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Child-Turcotte-Pugh Class Is Best at Stratifying Risk in Variceal Hemorrhage: Analysis of a U.S. Multi-Center Prospective Study

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Abstract

Goals/Background—Data on acute variceal hemorrhage (AVH) in the U.S. is limited and the best method to stratify risk is not clear. Taking advantage of a prospective U.S. cohort study, we aimed to 1) describe clinical outcomes of AVH and their predictors; 2) compare predictors of 6-week mortality.

Study—Prospective 15-center U.S. cohort of patients with cirrhosis presenting with endoscopically–proven AVH, all of whom received antibiotics, vaptotide (a somatostatin analogue) infusion and endoscopic band ligation. Patients were enrolled between August 2006 and April 2008. Primary outcome was 6-week mortality. Secondary outcome was 5-day treatment failure. The prognostic value of Child-Turcotte-Pugh class (CTP), MELD score and a recent recalibrated MELD were compared.

Results—Seventy eligible patient were enrolled; 18 (26%) patients died within 6-weeks of index bleed. Demographic, clinical and laboratory data were compared between survivors and non-survivors. Multivariate models showed that admission CTP or the MELD score (separately) were independent predictors of survival. The discriminative values of CTP (AUROC 0.75) and MELD (AUROC 0.79) were good and not significantly different ($p=0.27$). However, calibration (correlation between observed and predicted mortality) test was significantly better for CTP than for MELD, with the recently described recalibrated MELD model having the worst agreement. Predicted mortality for CTP-A was <10%, CTP-B 10%-30%; and CTP-C >33%.

Conclusions—AVH mortality of 26% in the U.S. is in the upper range limit compared to recent series but may be due to inclusion of patients with more advanced cirrhosis. CTP score has the best overall performance in the prediction of 6-week mortality and is best at stratifying risk.

Keywords

cirrhosis; GI bleeding; mortality; risk stratification

Introduction

Acute variceal hemorrhage (AVH) is a major complication of cirrhosis and one of the clinical events that define decompensation¹. Although there have been advances in the management of AVH that have led to a decrease in mortality, published series over the past 7 years when current standards of care were established^{1, 2} confirm that AVH still carries a 6-week mortality that ranges between 16 to 23%^{3–6}. This variability suggests that cohorts included in these studies belong to different prognostic subgroups. The Child-Turcotte-Pugh

(CTP) and the Model for End-Stage Liver Disease (MELD) scores have been identified in several cohort studies as being strongly predictive of outcomes (treatment failure and death) in AVH^{1, 4, 6, 7}. In fact, individualized management based on risk stratification by CTP score has already been shown to improve survival in patients with AVH⁸.

Although other prognostic models have been developed in patients with AVH^{3, 4, 7, 9}, a recent study showed that recalibration of a MELD-based model could accurately predict the risk of death and was superior to other models, including the CTP score⁶. It also identified cutoffs that could be used for risk stratification. Notably, all recent studies were performed in cohorts from outside the United States (U.S.) and contemporary data on mortality of patients with AVH treated with standard therapy (vasoactive drug, antibiotics and endoscopic band ligation) in the U.S. are lacking.

A multi-center prospective study of patients with AVH in 15 U.S. centers was performed between August 2006 and April 2008 with the objective of obtaining FDA label for vaptotide in the treatment of AVH. Vaptotide, a somatostatin analogue akin octreotide, had been previously shown in a placebo-controlled trial to be effective in the treatment of AVH¹⁰. Patients with AVH were treated with vaptotide, antibiotic prophylaxis, and band ligation as indicated by current guidelines^{1, 2} and followed prospectively until death or 42 days after enrollment in the study. Taking advantage of available data from this study, we sought to 1) describe the clinical outcomes of a prospective U.S. cohort of patients with AVH treated with current standard of care; 2) determine predictors associated with 6-week mortality and 5-day treatment failure; and 3) compare the ability of CTP, MELD and re-calibrated MELD scores in predicting 6-week mortality.

