



RAPID COMMUNICATION

Child-Pugh-Turcotte versus Meld score for predicting survival in a retrospective cohort of black African cirrhotic patients

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prognostic significance as does the MELD score in black African patients with cirrhosis. Moreover, its handling appears less cumbersome in clinical practice as compared to the latter.

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Key words: Model for end-stage liver disease score; Child score; Cirrhosis; Black African; Survival

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Abstract

AIM: To compare the performance of the Child-Pugh-Turcotte (CPT) score to that of the model for end-stage liver disease (MELD) score in predicting survival of a retrospective cohort of 172 Black African patients with cirrhosis on a short and mid-term basis.

METHODS: Univariate and multivariate (Cox model) analyses were used to identify factors related to mortality. Relationship between the two scores was appreciated by calculating the correlation coefficient. The Kaplan Meier method and the log rank test were used to elaborate and compare survival respectively. The Areas Under the Curves were used to compare the performance between scores at 3, 6 and 12 mo.

RESULTS: The study population comprised 172 patients, of which 68.9% were male. The mean age of the patient was 47.5 ± 13 years. Hepatitis B virus infection was the cause of cirrhosis in 70% of the cases. The overall mortality was 31.4% over 11 years of follow up. Independent factors significantly associated with mortality were: CPT score (HR = 3.3, 95% CI [1.7-6.2]) ($P < 0.001$) (stage C vs stage A-B); Serum creatine (HR = 2.5, 95% CI [1.4-4.3]) ($P = 0.001$) (Serum creatine > 1.5 mg/dL versus serum creatine < 1.5 mg/dL); MELD score (HR = 2.9, 95% CI [1.63-5.21]) ($P < 0.001$) (MELD > 21 vs MELD < 21). The area under the curves (AUC) that predict survival was 0.72 and 0.75 at 3 mo ($P = 0.68$), 0.64 and 0.62 at 6 mo ($P = 0.67$), 0.69 and 0.64 at 12 mo ($P = 0.38$) respectively for the CPT score and the MELD score.

CONCLUSION: The CPT score displays the same

INTRODUCTION

The Child-Pugh-Turcotte (CPT) score has usually been used to assess the prognosis of patients with cirrhosis^[1], since it is related to the severity of the liver disease.

The detrimental effect of renal failure on survival of patients with cirrhosis is widely acknowledged^[2-6]. The prevalence of renal failure in cirrhotic patients varied between 7%-65%^[7-9]. About 20% of the cirrhotic patients presenting with ascites were likely to display an acute pre-renal failure. This value has been reported to exceed 50% when end-stage liver disease is present^[10].

The model for end-stage liver disease (MELD) score has recently been developed to better rationalize liver graft allocation. Indeed liver graft allocation has been so far performed according to the severity of the liver failure as determined by the CPT score plus the time spent on the waiting list. Since the first transplanted have almost been the first on the waiting list and knowing that they did not necessarily display the most severe disease, such an approach has been subjected to debate^[11-17]. The MELD score has been elaborated using three independent prognostic factors: creatine, International Normalized Ratio (INR) and bilirubin. In a study in 311 patients on the waiting list, the MELD score has been found adequate to predict mortality^[12-20]. The MELD score has been thus far used in the USA for liver graft allocation in place of the CPT score.

Several studies have been performed to compare the performance of the two scores in predicting survival in patients with cirrhosis^[21-33]. However such studies have yielded conflicting results^[23, 24, 28, 30-33].

The aim of the present study was to compare the performance of the MELD score to that of the CPT score to predict survival in a retrospective cohort of 172 black African patients with cirrhosis.

MATERIALS AND METHODS

Type of study

A retrospective analysis of a cohort of black African patients with cirrhosis has been undertaken. Patients have been recruited from January 1, 1991 to December 31, 2001 (11 years) at the hepatology unit of the University hospital of Yopougon (Abidjan), one of the three tertiaries hospitals of the capital, admitting and hospitalising at least 650 patients a year for a total capacity of 20 beds.

