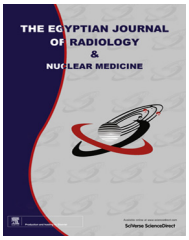
The Egyptian Journal of Radiology and Nuclear Medicine (2014) **45**, 1275–1283

Egyptian Society of Radiology and Nuclear Medicine

The Egyptian Journal of Radiology and Nuclear Medicine

www.elsevier.com/locate/ejrnm
www.sciencedirect.com



ORIGINAL ARTICLE

Apparent diffusion coefficient of renal parenchyma and color Doppler ultrasound of intrarenal arteries in patients with cirrhosis related renal dysfunction

Mohamed M Hefeda *, Khaled A Abo Dewan, Mahmoud A Dawoud

Faculty of Medicine, Tanta University, Egypt

Received 10 January 2014; accepted 3 April 2014
Available online 28 April 2014

KEYWORDS

Diffusion weighted imaging;
Hepatorenal syndrome;
Color Doppler ultrasound;
Liver cirrhosis

Abstract *Objectives:* The aim of this work was to study the renal hemodynamic changes which occur with liver cirrhosis using diffusion weighted magnetic resonance imaging (DW-MRI) and renal color duplex Doppler ultrasound.
Patients and methods: Patients were divided into four groups: Group A: 15 cirrhotic patients with compensated liver cirrhosis, Group B: 15 cirrhotic patients with refractory ascites, Group C: 15 cirrhotic patients with hepatorenal syndrome, Group D: 10 healthy persons as a control. The apparent diffusion coefficient (ADCs) of the kidneys was calculated using low *b* values (ADC_{low}) and high b values (ADC_{high}). Color Doppler ultrasound was performed in interlobar and arcuate arteries to calculate resistive index (RI) and pulsatility index (PI) in all patients.
Results: ADC_{low} showed a statistically significant difference between patients with hepatorenal syndrome and other groups. Using ADC_{high} no significant difference between different groups was noted. RI and PI of both interlobar and arcuate arteries were significantly higher in all the patient groups than the control group ($P < 0.0001$). RI and PI of both interlobar and arcuate arteries were significantly higher in patients with hepatorenal syndrome.
Conclusion: Liver cirrhosis, even in the presence of refractory ascites, did not affect the ADC value of renal parenchyma, however ADC value is affected in renal parenchyma of patients with hepatorenal syndrome. Duplex-Doppler ultrasound of intrarenal arteries enables the early detection of renal hemodynamic disturbances in patients with liver cirrhosis.

1. Introduction

The first description of disturbances in renal function in chronic liver diseases was made by Frerichs and Flint in two independent reports from the late nineteenth century (1). The impairment of kidney function is caused by severe renal

* Corresponding author. Tel.: +20 124569391.
E-mail addresses: mohamedhefeda@yahoo.com, mohamedhefeda@gmail.com (M.M Hefeda).
Peer review under responsibility of Egyptian Society of Radiology and Nuclear Medicine.

0378-603X © 2014 The Egyptian Society of Radiology and Nuclear Medicine. Production and hosting by Elsevier B.V.
Open access under CC BY-NC-ND license. http://dx.doi.org/10.1016/j.ejrnm.2014.04.003

arterial vasoconstriction due to complex changes in systemic hemodynamics (2) [Fig. 1] (3).

Retrospective studies have identified hepato-renal syndrome (HRS) in about 17% of the patients with ascites admitted to hospital and in more than 50% of deaths occurring among cirrhotic patients with liver failure (4).

The apparent diffusion coefficient (ADC), as a quantitative parameter calculated from diffusion-weighted magnetic resonance images, combines the effects of capillary perfusion and water diffusion in the extracellular extravascular space. Therefore, diffusion-weighted magnetic resonance imaging (DW-MRI) can be used to differentiate normal from abnormal tissue structure and might be useful in characterizing various renal abnormalities (5).

DW-MRI of renal disease is an evolving field and previous investigators have tried to investigate its role in characterization of focal renal lesions, parenchymal disease and renal infections (6–11). To the best of our knowledge, no previous study investigated its role in diagnosis of renal dysfunction in cirrhotic patients.

Duplex Doppler ultrasonography of the kidneys is an easy and non-invasive method to assess blood flow and arterial vascular resistance as a parameter for vasoconstriction (12,13). The arterial resistance index is the most widely used parameter to estimate the arteriolar vascular resistance (14).