Materials and Methods

The vaptotide trial (DEBV-VAP/EVP-301) was a registered observational, open-label, multi-center prospective study using vaptotide in continuous intravenous infusion for 5 days in conjunction with endoscopic band ligation and antibiotics in patients with endoscopically-proven AVH. The reason that the study was planned as an open label study, and not a double-blinded placebo-controlled study, was because the use of octreotide was already recommended in society guidelines and because a well-designed study by Calès, et al had already shown favorable results with vaptotide compared to placebo^{10, 11}. Therefore, it was considered unethical to randomize patients to a placebo. Patients were recruited ([ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT00331188): NCT00331188) at 15 centers across the United States. With permission from Debiopharm International S.A (Lausanne, Switzerland) and approval by the institutional review boards from all participating centers, we were provided with the trial database that included de-identified data.

Patients

Patients included in the study were required to have cirrhosis (by biopsy, or a combination of clinical, laboratory and imaging evidence), an age between 18 to 75 years, presenting with gastrointestinal hemorrhage (hematemesis and/or melena) with an endoscopy (performed within 12 hours of presentation) showing that the source of hemorrhage was related to gastroesophageal varices according to Baveno IV criteria¹².

Patients were excluded if they had prior treatment with another vasoactive drug during the active bleeding episode, grade 4 hepatic encephalopathy, balloon tamponade placed at time of admission, CTP score over 13, pregnant or breast-feeding women, known diffuse hepatocellular carcinoma, known complete portal venous thrombosis, had prior variceal bleeding within the last 6 weeks, known allergy to somatostatin or its analogues, prior portosystemic shunt placement (TIPS or surgical shunt), prior liver transplantation, known cancer, and known chronic kidney disease.

Baseline demographic, history, laboratory, and imaging data were collected at admission. Patients were followed for 42 days or until death. Except for having a placebo arm, this study's protocol was similar to the published vaptotide trial by Calès and colleagues¹⁰. Blood pressure, heart rate, body temperature, any clinical signs of hemorrhage, hemoglobin, hematocrit, number of units of blood, plasma, or substitutes given were recorded at admission, at the end of the initial endoscopy, every 6 hours for the first 48 hours, and then every 12 hours until the end of the 5-day treatment period. Serum glucose, creatinine, aspartate aminotransferase, and alanine aminotransferase, total bilirubin were measured at admission and days 2 and 5 of treatment. Hepatic ultrasound was performed on day 5. Additional patient clinical examinations were performed on days 7, 30 and 42. Adverse events were closely monitored throughout the study period.

Endoscopic and Pharmacologic Therapy

Once enrolled, patients were given vaptotide as an intravenous bolus of 50 micrograms followed by a continuous infusion of 50 micrograms per hour for 5 days. Infusion was discontinued if endoscopy did not identify the source of bleeding as being related to gastroesophageal varices. Diagnostic and therapeutic endoscopy was performed within 12 hours of admission. Endoscopic band ligation was performed on patients with confirmed esophageal varices. Sclerotherapy was to be used if band ligation was not feasible or was technically difficult. Antibiotic prophylaxis, including either oral norfloxacin or an equivalent fluoroquinolone or intravenous ceftriaxone, was given for at least 5 days. Rescue therapies (balloon tamponade or TIPS) were utilized when there was failure to control bleeding with endoscopy. After 5 days, patients proceeded to have secondary prophylaxis (nonselective beta blocker plus band ligation in 2-week intervals).

Outcomes of interest

In accordance with the more recent Baveno VI consensus conference, 6-week mortality was considered the primary endpoint and 5-day treatment failure, as defined by Baveno IV/V criteria (and as used in the vaptotide trial), was considered a secondary endpoint¹³. In addition to the original objectives of the vaptotide trial, this paper's objectives were to determine predictors of 6-week mortality and to investigate the prognostic performance of CTP in comparison to the recalibrated MELD-based model⁶. All items described in the TRIPOD statement for studies developing or validation prediction models are reported in the study¹⁴.

Statistical Analysis

Analyses were performed using intention-to-treat and p-values were two-tailed. Continuous variables that were not skewed are summarized using means with standard deviation. Continuous variables that tended to be skewed are summarized using medians with interquartile ranges. The 6-week mortality rate was calculated as a percentage of those who died or were lost to follow-up during six weeks after the index bleed divided by the total study population size. The five-day treatment failure rate was calculated as a percentage of those who developed uncontrolled bleeding, early rebleeding, or death within five days over the total study population size.

