

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

186,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



Constipation

Tika Ram Bhandari and Sudha Shahi

Abstract

Constipation is a common gastrointestinal (GI) disorder among all age groups. Constipation can be functional or pathological comprising of many etiologies. It can also be classified as acute or chronic; mild to severe. Although in most of the cases it is benign, symptoms can significantly affect the quality of life and cost-related burden for the patient. However, chances of late diagnosis of constipation are high due to a variety of etiologies and variable presentation. Most of the times, it is a great challenge for the clinician to find out the cause of constipation. Healthy lifestyle, especially keeping regular bowel habit, drinking adequate fluid, and the use of high-fiber diet that reduces the viscosity of stool, minimizes intestinal transit time and decreases the chance of constipation. Early diagnosis and management of other underlying factors are important to give relief to the patient from the undue physical and psychological stress.

Keywords: constipation, gastrointestinal disorder, clinical approach, diagnosis, management

1. Introduction

Constipation is a vague term. There is no single definition of it. Constipation is mostly defined by one or more of following symptoms: passage of hard-formed stools or less and dry bowel movements (typically less than three per week), excessive straining, a sense of incomplete bowel evacuation, and excessive time spent on the toilet or in unsuccessful defecation. Nevertheless, even those with regular bowel habits might experience constipation [1, 2]. Similarly, definition of constipation has also been devised according to Rome Criteria (**Table 1**).

Many factors seem to play roles in the causation which when taken care of timely and wisely can create a huge difference. Besides the medical and surgical causes which are mostly unavoidable, food habits and other personal habits are within everyone's control. Healthy lifestyle, consumption of high fiber diet, maintaining adequate hydration and regular bowel habits, careful use of laxatives, and control of medications minimize the problems of constipation.

2. Epidemiology

Constipation is a common condition all around the globe. Worldwide prevalence rates range from 0.7 to 79% with an overall median of 16% and a median of 33.5% among older population [5]. Different surveys have reported the prevalence between 1% and more than 20% in Western populations which can be attributed to different factors [6]. Constipation has been found more prevalent in women than in

Rome II criteria	Rome III for pediatric age group
Adults Two or more of the following for at least 12 weeks (not necessarily consecutive) in the preceding 12 months: <ul style="list-style-type: none">• Lumpy or hard stools for >25% of bowel movements• Sensation of anorectal blockage for >25% of bowel movements• Straining during >25% of bowel movements• Sensation of incomplete evacuation for >25% of bowel movements• Manual maneuvers to facilitate >25% of bowel movements (e.g., digital evacuation or support of the pelvic floor)• Loose stools not present and insufficient criteria for irritable bowel syndrome• Less than three bowel movements per week	Child with developmental age < 4 years: <ul style="list-style-type: none">• Less or equal to two defecations per week• At least one incontinence per week after the acquisition of toileting skills• History of painful or hard bowel movements• History of excessive stool retention• History of large-diameter stools that may obstruct the toilet• Presence of a large fecal mass in the rectum• Additional symptoms may include irritability, decreased appetite, and/or early satiety, which may resolve immediately after defecation of a large stool Child with developmental age ≥ 4 years: <ul style="list-style-type: none">• ≤ 2 defecations in the toilet per week• At least one episode of fecal incontinence per week• History of retentive posturing or excessive volitional stool retention• History of painful or hard bowel movements• Presence of a large fecal mass in the rectum• History of large-diameter stools that may obstruct the toilet
Infants and children <ul style="list-style-type: none">• Pebble-like, hard stools for a majority of bowel movements for at least 2 weeks• Firm stools ≤ 2 times per week for at least 2 weeks• No evidence of structural, endocrine, or metabolic disease	

Table 1.
Rome II criteria [3] and Rome III for pediatric age group [4].

men, in nonwhites than in white persons, in children than in adults, and in elderly than in younger adults. According to the 1996 National Health Interview Survey, about 3 million people in the United States are found to have frequent constipation. Likewise more than 2.5 million visit to physicians, 92,000 hospitalizations, and laxative sales of several hundred million dollars a year in US [7–9]. It has also been stated as a common problem during pregnancy and childbirth [1] According to a study by Jewell DJ and Young G, the prevalence of constipation was estimated to affect 11–38% of pregnancies [10]. To be more specific, constipation is an extremely common disorder in childhood. Up to 25% of all pediatric gastroenterological consultations and 3% of all pediatric outpatient visits are due to constipation. The prevalence of functional constipation at pediatric gastroenterology clinics in secondary or tertiary care hospitals ranged from 1.8 to 13.9% [11]. Studies have shown that 0.7 to 29.6% of children are constipated worldwide. Similarly, 3–5% of pediatric primary care visits and up to 25% of gastroenterology consultations are accounted to constipation. Nearly all childhood constipation is functional, but 5–10% is due to an organic cause [12–16].

