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Accuracy of Hepatic Angiogram During Trans-Arterial Chemoembolization (TACE) With Triphasic CT Scan in Detecting Tumor Size and Number of Lesions in Diagnosed Hepatocellular Carcinoma Patients

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ABSTRACT

Objective: To determine the accuracy of the hepatic angiogram during trans-arterial chemoembolization (TACE) with triphasic computed tomography (CT) scan in detecting tumor size and number of lesions in diagnosed hepatocellular carcinoma (HCC) patients.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Radiology, Memon Medical Institute Hospital, Karachi, Pakistan, from Feb to July 2024.

Methodology: Both male and female patients aged 40 to 80 years with HCC were assessed based on serum Alpha-Fetoprotein (AFP) levels> 200 ng/ml with a duration of at least three months. All patients were referred for TACE and underwent pre-procedural imaging with triphasic CT to detect the tumor size and number of lesions. Results of the diagnosis were recorded in a predesigned proforma.

Results: A total of 133 patients were included, aged 59.09±10.36 years, with a mean HCC duration of 4.45±1.22 months, and an average lesion size of 5.53±0.846 cm. The overall accuracy of hepatic angiograms during TACE with triphasic CT scans in detecting tumor size and the number of lesions among diagnosed HCC was 74% (n=98). Accuracy was significantly high in those cases whose duration of HCC was above 5 months (*p*-value=0.015).

Conclusion: The study demonstrated that hepatic angiography during TACE provides a reasonable accuracy rate of 74% in detecting tumor size and the number of lesions in HCC patients, with particularly high accuracy in patients with prolonged disease duration.

Keywords: Accuracy, Detection, Hepatic angiogram, Hepatocellular carcinoma, Trans arterial chemoembolization, Triphasic CT scan.

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INTRODUCTION

Hepatocellular carcinoma (HCC) is a highly aggressive primary liver tumor that presents significant global health challenges due to its rapid progression and poor prognosis.[1] Ranking as the sixth most common cancer worldwide,[2] HCC accounts for a substantial number of new cancer cases annually and is the third leading cause of cancer-related deaths.[3]

The World Health Organization (WHO) Elimination Between 2022 and 2030, an average of 18.8 million screenings, 1.1 million more treatments, and 46,700 fewer new infections would be needed to achieve. Between 2015 and 2030, elimination would result in a 7,045,000 reduction in overall infections, save 152,000 deaths, and save 104,000 incident instances of HCC.[4] With an Age-Standardized Rate (ASR) of 11.6 per 100,000 in 2020, Asia accounted for approximately 72.5% of the global incidence of liver cancer, with 609,596 new cases. With an ASR of 10.7, liver cancer-related fatalities, with an estimated 566,269 deaths in Asia, accounted for 72.4% of all liver cancer deaths worldwide.[5]

The burden of HCC is particularly pronounced in developing countries, where most cases are reported, contributing to a global health disparity. In Pakistan, the prevalence of HCC is particularly concerning, as it represents a significant proportion of all malignant tumors.[6]

Chronic hepatitis B (HBV) and hepatitis C (HCV) infections are well-established risk factors for HCC, particularly in patients with cirrhosis, and are prevalent in Pakistan, where carrier rates are alarmingly high.[7] These infections contribute to the high incidence of HCC in the country, where the disease typically presents at an advanced stage, often

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with large, multi-centric tumors that are frequently deemed unresectable.[8] As a result, trans-arterial chemoembolization (TACE) has emerged as a crucial therapeutic approach for managing unresectable HCC, especially in Pakistan.[9]

TACE delivers chemotherapy directly to the hepatic artery, targeting HCC tumors. It can serve as adjuvant or palliative therapy, with evidence showing it may shrink tumors and prevent recurrence before surgery. TACE's effectiveness depends on precise detection and assessment of tumor size and lesion count for proper treatment planning and monitoring.[10]

Hence, this study aimed to determine the accuracy of hepatic angiogram during Trans arterial chemoembolization (TACE) with triphasic computed tomography (CT) scan in the detection of tumor size and the number of lesions among diagnosed hepatocellular carcinoma (HCC) patients. So, this would help to develop management guidelines to assess tumor size and number of lesions by using an angiogram during TACE in HCC patients.

METHODOLOGY

This cross-sectional study was carried out at the Department of Radiology, Memon Medical Institute (MMI) Hospital, Karachi, Pakistan, from Feb to Jul 2024 after obtaining approval from the Institute Research Board (IRB) of MMI Hospital via letter number IRB/MMIH/2024/02. Informed consent was obtained from all patients before they were enrolled in the study.