Patients

In our daily practice, all the patients who were diagnosed as having cirrhosis were systematically hospitalised, because most of them were seen at a very late stage of the disease. Of 307 patients recruited over this study period, 135 have been excluded because of missing data. 172 patients have, therefore, been considered for analysis.

Methods

Data of the patients such as, age, gender, motives of admission, aetiology of cirrhosis, serum creatine, CPT score and the MELD score, date of first symptoms of decompensated cirrhosis, date of first admission, date of last visit for the patients lost to follow up or still alive, the date of death for deceased patients have been all collected using a standardized collection sheet.

Definitions

The CPT score has been widely described elsewhere. It has been elaborated by using five (5) parameters: hepatic encephalopathy, ascite, prothrombin in percentage, serum albumin in g/L and bilirubin in mg/L.

The MELD score: It has been elaborated by using the Malinchoc formula which comprises 3 parameters: INR, bilirubin (mg/dL) and creatine (mg/dL). This formula is as follow: $[9.57 \times \text{Loge creatine (mg/dL)} + 3.78 \times \text{Loge bilirubin (mg/dL)} + 11.20 \times \text{Loge INR} + 6.43]$.

Time of follow up: It corresponds to the time between the date of first admission for cirrhosis and the date of last visit or the date of death for deceased patients.

Time of survival: It corresponds to the time between the date of the first symptoms of decompensated cirrhosis as reported by the patient and the date of last visit for the patients lost to follow up or still alive or the date of death for the deceased patients.

Statistical analysis

By univariate analysis, relationship between mortality and the following parameters has been assessed: age, gender, aetiology of cirrhosis, serum creatine, CPT score

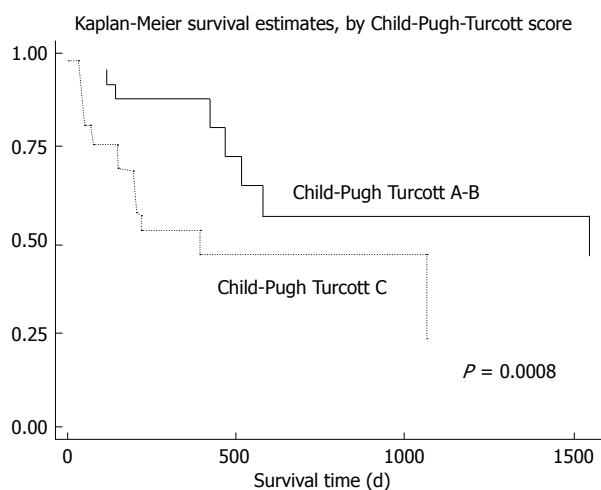
Table 1 Characteristics of the study population

Male (%)	120/172 (69.8)
Mean age (yr)	47.5 ± 13.54
Child-Pugh-Turcott score (%)	
A	20 (11.6)
B	54 (31.4)
C	98 (57)
Serum creatine (mg/dL) (%)	
≤ 1.5	132 (76.7)
> 1.5	40 (23.3)
MELD score (mean ± SD)	20.9 ± 10.87
MELD: Median (extreme)	19.5 [3-66]
Etiology (%)	
Virus B	78 (45.3)
Virus C	17 (10)
Both alcohol and virus B or C	41 (23.8)
Unknown	36 (20.9)

and the MELD score. The Student t-test or the Mann-Whitney test was used for quantitative parameters and the chi square test or the Fischer exact test for qualitative parameters. A multivariate analysis has been performed using a Cox model in a forward selection manner. Two models have been elaborated subsequently: the first has included all the parameters used in the univariate analysis with the exception of serum creatine. The second model has included all the parameters used in the univariate analysis at the exception of the MELD score. Survival has been elaborated using the Kaplan Meier method. The log rank test has been used for comparison of survival between groups. Correlation between the two scores has been evaluated. The ROC curve has been used to compare performance between scores.

