

International Journal of Radiology and Diagnostic Imaging



E-ISSN: 2664-4444
P-ISSN: 2664-4436
IJRDI 2019; 2(2): 07-09
Received: 06-05-2018
Accepted: 10-06-2018

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Diagnostic test validity of CT-scan for detection of liver abscess

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DOI: <http://dx.doi.org/10.33545/26644436.2019.v2.i2a.30>

Abstract

Background: Detection of hepatic abscess is very crucial for the management of the patient. **Objective:** The purpose of the present study was to validate the diagnostic ability of CT-scan during detection of hepatic abscess.

Methodology: This cross-sectional study was carried out in the Department of Radiology and Imaging at Mymensingh Medical College Hospital (MMCH), Mymensingh, Banghabandhu Sheikh Mujib Medical University (BSMMU), Dhaka and Dhaka Medical College Hospital (DMCH), Dhaka during the period of January 2006 to December 2007 for a period of two (02) years. Patients admitted in the Department of Medicine and Department of Hepatobiliary of MMCH, BSMMU, and DMCH with the clinical diagnosis of hepatic abscess with the presentation of fever, abdominal pain, anorexia, nausea/vomiting, loss of appetite, jaundice, weight loss and ascites were selected as study population. CT scan and histopathology were performed to all the patients.

Result: A total number of 50 suspected cases of hepatic abscess patients were recruited for this study. Maximum patients were within 56 to 65 years age range. 15 (30%) patients were within 56 to 65 years age range. In case of hepatic abscess, 11 patients were diagnosed as having hepatic abscess by CT and confirmed by histopathological evaluation. One patient was diagnosed other lesion by CT and confirmed by histopathology. Of 38 patients of other lesions, which were confirmed by CT, two confirmed as hepatic abscess and 36 were other lesions by histopathology. The sensitivity of CT scan in the diagnosis of hepatic abscess was 84.6% (95% CI 54.55% to 98.08%). However specificity was 97.3% (95% CI 85.84% to 99.93%). The accuracy was 94.0% (95% CI 83.45% to 98.75%). The area under the curve value was 0.09 (95% CI 0.000 to 0.211) which was statistically significant. **Conclusion:** In conclusion CT-scan has a very high specificity with sensitivity for the detection of hepatic abscess.

Keywords: Hepatic mass; CT-scan; hepatomegaly; hepatic abscess

Introduction

Space occupying lesions within the liver were detectable by CT when their attenuation of the x-ray beam differs appreciably from the attenuation by surrounding tissue. The great majority of all intrahepatic masses discovered, whether they are solid or cystic, neoplastic or inflammatory are of diminished radiographic density (Stephan *et al*, 1977) ^[10].

CT scan has some additional advantage over ultrasonography. Firstly it is more reproducible because it is operator dependent. Secondly all the upper abdominal anatomy is displayed on the CT image, providing information about extra hepatic process that may be important to scan interpretation. Thirdly, the administration of water soluble intravenous contrast medium provides information regarding the regional blood flow characteristics of focal lesion and increases the detection rate of small masses (<20 mm) (Balfe and Hee 1988) ^[3].

Computed tomography has been highly useful in detecting liver tumours and in determining their extent. However, with the exception of some hepatic lesions containing calcium, extravasated blood, fat or densely enhanced parts, the CT appearance of liver tumours is similar and nonspecific regardless of their histologic type (Araki *et al*, 1980) ^[2]. This present study was undertaken to validate the diagnostic ability of CT-scan during detection of hepatic abscess.

