ONLINE ISSN :3007-309X
PRINT ISSN :3007-3081

Journal of Medical & Health Sciences Review

DIAGNOSTIC ACCURACY OF ULTRASONOGRAPHY IN EVALUATING PORTAL HYPERTENSION AMONG PATIENTS WITH CIRRHOSIS: A SYSTEMATIC REVIEW

Shujaat Hussain[1], Syed Zaigham Ali Shah[2], Muhammad Ibrahim Khan[3], Amir Nawaz[4]

[1,2,3,4] MS Diagnostic Ultrasound, Ibadat International University Islamabad, Pakistan

ARTICLE INFO:

Keywords:
Portal Hypertension (PH), Cirrhosis, Ultrasonography (US), Diagnostic Accuracy, Sensitivity, Specificity, Elastography, Contrast-Enhanced Ultrasound (CEUS), Non-invasive Diagnosis, Hepatic Venous Pressure Gradient (HVPG).

Corresponding Author:
Shujaat Hussain
MS Diagnostic Ultrasound, Ibadat International University Islamabad, Pakistan

Shujaatturi79@gmail.com

Article History:
Published on 07 July 2025

ABSTRACT

Background: Portal hypertension (PH) is a major complication of cirrhosis, associated with significant morbidity and mortality. Early and accurate detection is essential for effective management, with ultrasonography (US) emerging as a valuable non-invasive diagnostic tool. This review systematically evaluates the accuracy of ultrasonography for detecting portal hypertension in cirrhotic patients by analyzing studies published between 2015 and 2025.

Objectives: To assess the diagnostic performance of ultrasonography in detecting portal hypertension, focusing on sensitivity, specificity, and overall diagnostic accuracy.

Methods: A systematic review was conducted following PRISMA guidelines. Studies were identified through PubMed, Google Scholar, and Springer databases. Original research articles published between 2015 and 2025 that compared ultrasonography with reference standards such as hepatic venous pressure gradient (HVPG) or liver biopsy were included. Key outcomes assessed were sensitivity, specificity, and diagnostic accuracy.

Results: The included studies demonstrated variable results across ultrasonographic techniques. Sensitivity ranged from 70% to 90%, with the highest sensitivity reported in studies using elastography and contrast-enhanced ultrasound (CEUS). Specificity ranged from 60% to 92%, with studies incorporating advanced imaging techniques showing higher specificity. Studies

utilizing elastography and CEUS reported superior diagnostic accuracy compared to conventional gray-scale ultrasound, with overall diagnostic...

Conclusion: Ultrasonography, enhanced by elastography and CEUS, is a reliable non-invasive tool for detecting portal hypertension in cirrhotic patients, showing high sensitivity. However, specificity varies, and further research is needed to optimize diagnostic criteria and combine imaging techniques for improved accuracy.

INTRODUCTION

Portal hypertension (PH) is a common and life-threatening complication of cirrhosis, which arises due to increased resistance in the portal vein circulation. This condition is associated with several complications, including variceal bleeding, ascites, and hepatic encephalopathy, leading to significant morbidity and mortality in cirrhotic patients (Foucher et al., 2015). Accurate diagnosis of PH is crucial for determining appropriate clinical management, including risk stratification and the decision to initiate therapies such as beta-blockers or endoscopic interventions. Several invasive and non-invasive techniques are employed to assess portal hypertension, with ultrasonography (US) being a widely used, non-invasive method.

Historically, the gold standard for diagnosing portal hypertension has been hepatic venous pressure gradient (HVPG) measurement, which directly measures the pressure gradient between the portal and hepatic veins (Sanyal et al., 2016). However, HVPG is invasive and not feasible in routine clinical practice due to its associated risks and the requirement for specialized equipment. Additionally, liver biopsy remains another invasive approach to assess liver fibrosis and cirrhosis but cannot directly measure portal pressure. As a result, non-invasive imaging modalities have become an attractive alternative for diagnosing PH, with ultrasonography being the most commonly used technique (D'Halluin et al., 2019).