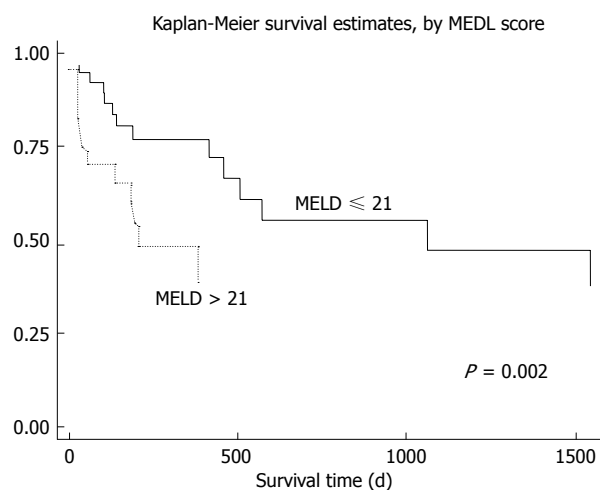
RESULTS

The different motives of admission of patients with cirrhosis were: ascites and oedema of the lower limbs (68.6%), jaundice (25.2%), haemorrhage of the digestive tract (15.1%) and hepatic encephalopathy. The study population comprised 172 patients, of which 69.8% were male. The mean age of the patients was 47.5 ± 13.54 years. 57% of the patients were with a CPT score stage C, 23.3% had renal failure and the mean MELD score was 20.9 ± 10.87. Hepatitis B was the main cause of cirrhosis in 45.3% of the case (Table 1). Over the study period (11 years), 54 out of 172 patients (31.4%) have died, of which 22 during the first three months and 32 the first 6 mo. The median and the mean duration of follow up were 206 and 226.6 ± 41.6 d, respectively. By univariate analysis, the following parameters have appeared to significantly influence mortality: age > 48 years old ($P < 0.023$); male gender ($P < 0.003$); CPT score stage C ($P < 0.016$); serum creatine > 1.5 mg/dL ($P < 0.001$) and MELD score over 21 ($P < 0.03$). Indeed, the mean CPT score has appeared significantly less elevated in living cirrhotics as compared to those who have died during the study period (10.2 ± 0.28 vs 11.3 ± 0.33 , respectively; $P = 0.02$), as it was with the MELD score (19.4 ± 0.83 vs 24.2 ± 1.85 , $P = 0.007$, respectively). Moreover mortality increased proportionally to the level



	Probability of survival (95% CI):	
	Child-Pugh-Turcott A-B (%)	Child-Pugh-Turcott C (%)
-3 mo	100	75.1 (64.5-82.9)
-6 mo	87.3 (73.9-94.1)	68.6 (57-77.7)
-12 mo	87.3 (73.9-94.1)	52.1 (38.8-63.9)
-24 mo	56.0 (35.9-72)	45.6 (31.4-58.8)

Figure 1 Survival according to the CPT score.



	Probability of survival (95% CI):	
	MELD ≤ 21 ¹ (%)	MELD > 21 ¹ (%)
-3 mo	93.3 (85.6-97.0)	71.2 (57.2-81.4)
-6 mo	81.7 (70.9-88.8)	66.1 (51.3-77.4)
-12 mo	78.0 (66.2-86.1)	49.0 (33.1-63.1)
-24 mo	56.3 (40.4-69.4)	39.2 (22.3-55.7)

Figure 2 Survival according to the MELD score. ¹Through value of the MELD score significantly associated with mortality.

Table 2 Relationship between mortality and parameters

Parameters	Mortality		
	Univariate analysis	Multivariate analysis	
	Death (%)	P	Hazard ratio (95% CI); P
Age (yr) ¹			
≤ 48	23.90	0.023	
> 48	40.00		
Gender			
Female	15.40	0.003	1.8 [0.96 - 3.24]; P = 0.07
Male	38.30		
Child-Pugh-Turcott			
A-B	21.60	0.016	3.3 [1.7 - 6.2]; P < 0.001
C	38.80		
Serum creatine (mg/dL)			
≤ 1.5	24.20	< 0.001	2.5 [1.4 - 4.3]; P = 0.001
> 1.5	55.00		
MELD ²			
≤ 21	25.50	0.030	2.9 [1.63 - 5.21]; P < 0.001
> 21	41.90		
Aetiology			
Virus B or C	32.90	0.670	
Both alcohol and virus ³	40.20		
Unknown	36.80		

