Hepatic Lesions Spectrum in Sudanese Patients by using Computed Tomography

Maram A. Fagiri[1], Mustafa Z. Mahmoud[2, 3], Ikhlas Abdelaziz Hassan[3], Leina Mhmoud[4]

[1]Sudan University of Science and Technology,
College of Graduate Studies, P. O. Box: 407, Khartoum- Sudan.
maramfagiri@gmail.com

[2]Salman bin Abdulaziz University, College of Applied Medical Sciences,
Radiology and Medical Imaging Department, P. O. Box: 422, Al-Kharj- Saudi Arabia.

[3]Sudan University of Science and Technology, College of Medical Radiological Science,
Basic Sciences Department, P. O. Box: 1908, Khartoum- Sudan.

[4]Fedail Hospital, Radiology and Ultrasound Department, Khartoum- Sudan.

Abstract: ***This study was designed with an aim to determine the incidence of different hepatic lesions occur in Sudanese patients whom presents at the Radiology and Ultrasound Department of Fedail Hospital at Khartoum, when the liver is investigated using computed tomography (CT) modality. CT instrument used was Siemens Somatom, the scanner features include 70 cm aperture, 50 cm scan the field and a patient table that can hold patients up to 440 pounds. Also it offers reconstructed on the fly with up to 16 slices per second. Data were initially summarized into means, standard deviations (SD); mean ± SD and percentages in a form of comparison tables and graphs. Statistical analysis was performed using Microsoft Excel Software and the Standard Statistical Package for the Social Sciences version 15 for windows. Out of 125 examined samples [mean age of 54.1 ± 17.6 years; male to female ratio of 3:1] 10.4% were primary hepatic malignancies and 21.6% were metastatic tumor to the liver while 41.4% are benign lesions included 1.6% cases each of liver abscess, fatty fibrotic changes, adenoma, haemengioma and hepatic calcifications. Beside 2.4% solitary/multiple cystic lesions and 4% liver cirrhosis. Metastatic liver lesions and liver cirrhosis were the commonest hepatic lesions detected in Sudanese patients.***

Keywords: Computed tomography (CT), Hepatocellular carcinoma (HCC), Liver cirrhosis, Metastatic liver lesions**.**

1. Introduction

CT has rapidly gained acceptance as the preferred CT technique for routine liver evaluation because it provides image acquisition at the peak enhancement of the liver parenchyma during a single breath hold [1-4]. In addition, the fast data acquisition allows successive scanning of the entire liver at different moments after injection of contrast material, thus creating the possibility of multiphasic liver CT.

The liver is a large, meaty organ that sits on the right side of the belly. Weighing about 3 pounds, the liver is reddish-brown in color and feels rubbery to the touch [5]. Among the most important liver functions are removed and excreting body wastes and hormones as well as drugs and other foreign substances, synthesizing plasma proteins, producing immune factors and removing bacteria, helping the body fight infection, producing bile to aid in digestion bile salts aid in fat digestion and absorption and storing certain vitamins, minerals, and sugars [6].

Recent studies have reported an improvement in lesion detection if arterial phase imaging is performed in addition to portal venous imaging, especially in the presence of hypervascular neoplasms, such as HCC [7-10].
This study was designed with an aim to determine the incidence of different hepatic lesions; either benign or malignant that occur in Sudanese patients whom presents at the Radiology and Ultrasound Department of Fedail Hospital in Khartoum, when the liver is investigated using CT modality.

2. Materials and Methods

2.1. Selection and Description of Participants

This retrospective cohort study was performed in the period of September 2012 to May 2013. A total of 125 consecutive patients referred to the Radiology Department of Fedail Hospital at Khartoum State were recruited. After the nature of the exam was fully explained, informed consent was obtained from both the consecutively enrolled outpatient and the Radiology Department.

Prior to samples scanning, a formal approval was obtained from Ethics and Scientific Committee of Fedail Hospital. Data collected included age, gender, ethnicity, underlying medical conditions, symptoms, signs, radiological imaging (including abdominal ultrasound and abdominal CT). Complications and outcome after intervention were recorded. Diagnosis of liver lesions was based on the typical appearance on CT of abdomen with clinical features consistent with the diagnosis; and/or CT-guided aspiration of pus from a hepatic lesion. Sample characteristics; including socio-demographic data, clinical history and physical examination findings were recorded. Patients who had no clinical evidence of abdominal complain were not included in this study.

2.2. Computed Tomography (CT) Instrument

CT instrument used was Siemens Somatom Emotion 16 slice CT machine. Scanner features include 70 cm aperture, 50 cm scan field and a patient table that can hold patients up to 440 pounds. Also the scanner offers an image reconstruction on the fly with up to 16 slices per second.