The aim of this work is to study the renal hemodynamic changes which occur with liver cirrhosis using DW-MRI and renal color Doppler ultrasound for prediction and diagnosis of hepatorenal syndrome.

2. Patients and methods

This study included 45 patients with liver cirrhosis (27 males and 18 females) as a purposive non-probability sample. They were selected from those admitted to the Internal Medicine Department. In addition 10 healthy persons were selected as a control group. Written consents were taken from all the patients after thorough explanation and understanding of the study.

The study subjects were classified into 4 groups:

Group A: included 15 cirrhotic patients with compensated liver cirrhosis and normal renal functions.
Group B: included 15 cirrhotic patients with refractory ascites, and normal renal functions.
Group C: included 15 cirrhotic patients with hepatorenal syndrome.
Group D: included 10 healthy persons as the control group.

Exclusion criteria for this study include patients with clinical or laboratory evidence of diabetes mellitus or hypertension and patients known to have nephropathies. There was no history of recent nephrotoxic drugs uptake in all of our study groups.

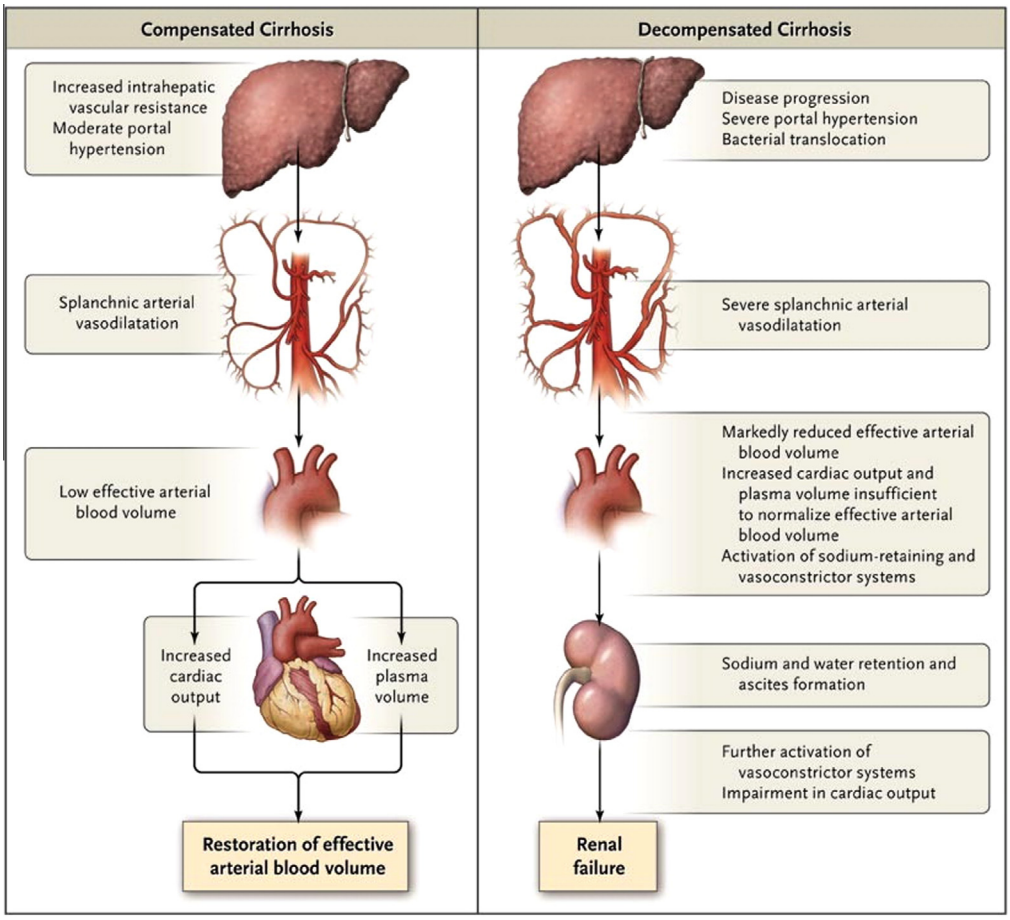


Fig. 1 Pathogenesis of circulatory abnormalities and renal failure in cirrhosis [adopted from Ginès and Schrier (3)].