Methodology

This cross-sectional study was carried out in the Department of Radiology and Imaging of three tertiary care hospitals in Bangladesh named as Mymensingh Medical College Hospital, Mymensingh; Dhaka Medical College Hospital, Dhaka and Banghabandhu Sheikh Mujib Medical University (BSMMU), Dhaka in collaboration with the Department of Pathology of the same institute for histopathological diagnosis from January 2006 to December 2007 for a period of 2 years. All the clinically suspected patients having hepatic abscess at any age with both sexes who were attended in three hospitals were taken as study population as per inclusion and exclusion criteria. Patients having hepatomegaly due to extra hepatic causes, patients who refused to undergo CT-scan, patients who refuse to do biopsy or whose biopsy result was not available and patients having known hypersensitivity reaction to contrast agent were excluded from this study. Purposive sampling technique was used to collect the patients. Prior to the commencement of this study, the research protocol was approved by the ethics review committee of the respective hospital. Each patient was undergone CT examination of hepatobiliary system (HBS) at the Department of Radiology and Imaging. All CT-scan were performed with a third generation CT-scan (Siemens). Somatom (2-5) mm thick contiguous slice were taken. These scan were obtained using 120 kv, 75 mm and 0.8 sec scanning time for 2 slice. Both pre and post contrast were performed. Oral contrast medium was routinely administered before the examination. Immediately after completion of bolus injection 8mm contiguous slice were obtained through the upper abdomen by CT-scan. All collected biopsy tissues were sent for histopathological examination in the histopathology department of respective hospital and collected reports were compared with CT-scan diagnosis. Percentages were calculated to find out the proportion of the findings. Further statistical analysis of the results was done by computer software devised as the statistical package for the social sciences (SPSS, win version 13). For the validity of the

study outcome sensitivity, specificity, accuracy, positive and negative predictive values were calculated after confirmation of the diagnosis histopathologically. For significance of differences was done using Student’s t test and Chi-square test where applicable. Statistical significance was set at p value less than 0.05 and confidence interval was set at 95% level. All probability values quoted were 2-tailed.

Result

A total number of 50 suspected cases of hepatic abscess patients were recruited for this study after fulfilling the inclusion and exclusion criteria. Age range of the total patients was 17 year to 78 years. Maximum patients were within 56 to 65 years age range. 15 (30%) patients were within 56 to 65 years age range followed by 13 (26%) were 46 to 55 years and 8 (16%) patients were 36 to 45 years age range.

Table 1: Age distribution among the study population

Age Group	Frequency	Percent
Less Than 26 Years	4	8.0
26 to 35 Years	4	8.0
36 to 45 Years	8	16.0
46 to 55 Years	13	26.0
56 to 65 Years	15	30.0
More Than 65 Years	6	12.0
Total	50	100.0

In case of hepatic abscess, eleven patients were diagnosed as having hepatic abscess by CT and confirmed by histopathological evaluation. These were true positive. One patient was diagnosed other lesion by CT and confirmed by histopathology. So, one false positive patients of hepatic abscess was in the study group. Of 38 patients of other lesions, which were confirmed by CT, two confirmed as hepatic abscess and 36 were other lesions by histopathology. They were false negative and true negative respectively (Table 2).

Table 2: CT-scan diagnosis of hepatic abscess and its relationship with histopathological findings (N=50)

CT diagnosis of hepatic abscess	Histopathological diagnosis		Total
	Hepatic abscess	Others	
Hepatic abscess	11 (84.6%)	1 (2.7%)	12 (24.0%)
Others	2 (15.4%)	36 (97.3%)	38 (76.0%)
Total	13 (100.0%)	37 (100.0%)	50 (100.0%)

Chi square value (after Yates correction) = 31.04 df= 1, p value=0.001

Validity tests revealed that sensitivity, specificity, PPV, NPV, and accuracy of CT scan in the diagnosis of hepatic abscess. The sensitivity was 84.6% (95% CI 54.55% to 98.08%). However specificity was 97.3% (95% CI 85.84% to 99.93%). The accuracy was 94.0% (95% CI 83.45% to 98.75%) (Table 3).

Table 3: Validity of CT-scan for Hepatic Abscess

Validity	Value	95% CI
Sensitivity	84.6%	54.55% to 98.08%
Specificity	97.3%	85.84% to 99.93%
PPV	91.7%	61.08% to 98.72%
NPV	94.7%	83.40% to 98.47%
Accuracy	94.0%	83.45% to 98.75%

The area under the curve value was 0.09 (95% CI 0.000 to 0.211) which was statistically significant (Table 4).

Table 4: Area Under the Curve of CT-Scan for detection of Hepatic Abscess

Variables	Value
AUC	0.090
Std. Error ^a	0.061
P value	0.000
95% CI	0.000 to 0.211

The test result variable(s): CT Scan has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased. A. Under the nonparametric assumption; b. Null hypothesis: true area = 0.5

Discussion

Age range of the total patients was 17 year to 78 years.

