

Correlation between MELD and UNa/K ratio in predicting renal dysfunction in cirrhotic patients

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ABSTRACT

Background: Renal dysfunction is one of the dreaded complications of cirrhosis. MELD is a validated chronic liver disease (CLD) severity scoring system. Urinary (U) Na/K ratio closely correlates with renal dysfunction in terms of low GFR in cirrhotic patients. Patients and Methods: All consecutive patients with decompensated cirrhosis between the age of 18 to 70 years, of either gender, presenting in the outpatients' department of Sindh Institute of Urology and Transplantation, Karachi, from June 2015 to June 2017 were included. The MELD score was calculated and the UNa/K ratio less than 1 was taken as surrogate marker of renal dysfunction. Statistical analysis was performed by SPSS (version 20.0). Results: A total of 71 patients were enrolled. The mean age was 43.79 years and majority were male (67.6%). The most common cause of liver cirrhosis was HCV, found in 42 (59.2%) patients. The mean CTP score was 10.48 ± 2.069 (range: 6-14) with majority of the patients following in class C, that is, 48 (67.6%). Mean MELD score was 21.75 ± 8.96 (range: 8-43). In 57 patients (80.3%), MELD score was > 15.The mean serum creatinine and mean serum sodium were 1.5 ± 1.1 mg/dl (range: 0.37-5.3) and 133.79 ± 6.9 mmol/L (range: 112-152), respectively. Mean urinary sodium and urinary potassium were 38.60 ± 46.64 mmol/L (range: 5-181) and 38.15 ± 23.9 mmol/L (range: 4.3-112), respectively. In majority of study population, UNa/K ratio was below 1, that is, in 52 patients (73.2%). Statistically significant correlation was documented between MELD score and UNa/K ratio (γ = 0.34, P = 0.004). **Conclusion**: The inverse correlation between MELD scores and UNa/K ratio indicates that patients with CLD and higher MELD scores might have renal dysfunction. This finding however should be corroborated by large scale studies.

Key words: decompensated, cirrhosis, renal dysfunction, MELD score, urinary electrolyte

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INTRODUCTION

Renal dysfunction is broadly defined as decline in renal perfusion associated with decrease glomerular filtration rate (GFR) < 60ml/min/1.73 m² and sodium excretion less than 10 mEq/day.^[1] It is one of the dreaded complications of cirrhosis^[2,3] and is a clinical consequence of peripheral arterial vasodilatation and hyperdynamic circulation caused by portal hypertension.^[4] The incidence of renal dysfunction in cirrhosis is approximately 8% with ascites but the prevalence increases with advancement of the disease.^[3]

Model of End Stage Liver Disease (MELD) is a validated chronic liver disease (CLD)

severity scoring system that includes serum bilirubin, serum creatinine, and the international normalized ratio (INR). An increasing MELD score is associated with progression of hepatic dysfunction, severity and three-month mortality risk. [5] MELD is also used to prioritize patients on liver transplant waiting list. It is considered better than the Child-Turcotte-Pugh (CTP) score, in part, because of the inclusion of creatinine, which reflects the prognostic impact of renal function. [6]

Evangelos *et al.* reported that urinary (U) Na/K ratio closely correlates with renal dysfunction in terms of low GFR in cirrhotic patients.^[7] As creatinine is a component of MELD score and it is routinely ordered in

decompensated cirrhotic patients, we aimed to determine the correlation between MELD and UNa/K ratio in predicting renal dysfunction in this population.

PATIENTS AND METHODS

All consecutive patients with decompensated cirrhosis, aged between 18 years and 70 years, of either gender, presenting in the outpatient department (OPD) of Sindh Institute of Urology and Transplantation (SIUT), Karachi, Pakistan from June 2015 to June 2017 were included. Cirrhosis is a chronic degenerative disease in which normal liver cells are damaged and are then replaced by scar tissue. ^[8] Decompensated cirrhosis was defined on radiological findings, history of hematemesis and/or clinical evidence of encephalopathy. MELD score was calculated by following formula on online calculator. ^[9]

MELD = 3.78 [in serum bilirubin (mg/dL)] + 11.2[in INR] + 9.57 [in serum Creatinine (mg/dL)] + 6.43

Urinary (U) Na/K ratio less than 1 was taken as the surrogate marker of renal dysfunction. [7]

Patients with evidence of intrinsic renal diseases, like proteinuria, hematuria, urinary cast and so on, and patients with hepatocellular carcinoma, infection, on diuretics therapy, ultrasonographic findings of obstructive uropathy or small sized kidneys and patients with history of liver transplant, were excluded from the study. After taking informed consent, blood sample for complete blood count, liver function tests, serum albumin, INR and serum creatinine was collected. Urinary sample for UNa and K were also collected on the same day.

