

Sonographic Evaluation of the Hepato-Biliary System in Viral Hepatitis at Jos University Teaching Hospital.

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Authors' contributions: This work was carried out in collaboration among all authors. The author AJS, SMD, YFT, EAG designed the study and performed statistical analysis and the author AHA, AAS, EOI, HOK managed literature review analysis. All authors read and approved the final manuscript.

Abstract- BACKGROUND: Ultrasonography offers a non-invasive and cost effective method for evaluation and hepatobiliary surveillance in viral hepatitis. Two distinct ultrasound patterns are often detected: Accentuated brightness and more extensive demonstration of the portal vein radicle in background of decreased echogenicity of the liver in acute hepatitis. While chronic hepatitis reveals; decreased brightness and number of portal vein radicle walls and overall increased liver echogenicity. Therefore, the aim of the present study was to detect the changes in the hepatobiliary system on ultrasound in viral hepatitis and the significance of these findings.

MATERIALS AND METHODS: This is a cross-sectional screening study of 322 patients in Jos, Plateau State, and Northern part of Nigeria. All participants were serologically tested for viral hepatitis B and C, and subsequently scanned.

All examinations were performed using LOGIC 5, a real-time ultrasound machine using a 5MHZ curvilinear transducer and ultrasound coupling gel. Results obtained were statistically analyzed using SPSS software version 17, which were presented in tables.

RESULTS: Out of 322 patients, 121 were males and 201 were females. Maximum number of infection was within age group of 20-39 years. Out of 121 males, 46(38%) were infected with HBV while 47 (23.4%) of the 201 females had HBV with p-value of 0.005. Only 1 male (0.8%) and 5(2.5%) of the females tested positive for HCV with $p = 0.286$. One patient with HBV had decreased hepatic parenchymal echogenicity. Eighty three (29.5%) of HBV patients had normal liver echogenicity. Similarly, 5(1.8%) HCV patients had normal liver echogenicity with p-value of 0.926. 7 (31.8%) of patients had coarse liver echo texture $p = 0.753$. Eighty six (28.7%) of the 322 participants had normal liver echo texture. Moderate ascites was noted in one patient $P = 0.129$

CONCLUSION: The notable imaging findings of viral hepatitis on ultrasound, includes; decrease parenchymal echogenicity and accentuation of portal vein radicles and ascites.

However, in early and uncomplicated viral hepatitis, ultrasound findings were normal in majority of the patients.

Index Terms- Viral hepatitis, ultrasound, hepatobiliary system

I. INTRODUCTION

Inflammation of the liver due to viral infection is referred to as viral hepatitis. Other agents, both infectious (ie, viral, bacterial, fungal, and parasitic organisms) and non-infectious (eg, alcohol, drugs, autoimmune diseases, and metabolic diseases) have been known to cause inflammation of the liver.^[1,2]

Viruses are the commonest cause of hepatitis and it often results from one of five viral agents: hepatitis A virus (HAV), hepatitis B virus (HBV), hepatitis C virus (HCV), the HBV-associated delta agent or hepatitis D virus, and hepatitis E virus^[1,2,3] (HEV). Infections caused by (HAV), (HBV), and (HCV) are by far the commonest. These three viruses can all result in acute disease with symptoms of nausea, abdominal pain, fatigue, malaise, and jaundice.^[4] Additionally, acute infection with HBV and HCV can lead to chronic infection. Patients who are chronically infected may go on to develop cirrhosis and hepatocellular carcinoma (HCC).^[2,4] Hence, the need for follow up and surveillance of these 2 viruses (HBV and HCV).

Ultrasonography offers a non-invasive, cost effective and readily available, method for evaluation and hepatic surveillance in viral hepatitis; hence its use in this resource limited setting.^[5] Two distinct ultrasound patterns are often detected. In acute hepatitis, the predominant findings were accentuated brightness and more extensive demonstration of the portal vein radicle walls and overall decreased echogenicity of the liver. Chronic hepatitis primarily revealed decreased brightness and number of portal vein radicle walls and overall increased liver echogenicity.^[6]

The aim of this study was to detect the changes in the hepatobiliary system in viral hepatitis and evaluate the significance of these ultrasound findings.

II. MATERIALS AND METHODS

STUDY AREA

Jos is the capital city of Plateau State. Plateau state has over 40 different ethnic groups. The 2006 Nigerian census put the population of Plateau State at 3,206,531, with a projected population of 4,200,442 in 2016.^[7,8] Jos University Teaching Hospital (JUTH) is one of the three teaching hospitals in the North-Central Zone of Nigeria. It serves as a referral center for the neighbouring states of Bauchi, Gombe, Benue, Kogi, Nassarawa, Taraba, Adamawa and parts of Kaduna State.

III. STUDY POPULATION AND DESIGN

This was a hospital-based Cross-sectional screening study that was done in the General outpatient department (GOPD); Jos University Teaching Hospital (JUTH), a tertiary health institution situated in the central part of Jos. A total of 322 volunteers attending the GOPD were recruited into the study during the hepatitis day celebration of 2015.

