Child-Pugh Score Predicts Mortality Better than Model of End Stage Liver Disease: A Study in a Tertiary Care Hospital in the Periphery of Karachi

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Abstract

Objective: To observe the scores of the model of end-stage liver diseaseand Child-Pugh (CP) scores on hospital admission in patients of cirrhosis.

Methods: A cross-sectional study, in 6 months from September 17th to March 18th, using non-probability convenience sampling was conducted, in which we inducted 165 patients with diagnosed cirrhotic liver disease in aninpatient department. We noted the demographics and staged the patient for chronic liver disease according to Child-Turcotte-Pugh classification using ascites, encephalopathy, prothrombin time, serum albumin and serum bilirubin levels and compared it with MELD (Model for End-Stage Liver Disease) score using serum bilirubin, creatinine and change in INR. We predicted the outcome of patient according to both scores.

Results: Out of 165 patients, 127 (76.96%, 84 males and 43 females) patients improved, while 38 (23.04%, 29 males and 9 females) patients expired. Correlation of CP and MELD scores was done by Pearson's bivariate correlation test and it gave the correlation coefficient of 0.626 with highly significant value of p<0.0001. The area under curve (AUC) was slightly more for CP (0.961) as compared to MELD (0.911).

Conclusion: The MELD score compared to the CP score does not appear to offer a clear advantage in predicting mortality in patients with decompensated cirrhosis, but comparatively CP score performed better than the MELD with significantly higher AUC.

Key Words: Liver cirrhosis,end stage liver disease, hepatic encephalopathy, ascites, prognosis.

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Introduction

Cirrhosis for a wide variety of chronic liver diseases represents the final outcome of disease. The term cirrhosis was first introduced by Laennec in 1826. It is derived from the Greek term scirrhusand used to describe the orange or tawny surface of the liver seen at autopsy.

Cirrhosis is defined histologically as a diffuse hepatic process characterised by fibrosis and the conversion of normal liver architecture into structurally abnormal nodules. The progression of liver injury to cirrhosis may occur over weeks to years. Patients with hepatitis C before progressing to cirrhosis may have chronic hepatitis for as long as 40 years[1].

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Cirrhosis is a fatal complication of many liver diseases among which hepatitis C and B are the most important causes followed by alcoholic and other metabolic diseases. Natural course of disease has a very poor prognosis with patients developing many complications like ascites, variceal haemorrhages, encephalopathy and death[2-4]. The poor survival of patients with cirrhosis has driven physicians to a constant search for good prognostic markers[2,4,5]. The Child Pugh (CP) score has been the most widely applied prognostic marker in patients with cirrhosis mainly due to their simplicity for use in daily clinical practice[6-8].

The determination of CP score, which may range from 5 to 15, is based on the presence and severity of ascites and hepatic encephalopathy, the prolongation of prothrombin time, and the levels of serum bilirubin and albumin. According to their CP scores, patients are classified into three classes (Child class A, B, and C with CP scores 5-6, 7-9, and 10-15, respectively)[7] The predictive value of the CP score has been shown in many studies in the past[6,7] but the inclusion of two subjective variables (ascites and encephalopathy) with the inevitable inter-observer variation and the need for even better prognosis have prompted the search for more objective and more accurate prognostic markers in this setting[6,9].

During the last two decades, several scoring systems or prognostic instruments have been proposed for predicting survival in patients with decompensated cirrhosis[7] but none gained wide acceptance until the recent development of the Model of End-stage Liver Disease (MELD)[6,10,11].

MELD score calculation is based on the aetiology of cirrhosis and three simple and objective laboratory variables, serum bilirubin, serum creatinine and prothrombin time expressed as international normalized ratio (INR), but it includes logarithmic transformations and multiplication by several factors being substantially more sophisticated than that of the CP score[12,13]. Moreover, it has been suggested that it may be difficult to reconcile clinical impression with MELD score. MELD scoring has an established role in organ allocation for transplant. Data is still lacking for its predictive value for mortality in cases of cirrhosis[14,15].

Material and Methods

The study design was cross-sectional analytical study. The duration of study was from September 2017 to March 2018. The sample size calculations are for estimating difference between two population proportions using non-probability convenience sampling and the following parameters16: confidence interval (1-α)= 95%; absolute precision required (d)= 0.10; anticipated population proportion (P1)= 0.40; anticipated population proportion (P2)= 0.25; and sample size (n)= 16.

