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# Accuracy of Ultrasound in Diagnosing Gastrointestinal Diseases: A Comprehensive Review

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**ABSTRACT**

**Background:** This review aims to explore the effectiveness of ultrasound (US) in diagnosing various gastrointestinal (GIT) diseases. The diagnostic accuracy of US varies by disease.

**Methods:** comprehensive research in several data bases to detect the accuracy of ultrsund in diagnosing GIT dieases t asses if it is possible to consider it as a single tool for diagnosis in certian diseases and asses its accuracy percentage in each disease.
**Results:** it is with high accuracy in conditions like gallstones, liver cysts and pyloric stenosis, moderate effectiveness in appendicitis and Crohn's disease and with lower diagnostic ability in pancreatic and colon cancer.

**Conclusion:** Ultrasound imaging offers a non-invasive, cost-effective and radiation-free alternative to traditional imaging techniques. This review article will discuss the accuracy of ultrasound in diagnosing a range of GIT complications, including inflammatory bowel disease, liver pathologies, gallbladder disorders and pancreatic diseases. We will explore the ability of ultrasound in detecting various GIT abnormalities, emphasizing its role in guiding clinical decision- making. Furthermore, we will address the limitations of ultrasound, including operator dependency, limited visualization of certain anatomical structures and challenges in obese patients. This review aims to provide a comprehensive overview of the role of ultrasound in the diagnostic pathway for GIT diseases, thereby improving patient outcomes in the management of gastrointestinal disorders.

***Keywords:*** *Accurate diagnosis; Ultrasound; GIT diseases; diseases diagnosed by ultrasound*

## 1. INTRODUCTION

The effectiveness of ultrasound in diagnosing gastrointestinal diseases has gained significant attention in recent years, as advancements in ultrasound techology and techniques have enhanced its diagnostic capabilities. Ultrasound, particularly trans

abdominal gastrointestinal ultrasound (GIUS), has emerged as a first-line imaging modality due to its non-invasive nature, safety and ability to provide real-time imaging of the gastrointestinal tract. This review aims to focus on ultrasound in diagnosing several gastrointestinal diseases, highlighting its effectiveness in identifying conditions such as inflammatory bowel disease (IBD) and gastrointestinal tumors. The role of ultrasound in diagnosing gastrointestinal diseases is underscored by its ability to visualize the bowel wall and surrounding structures, allowing for the assessment of various pathological conditions. For instance, studies have demonstrated that ultrasound can effectively detect inflammatory changes in patients with IBD, showing high sensitivity and specificity in identifying disease activity (1-3). This capability is particularly important as it allows for the monitoring of disease progression and response to therapy without the need for invasive procedures such as endoscopy (4). Furthermore, the introduction of advanced techniques such as elastography has further enhanced the diagnostic utility of ultrasound by enabling the evaluation of tissue stiffness, which can be indicative of neoplastic transformations or fibrosis (5).

In pediatric populations, ultrasound has proven to be a valuable tool for diagnosing conditions such as intussusception and congenital hypertrophic pyloric stenosis (CHPS). Research indicates that ultrasound is the preferred imaging modality for these conditions due to its ability to provide rapid and accurate diagnoses, which is crucial in acute settings (6,7). For instance, the diagnostic criteria for CHPS, including pyloric muscle thickness and length, can be effectively assessed using ultrasound, leading to timely interventions (7). Additionally, the use of contrast-enhanced ultrasound has showed to be promising in improving diagnostic accuracy for peptic ulcers, particularly in children,

where traditional imaging modalities may have limitations (8). Moreover, ultrasound has been recognized for its role in diagnosing gastrointestinal tumors. Recent advancements in ultrasound technology, including the use of contrast agents, have expanded its application in evaluating gastrointestinal malignancies. Studies have reported that ultrasound can not only visualize the gastrointestinal wall but also assess surrounding lesions and metastases, making it a valuable tool for preoperative evaluation and postoperative follow-up (9,10). The ability to perform ultrasound-guided biopsies has also been highlighted, with high diagnostic accuracy in identifying malignant lesions (11).