Analysis of predictors of 6-week mortality and 5-day treatment failure—

Univariate analysis comparing patients who died or failed therapy at 6 weeks vs. those who did not was performed using student's t-test or chi-square test. Multivariable models were developed with the objective of validating the prognostic value of MELD vs. CTP score using covariates that were statistically significant on univariate analysis. Because of the relatively small number of outcomes, a maximum of 2 covariates, outside of CTP or MELD, were used to control the models. Variables that were components of scores (CTP or MELD) were not included in the models.

Analysis of prognostic ability of CTP, MELD and re-calibrated MELD scores—

To investigate the discriminative ability of the prognostic models for 6-week mortality, receiver operating characteristic (ROC) curve analyses were performed. The Hosmer-Lemeshow goodness-of-fit test was used to determine the models' calibration (the agreement between the observed and predicted risk of mortality) after splitting the sample into deciles (that is, groups of ten patients each). If the specified model were to provide an adequate fit and model prediction was not different from observed values, then the null hypothesis could not be rejected (higher p-value means non-significant disagreement). However, evidence of poor agreement between observed and predicted risk of mortality would yield a smaller p-value (i.e. significant disagreement). Calibration was also performed for the recently described MELD – based model in patients with AVH⁶. Analyses were performed using SAS version 9.3 (SAS, Inc., Cary, NC) software.

Results

Description of cohort

A total of 103 patients with cirrhosis were admitted to 15 U.S. centers with upper gastrointestinal bleeding in the period between August 2006 and April 2008 and were initiated on vopreotide infusion prior to diagnostic endoscopy. Thirty-three patients were excluded and the causes for exclusion are specified in Figure 1. Therefore, the final intention-to-treat analysis included 70 patients who had endoscopically-proven variceal hemorrhage. Baseline characteristics of these patients are shown in Table 1. Eighteen (26%) patients died within six weeks of index hemorrhage, including 7 (10%) that died within the first 5 days. Only 1 patient died from uncontrolled bleeding (occurring after 5 days from index bleed) while the remaining deaths were related to either liver failure or multi-organ failure. Five-day treatment failure occurred in 16 (23%) of the 70 patients. Among those 16,

twelve (17%) patients had uncontrolled bleeding within the first 48 hours of the index bleed and 4 (6%) had early rebleeding (occurring between Day 2 and Day 5).

Predictors of 6-week mortality

Univariate analyses comparing 6-week survivors vs. non-survivors are shown in Table 2. As expected, Child score and MELD score were significantly different between groups, with a median Child score of 8 among survivors (compared to 10 among non-survivors) and a median MELD score of 13 among survivors (compared to 21 in non-survivors). Because ascites and albumin are part of the CTP score and INR and creatinine are part of the MELD score, they were not included in the multivariable model. We did not include prior variceal hemorrhage because of the small number of deaths in this category which would result in instability in the estimation of the coefficient for this covariate. Therefore, our multivariable model for 6-week mortality included only three covariates: the independent effects of either MELD or CTP score and potential confounders of prior prophylaxis and baseline hemoglobin. None of the models included both CTP and MELD scores because these two variables were highly correlated ($r = 0.72$, $p < 0.001$). Only CTP ($p = 0.01$) and MELD ($p = 0.004$) remained as independent significant predictors of six-week mortality (Supplementary Table 1).

Predictors of 5-day treatment failure

Univariate analyses comparing 5-day treatment failures vs. those who did not fail therapy are shown in Table 3. Because albumin is part of the CTP score and creatinine is part of the MELD score, they were not included in the multivariable model. Therefore, our multivariable model for 5-day treatment failure included only three covariates: the independent effects of either MELD or CTP score and potential confounders of age and baseline hemoglobin. Only CTP ($p = 0.03$) and MELD ($p = 0.02$) remained as independent significant predictors of 5-day treatment failure (Supplementary Table 2).

