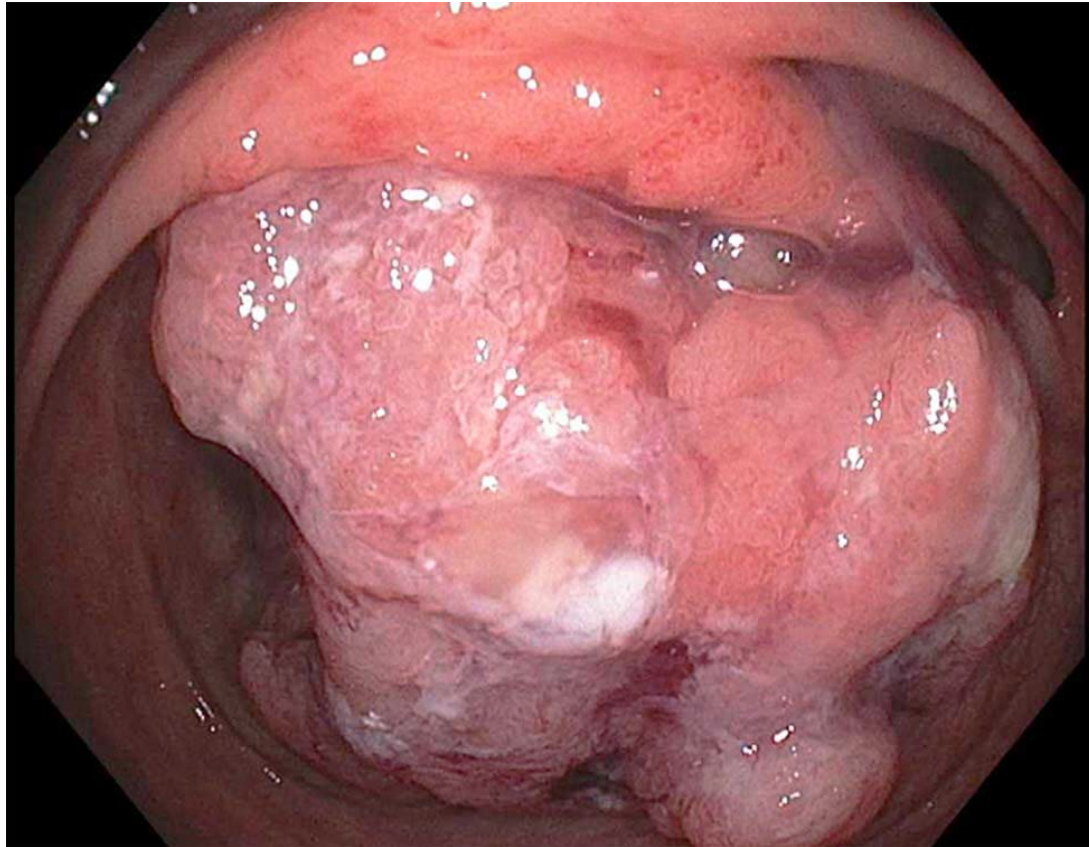
Case presentation (1)

47-year-old man

- Pan-colonic **UC** for 20 years – **PSC** 7 years ago
- Lost to follow-up for past several years
- Presents with progressive iron deficiency & jaundice
- No ascites, variceal bleeding or HE
- UGI endoscopy: large **EV**, no stigmata of bleeding/ high-risk marks
- Colonoscopy: 4 cm friable cecal mass – biopsy: **adenocarcinoma**
- Imaging: no regional/distant metastatic disease, no ascites

Laboratory assessment

- Total bilirubin 7.5 mg/dL (128 μ mol/L)
- ALT 167 IU/L
- Serum creatinine 0.9 mg/dL (80 μ mol/L)
- INR 1.7
- Serum sodium 139 mmol/L
- Albumin 3.0 g/dL (30 g/L)
- Platelet count $97 \times 10^9/L$



