
Ultrasound findings in patients with Visceral Leishmaniasis

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Abstract: Visceral leishmaniasis (VL) has been a major health burden on the Sudanese patients and to the health authorities in Sudan. Delay in diagnosis of VL leads to serious complications and eventually death. This study aimed to study the ultrasonographic findings of VL in Sudanese patients. 50 Sudanese patients who were clinically diagnosed as VL, attended to Ultrasound Department and were scanned for abdomen. Subject's ages, duration of the disease, liver, spleen, lymph nodes, portal vein and inferior vena cava (IVC) diameter, presence of asites and plural effusion, echogenicity of kidneys and pancreas were evaluated. VL affected the age group 15 – 30 years in 20 patients (40%) constituting the high incidence and it was less common in age group <15 years (10%). The diseases was common in males (76%) than females (24%) with a ratio of (3.6: 1). The Eastern states constituted the high incidence of the diseases among the other states 27 (54.0%), and Khartoum State constituted the lower incidence 1(2%). Splenomegally, hepatomegally, lymphadenopathy were the most common ultrasound findings. Portal vein, IVC dilatations were less common and were significantly affected with duration of diseases at p value $\square 0.0001$. VL associated with asites and plural effusion was found in the sample and has statistically significant relation at p value $\square 0.02$. Ultrasound detected changes in kidneys and pancreases echogeneity with prolonged disease duration. Ultrasonography has the capability of diagnosis of VL and by using ultrasound complications could be diagnosed earlier and treated before damaging the spleen, liver, lymph nodes or death to occur.

Keywords: Visceral Leishmaniasis, Ultrasound, Tropical Diseases

1. Introduction

Visceral leishmaniasis (VL) known as kala-azar, black fever, and Dumdum fever [1] Leishmaniasis is caused by parasites of the *Leishmania* genus. This disease is the second-largest parasitic killer in the world, responsible for an estimated 500,000 infections each year worldwide [2]. The parasite migrates to the internal organs such as liver, spleen and bone marrow, and results in the death of the host. Signs include substantial swelling of the liver and spleen. [3]

While the disease's geographical range is broad, it is not continuous. The disease clusters around areas of drought, famine, and high population density. In Africa, this has caused a great problem in Sudan, Kenya, and Somalia.

In the Sudan, kala-azar was concentrated in the Southern

border or into the Western part of the country [4]

VL (Kala-azar) is a protozoal infection common in underdeveloped countries; *Leishmania infantum* is the main cause of VL in the Mediterranean region [5, 6, 7]. Infected animals, mainly dogs are the carriers of the disease in the Mediterranean [8]. An insect bite is the vector of transmission. People from unaffected areas, may contract the disease [9, 10] after visiting endemic areas. Cases of leishmaniasis in overseas travelers and US Gulf War veterans have prompted growing interest in this disease [6, 11]. Factors increasing the risk of clinical development of the disease include malnutrition, immune suppression, and most importantly HIV infection [5] Delay and difficulties in diagnosis are common, especially in the early stages of the disease, due to non-specific symptomatology and difficulties

in demonstrating intracellular protozoa in tissue aspirates [12] Intracellular leishmania can be identified from aspirates of spleen, bone marrow, lymph node, or liver [5] The CT findings of hepatosplenomegaly, and abdominal lymphadenopathy secondary to visceral leishmaniasis were previously reported [12,13]. Patients with advanced Kala-azar die without treatment.

Visceral leishmaniasis (VL) needs quick, accurate, safe non invasive method for diagnosis; so this study was obtained for subjects coming to tropical hospitals in the Sudan using ultrasonography

2. Objectives

The objectives of this study were to evaluate the diagnostic role of ultrasound as well as to study the sonographic findings in Sudanese subjects affected with VL

3. Materials and Methods

This study was conducted at Omdurman Tropical Diseases Teaching Hospital in Sudan during the period from March up to August 2011

Ultrasound machine, version Aloka (500) (manufacture 2007). Probes (transducers) curve linear (3.5, 5, 7.5, 10 MHz) and convex (3.5, 5, 7.5 MHz) was used

50 Sudanese patients who were positively diagnosed as visceral leishmaniasis were included and non Sudanese patients and normal subjects were excluded.

