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ORIGINAL ARTICLE

Diagnostic Accuracy of Multi-Detector Computed Tomography Esophagography in Grading of Esophageal Varices in Cirrhotic Patients

MEHWISH BASHIR[1], HINA HANIF MUGHAL[2], FAISAL MEHMOOD[3], MUHAMMMAD IMRAN AFTAB[4], MADIHA ALI[5], MUHAMMAD MOBUSHIR[6]

[1]*Consultant Radiologist, Rawalpindi*
[2]*Assistant Professor and HOD, Department of Radiology, Benazir Bhutto Hospital and Rawalpindi Medical University, Rawalpindi*
[3]*Assistant Professor, Department of Diagnostic Radiology, Rawalpindi Medical University & Holy Family Hospital, Rawalpindi*
[4]*Associate Professor, Department of Physiology, Independent Medical College Faisalabad*
[5]*Associate Professor, Department of Anatomy, Independent Medical College Faisalabad*
[6]*Senior Registrar, Department of Orthopaedic Surgery, Fauji Foundation Hospital, Foundation University Medical College, Islamabad*
Correspondence to: Dr. Muhammad Imran Aftab, E-mail: dr.imranaftab@gmail.com Cell: 0332-5516601

ABSTRACT

Objective: To assess the diagnostic accuracy of computed tomography esophagography in grading esophageal varices using upper gastrointestinal endoscopy as a gold standard.

Study Design: Cross-sectional (validation) study

Place and Duration of Study: Radiology department, Holy Family Hospital, Rawalpindi from 14th July 2016 to 13th January 2017.

Methodology: One hundred and forty five clinically diagnosed patients of liver cirrhosis, age between 35-80 years were enrolled in this study. All patients underwent multi-detector computed tomography and endoscopy examination for the identification as well as grading of oesophageal varices.

Results: High risk varices were identified in 106 (73.1%) of patients on multi-detector computed tomography and were identified in 108 (74.5%) of patients on endoscopy. Sensitivity, specificity, negative predictive value, positive predictive value and accuracy of multi-detector computed tomography forthe identification of high risk esophageal varices were found to be 94.4%, 89.2%, 84.6%, 96.2% and 93.1% respectively.

Conclusion: Multi-detector computed tomography esophagography detected high risk esophageal varices with excellent accuracy. This could be a practical and non-invasive choice of imaging for the identification& grading of esophageal varices.

Key words: Esophageal varices, Multi-detector computed tomography (MDCT), Endoscopy

INTRODUCTION

The end stage of chronic liver disease is known as cirrhosis in which progressive destruction and regeneration of the liver parenchyma occurs that leads to fibrosis.[1] Risk of variceal haemorrhage is higher in cirrhosis patients. Cirrhosis patients with liver disease severity between 50%-80% eventually develop esophageal varices.[2] The consequences of having variceal haemorrhage are very bad, they have poor outcomes that mortality is 35% at 3 months and mortality at 2 years is 70%.[3] Patients whose first bleeding episode occur within 1 year of detection of varices are at greater risk of variceal bleeding rate.[4] The strong association of varices bleeding with high morbidity and mortality in cirrhotic patients necessitates the protocols that detect and prevent the first esophageal variceal hemorrhage in order to minimize the complications.[5]

The gold standard for diagnosing upper gastrointestinal varices is endoscopy. Endoscopic screening has some limitations including its poor tolerance due to invasive procedure, expensiveness and the need of sedation which reasons for the poor compliance of endoscopic screening recommendations.[6] As the development in multi-detector computed tomography (MDCT) imaging increases it is possible to detect esophageal varices noninvasively. The diagnostic accuracy of MDCT in detecting small and large varices comparable with upper endoscopy.[7]

The global burden of hepatic diseases is increasing, with the most rapid spikes showed by South Asian countries. Advanced liver diseases due to chronic liver diseases like hepatitis B & C are common in Pakistan and associated with life threatening complications like esophageal varices which need early detection and grading of their severity. In a recent study, esophageal varices were noted in 68 patients (61.3%) out of 111 liver cirrhosis patients.[4]

Morphological classification of cirrhosis include macronodular, micronodular or mixed.[8] Presence of cirrhosis can also determine by other radiologic studies including computed tomography scan, magnetic resonance imaging and abdominal ultrasound. Abdominal ultrasound is performed in patients who are at risk of cirrhosis in order to assess the liver parenchyma and extrahepatic manifestations of cirrhosis. For the confirmation of final diagnosis a liver biopsy is required.

