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ORIGINAL ARTICLE

Diagnostic accuracy of triphasic CT scan abdomen in the diagnosis of distal esophageal varices taking endoscopic findings as Gold standard.

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ABSTRACT… Objective: To determine the diagnostic accuracy of multidetector computed tomography in detection of esophageal varices in patients with hrpatic cirrhosis. **Study Design:** Cross Sectional study. **Setting:** Department of Diagnostic Radiology, Kot Khawaja Saeed Teaching Hospital, Lahore. **Period:** January, 2021 to July, 2021. **Material & Methods:** Two hundred seventy five patients diagnosed with liver cirrhosis were included in our study. Multidetector CT of the abdomen was performed using multislice CT and the findings were recorded. The cases underwent endoscopy within the subsequent 8 weeks. The results of MDCT were compared with endoscopy findings, which were taken as gold standard. **Results:** We found 190 true-positives, 80 true-negatives, 03 false-negatives, and 02 false-positive results. MDCT demonstrated a sensitivity of 98.4%, a specificity of 97.6%, PPV of 99.0%, NPV of 96.4%, and an accuracy of 98.1%. Extra-esophageal findings on MDCT included other porto-systemic collaterals and hepatocellular carcinoma. **Conclusion:** MDCT is an effective modality for diagnosis of esophageal varices and can be used as a screening test for varices. CT also permits evaluation of extra-luminal pathology that impacts management.

Key words: Cirrhosis, Esophageal Varices, Multidetector Computed Tomography.

INTRODUCTION

More than million liver cirrhosis related deaths are reported every year with an estimated 12.8 % increase in liver cirrhosis mortality rate in just South Asian region from 1980 to 2010.[1] Common causes of cirrhosis of the liver include infections caused by Hepatitis C, B, alcohol related hepatitis, steatohepatitis and autoimmune hepatitis.[2] A condition known as esophageal varices occurs when the lower esophageal artery becomes dilated as a result of high blood pressure in the cirrhotic patient's portal system. Nearly 50% of cirrhotic individuals have esophageal varices at the time of diagnosis. The overall prevalence of esophageal varices in cirrhotic patients ranges from 30 to 70 %, with an annual rate of development of 7 %.[3]

The most common deadly consequence of cirrhosis liver is bleeding from esophageal varices. A yearly incidence of 5% to 15% is recorded for variceal haemorrhage.[4] Variceal haemorrhage remains a life-threatening emergency, with a fatality incidence of 15 to 20 percent, despite significant advances in the early detection and management of the condition.[5] Esophageal variceal haemorrhages can have life-threatening consequences if not caught early enough. Conventional upper gastroduodenal endoscopy is considered the gold standard in diagnosis of esophageal varices. Screening endoscopy is advocated at the initial diagnosis of cirrhosis and every 1–3 years thereafter. Endoscopy, on the other hand, has a restricted application as a screening tool because it is invasive, costly, and requires sedation; in addition, patients have a poor acceptance rate for the operation.[6]

Various studies have been conducted in the past to identify non-invasive indexes of esophageal

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varices, these include platelet count, prothrombin time, spleen size and portal vein diameter to reduce the number of patients undergoing endoscopic screening.[7,8]

Multidetector Computed Tomography (MDCT) is a potential non-invasive and cost effective modality for esophageal varices identification. Abdominal CT imaging is frequently used in cirrhotic patients for screening & diagnosis of Hepatocellular carcinoma (HCC), and always covers the distal esophagus, thus permitting accurate evaluation of esophageal varices without the use of any additional technique.[9,10] MDCT has shown a high diagnostic accuracy in detecting esophageal varices with reported sensitivity of 94 %, specificity 98 %, accuracy 97 %, positive predictive value 94 % and negative predictive value of 98 %.[11]

The rationale of my study was to evaluate the role of MDCT, with its multiplanar capabilities, in accurate assessment of esophageal varices, thereby, serving as a potential non-invasive and cost effective screening modality in cirrhotic patients, reducing the number of unnecessary, time consuming and potentially invasive endoscopies. No local study has been conducted on this topic, therefore, my study not only provides local data but, will also serve as a reference for future research work.