¹Median age; ²Through value of the MELD score significantly associated with mortality; ³Aetiology both virus and alcohol.

of the CPT score (0% for stage A, 29.6% for stage B and 38.8% for stage C; $P = 0.001$), as it did with the MELD score (26.5% for MELD < 30, 42.9% for MELD between 30 and 40, 75% for MELD > 40; $P = 0.007$) (Table 2). By multivariate analysis, parameters such as CPT score stage C (HR=3.3 95% CI [1.7-6.2]) ($P < 0.001$); serum creatine > 1.5 mg/dL (HR = 2.5 95% CI [1.4-4.3]) ($P = 0.001$) and MELD score over 21 (HR = 2.9 95% CI [1.63-5.21]) ($P < 0.001$) have appeared to significantly influence mortality (Table 2). The overall survival at 3, 6 and 12 mo was 85.4% (95% CI: 78.5-90.1), 76.1% (95% CI:

Table 3 Stepwise evaluation to find out the optimal cutoff point for both CPT and MELD score (%)

	Sensitivity	Specificity	Positive predictive value	Negative predictive value
CPT score				
8	96.30	20.30	35.60	92.30
9	74.00	33.00	33.60	73.60
10 ¹	70.40	49.20	38.80	78.40
11	66.70	52.60	39.10	77.50
12	59.30	57.60	39.00	75.60
MELD score				
19	55.60	52.50	34.90	72.10
20	55.60	57.60	37.50	73.90
21 ²	48.20	69.50	41.20	74.60
22	44.00	69.50	40.00	73.20
23	44.40	76.30	46.20	75.00

¹Optimal cutoff point for CPT (Child-Pugh-Turcott) score; ²Optimal cutoff point for MELD (Model for End-stage Liver Disease) score.

67.7-82.6) and 67% (95% CI: 57.3-75), respectively. The median and the mean survival time were 142.6 and 318 + 45.1 d, respectively. When the CPT score was considered, survival at 1 year was just 52.1% for CPT score stage C as compared to CPT stage A-B which was over 85% (Figure 1). A MELD score over 21 was synonymous of 50% of survival at 1 year as compared to a MELD score less than 21 for which survival was about 80% (Figure 2). A cut off point of 10, corresponding to the very least value of the CPT score stage C, has been found optimal to predict sensitivity (74%), specificity (49.2%), positive predictive value (38.8%) and negative predictive value (78.4%). A cut off point of 21 for the MELD score has been found optimal to predict sensitivity (48.2%), specificity (69.5%), positive predictive value (41.9%) and negative predictive value (74.6%) (Table 3). However, when the performance of the two scores was

Table 4 Comparison between The Area Under the Curve (AUC) of the CPT score and the MELD score in predicting survival at 3, 6 mo

Survival	Pronostic score	AUC (95% CI)	P
At 3 mo	CPT	0.72 (0.64-0.80)	0.68
	MELD	0.75 (0.62-0.88)	
At 6 mo	CPT	0.64 (0.54-0.74)	0.67
	MELD	0.62 (0.49-0.74)	
At 12 mo	CPT	0.69 (0.60-0.78)	0.38
	MELD	0.64 (0.53-0.75)	

CPT: Child-Pugh-Turcotti; MELD: Model for End-stage liver disease.