Despite its advantages, ultrasound is not without limitations. Factors such as the presence of gas in the gastrointestinal tract can hinder image quality and diagnostic accuracy (12). However, with proper training and adherence to the established protocols, these challenges can be mitigated, reinforcing ultrasound's position as a primary diagnostic tool in gastrointestinal emergencies (13). The effectiveness of ultrasound in diagnosing gastrointestinal diseases is well-supported by a growing body of literature. Its non- invasive nature, coupled with advancements in technology, has solidified its role as a critical tool in diagnosis of gastrointestinal disorders.

## 2. RESULTS AND DISCUSSIONS

### *Ultrasound Accuracy in GIT Diseases*

Ultrasound is a powerful tool for GIT disease diagnosis but has certain limitations. The diagnostic accuracy of ultrasound (US) in gastrointestinal (GI) diseases varies based on some specific conditions as patient factors (e.g., obesity, bowel gas), and operator expertise. Below is an estimated percentage range of ultrasound's success rate for diagnosing various GIT diseases, based on the previous medical studies (14). These percentages highlight the importance of considering both patient characteristics and the skill level of the technician when interpreting ultrasound results, ultimately influencing clinical decision-making.

### *Gallbladder and Biliary Diseases*

Gallbladder and biliary diseases are commonly assessed using ultrasound, which serves as the gold standard for detecting gallstones (cholelithiasis) and acute cholecystitis due to its high sensitivity and specificity. However, ultrasound is less sensitive for detecting common bile duct (CBD) stones (choledocholithiasis) compared to MRCP (Magnetic Resonance Cholangiopancreatography) or ERCP (Endoscopic Retrograde Cholangiopancreatography). In cases of gallbladder and biliary diseases, ultrasound has been shown to achieve a success rate ranging from 85% to 95% for diagnosing conditions like cholelithiasis, while the detection of CBD stones typically falls between 60% and 80%, underscoring the need for complementary imaging techniques in certain scenarios (15).

### ULTRASOUND FINDINGS FOR GALLBLADDER & BILIARY DISEASES:

### *Gallstones (Cholelithiasis) – 95-98% Sensitivity*

Gallstones (cholelithiasis) have a high diagnostic sensitivity of 95-98% using ultrasound. They typically appear as hyperechoic (bright) foci with posterior acoustic shadowing and are mobile within the gallbladder lumen, shifting with patient positioning. The size of gallstones can vary from tiny to large. Other gallbladder conditions, such as cholecystitis and biliary obstruction, also exhibit high sensitivity rates with ultrasound, highlighting its crucial role in providing accurate diagnostic information for effective disease management (16).

***Acute Cholecystitis – 85-95% Sensitivity***

Acute cholecystitis has a diagnostic sensitivity of 85-95% using ultrasound. Key ultrasound findings include gallbladder wall thickening greater than 3 mm, the presence of pericholecystic fluid surrounding the gallbladder, and a positive sonographic Murphy's sign, which indicates pain when pressure is applied over the gallbladder with the ultrasound probe. Additionally, possible gallstones obstructing the cystic duct may be observed. These findings are crucial for accurately diagnosing acute cholecystitis and guiding appropriate clinical management (17).

***Gallbladder Polyps – 80-90% Sensitivity***

Gallbladder polyps have a diagnostic sensitivity of 80-90% using ultrasound. They appear as non-mobile, non-shadowing hyperechoic masses attached to the gallbladder wall. While smaller polyps are often benign, those larger than 1 cm raise suspicion for malignancy and may require further evaluation. Ultrasound plays a critical role in detecting and monitoring gallbladder polyps, aiding in the early identification of potentially malignant changes (18).