MATERIAL & METHODS

In this Cross-sectional study, two hundred and seventy five patients with diagnosis of liver cirrhosis referred to Radiology Department of Kot Khawaja Saeed Teaching Hospital, Lahore for CT Abdomen were enrolled in our study. Duration of Study was six months, from January, 2021 to July, 2021. Sample size of 275 cases was calculated taking prevalence of esophageal varices as 50% with sensitivity of MDCT as 94 % (with 6% margin of error) and specificity as 98 % (with 2% margin of error).

Non-probability, consecutive sampling technique was used. All patients of either gender between 30 - 75 years diagnosis of Liver cirrhosis (as per operational definition) were included. Patients not fit for CT (e.g. Deranged Renal function tests or History of contrast reaction); those with active GI bleed at the time of CT; those with history of endoscopic variceal ligation or sclerotherapy, known cases of portal vein anomalies and pregnant patients were excluded.

Demographic data like age and gender were recorded. Informed consent obtained. All the patients were subjected to a routine MDCT scan of abdomen (without additional technique or unnecessary exposure) eliminating any ethical issues. Toshiba Multislice CT scanner was used to obtain 3 - 5 mm axial images at a pitch of 1.5, from the dome of diaphragm to pelvic margins, in the unenhanced and portal venous phase after IV contrast administration. All the cases were transferred to console and multiplanar reformation (MPR) images in the coronal plane were also obtained. The results were evaluated by a fellow of Radiology having at least 5 year experience in interpreting the results of CT. MDCT findings suggestive of esophageal varices (as per the operational definition) were recorded. Endoscopy findings of all the patients who underwent endoscopy within the next 8 weeks of CT were recorded and taken as gold standard. All the information was collected on a specially designed proforma.

Variables were entered and analyzed through the SPSS version 20 and analyzed through it. Descriptive analysis was conducted i.e. frequencies and percentage for categorical variables like gender and esophageal varices on MDCT & endoscopy, mean and standard deviation for continuous variables like age. A 2 x 2 table was then used to calculate sensitivity, specificity, positive predictive value and negative predictive value of MDCT by taking endoscopic findings as gold standard. 2 x 2 table was used to calculate sensitivity, specificity, PPV, NPV and diagnostic accuracy. Effect modifiers were controlled by dividing the patients in different groups with reference to age and gender, and chi square test was used to determine the significance of difference with a p-value ≤ 0.05.

RESULTS

In our study 275 cases enrolled had a mean age

of 56.7 ± 9.417 years. There were 47 (17.1%) patients (30 – 45 years), 125 (45.5%) of 46 – 60 years, 103 (37.5 %) of 61 – 75 years. The sampled population was also distributed according to sex. There were 149 (54.2 %) male and 126 (45.8%) females. The esophageal varices were detected on MDCT among 192 (69.8%) patients, while MDCT could not detect esophageal varices among 83 (30.2%) patients. The esophageal varices were detected on endoscopy among 193 (70.2%) patients, while endoscopy could not detect varices among 82 (29.8%) patients. MDCT also demonstrated findings other than esophageal varices including gastric varices in 139 patients (50.5%), paraesophageal varices in 107 patients (38.9 %), and splenic varices in 105 patients (38.1%). Hepatocellular carcinoma (HCC) was found in 20 subjects (7.2%)

A total of 190 patients were true positive; 80 patients were true negative; 02 patients were false positive and 03 patients were false negative (Table-VII). The sensitivity of MDCT was 97.6%, specificity 98.4%, diagnostic accuracy 98.1%, PPV 99.0% and NPV 96.4%. The cross tabulation between MDCT and endoscopy findings yielded a statistically significant association (p value = 0.001).

To further stratify the data, we cross tabulated MDCT and endoscopic findings with variables such as age and gender. Of the 47 patients in the first age group (30 – 45 years), 30 patients (63.8%) were positive on MDCT vs 31 patients (66.0%) on endoscopy, while 17 patients (36.2%) were negative on MDCT vs 16 patients (34.0%) on endoscopy. In the second age group (46 – 60 years), 90 patients (72.0%) were positive on MDCT as well as on endoscopy, while 35 patients (28.0%) were found to be negative on MDCT and on endoscopy. In the third group (61 – 75 years), 76 patients (73.8%) were positive on MDCT as well as on endoscopy, while 27 patients (26.2%) were found to be negative on MDCT and on endoscopy. No statistically significant association was found between the age of the sampled population and MDCT & endoscopic findings (p value = 0.444 vs 0.610).

