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Risk Stratification in Cirrhotic Patients with Emergent Surgery

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ABSTRACT

Background: Patients with liver disease have a unique pathophysiology that results in the need for a specialized evaluation before undergoing any surgical procedure. The objective of the present study was to assess different risk scores for high-risk cirrhotic patients. **Patients and methods:** We evaluated 115 cirrhotic patients in an Emergency Department, of the National Liver Institute, Menoufia University, using MELD, PALBI, ALBI, MELD Na scores. The studied cases had different presentations; 79 patients with strangulated umbilical hernia with bowel loops, 29 patients with intestinal ischemia from acute mesenteric vascular occlusion managed by surgical explorations, and 7 patients with secondary peritonitis from neglected spontaneous bacterial peritonitis. All participants signed an informed written consent.

Results: MELD had a best cut off point 9.5, PALBI best cut off point -2.5, ALBI best cut off point -1.5, and MELD Na best cut off point 287.5. Sensitivities of MELD, PALBI, ALBI and MELD Na were 81.2%, 67%, 50%, and 44%, respectively. While specificities of MELD, PALBI, ALBI and MELD Na were 70%, 44.1%, 85.3%, and 77%, respectively.

Conclusion: MELD, PALBI, and ALBI could be used in risk stratification in cirrhotic patients with emergent surgery.

Keywords: Risk stratification; cirrhotic; emergent surgery; MELD, MELD Na, ALBI, PALBI.

INTRODUCTION

Studied cases with liver disease present for variety of surgical procedures. In significant proportion of these studied cases, surgery may result in problems. These problems may cause significant morbidity & mortality. In studied cases with liver disease undergoing surgical procedures, evaluation can expect survival to some extent **[(1)].** Number of studied cases with liver disease seeking surgical intervention is rising. However, there are significant risk factors present perioperatively when these studied cases undergo surgery under anaesthesia. Nature and type of surgery have impact on perioperative morbidity and mortality **[(2)].**

Surgical techniques in studied cases with liver cirrhosis are fraught with problems and have high mortality rate. Precise preoperative risk stratification can be difficult, and in some cases, cirrhosis is discovered during surgery **[(3)].**

When cirrhosis has been diagnosed, further risk stratification is largely determined by degree of hepatocellular dysfunction. Child Turcotte Pugh and model for end stage liver disease are 2 most commonly used scores to stratify intensity of liver disease. Both scores have been used to stratify preoperative risk, with greater MELD and CTP scores correlated with greater thirty-day mortality **[(4)].**

Studied cases with liver cirrhosis because of different etiologies are at higher rate of mortality when admitted with emergent surgical complaints especially when patients with Child-Pugh score B or C. patients at risk when admitted need ICU or a higher rate of mortality. The objective of the present study was to assess different risk scores for high-risk cirrhotic patients.

PATIENTS AND METHODS:

We evaluated 115 cirrhotic patients in an Emergency Department, of the National Liver Institute, Menoufia University.

Cirrhosis was affirmed by clinical signs and imaging, in all situations of intra-operatively diagnosed cirrhosis. Pre-treatment laboratory data were to calculate MELD, PALBI, ALBI and MELD Na scores by their equations:

1. MELD= 3.78 × ln (bilirubin [mg/dL]) + 9.57 × ln (creatinine [mg/dL]) + 11.20 × ln (international normalized ratio) + 6.43 (**Xu et al., 2007**).
2. PALBI = (2.02 x log10 bilirubin.37 x (log10 bilirubin in pmol/L) 2 0.04 x albumin in g/L+3.48 x log10platelets in p/L + 1.01 x (log10 platelets) (**Roayaie et al., 2017**).
3. ALBI= (log10 bilirubin ×.66) + (albumin × −.085) (**Johnson et al., 2015**).
4. MELD-Na= MELD + (140 − Na [mmol/L]) − 0.025 × MELD × (140 – Na [mmol/L]) (**Jiang et al., 2008**).

Ethical considerations:

An approval of the study was obtained from National Liver Institute's Ethics Committee approved research, Menoufia University.

All patients were informed about the surgery and the auto-transplantation technique, value and possible complications and informed written consent was taken from all studied cases. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

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Data management and statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for Social Sciences) version 25.0 for Windows® (IBM SPSS Inc, Chicago, IL, USA).