Sixty percent of women were found to have constipation at least weekly and more than 90% monthly in a study from Canada. Men had less frequency of constipation and GI symptoms than women. These symptoms were present for more than 10 years in around 60% of women [17]. In the same manner, the prevalence of self-reported constipation was 21% in community-dwelling adults in Australia. The prevalence in Norwegian nursing homes was 23.4%, and 67% while it was found in 50% of institutionalized elderly in a Swedish study. Prevalence in nursing homes in Ireland was 38% [18]. In a study in US elderly above 65 years that reported being constipated, persistent straining was reported by 65%. A study from Finland revealed that 57% of women and 64% of men reported chronic constipation

prevalence increased to 79 and 81%, respectively, in a nursing home setting [19–23]. The burden of constipation reflects on work productivity. According to a study by Hunt et al., almost 30% believe that they were less productive at work or at school, 13% missed work or school days, and nearly 10% were late or had to leave work or school because of their symptoms [19].

3. Etiopathogenesis

Constipation is multifactorial most of the times. It can be classified into three broad categories: Normal-transit constipation, slow-transit constipation, and defecatory disorders. In a study of more than 1000 patients with chronic constipation by Mugie Benninga and Di Lorenzo in 2011, normal transit was the most prevalent form (59%) followed by defecatory disorders (25%) and slow transit (13%) and a combination of defecatory disorders and slow transit (3%).

More than one mechanism may contribute to constipation in a patient [5, 24]. Normal-transit constipation is likely due to a perceived difficulty with evacuation or presence of hard stools. Stool traverses at a normal rate in the colon and is responsive to dietary modification alone medications [25]. Dysfunction of the pelvic floor or anal sphincter commonly leads to defecatory disorders. Failure of the rectum to empty effectively may be due to an inability to coordinate the abdominal, rectoanal, and pelvic floor muscles during defecation [26, 27].

Slow-transit constipation occurs most commonly in young women with infrequent bowel movement which occurs by colonic inertia and colonic overactivity mainly due to decreased colonic activity and increased, uncoordinated colon activity. Evacuation disorder is another subtype that occurs due to normal or prolonged colonic transit, but evacuating stools from the rectum are inadequate/difficult [6]. Associated symptoms are an infrequent urge to defecate, bloating, and abdominal pain or discomfort. Symptoms of constipation typically respond to therapy with dietary fiber alone or with the addition of an osmotic laxative [28]. There are a number of factors leading to the above condition that have been listed below [20, 29].

3.1 Causal factors

- Surgical conditions: colorectal tumor and compression from external tumor, diverticulosis, anal fissure, strictures, megacolon, and postsurgical abnormalities
- Metabolic diseases: diabetes mellitus, hypercalcemia, hypokalemia, hypomagnesemia, hypermagnesemia, hyperparathyroidism, hypothyroidism, chronic kidney disease, dehydration, heavy metal poisoning, multiple endocrine neoplasias II, and porphyria
- Gastrointestinal conditions: abscess, anal fissure, fistula irritable bowel syndrome, hemorrhoid, levator ani syndrome, megacolon, proctalgia fugax, rectal prolapse, rectocele, and volvulus
- Musculoskeletal disorder: scleroderma, systemic sclerosis, amyloidosis, and dermatomyositis
- Dietary: eating disorders, dehydration, and low fiber
- Depression and dementia

- Medications
- Others: degenerative joint disease, immobility, cardiac disease, pregnancy, and urinary incontinence

4. Specific associations

4.1 Constipation in children

Children presenting to the emergency department with abdominal pain are most often diagnosed with constipation. Different studies have reported behavior problems higher among children with constipation. Fecal incontinence is a mental disorder that requires psychiatric treatment [30–33]. Other studies, however, have shown that there is a strong association between successful treatment and the reduction of behavior problems suggesting that behavior problems are secondary to the clinical symptoms of constipation [34–36].