Cross tabulation of the gender with MDCT and endoscopy findings revealed that 106 males (71.1%) as positive on MDCT vs 107 (71.8%) on endoscopy, and 43 males (28.8%) negative on MDCT vs 42 (28.1%) on endoscopy. Out of the 126 females, 86 females (68.2%) were positive on MDCT as well as endoscopy, while 40 females (31.7%) were negative on MDCT and on endoscopy. The association was statistically non-significant (p value = 0.603vs 0.520).

		Esophageal Varices on Endoscopy		
		Yes	**No**	**Total**
Esophageal varices on MDCT	Yes	190	02	192 (69.8%)
	No	03	80	83 (30.2%)
	Total	193 (70.2%)	82 (29.8%)	275 (100%)
Using chi square test, p value= 0.001 (significant)				

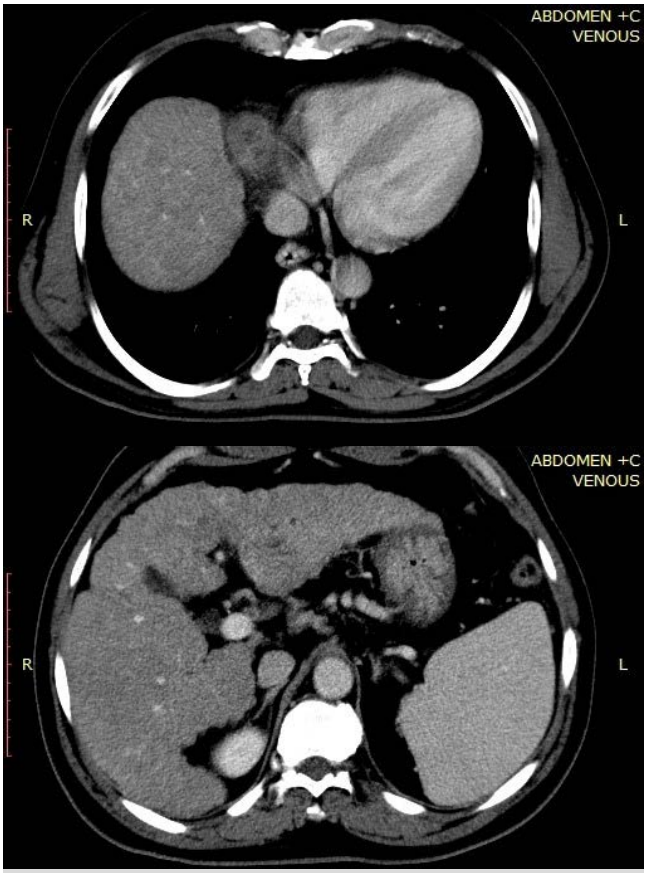
Table-I. Cross tabulation between MDCT and endoscopy Findings

		Esophageal Varices on Endoscopy		
		No	**Yes**	**Total**
Esophageal Varices on MDCT	No	80(TN)	03(FN)	83
	Yes	02(FP)	190(TP)	192
	Total	82	193	275
Using chi square test, p value= 0.001 (significant)				

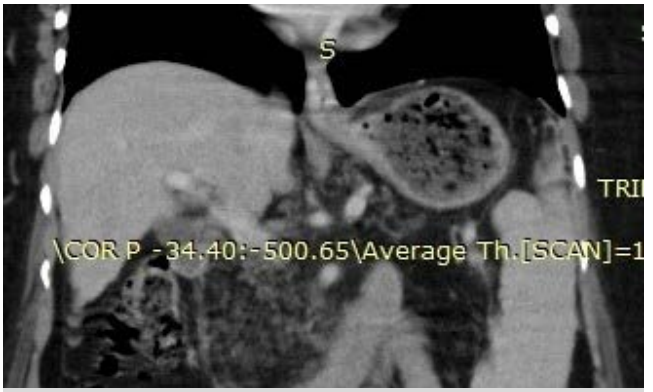
Table-II. Cross tabulation to determine TP, TN, FP & FN