Friable cecal mass of 4 cm

Scores to predict post-operative outcomes in cirrhosis

Score	Abbreviation	Year
Child-Turcotte- Pugh	CTP	1973
Model for End-Stage Liver Disease	MELD	2002
Model for End-Stage Liver Disease -NA	MELD-Na	2016
Mayo Postoperative Mortality Risk Score	MRS	2007
Adequate Operative tt for Liver Cirrhosis	ADOPT-LC	2016
VOCAL-Penn score	VOCAL-Penn	2021

Child-Turcotte-Pugh score (CTP)

1973

Score	1	2	3
Albumin (g/L)	>35	28 – 35	< 28
Bilirubin(mg/dL)	< 2	2 – 3	> 3
INR	< 1.7	1.7 – 2.2	> 2.2
Ascites	none	slight	moderate or severe
Encephalopathy	none	grade 1 or 2	grade 3 or 4
Class	A	B	C
Total score	5 – 6	7 – 9	10 – 15

CTP for this patient: 9 (B)

Child-Turcotte-Pugh score (CTP)

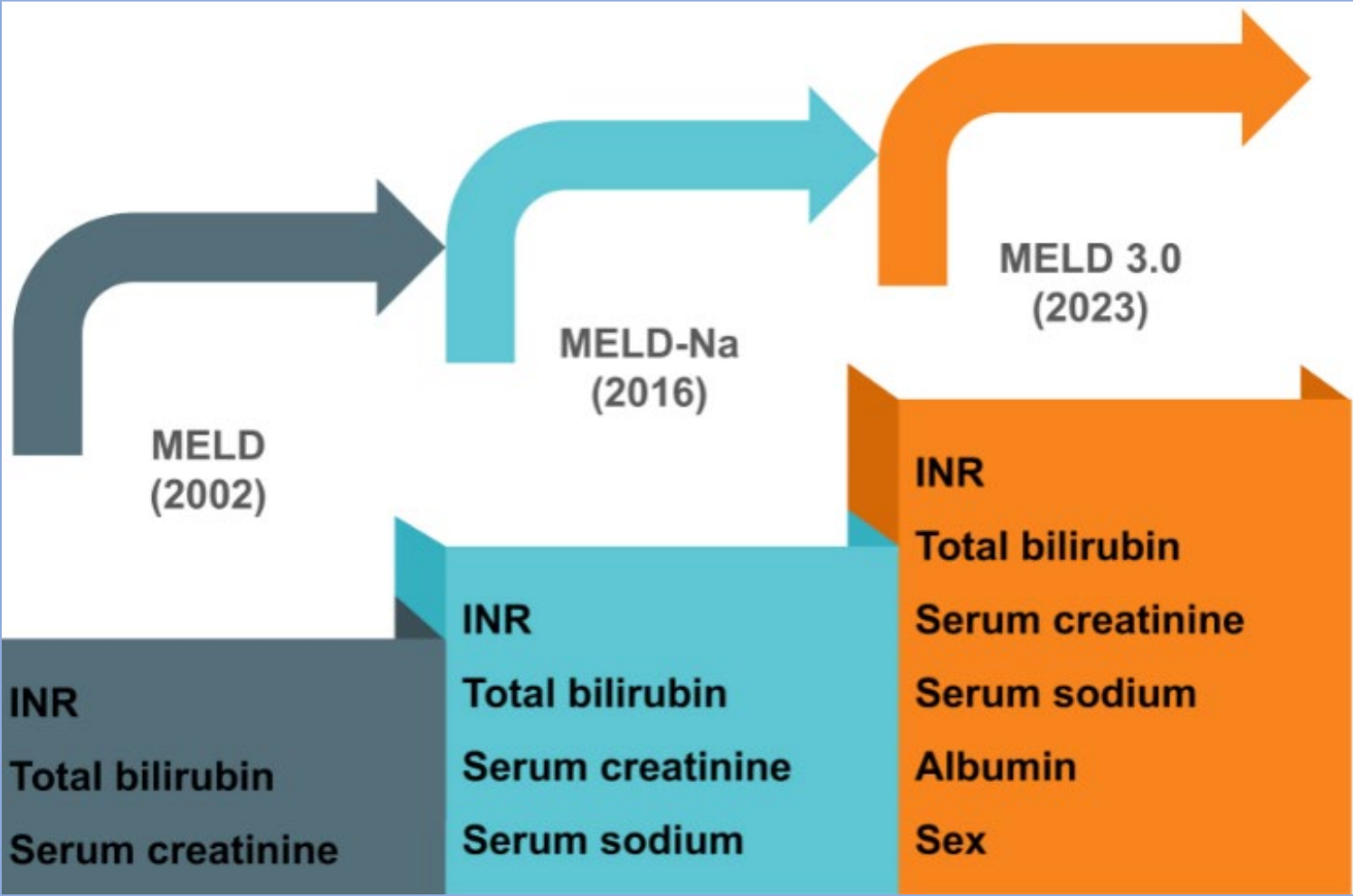
<https://www.mdcalc.com/>

CTP score	30-day mortality
Class A	10%
Class B	31%
Class C	63 – 82%

Criticized: Subjectivity of ascites & HE components
Doesn't take into account specific surgery
Lack of granularity \Rightarrow overestimation

HE: hepatic encephalopathy
Ziser A et al. Anesthesiology 1999;90:42–53.

MELD score