Taking the accuracy of HCC greater than 3cm at 21%, confidence level at 95% and margin of error at 7%.[11] The sample size was calculated to be 130; however, a total of 133 participants were included in the study through the non-probability consecutive sampling technique.

Inclusion Criteria: All patients of either gender, aged between 40 and 80 years, who were diagnosed with HCC after the assessment based on serum Alpha-Fetoprotein (AFP) level > 200 ng/ml, with a duration of at least three months, were included.

Exclusion Criteria: Patients who did not give consent and those with extrahepatic tumor spread were excluded based on history, CNS and lung examination, and CT scans of the chest, abdomen, pelvis, and brain. Additionally, patients with cardiovascular and respiratory failure were excluded based on history, ECG, echocardiography, chest X-ray, arterial blood gases (ABG), and spirometry results. Patients with ascites were also excluded with assessment on abdominal examination and abdominal ultrasound, and patients with partial or complete thrombosis of the portal vein were excluded with the help of color Doppler ultrasound.

The patients having hepatocellular carcinoma were referred to the department of radiology, MMI Hospital Karachi, and fulfilled the inclusion criteria of the study. Patient demographics and clinical history were taken by the principal investigator. All patients were referred for TACE. All individuals underwent pre-procedural imaging with triphasic CT to detect the tumor size and number of lesions. TACE was performed for all HCC patients. During TACE, hepatic angiography was done to detect the tumor size and number of lesions. The hepatic angiography was analyzed, and final comments were given by an experienced consultant radiologist with more than five years of experience. After receiving hepatic angiography results, the diagnosis of tumor size and the number of lesions was made as per the operational definition. The investigator recorded CT findings and hepatic angiography findings regarding tumor size and number of lesions in a predesigned proforma.

Patient data was compiled and analyzed through the Statistical Package for Social Sciences (SPSS) Version 21. Frequency and percentage were computed for qualitative variables like gender. Mean±SD was calculated for quantitative variables, i.e. age, duration of HCC, number of lesions, and size of the lesion. The normality of the data was assessed using the Shapiro-Wilk test and found to be non-parametric. The association between the accuracy of TACE and age, gender and duration was assessed through the Mann-Whitney U-test. A *p*-value of <0.05 was considered significant.

RESULTS

A total of 133 patients with HCC were included, with the majority aged between 51 and 60 years (33.00%), most being male (57.40%), and 75.94% having single lesions (Table I).

The average age was 59.09±10.36 years, with a mean HCC duration of 4.45±1.22 months, an average lesion size of 5.53±0.846 cm, and a mean number of lesions of 2.00±0.60 (Table-II).

The overall accuracy of hepatic angiograms during TACE with triphasic CT scans in detecting tumor size and the number of lesions among diagnosed HCC was 74.00% (n=98) (Figure).

Accuracy was not statistically significant among different age groups (*p*-value=0.910) or between genders (*p*-value=0.113); however, it was significantly higher in patients with HCC duration exceeding 5 months (*p*-value=0.015) (Table-III).

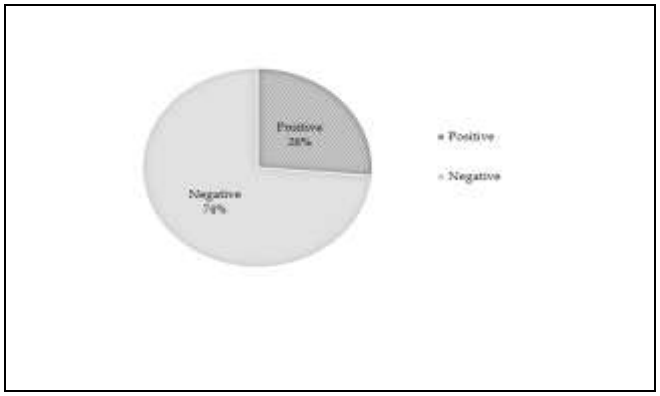

Figure: Accuracy of hepatic Angiogram During TACE with Triphasic CT scan in Detection of Tumor size and Number of Lesions Among Diagnosed HCC Patients (n=133)

Table-I: Demographic and Clinical History of Study Participants (n=133)

Variables		n (%)
Gender	Male	76(57.4%)
	Female	57(42.6%)
Age (Years)	<=50	39(29.3%)
	51-60	44(33.0%)
	61-70	28(21.0%)
	71-80	22(16.5%)
Number of lesions	Single	101(75.9%)
	Double	26(19.6%)
	Multiple	6(4.5%)

Table-II: Descriptives of the Patients Included in the Study (n=133)