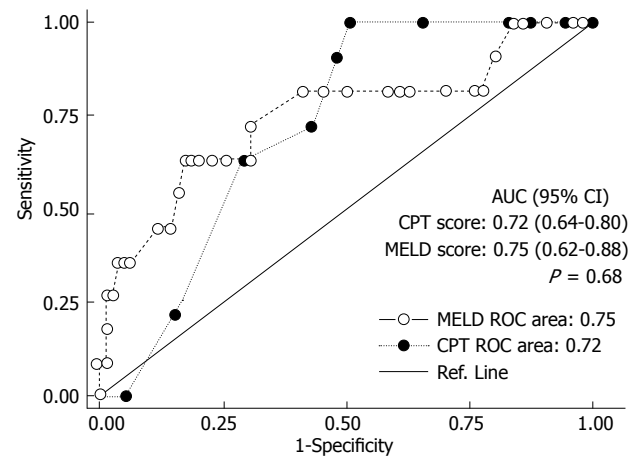
compared at 3, 6 and 12 mo, no significant difference could be found between them. Moreover, the correlation coefficient between the two scores was 0.57 ($P < 0.001$) (Table 4 and Figure 3).

DISCUSSION

About 60% of our patients have displayed a CPT score stage C that amounts to severe liver disease. Hepatitis B has been the main cause of cirrhosis in our study population. The main factors that have appeared to influence mortality were a CPT score stage C (with an optimal cutoff point of 10), renal failure that was present in 1/4 of the patients, and a MELD score over 21. The performances of the two scores were comparable.

Renal failure occurring in the setting of cirrhosis has widely been reported to represent an independent risk factor for mortality^[2-6]. However, the CPT^[1] score that has been used so far to appreciate prognosis in patients with cirrhosis does not take into account the renal function. This has led, therefore, to the elaboration of the MELD score which formula encompasses serum creatine for the evaluation of survival in patients with cirrhosis^[11]. The performance of the two scores has been compared in several studies with conflicting results: some studies^[11,18,22,25-27,29] have showed superiority of the MELD score over the CPT score in predicting survival in patients on the transplantation waiting list or in patients awaiting Transjugular Intrahepatic Portosystemic Shunt (TIPS), or even in patients with acute alcoholic hepatitis, while others have found the two score to be comparable^[13,14,18,20,21]. Indeed, in the study by Zhang *et al.*^[27], the area under the curve (AUC) was significantly more with the MELD score than the CPT score: 0.95, 0.85 and 0.83 for the MELD and 0.70, 0.66 and 0.61 for the CPT score ($P < 0.05$) at 3, 6 and 12 mo, respectively. In the study by Papatheodoridis *et al.*^[28] analysing a cohort of 102 decompensated cirrhotics, the AUC as determined by the MELD score was comparable to that of the CPT score in predicting survival at 3, 6, 12 mo: 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 CPT score. And a recent review by Cholongitas *et al.*^[31] has highlighted the lack of a clear cut superiority of the MELD score over the CPT score in predicting mortality of cirrhotic patients before and after liver transplantation.

The present study has showed that the two scores were also comparable as the AUC was: 0.75, 0.62, and 0.64 for the MELD score and 0.72, 0.64, 0.69 for the CPT score at

**Figure 3** Comparison between AUROC of the CPT score and of the MELD score in predicting survival at 3 mo. CPT: Child-Pugh-Turcotti; MELD: Model for End-stage liver disease; Ref. Line: Reference line.

3, 6, and 12 mo, respectively. Moreover, the through 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, 17 and 18 in the Angermayr^[24], Cestron^[32] and Ferral^[25] study, respectively. This could be attributed to the fact that most of our patients were admitted a very late stage of the disease, explaining an elevated mean and median MELD score. The retrospective nature of our study has led to the exclusion of many patients for missing data. Should these patients have been recruited, different findings as the one reported might have been found. However, the present findings could easily be extrapolated to any of our patients since the epidemiological profil of the 172 recruited patients represent the one currently encountered in our daily practice. Our study, which represents the only of its kind to be performed in black African patients with cirrhosis, appears to be of a great interest. Indeed, our population characteristics are quite different from what are currently reported in western countries since our patients are much younger with a diagnosis of cirrhosis made at a very late stage of the disease and hepatitis B being the main cause of cirrhosis. Moreover, the high prevalence of hepatitis B virus in an endemic country, like the Ivory Coast, is often responsible for contamination at birth and in infancy, leading to chronic hepatitis in 30%-50% (when contamination take place in infancy) to 90% (when contamination take place at birth) of the case^[34-40]. 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 insurance coverage, delay in hospital visit because of financial problems or cultural considerations. Consequently, few interventions could be offered to these patients as liver transplantation or endoscopic and/or radiological treatments are not currently available in our country. Inversely, Hepatitis C virus and alcohol remain the main causes of cirrhosis in western countries^[40-42]. Contamination by hepatitis C virus occurs in adult age and chronic hepatitis related to alcohol represents a disease of adult patient.