All patients of cirrhosis of liver were inducted at the time of discharge or death during the study period regardless of their aetiology, gender and age. Patients with hepato-cellular carcinoma and gastrointestinal malignancies were excluded. Informed verbal consent was taken from patients or relatives of selected patients. Permission of ethical committee was taken for the study. Clinical examination and related investigations required for the study were carried out. Grade of hepatic encephalopathy was calculated as defined in operational definitions by specific clinical examination. Presence of variceal bleeding was noted. Values of variables were Creatinine, Bilirubin, Alkaline phosphatase and INR (international normalized ratio) done at the time of admission and entered in the study pro forma for calculation of MELD and Child-Pugh score at the time of admission.

Grade of hepatic encephalopathy, presence of variceal bleeding, age of the patient was noted and analysed for the confounding effects. Two of the outcomes were noted; whether the patient improved and was discharged or the patient expired.

Age, gender and presence of variceal bleeding were evaluated for confounding effect by univariate analysis and factors found significant were evaluated further by multivariate analysis. Continuous variables like age, creatinine, bilirubin, PT/INR and MELD scores were compared using student 't'-test. The categorical variables of hepatic encephalopathy grade were compared by chi-square test. Confidence interval was set at 95% and p-values were calculated. Receiver operating characteristic (ROC) curve was plotted to determine predictive value for mortality for MELD and Child-Pugh scores. Signifi-

cance level was set at p≤0.05. SPSS version 15.0 was used for analysis[17].

Results

A total of 165 patients comprising of 113 (68.5%) males and 52 (31.5%) females satisfying the inclusion/exclusion criteria were included. Mean age ± standard deviation (SD) of males and females were 47.8 ± 13.8 years and 44.6 ± 12.3 years, respectively. No statistically significant difference was present between mean ages of both genders (p=0.149). At the time of presentation ascites was present in 128 (77.57%) patient's 91 males and 37 females. Jaundice was present in 69 (41.81%) patients 47 males and 22 females. In our study variceal haemorrhage was present in 35 (21.21%) patients 28 males and 7 females, details are given in Table 1. In our study 41 (24.84%) patients were alcoholic 39 males and 2 females.

Hepatic encephalopathy (HE) was present in 72 (43.63%) patients, Grade-I HE was present in 15 patients (11 males and 4 females), grade-II in 34 patients (22 males and 12 females), grade-III in 12 patients (all were male) and grade-IV in 11 patients (8 males and 3 females).

Segregation of patients according to severity of liver disease in Child's Class A showed 2 (1.21%) patients (1 male and 1 female), Child's Class B, 63 (38.65%) patients (38 males and 25 females) and Child's Class C 100 (60.60%) patients (74 males and 26 females). Out of 165 patients, 127 (76.96%) (84 males and 43 females) improved while 38 (23.04%) patients (29 males and 9 females) expired.

The median bilirubin ± interquartile range (IQR) was 2.0 ± 2.9 mg/dL and that of creatinine was 1.0 ± 0.95 mg/dL. The mean ± SD of PT prolongation was 15.2 ± 13.8 seconds. The mean ± SD of INR was 2.2 ± 1.1. The mean ± SD of albumin is 2.9 ± 0.3 mg/dL. The mean ± SD of CP score and MELD score were 10.3 ± 2.0 and 6.5 ± 4.5.

Correlation of CP and MELD scores was done by Pearson's bivariate correlation test it gave the correlation coefficient of 0.626 with highly significant value of p<0.0001. The ROC curves were plotted for CP and MELD scores for death and areas under the curve were calculated which is shown in figure. Both scores have showed high correlation of higher scores with expiry with p<0.0001 for both CTP and MELD. The area under curve was slightly more for CP (0.961) as compared to MELD (0.911) shown in Fig. 1.