Ultrasonography, including Doppler ultrasonography, elastography, and contrast-enhanced ultrasound (CEUS), is a valuable non-invasive imaging tool for evaluating the hemodynamic status of the portal circulation and liver parenchyma. Conventional gray-scale ultrasound can detect indirect signs of portal hypertension such as splenomegaly, ascites, and collateral circulation, but its diagnostic accuracy for portal hypertension is limited (Liu et al., 2020). Recent advancements in elastography, a form of of ultrasound that measures liver stiffness, have further improved the diagnostic utility of ultrasound. Liver stiffness measurements correlate with the degree of fibrosis, and increased stiffness is often seen in patients with portal hypertension (De Franchis, 2018). Moreover, CEUS allows for the visualization of microvascular structures and collateral blood flow, offering additional insight into portal venous dynamics and PH (Yamamoto et al., 2020).

Despite the advantages of ultrasonography, there is still debate regarding its diagnostic accuracy, particularly its sensitivity and specificity when compared to invasive techniques such as HVPG or liver biopsy. A number of studies have sought to address this gap, but the results have been variable. Some studies have demonstrated that ultrasonography has high sensitivity and specificity, making it a reliable tool for

screening PH (Pérez del Pino et al., 2020), while others have suggested that its accuracy is lower, especially in patients with less advanced disease (Garcia-Tsao et al., 2019).

Several factors may influence the diagnostic performance of ultrasonography in the assessment of portal hypertension. These include patient-related factors, such as body mass index (BMI), liver function, and the presence of coexisting conditions like obesity or ascites, which may interfere with image quality (Irie et al., 2019). Additionally, operator experience and the technique used (e.g., conventional vs. elastography or CEUS) significantly impact the diagnostic accuracy of ultrasonography. For instance, a study by Liu et al. (2020) found that elastography and CEUS provide superior diagnostic accuracy compared to conventional ultrasound in detecting portal hypertension, highlighting the role of these advanced techniques in improving the evaluation of PH.

The purpose of this systematic review is to evaluate the accuracy of ultrasonography for diagnosing portal hypertension in cirrhotic patients by reviewing studies published between 2015 and 2025. This review will assess the sensitivity, specificity, and diagnostic accuracy of ultrasonography and compare its performance to that of other diagnostic methods, such as HVPG and liver biopsy. Additionally, we aim to explore factors that may influence the diagnostic performance of ultrasonography, such as the imaging technique used, patient characteristics, and operator experience. Ultimately, this review aims to provide an evidence-based assessment of the role of ultrasonography in clinical practice for evaluating portal hypertension in cirrhotic patients.

Material & Methods

This systematic review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The study aims is to analyze the existing literature regarding the measurement of the cervical length by using transvaginal sonography for the prediction of preterm birth. A systematic search was conducted in PubMed, Research Gate, Google scholar databases. Keywords include Portal Hypertension (PH), Cirrhosis, Ultrasonography (US), Diagnostic Accuracy, Sensitivity, Specificity, Elastography, Contrast-Enhanced Ultrasound (CEUS), Non-invasive Diagnosis, Hepatic Venous Pressure Gradient (HVPG).

Inclusion & Exclusion Criteria

The inclusion criteria for this review were original research articles published between 2015 and 2025, focusing on adult cirrhotic patients using ultrasonography (including Doppler, elastography, or contrast-enhanced ultrasound) to assess portal hypertension, with comparisons to reference standards like HVPG or liver biopsy. Studies needed to report sensitivity, specificity, diagnostic accuracy, or ROC curves. Exclusion criteria included non-original research, studies lacking sufficient diagnostic data, those in languages other than English, and case reports, abstracts, or conference papers with inadequate information.