Data were tested for normal distribution using the Shapiro Walk test. Qualitative data were represented as frequencies and relative percentages. Chi square test ($\chi2$) and Fisher's exact test to calculate difference between two or more groups of qualitative variables. Quantitative data were expressed as mean and standard deviation (SD). Independent samples t-test or Mann-Whitney U test was used to compare between two independent groups. For modified result analysis, generalized linear model with years old, sex, surgical approach, and comorbidity index were used. Using receiver operating characteristic curves, sensitivity and specificity, of available scores and parameters, were calculated. P-value $\leq$0.05 was considered significant.

RESULTS

The mean age was 56.1 (SD 10.7) years; 52.5% were males and 47.5% were females. **Table 1** summarizes the sociodemographic, clinical and laboratory data of the cases.

Table 1: Socio-demographic and clinical data, and laboratory data of studied patients.

Socio-demographic and clinical data	
Age in years Mean ± SD (range)	 56.1 ± 10.7 (19 – 84)
Gender Male Female	 62 (52.5%) 56 (47.5%)
Comorbidities No Yes	 75 (63.6%) 43 (36.4%)
History of encephalopathy No Yes	 115 (97.5%) 3 (2.5%)
CHILD A B C	 19 (16.1%) 71 (60.2%) 28 (23.7%)
Liver ultrasound cirrhotic Hepatocellular carcinoma	 112 (94.9%) 6 (5.1%)
Splenomegaly No yes	 6 (5.1%) 112 (94.9%)
Ascites No Mild Moderate Tense	 2 (1.7%) 32 (27.1%) 67 (56.8%) 17 (14.4%)
Total bilirubin Mean ± SD (range)	 2.3 ± 1.6 (0.2 – 13)
Direct bilirubin, Mean ± SD (range)	1.09 ± 1.2 (0.00 – 11)
Albumin, Mean ± SD (range)	2.6 ± 0.70 (2 – 4)
Urea, Mean ± SD (range)	61.5 ± 50.5 (4 – 329)
Creatinine, Mean ± SD (range)	1.2 ± 1.0 (0.00 – 7.0)
Na, Mean ± SD (range)	130 ± 13.4 (4 – 143)
INR, Mean ± SD (range)	1.3 ± 0.61 (1 – 4)
Total leucocytic count, Mean ± SD (range)	8.9 ± 5.8 (2 – 39)
Platelet, Mean ± SD (range)	120.3 ± 103.4 (6 – 735)

Table 2 summarizes the operative data of the 115 studied cases.

Table 2: Operative data of the studied cases.

	Operative data	
Surgical cause	Bowel loop Omentum	66 (55.9%) 52 (44.1%)
Operative finding	Gangrenous Viable	25 (21.2%) 93 (78.8%)
Anesthesia	General Spinal	86 (72.9%) 32 (27.1%)
Early post-operative complication	No Yes	53 (44.9%) 65 (55.1%)
Mortality	Died Alive	16 (13.6%) 102 (86.4%)
Length of hospital stay	Mean ± SD (range)	6.8 ± 6.1 (1 – 34)

Table 3 showed that mean scores of MELD, PALBI, ALBI and MELD Na.

Table 3: MELD, PALBI, ALBI and MELD Na scores

Score Mean ± SD (range)	
MELD	9.07 ± 3.2 (2.0 – 18.0)
PALBI	-2.4 ± 0.61 (-4.0 – -1.0)
ALBI	-2.1 ± 0.74 (-4.0 – -1.0)
MELD Na	-283.8 ± 13.2 (-355 – -267)

Table 4 showed that Patients died was 13.9 % vs 86.1 % alive which had higher urea 100.7 (SD 53.3) vs 55.4 (SD 47.4) mg/dl.

