Original Research Article

Role of Ultrasonography in Predicting Gastro-oesophageal Varices in Patients with Liver Cirrhosis

Merina Gyawali,¹ Ramesh Raj Acharya²
¹Department of Radiodiagnosis and Imaging, Manipal Teaching Hospital, Pokhara, Nepal, ²Department of Medicine, Manipal Teaching Hospital, Pokhara, Nepal

ABSTRACT

Introduction
Upper Gastrointestinal endoscopy is considered the best screening tool in detecting gastro-esophageal varices in patients with cirrhosis. Ultrasonography of the abdomen can be used for assessment of liver and portal system. This research was undertaken to demonstrate that the portal vein diameter and splenic size by ultrasonography can be used as a non-invasive predictor of gastro-esophageal varices.

Methods
A cross-sectional hospital based study comprising of 290 consecutive patients with liver cirrhosis were enrolled between December 2019 to December 2020. Clinical profile at admission and sonological splenic size and portal vein diameter were studied in all cirrhotic patients. Patients were classified into 2 groups: one with presence of varices and second without varices. Data entry was done in Statistical Packages for the Social Sciences version 20.

Results
The mean age of subjects was 52±13.26 years with a range of 27 – 82 years of age (M:F=2:1). The commonest etiology of cirrhosis was chronic alcohol consumption. The prevalence of varices in cirrhotics was 42.8%. Average portal vein diameter of patients without gastro-esophageal varices was 11.12 ± 1.36 mm, while it was 12.81 ± 1.62 mm in patients with varices (p < 0.001). Average spleen size in cirrhotics without varices was 12.44 ± 1.32 cm and with varices was 14.32 ± 2.42 cm. This difference was also statistically significant (p < 0.001).

Conclusions
Measurement of portal vein diameter and spleen size by ultrasonography can be recommended as a non invasive predictor for gastro-oesophageal varices in patients with liver cirrhosis.

Keywords: cirrhosis; portal vein diameter; spleen size; ultrasonography; gastro-oesophageal varices

Correspondence: Dr. Merina Gyawali, Department of Radiodiagnosis and Imaging, Manipal College of Medical Sciences and Teaching Hospital, Pokhara, Nepal. Email: merinagyawali@gmail.com. phone: +977-9807265511.
INTRODUCTION

Cirrhosis is defined as the histological development of regenerative nodules and fibrous bands in patients with chronic liver diseases, that can lead to end stage liver disease.\(^1\) In patients with liver cirrhosis, portal hypertension causes splenomegaly, dilatation of portal vein, and formation of portal systemic collaterals like gastro-esophageal varices.\(^2\) Rupture of these dilated gastro-esophageal varices is responsible for most common complication in the form of upper gastrointestinal bleed.\(^3\) These are associated with re-bleeding and increased mortality. The presence of gastro-esophageal varices has been considered a prognostic indicator.\(^4\)

Upper Gastrointestinal endoscopy is considered the best screening tool in detecting gastro-esophageal varices in patients with cirrhosis.\(^5\) Despite the advantages of endoscopy, it is an invasive method and has poor compliance. In a low income country like Nepal, every hospital is not well equipped with endoscopy or trained staffs. Ultrasound is a non-invasive tool with high patients compliance and available in all hospitals within the country. Ultrasonography of the abdomen can be used for assessment of liver, spleen size, ascites and portal system.\(^6\). This research was undertaken to demonstrate that the portal vein diameter and spleen size by Ultrasonography can be used as a non-invasive predictor of gastro-esophageal varices in patients with cirrhosis of liver.

METHODS

The observational, cross-sectional, hospital based study was carried out in Department of Radiodiagnosis and Imaging at Manipal College of Medical Sciences Teaching Hospital, Pokhara, Nepal from December 2019 to December 2020. The study was approved and verified by the Institutional Review committee (IRC/385/GA). All consecutive patients aged above 18 years who presented to department of Radiodiagnosis and Imaging at Manipal Teaching Hospital at Pokhara, for ultrasonography with the diagnosis of cirrhosis of Liver were included in this study. Cirrhotic patients with endoscopic evidence of gastro esophageal varices were included in the case study group and those without varices were considered as control group. The minimum sample size calculated was 384.

