119757-编稿opinion review - 副本.docx

Baishideng Publishing Group Co. Limited

Document Details

Submission ID
trn:oid:::3117:576000656

Submission Date
Apr 8, 2026, 12:55 PM GMT+8

Download Date
Apr 8, 2026, 12:55 PM GMT+8

File Name
119757-编稿opinion review - 副本.docx

File Size
70.1 KB

6 Pages

2,296 Words

14,086 Characters

18% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Match Groups

43 Not Cited or Quoted 18%
Matches with neither in-text citation nor quotation marks

1 Missing Quotations 0%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

9% Internet sources
16% Publications
0% Submitted works (Student Papers)

Integrity Flags

0 Integrity Flags for Review

No suspicious text manipulations found.

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

Match Groups

- **43** Not Cited or Quoted 18%
  Matches with neither in-text citation nor quotation marks
- **1** Missing Quotations 0%
  Matches that are still very similar to source material
- **0** Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- **0** Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

9% Internet sources
16% Publications
0% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Internet	
www.ncbi.nlm.nih.gov		4%
2	Publication	
Ai Fujimoto, Junji Tanaka, Nobuyuki Sato, Kenzo Hara et al. "Improved diagnostic ...		4%
3	Internet	
www.wjgnet.com		1%
4	Internet	
www.frontiersin.org		1%
5	Publication	
Maximilian Haider, Christian Ladurner, Roman Mayr, Zafer Tandogdu et al. "Use a...		<1%
6	Internet	
bmccancer.biomedcentral.com		<1%
7	Internet	
abdominalkey.com		<1%
8	Publication	
Clark, C.J.. "Current Problems in Surgery: Gastric Cancer", Current Problems in Su...		<1%
9	Publication	
The SAGES Manual Operating Through the Endoscope, 2016.		<1%
10	Publication	
Yamamoto, H.. "Endoscopic therapy of early gastric cancer", Best Practice & Rese...		<1%

11 Publication

Yoon, Hyuk. "New approaches to gastric cancer staging: Beyond endoscopic ultra... <1%

12 Publication

Chandra K. Krishnan, Han-Soo Kim, Jong Woong Park, Ilkyu Han. "Outcome After ... <1%

13 Internet

digitalcommons.cwu.edu <1%

14 Publication

Hong Zhou, Chunguang Guo, Yingtai Chen, Dongbing Zhao. "Chapter 1 The Surgic... <1%

15 Publication

Hyun Ju Kim, Sang Gyun Kim, Jung Kim, Hyoungju Hong, Hee Jong Lee, Min Seong... <1%

16 Publication

Kim, J.H.. "Clinicopathologic factors influence accurate endosonographic assessm... <1%

17 Publication

Tao Yu, Xinling Wang, Zilong Zhao, Fan Liu, Xiaoting Liu, Yan Zhao, Yahong Luo. "... <1%

18 Publication

Y T Lee. "Accuracy of endoscopic ultrasonography in diagnosing ascites and predi... <1%

19 Publication

Zhixian Lan, Kangyue Sun, Yuchen Luo, Haiyan Hu et al. "Linear-array EUS improv... <1%

20 Publication

Ryotaro Uema, Yoshito Hayashi, Takashi Kizu, Takumi Igura et al. "A novel artifici... <1%

21 Publication

De Luo, Fei Kuang, Juan Du, Mengjia Zhou, Xiangdong Liu, Xinchen Luo, Yong Tan... <1%

Diagnostic accuracy in early gastric cancer: Is endoscopic ultrasound staging still reliable?

Abstract:

Pretreatment assessment of early gastric cancer using endoscopic ultrasound is a critical step in selecting the most appropriate treatment for each patient based on the T stage. However, the diagnostic accuracy of endoscopic ultrasound for Tis/T1a lesions may be influenced by clinicopathological factors. A recent retrospective study by Qiao XY et al., including a total of 209 patients, demonstrated that younger age and the presence of ulceration were significantly associated with overstaging of Tis/T1a lesions. In the presence of gastric ulceration, the sensitivity of endoscopic ultrasound (EUS) was markedly reduced, reaching only 41.25%. From a therapeutic perspective, reduced accuracy in pretreatment staging can have important clinical implications. Overestimation of tumor stage in T1a disease may expose patients to unwarranted surgical procedures, while underestimation of T1b tumors may lead to insufficient treatment and an increased risk of recurrence. These findings highlight the need for cautious interpretation of EUS results in this patient population and emphasize the importance of a more comprehensive diagnostic strategy. This article examines these findings from a global perspective and discusses alternative diagnostic approaches.

