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REVIEW ARTICLE

Chronic constipation in Rome IV era: The Indian perspective

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Abstract Chronic constipation (CC) is a common problem in the community and in gastroenterology practice all over the world including India. After release of Rome IV guidelines in April 2016, there is increasing interest among gastroenterologists and physicians in India to look into special issues on CC in the Indian perspective. There are important differences in the bowel habit, definition, epidemiology, and pathophysiology including dietary factors and management of CC in India as compared to the West. As severity and frequency of abdominal pain, a symptom essential to diagnose constipation-predominant irritable bowel syndrome (IBS-C) rather than functional constipation (FC), is less common among Indian patients, FC is commoner than IBS-C in India. The pathophysiological mechanisms of CC may include slow colon transit, fecal evacuation disorder (FED), or a combination of these; though CC in a third to half of patients presenting to tertiary care facilities may result from these pathophysiological mechanisms, most patients presenting to primary care may have lifestyle and dietary issues. The current Rome IV algorithm dictates to explore the underlying physiological factors in the pathogenesis of functional gastrointestinal disorders including CC, which may translate to its personalized management. However, the availability of the methods to explore pathophysiological factors and manage CC caused by FED non-pharmacologically (using biofeedback) in India is limited. Though several pharmacological agents are available in India to manage CC, there are several unmet needs in its treatment. This review explores CC in India in relation to these issues, some of which are unique in the Indian perspective.

Keywords Asia · Defecation · Functional constipation · Functional gastrointestinal disorders · Irritable bowel syndrome

Introduction

Chronic constipation (CC) is a common problem in medical practice around the world [1, 2]. Experts from India believed for a long time that the epidemiology, clinical spectrum, diagnostic assessment, treatment need, and patient expectations among patients with CC were somewhat different in India as compared to the West. However, there was scarcity of data supporting these beliefs from India. Moreover, recently, with the publication of Rome IV [3], there is increasing interest among clinicians and researchers in the field to look into special issues on CC in the Indian perspective. The special issues, which may be different in India as compared to the West, include definition and epidemiology of CC in the context of differing bowel habits, differentiation between functional constipation (FC) and constipation-predominant irritable bowel syndrome (IBS-C), and investigative and therapeutic approaches considering the fact that several modalities are not widely available in the country though a large number of pharmacological agents exist in contrast to the West, where therapeutic options are quite limited [4, 5]. Moreover, considering the fact that a large proportion of Indian populations are vegetarian and lactose malabsorption is common, special dietary issues need attention [1, 6]. An Indian type of toilet, which uses the squatting position rather than the sitting position during defecation, needs deliberation as well [7]. Hence, we wish to review the literature on CC with special emphasis on data from the Indian literature.

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Definitions

Chronic constipation In essence, symptoms of difficult, infrequent, incomplete defecation of sufficiently long duration and severe enough to force the patient to seek health care suggest CC. CC has been defined at different times differently. The initial definitions were based largely on weekly frequency of spontaneous bowel movement [8, 9]. These were based largely on data from the West, which showed that the normal people in these regions of the world pass at least three stools a week [8, 9], and hence, a stool frequency lesser than three per week was considered as constipation. However, healthy Indian populations pass one to two stools per day [1, 10, 11]. This might be related to fast gut transit, high dietary fiber intake associated with vegetarianism, and frequent lactose malabsorption [6, 12–14]. Moreover, in Indian studies, patients with IBS-C and IBS-D had similar median stool frequency [10, 15] possibly related to the fact that the IBS-C patients might be visiting toilet repeatedly in an attempt to evacuate their bowel. Realization of these issues over a period of time led even the global experts to change the physician-driven stool frequency-based definition of CC to patients' reported symptom cluster-based definition [3].

Table 1 lists the symptoms as per Rome IV criteria for diagnosis of CC; these include hard stool, straining, feeling of incomplete evacuation and anorectal blockage, manual evacuation, and infrequent bowel movement. Presence of any two of these symptoms for a long duration (with onset at least 6 months ago and currently symptomatic for a minimum of a 3-month period) in the absence of greater than 25% of stools being loose without treatment with laxative suggests a diagnosis of CC [3]. It is important to note that for research, a bowel diary should be recorded for at least 2 weeks [3]. However, the Rome IV criteria made it more practical for clinicians and epidemiologists. If the patients mention that during the period with abnormal bowel movement, the stools are predominantly type I or type II in the Bristol Stool Scale, a diagnosis of constipation can be made [3]. In an Asian context, however, even type III stool is also considered to denote constipation [16, 17].

Table 1 Rome IV diagnostic criteria for functional constipation

Following criteria should be present for at least 3 months with symptom onset at least 6 months prior to diagnosis	
1	Presence of ≥2 of the following symptoms: • Lumpy or hard stools (Bristol Stool Form Scale 1–2) in >25% of defecations • Straining during >25% of defecations • Sensation of incomplete evacuation for >25% of defecations • Sensation of anorectal obstruction/blockage for >25% of defecations • Manual maneuvers to facilitate >25% of defecations (digital manipulations, pelvic floor support) • <3 spontaneous bowel movements per week
2	Loose stools rarely present without the use of laxatives
3	Insufficient criteria for irritable bowel syndrome

Though a 2-week bowel diary is recommended, in Rome IV criteria, it has been suggested that as an alternative for clinical and epidemiological purpose, sub-typing can be done based on patients' reported pattern of stool types during the periods with abnormal bowel movement without laxative

Constipation-predominant irritable bowel syndrome In essence, according to the Rome IV criteria, patients with CC who fulfill the Rome IV criteria for IBS, the essential component of which is abdominal pain, would be diagnosed as IBS-C (Fig. 1) [3]. Table 2 lists the Rome IV criteria for diagnosis of IBS [3].

