The Role of Capsule Endoscopy in detecting Gastritis and Indigestion

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ABSTRACT

The study aimed to compare capsule endoscopy with traditional approaches for finding gastritis and indigestion (dyspepsia), mainly in KSA which is known for the high prevalence of these illnesses. It investigates how well CE helps in identifying these issues and how such findings relate to patients' symptoms and risk factors. This was a retrospective study analyzing CE reports and patient-reported symptoms to evaluate diagnostic outcomes. Both male and female patients, aged more than 18, were examined in a retrospective study at a specialised Gastroenterology Clinic in Riyadh, Saudi Arabia. To cheque diagnostic outcomes, we analysed CE reports and symptoms described by patients. The average age of patients was 51.1 years. Among the most frequent symptoms were trouble with digestion after meals, changes in bowel habits and pain in the abdomen. Esophagitis, gastritis and enteritis were often seen on the Foundation's cadasters. Smoking played a very clear role in causing gastritis. The test showed low sensitivity but high specificity, so a negative test result was always predicted to mean that CE was normal. Common diseases of the GI tract, like gastritis, esophagitis and enteritis, are effectively found with capsule endoscopy. How a patient has lived their life, including smoking, is important in interpreting the results of their diagnosis. CE is a good alternative option for spotting cancer early in people who are symptomatic.

Keywords: Capsule Endoscopy; Dyspepsia; Indigestion

INTRODUCTION

Gastrointestinal conditions called chronic gastritis and indigestion (dyspepsia) are common and have a major effect on healthcare and people's lives[1]. When gastritis occurs, the mucous lining in your stomach typically swells and, if it becomes long-lasting, may ultimately lead to thinning (atrophy) or change (metaplasia). The most common reason for this condition is an H. pylori infection, a response from the immune system or long-term use of NSAIDs. Indigestion is different from dyspepsia because it involves several upper abdominal symptoms, like discomfort, bloating, feeling full fast and nausea, but rarely has a clear reason[2].

The chance of getting gastritis rises when people get older, but it depends on their social background, daily habits and what they eat. People living in poverty tend to get H. pylori-caused gastritis more often because they share cramped living spaces and lack regular access to clean water and medical care[3]. KSA (Kingdom of Saudi Arabia) sees many cases of gastrointestinal diseases such as gastritis and dyspepsia, requiring advanced tools that benefits patients[4].

Traditionally, using tools like EGD is effective but the procedure is uncomfortable for individuals, it is invasive, and patients need to be sedated[5]. Because of these factors, not many patients follow cancer screening programmes, and these services are less available to rural or poor communities. Such problems require the creation and use of minimally invasive methods which are done in this case with capsule endoscopy (CE) (Kim and Chun, 2021)[6].

Since 2001, a capsule that is swallowed and has a built-in wireless camera has been approved by the FDA for viewing the GI tract without pain or invasive procedures (Jiang et al., 2024). CE can take images from many parts of the digestive tract and particularly from the small intestine which is harder to access with standard endoscopy. Patients will need to fast and almost always have bowel preparation ahead of swallowing the capsule[7]. Most people prefer this method because it does not require sedation, is safe, convenient and does not require them to stay after the procedure[8].

In cases where doctors have trouble finding the site of a GI bleed, Crohn's disease or bowel tumour, CE has greatly improved diagnostics[9]. In recent years, it has also been used to cheque upper GI signs like gastritis and dyspepsia. People choose CE because it causes little discomfort, requires no medications and examines the entire GI tract during one visit[10]. Not only that, due to its transportability, CE is extremely useful in both outpatient and distance healthcare[11].

Recent years have seen the interest in CE's role in gastritis and indigestion diagnosis increase[12]. Scientific studies generally recognise its value, but most research has been done on the small intestine to explore its usefulness in diagnosing gastritis is rare. On top of that, fewer upper GI symptoms are identified by CE compared to the number expected, especially in KSA, where gastritis and indigestion are quite common[13].