MELD score (2002)

<https://www.mdcalc.com/>

Dialysis at least twice in the past week	<input checked="" type="radio"/> No	<input type="radio"/> Yes
Creatinine	<input type="text" value="0.9"/>	mg/dL ↵
Bilirubin	<input type="text" value="7.5"/>	mg/dL ↵
INR	<input type="text" value="1.7"/>	

20 points
Original MELD Score (Pre-2016)*

19.6%
Estimated 3-Month Mortality

[Copy Results](#) 📄

[Next Steps](#) >>>

MELD-Na score (2016)

<https://www.mdcalc.com/>

Dialysis at least twice in the past week Or CVVHD for ≥ 24 hours in the past week	<input checked="" type="radio"/> No	<input type="radio"/> Yes
Creatinine Cr > 4.0 mg/dL is automatically assigned a value of 4.0	<input type="text" value="0.9"/>	mg/dL ↔
Bilirubin	<input type="text" value="7.5"/>	mg/dL ↔
INR	<input type="text" value="1.7"/>	
Sodium	<input type="text" value="139"/>	mmol/L ↔
20 points MELD Score (2016)*	19.6% Estimated 3-Month Mortality	
<input type="button" value="Copy Results 📄"/>		<input type="button" value="Next Steps >>>"/>

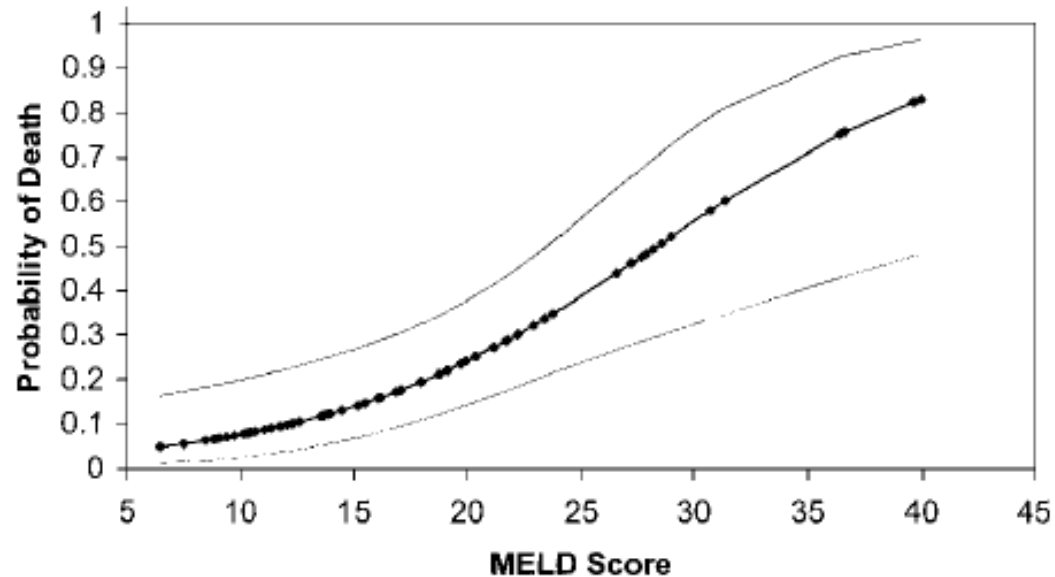
MELD 3.0 score (2023)