Data including (a) personal information (age, gender, locality and duration of illness) (b) Ultrasonic findings of abdominal examination (size of spleen, liver, lymph nodes, caliber of portal vein and vena cava, level of plural and ascitic fluid, echogenicity of pancreas and kidneys) were all been evaluated. Data were collected on data sheet and were statistically analyzed using SPSS programme version 16.

The ultrasound examinations were done after explaining the procedure to the patients. The patients came fasting for 8 hours, positioned in the couch comfortably in supine position. Coupled gel was applied to the abdomen; the patients were allowed to breathe quietly and deeply. The transducer was chosen and the gain was corrected. The scanning was taken in all directions (longitudinal and transverse views).

As for spleen, the long axis was measured (normal size <13 cm, mild splenomegally 13 – 15 cm, moderate splenomegally 15.1 – 19.9 cm, marked splenomegally >20 cm). Liver was measured in mid clavicular line (normal size <13 cm, mild hepatomegaly 13.1 – 15 cm, moderate hepatomegaly 15.1 – 18 cm, and marked hepatomegaly >18 cm). Lymph nodes were measured in the long axis (normal size <2 cm, mild lymphadenopathy 2.1 – 2.5 cm, moderate lymphadenopathy 2.6 – 3 cm and marked lymphadenopathy >3 cm). Regarding IVC diameter (normal < 2.4 cm, dilated if >2.5 cm) and portal vein diameter (normal 13 mm, dilated >13 mm). Concerning pancreas size it was measured in long axis (normal 15 – 20 cm,

increased >20 cm) and kidneys size were measured in long axis (normal 8 - 12 cm, increased >12 cm). Plural fluid/effusion were present if the distance between the lung and chest wall \geq 50 mm (500 ml) and ascites was present if >100 ml free fluid was presented in the peritoneal cavity.

4. Results

Fifty Sudanese patients with visceral leishmaniasis were studied by ultrasound at Omdurman Tropical Diseases Teaching Hospital during the period from March to August 2011. VL were more common in males (76%) than females (24%) the ratio was (3.6: 1)

Ultrasound findings were more common in age group 15 – 30 years (40%), and 31 – 45 years (36%), while less common in the age group > 45 years (14%) and < 15 years (10%)

According to geographic areas, VL was found common in the population studied from Eastern states (54%) and central states (26%), a considerable percentage (10%) in Southern states, and less common in Western and Northern states (4%) each, while very rare in Khartoum State (2%) .

The tables below presented the study results.

5. Discussion

In Sudan, Leishmania was studied long time ago [14]. The current study showed that Eastern States were more affected than other states. Similar studies showed that the visceral leishmania has hyper endemic foci and was mainly in East and South of the country [15,16]

The disease showed wild diversity in clinical pattern but the pathogenicity depends mainly on parasite genotype versus host immunogenic profile. [17]

Regarding US findings in the study population, (6%) of patients have normal ultrasound; majority (94%) had splenomegaly, (90%) lymph adenopathy, and (86%) hepatomegaly. Less commonly had ascites (26%) and pleural effusion (18%). Rare US findings were portal vein dilatation (10%), inferior vena cava dilatation (8%) and very rarely increased echogenicity of the kidneys (4%) and decreased echogenicity of the pancreas (2%) as shown in (Table 1). These results were justified by delayed attendance of the patients to the hospital, constituting to what was written in the literature [18, 19]

The study showed that the duration of disease can affect the presence of hepatomegally, splenomegally and lymphadenopathy significantly at $P \leq 0.0001$ as presented in table (2) in addition to the presence of ascites and plural effusion with significant relation at $p \leq 0.000$ and 0.002 respectively Table (3) Ascites was found to be less common in our study, constituting with the literature (19)

The portal vein and Inferior vena cava were detected to be dilated significantly at P values ≤ 0.016 and ≤ 0.029 respectively as the duration of the illness increased as presented in table (4) .This may be due to the portal hypertension that acts as a complication of visceral leishmaniasis.

Portal vein and inferior vena cava dilatation were rare in our study, this is similar to Parasad's study about portal hypertension in VL, which showed presence of portal hypertension and dilatation of hepatic veins in 10 out of 88 cases studied in India [20], also similar to Salmi study [21], and similar to what was observed in Moslihi's study that showed the presence of pancreatitis (decreased echogenicity) and renal tissue involvement (increased echogenicity) in few patients studied by ultrasound in southern Iran [22], and similar to Saunders study [23].