***Common Bile Duct Stones (Choledocholithiasis) – 50-80% Sensitivity***

Common bile duct stones (choledocholithiasis) have a diagnostic sensitivity of 50-80% with ultrasound, but the modality has notable limitations. Small stones or those obscured by bowel gas may be missed, reducing detection accuracy. Key ultrasound findings include a dilated common bile duct (CBD), with a normal diameter of up to 6 mm and greater than 10 mm in post-choledystectomy patients. Stones, when visible, appear as hyperechoic foci with posterior shadowing. However, magnetic resonance cholangiopancreatography (MRCP) or endoscopic retrograde cholangiopancreatography (ERCP) are preferred for more accurate detection. Given these limitations, it is crucial to correlate ultrasound findings with the patient's clinical presentation and laboratory results for a comprehensive assessment of biliary pathology (19). While ultrasound remains the first-line imaging modality for gallstones and cholecystitis, it is less effective for detecting bile duct stones, necessitating the use of MRCP or ERCP when suspicion remains high. Findings such as gallbladder wall thickening, pericholecystic fluid, and a positive Murphy's sign can further increase suspicion for cholecystitis and guide appropriate management.

***Ultrasound in Liver Diseases***

Ultrasound is a vital imaging modality for evaluating liver diseases, though its effectiveness depends on the specific condition. It is highly accurate in detecting fatty liver and liver cysts, providing a reliable and non-invasive diagnostic tool for these conditions. However, when it comes to detecting small liver tumors and assessing early cirrhosis, contrast-enhanced ultrasound (CEUS), CT, or MRI are often preferred due to their superior sensitivity and ability to provide more detailed structural and functional information. Despite these limitations, ultrasound remains an essential first-line imaging technique for liver evaluation, offering real-time assessment and guiding further diagnostic and therapeutic decisions (20).

***Fatty Liver (Hepatic Steatosis) – 85-95% Sensitivity***

Fatty liver (hepatic steatosis) has a high diagnostic sensitivity of 85-95% using ultrasound, making it a reliable tool for detecting fat deposition in the liver. Characteristic ultrasound features include increased echogenicity, often referred to as a "bright liver," due to excessive fat accumulation. Posterior attenuation occurs as sound waves are absorbed, reducing visibility of deeper structures, while blurry vascular markings result from fat obscuring the portal veins. Additionally, hepatorenal contrast is observed, where the liver appears brighter than the kidney. However, despite its high accuracy, ultrasound cannot differentiate between simple steatosis, non-alcoholic steatohepatitis (NASH), or fibrosis, necessitating a biopsy for a definitive assessment of disease severity (21).

***Liver Cirrhosis – 60-90% Sensitivity***

Liver cirrhosis has a diagnostic sensitivity of 60-90% with ultrasound, making it a useful tool for detecting advanced stages of the disease, though early cirrhosis may be missed. Key ultrasound features include an irregular liver surface with a nodular contour due to fibrosis, a coarse echo texture reflecting heterogeneous fibrotic changes, and an enlarged caudate lobe with a shrunken right lobe in more advanced cases. Additional findings such as splenomegaly and signs of portal hypertension, including a dilated portal vein greater than 13 mm, ascites, or varices, further support the diagnosis. However, ultrasound has limitations in identifying early-stage cirrhosis, where structural changes may not yet be evident. For a more precise assessment of fibrosis severity, elastography (Fibro Scan) or liver biopsy is preferred (22).

***Liver Tumors (Hepatocellular Carcinoma, Metastases) – 60-85% Sensitivity***

Liver tumors, including hepatocellular carcinoma (HCC) and metastatic lesions, have a diagnostic sensitivity of 60-85% with ultrasound, though contrast-enhanced ultrasound (CEUS) improves detection to approximately 90%. HCC typically appears as a hypoechoic or hyperechoic mass with irregular borders and increased vascularity on Doppler imaging. CEUS further enhances diagnostic accuracy by revealing arterial-phase enhancement followed by washout, a key characteristic of HCC. Metastatic liver lesions often present as multiple hypoechoic or hyperechoic abnormalities with a target-like or halo appearance. However, ultrasound has limitations in detecting small tumors, particularly those less than 1 cm in size. For a more precise diagnosis and staging, CT or MRI with contrast is preferred, as these modalities provide superior sensitivity and anatomical detail (23).