<https://www.mdcalc.com/>

Sex	<input checked="" type="radio"/> Male	<input type="radio"/> Female
Creatinine	<input type="text" value="0.9"/>	mg/dL ↵
Bilirubin	<input type="text" value="7.5"/>	mg/dL ↵
INR	<input type="text" value="1.3"/>	
Sodium	<input type="text" value="139"/>	mmol/L ↵
Albumin	<input type="text" value="30"/>	g/L ↵
18 points MELD 3.0		96.3 % Estimated 90-day survival
<input type="button" value="Copy Results 📄"/>		<input type="button" value="Next Steps >>>"/>

MELD score

30-day mortality for intra-abdominal surgery



MELD 5 – 20: 1% mortality for each 1-point increase of MELD

MELD > 20: 2% mortality for each 1-point increase of MELD

Mayo Risk score (2007)

Post-operative mortality risk in patients with cirrhosis

What is the age?	<input type="text" value="47"/>
What is the ASA score?	<input type="text" value="3"/>
	Enter 3 for compensated cirrhosis Enter 4 for decompensated cirrhosis
What is the bilirubin?	<input type="text" value="7.5"/> (mg/dl)
What is the creatinine?	<input type="text" value="0.9"/> (mg/dl)
What is the INR?	<input type="text" value="1.7"/>
What is the etiology of cirrhosis?	<input checked="" type="radio"/> Alcoholic or Cholestatic <input type="radio"/> Viral/Other

Probability of Mortality

7 days	30 days	90 days	1 year	5 years
<input type="text" value="2.418"/> %	<input type="text" value="9.554"/> %	<input type="text" value="14.97"/> %	<input type="text" value="25.97"/> %	<input type="text" value="56.52"/> %

American Society of Anesthesiology (ASA)

Physical status (1940s)

ASA I	Normal healthy patient
ASA II	Patient with mild systemic disease
ASA III	Patient with severe systemic disease that is not a constant threat to life (compensated cirrhosis)
ASA IV	Patient with severe systemic disease that is a constant threat to life (decompensated cirrhosis)
ASA V	Moribund patient not expected to survive with or without surgery
ASA VI	Declared brain dead

Adequate operative treatment for liver cirrhosis (ADOPT-LC)

2016 (formula not available)

2197 patients undergoing elective (90%) or emergency surgery (10%)

- Age
- CTP score
- Charlson comorbidity index: 5 points (estimated 10 y survival 21%)
- Duration of anesthesia
- Emergency indication

CTP: Child-Turcotte- Pugh

Sato M et al. Hepatol Res 2017;47(3):E35 – E43.



VOCAL-Penn

Cirrhosis Surgical Risk Score (2021)

Enter the following data:

SI Units

Age:

Albumin:

Total Bilirubin:

Platelet Count:

[BMI ≥30:](#) No Yes

[NAFLD:](#) No Yes

[ASA Score:](#) 2 3 4

Emergency: No Yes

Surgery Type:

Use

Surgery Types

About

VOCAL

Predicted Postoperative Outcomes:

30-day **mortality:**

90-day **mortality:**

180-day **mortality:**

90-day **decompensation:**

Warning: prediction accuracy may be reduced for this patient. [Learn more.](#)

VOCAL-Penn predicts post-operative mortality for patients with cirrhosis. It incorporates the type and circumstance of surgery under consideration, and utilizes other important and readily available clinical data. Predictions may be used to risk-stratify patients for surgery and help inform decisions to pursue surgical or non-surgical management.