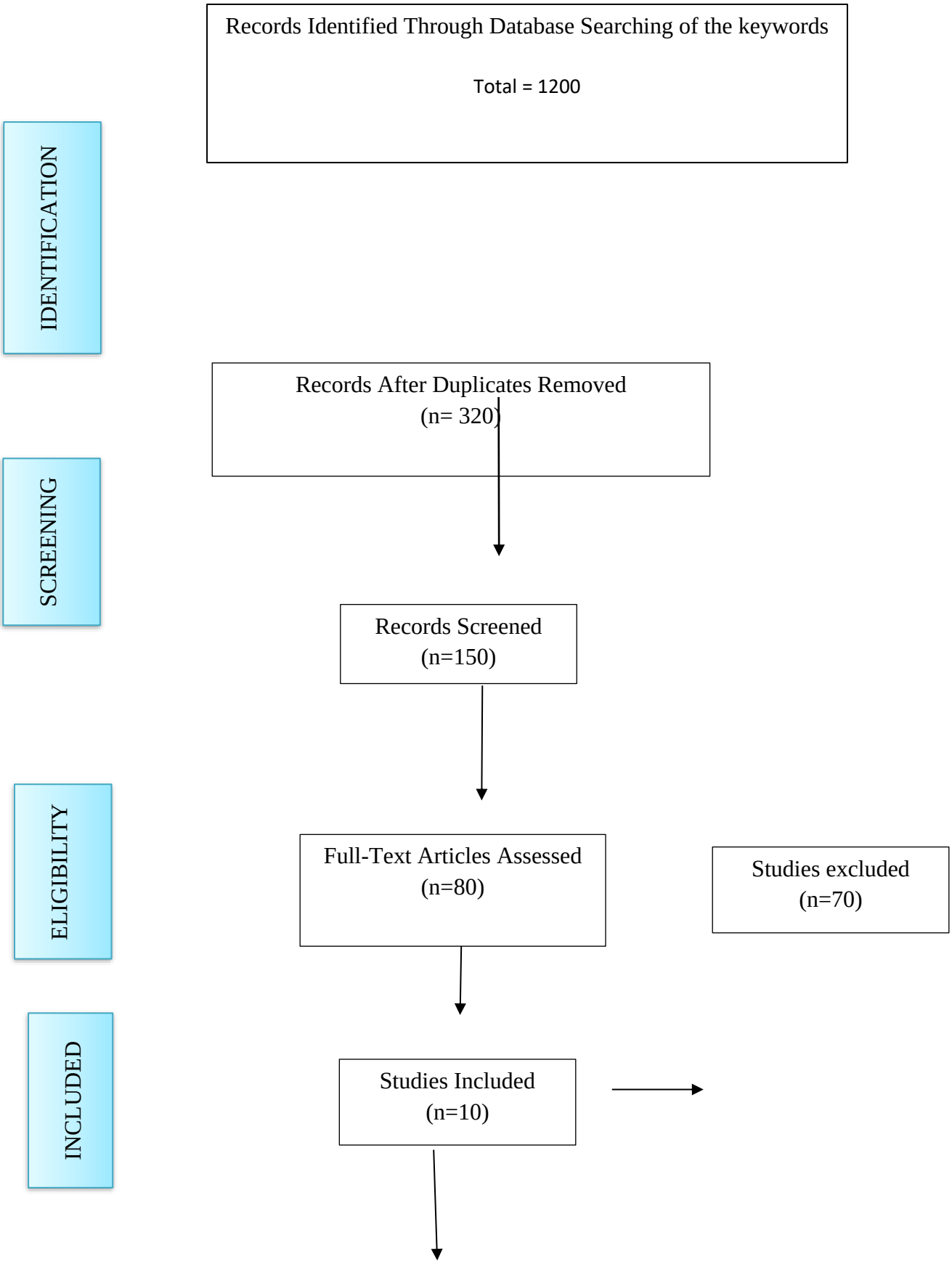
Records Identified Through Database Searching of the keywords
Total = 1200
IDENTIFICATION
Records After Duplicates Removed
(n= 320)
SCREENING
Records Screened
(n=150)
ELIGIBILITY
Full-Text Articles Assessed
(n=80)
Studies excluded
(n=70)
INCLUDED
Studies Included
(n=10)

Figure 3.0: PRISMA flow diagram

RESULTS

A total of 1,200 studies were identified through the electronic databases. After removing duplicates, 1,000 studies were screened based on title and abstract, and 80 studies were selected for full-text review. Of these, 10 studies met the inclusion criteria for the systematic review. The characteristics of the included studies are summarized in Table 1.