The objective of this research is to study how effective CE, has been in finding gastritis and indigestion in symptomatic Saudi patients. This study investigates whether the findings from capsule endoscopy (CE) in weight-loss cases align with patients' reported symptoms and results

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from esophagogastroduodenoscopy (EGD) and fecal occult blood tests (FOBT). The aims of the study are:

Ø To measure the effectiveness of CE as a way to diagnose both gastritis and indigestion.

Ø To compare how accurate CE is as a diagnostic test when compared to FOBT and EGD.

Ø To analyse the relationship between both demographic and clinical factors (such as smoking and additional health issues) and gastritis found using CE.

The paper analyses CE comprehensively as a part of GI diagnostics, hoping to encourage its wider use in healthcare for conditions that don't have a clear diagnosis.

LITERATURE REVIEW

Gastritis and indigestion (dyspepsia) are common upper gastrointestinal disorders everywhere, with a particularly heavy burden seen in the Kingdom of Saudi Arabia (KSA), according to scientific research[12]. Diagnosis made early and correctly helps prevent serious issues like atrophy, metaplasia and cancer of the stomach. Several tools are available for doctors to use to assess these disorders, including eating fibre and drinking water can help relieve it. The paper evaluates the usefulness of each method, how simple they are and what their main limitations are, with special attention to how CE helps diagnose gastritis and dyspepsia[14].

Esophagogastroduodenoscopy (EGD) is considered the standard way to examine the upper gastrointestinal tract. Lung disease can be identified directly, with samples taken for testing and certain treatments administered within the lungs[15]. Still, this procedure involves an invasive test, often needs sedatives and can be hard on elderly or high-risk patients. Being in remote or under-equipped locations also makes accessibility problematic. EGD is effective in finding inflamed mucous membranes, ulcers and cancers, yet its cost and organisation difficulties keep it from being used for widespread screening[16].

Fecal occult blood testing (FOBT) tests for hidden GI bleeding in patients without being invasive and can be done easily in most places. Many people use it, but it isn't very accurate when trying to diagnose gastritis or non-bleeding changes inside the stomach[17]. In their report, Horrigan et al., (2021) point out that a negative FOBT is not enough to exclude important issues in the upper GI tract. Also, it does not point out where the bleeding is happening which makes it not very reliable to use alone for symptoms of dyspepsia[18].

Capsule endoscopy (CE) is a new way doctors can image the entire GI tract using a camera inside a small pill. At first, CE was intended for small bowel evaluation, but medical experts now believe it can help in observing upper GI changes such as changes caused by gastritis[19]. Since it does not require sedation, is easy to prepare for, and is generally well-tolerated by patients, this procedure offers a viable alternative for women who are unable or unwilling to undergo an EGD[20].

Studies conducted these days confirm the value of CE in spotting upper GI lesions. According to Coelho-Prabhu et al., (2022), 70% of patients who received CE and subsequently had an EGD already had gastric problems identified by the first examination[5]. In a similar way, Rosa and Cotter (2024) discovered that CE was able to effectively see erosions, erythema and early ulcers in patients for whom routine endoscopy methods would not be used[20]. Even though CE cannot remove tissue for biopsies or operate on patients, its ability to evaluate conditions and be tolerated by many offers a big benefit for first assessments.

EGD remains the most accurate method for establishing a diagnosis and obtaining histological samples for analysis. However, researchers have found that capsule endoscopy (CE) can detect visual indicators suggestive of gastritis[21]. Rehan et al., (2024) confirmed that CE can detect gastric inflammation and ulcers, but pointed out that CE has difficulty exploring the gastric lining when there is variation in motility and food is left inside[22].