### *Liver Cysts – 95-100% Sensitivity*

Liver cysts are easily detected using ultrasound, with a sensitivity of 95-100%, due to their fluid-filled nature. They typically appear as anechoic (completely black) lesions with well-defined walls and exhibit posterior acoustic enhancement, which results in bright enhancement behind the cyst. Simple cysts are benign and lack internal echoes, septations, or vascularity. However, complex cysts that present with septations, debris, or irregular walls may indicate malignancy or infection, such as echinococcal cysts, and require further evaluation. While ultrasound is highly effective for detecting liver cysts and fatty liver, it is less sensitive for early cirrhosis and small tumors, where CT or MRI is preferred. For assessing fibrosis severity, a biopsy or Fibro Scan is necessary. The use of contrast-enhanced ultrasound (CEUS) significantly enhances the visualization of liver tumors by providing valuable insights into their vascularity, helping distinguish benign from malignant lesions. This advanced imaging technique has improved the diagnostic

process, allowing for more precise assessment of liver abnormalities and guiding appropriate management strategies. Incorporating CEUS into routine clinical practice holds great potential for improving patient outcomes through earlier detection and more accurate characterization of liver lesions (24).

### *Ultrasound in Pancreatic Diseases*

Ultrasound is a valuable imaging tool for assessing pancreatic diseases, though its sensitivity varies depending on the condition. It is particularly useful for detecting acute pancreatitis, where it can identify pancreatic swelling and peripancreatic fluid collections. However, its effectiveness is limited for chronic pancreatitis and pancreatic cancer, as ultrasound may struggle to detect subtle changes or small lesions due to interference from bowel gas. For more precise evaluation, especially in early disease stages or when small tumors are suspected, CT and endoscopic ultrasound (EUS) are preferred imaging modalities. These advanced techniques provide superior visualization, allowing for more accurate diagnosis, staging, and treatment planning (25).

### *Acute Pancreatitis – 70-90% Sensitivity*

Acute pancreatitis has a diagnostic sensitivity of 70-90% with ultrasound, making it a useful tool for detecting pancreatic inflamation. Key ultrasound features include an enlarged, hypoechoic (edematous) pancreas with poorly defined borders due to inflamation. In moderate to severe cases, peripancreatic fluid collections may also be present. If gallstone-induced pancreatitis is suspected, ultrasound can help identify gallstones within the gallbladder or common bile duct. However, its accuracy can be

limited by bowel gas (ileus), which may obscure the pancreas and hinder visualization. Additionally, ultrasound is less effective in detecting complications such as necrosis, abscesses, and pseudoysts, for which CT is the preferred imaging modality due to its superior sensitivity and ability to provide detailed structural assessment (26).

### *Chronic Pancreatitis – 50-80% Sensitivity*

Chronic pancreatitis has a diagnostic sensitivity of 50-80% with ultrasound, making it effective for detecting advanced disease but less reliable for early-stage changes. Key ultrasound findings include a shrunken, irregular pancreas with a coarse echo texture due to fibrosis, along with the presence of highly echogenic calcifications that produce shadowing. A dilated pancreatic duct greater than 3 mm may be observed, often resulting from fibrosis or strictures, and pseudoysts or cystic changes may also be present. However, ultrasound has limitations in identifying early disease, as subtle structural abnormalities may not be easily visualized. For a more accurate assessment, particularly in early stages, CT, MRI, or endoscopic ultrasound (EUS) is preferred, as these modalities offer superior sensitivity for detecting small ductal abnormalities and subtle parenchymal changes (27).

### *Pancreatic Cancer – 50-70% Sensitivity*

Pancreatic cancer has a diagnostic sensitivity of 50-70% with ultrasound, making it useful for detecting larger tumors but less effective for identifying small lesions. Ultrasound findings typically include a poorly defined, hypoechoic mass in the pancreas, along with a dilated pancreatic duct (>3 mm) or common bile duct, known as the "double

duct sign." In advanced cases, liver metastases or enlarged lymph nodes may also be visible. However, ultrasound has limitations, particularly in detecting tumors smaller than 2 cm, as bowel gas interference can obscure visualization. For more accurate detection and staging, CT or endoscopic ultrasound (EUS) is preferred, with EUS-guided biopsy being the most effective tool for definitive diagnosis. While ultrasound remains valuable for assessing pancreatitis, it has significant limitations in diagnosing chronic pancreatitis and pancreatic cancer, requiring additional imaging modalities for a comprehensive evaluation (28).