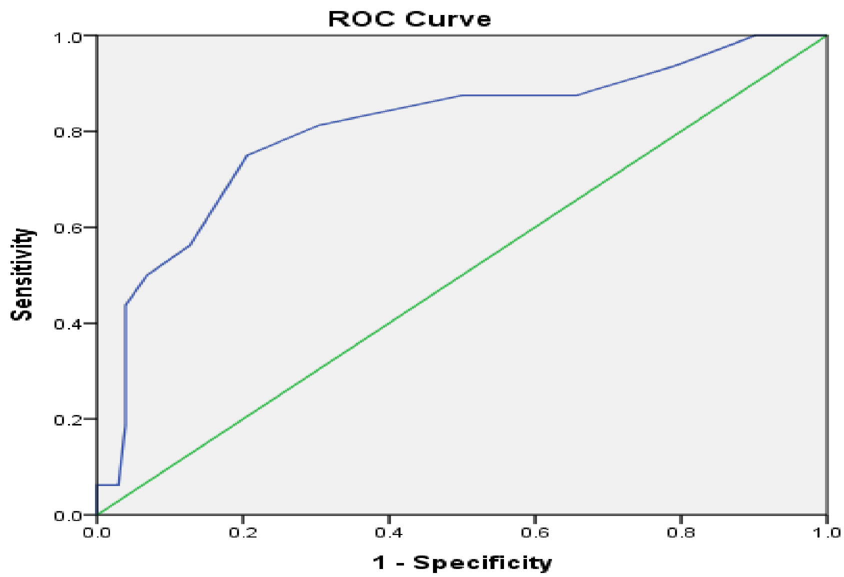
Table 4: Univar at analysis of factors affecting survival.

Variable	Alive	Died	Statistical Test	P-value
Gender			0.05	0.827
Male	54 (52.9%)	8 (50%)		
Female	48 (47.1%)	8 (50%)		
Age	56.0 ± 10.6	57 ± 11.8	0.220	0.826
History of encephalopathy			1.02	0.311
No	100 (98%)	15 (93.8%)		
Yes	2 (2%)	1 (6.2%)		
Comorbidities			3.1	0.077
No	68 (66.7%)	7 (43.8%)		
Yes	34 (33.3%)	9 (56.2%)		
Anesthesia			1.09	0.315
General	76 (74.5%)	10 (62.5%)		
Spinal	26 (25.5%)	6 (37.5%)		
Child			21.3	0.001
A	19 (18.6%)	0 (0.0%)		
B	66 (64.7%)	5 (31.2%)		
C	17 (16.7%)	11 (68.8%)		
Early post-operative complication				
No	49 (48%)	4 (25%)	2.9	0.085
Yes	53 (52%)	12 (75%)		
Total bilirubin	2.2 ± 0.2	3.1 ± 0.1	0.779	0.436
Direct bilirubin	0.98 ± 0.17	1.8 ± 0.6	1.2	0.225
Albumin	2.7 ± 0.21	2.2 ± 0.44	2.5	0.01
Urea	55.4 ± 7.4	100.7 ± .3	3.7	0.001
Creatinine	1.1 ± 0.5	1.8 ± 0.1	3.2	0.001
Na	130.6 ± 14.1	127.4 ± 7.9	2.0	0.04
INR	1.3 ± 0.2	1.8 ± 01	2.4	0.013
Total leucocytic count	8.1 ± 2.1	13.5 ± 3.4	2.6	0.009
Platelet	121.1 ± 18.3	115.2 ±6	0.77	0.439
MELD	8.5 ± 2.0	12.3 ± 3.0	3.9	0.001
PALBI	2.4 ± 0.59-	2.2 ± 0.77-	1.2	0.226
ALBI	2.2 ± 0.3	-1.5 ± 0.1	3.5	0.001
MELD Na	-282.1 ± 10.8	-294.6 ± 22.1	2.6	0.007
Length of hospital stay	6.2 ± 0.1	10.9 ± 2.9	3.8	0.001