Statistical analysis

Statistical analysis was performed by SPSS (version 20.0). Mean and standard deviation were calculated for continuous variables, while frequencies and percentages were calculated for categorical variables. Spearman's correlation coefficient was calculated to document the strength of association between UNa/K ratio and MELD score. P < 0.05 was considered significant for all statistical analysis.

RESULTS

A total of 71 patients were enrolled during the study period. Mean age of the study population was 43.79 ± 13.65 years (range: 19–70 years) and majority were male (67.6%). Clinical characteristics and laboratory parameters of the study population are shown in Table 1. The most common cause of liver cirrhosis was HCV, found in 42 patients (59.2%), followed by HBV, in 23 patients (32.5%). Wilson disease was documented as the least common cause, that is,

3 (4.2%). Mean CTP score was 10.48 ± 2.069 (range: 6–14) with majority of patients in class C, that is, 48 (67.6%). Mean MELD score was 21.75 ± 8.96 (range: 8–43). In 57 patients (80.3%), MELD score was greater than 15.

Mean serum creatinine and serum sodium were 1.5 ± 1.1 mg/dl (range: 0.37–5.3) and 133.79 ± 6.9 mmol/L (range: 112–152), respectively. Mean urinary sodium and urinary potassium were 38.60 ± 46.64 mmol/L (range: 5–181) and 38.15 ± 23.9 mmol/L (range: 4.3–112), respectively. In majority of study population, UNa/K ratio was below 1, that is, in 52 (73.2%). Correlation between MELD score and UNa/K ratio was assessed using the Spearman's correlation, as the data was skewed. Forty six patients had MELD score more than 15 with UNa/K ratio less than 1. Statistically significant correlation was documented between MELD score and UNa/K ratio (r = 0.34, P = 0.004). (Table 2)

DISCUSSION

Cirrhosis represents a late stage of progressive hepatic fibrosis characterized by distortion of the architecture and formation of regenerative nodules. It is usually considered to be irreversible in its later stages, at which point the only option may be of liver transplantation. However, reversal of cirrhosis in its earlier stages, has been recognized in several forms of liver disease following treatment of the underlying cause.^[10]

Multiple etiological agents have been identified that lead to liver cirrhosis varying from infection to mechanical (biliary) obstruction. [10] According to Pakistan Medical Research Council (PMRC) data, HCV and HBV are common causes of hepatitis accounting for 4.8% and 2.5%, respectively, in Pakistani population. [11] Similar to Nadeem *et al.* and Shah *et al.*, we also observed HCV as the single most common cause of liver disease in our population (59.2%). [12,13]

CTP and MELD scores are two widely used scoring systems in CLD patients, not only to assess disease severity but also to estimate survival. MELD score is also used to prioritize patients on liver transplant waiting list. Mean CTP score in our study population was 10.4 ± 2 . while mean MELD score was 21.75 ± 8.9 .

Patients with cirrhosis are susceptible to a variety of complications that reduce their life expectancy. Renal dysfunction is one such complication that is characterized by impaired natriuresis, decreased free water clearance, and decreased GFR.^[3] In the initial stages of cirrhosis, to maintain effective circulatory volume, cardiac output raises to balance the decrease in systemic vascular resistance. But with disease progression, this compensation becomes ineffective. In

