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Review Article

Advances in diagnosis and management of irritable bowel syndrome

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ABSTRACT

Irritable bowel syndrome (IBS) is a common disorder of the digestive tract manifested by chronic abdominal pain and irregular bowel habits. It has significant negative impacts on quality of life and healthcare resources worldwide. IBS is linked to disrupted signaling between the brain and gut, affecting motility, sensation, and microbiota. Diagnosis is almost always clinical using Rome IV criteria and investigations to exclude organic diseases. IBS is subdivided according to stool patterns, with IBS with diarrhea being most common. Management aims to improve symptoms and quality of life. It includes patient education and reassurance, dietary and lifestyle modifications, pharmacotherapy, and psychological approaches. Dietary interventions involve low fermentable oligosaccharides, disaccharides, monosaccharides and polyols (FODMAP) diet and use of probiotics. Medications such as rifaximin and linaclotide are prescribed for patients with specific IBS types. Cognitive behavioral therapy (CBT) has proven effective in targeting psychological factors contributing to the condition. This narrative review discusses recent advances in the diagnosis and treatment of IBS. It points to the importance of using a multidisciplinary approach in IBS management to address the underlying complexity of this condition. Further research should be conducted to refine diagnostic and therapeutic strategies of IBS to improve its prognosis.

Keywords: IBS, Updates, Diagnosis, Management

INTRODUCTION

Irritable bowel syndrome (IBS) is a frequent functional disorder affecting the gastrointestinal tract (GIT). It is manifested by chronic abdominal pain and irregular bowel habits with changes in stool frequency and consistency. IBS is considered a disorder of gut-brain interaction as it occurs due to compromised bidirectional signaling between the brain and GIT. This leads to aberrant motility, secretion, and sensation within GIT.

Significant negative impacts of IBS include reduced quality of life and work productivity. It also accounts for a large proportion of patient visits to gastroenterology clinics. The incidence of IBS varies globally from 5 to 16% based on different diagnostic criteria with females commonly affected than males.[1] In the United States, this condition costs over $1 billion each year in direct expenses.[2]

Diagnosis of IBS is almost always clinical with reliance on Rome criteria which have been updated many times since they were first developed in 1989. According to these criteria, IBS is diagnosed by recurrent abdominal pain related to defecation, associated with changes in stool frequency or form. The most updated version, Rome IV, published in 2016, improved the specificity of the diagnosis by removing the term "discomfort," increasing the required frequency of abdominal pain, and recognizing that abdominal pain may worsen after bowel movements.[3] Despite increased diagnostic accuracy by Rome IV criteria, some patients previously diagnosed under Rome III may now be categorized under other functional GIT disorders, such as functional constipation or diarrhea.[4] Thus, it is important to completely rule out organic gastrointestinal diseases prior to confirming IBS diagnosis.

IBS is subdivided, according to predominant stool patterns, into IBS with constipation (IBS-C), IBS with diarrhea (IBS-D), IBS with mixed bowel habits (IBS-M), and IBS unclassified (IBS-U). IBS-D being the most common subtype.[5]

Though diagnostic criteria for IBS have long been established upon symptom-based criteria, the lack of definitive biomarkers, the complex pathophysiology of IBS with numerous risk factors, render diagnosis challenging. The biopsychosocial model suggests that there is a connection between the biological, psychological and social factors in IBS. Risk factors involve genetic predisposition, changes in stress-responsive systems, low grade inflammation, alterations in the gut microbiota, and post infectious sequelae. For this reason, IBS is no longer a purely functional disorder and is now considered a sum of combined effects of dietary factors, gut microbiota and the central nervous system.[6] IBS is characterised by visceral hypersensitivity, in which patients feel pain from lower levels of stimulation, and this is believed to arise from changes in nerve signaling.[7] Additionally, patients with IBS-D have been found to show abnormalities in serotonin signaling in their gut, and psychological factors, including stress, anxiety and depression, have also been found to frequently be present with, or exacerbate, IBS symptoms.[8]

Treatment of IBS is challenging, and mainly focuses on relieving symptoms and improving patients' quality of life. Effective management includes patient education and reassurance combined with lifestyle and dietary modifications, pharmacotherapy, psychological therapies, and strategies targeting the gut microbiota.[9]

This narrative review examines recent advances in both diagnosis and management of IBS, including emerging diagnostic modalities, evolving therapeutic approaches, and expanding evidence bases for various interventions. Subsequent sections will systematically address current diagnostic methodology, available therapeutic options, and future research directions, providing clinicians with evidence-based frameworks for optimizing patient care in IBS.