4.2 Constipation and morphine

In a study by Joanne Droney et al. in 2007 in cancer patients in morphine, 72% of the patients were found to have mild to severe constipation. Among 53% out of those who were not constipated, 47% were taking laxatives on and off. Of those who said that they were constipated, 73% were already on laxatives, but 27% were not taking any laxatives [37]. Constipation in hospice patients occurs in the majority. About 70–87% opioids account for only 25% of constipation in hospice patients. Persistent constipation correlates with a reduced performance status and not morphine dose. A subgroup of individuals did not require laxatives despite being on higher doses of morphine [38, 39].

4.3 Enuresis association

Yanli Ma et al. in a study from 2016 to 2017 found a positive correlation between constipation (Rome III scores) and frequency of micturition. They also found that constipated children had a higher incidence of severe enuresis and lower incidence of mild-moderate enuresis (68.7 versus 44.6% and 31.3 versus 55.4%) [40].

4.4 Pregnancy and constipation

Hormonal changes during pregnancy, more specifically progesterone rise and serotonin, are responsible for reduced intestinal smooth muscle motility via inhibition of motilin, a smooth muscle stimulant. Similarly relaxin acts on the myometrium and contributes to intestinal gut hypomotility. Another important factor is increased sodium and water reabsorption due to increased aldosterone as a result of increased estrogen and progesterone. This results in hardening of stools [41]. Pregnant women were found to be most prone to developing constipation in the first two trimesters according to a study. In the first and second trimesters, the prevalence of functional constipation ranges between 35 and 39%. Similarly, it is 21 and 17% in the third trimester and puerperium, respectively. Adequate hydration and dietary fiber with or without laxatives are the first line of management. In case of severe or refractory cases, referral is mandatory for further management [42].

Class examples	Examples
5-HT3 receptor antagonists	Ondansetron
Analgesics	
Opiates	Morphine
Nonsteroidal anti-inflammatory agents	Ibuprofen
Anticholinergic agents	Belladonna
Tricyclic antidepressants	Amitriptyline, nortriptyline
Antiparkinsonian drugs	Benztropine
Antipsychotics	Chlorpromazine
Antispasmodics	Dicyclomine
Antihistamine	Diphenhydramine
Anticonvulsants	Carbamazepine
Antihypertensives	
Calcium channel blockers	Verapamil, nifedipine
Diuretics	Furosemide
Centrally acting	Clonidine
Antiarrhythmics	Amiodarone
Beta-adrenoceptor antagonist	Atenolol
Bile acid sequestrants	Cholestyramine, Colestipol
Cation-containing agents	Aluminum Antacids, Sucralfate
Iron supplements	Ferrous sulfate
Lithium	
Chemotherapy agents	
Vinca alkaloids	Vincristine
Alkylating agents	Cyclophosphamide
Miscellaneous compounds	Barium sulfate, Oral contraceptives, Polystyrene resins
Endocrine Medications	Pamidronate and alendronic acid
Other antidepressants	Monoamine oxidase inhibitors
Other antipsychotics	Clozapine, haloperidol, risperidone
Other antiparkinsonian drugs	Dopamine agonists
Other antispasmodics	Mebeverine, peppermint oil
Sympathomimetics	Ephedrine, terbutaline

Table 2.
List of drugs associated with constipation [45].

4.5 Constipation in elderly

Constipation is more frequent among elderly residents of long-term care facilities revealed by a study from the United States in persons older than 65 years. There are intrinsic changes, reduced number of neurons in myenteric plexus, and reduction in the amplitude of inhibitory nerve input to circular muscle layer of colon causing constipation in the elderly that has been found in the study of colonic physiology [43, 44].

4.6 Medications associated with constipation

Many groups of drugs have been found to be strong correlated with constipation, highest for calcium channel blockers, and least for antiarrhythmics (**Table 2**).

5. Symptoms and signs of constipation

Constipation basically is a subjective condition. This is why the most important tool for diagnosis of constipation mostly depends upon the clinical history. The signs and symptoms common for both childhood and adult constipation are Irregular bowel activity with excessive foul-smelling flatulence and stools with irregular texture. Sometimes patients may present with history of passage of small pellets or less frequent large amount of stools and painful defecation. Withholding or straining at stools, soiling or overflow. Abdominal distension or discomfort, decreased appetite, easy fatigability, and irritable mood are few other symptoms.