		Esophageal Varices on Endoscopy		
		No	**Yes**	**Total**
Esophageal Varices on MDCT	No	80 (29.1%) (NPV) 96.4% (Spec) 97.6%	03 (1.1%)	83 (30.2%)
	Yes	02 (0.7%)	190 (69.1%) (PPV) 99.0% (Sens) 98.4%	192 (69.8%)
	Total	82 (29.8%)	193 (70.2%)	275 (100%)
Using chi square test, p value= 0.001 (significant)				

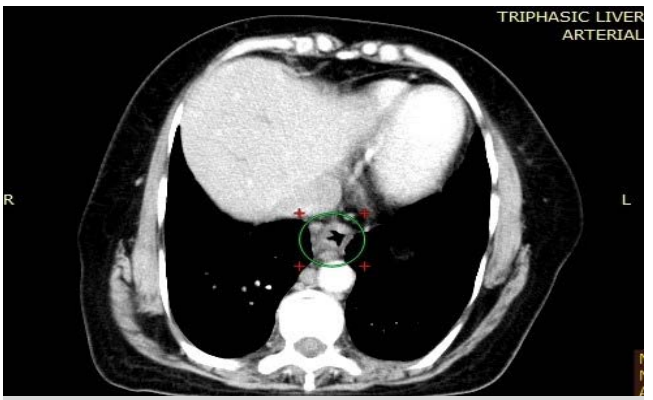
Table-III. Sensitivity, Specificity, PPV, NPV



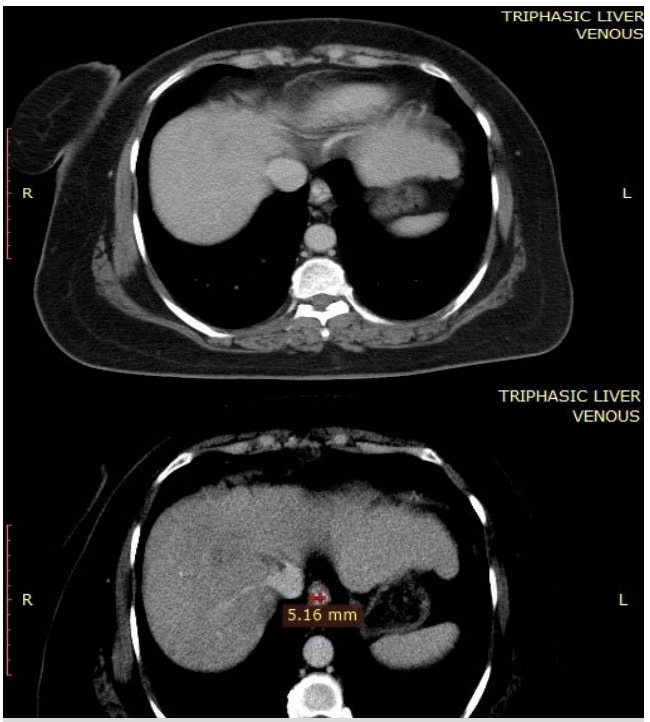
Case-1. 54 yr old Male patient with hepatic cirrhosis and lower esophageal varices (max. size 3.2 mm)



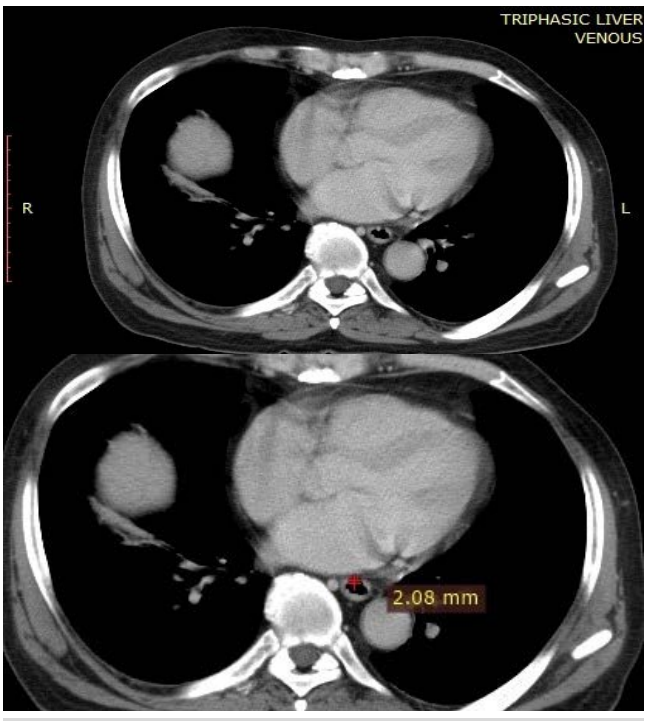
Case-3. Coronal reformatted image in a female patient demonstrating distal esophageal varices