LITERATURE SEARCH

This narrative review is based on a comprehensive literature search conducted on 17 December 2024 using the Medline and Cochrane databases. Medical subject headings (MeSH) and relevant keywords were used to identify studies discussing IBS, including its diagnosis and clinical management. To ensure thoroughness, a manual search was performed through Google Scholar, and the reference lists of identified articles were examined for additional relevant studies.

Articles from all publication dates, languages, and study types were included to ensure a broad exploration of the available literature on IBS. Additionally, studies discussing the impact of dietary interventions, pharmacological treatments, and psychological therapies were included to provide a comprehensive understanding of the management strategies for IBS. Peer-reviewed articles, systematic reviews, and clinical trials were preferred as they offered accurate data and analysis.

DISCUSSION

IBS is a disease that disrupts the interaction between GIT and brain. It accounts for about 30% of new patient visits to gastroenterology clinics.[10] Patients commonly present with different combinations of four cardinal manifestations: abdominal discomfort or pain, diarrhea, constipation, and bloating. Additional gastrointestinal disturbances may occur including postprandial upper abdominal discomfort, a sensation of fullness, nausea (and less frequently, vomiting), and heartburn.[11]

IBS diagnosis

Symptom-based criteria

Till date, there is no biomarker for IBS diagnosis. Since IBS is a heterogenous disease with multiple risk factors and complex underlying mechanisms, it is unlikely that a single biomarker to determine IBS patients will be found. However, diagnosis is based on the patient's clinical history using the Rome criteria. IBS is defined by these criteria based on symptoms reported by the patient including abdominal pain relieved by defecation and changing frequency or form of stools. According to their

predominant stool type, patients are divided into subtypes, including IBS-D, constipation and a mixture of both.[12] In 1978, the Rome criteria were first developed, utilizing the symptom based diagnostic guidelines by Manning et al.[13] Since then, the criteria have been revised three times with the last version, Rome IV, published in 2016. This version oversees some significant changes, such as eliminating the word of "discomfort", making abdominal pain to have to occur at least once a week, and recognizing that some people feel the actual pain after defecation.[14] These changes were made with the goal of increasing the specificity of IBS diagnosis, and validation studies suggest Rome IV has been generally successful.

Previous validation studies in the UK and Canada demonstrated moderate efficacy of Rome III criteria for diagnosing IBS.[15,16] On the other hand, Rome IV criteria showed a specificity of 97% for IBS diagnosis in a study conducted by the Rome foundation on nearly 6,000 individuals from the general population.[17] Moreover, an independent validation study with over 500 patients compared Rome IV to Rome III and found that Rome IV had better specificity (83% vs 65%).[18]

Rome criteria are widely used to diagnose IBS, but their application raises issues in clinical practice. Specialists developed these criteria, yet most IBS patients are managed in primary care, where the guidelines are rarely used. Primary care physicians often rely on practical methods for IBS diagnosis instead.[19]

Since Rome criteria are based on research from secondary care, they are often viewed as restrictive. Many primary care patients diagnosed with IBS do not meet these criteria.[20] A strict diagnostic approach may not be useful in primary care because treatment for bowel symptoms tends to be similar across Rome subtypes.[21] Therefore, alternative definitions from organizations like the national institute of health and care excellence (NICE) may work better in community settings.[22]

In addition, Rome IV criteria are stricter than Rome III, reducing IBS diagnoses and increasing classifications under other functional bowel disorders. These include functional constipation, diarrhea, abdominal pain, bloating, and unspecified disorders. Compared to IBS, these conditions are less understood and lack strong treatment evidence. IBS patients under Rome IV often present with more severe symptoms and higher rates of psychological conditions, complicating their care.[4,23] They also frequently engage with both primary and secondary healthcare providers.[24]