Several studies have shown that capsule endoscopy (CE) is easier to perform and better tolerated than EGD, particularly among elderly, high-risk, or rural patients. Li et al., (2024) explains that CE resulted in more patients following through and fewer complications which support its use in broad screening. They pointed out that CE might not detect larger lesions as well and that solutions such as using magnetically controlled capsules and artificial intelligence for images are needed[23].

Regardless of these achievements, there are no set procedures or guidelines for preparing the stomach's contents and reading images which could impact how consistently cases are diagnosed. In addition, existing studies in CE are often confined to one location, have a few participants, so their findings cannot be applied to a bigger population.

In essence, EGD is the standard for gastritis and dyspepsia diagnostics, but some groups of patients may prefer CE for being non-invasive, more comfortable and able to examine the GI tract without needing sedation. FOBT is handy for initial testing, but visual methods of observation should always be used. Including CE in routine diagnostics in low-resource health settings can make it simpler to catch diseases early and use less invasive screening techniques. It is important to conduct further large-scale studies to guarantee its use is standard and its use is maximized.

MATERIALS AND METHODS

Study Design and Study Setting: A prospective observational study was conducted at the Specialized Gastroenterology Clinic in Riyadh, Saudi Arabia, over a 13-year period from 2013 to 2021.

Criteria for Inclusion and Exclusion: The study accepted patients 18 years or older, of any gender, who showed symptoms such as indigestion, gastritis, dyspepsia, bloating, epigastric pain or nausea. Included only patients who used capsule endoscopy during their testing to find the cause of their symptoms.

Individuals were not included if they had a previous GI malignancy, had prior stomach operation, had issues with swallowing or if their endoscopy recording was not complete. This study did not include participants whose vital records did not reach the study variables.

Participant Recruitment and Data Collection: In total, 189 symptomatic patients with inclusion factors who had received CE were enrolled in the study. The data were obtained and confirmed by an experienced gastroenterologist. Variables analyzed consisted of age, gender; symptoms related to the disease or other medical problems; information about comorbidities; body mass index data; medicines or drugs taken by the person; laboratory values of H. pylori and hemoglobin, as well as the outcome of the feces check. When we had EGD findings, we looked them over as well. All those enrolled into the study did so by providing informed consent before participating.

CE Procedure: Prior to capsule administration, patients fasted and underwent bowel cleansing. The device generated high-resolution gastrointestinal images, which were interpreted by trained

gastroenterologists who were blinded to the initial results.

Statistical Analysis: All statistical analyses in this study were processed with R (version 3.6.3). When the data followed a normal or symmetrical pattern, results were presented as mean ± standard deviation, but if it was not, median and interquartile range were shown. Categorical variables were presented as how many times they appeared and what percentage that represents. Possible links between gastritis and a patient's characteristics were investigated using chi-square tests. A p-value under 0.05 was treated as a significant result.

Ethical Considerations: The study was conducted following the Declaration of Helsinki. All participants maintained their confidentiality and anonymity from beginning to end of the study. The study obtained approval from the Institutional Review Board (IRB) at IMAMU.

RESULTS

In this study 189 patients were enrolled. The mean age of patients was 51.1 (SD ±15.6), the most common age group being patients aged 37 – 55 years (40.2%) and 56 – 74 years old (31.7%). Male patients were 99 (52.4%) and females were 90 (47.6%) so both genders were equally represented in the sample. The BMI was available in 112 of the 189 patients and the average was 28.6 (SD ±6.03) with overweight and obese patients represented three-quarters of the patients, and the hemoglobin level was available in 105 patients with the average level of hemoglobin being 13.3 (SD ± 2.12 g/d). The most prevalent comorbidities were DM (30.8%) and hypertension (HTN) (23.8%). On the other hand, dyslipidemia, depression, and cerebral vascular accident (CVA) were the lowest comorbidities found in all participants and less than one-half of the respondents had no comorbidities (44.9%). In addition to this, The FOBT test was available in 57 patients and most of the test results were negative in (82.5%) while they were positive in only (17.5%) patients. Moreover, H. Pylori test results were available in 82 patients and were positive in (19.5%) patients whereas, the majority evaluated negatively (80.5%) (Table 1).