Case-4. Small distal esophageal varices (average size 2.0 mm)



Case-2. 55 yr Female with esophageal varices (maximum diameter 5.1 mm)



Case-5. Small esophageal varix (2.0mm) in a 75 yr old Male patient with cirrhosis

DISCUSSION

The results of this study were in favor of MDCT which detected as well as ruled out esophageal varices among the sampled population, demonstrating accuracy of 98.1%. Our results are similar to many international studies in this regard.

In a study published in 2007, Young Jun Kim et al[12], looked at the results of routine helical liver CT in 67 cirrhotic patients to see if it was effective in the identification and grade of esophageal varices, she came to the conclusion that it was, with a sensitivity, specificity and accuracy of 92%, 84% and 85%. Andreas Karatzas et al[13], in their study published in 2016, evaluated the role of Multidetector CT one of the safest methods used for the diagnosis of esophageal varices and associated pathologies. They included 38 cirrhotic patients who underwent upper gastrointestinal endoscopy and MDCT, with reported sensitivity of 100% in patients with large varices (> 5 mm). They concluded MDCT as an accurate method for detecting clinically significant esophageal varices, thus capable of replacing upper GI endoscopy in selected patients.

Shen Min et al[14], in their 2010 study, reported MDCT to be a useful modality for detection and grading of varices, having a high sensitivity, specificity, diagnostic accuracy, PPV and NPV of 95%, 100%, 97%, 100% and 93%, respectively. A 2016 meta-analysis[15], including 10 studies with 807 subjects, reported the pooled sensitivity for identifying EV as 89.6%. They also concluded that CT can be used instead of invasive techniques like upper GI endoscopy.

In our study we obtained CT images at 3 – 5 mm slice thickness in the axial plane and later obtained thin sections through multiplanar reconstruction in the coronal plane. This provided better resolution, further aiding in the visualization of varices. Our results were comparable to the 2011 study by Nam C. Yu et al.[16] Associated findings in our study, other than esophageal varices, were the detection of other porto-systemic collaterals including gastric varices in 139 patients out of the sampled population (50.5%), para-esophageal varices in 107 patients (38.9%), and splenic collaterals in 105 patients (38.1%). Hepatocellular carcinoma (HCC) was found in 20 patients (7.2%). These extra-esophageal findings are not demonstrated on endoscopy, thus proving to be an added benefit of MDCT in patients with cirrhosis. Kodama et al.[17] and Mifune et al.[18] have also established this advantage of MDCT in their studies.

This study has several drawbacks. Although we completed the randomization of the patients, this represents only a small sample size of a single institution. All the CT pictures were relayed by a single interpreter. We did not explore if any discrepancies in reporting exist across the different interpreters.

CONCLUSION

This study concludes that Multidetector CT imaging can determine esophageal varices accurately among patients with liver cirrhosis. It is a rapid, non-operator dependent and convenient imaging modality that can be utilized as a screening technique especially for large high risk esophageal varices. It has added benefit of detecting other complications of cirrhosis including HCC, which has an impact on patient management.

Local studies are needed in this regard to increase our experience in accurate identification and grading of esophageal varices, and to develop a standard protocol for reporting and grading esophageal varices, which could then be incorporated in the routine liver CT reporting in cirrhotic patients.

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3	Khalid Javed	Synopsis writing, Data analysis, Article writing.	
4	Fareeha Shahid	Data analysis.	
5	Aamenah Malik	Discussion writing.	
6	Huda Fazli	Data entery and analysis.	
7	Islah Ud Din	Discussion writing.	
8	Muhammad Ahsan	Discussion writing, Data analysis and resutls writing.