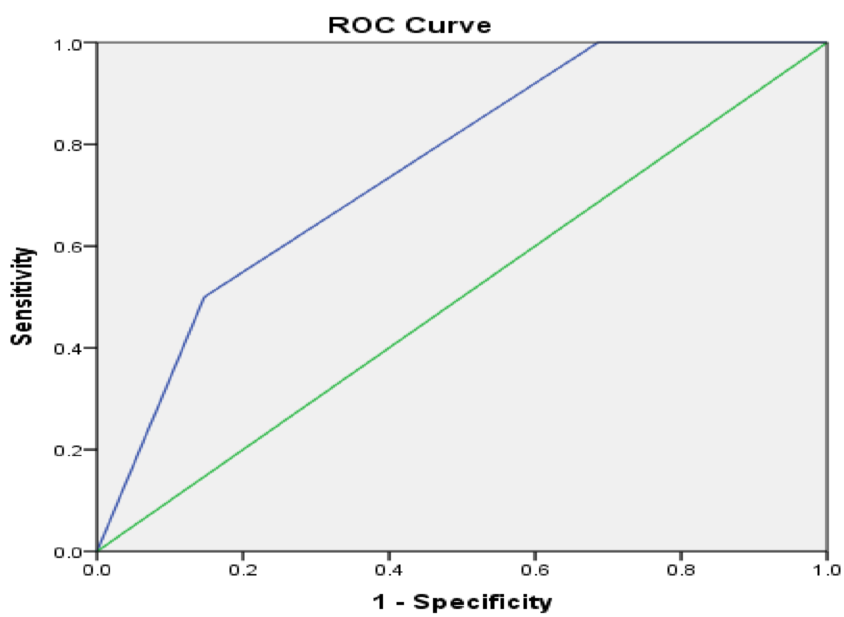
Table 5 showed best cut off point and validity scores of MELD, PALBI, ALBI, and MELD Na.

Table 5. Validity of different scoring systems to predict mortality.

Variable	AUC	best cut off point	Sensitivity	Specificity	PPV	NPV	Precision
MELD	.806	9.5	81.2%	70%	20%	96%	71%
PALBI	0.583	-2.5	67%	44.1%	16%	90%	47%
ALBI	0.755	-1.5	50%	85.3%	40%	92%	80%
MELD Na	0.708	-287.5	44%	77%	23%	90%	72%



Diagonal segments are produced by ties.



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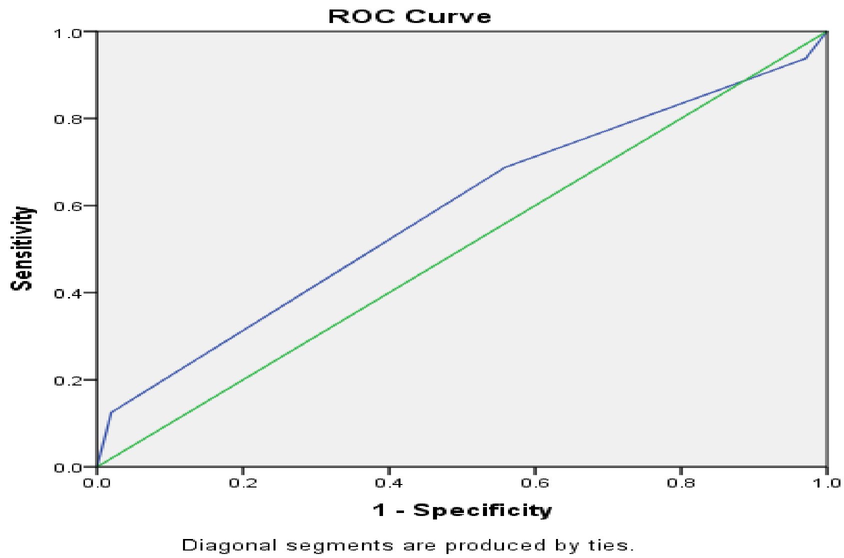