Maximum patients were within 56 to 65 years age range. 15 (30%) patients were within 56 to 65 years age range followed by 13 (26%) were 46 to 55 years and 8 (16%) patients were 36 to 45 years age range. Statistical analysis of patients of both sex has revealed that they were within similar age distribution (p value= 0.617). Liver mass can occur in a person of any age but the incidence is more common in middle aged and elderly persons which have been observed by Saad *et al* (1996) [9]. In their study age of the patients varied from 20 to 75 years. Most of the patients were found between 41 to 50 years. These results are nearly comparable with present study.

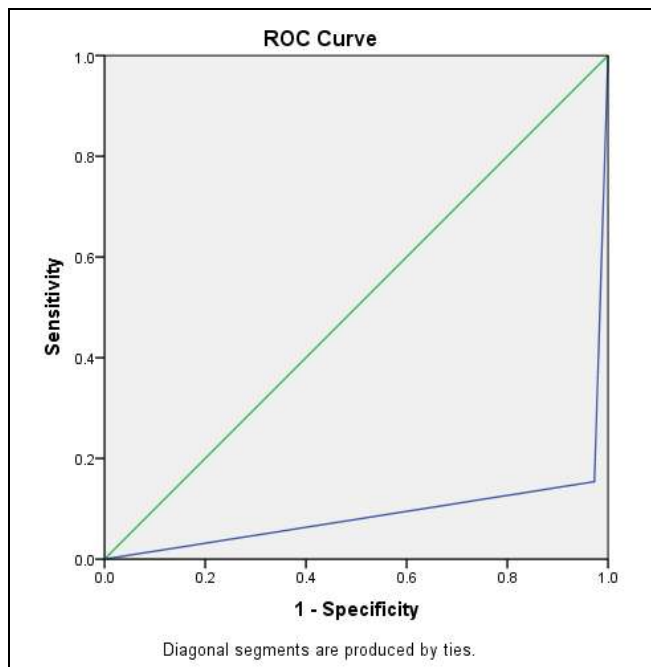


Fig I: ROC Curve of CT-scan for detection of Hepatic mass

In the USA and Western Europe, HCCs are seldom encountered before the age 60 with male and female ratio of about 6:1 to 8:1. In Africa and Asia this form of cancer occurs in younger individuals often between 20 and 40 years age with a male and female ratio about 3:1 to 4:1 (Crawford 1999) [4].

Histopathology reports revealed that maximum patients had hepatic abscess. Parveen (2000) [8] found in her study 25% hepatic abscess and rests others. However, Liver abscess was a common finding (6.99%), more in male noted in a study conducted by Ahmed (1996) [1]. Haque *et al* (1998) [7] described in their series a total 24.0% abscess in the liver detected by CT-scan. Variation of hepatic masses was seen in different studies conducted in Bangladesh.

In this series sensitivity, specificity, PPV, NPV and accuracy of CT scan in the diagnosis of hepatic abscess are 84.6%, 97.3%, 91.7%, 94.7% and 94.0% respectively. In case of diagnosis of hepatic abscess the findings are comparable with Kang *et al* (2003). They reported that CT was 88.0% sensitivity of 88.0% and 98.0% specific in the diagnosis of hepatic abscess. Pyogenic hepatic abscesses may be solid on diagnostic imaging. Alsaif *et al* reported an incidence of predominantly solid abscesses on monophasic contrast-enhanced CT scans in 57.0% of cases of monomicrobial *Klebsiella pneumoniae* infection versus 36.0% of cases of polymicrobial infections, with a 90.0% positive pus culture rate for both groups; these abscesses are

however “predominantly” solid and are not circumscribed by a rim. These findings suggest that such abscesses are discrete entities compared to those described by Kim *et al* in which an idiosyncratic inflammatory reaction perhaps plays a main role.

Conclusion

In conclusion CT-scan has a very high specificity for the detection capacity of hepatic abscess. However, the sensitivity is also acceptable considering the detection of hepatic abscess. The accuracy is also very high. Therefore CT-scan can be used for the detection of hepatic abscess.

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