2.3. Methodology

During scanning the patient wear comfortable, loose fitting clothing. Special preparation is needed for a CT abdomen scan, while the patient receives a contrast material that highlights the abdominal vasculature. Routine scans start with scout view; Antero-posterior with 90 degrees central ray by using 135 kVp; 300 mA and 1.0 Sec with window width/window level of 80/30 for soft tissue.

100 ml meglumine iothalamate 60% (Conray 60) was hand-injected as an intravenous bolus immediately before scanning. Dilute oral contrast was administered before scanning for all patients. Scans were photographed at both soft tissue (width 500, level 30 HU) and liver (width 150, level 70 HU) windows prior to interpretation.

The following characteristics of each lesion were recorded: size (maximum diameter in millimeters), shape (round or irregular), edge (sharp or un-sharp), attenuation (water or soft tissue attenuation, visually assessed), internal structure (homogeneous or heterogeneous). Where lesions were thought to have changed in size, the CT images were reviewed by a second observer and then by both readers in consensus.

A change in size was defined as a difference in the maximum diameter of the lesion. Particular attention was paid to ensure that any differences in slice registration in follow-up examinations were recognized. Cases in which slight differences in the registration or partial volume effects were believed to explain apparent changes in lesion size were recorded as showing no change.

Consensus review was undertaken to establish whether the lesions had increased in size, decreased or disappeared, and if so to determine whether any technical variables (slice registration, respiratory artifact, windowing) could account for the apparent change.

The case notes of the patients were reviewed to identify episodes of treatment- either surgery, radiotherapy or chemotherapy. The histology of primary tumors was recorded when known, liver histology when available and treatment outcomes were also recorded.

2.4. Statistical Study

Data were initially summarized into means, standard deviations (SD); mean ± SD and percentages in a form of comparison tables and graphs. Statistical analysis was performed using Microsoft Excel Software and the Standard Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA) version 15 for windows.

3. Results

The sample population compromised 125 consecutive patients. Their ages ranged between 4 to 86 years, with a mean age ± SD of (54.1 ± 17.6) years. Males represent 75 (60%) of the study population, while 50 (40%) were females, with male to female ratio of (3:2) (Table 1 and Figure 1). The peak age was in 48-58 years which accounted (37; 29.6%) cases (Table 2).

Table 1. Frequency and percentage of genders

Gender	*Frequency*	*Percentage (%)*
Males	75	(60%)
Females	50	(40%)
Total	125	(100%)

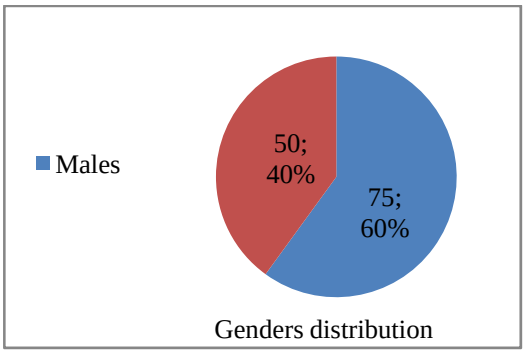

Figure 1. Genders distribution in the study sample

Table 2. Distribution of patients' age

Gender	*Frequency*	*Percentage (%)*	*Age ranges (Mean±SD*
4 – 14	4	(3.2%)	5.0 ± 1.2
15 – 25	7	(5.6%)	20.9 ± 4.1
26 – 36	9	(7.2%)	33.1 ± 2.0
37 – 47	10	(8%)	40.1 ± 3.2
48 – 58	37	(29.6%)	52.9 ± 2.4
59 – 69	31	(24.8%)	62.2 ± 2.8
70 – 80	24	(19.2%)	73.7 ± 3.2
81 – 91	3	(2.4%)	85.3 ± 1.2
Total	125	(100%)	54.1 ± 17.6

Of the 125 patients studied, abdominal pain, jaundice and nausea/vomiting were the most common clinical findings, reported in (38.4%) patients. Abdominal distention was presented in (4.8%) patients, while hepatosplenomegally, weight loss, backache and dyspepsia was noticed in (11.2%) patients. Fever, constipation, cough and heamoptasis was the least clinical features with a percentage of (0.8%) for each (Table 3 and Figure 2).