Functional constipation Patients with CC who do not fulfill the Rome IV criteria for IBS (the essential symptom being

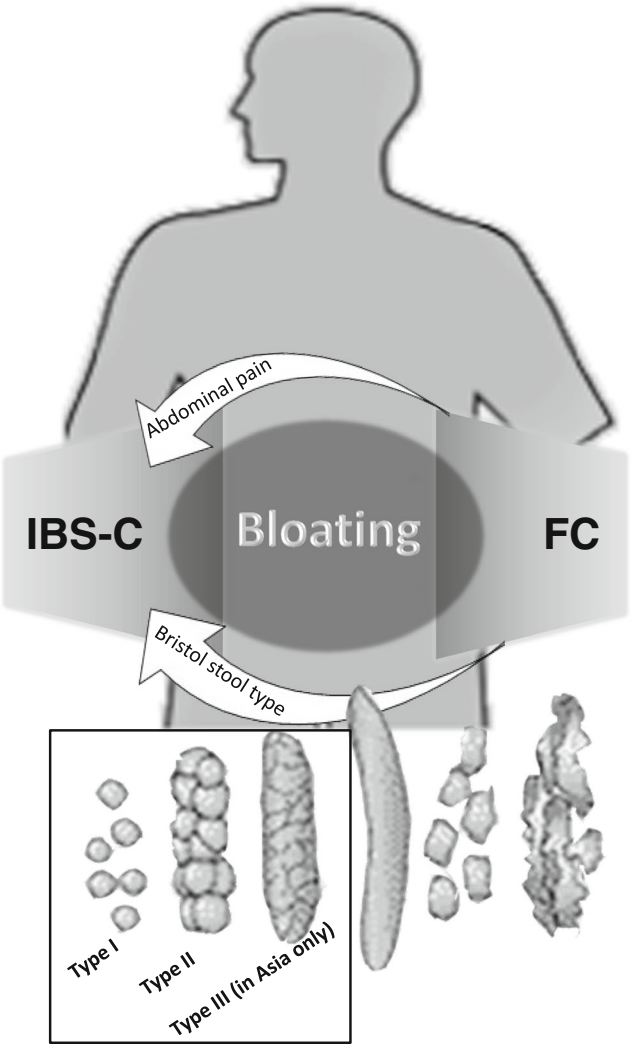

Fig. 1 Diagram showing overlap of symptoms of FC and IBS-C

Table 2 Rome IV criteria for diagnosis of irritable bowel syndrome

Following criteria should be present for at least 3 months with symptom onset at least 6 months prior to diagnosis
Recurrent abdominal pain, on average, at least 1 day per week in the last 3 months, associated with 2 or more of the following criteria: 1. Related to defecation 2. Associated with a change in frequency of stool 3. Associated with a change in form (appearance) of stool

abdominal pain) would be diagnosed as FC (Fig. 1) [3]. It is important to note that abdominal bloating, which means feeling of abdominal distension, occurs in IBS-C as well as FC (Fig. 1) [3].

Epidemiology of CC in India

Though community studies on prevalence of CC in India are scarce, a few recent studies did show it to be common (Fig. 2) [18]. A recent study on 505 people in Chandigarh, northern India, found the prevalence of constipation, evaluated using the Rome II criteria, to be 16.8% and self-reported constipation to be 24.8% (Table 3) [18]. Additionally, this study found that CC was commoner among females than males (20% vs. 13%) and among the non-working than working population (20% vs. 12%) [18]. Poor dietary habits, less fluid intake, and low levels

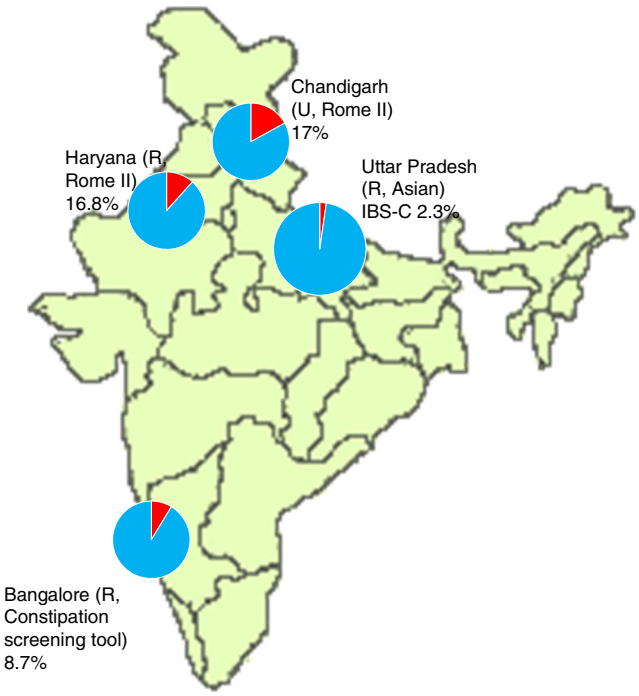

Fig. 2 Map of India showing prevalence of chronic constipation based on the population surveys *U* urban, *R* rural, IBS-C constipation-predominant irritable bowel syndrome