****Disclaimer: note that VOCAL-Penn predictions should not substitute for clinical judgment. They are an adjunctive tool to be used in prognostic discussions between clinicians and patients.****

www.vocalpennscore.com

Vocal-Penn versus other scores

Superior performance to CTP, MELD, MELD-Na
& MRS (30-day C-statistic – $p = 0.003$)

<u>Score</u>	<u>30-day C-statistic</u>
CTP	0.86
MELD	0.66 – 0.72
MRS	0.77
VOCAL–Penn	0.80 – 0.87

Mahmud N et al. Hepatology 2021 ; 73(1): 204 –218.

CTP: Child-Turcotte-Pugh – MELD: model for end-stage liver disease – MRS: Mayo risk score
VOCAL-Penn: veterans outcomes & costs associated with liver disease

Result of different scores

<u>Score</u>	<u>30-day post-operative mortality</u>
CTP score:	30%
MELD score:	20%
MELD-Na score:	20%
Mayo Risk Score:	10%
VOCAL-Penn score:	12.7%

Limitations of existing scores

- Based on **retrospective data**, some dating back 25 years
- Do not quantify degree of **portal hypertension**
- CSPH is the cause of majority of complications:
Ascites, variceal bleeding, hepatic encephalopathy, ...
- CSPH is associated with increase post-operative mortality

CSPH: clinically significant portal hypertension

Abbas N et al. Frontline Gastroenterology 2023;14:359–370.

Velarde-Ruiz Velasco JA et al. Revista Gastroenterología México 2024;89:418–441.

Hepatic venous pressure gradient (HVPG)

Gold standard for diagnosis of PHT

Invasive – limited to large specialist centers

HVPG (mmHg)

Interpretation

HVPG 1– 5

normal value

HVPG <10

no decompensation in post-operative period

HVPG \geq 10

clinically significant PHT (CSPH)

HVPG >16

high risk of surgical intervention

HVPG >20

very high risk of surgical intervention

Non-invasive diagnosis of CSPH

- **UGI endoscopy:** Esophageal/gastric varices – PHT gastropathy
- **Imaging (US/CT):** Porto-systemic collaterals – SMG – ascites
- **LSM (kPa):**
 - <15 & platelets $\geq 150 \times 10^9/L$: rule out CSPH
 - 20–25 & platelet $< 150 \times 10^9 /l$: 60% risk of CSPH
 - 15–20 & platelet $< 110 \times 10^9 /l$: 60% risk of CSPH
 - ≥ 25 rule in CSPH
- **SSM (kPa):** 40 significantly reduced gray zone to 7–15%

CSPH: clinically significant portal hypertension – LSM: liver stiffness measurement
PHT: portal hypertension – SMG: splenomegaly – SSM: spleen stiffness measurement
de Franchis R et al. J Hepatol 2022;76 : 959 – 74.

Patients with cirrhosis requiring surgery

Risk stratification

CTP – MELD – ASA – VOCAL-Penn – HVPG – Surgical risk

If any of the following

CTP-A
MELD <10
ASA ≤ II
HVPG ≤ 16
LSM < 25 kPa
low risk surgery

If any of the following

CTP-B
MELD 10 – 15
ASA III
HVPG >16
LSM ≥ 25 kPa
high risk surgery

If any of the following

CTP-C
MELD >15
ASA IV/V
HVPG > 20

discussion risk with
patient & consider
surgery

MDT discussion
pre-operative TIPPS in some
suitability for LT
optimize nutrition & frailty

defer surgery
consider alternative
palliation
non-surgical option

Absolute contraindications for surgery in cirrhosis

- Acute liver failure
- Acute viral hepatitis
- Severe alcoholic hepatitis
- CTP class C
- Severe coagulopathy (despite treatment)
- Severe comorbidities: cardiomyopathy – hypoxemia – ASA V

Case presentation (continued)

- MDT consultation:
hepatologist–anesthetists–surgeon–liver transplant team–nutritionist
- Patient underwent esophageal band ligation & NSBB (**carvedilol**)
- Total proctocolectomy with diverting ileostomy
- Minor surgical bleeding requiring 3 U of packed red cell transfusion
- Recovered otherwise uneventfully

MDT: multi-disciplinary team – NSBB: non-selective beta blockers
Torres-Hernandez A et al. Clinical Liver Disease 2024;23:e0109.

