

World Journal of *Radiology*

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World Journal of Radiology (World J Radiol, WJR, online ISSN 1949-8470, DOI: 10.4329) is a peer-reviewed open access academic journal that aims to guide clinical practice and improve diagnostic and therapeutic skills of clinicians.

WJR covers topics concerning diagnostic radiology, radiation oncology, radiologic physics, neuroradiology, nuclear radiology, pediatric radiology, vascular/interventional radiology, medical imaging achieved by various modalities and related methods analysis. The current columns of *WJR* include editorial, frontier, diagnostic advances, therapeutics advances, field of vision, mini-reviews, review, topic highlight, medical ethics, original articles, case report, clinical case conference (clinicopathological conference), and autobiography.

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INDEXING/ABSTRACTING

World Journal of Radiology is now abstracted and indexed in Emerging Sources Citation Index (Web of Science), PubMed, PubMed Central, China National Knowledge Infrastructure (CNKI), and Superstar Journals Database.

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NAME OF JOURNAL

World Journal of Radiology

ISSN

ISSN 1949-8470 (online)

LAUNCH DATE

January 31, 2009

FREQUENCY

Monthly

EDITORS-IN-CHIEF

Neeraj Lalwani, MBBS, MD, Associate Professor

EDITORIAL BOARD MEMBERS

<https://www.wjnet.com/1949-8470/editorialboard.htm>

EDITORIAL OFFICE

Jin-Lei Wang, Director

PUBLICATION DATE

November 28, 2018

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<https://www.wjnet.com/bpg/gerinfo/242>

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Review of the role of abdominal imaging in irritable bowel syndrome

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Author contributions: Kavanagh RG and Maher MM involved with study design, manuscript drafting and revising; O'Grady J and Carey BW involved with manuscript drafting and revising; O'Connor OJ involved with study design, data acquisition, manuscript drafting and revising; all authors given final approval to manuscript publication, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict-of-interest statement: The authors declare that there is no conflict of interest regarding the publication of this paper.

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Manuscript source: Unsolicited

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Abstract

The role of radiologic imaging in the investigation of irritable bowel syndrome (IBS) remains a subject of debate and there is some evidence, from recent studies of utilization of imaging in IBS, which focused on associated costs and radiation exposure, that imaging is being used relatively widely in these patients. This review aims to assess current best evidence to accurately define the role of radiologic imaging in IBS patients. Primary and secondary literature searches were performed. Evidence suggests that the lack of "red flag" or alarm features in IBS patients should reassure the clinician that the diagnosis of IBS is correct and United States and United Kingdom guidelines recommend no radiologic imaging for IBS patients if alarm features are not present. In patients presenting with IBS symptoms and alarm features, radiologic testing may be used to exclude an alternative diagnosis and the imaging modality should be chosen based on the most likely alternative diagnosis.

Key words: Abdominal imaging; Rome criteria; Irritable bowel syndrome

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Core tip: Radiologic imaging in irritable bowel syndrome (IBS) remains contentious and the evidence guiding its use is limited. Recent studies indicate that imaging is being widely used in these patients. This review assesses current best evidence for the role of imaging in IBS. Primary and secondary literature searches were performed. The cornerstone of diagnosis remains the Rome criteria. Lack of "red flag" features in IBS patients should strengthen diagnosis of IBS and obviate the need for radiologic imaging. If red flag features are present, appropriate imaging may be used to exclude a suspected alternative diagnosis.

Kavanagh RG, O'Grady J, Carey BW, O'Connor OJ, Maher MM. Review of the role of abdominal imaging in irritable bowel syndrome. *World J Radiol* 2018; 10(11): 143-149
URL: <https://www.wjgnet.com/1949-8470/full/v10/i11/143.htm>