of physical activity were the risk factors of CC. In another study from a rural northern Indian community, 555 of 4767 (11.6%) had CC [21]. In a study conducted in 17 centers across India among 1618 adults with chronic lower gastrointestinal (GI) symptoms, 43 (2.7%) patients had ≤3 stools per week [15]. It is needless to mention that a stool frequency-based definition is expected to under-estimate the prevalence of constipation. A study on 1200 subjects from coastal eastern India showed that stool frequency decreased with age, particularly among females [11]. The authors suggested that this might be related to the pelvic floor trauma due to childbirth. However, this hypothesis needs to be proved by further study. Overall, the prevalence of CC in India may be considered to vary from 12% to 17% based on the limited data available currently. This is somewhat higher than the world average of 10% but in line with the findings from a survey, which estimated the prevalence of self-reported constipation in Asia to be 15% to 23% in women and about 11% in men (https://scinergy21.wordpress.com/2015/06/18/the-grim-reality-of-constipation-prevalence-in-india/).

A few studies reported FC to be more common than IBS-C in India. A prospective study reported that 75.6% and 24.4% had FC and IBS-C, respectively, among 925 patients with CC using the Rome III criteria [22]. This is also supported by data from a prospective study from West Bengal, in which FC was diagnosed in 69% (of whom most were elderly with comorbidities) and IBS-C in 13.8% of the 331 patients consulting for CC [19]. Similar results were obtained from a study in rural Haryana [21]; in this study, 555 (11.6%) and 191 (4%) of 4767 subjects had constipation and IBS, respectively; as only 12/191 IBS patients had IBS-C, it may be concluded that FC was a commoner cause of CC [21]. FC is also one of the more frequently observed medical ailments in individuals 65 years of age or older. FC was reported in 8.7% people in a recent study conducted among 92 elderly people in rural India near Bangalore [20]. A higher proportion of FC than IBS-C in India is quite expected as abdominal pain, which is essential to diagnose IBS according to the Rome criteria, is less in frequency and severity among Indian patients with IBS [23].

Stool frequency and form

Normal stool frequency and form, which have wide geographic variation, are also important factors in assessing the constipation [2, 5]. Stool form (described by the Bristol Stool Form Scale [BSFS], Fig. 1) is reported to be a good marker of colonic transit in the West [24]; stool types 1 and 2 on BSFS are regarded as indicating slow colon transit and constipation, respectively [24]. In the Western population, a stool frequency between 3 and 21/week is considered normal [8]. This is the basis for an older frequency-based definition of constipation, which suggested that a stool frequency less than 3/week should be considered as constipation [2]. However, this definition may

Table 3 Frequency of chronic constipation (CC) and constipation-predominant IBS (IBS-C) in India

Author	City	Study population	Sample size	Diagnostic criteria	Prevalence of constipation	Prevalence of IBS-C
Ghoshal et al. 2017 [1]	Uttar Pradesh (rural)	Adult general population	2774	Rome III	–	2.5%
Ray 2016 [19]	West Bengal	Consulting adults with CC	331	Rome III	69.1%	13.8%
Rajput and Saini 2014 [18]	Chandigarh	Adult general population	505	Rome II Self-reported	16.8% 24.8%	–
Ghoshal et al. 2013 [15]	17 centers across India	Adults with chronic lower GI symptoms	1618	≤3 stools/week	–	19.7%
Kasthuri et al. 2013 [20]	Bangalore (Rural)	Elderly general population	92	Constipation screening tool	8.69%	–
Panigrahi et al. 2013 [11]	Odisha	Asymptomatic adults	1200	≤3 stools/week	2.6%	–
Makharia et al. 2011 [21]	Haryana	Adult general population	4767	Rome III	11.6%	0.3%
Ghoshal et al. 2008 [10]	22 centers across India	Adults with IBS	2785	≤3 stools/week	–	39%

Adults: ≥18 years, elderly: ≥60 years

not apply widely in different parts of the world including India as several studies showed the frequency of defecation to be higher in several Indian populations [1, 11].

However, data on stool form and frequency among healthy subjects in India are scanty. Several Indian studies reported that most people in the community (up to 99%) pass one or more stools a day, and patients with self-perceived constipation report a median of two stools per day [1, 10]. Stool weight in Indians is also higher than that in the West [14]. A study from northern India showed that the mean fecal weight among 514 healthy subjects older than 15 years was 311 g/24 h, a value much higher than that in the Western population [14]. Indian people also tend to pass somewhat softer stools. In an eastern Indian study among 1200 subjects, predominantly Bristol type IV, V, VI, and VII stools were passed by 50%, 6%, 18%, and 0.6% people, respectively [11]; the corresponding figures from a rural northern Indian study were 39.5%, 26%, 7%, and 3%, respectively [1]. These differences in stool frequency, weight, and form might be related to faster gut transit, higher dietary fiber intake, vegetarianism, lactose malabsorption, and higher degree of small intestinal bacterial colonization [1, 6, 14, 25]. These issues, therefore, need consideration while defining constipation in India. Because of these reasons, in Asian criteria for defining constipation, Bristol type III stool has also been regarded to indicate hard stool based on a Korean study [17, 26]. This view is supported by several studies including a few from India, which showed that using the Western definition of constipation failed to categorize a large proportion of patients; this discrepancy, however, got corrected when patient-perceived or Asian definitions of constipation (BSS III in addition to I and II as constipation) were used [15].