### *Ultrasound in Acute Appendicitis*

Ultrasound is the first-line imaging modality for diagnosing acute appendicitis in children and pregnant women, offering a high sensitivity of 80-95% while avoiding radiation exposure. It is particularly useful in these populations due to its safety and effectiveness in detecting an inflamed appendix. However, its accuracy is lower in obese patients or when excessive bowel gas obscures visualization, making diagnosis more challenging. In adults, if ultrasound findings are inconclusive or the appendix is not clearly visualized, CT is preferred as it provides greater diagnostic accuracy and detailed anatomical assessment (29).

Ultrasound findings of acute appendicitis typically include an enlarged, non-compressible appendix measuring greater than 6 mm in diameter, with a thickened, hypoechoic wall exceeding 2 mm. A characteristic "target sign" may be observed in cross-sectional views, showing a hypoechoic ring surrounding a central lumen. Additional sonographic indicators of inflamation include periappendiceal fat stranding, seen as hyperechoic

changes in the surrounding fat, and increased vascularity on color Doppler imaging. In some cases, an appendicolith (fecalith) may be present, appearing as an echogenic focus with posterior shadowing. Complicated cases may also exhibit periappendiceal fluid collection or abscess formation, suggesting perforation or advanced infection (30).

Despite its high accuracy in children and pregnant women, ultrasound has limitations, particularly in obese patients or when bowel gas interfere with visualization. These factors can obscure the appendix, making diagnosis more challenging. If the appendix is not clearly seen and clinical suspicion remains high, CT is recommended for a more definitive assessment, particularly in adult patients. While ultrasound remains a crucial first-line diagnostic tool for appendicitis, its limitations highlight the need for complementary imaging modalities like CT when necessary, ensuring accurate and timely diagnosis (31).

### *Ultrasound in Intestinal Obstruction and GIT Conditions*

Ultrasound is highly effective for diagnosing pediatric gastrointestinal conditions such as intussusception and pyloric stenosis, offering rapid and accurate assessment in these cases. However, its utility is more limited in evaluating bowel obstruction, inflammatory bowel disease (IBD), and colon cancer, where deeper bowel pathology is often involved. While ultrasound can detect dilated bowel loops and abnormal peristalsis in obstruction cases, CT or MRI is preferred for identifying the precise location and underlying cause, such as adhesions, tumors, or strictures. Similarly, although ultrasound can assess bowel

wall thickening and vascularity in IBD, MRI or CT enterography provides a more comprehensive evaluation of disease extent and complications. For colon cancer, ultrasound is not a reliable diagnostic tool, as early-stage tumors are difficult to visualize, and CT colonography or colonoscopy remains the gold standard for detention and staging (32).

### *Bowel Obstruction – 75-85% Sensitivity*

Bowel obstruction has a diagnostic sensitivity of 75-85% with ultrasound, making it a useful but less definitive tool compared to CT. Ultrasound findings typically include dilated bowel loops, measuring greater than 2.5 cm for the small bowel and over 5 cm for the large bowel, along with to-and-fro or absent peristalsis, depending on the severity of the obstruction. Fluid-filled bowel loops with a “tethered” appearance may also be observed, and the presence of free fluid between loops suggests severe obstruction or potential perforation. Despite these capabilities, ultrasound has limitations in assessing the full extent of bowel obstruction, particularly in deeper bowel segments where gas interference may hinder visualization. CT remains the preferred imaging modality for precisely locating the obstruction site and identifying the underlying cause, such as adhesions, hernias, or tumors, making it essential for comprehensive diagnosis and treatment planning (33).