Table 3. Distribution of clinical features

Clinical features	*Percentage (%) out of 125 samples*
Abdominal pain	20%
Jaundice	10.4%
Nausea/Vomiting	8%
Abdominal distention	4.8%
Hepatosplenomegally	4%
Weight loss	2.4%
Backache	2.4%
Dyspepsia	2.4%
Fever	0.8%
Constipation	0.8%
Cough& heamoptasis	0.8%

In 125 studies, 32% primary or metastatic malignancies involved the liver. Of these 32%, 10.4% were primary hepatic malignancies (HCC and hepatoblastoma), all of which were proven, and 21.6% were metastatic tumor in the liver, 32% of which were histologically demonstrated. In the remaining 41.4% of the 125 total studies, benign liver abnormalities were detected. Theses 41.4% are benign lesions; included 1.6% cases of liver abscess, fatty fibrotic changes, adenoma, haemengioma and hepatic calcifications. Beside 2.4% solitary/multiple cystic lesions and 4% liver cirrhosis are also benign conditions (Table 4 and Figure 3).

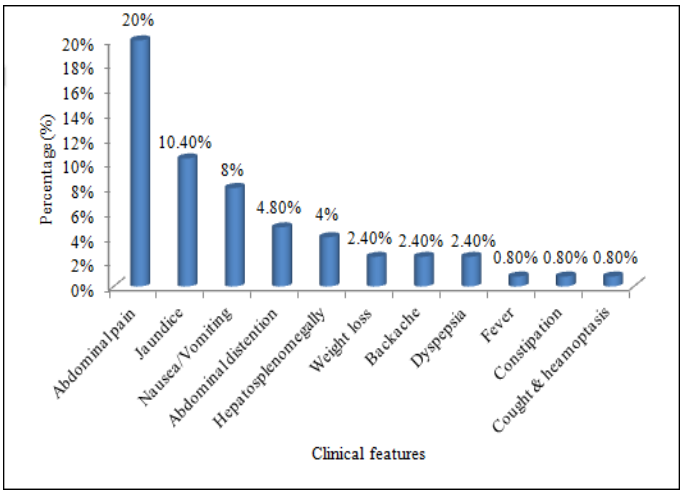

Figure 2. Distribution of clinical features

4. Discussion

The liver likewise is a common site for small cysts, haemangiomas, microhamartomas and other benign malformations, which become more prevalent with increasing age and dose no threat to health, but create difficulty in the early diagnosis of significant pathologies, particularly malignancy. We need to characterize these lesions in order to avoid inappropriate diagnosis, and particularly in patients with known malignancy, to avoid unnecessary surgery or chemotherapy.

The conventional approach to differential diagnosis of focal liver disease is to try to distinguish between benign and malignant lesions. When imaging characteristics are regarded as indeterminate, guided biopsy or surgical removal of the lesions may be the only definitive diagnostic approach. In expert hands, ultrasound guided biopsy has been shown to be highly successful in obtaining positive histology from lesions in the size range of 9-15 mm [11]. However, improving CT techniques, particularly multidetector CT is using thin slice reconstructions, now allow us to detect increasing numbers of smaller and smaller lesions, so biopsy becomes impractical.

Our study showed the 32% of detecting hepatic were malignant. This was explained by the high prevalence of hepatitis B virus (HBV) and hepatitis C virus (HCV) in this region [12, 13]. About 4% of detecting lesions were liver cirrhosis and this is due to Alcohol consumption and hepatitis B infection in our patients, therefore, health education to prohibit traditional practices that could predispose individuals to hepatitis B infection should be emphasized [14].

Table 4. Hepatic lesions spectrum in Sudanese patients

CT findings	*Percentage (%) out of 100 samples*
Metastatic liver lesions	21.6%
HCC	9.6%
Liver cirrhosis	4%
Solitary/Multiple cystic lesions	2.4%
Liver abscess	1.6%
Fatty fibrotic changes	1.6%
Liver adenoma	1.6%
Haemengioma	1.6%
Hepatic calcifications	1.6%
Hepatoblastoma	0.8%
Biopsy was performed using CT-guided aspiration to confirm the diagnosis liver mets, HCC and hepatic adenoma.	

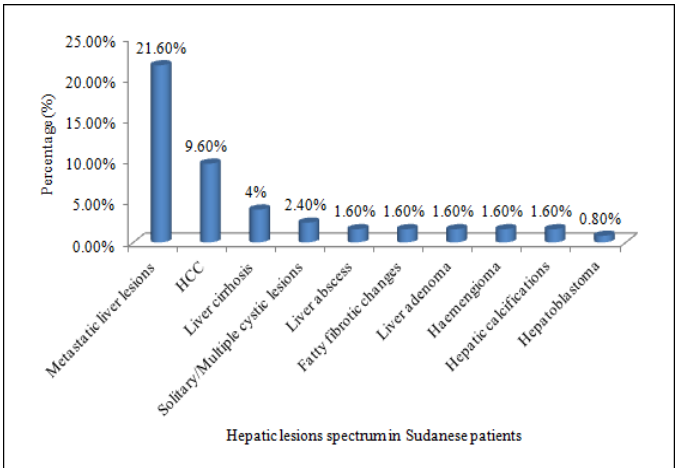

Figure 3. Hepatic lesions spectrum in Sudanese Patients

A number of limitations are present in our study. The study was not blinded; the clinical history of all but one patient and the results of other imaging studies in some patients were known.