Pathogenesis of constipation

In epidemiological surveys, several lifestyle factors have been found to contribute to CC; these include inadequate dietary fiber and fluid intake, irregular and inadequate time in the toilet, sedentary life, and consumption of some drugs such as anti-cholinergics, opiate, tricyclic anti-depressants, and calcium channel blockers [2, 27]. However, in patients presenting with CC to the clinicians, particularly in tertiary care facilities, major pathophysiological abnormalities, either alone or in combination, often contribute to constipation in addition to these trivial factors. Accordingly, CC can be divided into three broad categories: slow and normal transit constipation, and defecatory or fecal evacuation disorder (FED) [2]. Some recent studies have suggested that FC might have some organic basis such as histologic abnormalities, which can alter colonic motility or rectoanal co-ordination [28]. Histologic abnormalities include reduced number of enteric neuronal elements including interstitial cells of Cajal, nuclear abnormalities in the ganglia, and reduction of acetylcholinesterase activity [29, 30]. Presence of methane-producing gut flora has also been shown recently to be associated with constipation as methane gas might slow gut motility [31]. Solitary rectal ulcer is known to be associated with FED [32].

Diagnosis of constipation

Diagnosis of CC entails thorough history taking, physical examination including per-rectal examination (Table 4), and investigations to exclude organic causes and explore possible contributing pathophysiological factors, when indicated [2, 16]. Asian experts suggested that bloating and need for laxative should be considered as alert symptoms for constipation [16]. Alarm features such as age >45 years, blood in stool, unintended weight loss, fever, abdominal mass, and family history of GI cancer should alert the clinicians of possible organic causes to undertake investigations including colonoscopy [16]. In the recent Rome IV algorithm, it has been suggested that the multi-dimensional clinical profile (MDCP) of

patients with functional gastrointestinal disorders including CC should be evaluated (Table 5) [33].

Assessment of severity Severity assessment is important to guide treatment and assess improvement (Table 6). The profile of patients of different severity has been presented in Rome IV; treatment recommendations may be based on severity of symptoms such that the patients with severe symptoms get more effective treatment options early and patients with mild symptoms may be managed by lifestyle modification and simple therapies [34]. In fact, patients with more severe symptoms should better be treated with more effective drugs at the outset (step down approach) rather than relying entirely on a step-up approach beginning with lifestyle modification. It is important to note that patients with CC remained most often dissatisfied with treatment as compared to other sub-types of functional gastrointestinal disorders (FGIDs) [35]. Several other disease-specific instruments are available to assess severity of CC. These include Patient Assessment of Constipation-Symptom (PAC-SYM), Symptom Severity Score, Visual Analogue Scale, Longo Scoring System for Obstructed Defecation, and Cleveland Clinic Score [36]. However, none of these scoring systems have been used in India.

Table 4 Major parameters needing attention while history taking and physical examination of patients with chronic constipation

History
Constipation symptoms as listed in Table 1
Bristol stool type (over the last 2 weeks)
Symptoms suggestive of fecal evacuation disorder Prolonged (>30 min) and excessive straining Infrequent defecation (<3 per week) Manual evacuation, need of perineal and vaginal pressure to assist defecation
Obstetric history
Urge to evacuate
Abdominal pain, bloating
Toilet type (Indian vs. Western) and any recent change
Dietary history (vegetarian vs. non-vegetarian), dietary fiber, water intake
Physical exercise
Systemic including neuro-psychiatric diseases and drugs
Pain during defecation
Physical examination
Features of systemic diseases
Per-rectal examination Resting anal tone Squeeze tone Relaxation of anal sphincter and puborecal tone on attempt at defecation
Perineal descent/rectal prolapse on straining
Presence of anal fissure

Physical examination The next step should include detailed abdominal as well as rectal examination, which includes presence of pallor, weight loss, abdominal mass, liver enlargement, or a palpable colon. The examination should be completed with a digital rectal examination. If the history and physical examination show features of organic disease, like hypothyroidism, further diagnostic tests are required. If the patient does not respond to laxative therapy and continue to report self-perceived constipation, incomplete evacuation, and prolonged straining, even with soft stools, testing for pelvic floor disorder is warranted [37]. If the patient is suffering from defecatory disorder, main physiological tests such as anorectal manometry, balloon expulsion test, defecography, and colon transit study should be used to assess the condition [2, 37]. Diagnostic evaluations should preferably be performed while the patient is not taking laxatives. Mechanical obstruction, medications, and systemic illnesses can cause constipation, and these causes must be excluded, especially in patients presenting with new-onset symptoms. Finally, physicians should use the BSFS, which is a good marker of stool form and colonic transit time. The BSFS has a simple visual descriptor that illustrates the common stool forms and consistency on a 7-point scale. The use of BSFS (Fig. 1) rather than stool frequency is particularly useful for assessment of constipation in an Indian population due to the higher frequency of bowel movement in them as a result of high fiber vegetarian diet and shorter colonic transit time [1, 14]. Bristol stool form depends on the time it takes to traverse the colon, and thus is a simple clinical indicator of colonic transit time [24]. The longer it takes to traverse the colon, the harder the stool form.