The radiological findings of cirrhosis may lead to identification of the root cause. Etiology of cirrhosis can be recognized by radiographic findings in some exceptional cases. For instance, appearance of hypertrophied caudate lobe on computed tomographic (CT) scanning indicates Budd-Chiari syndrome.[9] During magnetic resonance imaging reduced signal concentration suggests iron overload because of hereditary hemochromatosis.[10]

CT scan is still not considered as the gold standard for the diagnosis of cirrhosis. CT is not regularly used because it gives almost same information as in ultrasonography but with the outlay of contrast and

radiation exposure. CT findings of varices, hepatic nodularity, hypertrophy of the caudate or left lobes and atrophy of the right lobe ascites suggest the presence of cirrhosis, yet these are not diagnostic. CT portal phase imaging can reveal patency of the portal vein, but blood flow directions cannot be validated. It is still a contentious debate that how far the magnetic resonance imaging (MRI) can be valid in diagnosing cirrhosis. Several authors suggest that MRI can accurately diagnose cirrhosis as well as identifies association with its severity.[11-13]

MATERIALS AND METHODS

The current cross sectional validation study was conducted at the Department of Medical Imaging and Endoscopy Unit of the Medical Department of Holy Family Hospital, Rawalpindi from 14th July 2016 to 13th January 2017 and comprised of 145 patients. Clinically diagnosed cases of liver cirrhosis (nodular margins, lobar hypertrophy/atrophy and signs of portal vein may be demonstrated), age between 35-80 years of both gender were included. Patients with the history of surgery for portal hypertension, active GI haemorrhage at the time of admission, history of earlier ligation or injection of varices, preceding bleeding history from varices or porto-systemic shunts, documented hypersensitivity to intravascular contrast agent and who used medicine for primary prophylaxis of variceal bleeding were excluded.

Computed tomography images were taken during a single breath-hold, from the dome of the diaphragm to the lowest level of the liver. Parameters for CT scan were attained with 1.5 reconstruction intervals, 2.5 mm slice thickness,0.8-s gantry rotation time and140 kV, 200–300 mA. As a result of the intravenous (IV) administration of nonionic contrast material at the rate of 4 ml/s, a triphasic dynamic study was obtained. After 20–25 s of injection (arterial phase), 60 s (portal venous phase) and 180 s (portal venous phase), scanning was done (delayed phase). The workstation received the pictures. The axial pictures were obtained using an interval of 2.5 mm and a slice thickness of 5 mm. A 3 mm slice thickness and interval was used for each reformat, if necessary. Two blinded experienced radiologists reviewed MDCT images in order to spot the presence of esophageal varices. In endoscopy unit of medicine, experienced gastroenterologist performed endoscopy for the confirmation of varices. MDCT esophagography findings were compared with the findings of endoscopic examination for determining the diagnostic accuracy of MDCT esophagography in the detection of varices. The data entered and analyzed through SPSS-17. A 2×2 table was constructed and ROC was measured.

RESULTS

High risk varices were identified in 106 (73.1%) of patients on MDCT and were identified in 108 (74.5%) of patients on endoscopy. One hundred and two (70.3%) of patients were true positives, 33 (22.8%) were true negatives, 4 (2.8%) were false positives and 6 (4.1%) were false negatives (Tables 1-2). The specificity, sensitivity, negative predictive value, positive predictive value and accuracy were 89.2%,94.4%, 84.6%,96.2% and 93.1% respectively (Table 2).

ROC curve was generated. Best cutoff value came out to be 2.35 mm (left upper corner of the curve, where sensitivity of 56.5% and specificity of 91.9% was achieved, area under the curve AUC was 0.912 (Fig. 1).

