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Renal Duplex Doppler Ultrasound In Elderly Patients With Liver Cirrhosis

KEYWORDS: renal resistive index, liver cirrhosis, elderly.

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ABSTRACT *Objective: To study the renal resistive index measured by duplex doppler ultrasound in elderly patients with compensated and decompensated cirrhosis.*

Methods: 100 elderly patients aged 60 years and older were divided as group 1 with compensated cirrhosis and group 2 with decompensated cirrhosis. Renal duplex ultrasound was done to both groups. Renal resistive index (RRI) was measured bilaterally, and then compared in both groups.

Results: Patients with liver cirrhosis have higher RRI values, and the RRI is significantly higher in patients with decompensated cirrhosis in comparison to patients with compensated cirrhosis.

Conclusion: Renal duplex ultrasound is a non-invasive, simple and easy method to study intra-renal hemodynamics in patients with liver cirrhosis that predicts patients at risk of hepatorenal impairment. The RRI increases with the degree of hepatic decompensation.

Introduction

Patients with liver cirrhosis develop circulatory dysfunction characterized by disturbance in systemic and renal hemodynamics. Renal hemodynamic changes with intense intrarenal vasoconstriction begin early in the course of liver disease before changes in the level of serum urea and serum creatinine [1]. Decreased peripheral vascular resistance, with the activation of compensatory mechanisms [the sympathetic nervous system (SNS), renin-angiotensin-aldosterone system (RAAS) and anti-diuretic hormone (ADH)] lead to renal vasoconstriction [2].

The renal resistive index (RRI) is the most frequently used parameter to assess intra-renal resistance, and is calculated based on intra-renal duplex Doppler ultrasound measurements. Renal RI was reported to be higher in cirrhotic patients than in healthy controls [3].

The RI also provides useful information for the prognosis and management of cirrhotic patients. According to Gotzberger et al. study, elevated RIs may even disclose progress of the liver disease before changes in laboratory results and cirrhotic patients with elevated RIs have impaired short and long-term survival. Thus RI may help identify high-risk patients that require special therapeutic care [4].

Subjects and Methods

Study population and design

Case-control study was conducted on 100 elderly participants aged 60 years and above, after obtaining an informed consent. All participants were recruited from Ain Shams University hospitals, Cairo governorate, Egypt.

Group 1:

Fifty elderly patients (both males and females), diagnosed to have compensated cirrhosis (absence of major previous complications i.e.: severe ascites, jaundice, hepatic encephalopathy, and variceal gastrointestinal hemorrhage).

Group 2:

Fifty elderly patients (both males and females), diagnosed to have decompensated chronic liver disease (presence of any of the above criteria, plus hyperbilirubinemia (0.2-1.2 mg/dL), hypoalbuminemia (3.5-5.5 gm/dL), and presence of peripheral edema of non-cardiac or renal origin).

Exclusion criteria: history of cardiovascular diseases (hypertension, ischemic heart disease, heart failure), severe anemia, baseline ECG with major abnormalities (left bundle branch block and left ventricular hypertrophy), chronic kidney disease, and patients with diagnosis of hepatorenal syndrome.

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Tools of assessment
Both groups were subjected to:

- Comprehensive geriatric assessment including medical history and full examination.
- Liver function tests: including, albumin, total proteins, prothrombin time (PT), aspartate transaminase (AST), alanine transaminase (ALT), total bilirubin, and direct bilirubin levels.
- Pelvi-abdominal ultrasound: as a non-invasive and readily available method for diagnosis of liver cirrhosis.
- Hepatitis viral markers: to detect viral hepatitis as an etiology of cirrhosis. (Hepatitis B virus s Antigen (HBVs Ag) and hepatitis C virus Antibody (HCV Ab)).
- Renal function tests: including, blood urea nitrogen (BUN), serum creatinine, and creatinine clearance (estimated using Cockcroft-Gault formula).
- Renal arterial duplex study: Colored Doppler ultrasonography using a high frequency probe was used for the sonographic assessment of renal dysfunction. The RI ([peak systolic velocity- end diastolic velocity] / peak systolic velocity) was measured. Values > 0.70 are considered high.

Statistical analysis:

- IBM SPSS statistics (V, 23.0, IBM Corp., USA, 2015) was used for data analysis. Data were expressed as Mean±SD for quantitative parametric measures in addition to Median Percentiles for quantitative non-parametric measures and both number and percentage for categorized data.

The following tests were done:

1. Comparison between two independent mean groups for parametric data using Student t test.
2. Comparison between two independent groups for non-parametric data using Wilcoxon Rank Sum test.
3. Ranked Spearman correlation test to study the possible association between each two variables among each group for non-parametric data.

- The probability of error at below 0.05 was considered significant.

