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Original Article

Diagnostic Accuracy of Computed Tomography Scan for Solitary Liver Lesions Using Histopathology as the Gold Standard

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ABSTRACT

Objective: To compare the diagnostic accuracy of CT scan in identifying solitary liver lesions, in reference to histopathology as the gold standard.

Study Design: Cross-sectional Study.

Place and Duration of Study: Department of Gastroenterology, Pak Emirate Military Hospital, Rawalpindi, Pakistan, from Jan to Jun 2023.

Methodology: A total of 180 patients of both genders, aged 30 to 70 years, who were clinically diagnosed of a solitary liver lesion were included. CT was studied for liver lesions, attenuation value was obtained, and diagnosis was then confirmed with aspiration, cytology, and histopathology by a consultant pathologist. Data was recorded on a proforma and analyzed through SPSS.

Results: The Mean age of 51.82±5.98 years. Male patients were 135(75%), and 45(25%) were female patients. CT scan diagnosed 101(56.1%) patients, while histopathology diagnosed 96(53.3%) patients with malignant liver lesions. CT scan has shown sensitivity of 91.6%, specificity 84.5% and diagnostic accuracy of 88%, PPV 87.1% and NPV 89.8% in the diagnosis of malignant liver lesions.

Conclusion: The results of our study showed that a CT scan is a useful tool in diagnosing malignant liver masses and helps to avoid unnecessary liver biopsy.

Keywords: CT scan, Diagnostic accuracy, Histopathology, and Malignant Liver Lesion.

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INTRODUCTION

Hepatocellular carcinoma (HCC) is a leading cause of death, primarily affecting patients with cirrhosis. It is a global health challenge, with an annual incidence of more than one million cases.[1] Chronic hepatitis B, C, and nonalcoholic fatty liver disease are the most common etiological factors.[2] Multiple risk factors contribute to the development of hepatocellular carcinoma.[3] It occurs in patients with chronic hepatitis B and C viruses (HBV and HCV), and the risk increases with alcohol consumption and cigarette smoking.[4] Early diagnosis is the key factor in managing HCC.[5] Proper differentiation is necessary to avoid unnecessary biopsies. Most benign lesions only require surveillance.[6] Characterization of liver lesions is crucial for appropriate treatment. After an ultrasound of the abdomen, computed tomography (CT) is a second-line imaging tool to confirm hepatic lesions.[7] CT is also highly sensitive in detecting liver lesions in obese patients and those with massive ascites.[8] To achieve optimal results, the timing of contrast media administration is especially important. Contrast media is injected based on the patient's body weight (0.6 gm/kg).[9] The study by Hsiao CY *et al*., has shown that CT scan has a sensitivity of 83.9% and a specificity of 50% in diagnosing solitary malignant liver lesions, with a prevalence of 62.1%.[10]

CT scan plays a significant role in the diagnosis of hepatic lesions. It is readily available with cost-effectiveness, and furthermore, it reveals good anatomy and the extent of the lesion. the cost in Pakistan and accessibility to invasive procedures are the key factors in choosing the correct tool, so the CT scan has become the best modality for detecting the hepatic mass. The study results will help the physicians to estimate the probability of benign or malignant nature more accurately for a liver lesion, and to decide the further need for invasive investigation. Our objective was to estimate the accuracy of CT scan in diagnosis of solitary liver lesions vs histopathology as the gold standard.

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METHODOLOGY

This Cross-Sectional Study was conducted in the Department of Gastroenterology, Pak Emirate Military Hospital, Rawalpindi, Pakistan, from 1st Jan to Jun 2023, after approval by the Hospital Ethical Review Committee (A/28/EC/549123). Sample size was calculated using the WHO sample size calculator, taking a confidence level 95%, a margin of error of 7.1%, reported prevalence of pathological diagnosis was HCC 62.1%.[10] The estimated sample size came out to be 180 Patients. Non-probability consecutive sampling technique was used.