Conclusion

- Multiple scores to assess perioperative risk in cirrhosis
- Each score has its strengths & weaknesses
- Can be used in conjunction to better gauge patient's risk
- **VOCAL-Penn** is preferable at present time
- It is not a yes or no decision – Compare risk vs benefit
- Need new score: prospective study with PHT assessment

Selection of patients with cirrhosis for surgery:

as much art as science



Dr P. Kamath



**AMERICAN COLLEGE OF
GASTROENTEROLOGY**

Advancing Digestive Health, Improving Patient Outcomes

Guidelines

ACG 2024

● NEW - IN PROGRESS

Liver: Perioperative Management of Cirrhosis

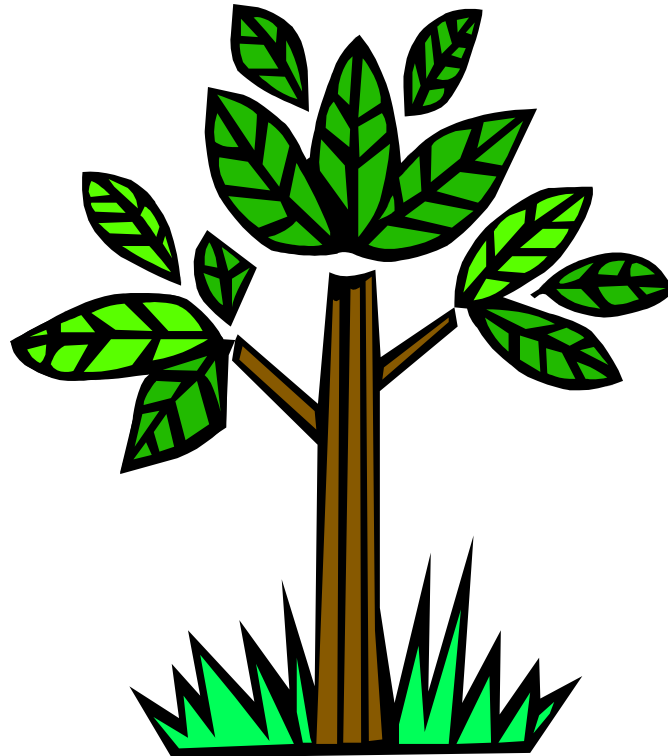
👤 Nadim Mahmud, MD

● NEW - IN PROGRESS

Liver: Perioperative Risk Assessment and Management of Patient with Chronic Liver Disease