Laboratory evaluation Whereas most patients presenting to primary care services may not have complicated pathophysiological mechanisms but may have lifestyle and dietary issues, as high as one third of patients presenting to tertiary care services may have FED, slow colonic transit, or a combination of the two [37, 38]. Patients with alarm features should undergo colonoscopic examination [16]. Investigations for systemic

Table 5 Multi-dimensional clinical profile as applicable to patients with chronic constipation

- Categorical diagnosis (symptom-based criteria for FC and constipation-predominant irritable bowel syndrome)
- Clinical modifier (FODMAP sensitivity)
- Impact (mild, moderate, severe)
- Psychosocial modifier
- Physiological dysfunction and biomarker

IBS irritable bowel syndrome, *FODMAP* fermentable oligo-di-monosaccharides and polyols

Table 6 Symptoms indicating severity of FGIDs

Parameters	Mild symptoms	Moderate symptoms	Severe symptoms
Impairment in daily activities	Very minor	Intermittent	High
Symptoms	Infrequent	Related to dietary indiscretion, travel, or distressing experiences	Severe and refractory
Abdominal pain	Minimal	Moderate	Severe
Psychosocial distress	Usually none	More distressed	Very high
Quality of life	Good	Poor, may lose time from work	Very poor, 10% or more have work disability

diseases such as diabetes mellitus, hypothyroidism, hypercalcemia, amyloidosis, Parkinson's disease, and other neurological diseases should be undertaken based on the clinical suspicion by the physicians. A per-rectal examination by an experienced physician assessing for resting and squeeze sphincter tone and relaxation of the sphincter complex including that of the puborectal sling has reasonable sensitivity to detect puborectal dyssynergia though a multi-center study showed that most physicians are not quite competent in performing it [39].

Subsequently, the patients with severe constipation consulting a tertiary care facility should be subjected to a variable combination of the following tests (Fig. 3): (a) colon transit time by radio-opaque markers, (b) balloon expulsion test, (c) anorectal manometry, and (d) defecography. It is important to note that fulfilling Rome criteria for IBS-C does not exclude possibility of FED and slow colon transit [37]. It is important to note that combination of multiple abnormal test results increases the diagnostic specificity to detect underlying pathophysiological abnormalities causing CC. Moreover, uncovering the pathophysiological abnormality may translate into specific management, and hence, the recent Rome IV guidelines recommended evaluation for the MDCP in patients with CC [33].

Colon transit study This is performed with radio-opaque markers using a protocol that has been validated for Indian patients with fast gut transit [13]. As per this protocol, 20 radio-opaque markers, typically packaged inside two capsules, are ingested each time at 0, 12, and 24 h and then radiographs of the whole abdomen are obtained at 36 and 60 h. Retention of 30 and 14 radio-opaque markers at 36 h (sensitivity 90%, specificity 82%) and 60 h (sensitivity 95%, specificity 100%) is considered abnormal, respectively [13]. Since patients with FED may have more markers retained in the recto-sigmoid segment (RS, Fig. 3) compared to patients with slow colon transit, in whom markers tend to be retained diffusely in the right and left segments (RS, LS, Fig. 3) as well, this test may also suggest this possibility in patients with FED [13].

Balloon expulsion test This test is a simple screening test for FED. The patient, while lying in left lateral decubitus position, is asked to expel an intra-rectal latex balloon filled with 50 mL water and tied to a thin catheter passing over a pulley (Fig. 3) [37]. If the patient cannot evacuate the balloon, increasing weight is added to the hanging end of the catheter. A need for more than 250 g added weight to evacuate out the balloon is considered suggestive of FED [37]. In another protocol, the patient is asked to record the time taken to evacuate out the intra-rectal balloon in privacy in the lavatory [40]. Time longer than 2 min to evacuate the balloon is considered abnormal. A recent study from USA comparing the two protocols showed the former to be as good as or better than the latter [41].

Anorectal manometry Anorectal manometry is performed currently using a high-resolution solid state or water perfusion manometry system. After placement of the catheter, basal sphincter pressure (denotes external anal sphincter activity) and the length of the sphincter zone are estimated. Subsequently, the squeeze sphincter pressure is recorded (denotes external sphincter activity). To evaluate the defecation index, the maximum intra-rectal and the minimum residual anal pressures are recorded while the patient attempts to simulate the act of defecation with the manometry catheter in situ. As a minimum defecation index (defined as maximum rectal pressure divided by the minimum anal sphincter pressure) of at least 1.5 is needed to expel the feces, a value ≤1.4 has been used to indicate FED [37]. Dyssynergic defecation is classified into four sub-types (Fig. 3): (i) type I, adequate increase in rectal pressure (>40 mmHg) with paradoxical simultaneous rise in anal pressure; (ii) type II, inadequate increase in rectal pressure (<40 mmHg) accompanied by a paradoxical simultaneous increase in anal pressure; (iii) type III, adequate increase in rectal pressure (≥40 mmHg) accompanied by a failed reduction in anal pressure (≤20% of baseline pressure); and (iv) type IV, inadequate increase in rectal pressure of (<40 mmHg) accompanied by a failed reduction in anal pressure (≤20% of baseline pressure) [42]. The clinical importance of these sub-types, however, needs to be studied. To evaluate