Discussion

Many studies have been performed to compare the performance of the CP and MELD scores in predicting survival in patients with cirrhosis with conflicting results, but in our study we compared the two scores for mortality. MELD score has been proven to be a reliable measure of short-term mortality risk in patients with end stage liver disease and a suitable marker for allocation of donor livers, but the results in studies comparing MELD with CP score appear to be unclear[12,14]. However, the CP score that has been used so far to assess prognosis in patients with cirrhosis does not take into account the renal function. This has led to the elaboration of the MELD score whose formula encompasses serum creatinine for the evaluation of survival in patients with cirrhosis[15]. The performance of the two scores has been compared in several studies with conflicting results: some studies have showed superiority of the MELD score over the CP score in predicting survival while others have found the two scores to be comparable[12,19,20,21]. In our study CP correlated significantly better with risk of mortality as compared to MELD. In studies from Italy and Germany MELD was found to be slightly superior but in a study from Austria it was equally accurate[9,21,22]. In patients with liver cirrhosis, however, both MELD and CP scores have been found to beequally good predictors of survival without significant differences in the accuracy of their predictive values in all but one study population. MELD was found to be equivalent to CP score for predicting in-hospital mortality in patients with cirrhosis. Our data supports that MELD score is not significantly superior to CP score in predicting mortality in patients with decompensated liver disease. CP score has the advantage that it is easier to calculate and utilize as compared to MELD.

The aim of our study was to compare the MELD and Child-Pugh's score on hospital admis-

Table 1. Patient Details According to Gender

		Gender Male	Female	Total
Ascites	Present	91 (71.1)	37 (28.9)	128
Jaundice	Present	47 (68.1)	22 (31.9)	69
Variceal Haemorrhage	Present	28 (80)	7 (20)	35
Alcoholic	Yes	39 (95.1)	2 (4.9)	41
Encephalopathy	Grade-0	60 (64.5)	33 (35.5)	93
	Grade-I	11 (73.3)	4 (26.7)	15
	Grade-II	22 (64.7)	12 (35.3)	34
	Grade-III	12 (100)	0 (0)	12
	Grade-IV	8 (72.7)	3 (27.3)	11
Child's Class	A	1 (50)	1 (50)	2
	B	38 (60.3)	25 (39.7)	63
	C	74 (74)	26 (26)	100
Outcome	Improved	84 (66.1)	43 (33.9)	127
	Expired	29 (76.3)	9 (23.7)	38

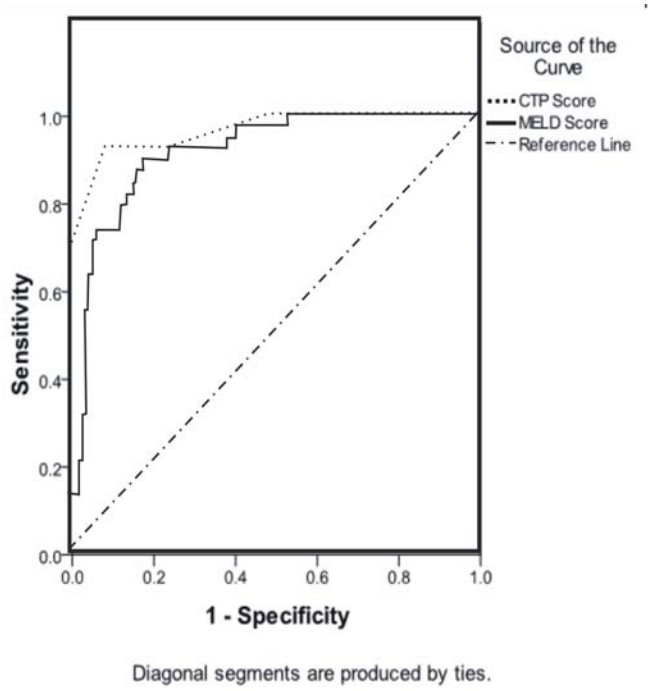

Fig 1. Receiver Operating Characterstics (ROC) Curve for Child-Tureotte-Pugh (CTP) and Model for End Stage Liver Disease (MELD) Scores

sion in patients of cirrhosis. In our study 60% patients have shown a CP score stage C that indicates severe liver disease. Both the scores individually correlated well with mortality in our study but comparatively CP score performed better than MELD with significantly higher AUC. In this study both scores have showed high correlation of higher scores with death $p<0.0001$ for both.

In comparison with other study conducted by Zhang et al. the area under curve was significantly more with the MELD score than the CP score: 0.95, 0.85 and 0.83 for the MELD and 0.70, 0.66 and 0.61 for the CP score ($p<0.05$) at 3, 6 and 12 months, respectively[23].