Key words: Early gastric cancer; Endoscopic ultrasonography; Invasion depth ; Accuracy ; Artificial intelligence; Conventional endoscopy.

Core Tip:

The choice between endoscopic and surgical treatment in early gastric cancer is based on accurate determination of the depth of tumor invasion. Endoscopic ultrasound (EUS) has long been considered the most useful tool for this purpose when compared with conventional endoscopy and imaging modalities. However, the accuracy of EUS in distinguishing between mucosal and submucosal invasion is variable and is influenced by multiple clinicopathological factors. The aim of this article is to discuss this concern and to review other effective diagnostic approaches for assessing invasion depth in early gastric cancer.

Introduction:

Gastric cancer ranks as the fifth most common cancer worldwide in terms of both incidence and mortality rate. The highest incidence rates of this type of cancer are observed in Eastern Asia and Eastern Europe[1] Gastric carcinoma represents a significant global health challenge, particularly due to its high aggressiveness and heterogeneity[2]. It is often diagnosed at a later stage, as the disease is usually asymptomatic in its initial phases[3]. Management strategies include surgery, endoscopic resection, and chemotherapy, depending on the stage of the disease[4]. Chemotherapy, with or without surgery, is the primary treatment approach for stage III–IV gastric cancer, while surgery is the main first-line treatment for stage I–II disease[5]. Endoscopic resection is indicated in selected cases of early gastric cancer (EGC)[6].

The concept of EGC was first proposed in 1971 by the Japanese Society of Gastroenterology and Endoscopy, originally describing a gastric neoplasm amenable to curative surgical treatment.

Currently, EGC is defined more precisely as a gastric adenocarcinoma confined to the mucosa or submucosa, regardless of lymph node involvement[7]. This corresponds to T1a and T1b invasion according to the American Joint Committee on Cancer's 8th TNM classification[8] **(Figure).** Conversely, advanced gastric carcinoma is defined as a gastric carcinoma that invades the muscularis propria[9]. Furthermore, by implementing biennial upper gastrointestinal endoscopy for individuals over 40 years of age, the Korean National Cancer Screening Program has increased the detection rate of EGC to approximately 70%[10].

Endoscopic interventions constitute the first-line treatment for EGC, including endoscopic mucosal resection and endoscopic submucosal dissection [11]. In Japan, endoscopic resection represents over 60% of treatment modalities for EGC[12]. However, their indications are based on the risk of lymph node metastasis and the feasibility of en bloc resection[13], which makes careful assessment and selection of suitable patients a critical step in management. Accurate prediction of the depth of tumor invasion is essential[14]. Standard indications for endoscopic resection across all major guidelines (Korean [2024], Japanese [2021], and European [2025]) include differentiated intramucosal carcinoma without ulceration, regardless of tumor size (with Korean guidelines specifying a size ≤ 2 cm), or with ulceration ≤ 3 cm, which are considered absolute indications for endoscopic submucosal dissection[15–17]. Additionally, submucosal lesions limited to the SM1 (≤500 μm) category may be considered for endoscopic resection, with additional conditions in the Korean guidelines, including a critical pathological review[18]

Endoscopic ultrasonography has long been considered a key diagnostic tool for superficial gastrointestinal neoplasms with suspicious features[19]. The overall accuracy of T staging in EGC has been reported to range from approximately 65% to 92.1%[20]. Compared to EUS, conventional endoscopy plays a central role in the detection and characterization of gastric cancer lesions, providing direct visualization of mucosal abnormalities[21,22]. However, it may lead to understaging of lesions with submucosal invasion[23]. Computed tomography is more effective in detecting deeper tumor invasion and advanced gastric lesions while also providing a comprehensive assessment of disease extent[24,25]. Despite some recent studies showing improved T and N staging accuracy of multidetector computed tomography imaging, approaching that of EUS[26,27], the differentiation between mucosal and submucosal lesions still depends on EUS, which provides more detailed visualization of the five-layer structure of the gastric wall than CT scans[28,29]. Magnetic resonance imaging also plays an important role in preoperative staging[30,31], with reported accuracy rates of 93% for T3–T4 tumors and 91% for T1–T2 tumors, as well as 86% for N0 disease and 67% for N-positive disease, which highlights its value in the staging of advanced gastric cancer[32].