Age (years), mean ± SD	43.79 ± 13.65			
Gender, n (%)	Male: 48(67.7%), Female: (32.3%)	Male: 48(67.7%), Female: (32.3%)		
Etiology, n (%)				
HC	34 (47.7)			
НВ	7 (9.9)	7 (9.9)		
HB + HD	8 (11.3)	8 (11.3)		
HB + HC	8 (11.3)	8 (11.3)		
AIH	4 (5.6)	4 (5.6)		
WD	3 (4.2)			
Cryptogenic	7 (9.9)			
Mild ascites	15 (21.1%)			
Moderate ascites	30 (42.3%)			
Severe ascites	14 (19.7%)	14 (19.7%)		
Laboratory Parameters, mean \pm SD (range)				
Serum platelet (×10³ mm)	96 ± 61 (14 - 277)	96 ± 61 (14 - 277)		
Serum creatinine (mg/dL)	1.5 ± 1.11 (0.37 - 5.3)	1.5 ± 1.11 (0.37 - 5.3)		
Serum sodium (mmol/L)	133.7 ± 6.9 (112-152)	133.7 ± 6.9 (112-152)		
Serum bilirubin (mg/dL)	5.8 ± 6.3 (0.19 - 29)	5.8 ± 6.3 (0.19 - 29)		
Serum albumin (mg/dL)	1.8 ±0.59 (0.80 - 5)	1.8 ±0.59 (0.80 - 5)		
Mean urinary sodium (mmol/L)	38.6 ± 46.6 (5-181)	38.6 ± 46.6 (5-181)		
Mean urinary potassium (mmol/L)	38.1 ± 23.9 (4.3-112)	38.1 ± 23.9 (4.3-112)		
СТР	10.48 + 2.069 (Range 6-14)	10.48 + 2.069 (Range 6-14)		
MELD	21.75 + 8.96 (Range 8-43).	21.75 + 8.96 (Range 8-43).		
UNa/K	≥ 1 19 (26.8%)			
	< 1 52 (73.2%)			

AIH: Autoimmune hepatitis; CTP: Child Turcotte Pugh score: HC: Hepatitis C; HB: Hepatitis B; HD: Hepatitis D; MELD: model end stage liver disease; UNa/K: urinary sodium to potassium ratio; WD: Wilson disease

Table 2: Correlation between MELD score and urinary sodium to potassium ratio							
Less than 15		MELD Score		<i>P</i> -value			
		More than 15					
UNa/K	≥ 1	8	11	0.004			
	< 1	6	46				

MELD: Model end stage liver disease; UNa/K: urinary sodium to potassium ratio

order to maintain hemodynamic circulation, neurohormonal vasoconstriction system is activated, which includes renin angiotensin aldosterone system, the sympathetic nervous system and non-osmotic hypersecretion of antidiuretic hormone (ADH). Thus, sodium retention occurs leading to ascites and edema, free water retention, and renal vasoconstriction. The reduced renal blood flow causes fall in GFR and ultimately kidney failure.^[14]

Renal dysfunction is usually assessed by serum creatinine level and it is a key component in MELD score. [15] Optimal management of renal dysfunction in cirrhosis is extremely important as it frequently complicates the clinical course of advanced liver disease and is invariably associated with poor clinical outcomes. [3] Gomes *et al.* showed in a study that serum creatinine in MELD score had no impact as

a prognostic tool for acute kidney injury (AKI) in liver transplant patients, despite its high impact on MELD calculation. [16]

Patients with decompensated cirrhosis, have reduced 24-hour sodium excretion due to consequences of portal hypertension. Da Silva et al. suggested significant correlation between 24-hour urinary sodium to spot UNa/K (UNa/K) ratio. ^[17] The author documented that UNa/K ratio at cut-off below 1 predicts low urinary sodium excretion, that is, less than 78 mmol/day. Evangelos et al. reported renal dysfunction and high mortality in decompensated cirrhotic patients with spot UNa/K ratio less than 1. ^[7] We have found an inverse correlation between UNa/K ratio and MELD score, but its prognostic impact in our study population was not assessed.

In our study population, 80.3% patients had MELD score > 15, while UNa/Kratio < 1 was observed in 73.2% patients. Similar to Da Silva *et al.*,^[17] we also found statistically significant inverse correlation between UNa/K ratio and MELD score (P = 0.004).

There are certain limitations in the study. These include its single center origin and small sample size. We also did not perform longitudinal follow-up of this cohort of patients. Despite the above limitations, this study provides a basis for performing multicenter prospective study on a large number of patients.

CONCLUSION

In conclusion, the inverse correlation between MELD scores and UNa/K ratio indicates that patients with CLD and higher MELD scores might have renal dysfunction. This finding, however, should be interpreted cautiously because of the small sample size to give adequate power for stratified analysis.

Conflict of Interest

None declared.

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