Results
The sample of this study included 100 elderly patients, aged 60 years and above. Subjects were divided into two groups: Group 1 (patients with compensated cirrhosis), and group 2 (patients with decompensated cirrhosis).

Regarding the socio-demographic characteristics, both study groups were matched for age, gender, body mass index (BMI), and smoking habit. Also the two groups showed no significant difference regarding the duration of liver cirrhosis and the number of other medical comorbidities.

Regarding renal duplex study, group 2 patients showed higher right and left RI, with significant difference for the right RI between the two groups (p-value of 0.033).

MELD score had a significant positive correlation with RI of both kidneys in both study groups.

Discussion
The aim of this study is to evaluate renal functions in cirrhotic elderly patients via studying the RI in compensated and decompensated cirrhotic patients.

The etiology of liver cirrhosis in the studied cases was largely due to hepatitis C virus (HCV), with a percentage of 86%. In the rest of cases, cirrhosis was due to Bilharziasis, hepatitis B virus (HBV), and coinfection with both HCV & HBV.

Egypt shows the highest HCV prevalence in the world. High rates of infection are observed among all age groups although there are regional differences in the average overall prevalence [5]. The prevalence ranges from 10% to 20% of the general population, and rural populations show a higher prevalence than urban ones [6].

Renal vasoconstriction has been observed in several series of cirrhotic patients. The decrease in peripheral vascular resistance in cirrhosis, together with the activation of compensatory mechanisms –[the sympathetic nervous system (SNS), the renin- angiotensin-aldosterone system (RAAS), and anti-diuretic hormone (ADH)]- lead to renal vasoconstriction. The intra-renal resistance is assessed via measuring the RRI.

On studying renal functions in relation to cirrhosis, this study showed that, cirrhotic patients had higher right and left RI, with mean values ±SD of (0.69 ±11) for both right and left RI in patients with compensated cirrhosis, and (0.74 ± 0.12), (0.73 ± 0.13) for right and left RI, respectively, in patients with decompensated cirrhosis, with a statistically significant difference between the two groups (p value of 0.03, 0.06 for right and left RI, respectively). Similar results were found by Abdel-bary et al. [3], Wang et al. [7], Ustundag et al. [8], and Cazzaniga et al. [9].

Moreover, in this study, renal RI also correlated with the severity of liver disease, as MELD score was found to be significantly correlated with RI of both kidneys in compensated and decompensated groups. These results are similar to results of Culafic et al. [10], Umbro et al. [11], and Popov et al. [12].

Conclusion and recommendations
Patients with liver cirrhosis have high RRI, and this is significantly higher among decompensated group when compared to the compensated one.

MELD score is significantly correlated with RI of both kidneys in compensated and decompensated patients. Creatinine clearance is significantly lower in patients with decompensated cirrhosis.

Renal functions and renal arterial resistive index are affected in patients with liver cirrhosis. Evaluation and follow up of creatinine clearance, and measuring renal resistive index is recommended in cirrhotic elderly patients.

Further research is needed to explore the effects of liver cirrhosis on renal functions especially in older patient groups.

CONFLICT OF INTEREST
None

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Table (1): Baseline characteristics of the study groups.

		Group 1		Group 2		t	p-value
Age (yrs.)		65.81 ± 3.794		64.98 ± 4.827		0.949	0.345
Liver cirrhosis duration (yrs.)		6.789 ± 2.645		7.792 ± 3.421		-1.631	0.106
BMI		33.947 ± 9.648		33.103 ± 7.391		-2.025	0.054
		N	%	N	%	Chi- Square tests **Value P**	
Gender	**Male**	25	50%	28	56%	1.054	0.305
	Female	25	50%	22	44%		
Smoking	Non smoker	37	0.74%	25	50%	3.858	0.145
	Ex- smoker	8	0.16%	12	0.24%		
	Smoker	5	0.1%	13	0.26%		
No. of comorbidities	1	8	0.16%	10	0.2%	4.329	0 .228
	2	23	0.46%	19	0.38%		
	3	15	0.3%	19	0.38%		
	4	4	0.08%	2	0.04%		
Etiology of Cirrhosis	HBV	2	0.04%	2	0.04%	1.167	0.761
	HCV	44	0.88%	42	0.48%		
	HBV&HCV	0	0%	2	0.04%		
	Bilharziasis	4	0.08%	4	0.08%		

Table (2): Comparison between study groups as regards renal resistive index (RI)

	Group 1	Group 2	t	p-value
Right RI	0.69 ± 0.11	0.74 ± 0.12	-2.166	0.033
Left RI	0.69 ± 0.11	0.74 ± 0.13	-1.903	0.06

Table (3): Correlation between MELD score and renal resistive index in study population.

	MELD Score	
	r	p-value
Right RI	0.328	0.018
Left RI	0.288	0.039

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