manuscript

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Received: July 14, 2018

Peer-review started: July 17, 2018

First decision: August 2, 2018

Revised: August 30, 2018

Accepted: October 9, 2018

Article in press: October 9, 2018

Published online: November 28, 2018

DOI: <https://dx.doi.org/10.4329/wjr.v10.i11.143>

INTRODUCTION

Irritable bowel syndrome (IBS) is a chronic functional gastrointestinal disorder (FGID) that is broadly characterized by recurrent abdominal pain and alterations in stool consistency or form^[1]. Multinational expert groups in FGIDs have devised the Rome criteria, most recently Rome IV criteria, as a symptom-based diagnostic standard to diagnose IBS. Despite this, as IBS is associated with loss of work days and productivity and negatively impacts quality of life, it often remains a diagnosis of exclusion after invasive investigations are performed to rule out other specific pathology. Interestingly, a comparison of an exclusion approach to diagnosis of IBS, using investigations such as sigmoidoscopy, and a positive diagnostic approach using the Rome criteria, showed little differences in terms of patients' health-related quality of life in one Danish study of over 300 patients^[2]. The positive diagnostic approach based on Rome criteria, was however, cheaper when compared to the exclusion approach. This study supports current guideline recommendations and suggests an unnecessary reliance on alternative diagnostic investigations.

Epidemiology

The worldwide prevalence of IBS is estimated to be 7%-10% with wide geographic variability^[3]. In the United States the prevalence of IBS is estimated to be approximately 10% to 15%^[4] and one large European prospective, population-based cohort study estimated prevalence of 15.4%^[5]. IBS is less common in people older than 50 compared with those younger than 50 (OR 0.75)^[6] and is more common in women compared with men (OR 1.67)^[7]. IBS may be associated with a number of other disorders including fibromyalgia, depression, chronic fatigue syndrome, non-cardiac chest pain and anxiety^[4]. There is conflicting evidence regarding IBS prevalence and socioeconomic status^[6,8,9] and this relationship remains unproven.

Pathophysiology

That the diagnosis and management of IBS relies on clinical symptoms highlights that the pathophysiology remains incompletely understood. Initial research in the early 20th century utilizing direct visualization of the gastric mucosa in patients with gastrocutaneous fistulae provided the first scientific evidence that the gut is physiologically responsive to stressful emotional and environmental stimuli. Later studies showed that patients with IBS-type symptoms had an enhanced gastrointestinal motor response to various stimuli such as fatty meals, peptide hormones and psychological stressors and increased motility was sometimes associated with pain^[10]. Recent advances in knowledge have, however, facilitated an increased understanding of the underlying disease processes, but it remains likely that there are multiple etiological factors involved. Those currently implicated in IBS symptom presentation include altered gastrointestinal motility, visceral hypersensitivity, post-infectious gastroenteritis, intestinal inflammation, altered gut microbiota, food sensitivity and interactions of the brain-gut axis^[11]. IBS linked to brain-gut interactions is suggested by the association of IBS with anxiety, depression and other psychiatric conditions^[1]. Furthermore, it is recognized that psychological stress exacerbates and exaggerates the symptoms of IBS and associated psychological and psychiatric co-morbidity negatively influence the patient experience of the condition^[12]. Persistent post infectious gastroenteritis IBS-type symptoms are common in up to 20% of cases^[1], and this is linked to an intestinal inflammatory etiology indicating an alternate pathogenesis to brain-gut interactions^[13]. Further etiological factors for IBS development include alterations in gut microbiota and associated predisposing influences on both the microbiome and IBS symptoms including host genetics, stress, diet, antibiotic use and early life experiences^[14]. Gut microbiota and their metabolites have notable influences on recognised IBS associations including the brain-gut axis, visceral hypersensitivity, gastrointestinal motility, intestinal barrier function and immune regulation^[14]. Though causation is not established, the expanding science of the human gut microbiome and microbe-host interactions suggest gut microbial alterations play a key role in IBS pathophysiology^[14]. These various pathophysiological factors may co-exist in the same patient, adding to the heterogeneity and complexity of understanding IBS and may, in part, explain the varying response to current symptom based treatments^[15].

Diagnosis

The Rome criteria are criteria that were devised by expert consensus for the diagnosis of FGIDs; these criteria define multiple different FGID including IBS. The most recent iteration of these criteria is the Rome IV, released in 2016. The diagnostic criteria for IBS by the Rome IV criteria are as follows^[16]: Recurrent abdominal pain, on average, at least one day per week in the last 3 mo associated with two or more of the following: Pain related to defecation; Associated with a change in frequency of stool; Associated with a change in form (appearance) of stool. The criteria should be fulfilled for the last 3 mo with symptom onset at least 6 mo before diagnosis.