The reported data are only relevant to the studied population, wherein some abnormalities were not represented (e.g., infectious disease). Some of the standards of reference used can be criticized. In some patients with multiple lesions, biopsy was performed of only one lesion, and coexisting lesions with the same CT appearance were assumed to represent the same abnormality as the biopsy lesion. Preferably, each lesion would have been correlated with surgery or biopsy, but this would exclude a large amount of lesions from the study and introduce a selection bias.

Although all the images of all the CT examinations were reviewed for this study, the initial review was made by a single observer and only those cases in which the lesions were thought to have changed over time were reviewed again by a second observer, and then finally in consensus by both observers. The authors did not attempt to measure the effect of observer variation on our classification of lesions so the results may harbor a margin of error from this source. However, both observers had extensive experience in liver CT, and both had taken part in previous studies of lesion detection which incorporated alternative free response receiver operating characteristic (AFROC) analysis, in which the variation between these observers was shown to be small [15].

5. Conclusion

In conclusion, liver CT enables detection and characterization of a large variety of focal liver lesions, including the benign and malignant liver lesions that occur most frequently, also in the presence of different pathologic conditions and multilevel disease. Our results demonstrate that 32% primary or metastatic malignancies involved the liver. Of these 32%, 10.4% were primary hepatic malignancies (HCC and hepatoblastoma) and 21.6% were metastatic tumor to the liver. In the remaining 41.4% of the 125 total studies, benign liver abnormalities were detected. Theses 41.4% are benign lesions included 1.6% cases each of liver abscess, fatty fibrotic changes, adenoma, haemengioma and hepatic calcifications. Beside 2.4% solitary/multiple cystic lesions and 4% liver cirrhosis are also benign conditions.

References

[1] Bluemke DA and Fishman EK. Spiral CT of the liver. AIR 1993; 160: 787-792.

[2] Zeman RK, Fox SH, Silverman PM, et al. Helical (spiral) CT of the abdomen. AJR 1993; 160: 719-725.

[3] Zeman RK, Zeiberg AS, Davros WJ, et al. Routine helical CT of the abdomen: image quality considerations. Radiology 1993; 189: 395-400.

[4] Bluemke DA, Urban BA, Fishman EK. Spiral CT of the liver: current applications. Semin Ultrasound CT MR 1994; 15:107-121.

[5] Digestive Disorders Health Center. Available from: http://www.webmd.com/digestive-disorders/picture-of-the-liver. Accessed on 11 April 2013.

[6] Normal Liver Physiology. Available from: http://biomed.brown.edu/Courses/BI108/BI108_2002_Groups/liver/webpage/NormalLiver.htm. Accessed on 10 April 2013.

[7] Baron RL, Dodd GD III, Holbert BL, et al. Helical biphasic contrast CT in evaluation of hepatocellular carcinoma. Radiology 1994; l93: 428-435.

[8] Murakami T, Kim T, Oi H, et al. Detectability of hypervascular hepatocellular cancinoma by arterial phase images of MR and spinal CT. Acta Radiol 1995; 36: 372-376.

[9] Hollett MD, Brooke Jeffrey R, Nino-Murcia M, et al. Dual-phase helical CT of the liver: value of arterial phase scans in the detection of small (< 1.5 cm) malignant hepatic neoplasm. AJR 1995; 164: 879-884

[10] Bonaldi VM, Bret I'M, Reinhold C, et al. Helical CT of the liver: value ot an early hepatic arterial phase. Radiology 1995; 197: 357-363.

[11] Middleton WD, Hiskes SK, Teefey SA, et al. Small (1.5 cm or less) liver metastases: US-guided biopsy. Radiology 1997; 205: 729-732.

[12] Al Faleh F. Hepatitis B Infection in Saudi Arabia. Ann Saudi Med J 1988; 8: 474-479.

[13] Saeed AA, Ahmed AM, Al-Karawi MA, et al. The association between hepatitis C virus antibody and hepatocellular carcinoma in relation to hepatitis B viral infection (RAFH experinece). Ann Saudi Med J 1992; 12: 283-285.

[14] Elfaki AM. Aetiology, complications, and preventive measures of liver cirrhosis; Elobeid Hospital; West Sudan. Sudan JMS 2008; 3: 25-28.

[15] Scott DJ, Guthrie JA, Arnold P, et al. Dual phase helical CT versus portal venous phase CT for the detection of colorectal liver metastases: correlation with intra-operative sonography, surgical and pathological findings. Clin Radiol 2001; 56: 235-242.