Table 1. Descriptive statistics for the study sample(n=189)

Study Data	[ALL]	Valid N
Age (mean ± SD)	51.1 (15.6)	189
BMI (mean ± SD)	28.6 (6.03)	112
Hemoglobin (mean ± SD)	13.3 (2.12)	105
Age Group (N=189)		
18 - 36 years	38 (20.1%)	
37 - 55 years	76 (40.2%)	
56 - 47 years	60 (31.7%)	
>74 years	15 (7.94%)	
Gender (N=189)		
Female:	90 (47.6%)	
Male:	99 (52.4%)	
Comorbidities:		
Diabetic mellitus (DM):	57 (30.8%)	185
Thyroid problem:	5 (2.70%)	185
Asthma:	15 (8.11%)	185
Smoking:	17 (9.19%)	185
Dyslipidemia:	3 (1.62%)	185
Ischemic heart disease (IHD)	9 (4.86%)	185
Depression:	3 (1.62%)	185
Allergy:	7 (3.78%)	185
Cerebral vascular accident	3 (1.62%)	185
No comorbidities:	83 (44.9%)	185
FOBT (N=57)		
Negative	47 (82.5%)	
Positive	10 (17.5%)	
H Pylori results (N=82)		
Negative	66 (80.5%)	
Positive	16 (19.5%)	

Concerning the symptoms reported by the patients Dyspepsia was the most common symptom (81.9%) followed by altered BM (78.7%) and abdominal pain (71.3%), while the least common symptoms were Diarrhea (9.04%) and weight loss (27.1%). (see Table 2).

Table 2. Reported symptoms by the respondents(n=189)

Symptoms	***Count (%)***
Dyspepsia:	154 (81.9%)
Altered BM:	148 (78.7%)
Abdominal pain:	134 (71.3%)
Other:	119 (63.3%)
Psych disorders:	90 (47.9%)
Distension:	124 (66.0%)
Heartburn:	69 (36.7%)
Nausea & vomiting:	60 (31.9%)
Constipation:	58 (30.9%)
Weight loss:	51 (27.1%)
Diarrhea:	17 (9.04%)

According to the CE findings, the most common was gastritis (85.2%) followed by esophagitis (38.6%) and enteritis (8.47%) whereas no pathologies were detected in 8.47% of the patients. In addition, 9.5 % of the participants had other symptoms including hemorrhoids, severe erosions, whitening mucosa, gastric polyp, telangiectasia, Gilbert disease, gastric erythema, and bile in the stomach (see Figure 1).

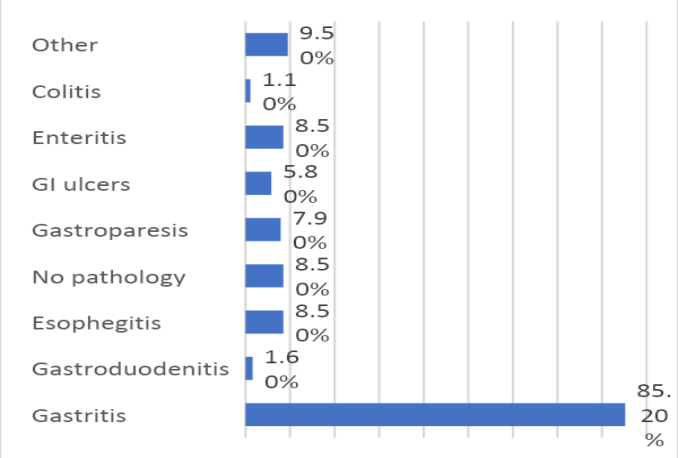

Figure 1. CE Findings Among Symptomatic Patients (n = 189)

Regarding the EGD findings were available in 33 patients, and Gastritis was present in approximately one-half of the patients (48.5%) followed by lax cardia (33.3%) and esophageal pathology (18.2%) while in 42.4% of the patients no pathology was detected. Other symptoms included H. Hernia, duodenitis, colonic polyp, lactose intolerance, and colitis (Figure 2).