Patients with cirrhosis are diagnosed at a very late

stage of the disease. Consequently, mortality is elevated. Renal and liver failures represent independent risk factors of mortality. In the present study, the performance of the MELD score has appeared comparable to that of the CPT score which remains the primary tool to assess patients in the daily practice. The improvement in the MELD score predicting survival ability over the CPT score may necessitate the incorporation in its determination of several others factors such as age, and population characteristics to allow the universal utilizability of this equation. The present study has indeed suggested the impact of the population characteristics on the MELD score level. The use of the CPT score in association with serum creatine as proposed by Angermayr^[24] could also be currently performed in daily practice in order to also improve its predicting survival ability.

COMMENTS

Background

Renal failure occurring in the setting of cirrhosis is an independent risk factor of mortality. The Child-Pugh-Turcotte (CPT) score has usually been used to assess the prognosis of patients with cirrhosis. Formulas devoted to include the renal function in the determination of the CPT score have not gained wide acceptance. The Model for End-Stage Liver Disease (MELD) score which encompasses renal function and other factors known to influence mortality in cirrhotic patients has also been found adequate to predict mortality in patients awaiting liver transplantation. The MELD score has thus far been used in the USA for liver graft allocation instead of the CPT score.

Research frontiers

The superiority of one score over the other is subjected to debate as studies comparing the two scores have yielded conflicting results.

Innovations and breakthroughs

Studies performed so far were mostly in western populations, with few in Asian. The present study represents the first of its kind in black Africans. In Africa the main cause of cirrhosis is hepatitis B virus, inversely to hepatitis C and alcohol in western countries. Affecting patients are much younger. Cirrhosis is diagnosed at a very late stage and very little can be done to prolong life of the patients, explaining very high mortality related to it. No difference has been found between the performance of the two scores. However, the optimal cut-off point of the MELD score that is determined from our study appears much higher than any of what that has been published to date.

Applications

The improvement in the MELD score predicting survival ability may necessitate the incorporation in its formulation of several other factors including population characteristics to allow the universal applicability of this equation. Consequently, the setting up of an international collaborative study appears urgent than ever.

Terminology

Cirrhosis: End-stage liver disease. Renal failure: Kidney dysfunction amounting to serum creatine value more than 1.5 mg/dL. CPT score: Five parameters are used to calculate the CPT score. These are hepatic encephalopathy, ascites, and prothrombin in percentage, serum albumin in g/L and bilirubin in mg/L. Each parameter is affected a number going from 1 to 3 depending on its degree of impairment, so that the very least score amounts to 3 and the very most to 15. MELD score: The MELD score is determined through the following equation: $[9.57 \times \text{Loge creatine (mg/dL)} + 3.78 \times \text{Loge bilirubin (mg/dL)} + 11.20 \times \text{Loge INR} + 6.43]$. Its value appears to vary from one study to another, depending probably to the population characteristics. Optimal cut-off point: The value of the equation that yields the best sensitivity, specificity, positive predictive value and the negative predictive value.

Peer review

The authors conducted a retrospective study to compare the ability of the CPT and

MELD scores to predict mortality in a cohort of black patients with cirrhosis. The key findings of the study are that the CPT and MELD scores had similar predictive ability. Based on the fact that the CPT is easier to compute than the MELD score, the authors recommend the CPT over the MELD score in blacks with cirrhosis. Although not entirely novel, the study does provide interesting and important findings.

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