The following cases with portal hypertension were excluded from the study:

1. Other cases with portal hypertension, i.e., non cirrhotic portal fibrosis, Budd-Chiari syndrome, extra hepatic portal venous obstruction.
2. Critically ill patients, cirrhotic patients with hepatocellular carcinoma and those who fail to give consent.

A detailed history, general physical examination and clinical examination of the abdomen were carried out. A complete study of liver, spleen and portal system was done by Doppler ultrasonography (GE Healthcare GE Logiq P3, Chicago, Illinois, United States) using B-mode imaging with 3-5 MHz curved array transducer. Portal vein diameter and spleen size were measured by placing the patient in supine position during full inspiration. Measurement of more than 13 cm indicates enlargement of spleen.\(^7\) The portal vein diameter exceeding 13 mm in quiet respiration can be suggestive of portal hypertension.\(^7\)

Each patient underwent endoscopic investigation by standard flexible gastro duodenal endoscope (PENTAX EPK 700, PENTAX JAPAN Inc). Endoscopy was done by consultat gastroenterologist and presence of gastro-esophageal varices and other findings were documented. Varices were classified as small (≤
5 mm diameter) or large (>5 mm diameter) when assessed with full insufflations. Computed Tomography scan (PHILIPS Ingenuity 128 CT Scanner, NETHERLANDS Inc) of abdomen was also done in few selected cases.

Data were collected on a structured Performa covering the relevant parameters for the study. Data were entered and evaluated with Statistical Packages for the Social Sciences (SPSS) version 20. All categorical data were expressed in absolute number and percentage. All numerical continuous data were expressed in mean ±SD. The data analysis was done using Statistical Packages for the Social Sciences (SPSS) version 20. Chi squared test was used to test for significant difference of proportions (categorical data). All tests were analyzed with a 95% confidence interval and a P value of <0.05 was considered significant.

RESULTS

A total of 302 cirrhotics patients presented to department of Radiodiagnosos and Imaging over the study period. Twelve were excluded due to lack of adequate data. Finally, 290 patients were enrolled for the study. The study population comprised of 194 (66.9%) males and 96 (33.1%) females (M:F=2:1). Among them, 124 patients had evidence of Gastro-esophageal varices in upper GI endoscopy. The prevalence of varices in cirrhotics was thus 42.8%. Rest, 166 were in the control group (non varices).

The mean age of subjects was 52±13.26 years with a range of 27 – 82 years of age. Patients were further classified as per sex and age groups as in table 1 with maximum cases in 41-59 years of age group. Chronic alcohol consumption accounted 98 (80%) of total cases. Sixteen cases (13.3%) of cases were chronic hepatitis B. 4 cases (3.3%) were diagnosed with chronic hepatitis B and rest 6 (3.3%) were classified as cryptogenic.

These cirrhotic patients presented with varied clinical presentation as in table 2. The most common complaint was anorexia (95.2%) followed by abdominal distension (83.4%), vomiting (80%) and jaundice (72.8%).

Average portal vein diameter (PVD) of patients without gastro-esophageal varices measured by ultrasonography was 11.12 ± 1.36 mm, while it was 12.81 ± 1.62 mm in patients with varices. This difference was statistically significant (p < 0.01). Patients with small varices had average PVD of 12.45 ± 1.35 mm and those with large varices had 13.85 ± 1.75 mm. Average spleen size measured by ultrasonography in patients without varices was 12.44 ± 1.32 cm and with varices was 14.32 ± 2.42 cm. This difference was statistically
DISCUSSION

In the current study, average portal vein diameter (PVD) of patients without gastro-oesophageal varices was 11.12 ± 1.36 mm, while it was 12.81 ± 1.62 mm in patients with varices. In the Indian study by Mandal et al., average PVD of patients without gastro-oesophageal varices was 11.545 ± 1.514 mm and with varices was 13.998 ± 1.123 mm (p < 0.05). The average PVD was 11.78 ± 1.58 mm in non-variceal group and 14.05 ± 2.26 mm in variceal group (p < 0.01) by Shanker et al. According to Bhattarai et al., in a previous study in Nepal, average portal vein diameter (PVD) of patients without gastro-oesophageal varices was 10.82 ± 1.18 mm, while it was 13.69 ± 1.10 mm in patients with varices (p < 0.01). The findings of all these studies are in consistency with our study. Ng et al. detected oesophaeal varices in cirrhosis patients even at a lower mean PVD of 11.5 ± 2.4 mm. Schepis et al. and Thomopoulos et al. found PVD of 13 mm and 13.5 mm respectively to be predictive for variceal detection in cirrhotic patients. There was 92.7 % sensitivity and 90 % specificity for prediction for presence of esophageal varices when the cutoff value of portal vein diameter was >12.25 mm by Bhattarai et al. Shanker et al., reported PVD > 12.2 mm as a predictor of esophageal varices with sensitivity of 80 %, and specificity of 80 %.