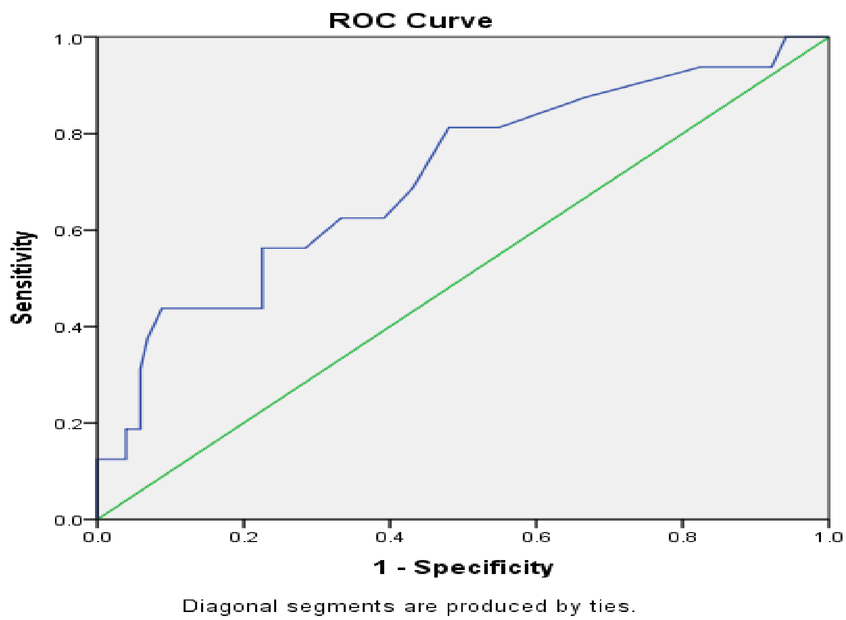

DISCUSSION

Chronic liver diseases (CLD) are major source of morbidity and mortality. Overall life span of CLD studied cases has risen, as has number of surgical procedures they have undergone. Cirrhotic studied cases are more vulnerable to hypotension and hypoxia throughout surgery due to pathophysiological and hemodynamic variations. They are at high risk of developing drug-induced liver damage, renal dysfunction, and post-operative liver decompensation. Studied cases with CLD who are scheduled for elective and semi-elective surgery should have thorough preoperative risk evaluation [5].

Surgical techniques in studied cases with liver disease carry significant risks of serious problems, which can result in high rates of morbidity & mortality. Severity of liver disease, type & location of surgical procedure, degree of urgency, type of anaesthesia, & comorbidities all influence magnitude of surgical risk [6]. Even though hepatic resection of tumors and liver transplantation are most common surgical procedures for cirrhotic studied cases, these studied cases frequently require additional surgical procedures. Furthermore, number of cirrhotic studied cases has been rising in recent years [7].

The goal of the current research was to compare various risk scores for high-risk studied cases. Upon educated written consent, 115 studied cases were checked in emergency department at National Liver Institute at Menoufia University.

In comparison with our study, the study of **Alsultan *et al.*** [8] recruited over 1-year 226 cirrhotic hospitalized patients; of them 148 (65%) cases were discharged alive. Non-survivor group had significantly greater mean age (64.4 vs. 59.9, P<0.05). There was no discernible gender variation among survivors and non-survivors. There was trend toward longer hospital stays in non-survivor group when compared to survivors (11 days vs. 14.7 days, P< 0.06). Most common reason for hospitalization was infection.

In the current study, 115 studied cases attended the emergency department with different presentations; 79 patients with strangulated umbilical hernia with bowel loops, 29 patients with intestinal ischemia from acute mesenteric occlusion managed by surgical explorations, and 7 patients with secondary peritonitis from neglected spontaneous bacterial peritonitis.

Moreover, we found that 53 (44.9%) of patients had no early post-operative complication and 65 (55.1%) had early post-operative complication; mean of Length of hospital stay was 6.8 (SD 6.1).

This was in harmony with a retrospective study of **Andraus *et al*.** [8] carried out from January 1998 to December 2009. All studied cases with recorded cirrhosis who underwent hernia repair at Department of Digestive and Liver Transplant Surgery at University of Sao Paulo Medical School were investigated. A total of 67 cases underwent 74 surgeries; even so, final analysis included 56 studied cases who underwent 61 surgeries.

Chebl *et al*. [9] included a total of 7906 cases were admitted to the ICU with sepsis, of whom 497 (6.29%) patients had cirrhosis. 64.78% of cirrhotic patients died during their hospital stay compared to 31.54% of non-cirrhotic. The authors reported that septic cirrhosis patients had greater risk of dying during their hospital stay.

According to some reviews, adequate preparation of cirrhotic studied cases with ascites control and increased nutrient status allows for more successful elective hernia maintenance [10]**.** Although elective hernia fix in studied cases with concomitant ascites is controversial, it is not novel idea. In early **Salamone *et al*.** [11] advocated that in selected studied cases with ascites, elective inguinal hernia fix can be done safely and with acceptable recurrence rate.

Lately, MELD score has been proposed and validated like predictor of mortality in cirrhotic studied cases following non-hepatic digestive surgery. MELD score is dependent on quantitative parameters such as INR, total bilirubin, and creatinine, which can all be measured retrospectively [12]. In a research published in **Northup *et al*.** [13] when MELD score was 25, risk of death after GI surgery was 35%, while it was 58% when MELD score was 30.