IV. INCLUSION CRITERIA

- Patients that consented to the study (abdominal ultrasound and viral serology)
- Patients who tested positive to either Hepatitis A and B serology.
- Viral hepatitis A and B patients on follow up.

V. EXCLUSION CRITERIA

- Subjects with decompensated liver disease
- Patients with known primary liver cell carcinoma
- Subjects who did not consent to participate in the study

VI. DATA ACQUISITION

The procedure was explained to all participants, and informed consent was obtained. A data sheet was completed for the all participants in which the ages, sex and alcohol consumption were obtained. All ultrasound examinations were done on GE Logiq 5 machine a real-time ultrasound machine fitted with a 5MHZ curvilinear transducer.

VII. IMAGING TECHNIQUE AND PARAMETERS

All subjects were scanned in supine and both lateral decubitus positions. Ultrasound findings were analyzed systematically for gall bladder (GB) distension, liver and splenic size, periportal cuffing, and ascites.

The liver was considered to be enlarged if the size was >15.5 cm in the midclavicular line. Spleen size >12 cm was considered as splenomegaly. Periportal cuffing was considered to be present

when there were increased brightness and clear visualization of portal vein radical walls. Partially distended or empty GB in the fasting state indicated the reduced volume of the GB. The gall bladder measuring > 10cm was considered dilated while GB wall showing diffuse and >3 mm was considered thickened.

VIII. STATISTICAL ANALYSIS

The data obtained from the structured questionnaire and imaging findings was entered into a computer to generate a computerized database for subsequent analysis and processing using SPSS version 22. Statistical parameters such as student's test were used for the association between different variables. P-value of 0.05 or less was considered statistically significant. The results were presented in the form of tables.

IX. ETHICAL CONSIDERATION

Ethical clearance was obtained from the general outpatient department as well as verbal informed consent from the participants. They were assured of confidentiality of information provided.

X. RESULTS

Only 322 participants met our inclusion criteria from the patients attending the general outpatient clinic. Out of 322 participants, 121 were males and 201 were females Table 1. Out of 121 males, 46(38%) were infected with HBV while 47 (23.4%) of the 201females had HBV with p-value of 0.005. Only 1 male (0.8%) and 5(2.5%) of the females tested positive for HCV with p = 0.286.

Majority of the infected individuals were young people with the age group of 20-29years, followed by 30-39years. There were more patients with hepatitis B virus (93persons) compared to hepatitis C viral infection (6persons)[Table 1and 2].

Table 1 Sex distribution of viral hepatitis B and C

Variable	Gender		P
	Male	Female	
Hepatitis B			
Positive	46(38.0)	47(23.4)	0.005
Negative	75(62.0)	154(76.6)	
Hepatitis C			
Positive	1(0.8)	5(2.5)	0.286
Negative	120(99.2)	196(97.5)	

Table 2. Age distribution of hepatitis infection in subjects

Variable	Age group						P
	<20	20-29	30-39	40-49	50-59	>59	
Hepatitis B							
Positive	3(25.0)	37(41.1)	24(25.5)	13(21.7)	11(23.4)	5(26.3)	0.093
Negative	9(75.0)	53(58.9)	70(74.5)	47(78.3)	36(76.6)	14(73.7)	

Hepatitis C							
Positive	0(0.0)	2(2.2)	2(2.1)	1(1.7)	0(0.0)	1(5.3)	0.787
Negative	12(100.0)	88(97.8)	92(97.9)	59(98.3)	47(100.0)	18(94.7)	

Only one patient with HBV show decreased hepatic parenchymal echogenicity $p=0.568$. Majority of HBV infected participants 83(29.5%) had normal liver echogenicity. Similarly, almost all the HCV infected individuals 5(1.8%) had normal liver echogenicity. Only 1(2.6%) showed hyper echoic liver parenchyma with p-value of 0.926 [Table 3].

Table 5a

Variables	Ascities			P
	Nil	Mild	Moderate	
Hepatitis B				
Positive	92(29.0)	0(0.0)	1(100.0)	0.129
Negative	225(71.0)	4(100.0)	0(0.0)	
Hepatitis C				
Positive	6(1.9)	0(0.0)	0(0.0)	0.953
Negative	311(98.1)	4(100.0)	1(100.0)	

Table 3. Relationship between viral hepatitis infection and hepatic parenchymal echogenicity.