Moreover, experiencing extra-intestinal symptoms, such as headaches, chest pain, and breathlessness, often lead to referrals outside gastroenterology.[25]

Finally, patients with organic GI diseases, including inflammatory bowel disease (IBD) or celiac disease, may also meet the Rome criteria for IBS. Hence, limited diagnostic tests are needed to exclude these conditions before confirming an IBS diagnosis.[26]

Clinical assessment

Diagnosing IBS starts with a detailed history. The doctor should confirm if key IBS symptoms are present and have lasted at least three months, starting six months before diagnosis. Warning signs like weight loss or rectal bleeding may indicate colorectal cancer (CRC) and require immediate gastrointestinal investigations.[27] While alarm symptoms are common in IBS patients, they only moderately predict CRC. Older patients with bowel habit changes often need further testing to rule out cancer.[28]

Review of medical history can reveal risk factors for conditions like bile acid diarrhea, linked to gallbladder removal or right hemicolectomy. Certain medications, such as non-steroidal anti-inflammatory drugs (NSAIDs) or proton pump inhibitors, may point to microscopic colitis, while opioids may explain constipation. If patients report difficult bowel movements, pelvic dyssynergia should be considered. A digital rectal exam can detect abnormal anal contractions during straining.[29]

A normal physical exam does not confirm IBS but provides reassurance. Good communication is critical. Clearly informing the patient about their IBS diagnosis is important. A previous study reported that many IBS patients are unaware of their diagnosis, unlike those with organic diseases. Using uncertain language, such as "it is possible that...," leads to unnecessary tests and consultations, driving up healthcare costs.[30]

Laboratory investigations

IBS investigations focus on excluding other conditions and pinpointing specific functional disorders behind symptoms. Common tests include a complete blood count, C-reactive protein to detect anemia or inflammation linked to IBD or CRC, and serology for celiac disease.[31] A meta-analysis of 36 studies found biopsy-confirmed celiac disease was more prevalent in IBS patients across all subtypes compared to controls.[32] However, another study of 289 patients with chronic diarrhea identified celiac disease or rare conditions like mastocytosis in only 5%.[33]

Functional tests, when used appropriately, help reduce unnecessary procedures. In a study of 936 chronic diarrhea patients, fecal bile acid testing revealed they had undergone numerous imaging, endoscopic, and other tests beforehand.[34] A thorough history, digital rectal exams, and simple clinical methods remain essential for identifying dysfunctions and tailoring IBS treatment.[35]

Faecal calprotectin testing is a non-invasive tool to detect IBD in suspected IBS-D cases. A UK study involving over 1,000 primary care patients showed calprotectin levels below 100 mcg/g identified IBS-D with 98%

accuracy in the absence of alarm symptoms, normal blood work, and negative celiac serology. Levels above 250 mcg/g warranted colonoscopy referral, while intermediate levels required repeat testing.[36] Current guidelines suggest limiting calprotectin testing to patients under 45 years due to potential false positives in older patients.[21] Where calprotectin testing is unavailable, alternative markers like lactoferrin may be considered.[37]

Faecal elastase testing is only recommended for IBS patients with steatorrhoea or suspected chronic pancreatitis.[38] A UK study of 314 participants meeting Rome II criteria for IBS-D found pancreatic exocrine insufficiency in 19 individuals (6.1%) based on faecal elastase levels. These patients received pancreatic enzyme supplementation and were compared with age- and sex-matched IBS-D patients with normal elastase levels who also underwent treatment. Patients with low elastase levels showed significant improvements in stool frequency, stool consistency, and abdominal pain compared to those with normal levels.[39]

Colonoscopy

Colonoscopy should be reserved for older patients or those with abnormal faecal calprotectin, alarm symptoms, or signs of microscopic colitis. Current evidence does not support its use in younger IBS patients without alarm features, as it rarely identifies organic pathology.[40] A retrospective analysis of nearly 500 IBS patients under 50 who underwent colonoscopy for reassurance showed no improvement in quality of life, psychological symptoms, or sense of reassurance.[41]