Based on the results of this study, the researchers concluded that patients living in Eastern Sudan were highly exposed to the risk of infection by VL. Large variation in the geographical distribution of infection cases highlights the presence of environmental and/or social factors, which identify the relevance risk of VL. Clinical concerns should arise in patients with VL, as significant relation of their clinical conditions was observed with the long existence of the diseases.

Results showed that abdomen ultrasound can detect the changes in organs size in an appropriate manner as well as to demonstrate the echo texture changes as hyper or hypo echogenicity in case of inflammation as pancreatitis and renal inflammatory diseases resulted from VL.

Ultrasound has the ability to find out more than one sign and complication, at the same time has the capability in diagnosis of VL and differentiating it from mimicking conditions, in complement with other laboratory tests.

Delayed diagnosis due to A typical manifestation can lead to fatal outcome in patients. Instead of relying solely on the classical clinical features of visceral leishmaniasis, simple abdominal ultrasound examination can help to make an early diagnosis even in atypical cases, thereby reducing the mortality of visceral leishmaniasis. The usage of ultrasound as a primary model in the diagnosis of patients with VL, and characterization of the signs and complications in Tropical Sudanese hospitals is enlightening

Table 1: Frequency , percentages and distribution according to ultrasound findings.

Findings	Frequency	Percentage
Normal	3	6%
Splenomegally	47	94%
Hepatomegaly	43	86%
Lymphadenopathy	45	90%
Ascites	12	24%
Pleural effusion	8	16%
Portal vein dilatation	9	18%
Inferior vena cava dilatation	7	14%
Increased kidneys echogenicity	2	4%
Decreased pancreas echogenicity	1	2%

Table2 Cross tabulation of visceral leishmaniasis duration/weeks and ultrasound findings(Spleno megally ,Hepatomegally,Lymphadenopathy) .

Crosstab tabulation		Spleno megally*				Total
	Weeks	normal	mild	moderate	huge	
*Illness Duration	Less than 4	3	1	0	0	4
	4-8	0	4	10	7	21
	More than 8	0	0	0	25	25
Total		3	5	10	32	50
		Hepato megally*				
*Illness Duration	Less than4	4	0	0	0	4
	4-8	3	9	9	0	21
	More than8	0	0	0	25	25
Total		7	9	9	25	50
		Lymph adenopathy*				
*Illness Duration	Less than 4	4	0	0	0	4
	4-8	1	5	10	5	21
	More than 8	0	0	0	25	25
Total		5	5	10	30	50

*Correlation is significant at $p \leq 0.0001$

Table3 Cross tabulation of visceral leishmaniasis duration/weeks and ultrasound findings (presence of Ascites and Plural effusion) .

Cross tabulation				
*Ascites				
	Weeks	Normal	present	Total
*Illness Duration	Less than 4	4	0	4
	4-8	21	0	21
	More than 8	13	12	25
Total		38	12	50
**Plural effusion				
*Illness Duration	Less than 4	4	0	4
	4-8	21	0	21
	More than 8	17	8	25
Total		42	8	50
**Correlation is significant at $p \leq 0.002$		*Correlation is significant at $p \leq 0.000$		

Table4 Cross tabulation of visceral leishmaniasis duration/weeks and ultrasound findings (Portal Vein and IVC Diameter dilatation).

Cross tabulation				
	Weeks	*Portal Vein Diameter		Total
		Normal	Dilated	
*Illness Duration	Less than4	4	0	4
	4-8	21	0	21
	More than 8	20	5	25
Total		45	5	50
**IVC Diameter				
**Illness Duration	Less than4	4	0	4
	4-8	21	0	21
	More than8	21	4	25
Total		46	4	50
* Correlation is significant at $p \leq 0.016$		** Correlation is significant at $p \leq 0.029$		

Table5 Cross tabulation of visceral leishmaniasis duration/weeks and ultrasound findings (Changes of Echo texture of Kidney and Pancreas) .

Cross tabulation					
	Echogenicity	Illness Duration /Weeks			Total
		Less than4	4-8	More than 8	
Pancreas Echogenicity	Normal	4	21	24	49
	Hypo echoic	0	0	1	1
Total		4	21	25	50
Kidney Echogenicity	Normal	4	21	23	48
	Hyper echoic	0	0	2	2
Total		4	21	25	50

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