Inclusion Criteria: Patients aged 30 to 70 years of both genders with clinical diagnoses of solitary liver lesion as per operational definition were included.

Exclusion Criteria: Patients with a history of trauma, contrast allergy, pregnant females, and non-willing participants were excluded. The study was started after approval from hospital ethical committee. Basic demographics like age, gender, and duration of complaint were recorded. After receiving contrast, computed tomography was performed. Axial, coronal, and sagittal slices were recorded as per the requirement for assessment of focal hepatic lesion location, size, number, margin, density, calcification, necrosis, contrast enhancement, and other associated findings. In this study, CT was studied for liver lesions and reported by a consultant Radiologist. Diagnosis was then confirmed with aspiration, cytology, and histopathology reported by a consultant Histopathologist. Malignant liver lesion was noted on proforma.Data was analyzed by using Statistical Package for the social sciences (SPSS) version 23.00 and MS Excel 2016 software. Mean±SD was calculated for continuous variable. Frequency and percentage was calculated for categorical variables. 2X2 model was used for Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of CT scan against. The p value ≤ 0.05 was considered significant.

RESULTS

A total of one hundred and eighty (n=180) Patients were included in this study, mean age was 51.827±5.98 years, ranging from 30 to 70 years. out of total, 135(75%) patients were male, and 45(25%) were female. Mean duration of complaint was 7.633±2.28 weeks as shown in Table-I. CT scan diagnosed 101(56.1%) patients while histopathology diagnosed 96(53.3%) patients with malignant liver lesion, as shown in Table-II. CT scan has shown sensitivity of 91.6%, specificity 84.5% and diagnostic accuracy of 88%, PPV 87.1% and NPV 89.8% in the diagnosis of malignant liver lesions as shown in Table-III. CT Scan stratification with respect to the duration of complaint is also shown in Table-IV.

Table-I: Demographic Characteristics of the Patients (n=180)

Parameters		Values
Age in Years	Mean±SD	51.827±5.98
	Range	30 - 70
Duration of complaint (weeks)	Mean±SD	7.633±2.28
Gender	Male	135 (75.0%)
	Female	45 (25.0%)

Table-II: Overall results of CT scan and Histopathology in diagnosis of Malignant liver lesions (n=180)

Malignant liver lesion	CT scan	Histopathology
Positive	101(56.1%)	96(53.3%)
Negative	79(43.9%)	84(46.7%)
Total	180 (100%)	180 (100%)

Table-III: Comparison of CT Scan versus Histopathology of Malignant liver lesion (n=180)

CT Scan	Histopathology		Total (n=180)	*p*-value
	Positive (n=96)	Negative (n=84)		
Positive	88 (TP)	13 (FP)	101	< 0.001
Negative	8 (FN)	71 (TN)	79	

Sensitivity = 91.6%
Specificity = 84.5%
Positive Predictive Value =87.1%
Negative Predictive Value =89.8%
Diagnostic Accuracy= 88.0%

Table-IV: Stratification with Respect to Duration of Complaint (1-6 weeks) of CT Scan Versus Histopathology (n=65)

CT Scan	Histopathology		Total (n=180)	*p*-value
	Positive (n=96)	Negative (n=84)		
Positive	14 (TP)	07 (FP)	21	< 0.001
Negative	4 (FN)	40 (TN)	44	

Sensitivity = 77.8%
Specificity = 85.1%
Positive Predictive Value =66.6%
Negative Predictive Value =90%
Diagnostic Accuracy= 83%

DISCUSSION

The findings of our study demonstrate that CT scan is a valuable modality for detecting malignant hepatic lesions. The strong correlation between CT-based diagnosis and histopathological findings highlights its sensitivity in identifying liver lesions. These results support the role of CT imaging as a reliable diagnostic tool, potentially reducing the need

for unnecessary liver biopsies in appropriate clinical settings.