### *Intussusception (Children) – 90-100% Sensitivity*

Intussusception in children has a diagnostic sensitivity of 90-100% with ultrasound, making it the gold standard imaging modality for this condition. Key ultrasound features

include the classic “target sign” or “donut sign,” characterized by concentric alternating echogenic and hypoechoic rings in a transverse view, and the “pseudokidney sign,” seen in the longitudinal view as hypoechoic outer bowel layers surrounding a central echogenic core. In severe cases, decreased blood flow on Doppler imaging may indicate ischemia, necessitating urgent intervention. Intussusception is most commonly seen in children under two years old and requires prompt reduction using an air or barium enema if there are no signs of necrosis. Early and accurate diagnosis with ultrasound is crucial to preventing complications and ensuring timely treatment (34).

### *Pyloric Stenosis (Infants) – 95-100% Sensitivity*

Pyloric stenosis in infants has a diagnostic sensitivity of 95-100% with ultrasound, making it the gold standard imaging modality for this condition (35). Key ultrasound features include a thickened pyloric muscle measuring greater than 3 mm, an elongated pyloric channel exceeding 15-18 mm, and the absence of gastric contents passing through the pylorus, known as the “cervix sign” This condition typically presents in infants between 2 to 8 weeks of age with projectile, non-bilious vomiting, leading to dehydration and weight loss if left untreated. Once diagnosed, pyloric stenosis is effectively managed with pyloromyotomy, a surgical procedure that relieves the obstruction and restores normal gastric emptying. Early detection with ultrasound ensures prompt treatment and prevents complications.

### *Inflammatory Bowel Disease (IBD – Crohn’s, Ulcerative Colitis) – 60-85% Sensitivity*

Ultrasound has a diagnostic sensitivity of 60-85% for inflammtory bowel disease (IBD), with greater utility in detecting Crohn’s disease than ulcerative colitis. Key ultrasound features of IBD include bowel wall thickening, defined as greater than 3 mm in the small bowel and more than 4 mm in the colon, along with increased Doppler vascularity indicative of active inflammtion. Additional findings may include hyperemia and mesenteric fat proliferation, known as the “creeping fat” sign, as well as complications such as abscesses or fistulas, which are more common in Crohn’s disease. However, ultrasound has limitations, particularly in evaluating deeper bowel involvement, for which CT or MRI enterography is preferred. Additionally, ultrasound is less effective in diagnosing ulcerative colitis, as this condition primarily affects the mucosal layer, which is more challenging to visualize with sonography (36).

### *Colon Cancer – <50% Sensitivity*

Ultrasound has a sensitivity of less than 50% for detecting colon cancer, making it an unreliable imaging modality for diagnosis. While advanced tumors may sometimes appear as a hypoechoic mass with irregular thickening, ultrasound is generally inadequate for identifying early-stage colorectal malignancies. For a definitive diagnosis, CT colonography or colonoscopy is required, as these methods provide a more detailed evaluation of the bowel and allow for tissue biopsy if needed. While ultrasound is highly effective for diagnosing conditions like intussusception and pyloric stenosis, it is only moderately useful for assessing bowel obstruction and inflammtory bowel disease, with better performance in Crohn’s disease than ulcerative colitis. For comprehensive bowel

evaluation, particularly for cancer detection and obstruction assessment, CT or MRI remains the preferred imaging choice (37).

### *Ultrasound in Abdominal Aortic Aneurysm (AAA)*

Ultrasound is the gold standard for screening and measuring abdominal aortic aneurysm (AAA) size, with a sensitivity of 95-100%. It is a non-invasive, widely available, and highly accurate imaging modality for detecting aneurysms measuring ≥3 cm in diameter. Ultrasound is particularly valuable for routine screening in high-risk populations, as it provides real-time visualization of the aorta and allows for serial monitoring of aneurysm progression. However, while ultrasound is highly effective for initial detection, CT angiography is preferred for surgical planning or when rupture is suspected, as it offers more detailed visualization of the aneurysm and surrounding structures (38).