Average spleen size of patients without varices was 12.44 ± 1.32 cm and those with varices was 14.32 ± 2.42 cm in the present study. Shanker et al. reported similar average spleen size in variceal group (14.69 ± 1.08 cm) than those in non variceal group (12.45 ± 0.65 cm). In a previous Nepalese study by Bhattarai et al., average spleen size of patients without varices was 12.66 ± 2.15 cm. and those with varices was higher (15.50 ± 1.01 cm). Thomopoulos et al. had reported spleen size more than 13.5 cm to be associated with gastro-oesophageal varices. Even lower splenic size of >13.15 cm and >13.13 cm were associated

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Variceal group (n =62)</th>
<th>Non variceal group (n = 20)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average portal vein diameter (mm)</td>
<td>12.81 ± 1.62</td>
<td>11.12 ± 1.36</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Average spleen size (cm)</td>
<td>14.32 ± 2.42 cm</td>
<td>12.44 ± 1.32</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>

significant (p < 0.01). Patients with small varices had average 13.8 ± 1.25 cm and those with large varices had 15.4 ± 1.28 cm.

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anorexia</td>
<td>276</td>
<td>95.2%</td>
</tr>
<tr>
<td>Abdominal distension</td>
<td>242</td>
<td>83.4%</td>
</tr>
<tr>
<td>Vomiting</td>
<td>232</td>
<td>80%</td>
</tr>
<tr>
<td>Jaundice</td>
<td>211</td>
<td>72.8%</td>
</tr>
<tr>
<td>Limb swelling</td>
<td>192</td>
<td>66.2%</td>
</tr>
<tr>
<td>UGI Bleed</td>
<td>103</td>
<td>35.5%</td>
</tr>
<tr>
<td>Dyspnoea</td>
<td>95</td>
<td>32.8%</td>
</tr>
<tr>
<td>Altered sensorium</td>
<td>45</td>
<td>15.5%</td>
</tr>
</tbody>
</table>

Table 2. Symptomatology of study subjects. (n=290)

Table 3. Sonological Measurements in variceal and non variceal groups.
with presence of gastro-esophageal varices in their studies by Serag et al.\textsuperscript{14} and Mandal et al.\textsuperscript{8} respectively. There was 94.5% sensitivity and 75% specificity for prediction for presence of esophageal varices when the cutoff value of spleen size for was >13.9 cm by Bhattarai et al.\textsuperscript{10} Even at a lower cutoff value of spleen size >13.5 cm, Shanker et al.\textsuperscript{9} reported 90% sensitivity and 80% specificity.

In the current study, it was found that when portal vein diameter and spleen size increased, gastro-oesophageal varices also transformed to higher grades. Our findings are in consistent with published literatures by Mandal et al.\textsuperscript{8}, Shankar et al.\textsuperscript{9} and Nemichandra et al.\textsuperscript{15}, Basnet et al.\textsuperscript{16} and Sharma et al.\textsuperscript{17} who have described positive correlation between portal vein diameter and grades of esophageal varices and also between spleen size and variceal grading.

**CONCLUSIONS**

In cirrhotic patients with portal hypertension, as portal vein diameter increases by > 12.8 mm and as size of spleen increases by >14.3 cm there is increased risk of development of gastro-oesophageal varices. Grades of varices increase with increment of portal vein size and splenic size. Measurement of portal vein diameter and spleen size by ultrasonography can be utilised as a non invasive predictors for gastro-oesophageal varices in patients with liver cirrhosis. Ultrasonography can be used not only for evaluating liver echotexture and ascites in patients with liver cirrhosis but can also be utilized in surveillance and long-term clinical monitoring for varices.

**REFERENCES**


Citation: Gyawali M, Acharya R. Role of Ultrasonography in Predicting Gastro-oesophageal Varices in Patients with Liver Cirrhosis. JCMS Nepal. 2021; 17(1):10-5.