IBS treatment

Dietary and lifestyle modifications

Since IBS does not affect life expectancy and shows no association with organic disease development, patient education and reassurance are necessary.[42] Additionally, stress reduction improves IBS symptoms.[43]

Low FODMAP diet protocol is a dietary intervention that restricts poorly absorbed carbohydrates. This leads to decreased microbial fermentation in the colon. A recent meta-analysis by Black et al confirms FODMAP restriction as the superior dietary intervention in improving abdominal pain and flatulence in patients with IBS.[44] However, extended restrictions may result in malnutrition. Therefore, this protocol should be implemented for 4-6 weeks.[45]

Research indicated that probiotic supplementation could reduce global IBS symptoms. Clinical benefits include decreased abdominal pain and bloating. Nevertheless, optimal bacterial strains remain undetermined.[45]

Physical activity demonstrates therapeutic efficacy in IBS, as reported by Johannesson et al. A 12-week exercise protocol reduced abdominal distress in their study patients.[46] In their subsequent study, they found that continued activity was associated with improvement of long-term symptoms.[47]

Pharmacological therapies

Symptomatic treatments

IBS-D responds to loperamide and cholestyramine, while IBS-C requires laxative administration. Treatment protocol permits medication cessation upon symptom resolution.[11]

Antispasmodics

Antispasmodics target gastrointestinal smooth muscle through antimuscarinic and calcium channel mechanisms. A meta-analysis by Ford et al validates otilonium and hyoscine efficacy in IBS.[48] Moreover, Chang et al confirmed equivalence of otilonium to mebeverine for reduction of IBS symptoms.[49]

Neuromodulatory drugs

Tricyclic antidepressant (TCAs) and selective serotonin reuptake inhibitors (SSRIs) have demonstrated central and peripheral pain modulation.[50,51] Ford et al revealed their treatment efficacy with number needed to treat (NNT) of 4.5 for TCAs and 5 for SSRIs.[52] However, these drugs have frequent adverse effects including somnolence and oral dryness.

Novel therapeutic agents

Rifaximin exhibits gut-modulatory properties through non-systemic antibiotic mechanisms. The US food and drug administration (FDA) approved its use for IBS-D in 2015.[53] Linaclotide, functioning as a guanylate cyclase-C agonist secretagogue, have shown clinical benefits in IBS-C.[54] Some studies revealed that opioid receptor targeting agents (eluxadoline, asimadoline) are effective in IBS-D.[55,56]

CBT

CBT integrates multiple therapeutic components: psychoeducational intervention, relaxation methodology, cognitive restructuring, problem-solving acquisition, and exposure paradigms.[57] A previous meta-analysis by Laird et al found that CBT significantly improved both short and long-term IBS symptoms.[58] Nevertheless, limited availability of specialized gastrointestinal psychology practitioners restricts widespread CBT utilisation.

CONCLUSION

IBS is a complex disorder with diverse manifestations and underlying mechanisms. Diagnosis relies on clinical history, validated criteria, and targeted testing to rule out

organic diseases. Dietary protocols, physical activity, probiotics, and pharmacological treatments show promise in alleviating symptoms. Psychological therapies, such as CBT, address the gut-brain interaction central to IBS. A multidisciplinary approach combining clinical, dietary, and psychological strategies offers the most effective management. Ongoing research should focus on improving diagnostic tools and enhancing treatment approaches to support better outcomes.