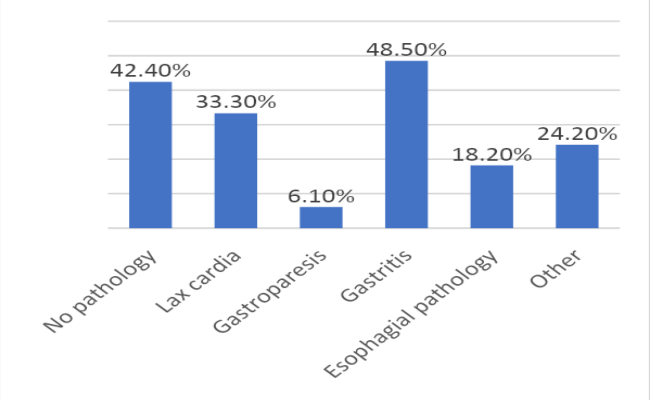

Figure 2. EGD Findings in a Subset of Patients (n = 33)

Chi-square test of independence showed that neither age nor gender were significantly associated with the risk of gastritis (P > 0.05). Chi-square test of independence showed that only smoking was significantly associated with the risk of gastritis (P < 0.05). None of the remaining comorbidities was significantly associated with the risk of gastritis (Table 3).

Table 3. Association between gastritis and comorbidities and demographic factors of the included patients

	No	**Yes**	**P-value**
	N (%)	***N (%)***	
Age	51.1 (12.3)	51.2 (16.2)	0.986
Age			0.078
0-36 years	2 (7.14%)	36 (22.4%)	
37-55 years	17 (60.7%)	59 (36.6%)	
56 – 75 years	8 (28.6%)	52 (32.3%)	
> 75 years	1 (3.57%)	14 (8.70%)	
Sex			0.891
FEMALE	13 (46.4%)	77 (47.8%)	
MALE	15 (53.6%)	84 (52.2%)	
Comorbidities			
Hypertension	6 (22.2%)	38 (24.1%)	1.000
Diabetes	8 (29.6%)	49 (31.0%)	1.000
Thyroid disorder	0 (0.00%)	5 (3.16%)	1.000
Asthma	0 (0.00%)	15 (9.49%)	0.133
Smoking	6 (22.2%)	11 (6.96%)	**0.022***
Dyslipidemia	0 (0.00%)	3 (1.90%)	1.000
Ischemic heart disease	1 (3.70%)	8 (5.06%)	1.000
Depression	0 (0.00%)	3 (1.90%)	1.000
Allergy	0 (0.00%)	7 (4.43%)	0.596
CVA	0 (0.00%)	3 (1.90%)	1.000
No comorbidities	13 (48.1%)	70 (44.3%)	0.871

Analysis was performed using Chi-square test of independence.
* Significant at p-value at lower than 0.05

Results indicated poor sensitivity of FOBT in detecting CE findings. The sensitivity was lowest for gastroparesis and highest for colitis. The specificity was high for FOBT in detecting CE findings with values ranging from 81.13% to 85%. The Negative predictive value (NPV) for FOBT was high indicating that a negative FOBT test result is a good predictor of negative CE findings while a positive test result had poor predictive ability of a positive CE finding (Table 4).