Comparison of the ability of CTP, MELD and re-calibrated MELD in the prediction of 6-week mortality

Given that CTP and MELD score were both found to be independent predictors of 6-week mortality, comparisons on their prognostic capabilities (discrimination and calibration) were performed using the original CTP and MELD scores from our cohort. Area under the receiver operating characteristic (AUROC) analyses were used to measure the discriminative ability (i.e. distinguishing the risk of dying vs. not dying) between both scores (Figure 2). Although the AUROC for MELD score (AUROC: 0.79; 95% CI: 0.68 – 0.90) was greater than for the CTP score (AUROC: 0.75; 95% CI: 0.63– 0.87), the difference was not statistically significant ($p = 0.27$).

Calibration plots for the CTP, MELD, and MELD-based model developed by Reverter are shown in Figure 3. Agreement between observed and predicted risk of 6-week mortality was best for the CTP score ($p = 0.45$, that is, there was no significant disagreement between observed and predicted), intermediate for the MELD score ($p = 0.02$, that is, a significant disagreement between observed and predicted) and worst for the MELD-based model

developed by Reverter ($p=0.0006$, that is, a very significant disagreement between observed and predicted).

Table 4 shows the predicted risk of 6-week mortality for every CTP score. Child CTP class A (scores 5–6) has a predicted mortality of less than 10%, class B (scores 7–9) a mortality risk between 10–30% and class C (scores 10–13) was associated with a risk greater than 33%. Using data from our cohort, a fitted model for CTP score was developed: **logit = $-5.5125+0.4865*CTP$ score.**

Discussion

This study presents clinical outcomes after AVH using a contemporary prospective multi-center cohort from the United States. Per recent Baveno consensus recommendations, we specifically looked at 6-week mortality as the primary outcome and looked at predictors of death to further refine risk stratification as was also suggested in Baveno¹³.

Compared to recent (mid-2000's or later) prospective cohort (non-randomized) studies enrolling patients with cirrhosis of all severities, our 6-week mortality rate of 26% is comparable to that of Amitrano, et al (23%)⁵ but higher than that of Reverter, et al (16%)⁶ which could be explained given a higher proportion of CTP class C patients in our cohort (36% vs. 28% in the Reverter cohort). The Amitrano, et al study had an even lower proportion of CTP class C patients (20%) but included patients with hepatocellular carcinoma and portal vein thrombosis, complications that were not present in our or Reverter's cohorts and that could carry a higher mortality. Both these recent studies were single center studies while our cohort was a 15-center study. Compared to an older U.S. multi-center cohort³, our 6-week mortality was higher (26% vs. 19%) but the study does not specify the proportion of CTP class C patients so the severity of liver disease cannot be adequately assessed, although a higher MELD score in our cohort (14.5 vs. 12) suggests a sicker patient population. Compared to the original RCT by Calès et al¹⁰, the mortality in the present study was higher (26%) than in their vaptotide arm (14%) despite the fact that Child class distribution was comparable between studies. However, the etiology of cirrhosis was different; while in the Calès study 84% of patients had alcoholic cirrhosis, this was only present in 43% of patients in the present study. Because non-alcoholic cirrhosis has been shown to be an independent risk factor for treatment failure and death, this factor could explain survival differences between the studies.⁹

Therefore, a somewhat higher mortality in our cohort may be explained on the basis of a greater severity of cirrhosis. Our cohort was collected before the “early” TIPS study had been published⁸. This study was the first to demonstrate that survival could be improved in patients at a higher risk of failing standard therapy (antibiotics, vasopressors, endoscopic ligation) by pre-empting failure with TIPS placement (that had previously been reserved for patients who failed standard therapy). These were patients with CTP scores 10–13 or CTP B patients (score 7–9) with active variceal hemorrhage on diagnostic endoscopy. In our cohort, the failure and mortality rates of patients meeting these criteria were 26% and 32%, respectively, and were higher than those who did not meet these criteria, 8% and 0%, respectively.