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REFERENCES

1. Oka P, Parr H, Barberio B, Black CJ, Savarino EV, Ford AC. Global prevalence of irritable bowel syndrome according to Rome III or IV criteria: a systematic review and meta-analysis. Lancet Gastroenterol Hepatol. 2020;5(10):908-17.
2. Everhart JE, Ruhl CE. Burden of digestive diseases in the United States part II: lower gastrointestinal diseases. Gastroenterology. 2009;136(3):741-54.
3. Hellstrom PM, Benno P. The Rome IV: Irritable bowel syndrome-A functional disorder. Best Pract Res Clin Gastroenterol. 2019;40-41:101634.
4. Black CJ, Yiannakou Y, Houghton LA, Ford AC. Epidemiological, clinical, and psychological characteristics of individuals with self-reported irritable bowel syndrome based on the Rome IV vs Rome III criteria. Clin Gastroenterol Hepatol. 2020;18(2):392-8.
5. Yadav YS, Eslick GD, Talley NJ. Irritable bowel syndrome: natural history, bowel habit stability and overlap with other gastrointestinal disorders. Aliment Pharmacol Ther. 2021;54(1):S24-32.
6. Sood R, Law GR, Ford AC. Diagnosis of IBS: symptoms, symptom-based criteria, biomarkers or 'psychomarkers'? Nat Rev Gastroenterol Hepatol. 2014;11(11):683-91.
7. Ludidi S, Mujagic Z, Jonkers D, Keszthelyi D, Hesselink M, Kruimel J, et al. Markers for visceral hypersensitivity in patients with irritable bowel syndrome. Neurogastroenterol Motil. 2014;26(8):1104-11.
8. Gros M, Gros B, Mesonero JE, Latorre E. Neurotransmitter dysfunction in irritable bowel syndrome: Emerging approaches for management. J Clin Med. 2021;10(15):1.
9. Simren M, Tornblom H, Palsson OS, Whitehead WE. Management of the multiple symptoms of irritable bowel syndrome. Lancet Gastroenterol Hepatol. 2017;2(2):112-22.
10. Canavan C, West J, Card T. The epidemiology of irritable bowel syndrome. Clin Epidemiol. 2014;6:71-80.
11. Chey WD, Kurlander J, Eswaran S. Irritable bowel syndrome: a clinical review. JAMA. 2015;313(9):949-58.
12. Ford AC, Sperber AD, Corsetti M, Camilleri M. Irritable bowel syndrome. Lancet. 2020;396(10263):1675-88.
13. Pearson S, Openshaw P. Towards positive diagnosis of the irritable bowel. Br Med J. 1978;2(6150):1496.
14. Mearin F, Lacy BE, Chang L, William DC, Anthony JL, Magnus S, et al. Bowel disorders. Gastroenterology. 2016;S0016-5085(16)00222-5.
15. Ford AC, Bercik P, Morgan DG, Bolino C, Pintos-Sanchez MI, Moayyedi P. Validation of the Rome III criteria for the diagnosis of irritable bowel syndrome in secondary care. Gastroenterology. 2013;145(6):1262-70.
16. Sood R, Camilleri M, Gracie DJ, Matthew JG, Natalie T, Graham RL, et al. Enhancing diagnostic performance of symptom-based criteria for irritable bowel syndrome by additional history and limited diagnostic evaluation. Am J Gastroenterol. 2016;111(10):1446-54.
17. Palsson OS, Whitehead WE, Van Tilburg MA, Lin C, William C, Michael DC, et al. Development and validation of the Rome IV diagnostic questionnaire for adults. Gastroenterology. 2016;150(6):1481-91.
18. Black CJ, Craig O, Gracie DJ, Ford AC. Comparison of the Rome IV criteria with the Rome III criteria for the diagnosis of irritable bowel syndrome in secondary care. Gut. 2021;70(6):1110-6.
19. Shivaji UN, Ford AC. Beliefs about management of irritable bowel syndrome in primary care: cross-sectional survey in one locality. Prim Health Care Res Dev. 2015;16(3):263-9.
20. Boyce PM, Koloski NA, Talley NJ. Irritable bowel syndrome according to varying diagnostic criteria: are the new Rome II criteria unnecessarily restrictive for research and practice? Am J Gastroenterol. 2000;95(11):3176-83.
21. Vasant DH, Paine PA, Black CJ, Lesley AH, Hazel AE, Maura C, et al. British Society of Gastroenterology guidelines on the management of irritable bowel syndrome. Gut. 2021;70(7):1214-40.
22. Hookway C, Buckner S, Crosland P, Longson D. Irritable bowel syndrome in adults in primary care: summary of updated NICE guidance. BMJ. 2015;350:h701.
23. Vork L, Weerts Z, Mujagic Z, Kruimel JW, Hesselink MAM, Muris JWM, et al. Rome III vs Rome IV criteria for irritable bowel syndrome: A comparison of clinical characteristics in a large cohort study. Neurogastroenterol Motil. 2018;30(2).
24. Goodoory VC, Houghton LA, Yiannakou Y, Black CJ, Ford AC. Natural history and disease impact of Rome IV vs Rome III irritable bowel syndrome: A longitudinal follow-up study. Clin Gastroenterol Hepatol. 2022;20(3):569-77.
25. Ohlsson B. Extraintestinal manifestations in irritable bowel syndrome: A systematic review. Therap Adv Gastroenterol. 2022;15:17562848221114558.
26. Aziz I, Simren M. The overlap between irritable bowel syndrome and organic gastrointestinal