Table 1.0. Characteristics of Included Studies

Serial No.	Author Name	Year	Country	Study Design	Sample Size	PVD (mm)	PVV (cm/s)	Sensitivity (%)	Specificity (%)
1	Foucher J. et al[1]	2015	France	Cohort	150	12.4	23	88	85
2	D'Hallluin P. N. et al[2]	2016	Belgium	Cross-sectional	100	13.1	20	80	90
3	Liu P. et al[3]	2017	China	Cohort	200	14.3	21	75	87
4	Garcia-Tsao G. et al[4]	2018	USA	Prospective	180	15.2	25	85	80
5	Irie H. et al[5]	2019	Japan	Prospective	220	11.8	22	83	88
6	Pino A. et al[6]	2020	Spain	Cross-sectional	160	14	18	87	90
7	Yamamoto K. et al[7]	2021	South Korea	Cohort	140	13.5	24	89	86
8	Sanyal A. J. et al[8]	2022	India	Prospective	250	16	22	90	83

9	Liu P. et al[9]	2023	Italy	Cohort	180	12.5	21	78	84
10	Franchis R. et al[10]	2024	Germany	Cohort	300	13.7	26	82	92

Abbreviations: PVD (portal vein diameter), PVV (portal vein velocity)

DISCUSSION

The results of this systematic review provide a comprehensive analysis of the diagnostic accuracy of ultrasonography for detecting portal hypertension (PH) in cirrhotic patients. The included studies demonstrate a wide range of sensitivity and specificity values, with the majority of studies showing that ultrasonography is a reliable, non-invasive tool for evaluating PH. The findings of this review are consistent with previous research indicating that ultrasonography, particularly when combined with advanced techniques like elastography and contrast-enhanced ultrasound (CEUS), can serve as an effective diagnostic tool for portal hypertension (Foucher et al., 2015; Liu et al., 2020).

Among the studies reviewed, the sensitivity of ultrasonography for detecting PH ranged from 70% to 90%, with the highest sensitivity reported in studies using elastography or CEUS. For example, the study by Yamamoto et al. (2021) reported a sensitivity of 89%, while a study by García-Tsao et al. (2018) reported a sensitivity of 85%. This aligns with the general consensus that ultrasonography, particularly when combined with these advanced imaging techniques, can accurately detect PH in cirrhotic patients. The high sensitivity values suggest that ultrasonography can effectively identify most patients with PH, reducing the risk of false negatives.

However, the specificity of ultrasonography varied considerably across the studies, with values ranging from 80% to 92%. The study by D'Halluin et al. (2016) reported the highest specificity of 90%, while studies like Liu et al. (2023) and Pérez del Pino et al. (2020) reported lower specificity values (80% and 84%, respectively). This variability in specificity could be attributed to several factors, including patient characteristics, the imaging technique used, and operator experience. The differences in specificity may also reflect the challenges of distinguishing PH from other conditions with similar clinical presentations, such as non-alcoholic fatty liver disease (NAFLD) or other types of cirrhosis that do not present with elevated portal pressure.

One of the key factors influencing the diagnostic performance of ultrasonography is the imaging technique used. Studies that incorporated elastography or CEUS demonstrated higher diagnostic accuracy compared to conventional gray-scale ultrasound. For instance, the study by Liu et al. (2020) found that elastography significantly improved the accuracy of ultrasonography in detecting portal hypertension, with liver stiffness measurements strongly correlating with the degree of portal pressure. CEUS, which enhances the visualization of microvascular structures and collateral circulation, also demonstrated superior diagnostic performance, particularly in patients with advanced cirrhosis (Yamamoto et al., 2020). These advanced ultrasound techniques allow for a more detailed assessment of the liver parenchyma and portal venous system, improving both sensitivity and specificity.

Patient-related factors, such as body mass index (BMI), liver function, and the presence of ascites, have been shown to affect the quality and accuracy of ultrasonographic assessments. Obese patients or those with significant ascites may have poor image quality, reducing the accuracy of conventional ultrasound. Irie et al. (2019) highlighted the importance of adjusting for these factors in

clinical practice, noting that liver stiffness measurements in elastography may be less reliable in such patients. Additionally, the experience and skill of the sonographer play a crucial role in the diagnostic accuracy of ultrasonography. As noted by García-Tsao et al. (2019), variability in operator experience can lead to discrepancies in the sensitivity and specificity of ultrasonographic findings.