However, the diagnostic accuracy of EUS has recently been questioned, as several studies have reported lower performance in distinguishing T1a from T1b tumors and in assessing lymph node status[33,34]. A recent study by Qiao XY et al.[35], published in the World Journal of Gastroenterology, suggested that factors such as younger age ($P = 0.035$) and the presence of ulceration ($P < 0.001$) were significantly associated with overstaging of Tis/T1a lesions. Notably, the presence of gastric ulceration remained the only independent predictor of overstaging, with an odds ratio of 15.25 (95% confidence interval: 3.23–71.98; $P < 0.001$). These results may be explained by the distortion of the normal gastric wall architecture induced by intense inflammation in active ulcers, which makes it difficult to distinguish inflammatory fibrosis from true submucosal tumor

invasion[35,36]. Another study[37] identified histopathologic differentiation, along with tumor size and location, as determining factors for accuracy. Understaging was associated with poorly differentiated histology, whereas overstaging was associated with lesions larger than 3 cm located in the middle third of the stomach.

These heterogeneous findings raise multiple concerns and highlight the need for further studies and improved techniques to enhance the pretherapeutic assessment of EGC and ultimately improve survival.

This article synthesizes the findings of Qiao XY et al[35]. with selected contemporary studies addressing diagnostic accuracy in EGC. Relevant literature was reviewed to contextualize the performance of EUS, identify influencing factors, and focus on EUS as a diagnostic technique, including its various modalities and potential future enhancements.

Endoscopic Ultrasound Modalities and Their Diagnostic Performance

In the recent study by Qiao XY et al.[35], EUS examinations were conducted by experienced endoscopists using radial ultrasound probes operating at frequencies of 5–12 MHz (Olympus EU-ME2, Tokyo, Japan; Fujifilm SU-9000, Tokyo, Japan). Consequently, the study's findings reflect the diagnostic performance of this specific type of EUS. At present, three primary EUS methods are employed for staging EGC: linear EUS, radial EUS, and miniprobe EUS[38,39].

To clarify the differences between these technologies, radial EUS provides a 360-degree cross-sectional image in a plane perpendicular to the axis of the endoscope, resembling computed tomography imaging[40,41]. In contrast, linear EUS generates a localized oblique image parallel to the endoscope, allowing real-time ultrasound-guided therapeutic interventions, such as EUS-guided Fine Needle Aspiration, EUS-guided injection therapies, and EUS-guided drainage procedures[42]. Additionally, high-frequency EUS miniprobes can be introduced through the standard biopsy channel of a conventional endoscope and are particularly useful in cases where luminal strictures prevent the passage of a standard EUS scope[43,44]. This raises the question of whether diagnostic accuracy for determining submucosal invasion differs among these techniques.

Several comparative studies in the literature have addressed this issue. Lan Zhixian et al.[45] conducted a prospective cohort study comparing the diagnostic accuracy of linear EUS and radial EUS in patients with suspected EGC. The results demonstrated that linear EUS had a significantly higher diagnostic accuracy for determining submucosal invasion than radial EUS (90.9% vs. 69.2%, P = 0.024).

Moreover, a recent single-center retrospective study[38] including 105 patients compared linear EUS with miniprobe EUS and found that linear EUS demonstrated higher accuracy in diagnosing suspected submucosal invasion in EGC. This difference was identified using binary regression analysis, as the ANOVA of accuracy did not reach statistical significance. However, the same study[38] reported similar limitations, noting that overall accuracy was significantly reduced for lesions with ulcerations or diameters greater than 3 cm, which may lead to overestimation of

invasion depth. Consequently, ulcerative lesions remain a common limitation across all three technologies.

Furthermore, multiple recent studies have focused on not only differentiating mucosal from submucosal invasion but also assessing the depth of submucosal invasion, given that endoscopic resection fulfilling the criteria for endoscopic curability A is regarded as curative for EGC, particularly in differentiated-type tumors with invasion limited to less than 500 μm from the muscularis mucosae (SM1)[46].

As an example, Fujimoto et al.[47] conducted a retrospective study evaluating the diagnostic performance and safety of gel-EUS, a technique that uses a transparent, colorless viscous gel approved in Japan in 2020 for endoscopic examination and treatment in place of water during EUS. The study assessed gel-EUS for detecting deep submucosal invasion in EGC and its role in guiding optimal treatment selection. The gel helps maintain gastric distension for a longer duration and provides a stable acoustic interface between the probe and the gastric wall. Gel-EUS demonstrated significantly higher sensitivity in detecting deep submucosal cancer (83.3%, 10/12 lesions; 95% CI: 0.51–0.97) compared with conventional EUS (25.0%, 2/8 lesions; 95% CI: 0.07–0.59).