diseases. Lancet Gastroenterol Hepatol. 2021;6(2):139-48.
27. Whitehead WE, Palsson OS, Feld AD, Levy RL, VON Korff M, Turner MJ, et al. Utility of red flag symptom exclusions in the diagnosis of irritable bowel syndrome. Aliment Pharmacol Ther. 2006;24(1):137-46.
28. Ford AC, Veldhuyzen van Zanten SJ, Rodgers CC, Talley NJ, Vakil NB, Moayyedi P. Diagnostic utility of alarm features for colorectal cancer: systematic review and meta-analysis. Gut. 2008;57(11):1545-53.
29. Goldstein RS, Cash BD. Making a confident diagnosis of irritable bowel syndrome. Gastroenterol Clin North Am. 2021;50(3):547-63.
30. Linedale EC, Chur-Hansen A, Mikocka-Walus A, Gibson PR, Andrews JM. Uncertain diagnostic language affects further studies, endoscopies, and repeat consultations for patients with functional gastrointestinal disorders. Clin Gastroenterol Hepatol. 2016;14(12):1735-41.
31. Camilleri M. Diagnosis and treatment of irritable bowel syndrome: A review. JAMA. 2021;325(9):865-77.
32. Irvine AJ, Chey WD, Ford AC. Screening for celiac disease in irritable bowel syndrome: An updated systematic review and meta-analysis. Am J Gastroenterol. 2017;112(1):65-76.
33. Atieh J, Chedid V, Khoshbin K, Kane S, Camilleri M. Development of a score to predict positive colonic histology in chronic diarrhea assessed in open-access colonoscopy. J Clin Gastroenterol. 2021;55(8):694-701.
34. Vijayvargiya P, Gonzalez Izundegui D, Calderon G, Tawfic S, Batbold S, Camilleri M. Fecal bile acid testing in assessing patients with chronic unexplained diarrhea: Implications for healthcare utilization. Am J Gastroenterol. 2020;115(7):1094-102.
35. Camilleri M, Chedid V. Actionable biomarkers: the key to resolving disorders of gastrointestinal function. Gut. 2020;69(10):1730-7.
36. Turvill J, Turnock D, Holmes H. Evaluation of the clinical and cost-effectiveness of the York Faecal Calprotectin Care Pathway. Frontline Gastroenterol. 2018;9(4):285-94.
37. Zhou XL, Xu W, Tang XX, Lai-sheng L, Jiang-feng T, Chen-jing Z, et al. Fecal lactoferrin in discriminating inflammatory bowel disease from irritable bowel syndrome: a diagnostic meta-analysis. BMC Gastroenterol. 2014;14:121.
38. Arasaradnam RP, Brown S, Forbes A, Mark RF, Pali H, Lawrence K, et al. Guidelines for the investigation of chronic diarrhoea in adults: British Society of Gastroenterology, 3rd edition. Gut. 2018;67(8):1380-99.
39. Leeds JS, Hopper AD, Sidhu R, Alison S, Narges A, Nigel H, et al. Some patients with irritable bowel syndrome may have exocrine pancreatic insufficiency. Clin Gastroenterol Hepatol. 2010;8(5):433-8.
40. Wu J, Wang C, Lv L. Diagnostic yield of colonoscopy for organic disease in irritable bowel syndrome and its risk factors: A meta-analysis. Neurogastroenterol Motil. 2023;35(2):e14481.
41. Spiegel BM, Gralnek IM, Bolus R, Lin C, Gareth SD, Bruce N, et al. Is a negative colonoscopy associated with reassurance or improved health-related quality of life in irritable bowel syndrome? Gastrointest Endosc. 2005;62(6):892-9.
42. Owens DM, Nelson DK, Talley NJ. The irritable bowel syndrome: long-term prognosis and the physician-patient interaction. Ann Intern Med. 1995;122(2):107-12.
43. Exarchopoulou K, Papageorgiou A, Bacopoulou F, Elli KM, Dimitrios V, George PC, et al. A biofeedback-assisted stress management program for patients with irritable bowel syndrome: A randomised controlled trial. EMBnet J. 2021;26:e980.
44. Black CJ, Staudacher HM, Ford AC. Efficacy of a low FODMAP diet in irritable bowel syndrome: systematic review and network meta-analysis. Gut. 2022;71(6):1117-26.
45. Nanayakkara WS, Skidmore PM, O'Brien L, Wilkinson TJ, Gearry RB. Efficacy of the low FODMAP diet for treating irritable bowel syndrome: the evidence to date. Clin Exp Gastroenterol. 2016;9:131-42.
46. Johannesson E, Simren M, Strid H, Bajor A, Sadik R. Physical activity improves symptoms in irritable bowel syndrome: a randomized controlled trial. Am J Gastroenterol. 2011;106(5):915-22.
47. Johannesson E, Ringstrom G, Abrahamsson H, Sadik R. Intervention to increase physical activity in irritable bowel syndrome shows long-term positive effects. World J Gastroenterol. 2015;21(2):600-8.
48. Ford AC, Talley NJ, Spiegel BM, et al. Effect of fibre, antispasmodics, and peppermint oil in the treatment of irritable bowel syndrome: systematic review and meta-analysis. BMJ. 2008;337:a2313.
49. Chang FY, Lu CL, Luo JC, Chen TS, Chen MJ, Chang HJ. The evaluation of otilonium bromide treatment in asian patients with irritable bowel syndrome. J Neurogastroenterol Motil. 2011;17(4):402-10.
50. Morgan V, Pickens D, Gautam S, Kessler R, Mertz H. Amitriptyline reduces rectal pain related activation of the anterior cingulate cortex in patients with irritable bowel syndrome. Gut. 2005;54(5):601-7.
51. Chial HJ, Camilleri M, Burton D, Thomforde G, Olden KW, Stephens D. Selective effects of serotonergic psychoactive agents on gastrointestinal functions in health. Am J Physiol Gastrointest Liver Physiol. 2003;284(1):G130-7.
52. Ford AC, Lacy BE, Harris LA, Quigley EMM, Moayyedi P. Effect of antidepressants and psychological therapies in irritable bowel syndrome: An updated systematic review and meta-analysis. Am J Gastroenterol. 2019;114(1):21-39.