Table 1: MDCT results (n=145)

Varcies on MDCT	No.	%
High risk	106	73.1
Low risk	39	23.9

Table 2: Endoscopy results (n=145)

Varcies on MDCT	No.	%
High risk	108	74.5
Low risk	37	25.5

Table 3 Cross-tabulation of MDCT and endoscopy results

Varices on MDCT	Varices on endoscopy		Total
	High risk	Low risk	
High risk	102 (TP)	4 (FP)	106
Low risk	6 (FN)	33 (TN)	39
Total	108	37	145

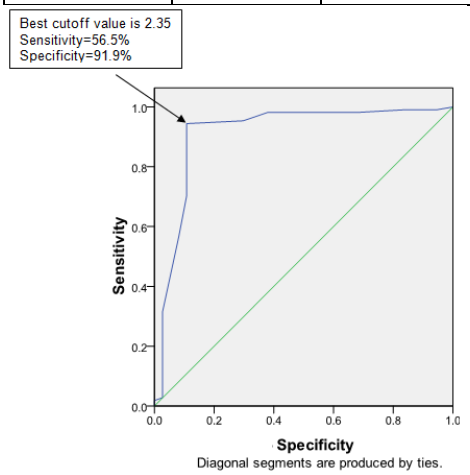

Fig. 1: ROC curve for different cutoff values of diameter of varices obtained by MDCT

DISCUSSION

Esophageal varices are common in at least two thirds of cirrhotic patients. As the load of end stage hepatic failure is growing in Pakistan, the esophageal varices are viewed as a major health issue. About 30-40% of cirrhotic patients develop portal hypertension which causes severe upper gastrointestinal (UGI) bleeding. Despite the availability of modern treatment options, the mortality ratio is as high as 35% in variceal bleeding patients.[14] It is very important to reduce the burden of mortality by avoiding the first variceal bleed through prophylaxis. This prevention of first variceal hemorrhage decreases morbidity, mortality and related health care expenses. An excellent image quality with excellent accuracy of liver multi-detector row computed tomography (MDCT) has been documented for the detection of high-risk esophageal varices with clinical relevance as it covers distal esophagus.[15,16] In this study we determined the diagnostic accuracy of MDCT in detecting and grading of esophageal varices taking endoscopy as gold standard. All patients underwent MDCT and endoscopy examination for detection and grading of oesophageal varices. ROC curve was generated. Best cutoff value came out to be 2.35 mm, where sensitivity of 56.5% and specificity of 91.9% was achieved. Area under the curve AUC was calculated as 0.912.

Our research findings are quite comparable to those published in the literature as well as the identification of

esophageal varices, Moftah et al[17] evaluated the usefulness of CT esophageography with upper endoscopy for the distinction of varices with low and high bleeding risk. Post-contrast portal venous phase axial multidetector-CT (MD-CT) images provided the greatest visualization of OV. No air insufflations or oral contrast media were utilized for esophageal lumen delineation.

Yu et al[18] assessed the performance of liver CT for diagnosing esophageal varices in cirrhosis patients and evaluated whether thin-section multiplanar reconstructions (MPRs) improve accuracy.

Park and colleagues[19] during their research, they compared the effectiveness of liver CT sections with thicknesses of 1 mm, 3 millimeters, and 5 millimeters for the identification and grading of esophageal varices in cirrhotic patients. They found that cirrhotic individuals' esophageal varices may be evaluated using a standard liver CT procedure without the addition of thin section reconstruction pictures. Multi-detector computed tomography (MDCT) was shown to be more effective with effervescent powder (EP) than endoscopy in identifying and grading esophageal varices in patients with cirrhosis. When used in conjunction with MDCT during periodic CT scanning to identify and grade esophageal varices in cirrhotic patients, EP increases the success rate.[20]

According to Kim et al[21], regular helical liver CT scans are effective for the identification and evaluation of varices on the esophagus of patients with cirrhosis. For the identification and grading of esophageal varices, they concluded that liver CT is trustworthy and helpful. For big clinically significant varices, a screening criterion of about 3 mm in diameter should be used.

As described by Somsouk et al[22], abdominal CT imaging revealed variceal hemorrhage. The diameter of the esophageal varices was shown to be strongly associated with the development of VH. Patients with cirrhosis at low and high risk of hemorrhaging should be identified using thresholds of 3 mm and 5 mm, respectively.

Kim et al[23] assessed follow-up liver CT performance for detecting high-risk esophageal varices patients who were treated with locoregional therapy for hepatocellular carcinoma (HCC). In their results, it was documented that follow-up liver CT showed admirable sensitivity, diagnostic performance and NPV to identify high-risk esophageal varices after local regional therapy for HCC.

CONCLUSION

MDCT esophagography detects high risk esophageal varices with excellent accuracy. Our study results showed sensitivity, specificity, PPV, NPV and accuracy of 94.4%, 89.2%, 96.2%, 84.6% and 93.1% respectively. This could be a practical non-invasive choice of imaging for the identification and grading of esophageal varices in clinical practice.

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