Key ultrasound findings for AAA include fusiform or saccular dilation of the aorta, the presence of mural thrombus appearing as hypoechoic or mixed echogenicity areas inside the aneurysm, and a lack of normal aortic tapering. In cases of suspected rupture, free fluid may be detected. Aneurysms are classified based on size, with small AAAs (3.0-3.9 cm) requiring annual monitoring, medium AAAs (4.0-5.4 cm) monitored every six months, and large AAAs (≥5.5 cm) posing a high rupture risk, necessitating surgical intervention. Screening is particularly recommended for men over 65 years with a history of smoking, individuals with a family history of AAA, and patients experiencing symptoms such as abdominal pain, a pulsatile mass, or back pain. While ultrasound remains the best screening tool, CT angiography is essential for detailed evaluation and preoperative planning in cases where intervention is needed (39). Finally we can

represent the collected previous data in the following table 1 and figure 1 that illustrate the percentage of accuracy of ultrasound in detecting GIT diseases.

**Table 1: Ultrasound’s percentage of Success in GIT diseases Diagnosis:**

| Disease | Ultrasound Accuracy (%) | Alternative/Complementary Test |
|---|---|---|
| **Gallstones** | **95-98%** | CT, MRCP for bile duct stones |
| **Acute Cholecystitis** | **85-95%** | HIDA scan if unclear |

| | | |
|---|---|---|
| **Fatty Liver** | **85-95%** | MRI for quantification |
| **Liver Cirrhosis** | **60-90%** | Fibroscan, biopsy for staging |
| **Liver Tumors (HCC, Mets)** | **60-85%** | Contrast US, CT, MRI |
| **Liver Cysts** | **95-100%** | No alternative needed |
| **Acute Pancreatitis** | **70-90%** | CT preferred for complications |
| **Pancreatic Cancer** | **50-70%** | EUS, CT, MRI better |
| **Appendicitis** | **80-95%** | CT for unclear cases |
| **Bowel Obstruction** | **75-85%** | X-ray, CT for full assessment |
| **Intussusception** | **90-100%** | Fluoroscopy for reduction |
| **Pyloric Stenosis** | **95-100%** | No alternative needed |
| **Crohn's Disease** | **60-85%** | MRI/CT enterography better |
| **Colon Cancer** | **<50%** | Colonoscopy, CT colonography |
| **AAA (Aortic Aneurysm)** | **95-100%** | No alternative needed |

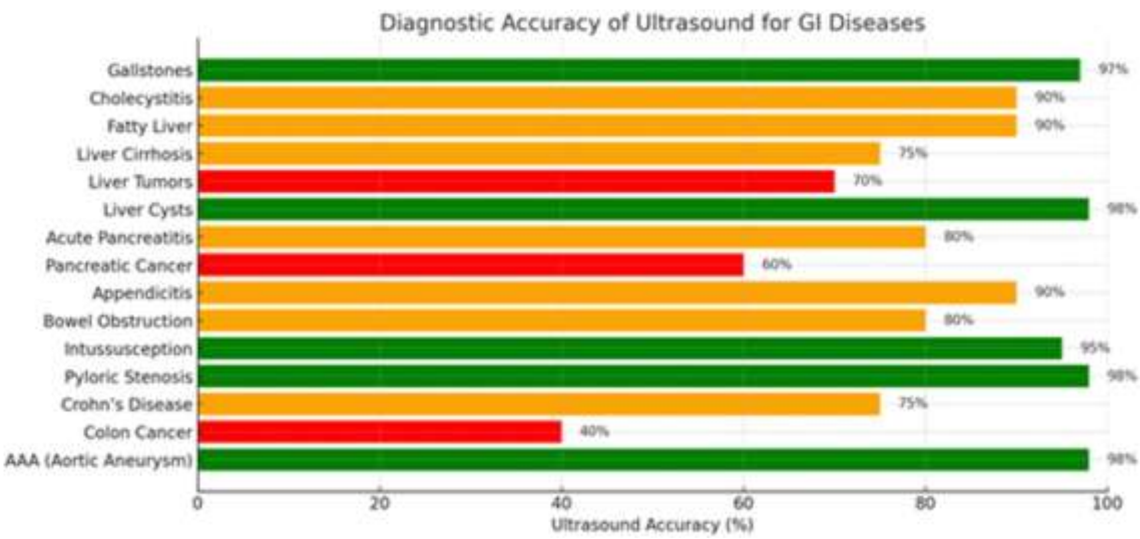


**Figure 1: Bar chart illustrating the ultrasound accuracy for different GIT diseases. Green: Highly effective (>90%). Orange: Moderately effective (70-90%). Red: Less effective (<70%).**