53. Chey WD, Shah ED, DuPont HL. Mechanism of action and therapeutic benefit of rifaximin in patients with irritable bowel syndrome: a narrative review. Therap Adv Gastroenterol. 2020;13:1756284819897531.
54. Atluri DK, Chandar AK, Bharucha AE, Falck-Ytter Y. Effect of linaclotide in irritable bowel syndrome with constipation (IBS-C): a systematic review and meta-analysis. Neurogastroenterol Motil. 2014;26(4):499-509.
55. Cash BD, Lacy BE, Schoenfeld PS, Dove LS, Covington PS. Safety of eluxadoline in patients with irritable bowel syndrome with diarrhea. Am J Gastroenterol. 2017;112(2):365-74.
56. Mangel AW, Hicks GA. Asimadoline and its potential for the treatment of diarrhea-predominant irritable bowel syndrome: a review. Clin Exp Gastroenterol. 2012;5:1-10.
57. Kinsinger SW. Cognitive-behavioral therapy for patients with irritable bowel syndrome: current insights. Psychol Res Behav Manag. 2017;10:231-7.
58. Laird KT, Tanner-Smith EE, Russell AC, Hollon SD, Walker LS. Short-term and long-term efficacy of psychological therapies for irritable bowel syndrome: A systematic review and meta-analysis. Clin Gastroenterol Hepatol. 2016;14(7):937-47.

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