By the Rome IV criteria, the IBS subtype is classified based on the predominant symptom of constipation or diarrhea as follows^[16]: IBS with predominant constipation (IBS-C); IBS with predominant diarrhea (IBS-D); IBS with mixed bowel habits (IBS-M); IBS unclassified (IBS-U).

This classification is based upon the percentage of different stool types as defined by the Bristol stool scale. IBS-C is diagnosed if > 25% are stool type 1 and 2 and < 25% are stool type 6 and 7; IBS-D is diagnosed if < 25% are stool type 1 and 2 and > 25% are stool type 6 and 7; and IBS-M is diagnosed if > 25% are stool type 1 and 2 and > 25% are stool type 6 and 7. IBS-U is diagnosed if the patient meets diagnostic criteria for IBS but stool type cannot be accurately categorized into one of the other subtypes.

Assessment for alarm features should be performed in all patients that meet the diagnostic criteria for IBS^[17]. The aim of identifying alarm features is to allow consideration of further investigations in patients with signs/symptoms of other possible underlying conditions such as colorectal/ovarian cancer and inflammatory bowel disease. Alarm features include the following^[16,18,19]: New onset, or overt, rectal bleeding or melena; Nocturnal pain or diarrhea; Iron-deficiency anemia; Unexplained weight loss; Family history of colon cancer, ovarian cancer, celiac disease, IBD; Fever; Age of onset > 50 years; Severe or progressively worsening symptoms; Abdominal/pelvic/rectal mass or lymphadenopathy; Recent change in bowel habits.

Although the prevalence of alarm features is high in IBS patients^[18] the sensitivity of alarm features in predicting organic disease in patients with typical symptoms of IBS is low. This may be due to the fact that besides celiac disease, which a large systematic review demonstrated is four times as prevalent in patients with IBS compared with the general population^[20], the prevalence of underlying organic disease is the same in patients with IBS as in the general population^[3]. However, certain alarm features such as weight loss and anemia do offer high specificity for organic disease and the American College of Gastroenterology (ACG) state that the absence of alarm features should reassure the clinician that the diagnosis of IBS is correct^[3].

IBS burden of disease

IBS is a disease that is associated with significantly reduced health-related quality of life and impaired work productivity^[3]. IBS patients utilize 50% more healthcare resources than matched controls without IBS and overall direct and indirect annual healthcare costs in these patients are estimated at \$20 billion^[3]. This increased cost can be attributed not only to increased medication use but also increased diagnostic testing and lost wages. In 1995, Talley *et al.*^[21] estimated the excess yearly direct healthcare cost of IBS in the United States to be \$8 billion and extrapolating from that study, excess cost of approximately \$800 million was estimated for radiologic services in these patients. This highlights the importance of accurately defining the role of radiologic imaging in the investigation of patients presenting with IBS-type symptoms in order to rationalize the use of this expensive and, in certain jurisdictions, limited resource.

As well as increased costs, another concern regarding the over-utilization of radiologic diagnostic testing is the radiation exposure imparted as a result of plain radiography, nuclear medicine and CT imaging. Although there is evidence of significant costs associated with radiologic imaging in these patients there is a paucity of studies assessing radiation exposure in this patient group. Englund *et al.*^[22] demonstrated that over a 10-year period in Sweden, 149 IBS patients had a radiation exposure similar to that of a subgroup of patients with ulcerative colitis. A direct comparison of radiation exposure in IBS patients with that of the general population was not performed in this study so it is difficult to draw conclusions from these results. This result does, however, again demonstrate that radiologic imaging is still being used frequently in the investigation of patients with IBS.

ROLE OF RADIOLOGIC IMAGING IN IBS

The exact role of abdominal radiologic imaging in IBS remains poorly defined and

some studies suggest that imaging is being used relatively widely in this patient population^[21,22]. There is a marked paucity of modern scientific studies regarding the appropriate use of imaging in this patient group^[23].

In terms of international guidelines, the ACG state the following in their position statement on IBS^[3] based on an evidence-based systematic review^[24]: “Routine diagnostic testing with complete blood count, serum chemistries, thyroid function studies, stool for ova and parasites, and abdominal imaging is not recommended in patients with typical IBS symptoms and no alarm features because of a low likelihood of uncovering organic disease”.

The ACG do recommend serological testing for celiac disease and colonoscopy in patients with alarm features and those over the age of 50 to assess for colorectal cancer. When colonoscopy is performed in patients with IBS-D, the ACG recommend random biopsies are taken to assess for microscopic colitis.