The pre-emptive TIPS study has opened the way to proper risk stratification of patients with AVH and thereby demand the need to better stratify. In fact, the Baveno consensus suggested the need for improved risk stratification for this particular patient population¹³. Clearly, not all patients carry the same risk of treatment failure and death. Several studies have investigated prognostic models on their prediction for adverse outcomes after AVH^{1, 3, 4, 6, 7, 9}. One particularly strong prognosticator is the measurement of the hepatic venous pressure gradient (HVPG) 20mm Hg within 24 hours of the bleeding episode, but this strategy is not universally accessible, especially in the U.S.⁹. Nonetheless, accurate risk stratification based on prognostic models will allow for better individualized management of AVH.

Recently, Reverter and colleagues used a Spanish cohort and developed a MELD-based model in order to provide defined cut-offs that accurately predict low and high mortality risk specifically after AVH⁶. One advantage from this study included the ability to report the risk of dying from AVH for each MELD score, and thus allowed providers the ability to counsel patients and their families. Yet, the use of just three CTP classes provide clinicians easy-to-use risk stratification and may carry an advantage over MELD in that CTP also accounts for known important prognostic factors (i.e. ascites and encephalopathy). Ascites has consistently been shown to improve mortality risk prediction in patients who have low MELD scores^{15, 16}.

The present study confirms that the two best predictors of death (and failure of standard therapy) are in fact the CTP and MELD scores. We could however not confirm the agreement between predicted and actual risk of death using the recalibrated MELD score and showed that this agreement was better with the CTP score. Although the CTP score provides less granularity regarding individual risk (with a score ranging from 5–15, it provides 11 “risk” points) than the MELD score (with a score ranging from 6 to >30, it provides 25 risk points), it would provide a more reliable way to stratify patients into 3 risk strata; thus, allowing further investigation into different treatment regimens for each risk group – providing less intense therapy to those with lower risk of dying and more intense therapy to those with higher risk of dying. This strategy can be already appreciated in the pre-emptive TIPS study described above⁸ as well as a recent analysis of antibiotic use in patients with cirrhosis and variceal hemorrhage that showed that CTP class A patients may derive no benefit from antibiotic prophylaxis and showed that MELD scores were not as useful in classifying patients at risk for infection as the CTP class¹⁷. Based on our results, we have provided a fitted Child-Pugh score model that could be validated and even recalibrated in future cohorts with a larger number of patients/outcomes.

This study therefore describes a relatively recent prospective cohort study of patients with AVH across the United States using current standards of care and shows that the patients with acute variceal hemorrhage may be presenting at more advanced stages of cirrhosis. It also demonstrates that our current practice of stratifying patients using the CTP class is sound and should be used both clinically and in research.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

ALT	alanine aminotransferase
AST	aspartate aminotransferase
AUROC	area under receiver operating characteristic
AVH	acute variceal hemorrhage
BMI	body mass index
CTP	Child-Turcotte-Pugh
FDA	Food Drug Administration
HR	heart rate
INR	international normalized ratio
MELD	Model for End-stage Liver Disease
ROC	receiver operating characteristic
SBP	systolic blood pressure
TIPS	transjugular intrahepatic portosystemic shunt
U.S.	United States

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Figure 1. Flowchart of patients admitted to 15 centers for upper gastrointestinal bleeding (UGIB), reasons for exclusion, and results of primary endpoints (5-day treatment failure and 6-week mortality).

Figure 2. Receiving Operating Characteristic (ROC) curves for CTP (A) and MELD (B) scores for 6-week mortality. Differences between the two areas under the ROC curves (AUROC) were not statistically significant ($p=0.27$).

Figure 3.

Calibration plots for CTP (A), MELD (B), Reverter-MELD Models (C) on 6-week Mortality. P-values determined by the Hosmer-Lemeshow Goodness-of-Fit test. The only model that showed a non-significant difference between predicted and observed risk in our cohort was the CTP score. Both the MELD and the Reverter-MELD model had a significant disagreement between predicted and observed risk of death.