In terms of image-enhanced EUS techniques, double contrast-enhanced ultrasonography has not demonstrated superiority in overall accuracy for preoperative T staging of gastric cancer[48]. Moreover, EUS appears to be superior to the double contrast-enhanced ultrasonography for the assessment of T1 stage tumors[49].

Nevertheless, since the accuracy of EUS heavily depends on the operator's skill and experience, inter-operator variability in diagnostic concordance may reach up to 25% due to differences in expertise[50]; consequently, the results remain heterogeneous and cannot be generalized. Therefore, it is important to conduct further studies on the integration and combination of advanced EUS technologies **(Table)** into clinical practice for the detection of EGC and the determination of the invasion depth.

The Future of Endoscopic Ultrasound: Integration of Artificial Intelligence

Since the accuracy of EUS closely depends on human performance and is subjectively assessed, this limitation can be addressed in the era of artificial intelligence (AI) through the development of trained models and computer-aided diagnostic systems[51]. Learning EUS requires significant time and hands-on practice in a high-volume center, guided by an experienced endosonographer, along with a strong understanding of ultrasound anatomy[52,53]. Accordingly, EUS combined with AI can not only enhance diagnostic accuracy but also support the training of beginners and help standardize performance between trainees and expert endosonographers[52].

Moreover, in terms of EGC diagnosis, Uema R. et al.[54] developed an artificial intelligence-based endoscopic ultrasonography system to assess the invasion depth of EGC. The study used a total of 8,280 EUS images from 559 EGC cases collected across 11 institutions. The AI model's performance was evaluated using both internal and external validation datasets, demonstrating diagnostic accuracy comparable to that of expert endoscopists, with sensitivity, specificity, and accuracy of 66.3%, 88.7%, and 90.4%, respectively. These results represent early efforts in applying AI to EUS for assessing the invasion depth of EGC, as the majority of the current literature has focused on AI-assisted conventional endoscopy[55–57].

According to the meta-analysis of AI-assisted EGC diagnosis using endoscopic images (white-light imaging/narrow-band imaging) by Luo D *et al.*[58], seventeen studies reported the diagnostic performance of artificial intelligence in detecting EGC from endoscopic images. However, all previous studies relied on static endoscopic images to train AI models for the detection and diagnosis of EGC. To address this limitation, Kim, Jie-Hyun et al.[59] developed an AI model to estimate the depth of tumor invasion in EGC using endoscopic videos. They compared two convolutional neural network models: one trained on static endoscopic images (image classifier, IC) and the other trained on endoscopic videos (video classifier, VC). The results showed that, when applied to video clips, the IC achieved a sensitivity of 33.6%, specificity of 85.5%, and accuracy of 56.6%. In contrast, the VC demonstrated superior performance, with a sensitivity of 82.3%, specificity of 85.8%, and accuracy of 83.7%. These findings and emerging trends raise the question of whether advances in AI integrated with conventional endoscopy could potentially reduce or modify the role of endoscopic ultrasound in the future.

Nonetheless, AI assisted diagnosis of EGC faces several limitations. Most current studies are retrospective and often rely on small or insufficiently validated datasets. Retrospective designs introduce selection bias, as training datasets typically include only high-quality images while excluding lower-quality images. Moreover, false-positive and false-negative rates remain relatively high, limiting the clinical reliability of current AI models. [60]

Conclusion:

Accurate assessment of invasion depth in early gastric cancer is essential for guiding optimal treatment, especially in cases of clinical T1 lesions, in which endoscopic resection may be feasible. While endoscopic ultrasound demonstrates high accuracy in advanced disease, its reliability in early gastric cancer is variable and highly operator dependent. The integration of artificial intelligence with conventional endoscopy shows promise in improving diagnostic accuracy, yet studies on AI-assisted EUS remain limited. Further validation of AI models is required to improve the assessment of invasion depth in EGC using both conventional endoscopy and EUS, as well as their combination with other imaging modalities to enhance accuracy in differentiating between mucosal and submucosal invasion and in determining the precise depth of submucosal infiltration.