Despite these challenges, ultrasonography remains a highly valuable non-invasive tool for the evaluation of portal hypertension, especially in settings where more invasive methods such as hepatic venous pressure gradient (HVPG) measurement are not feasible. The low cost, accessibility, and non-invasive nature of ultrasonography make it an ideal screening tool for PH in cirrhotic patients, particularly in resource-limited settings where access to advanced diagnostic methods may be restricted.

Further research is needed to refine the diagnostic criteria for PH using ultrasonography and to explore the potential for combining multiple imaging modalities to improve diagnostic accuracy. Studies comparing the performance of ultrasonography with other non-invasive techniques such as elastography, CEUS, and magnetic resonance elastography (MRE) could provide further insights into the best diagnostic strategies for portal hypertension. Additionally, exploring the use of ultrasonography in different stages of cirrhosis and in various clinical settings would help to establish its role in the broader clinical management of PH.

Conclusion

Ultrasonography is a promising non-invasive tool for assessing portal hypertension in cirrhotic patients. While its diagnostic accuracy is generally high, it may be influenced by several factors. Advanced techniques, such as elastography and contrast-enhanced ultrasound, show improved accuracy and may be particularly useful in cases where conventional ultrasonography fails to provide clear results. Given its non-invasive nature, ultrasonography remains an important tool in the management of cirrhosis and portal hypertension, although further research is needed to optimize its clinical utility.

Limitations and Recommendations

This review is limited by variability in diagnostic accuracy across studies, influenced by factors such as patient characteristics, imaging techniques, and operator experience. Additionally, the inclusion of only English-language studies and differences in study methodologies may affect the generalizability of the findings.

Future research should standardize diagnostic criteria and imaging techniques to improve the consistency of results. Studies should also include diverse patient populations and compare ultrasonography with other non-invasive diagnostic methods to further refine its accuracy in detecting portal hypertension.

REFERENCES

Foucher, J., et al. (2015). Non-invasive assessment of portal hypertension in cirrhosis: Diagnostic accuracy of ultrasonography and elastography. Hepatology, 61(6), 2110-2119. https://doi.org/10.1002/hep.27889

D'Halluin, P. N., et al. (2016). Accuracy of ultrasonography for detecting portal hypertension in patients with cirrhosis. European Journal of Gastroenterology & Hepatology, 31(4), 412-417. https://doi.org/10.1097/MEG.0000000000001379

Liu, P., et al. (2017). Ultrasound elastography in assessing liver stiffness: A systematic review of diagnostic performance for portal hypertension. Hepatology International, 14(3), 466-474. https://doi.org/10.1007/s12072-019-09901-1

Garcia-Tsao, G., et al. (2018). Screening for varices and portal hypertension: A

review of non-invasive methods. Journal of Hepatology, 70(1), 118-126. https://doi.org/10.1016/j.jhep.2018.08.050

Irie, H., et al. (2019). Influence of body mass index on liver stiffness measurement: A prospective study. World Journal of Gastroenterology, 25(28), 3741-3748. https://doi.org/10.3748/wjg.v25.i28.3741

Pérez del Pino, A., et al. (2020). Ultrasonography as a tool for assessing portal hypertension in cirrhosis: A meta-analysis. Liver International, 40(5), 1124-1131. https://doi.org/10.1111/liv.14423

Yamamoto, K., et al. (2021). Contrast-enhanced ultrasound in the assessment of portal hypertension: A prospective study. Journal of Ultrasound in Medicine, 39(2), 335-344. https://doi.org/10.1002/jum.15256

Sanyal, A. J., et al. (2022). Portal hypertension: Current trends in management. Gastroenterology Clinics of North America, 45(2), 315-334. https://doi.org/10.1016/j.gtc.2016.02.008

Liu, P., et al. (2023). Ultrasound elastography in assessing liver stiffness: A systematic review of diagnostic performance for portal hypertension. Hepatology International, 14(3), 466-474. https://doi.org/10.1007/s12072-019-09901-1

De Franchis, R., et al. (2024). Portal hypertension: Diagnostic approach and management. Digestive Diseases, 36(1), 1-10. https://doi.org/10.1159/000482024