## 3. CONCLUSION

Ultrasound is a first-line imaging tool in many clinical settings due to its non- invasiveness, availability, and high sensitivity for several diseases. However, its effectiveness depends on factors such as the specific condition, body habitus, and anatomical location. For deeper structures and tumors, additional imaging modalities like CT, MRI, or endoscopy are often required. Ultrasound is highly effective (>90%) for diagnosing gallstones and gallbladder diseases, making it the gold standard for detecting cholelithiasis (95-98% sensitivity) and acute cholecystitis (85-95% sensitivity). It easily visualizes gallstones, gallbladder wall thickening, pericholecystic fluid, and bile sludge. It is also highly accurate in detecting liver cysts (95-100% sensitivity) and fatty liver (85- 95% sensitivity), as well as conditions such as pyloric stenosis (95-100%),

intussusception (90-100%), and abdominal aortic aneurysms (AAA) (95-100%), making it the preferred screening tool for these diseases.

Ultrasound has moderate effectiveness (60-85%) for conditions such as liver tumors, Crohn's disease, pancreatitis, and appendicitis. While it can detect larger liver tumors and hepatic metastases, CT or MRI with contrast is preferred for better characterization, though contrast-enhanced ultrasound (CEUS) can improve detection to ~90%. For Crohn's disease, ultrasound can identify bowel wall thickening, hyperemia, and complications like abscesses and fistulas, but MRI or CT enterography provides a more comprehensive assessment. Ultrasound is useful for detecting acute and chronic pancreatitis, showing pancreatic enlargement, edema, and peripancreatic fluid, but CT is superior for evaluating complications like necrosis, pseudocysts, and abscesses. Similarly, ultrasound is effective in diagnosing appendicitis in children (80-95%) but is less reliable in obese adults due to gas interference, with CT preferred in inconclusive cases. However, ultrasound is unreliable (<50%) for conditions such as colon cancer, early liver cirrhosis, and small pancreatic tumors. Colon cancer is best diagnosed with colonoscopy or CT colonography, early liver cirrhosis often requires Fibro Scan or biopsy for accurate detection, and small pancreatic tumors (<2 cm) are frequently missed due to bowel gas interference, making EUS or CT the preferred diagnostic methods. Overall, ultrasound remains the gold standard for diagnosing gallbladder disease, liver cysts, AAA, pyloric stenosis, and intussusception, while CT and MRI are necessary for more complex or deep-seated conditions.

## 4. FUTURE DIRECTIONS

Future advancements in ultrasound imaging, including artificial intelligence (AI)- assisted interpretation, 3D ultrasound, and fusion imaging, have the potential to significantly enhance diagnostic precision and reduce operator dependency. AI integration can improve image analysis, automate measurements, and assist in identifying subtle abnormalities, making ultrasound more reliable and accessible. Additionally, the growing use of point-of-care ultrasound (POCUS) in primary care and emergency settings may facilitate early detection and timely intervention for gastrointestinal diseases, improving patient outcomes. To maximize ultrasound's diagnostic utility, further large-scale, multicenter studies are essential to refine imaging protocols, develop standardized diagnostic algorithms, and optimize its integration with other imaging modalities like CT and MRI. These advancements will help solidify ultrasound's role as a vital, first-line imaging tool in gastrointestinal diagnostics.

### *Consent for Publication*

The author reviewed and approved the final version and has agreed to be accountable for all aspects of the work, including any accuracy or integrity issues.

## 5. DISCLOSURE

The author declares that they do not have any financial involvement or affiliations with any organization, association, or entity directly or indirectly related to the subject matter or materials presented in this review paper. This includes honoraria, expert testimony,

employment, ownership of stocks or options, patents, or grants received or pending royalties.

### *Data Availability*

Information for this review paper is taken from freely available sources.

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