6. Diagnosis and diagnostic approaches

Diagnosis mostly depends upon clinical history aided by radiological examination and blood examination to rule out underlying conditions: a thorough history taking and physical examination can rule out most secondary causes of constipation.

6.1 Steps of evaluation

6.1.1 *The clinical history and physical examination*

Assessment of clinical criteria, presence of risk factors, and identification of alarming features indicate the need for colonoscopy and/or radiological examination to rule out secondary causes [46, 47]. Digital rectal examination and proctological examination may help to identify surgical causes of constipation. A careful rectal examination should be performed in every patient with constipation and is often the most revealing part of the clinical evaluation. A number of criteria have been devised by different studies for the evaluation of constipation that have been approved in the clinical practice which are as shown below.

6.1.1.1 *Classic Iowa criteria*

Pediatric constipation is defined whenever presence of at least two of the following criteria [48]:

- Two or more encopresis episodes per week
- Defecation frequency less than 3 times per week
- Periodic passage of very large amounts of stool once every 7–30 days (the criterion of a large amount of stool is satisfied if it is estimated to be twice the standard amount of stool, shown in a clay model, or if stools are so large that they clog the toilet).

Solitary encopresis is defined in a child older than 4 years of age:

- Two or more encopresis episodes per week
- Defecation frequency equal or more than 3 times per week

No passage of very large amounts of stool.

6.1.1.2 *Paris consensus on childhood constipation terminology (PACCT criteria)*

Chronic constipation is caused by the occurrence of two or more of the following characteristics during the preceding 8 weeks [49]:

- Fewer than three bowel movements per week
- More than one episode of fecal incontinence per week
- Large stools in the rectum or palpable on abdominal examination
- Passage of large-diameter stools that may obstruct the toilet
- Display of retentive posturing and withholding behaviors
- Painful defecation

6.1.2 *Investigations*

Fecal, radiological, or endoscopic examinations are not routinely indicated in case where severe symptoms are absent. Sigmoidoscopy is usually sufficient in patients without severe symptoms and those under 50 years of age. Adults more than 50 years of age are entitled to colonoscopy or both sigmoidoscopy and barium-enema examination to rule out colorectal carcinoma.

6.1.3 *Blood tests*

Electrolyte imbalances, metabolic disorders, endocrine disorders, and parasitological infestation can be ruled out by blood test. These examinations should be ordered mainly in clinically suspicious cases.

6.1.4 *Barium defecography*

Barium defecography is an X-ray test where a thick paste containing barium is placed into the rectum. It determines whether there are any abnormalities in the pelvic floor. It is recommended to identify colorectal diseases (diverticular disease, neoplasia, and megacolon).

6.1.5 *Anorectal manometry*

This test measures the pressure in anal canal when patient pushes during a bowel movement. This test is recommended in cases refractory to medical treatment. The main aim is to rule out diseases like aganglionosis and psychogenic megacolon. It provides information about the rectoanal inhibitory reflex, the musculature tone of the internal and external sphincters, and the rectal sensitivity, capacity, and complacency.

6.1.6 Videodefecography, magnetic resonance defecography, or echodefecography

Videodefecography is the radiological study of evacuatory dynamics. It is useful in the study of abnormalities such as rectocele, intussusception, enterocele, sigmoidocele, anismus, and paradoxical contraction of the puborectalis muscle. Recent literature suggest video defecography using only video recording without radiography because of its high radiation exposure, whereas others have chosen magnetic resonance defecography or echodefecography, without the use of ionizing radiation.

6.1.7 The colonic transit time (CTT) examination

A capsule containing radiopaque markers is swallowed and an abdominal radiography is taken 5 days later. With this, the identification of three types of patterns in patients can be done; in normal transit time, patients eliminate 80% of the markers by the fifth day. In slow transit, more than 20% of the marker is retained by the fifth day, distributed throughout the colon, and in those with bowel obstruction, they retain more than 20% of the markers on the fifth day which remains accumulated in the rectosigmoid region. Though it is a noninvasive test, there is exposure to radiation even in low doses. CTT may be recommended to assess the success of clinical or surgical treatment of chronic constipation.

6.1.8 Balloon expulsion test

A balloon filled with water (50–60 mL) is positioned in the rectal ampulla. If expulsion is achieved by patient, pelvic floor dysfunction may be excluded. It has been recommended by many constipation evaluation guidelines.