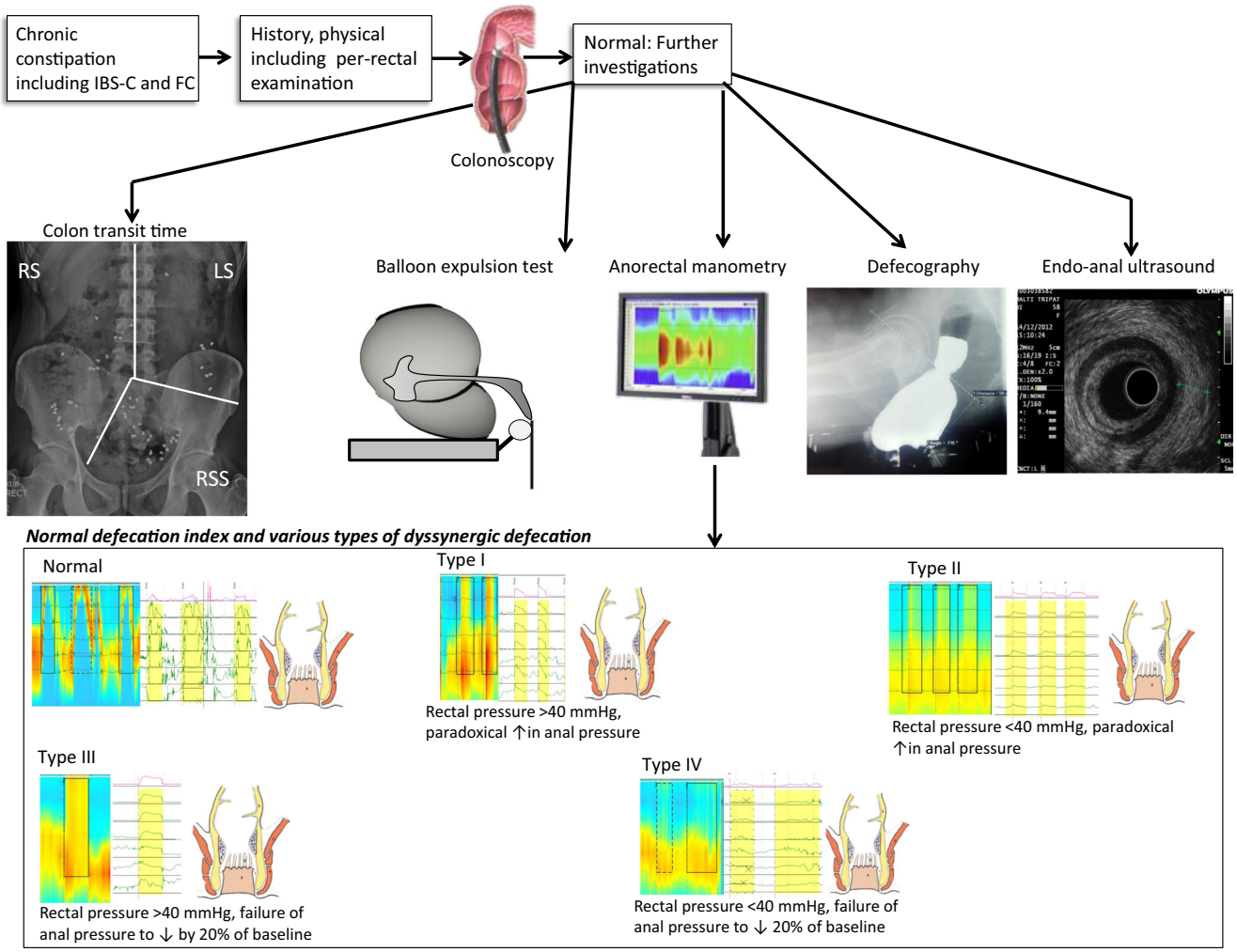

Fig. 3 Schematic diagram showing the various investigations to evaluated patients with chronic constipation *FC* functional constipation, *IBS-C* constipation-predominant irritable bowel syndrome

sensory function, the patient is asked to report about the feel, the urge to defecate, and the maximum tolerable limit while an intra-rectal balloon is inflated with increasing volume of air (20, 40, 60, 80 mL and so on) and deflated each time after inflation. In a South Korean study, the authors defined rectal hyposensitivity as the maximum tolerable limit greater than 240 mL or at least two of the followings: (i) minimal volume of sensation greater than 25 mL, (ii) desire to defecate at a volume greater than 150 mL, and (iii) urgency to defecate at a volume more than 200 mL [43]. In the absence of normative data from India, these values have been used in an Indian study as well [37]. Rectal hyposensitivity is a predictor of poor response to treatment of constipation [43]. Recto-anal inhibitory reflex is also assessed during balloon inflation.

Defecography Defecography helps to detect not only functional abnormalities in the evacuation machinery such as puborectal dyssynergia but also structural abnormalities such as rectocele, intra-rectal intussusception, pelvic floor descent, and rectal prolapse [44]. Defecoraphy can be performed not only conventionally (barium defecography) but also using advanced technology such as magnetic resonance defecography [45]. The technique and interpretation of defecography have been reviewed recently [44]. Several studies demonstrated that defecographic abnormalities are commoner among female patients with CC, particularly those developing after multiple and difficult vaginal deliveries and hysterectomy [46].

Other investigative techniques Other investigations for evaluation of pelvic floor and fecal evacuation machinery include endoscopic ultrasonography of anal sphincter using a radial echoendoscope in high-frequency range (typically 12 MHz) for sphincter anatomy (Fig. 3), perineometry, sphincter electromyography, and pudendal nerve terminal motor latency study [2]. However, these are undertaken in selected patients only in some laboratories.