Variables		Age (Years)	Duration of HCC (months)	Average Lesion size (cm)	Number of Lesions
Mean		59.09±10.36	4.45±1.22	5.53±0.84	2.00±0.60
95% Confidence Interval for Mean	Lower Bound	57.31	4.24	5.38	1.00
	Upper Bound	60.87	4.66	5.67	4.00

DISCUSSION

In the current study, most patients were male (57.4%) and aged between 51 and 60 years, reflecting that HCC predominates in male gender of regional population. The overall accuracy of hepatic angiograms in detecting tumor characteristics found in this study was 74%. These findings align with the range reported in a study conducted by Zarlasht *et al*., though highlighting differences in detection rates compared to both local and international research.[12]

Comparing the current study results with the literature, Bhatti *et a*l., reported that the accuracy of hepatic angiography in detecting tumor size and lesions is somewhat lower than the 80-85% reported in some regional studies.[13] This discrepancy might be due to differences in patient populations, the extent of tumor progression, or the technology used. However, the accuracy rate is within the range reported in other international studies, where accuracy rates typically range from 70% to 80% depending on the study design, patient selection, and imaging techniques used.[14,15]

Table-III: Significance of Accuracy of Hepatic Angiogram During TACE with Triphasic CT scan Among Diagnosed HCC Patients (n=133)

Variables		Accuracy		Mann-Whitney U test	*p*-value
		Positive	Negative		
Age (Years)	≤50	29(74.3%)	10(25.7%)	1815.5	0.910
	>50	69(73.4%)	25(26.6%)		
Gender	Male	52(68.4%)	24(31.6%)	1900.0	0.113
	Female	46(80.7%)	11(19.3%)		
Duration of HCC (months)	3-5	78(69.6%)	34(30.4%)	875.0	0.015
	>5	20(95.2%)	1(4.8%)		

**HCC=Hepatocellular Carcinoma*

Yazdanpanah *et al*., have shown that hepatic angiography remains a valuable tool in the management of HCC, particularly in cases where CT or MRI might not provide sufficient detail, especially for smaller lesions.[16] For instance, a study by Liao *et al*., reported a sensitivity of approximately 78% for hepatic angiography, which is comparable to the 74% accuracy rate found in the current study.[17] The variation in accuracy rates across different studies might be attributed to the different imaging protocols, the experience of radiologists, and the tumor biology prevalent in different populations.[18]

Additionally, the current study found that hepatic angiography accuracy was significantly higher in patients with an HCC duration longer than five months, with an accuracy rate of 95.2%. This suggested that hepatic angiography might be particularly beneficial in detecting advanced tumors or those with more prolonged disease progression.[19,20] This finding is in line with study of Ebeling *et al*., who noted increased accuracy in detecting larger or more developed tumors, likely due to the more pronounced vascular changes that occur as tumors grow.[21,22]

The use of hepatic angiography during TACE is further supported by its ability to provide real-time visualization of tumor vasculature, which can guide more targeted treatment delivery, as confirmed by Calem *et al*.[23] However, Fitzgerald *et al*., suggested that its invasiveness and the need for specialized expertise limit its widespread use, especially in resource-limited settings.[24]

Nevertheless, hepatic angiography during TACE offers a reliable method for assessing tumor size and the number of lesions in HCC patients, particularly in cases where other imaging modalities might fall short. However, the variability in accuracy rates underscores the need for standardized protocols and further research to optimize its use in clinical practice. The findings from this study contribute to the growing body of evidence supporting the use of hepatic angiography in the management of HCC and might help inform future guidelines, particularly in the context of Pakistan and similar settings.

LIMITATIONS OF STUDY

The study's cross-sectional design limited the ability to assess long-term outcomes and potential complications. Additionally, the small sample size and single-center study might affect the generalizability of the results.

CONCLUSION

The study demonstrated that hepatic angiography during TACE provides a reasonable accuracy rate of 74% in detecting tumor size and the number of lesions in HCC patients, with particularly high accuracy in patients with prolonged disease duration. This reinforces the utility of hepatic angiography as a valuable diagnostic and therapeutic tool, particularly in advanced cases where traditional imaging techniques, such as computed tomography (CT), might not fully capture the extent of the disease.

However, the variability in detection rates between different studies highlights the need for further research to refine the use of hepatic angiography, ensuring more consistent and accurate outcomes across diverse patient populations. The findings suggest that while hepatic angiography is beneficial, especially in cases where other modalities are insufficient, its invasive nature and resource requirements limit its broader applicability.

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Authors' Contribution

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

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

AQR & MR: Study design, data interpretation, drafting the manuscript, critical review, 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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