6.1.9 Electromyography of the anal sphincter (EMG)

Small electrical sensors are placed in the anal canal to record the electrical activity of sphincter muscles during voluntary contraction, at rest, and with coughing and evacuatory effort.

6.1.10 Hydrogen breath test

It is recommended for assessing the orocecal transit time. It aids to differentiate dysmotility of the gastrointestinal tract (superior and inferior) from isolated colonic inertia. It is recommended for serious and refractory cases of colonic inertia, prior to the indication of a colectomy. Similarly a number of criteria have been devised by different studies for the evaluation of constipation.

7. Management of constipation

7.1 Lifestyle modifications

Dehydration and decrease in physical activity are found to worsen so different studies recommend adequate hydration and increase in physical activity [50].

High fiber diet is found to be beneficial for constipation. The ideal amount is 25–35 g per day. Fiber adds bulk to stools and makes bowel movements soft or firm. To improve compliance with treatment, patients should be instructed to increase their dietary fiber intake gradually to 20–25 g per day over a period of 1–2 weeks. If this approach is not effective, commercially packaged fiber supplements should be

tried. Regular bowel habits, careful use of laxatives, and control of medications including dosage and timing are also effective for constipation.

7.2 Medications commonly used for constipation

7.2.1 Laxatives

7.2.1.1 Bulk laxative

The medications used for constipation are stated below in order [1].

Psyllium (Metamucil, Perdiem, and Fiberall)

- Natural fiber should be taken with plenty of water to avoid intestinal obstruction; allergic reactions such as anaphylaxis and asthma are rare; titrate up to 20 g.

Methylcellulose (Citrucel)

- Semisynthetic cellulose fiber that is relatively resistant to colonic bacterial degradation; titrate up to 20 g

Polycarbophil (FiberCon, Equalactin, and Konsyl)

- Synthetic fiber of polymer of acrylic acid, resistant to bacterial degradation; titrate up to 20 g

7.2.1.2 Osmotic laxative

This draws water into the intestines along osmotic gradient.

Magnesium hydroxide (Phillips' Milk of Magnesia); 15–30 ml once or twice.

Magnesium citrate (Evac-Q-Mag); 150–300 ml as needed.

Sodium phosphate (Fleet Enema, Fleet Phospho-Soda, Visicol); 10–25 ml with 12 oz. (360 ml) of water as needed.

7.2.1.3 Poorly absorbed sugar

Lactulose (Cephulac, Chronulac, and Duphalac);

Synthetic disaccharide; 15–30 ml once or twice a day.

7.2.1.4 Stimulant laxative

Stimulates intestinal motility or secretion.

Anthraquinones.

Cascara sagrada (Coleman, Sagrada-lax): 325 mg (or 5 ml) daily.

Senna (Senokot, Ex-Lax): 187 mg daily.

Castor oil (Purge, Neoloid, Emulsoil): 15–30 ml daily.

Bisacodyl (Dulcolax, Correctol): 5–10 mg every night.

Sodium picosulfate (Lubrilax, Sur-Lax): 5–15 mg every night.

7.2.1.5 Stool softener

Docusate sodium (Colace, Regulax SS, Surfak): 100 mg twice a day.

Mineral oil (Fleet Mineral Oil): 5–15 ml orally every night.

Phosphate enema (Fleet Enema): 120 ml daily.
Mineral oil retention enema (Fleet Mineral Oil Enema): 100 ml daily.
Tap-water enema: 500 ml daily.
Soapsuds enema: 1500 ml daily.
Glycerin bisacodyl suppository: 10 mg daily.

7.2.2 Cholinergic agent

Bethanechol (Urecholine): 10 mg daily.

7.2.3 Miscellaneous

Colchicine (Colsalide): 0.6 mg three times a day.
Misoprostol (Cytotec): 600–2400 µg daily.

7.2.4 Prokinetic agent

Tegaserod is a colonic prokinetic agent that improves stool consistency and frequency in women with irritable bowel syndrome characterized by constipation. 5-HT₄ receptor agonists* Cisapride (Propulsid): 10–20 mg four times a day.
Tegaserod (Zelnorm): 6 mg, twice a day.