Treatment

Diet and lifestyle Though epidemiological studies showed that reduced intake of dietary fibers and water and lack of physical exercise and sleep may be associated with constipation, these measures alone are unlikely to relieve CC in patients having more complex pathophysiological mechanisms consulting secondary and tertiary care facilities [37]. Moreover, a few Indian studies showed that these patients are already on recommended quantity of fibers (20–30 g/day) [47, 48]. Moreover, dietary fiber, particularly the insoluble ones (such as wheat, vegetables), usually contains large amount of fermentable oligo-di-monosaccharides and polyols (FODMAPs) and may increase abdominal bloating, a common symptom in patients with CC [1, 49]. In fact, vegetarianism has been shown to be an independent risk factor for functional GI disorder in an Indian study [1]. Though soluble fibers (e.g. ispaghula husk) cause less bloating than insoluble fibers, this is better avoided in patients already consuming a large amount of dietary fibers and reporting marked bloating, slow colon transit, and FED. Lactose may exert osmotic and prebiotic effect in India due to high frequency of lactase deficiency [6]. However, it may be counter-productive in patients with marked bloating associated with CC. Though not proved by well-designed randomized controlled trials, the lifestyle measures mentioned above are worth advising as these are simple, safe, and cheap and have several other health benefits. Hence, education of the patients is an important aspect of management (www.spreadhealth.in). Also, posture during defecation is found to be an important factor for smooth bowel movement [7].

Posture during defecation Defecating postures vary according to culture; worldwide, people defecate mostly in two postures, namely, squatting and sitting. Traditional Indian and Japanese toilets need squatting posture (Fig. 3), which is changing currently in urban areas due to westernization. In contrast, Western toilets are used in sitting posture. Normal defecation includes coordination between three processes: (i) increase in the intra-rectal pressure by spontaneous phasic rectal contraction (involuntary) and contraction of abdominal muscles (voluntary), (ii) relaxation of the anal canal (involuntary relaxation of internal sphincter and voluntary relaxation of external sphincter), and (iii) widening of the ano-rectal angle by relaxation of pelvic floor including sling fibers of the puborectalis muscle (voluntary). The squatting posture for defecation is more physiological, as shown in a few studies. In a study by Sakakibara et al., comparing three postures during defecation (sitting, sitting on a low chair, and squatting) showed that squatting required the shortest time and least effort to pass stool, which might be related to augmented abdominal pressure and wider recto-anal angle (Fig. 4) [7]. In Western toilets, though, a non-physiological, a wider recto-anal angle may also be achieved by placing a foot rest below and bending forward so that the abdomen touches the thighs (35°). It is important, therefore, to enquire about recent change in the toilet type in patients with CC and to encourage them to use a squatting position to pass stool rather than sitting position. More studies are needed on this issue.

Pharmacological treatment Table 7 lists the pharmacological agents currently available in India for treatment of CC [2, 4]. These include bulking agents such as soluble fibers (i.e. psyllium, ispaghula), osmotic laxatives (i.e. lactulose, polyethylene glycol [PEG], macrogol, milk of magnesia), stimulant laxatives (i.e. sennosides, bisacodyl, sodium picosulfate), stool softeners, secretagogues, 5-HT4 agonists, and enemas [4]. Bulking agents and osmotic laxatives are poorly absorbed by the gut and act as hyperosmolar agents, increasing the water content of stool making it softer and easier to pass [2, 27]. Though soluble fibers such as psyllium (husk of the seeds of the plant *Plantago ovata* that grows in India and the neighboring areas) cause less bloating than insoluble dietary fibers, it is important to use these judiciously based on the dietary intake of fiber by the patients and the presence of bloating [2, 16]. In a dose finding study from India, 20- and 30-g daily dosages were found equally effective and were better than the 10-g dose [50]. Stool softeners (i.e. docusate sodium or calcium) are thought to facilitate the mixing of aqueous and fatty substances and thereby soften the stool. Stimulant laxatives stimulate water and electrolyte secretion and high-amplitude propagated contractions in the colon, which is the driver for abroad movement of the intra-luminal contents [16, 51]. In an old Indian study, 69% patients with advanced cancer and opioid-induced constipation, which is usually slow-transit in nature, responded to sofsena [52]. Therefore, these stimulant purgatives are expected to be useful in patients with slow transit constipation. The 5-HT4 agonists (i.e. prucalopride) hasten colonic motility in patients with slow transit constipation [16]. An Indian study showed that tegaserod (currently withdrawn due to adverse effect) hastens colonic transit and improved CC [53]. Combination of various pharmacological agents based on their mechanism of action and the underlying pathophysiology of CC may be effective management strategies. In contrast to the West with restricted referral-based healthcare delivery system, in the open patient-decided delivery system in India [4], a step-down approach starting with most effective drugs and gradually reducing to simple agents may warrant due consideration.