Our results come in comparison with the study of **Fragaki *et al*.** [14] which included 127 cases; 65.1% were men, with median age of 66 years. Most common reason for cirrhosis (36.4%) was alcohol, followed by viral hepatitis (28.7%). Total of 142 studied cases (72.8%) proffered with decompensated cirrhosis. Median MELD, MELD-Na, CP, CP-I, CP-II, ALBI, and PALBI scores were 12 (IQR 9, range 6-30), 15 (IQR 11, range 3-33), 7 (IQR 4, range 5-13), 8 (IQR 5, range 5-17), 7 (IQR 5, range 5-15), and -2.68 (IQR 1.23, range -4.25 to -0.64).

Moreover, **Grass *et al*.,** [15] reported that as per 28.6% CTP A and 71.4% CTP B studied cases, 64.3% of LCP had preoperative MELD score of 9, 28.6% had MELD score of 10-13 and 7.1% had MELD score of >13. Only 7 studied cases had preoperatively diagnosed liver cirrhosis, with 57.1% having MELD score of 9; 3 of these studied cases had preoperative transjugular intrahepatic portosystemic shunt. MELD (p = 0.577) and CTG scores were not significantly variation among studied cases with cirrhosis before and after surgery. Portal hypertension was found in 35.7% of LCP. Alcohol abuse was most common cause of cirrhosis (85.7%). Furthermore, 64.3% of LPC had severe hypalbuminaemia (25mg/dl), which did not vary considerably from NLCP cohort (50.4%, p = 0.385).

In our study, died patients was 13.9 % vs 86.1 % alive which had higher urea 100.7 (SD 3.3) vs 55.4 (SD 47.4) mg/dl.

In agreement with our results, **Grass *et al*.** [15] reported that preoperative ascites and portal hypertension were predictive for mortality. MELD and Child Score, like their respective groups, were unable to anticipate 30-day and 90-day mortality. As a result, numerous elements of these scores significantly associated with mortality, including bilirubin (p = 0.018, p = 0.001) and INR (p = 0.009, p = 0.002), as well as platelet count (p = 0.002, p = 0.003). Furthermore, incidence of specific problems was not linked to mortality.

In recent years, it has become critical tool for stratifying studied cases with liver diseases in variety of scenarios. researches of **Telem *et al*.** [16] **and Marrocco-Trischitta *et al*.** [17] When MELD scores are compared to CTP scores, it was discovered that MELD anticipated unfavorable results with significant risk beginning with MELD scores greater than 10, and that MELD cutoffs of 14 and 15 are more specific.

Research of **Rashid *et al*.** [18] studied cases with MELD scores greater than 15 and albumin levels less than 2.5 g/L had 60% mortality rate compared to 14% for other studied cases. This mixture of indicators predicted more accurately than CTP score.

In addition, **Ruault *et al*.** [19] reported that MELD has been found to be best forecaster of postoperative mortality at 30 and 90 days. It is believed that studied cases with MELD 10 can undergo surgical procedures without major complications, that those with MELD >15 and albumin 2.5 g/L should avoid surgery, and that studied cases with MELD 10 to 15 can undergo surgery in specialized centers after strict assessment.

In addition to above findings, we found that in patients with MELD with cut off 9.5, ALBI with cut off -1.5, and MELD Na with the cut of level -287.5 are at greater risk for morbidity and mortality.

Nearly similar to our findings, the study of **Fragaki *et al*.** [(14)] reported that All scoring systems were found to predict survival with diagnostic accuracy (P<0.001). When compared to other scores, ALBI had best balance of sensitivity and specificity. For one-month survival, all scoring system was introduced to have excellent prognostic accuracy (AUC>0.80). ALBI score showed up to be more accurate in predicting one-, twelve-, and twenty-four-month survival. CP-I and MELD-Na predicted 6 month survival slightly better. Limitation of research is that it was performed in single tertiary institute with relatively small number of cases. To verify our research results, larger cohort of well stratified cirrhotics with different etiologies should be researched.

In conclusion, MELD, ALBI, and MELD Na could be used in risk stratification in patients with emergent surgery studied cases with liver cirrhosis, particularly those with portal hypertension, face increased surgical risks than general population. When cirrhotic cases need surgery, clinician must conduct thorough assessment to detect liver function, urgency of cure, and type of process. With this information, decision about how to proceed can be made. If surgery is chosen, this knowledge can be used to ensure necessary perioperative measures to improve surgical procedure success.

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