In a study by Papatheodoridis et al. analysing a cohort of 102 decompensated cirrhotic, the AUC as determined by the MELD score was comparable to that of the CP score in predicting survival at 3, 6, 12 months 0.79, 0.77, 0.78 and 0.79 for the MELD score and 0.73, 0.71, 0.68 and 0.70 for the CP score 7.

A recent review by Cholongitas et al. has highlighted the lack of a clear cut superiority of the MELD score over the CP score in predicting mortality of cirrhotic patients before and after liver transplantation. In this review he had taken 11 studies from which only 4 studies have shown superiority of the MELD score over the CP score[24].

Our study has showed that the CP score is significantly better than the MELD score as the AUC was 0.961 for the CP score and 0.911 for the MELD score. The value of the MELD score in our study confirms the fact that this value varies from one study to another as it was at 14 and 18 in Angermayr[9] and Ferral[23] study, respectively. This could be attributed to the fact that most of our patients were admitted at a very late stage of the disease, explaining an elevated mean and median MELD score. Therefore, mortality is high. Renal and liver failures represent independent risk factors of mortality. Indeed, our population characteristics are quite different from those of western countries since our patients are much younger with a diagnosis of cirrhosis made at a very late stage of the disease and viral hepatitis being the main cause of cirrhosis. In addition, the prognosis of our patients is further aggravated by the fact that most of them are

diagnosed as having cirrhosis at a very late stage of the disease for different reasons; lack of education, lack of awareness regarding viral hepatitis, lack of facilities, financial problems and cultural considerations. On the other hand, hepatitis C virus and alcohol are the main causes of cirrhosis in western countries.

If two or more scoring systems offer similar accuracy in predicting survival, then other characteristics should be considered for adopting one of them into clinical practice. The main drawbacks of the old CP score are the inclusion of two subjective parameters, such as ascites and encephalopathy, and the estimation of three objective parameters; prothrombin time, serum bilirubin and albumin levels, as categorical variables. Thus, in the CP score, there may be significant inter-observer variation in the assessment of the severity of ascites and encephalopathy, which may easily change by medical interventions, while an extended range of values of prothrombin time, bilirubin and albumin levels take the same points even if they may reflect different degrees of liver failure. Moreover, CP score does not take into account the patient's renal function, which appears tobe strongly associated with survival[25]. MELD score is undoubtedly more objective than the CP score, since its calculation is based on the aetiology of cirrhosis and three simple and reproducible laboratory parameters, INR, serum creatinine and bilirubin levels[12]. Moreover, the dynamic nature of MELD score, which is expressed within a continuous scale of 34 points taking into account the exact value of its laboratory parameters, offers an advantage in the determination of priorities of liver organs allocation[6,8]. On the other hand, MELD score cannot be calculated at the bedside and is much more complex than the easy to calculate CP score, since it includes logarithmic transformations and multiplication by several factors[12]. In addition, changes in several parameters of the MELD score may not be directly related to changes of the severity of liver disease, such as a creatinine increase due to extensive use of diuretics or other iatrogenic factors.

Finally, it has been suggested that MELD score may underestimate the severity of liver disease in patients with decompensated cirrhosis and predominant complications of portal hypertension, since it does not include any parameter related to portal hypertension[8]. Although a fair amount of knowledge has been gained from the recent surge in the disease and subsequent investigations, further studies will clarify the current situation. For instance, additional studies regarding management of complications of chronic liver disease are required. Research should continue in finding ways to decrease occurrence of disease and early detection. Hopefully, timely sharing of accurate information will help control the spread and magnitude of future occurrences. By this study we know that there were no limitations.

Conclusion

In conclusion, in this study the MELD score compared to the CP score does not appear to offer a clear advantage in predicting mortality in patients with decompensated cirrhosis but comparatively CP score performed better than the MELD with significantly higher AUC. Moreover, the CP score has the advantage that it is much easier to calculate and utilize than the much more complex MELD score in daily clinical practice.The use of CP score in association with serum creatinine as proposed by Angermayr[9] could also be currently performed in daily practice in order to improve its predicting survival ability.

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Conflict of Interest

Authors have no conflict of interests and no grant/funding from any organisation.

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