Radiological diagnostic tools detect Liver lesions.[11] Early diagnosis is possible due to advances in radiological technology. A CT scan detected the lesion, which was confirmed by histopathological examinations. In our study, the age range was 30 to 70 years, with the maximum detected in the 51 to 70 years group, with a mean age of 51.827±5.98 years. Liver lesion in patients of both sexes has a similar age distribution. The incidence of liver cancer increases with age, as shown in the study by Hsiao *et al*., The study highlighted that a CT scan has a sensitivity of 83.9% and specificity of 50% in the diagnosis of solitary malignant liver lesions with a prevalence of 62.1%.[12] In a global study by Sung *et al.,* an update on the global cancer burden using the GLOBOCAN 2020 estimates of cancer incidence and mortality was produced by the International Agency for Research on Cancer. It was reported that most of the patients clinically diagnosed with cancer were found to be between 41 and 50 years old.[13]

Shen *et al.,* observed that Hepatocellular Carcinoma (HCC) is one of the most common malignant tumors with high incidence and mortality rate. Precision and effective biomarkers are therefore urgently needed for the early diagnosis and prognostic estimation. It has been observed that the female-to-male ratio of about 6:1 to 8:18.14 HCC is a complex disease, which is difficult to diagnose early for effective treatment, and hence, the death rate of HCC remains high due to its poor prognosis. In a study of diagnostic accuracy for early assessment of various abdominal tumors Angelo *et al.,* conducted a study describing this study aimed to evaluate the diagnostic accuracy of conventional CT values and the dual-energy computed tomography (DECT)-derived effective atomic number (Zeff), fat fraction (FF) and iodine concentration (IC) for the differentiation of hypodense liver lesions in patients with colorectal cancer (CRC).[15]

Nadarevic *et al.,* confirmed that in clinical practice, computed tomography (CT) is used as a second-line diagnostic imaging modality to confirm the presence of focal liver lesions suspected as hepatocellular carcinoma on prior diagnostic tests such as abdominal ultrasound or alpha-foetoprotein, or both.[16] Fraquelli et al. found that result heterogeneity remained inconclusive and rated the evidence certainty using GRADE. The author reported uncertainty using 95% confidence intervals, and sensitivity analyses limited to studies with prespecified positivity criteria and blinded reference standard interpretation showed no meaningful change in the findings.[17]

Sonthalia *et al.,* explained diagnosis of hepatocellular carcinoma primarily relies on cross-sectional imaging (CSI), yet certain focal hepatic lesions may still be overlooked. Endoscopic ultrasound (EUS) is emerging as a valuable tool in hepatology, offering improved lesion detection along with the ability to obtain tissue samples. The author presented a case of hepatitis B–related cirrhosis with acute decompensation in which EUS successfully identified HCC and enabled tissue acquisition after CSI failed to provide a diagnostic result.[18]

Keeping in view the above, recent literature, this study has confirmed that CT scan demonstrated high diagnostic accuracy for detecting liver lesions, performing reliably across various lesion types. Compared with other non-invasive imaging modalities, CT provided an accurate anatomical location of the lesion and consistent correlation with histopathological findings. While ultrasound and MRI offer complementary strengths, CT remained a practical and widely accessible option for initial evaluation. This study validates that CT imaging may reduce the need for invasive procedures when appropriately applied in clinical practice and supports its continued use as a primary diagnostic tool.

CONCLUSION

It is conclusive from this study that CT scan is a valuable and sensitive modality for detecting malignant hepatic lesions. Its strong correlation with histopathological findings supports its reliability as a diagnostic tool. These results suggest that CT imaging can aid in the accurate evaluation of liver lesions and can be used as the Gold Standard to reduce the need for unnecessary liver biopsies.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

QI & NQ: Data acquisition, data analysis, critical review, approval of the final version to be published.

FS & SB: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

NU & EA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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