Table 4. Sensitivity and specificity of CE findings of diffuse symptoms and FOBT test (n=189)

Reported findings	**Sensitivity**	**specificity**	**PPV**	**NPV**
Gastritis	20.4%	100%	17%	100%
Gastroparesis	0%	81.82%	0%	95.74%
Esophageal pathology	23.53%	85%	40%	72.34%
Enteritis and Gastroduodenoscopy	NA	82.46%	NA	NA
Colitis	NA	82.46%	NA	NA
GI ulcer	33.33%	83.33%	100%	95.74%
No pathology	0%	81.13%	0%	91.49%
Other	0%	81.13%	0%	91.49%

NA: Not applicable

DISCUSSION

The purpose of the study was to assess how useful CE is in diagnosing gastritis and indigestion in people with typical symptoms and to see whether CE gives better results for some patients than others or when it is used along with other tests and tools such as FOBT and EGD. The results suggest that CE is a reliable test for common GI problems and might be able to either work together with or sometimes replace conventional procedures.

The typical age for participants in the study was about 51 and most were contained in the 37–55 and 56–74 age ranges. What we observed agrees with what is described in the literature about the connection between age and the rise of gastrointestinal disorders. For instance, Dumic et al., (2019) pointed out that bothersome GI conditions are more common in older people, because there are changes in their GI movement, inner tissue and immune system[24]. Likewise, our discovery that overweight and obesity were high among our patients (on average, a BMI of 28.6) is in line with earlier studies connecting higher BMI with conditions like GERD, gastritis and dyspepsia[25,26]. Because diabetes mellitus (30.8%) and hypertension (23.8%) are common in the study, these well-established links between metabolic problems and digestive issues call for doctors from different fields to treat patients as a team.

According to our study, patients said they most often had dyspepsia (81.9%), trouble with bowel movements (78.7%) and felt abdominal pain (71.3%). These symptoms are found in the Rome IV criteria as Zádori et al., (2022) noted that symptoms like those in functional dyspepsia were the most common among people with chronic gastritis[27]. Though nonspecific, abdominal pain and dyspepsia are common signs of inflammatory changes in the stomach. When they persist despite treatment, an endoscopy should be performed.

Patients in the CE reports were most found to have gastritis (85.2%), then esophagitis (38.6%) and enteritis (8.47%). The many discoveries of gastritis confirm that CE is excellent for revealing problems in the gastric lining. Visaggi et al., (2022) also indicate that CE can identify lesions in the upper gastrointestinal tract for many people, mainly with the help of updated technology and good patient preparation[28]. In some patients, our study found that CE tests revealed no signs of disease which suggests that either functional problems were present, or the sensitivity of CE was not sufficient for picking up gentle lesions. Robertson et al., (2021), also revealed that CE is at its best for structural problems but sometimes misses less visible or tiny changes[29].

Among the 33 patients, we found gastritis in 48.5% using EGD which is less than 85.2% found in the complete sample by CE. Even though some difference can be explained by different sampling methods, it further supports Rosa and Cotter, (2024) study that CE often covers more of the mucosa than EGD and thus could better detect patchy areas or lesions found in complex spots[20]. Also, CE always has a clear view, unlike traditional forward-viewing endoscopes which have limited vision because of their blind spots.

Smoking was linked to gastritis at a significant level ($p < 0.05$) and may therefore damage the mucous lining in the stomach. Results from clinical studies indicate that smoking weakens the gut lining by narrowing blood flow to the mucosa, triggering acid secretion and making it harder for gastric damage to heal, all things that can cause gastritis (Berkowitz et al., 2018; Jiang et al., 2020)[30,31]. Unlike the findings for other comorbidities, gastritis was not significantly associated with diabetes or hypertension in this study. This indicates that diet and smoking might be more important causes of stomach damage than metabolic problems.

FOBT was mainly used to help diagnose colon cancer, but it had poor sensitivity for most types of celiac-related diseases. The results showed that FOBT was only about one out of five cases sensitive to gastritis, but it was 100% specific. This agrees with Kościelniak-Merak et al., (2018), in that FOBT is effective in picking up bleeding lesions but is not sensitive enough to detect non-bleeding lesions[32]. Just as Meza and colleagues, Bull-Henry and Al-Kawas, (2013) explained that FOBT has limitations for detecting upper GI issues and believe it is mainly used for screening colorectal cancer[33]. During our study, we saw that a negative FOBT result could generally be trusted to rule out pathology found by colonoscopy. The modest PPV means upper gastrointestinal disorders should not rely on this test as their first step for people with upper GI symptoms[34].