Non-pharmacological treatment The first-line treatment of patients with FED is biofeedback [2]. Biofeedback involves a training technique which aims to teach patients to relax, instead of contracting, their pelvic floor including the anal sphincter muscles during defecation [42]. Despite its demand, availability of biofeedback in India is limited [54]. Two

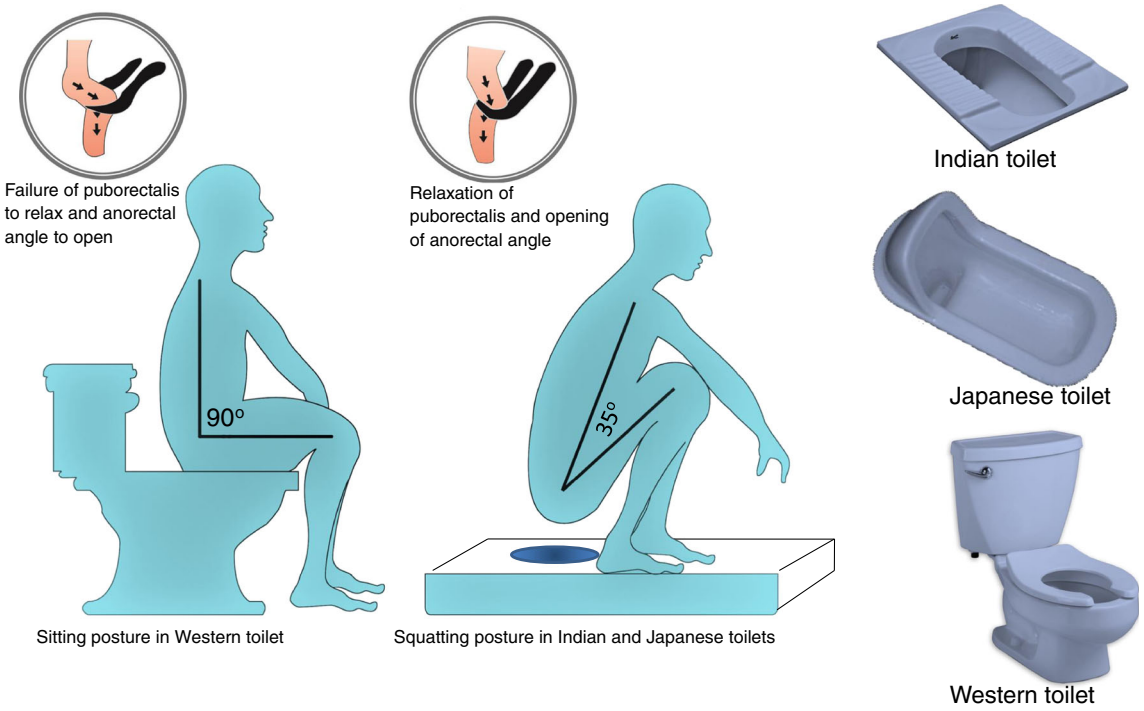

Fig. 4 Comparative illustration of the l ano- rectal angle while defecating in different postures

uncontrolled studies published till date on biofeedback in patients with FED from India showed it to be effective [38, 42]. A few studies from other countries showed that injection of botulinum toxin in the pelvic floor muscles including the external sphincter was useful to treat FED following failure of biofeedback therapy or in combination with it [55, 56]. Low-

Table 7 Commonly prescribed medications for constipation

Categroy	Sub-category	Agent	Adult dose	Remarks
Pharmacological	Osmotic, bulking agents	Psyllium	20–30 g/day	Avoid in bloaters
		Polyethylene glycol	17 g/day	
		Magnesium hydroxide	30–60 mL/day	Safe in bloater, unsafe in patients with renal failure
		Lactulose Lactitol	15–30 mL/day for both	Avoid in bloaters
	Stool softener	Liquid paraffin Docusate sodium	10–30 mL/day	
	Stimulants	Bisacodyl	5–15 mg/day	Stimulates HAPC
		Sodium picosulfate	5–10 mg/day	Stimulates HAPC
		Senna	17.6–26.4 mg/day	
		Castor oil	15–60 mL/day	
	Suppository	Glycerine Bisacodyl	10 mg/day	Used to disimpact stool
	Enema	Phosphate and citrate enemas		Used to disimpact stool
	Secretagogue	Lubiprostone	8 μg twice daily	
	Enterokinetics	Prucalopride	1–2 mg/day	Improves colon transit
	Antibiotics	Rifaximin	550 mg thrice/day for 14 days	Only useful in methane producers
Others	Intra-sphincteric botulinum toxin injection		100 botulinum toxin into multiple sites in external sphincter and puborectalis	Shown to be useful alone, in combination with biofeedback and after biofeedback failure in patients with fecal evacuation disorder

HAPC high-amplitude propagated contraction

level electrical stimulation of the anal sphincter has also been found effective in a retrospective study from Korea [57]. However, there is no study on these options from India till date.

Surgery is only considered for patients with intractable CC refractory to treatment particularly when associated with either structural abnormalities or specific motility disorders such as Hirschsprung's disease and rectocele. During a 6-year period, 34 patients with refractory CC (23% with slow colon transit, 12% with Hirschsprung's disease, and 65% with rectal prolapse) treated surgically in our center had improvement in median spontaneous bowel movement as compared to that before surgery [58]. However, patients with rectal prolapse may have post-rectopexy constipation and hence should be counseled accordingly before undertaking surgical management.

Conclusion

CC is common both in the community and in gastroenterology clinics. There are several issues in definition, clinical presentation, pathophysiology, investigative modalities, and lifestyle factors including dietary issues and management of CC, which are unique to India as compared to the West. Though lifestyle and dietary factors may be the major factors contributing to CC in community and primary care practice, complex pathophysiological factors such as slow colon transit, FED, and a combination of these two may be common in tertiary care practice. Patients with CC are least satisfied to treatment among all patients with functional GI disorders [35]. Hence, there are unmet needs in treating these patients. Exploring various pathophysiological factors contributing to CC, as suggested in the recent Rome IV guidelines (MDCP), may translate into personalized care of these patients [33].

Compliance with ethical standards

Conflict of interest UCG declare that they have no conflict of interest.

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