Table 1

Baseline Characteristics of all patients at admission

	N = 70
Age, years	51 (48, 57)
Male/Female	53 / 17
Etiology of Liver Disease	
Viral hepatitis alone	10 (14%)
Alcohol liver disease alone	30 (43%)
Viral and Alcohol	20 (29%)
Other	10 (14%)
Previous episodes of variceal hemorrhage	30 (43%)
Any Previous Prophylaxis (Beta-Blockers ± Ligation, etc.)	35 (50%)
BMI, kg/m ²	26.7 (23.7, 31.8)
Admission SBP, mm Hg	113 (101, 129)
Admission HR, bpm	97 (80, 115)
Ascites	36 (51%)
Hepatic Encephalopathy	16 (23%)
Labs at Admission	
Hemoglobin, g/dL	9.6 (8.3, 11.2)
White Blood Cells, 10 ⁹ /L	8.9 (6.2, 13.0)
AST, Units/L	78 (42, 115)
ALT, Units/L	39 (25, 54)
Albumin, g/dL	2.5 (2.0, 3.2)
Total Bilirubin, mg/dL	1.9 (1.1, 3.6)
Creatinine, mg/dL	0.9 (0.8, 1.2)
Platelets, 10 ⁹ /L	120 (75, 175)
INR	1.5 (1.3, 1.7)
Child-Turcotte-Pugh score	8 (7, 10)
Child-Turcotte-Pugh class % (A/B/C)	18% / 46% / 36%
MELD score	14.5 (11.0, 19.5)
Active bleeding at endoscopy	17 (24%)
Endoscopic band ligation / sclerotherapy	90% / 10%
Need for balloon tamponade	3 (4%)
Rescue TIPS	3 (4%)

Data are expressed as medians (first interquartile, third interquartile) or N (percentage) unless otherwise stated.

BMI, body mass index; AST, aspartate aminotransferase; ALT, alanine aminotransferase; INR, international normalized ratio; MELD, Model for End-Stage Liver Disease; TIPS, transjugular intrahepatic portosystemic shunt; SBP, systolic blood pressure; HR, heart rate

Table 2

Univariate Analysis of Variables Associated with 6-week Mortality

	6-week Mortality		P-value
	Alive (N=52)	Dead (N=18)	
Age, years	51 (48, 56)	53 (47, 60)	0.57
Male / Female	38 / 14	15 / 3	0.53
Etiology of cirrhosis			0.75
Viral hepatitis alone	7 (13%)	3 (17%)	
Alcohol alone	22 (42%)	8 (44%)	
Viral and Alcohol	14 (27%)	6 (33%)	
Other	9 (17%)	1 (6%)	
Previous episode of variceal hemorrhage	27 (52%)	3 (17%)	0.01
Any previous prophylaxis (beta-blockers ± ligation, etc.)	30 (58%)	5 (28%)	0.03
BMI, kg/m ²	27.3 (24.1, 32.1)	24.7 (20.0, 30.1)	0.13
Admission SBP, mm Hg	115 (103, 130)	105 (97, 119)	0.21
Admission HR, bpm	95 (80, 109)	102 (90, 123)	0.2
Ascites	23 (44%)	13 (72%)	0.04
Hepatic Encephalopathy	11 (21%)	5 (28%)	0.56
Labs at Admission			
Hemoglobin, g/dL	10.0 (8.6, 11.7)	8.7 (7.1, 10.4)	0.04
White Blood Cells, 10 ⁹ /L	8.5 (5.8, 12.3)	9.1 (8.2, 17.2)	0.1
Platelets, 10 ⁹ /L	122 (75, 182)	104 (66, 147)	0.52
AST, Units/L	71 (36, 112)	99 (56, 153)	0.09
ALT, Units/L	39 (25, 50)	40 (26, 75)	0.72
Total Bilirubin, mg/dL	1.7 (1.1, 3.3)	3.4 (1.2, 6.0)	0.06
Albumin, g/dL	2.8 (2.3, 3.2)	2.0 (1.8, 2.1)	0.0002
INR	1.4 (1.2, 1.7)	1.6 (1.4, 2.0)	0.02
Creatinine, mg/dL	0.8 (0.7, 1.0)	1.3 (1.1, 1.8)	<0.0001
Child-Turcotte-Pugh score	8 (7, 10)	10 (9, 12)	0.002
Child-Turcotte-Pugh class % (A / B / C)	24% / 47% / 29%	0% / 41% / 59%	0.03
MELD score	13 (10, 18)	21 (17, 23)	0.0004
Active bleeding at endoscopy	13 (25%)	4 (22%)	0.99
Endoscopic band ligation / sclerotherapy	88% / 10%	100% / 11%	0.33
Need for balloon tamponade	1 (2%)	2 (11%)	0.99
Rescue TIPS	1 (2%)	2 (11%)	0.99

Data are expressed as medians (first interquartile, third interquartile) or N (percentage) unless otherwise stated.