Enteritis is often overlooked in endoscopy because it is hard to reach the small intestine during a traditional exam. The fact that enteritis was seen in nearly 9% of our patients indicates that CE can help identify important pathology that might be missed otherwise. This complies with Axelrad et al., (2021) that CE is very helpful for detecting small bowel inflammation in patients with suspected IBD or abdominal symptoms of unknown origin[35]. Even though the main goal of this study is different, the capacity of CE to investigate the entire GI tract at once is useful for patients reporting problems in the stomach and intestine[36].

It is notable that 9.5% of people taking part in the trial displayed unusual discoveries such as gastric polyps, telangiectasia, bile in the stomach and white patches on the lining. Often, these lesions cause no symptoms but still have clinical importance when cancer or abnormal blood vessels are present. The wide range of findings reported by CE is why Hong et al., (2021) believe that CE is better than focused endoscopic examinations at surveying the whole GI tract[37].

Furthermore, researchers now must address concerns about which procedure works better between CE and EGD. An EGD allows for a biopsy and treatment, although CE is safe and does not require invasive effort. Disabled by a lack of standard endoscopy, CE is a practical method to start evaluating diseases. In addition, deploying this technology in community clinics and areas without access to full healthcare services may make diagnosis easier[19]. This is important in Saudi Arabia where specialised gastroenterology services are not even and following through with invasive treatments may be difficult because of cultural or logistic difficulties. In clinical practise, the results suggest that CE can assist in diagnosing gastritis and indigestion. In the case of lasting symptoms and normal or doubtful results on EGD, CE can catch problems that EGD missed[38]. It helps doctors choose the best treatment which reduces the use of unneeded remedies or treatments.

Limitations: Only a single centre was used for this study, so the results may not be applicable to all populations. Since the analysis happens after the fact, it can introduce a bias during selection. Besides, CE cannot get a biopsy or carry out medical treatments.

Recommendations: New investigations need to repeat their findings in trials involving many centres to test whether the results hold true in various populations. Applying artificial intelligence may enhance how medical images from CE are interpreted. Changes to the protocol should help patients keep stomach images visible during capsule endoscopy and also keep reporting consistent.

CONCLUSION

This review emphasises that capsule endoscopy (CE) can help doctors diagnose gastritis and indigestion in symptomatic adults. Because gastritis is found so often using CE, it is recognised as a reliable method, especially for patients with dyspepsia who are not eligible for the usual endoscopy. It was established by researchers that CE is a trusted, harmless and preferred method for investigating diseases in the gastric and small bowel. As gastritis is strongly linked to smoking, including a lifestyle assessment should be included when examining patients. Although CE won't replace EGD for treating or examining tissue samples, it can serve as an alternative for those with different issues or concerns about having EGD. Because of how simple and effective CE is, it could completely change the approach to diagnostics in both general and specialised care. In future studies, it is important to look at how much the approach costs, what its lasting effects are and how it could be used with AI.

Authorship Contribution: As the primary investigator and corresponding author Waleed Mohammad Al-Huzaim from conceptualization, study design, data acquisition, analysis and interpretation, manuscript drafting, critical revision, to final approval oversaw all stages of the research and ensured integrity.

Raneem A. Alnutaifi, Reem M. Alkublan, Najd K. Aljarba, Lujain A. Alleft, Yara M. Alshayea contributed to study design, data collection, analysis, manuscript drafting, critical revision, and final approval. All authors fulfilled ICMJE criteria for authorship.

Potential Conflicts of Interest: None

Competing Interest: None

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