Variables	Liver echo pattern			P
	Normal	Hyper-echoic	Hypo-echoic	
Hepatitis B				
Positive	83(29.5)	9(23.1)	1(50.0)	0.568
Negative	198(70.5)	30(76.9)	1(50.0)	
Hepatitis C				
Positive	5(1.8)	1(2.6)	0(0.0)	0.926
Negative	276(98.2)	38(97.4)	2(100.0)	

Table 5b. A comparison of ascities in relation to some parameters

Parameter	Status of ascities			P
	Nil	Mild	Moderate	
Liver size	13.9± 1.60	13.3± 71.84	12.100.0	0.427
Gall bladder size 1	5.68± 1.33	5.03± 0.13	-	
Gall bladder size 2	2.10± 0.74	2.65± 0.88	-	0.007
Spleen size	8.34 ±1.48	9.03± 4.07	8.000.0	

In table 4, Only 7 patients (31.8%) of patients with coarse liver tested positive for HBV, with p-value= 0.753. 86 (28.7) of the 322 participants had normal liver parenchymal echo texture. Also, all patients with HCV had normal liver echo texture; p-value=0.503. Nil hepatomegaly was however seen.

Table 4. Relationship between viral hepatitis infection and hepatic parenchymal echotexture.

Variables	Liver echotexture		P
	Normal	Coarse	
Hepatitis B			
Positive	86(28.7)	7(31.8)	0.753
Negative	214(71.3)	15(68.2)	
Hepatitis C			
Positive	6(2.0)	0(0.0)	0.503
Negative	294(98.0)	22(100.0)	

Echogenic spleen was seen in 2 (50%) of HBV cases with $p=0.186$ and only 1 (100%) hypo echoic spleen with $P = 0.186$ [Table 6]. All patients however had normal sized spleen.

Table 6

Variables	Spleen echo pattern			P
	Normal	Hypo-echoic	Echogenic	
Hepatitis B				
Positive	90(28.4)	1(100.0)	2(50.0)	0.186
Negative	227(71.6)	0(0.0)	2(50.0)	
Hepatitis C				
Positive	6(1.9)	0(0.0)	0(0.0)	0.953
Negative	311(98.1)	1(100.0)	4(100.0)	

Moderate ascites was noted in one patient [Table 5a] who tested positive for viral hepatitis B. P -value = 0.129 which was not statistically significant. The liver size was also within normal range in case with ascites. $P=0.427$ which is not significant statistically.

Gall bladder wall (GBW) thickening and size was within normal limits. However there was statistical variation in size in those with and without ascites with $P = 0.001$ [Table 5b].

XI. DISCUSSION

Viral hepatitis (HBV and HCV) has become a major public health concern worldwide especially in sub-Saharan Africa.^[2] Hepatitis B viral infection is more prevalent than hepatitis C virus.^[2,9,10] as demonstrated in this study. Nevertheless, they are both associated with chronic hepatic manifestation with similar ultrasound findings.^[11]

The findings on ultrasound in viral hepatitis, depends on the chronicity and pathological severity of the disease.^[6,11] Hence, in acute hepatitis, the predominant findings were decrease liver parenchymal echogenicity with brightness and more extensive demonstration of the portal vein radical, giving the starry sky appearance.^[11,12] Giogio et al detected only 32.2% of the hepatitis patients with increased brightness and clear visualization of portal vein radicle walls; which were also seen in 30.9% of their normal controls.^[17] similarly in this study, only one patient showed hypoechoic parenchyma with accentuation of the portal vein radicles. Chronic hepatitis often reveals decreased brightness and number of portal vein radicle walls with overall increased liver echogenicity.^[6,11] In a study by Shen J. et al, where they evaluated liver echogenicity by ultrasound, to predict liver fibrosis of chronic hepatitis B patients without clear treatment indications however^[18]. They established that; there was a significant difference with respect to liver echogenicity between the mild and severe groups. These studies demonstrated that liver echogenicity was an independent predictor in patients with cirrhosis which could result from viral hepatitis.^[18] In this study, most of the patients had normal hepatic parenchymal echogenicity and echotexture. Only 10 patients showed increase parenchymal echogenicity and 7 with coarse liver. This may be attributed to the fact that; liver parenchymal echotecture may be normal especially in early stage of the disease.^[13]

HBV and HCV are notable causes of chronic liver disease. Ascites is one of the common features of chronic liver disease, especially in the setting of portal hypertension. In this study, only one patient infected with viral hepatitis (HBV) had moderate ascites, with $p= 0.129$. This is statistically insignificant and consistent with early findings in uncomplicated hepatitis.^[1,6,11,13,14] Similar findings were seen in study by Sudhamshu KC.^[16] in which none of the patients had ascites.

Splenomegaly is seen in 10%–20% of cases of viral hepatitis.^[3] Maurya et al, had splenomegaly incidence of 27.5% in their study.^[1] In this study, splenic sizes were however within normal limits. This could be attributed to asymptomatic state of patients in this study, which is in keeping with ultrasound findings in uncomplicated hepatitis.^[11]

XII. CONCLUSION

Hepatitis B and C virus are common causes of hepatitis in sub Sahara Africa, Nigeria inclusive. They have notable imaging findings on ultrasound: which includes; decrease parenchymal echogenicity and accentuation of portal vein radicles, ascites . However, in early and uncomplicated viral hepatitis, ultrasound findings may be normal in majority of the patients.

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