BMI, body mass index; AST, aspartate aminotransferase; ALT, alanine aminotransferase; INR, international normalized ratio; MELD, Model for End-Stage Liver Disease; TIPS, transjugular intrahepatic portosystemic shunt; SBP, systolic blood pressure; HR, heart rate

Table 3

Univariate Analysis of Variables Associated with 5-Day Treatment Failure

	Treatment Failure by Day 5		P-value
	No (N=54)	Yes (N=16)	
Age, years	52 (49, 60)	50 (45, 52.5)	0.04
Male/Female	38/16	15/1	0.09
Etiology of Liver Disease			0.08
Viral hepatitis alone	8 (15%)	2 (12%)	
Alcohol liver disease alone	19 (35%)	11 (69%)	
Viral and Alcohol	17 (31%)	3 (19%)	
Other	10 (19%)	0 (0%)	
Previous episodes of variceal hemorrhage	22 (41%)	8 (50%)	0.51
Any Previous Prophylaxis (Beta-Blockers ± Ligation, etc.)	29 (54%)	6 (38%)	0.26
BMI, kg/m ²	25.8 (23.6, 31)	30.6 (21.4, 32.5)	0.18
Admission SBP, mm Hg	113 (102, 127)	109 (98, 129)	0.56
Admission HR, bpm	95 (80, 109)	105 (87, 118)	0.33
Ascites	25 (46%)	11 (69%)	0.16
Hepatic Encephalopathy	12 (22%)	4 (25%)	0.99
Labs at Admission			
Hemoglobin, g/dL	10.2 (8.4, 11.7)	9.0 (7.0, 9.6)	0.03
White Blood Cells, 10 ⁹ /L	8.9 (6.8, 13.0)	7.5 (5.4, 12.5)	0.34
AST, Units/L	71 (42, 115)	82 (43, 120)	0.89
ALT, Units/L	40 (26, 68)	31 (23, 46)	0.15
Albumin, g/dL	2.8 (2.1, 3.2)	2.0 (1.8, 2.6)	0.01
Total Bilirubin, mg/dL	1.7 (1.1, 3.2)	3.4 (1.2, 5.4)	0.34
Creatinine, mg/dL	0.8 (0.7, 1.1)	1.3 (1.0, 1.7)	0.002
Platelets, 10 ⁹ /L	120 (75, 176)	99 (70, 169)	0.49
INR	1.4 (1.3, 1.7)	1.6 (1.4, 2.0)	0.06
Child-Turcotte-Pugh score	8 (7, 10)	10 (8, 12)	0.006
Child-Turcotte-Pugh class % (A/B/C)	23% / 47% / 30%	0% / 40% / 60%	0.03
MELD score	13 (11, 19)	18 (14, 27)	0.03
Active bleeding at endoscopy	14 (26%)	3 (19%)	0.74
Endoscopic band ligation / sclerotherapy	91% / 9%	94% / 12%	0.66
Need for balloon tamponade	2 (4%)	1 (6%)	0.99
Rescue TIPS	2 (4%)	1 (6%)	0.99

Data are expressed as medians (first interquartile, third interquartile) or N (percentage) unless otherwise stated.

BMI, body mass index; AST, aspartate aminotransferase; ALT, alanine aminotransferase; INR, international normalized ratio; MELD, Model for End-Stage Liver Disease; TIPS, transjugular intrahepatic portosystemic shunt; SBP, systolic blood pressure; HR, heart rate

Table 4

Predicted Mortality for Each Child-Turcotte-Pugh Value

CTP Class	CTP Value	Predicted Mortality, %
A	5	4.4
	6	7.0
B	7	10.8
	8	16.5
	9	24.3
C	10	34.4
	11	46.0
	12	58.1
	13	69.3