👤 Nadim Mahmud, MD

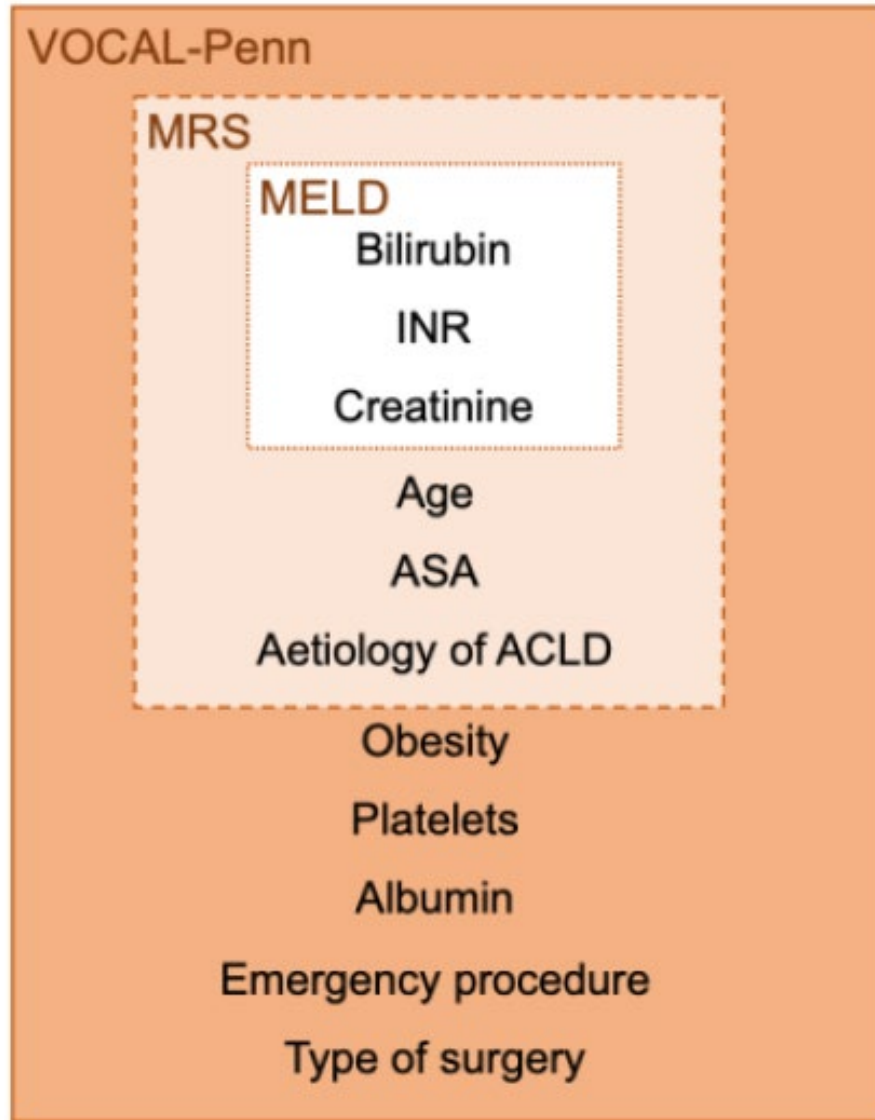
Thank You



Score	Components
Child-Turcotte- Pugh (CTP)	
Model for End-Stage Liver Disease (MELD)	
Mayo Postoperative Mortality Risk Score	
ASA	<p>ASA I: normal healthy patient</p> <p>ASA II: with mild systemic disease</p> <p>ASA III: severe systemic disease that is not a constant threat to life</p> <p>ASA IV: severe systemic disease that is a constant threat to life</p> <p>ASA V—Moribund patient not expected to</p>

Preoperative assessment in cirrhosis

- Indication of surgery: Emergency/elective
- Type of Surgery Cardiac, colorectal, abd wall, orthopedic
- Liver disease Etiology, duration, severity, cirrhosis
- CSPH: Present/absent (HVPG \geq 10 mm Hg)
- Hepatic decompensation Past & present
- Co-morbid conditions Present/Absent
- Nutrition Malnutrition, sarcopenia
- Blood investigations LFT, INR, platelet count, creatinine
- Liver imaging: Cirrhosis, ascites, portosystemic collaterals
- UGI endoscopy: Prophylactic banding if high risk varices
- Risk score: CTP, MELD, MRS, VOCAL Penn



- VOCAL-Penn demonstrated superior performance to other scores at all time points
- Scores 30-day C-statistic
- MELD
- MELD-Na
- CTP
- MRS at all time points (30-day C-statistic = 0.859 versus 0.766 for the MRS and 0.852 for MELD-Na ($p = 0.000$)).

VOCAL-Penn score versus other scores

Improvement in mortality risk discrimination (AUROC)
when compared with preexisting scores

<u>Score</u>	<u>AUROC</u>
CTP	0.59 – 0.68
MELD	0.66 – 0.72
MRS	0.73 – 0.77
VOCAL–Penn	0.80 – 0.87

CTP: Child-Turcotte-Pugh – MELD: model for end-stage liver disease – MRS: Mayo risk score
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