The United Kingdom National Institute for Health and Care Excellence (NICE) guidelines address the use of radiologic testing explicitly in their recommendations as follows^[17]: “The following tests are not necessary to confirm diagnosis in people who meet the IBS diagnostic criteria: Ultrasound; Rigid/flexible sigmoidoscopy; Colonoscopy; barium enema; Thyroid function test; Faecal ova and parasite test; Faecal occult blood; Hydrogen breath test”.

In an evidence-based review of the role of abdominal radiologic imaging in IBS by O’Connor *et al.*^[23] in 2012, the authors assessed that the best available evidence that included seven systematic reviews/guidelines and five primary research articles focusing on the use of barium enema and/or ultrasound. The authors concluded that radiologic imaging is not required in patients fulfilling the clinical diagnostic criteria for IBS if alarm symptoms are not present. The authors also concluded that further investigation should be considered in patients with alarm features and the appropriate modality should be chosen on a case-by-case basis and guided by the most likely alternative diagnosis and the American College of Radiology (ACR) Appropriateness Criteria. The lack of robust evidence and prospective studies regarding the role of abdominal radiologic imaging is noted in this review.

Since this review, several studies have used MRI to investigate IBS patients. These studies aimed to demonstrate differences in bowel response to food ingestion in IBS patients relative to healthy volunteers^[25,26] and differences between the various IBS subtypes^[27]. These studies suggest various sites of pathology to explain IBS symptoms but it is difficult to draw any firm conclusions from these studies due to small numbers and heterogeneous, and sometimes conflicting, results. No definitive role has been established for the routine use of MRI in the investigation of IBS and no studies have been performed to assess the performance of MRI relative to symptom-based diagnostic criteria.

In the setting of IBS patients that also demonstrate alarm features, further investigations should be guided by the most likely alternative diagnosis; this will often involve endoscopic assessment of the bowel but radiologic testing has a role in some circumstances. For example if a patient presents with signs/symptoms suggestive of colorectal cancer NICE guidelines recommend direct visualization with colonoscopy/sigmoidoscopy or CT colonography in patients unfit for colonoscopy. In the setting of a suspected ovarian neoplasm a pelvic ultrasound is the first investigation recommended by the ACR. In a patient with signs/symptoms suggestive of inflammatory bowel disease radiologic imaging studies (*e.g.*, CT or MR enterography) may be used to supplement findings on laboratory and endoscopic studies in order to establish a diagnosis^[28].

CONCLUSION

There remains a paucity of robust evidence regarding the appropriate use of abdominal radiologic imaging in the setting of IBS and no modern prospective studies exist. Symptom-based diagnostic criteria have a high sensitivity and specificity for diagnosing IBS. Alarm symptoms are common in IBS patients but demonstrate low sensitivity for alternative organic pathology if diagnostic criteria for IBS are satisfied. Weight loss and anemia have a high specificity for underlying organic disease and in patients meeting diagnostic criteria without alarm features, clinicians should be reassured that the diagnosis of IBS is correct.

Based on the current best evidence, the diagnosis of IBS should be based on clinical findings using expert consensus diagnostic criteria (Rome IV criteria) supplemented by laboratory testing with no role for abdominal radiologic imaging in most patients. In patients presenting with IBS symptoms and alarm features, radiologic testing may be used to investigate for an underlying organic disease and the imaging modality

should be chosen based on the most likely alternative diagnosis (see [Table 1](#) for practice guideline recommendations).

Table 1 Practice guideline recommendations

Patients fulfilling the Rome IV diagnostic criteria for IBS and who do not display “red flag” symptoms such as blood in stool, weight loss, recurrent fevers, anemia, and chronic severe diarrhea and who have no family history of colorectal cancer, inflammatory bowel disease, or celiac sprue do not require radiologic imaging

Radiologic imaging is required in patients with “red flag” symptoms who fulfill the Rome IV diagnostic criteria for IBS

Consideration of the probable alternative diagnosis and adherence to the relevant American College of Radiology Appropriateness Criteria should direct the optimal radiologic imaging of the patient with IBS

IBS: Irritable bowel syndrome.

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P- Reviewer: Mahajan A, Plataniotis G, Valek V

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