7.2.5 Emerging drugs

Velusetrag and Naronapride (5-HT₄ receptor agonists), Pumosetrag (5-HT₃ receptor agonist) and few other drugs like plecanatide (colonic secretagogue), methylnaltrexone (opioid receptor antagonist), elobixibat (prokinetic secretagogue), and alvimopan (opioid receptor antagonist) are the few emerging drugs for management of constipation [51].

7.3 Surgical management

Those patients who do not benefit from conservative treatment and without intestinal obstruction may profit from subtotal colectomy with ileorectal anastomosis. Refractory constipation may have good results from total colonic resection and ileorectostomy in a patient without defecatory disorder. A systematic review of 32 studies reported satisfactory results post colectomy ranging between 39 and 100% of patients. Few complications like diarrhea, incontinence, and intestinal obstructions were reported. Similarly, in some studies, it was revealed that laparoscopic subtotal colectomy was equally effective in those who were suitable for colonic resection [52–54].

7.4 Miscellaneous

7.4.1 Biofeedback

This represents a behavioral treatment. Patients are trained regarding physiological mechanisms of defecation. The use of their diaphragms and abdominal and pelvic floor muscles for evacuation is emphasized. Sensory retraining is also given [30]. Auditory or visual response, or both, on the functioning and coordination of their anal sphincter and pelvic floor muscles is provided to patients. Balloon or silicon-filled artificial stool, which is also termed as “freedom,” can be used as biofeedback with more focus to normal coordination for successful defecation [1]. Educating the patients and a good rapport between the physician and the patients are keys to successful biofeedback. Different studies on biofeedback treatment have

reported an overall success rate of 67%. Nevertheless, adequate data regarding the successful practice of biofeedback are still missing [55–57].

7.4.2 Abdominal massage

According to different studies, there is a positive influence of abdominal massage in constipation [58–60].

7.4.3 Botulinum type A toxin

Injection of botulinum type A toxin into the puborectalis muscle may be beneficial in the treatment of defecatory disorders revealed by some studies. However, no controlled trials have been done till date, so this method is not suggested [61].

8. Conclusions

Constipation is a very common problem worldwide that presents as a subtle disease yet can have relenting effects in a patient's life. There are a number of preventable risk factors, like food habit and personal habits, causing constipation; taking care of them on time can play an important role in minimizing their effects which in turn minimizes the socioeconomic burden of constipation significantly. Apart from that, the early diagnosis and management of other underlying factors are important to give relief to the patient from the undue physical and psychological stress.

Conflict of interest

All authors declare that there is no conflict of interest.

Author details

Tika Ram Bhandari^{1,2,3*} and Sudha Shahi⁴

¹ Department of General Surgery, People's Dental College and Hospital, Kathmandu, Nepal


² Formerly Department of Surgery, Institute of Medicine, Tribhuvan University Teaching Hospital, Kathmandu, Nepal

³ Formerly Department of Surgery, Universal College of Medical Sciences, Bhairahawa, Nepal

⁴ Department of Otorhinolaryngology Head and Neck Surgery, National Academy of Medical Sciences, Bir Hospital, Kathmandu, Nepal

*Address all correspondence to: tikanmc@gmail.com

IntechOpen

© 2019 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

References

- [1] Lembo A, Camilleri M. Current concepts chronic constipation. *The New England Journal of Medicine*. 2003; **349**(14):1360-1368
- [2] NICE Guidelines: Constipation in children. Internet communication. 2010. <http://www.nice.org.uk/guidance/CG99>
- [3] Thompson WG, Longstreth GF, Drossman DA, Heaton KW, Irvine EJ, Muller-Lissner SA. Functional bowel disorders and functional abdominal pain. *Gut*. 1999;**45**(2):II-43-II-47
- [4] Longstreth GF et al. Functional Bowel Disorders - *Gastroenterology*; **130** (5):1480-1491
- [5] Mugie SM, Bennings MA, Di Lorenzo C. Epidemiology of constipation in children and adults: A systematic review. *Best Practice & Research: Clinical Obstetrics & Gynaecology*. 2011;**25**(1):3
- [6] Lindberg G, Hamid SS, Malfertheiner P, Thomsen OO, Fernandez LB, Garisch J, et al. World gastroenterology organisation global guideline: Constipation—A global perspective. *Journal of Gastroenterology*. 2011;**45**(6):483
- [7] Sonnenberg A, Koch TR. Physician visits in the United States for constipation: 1958 to 1986. *Digestive Diseases and Sciences*. 1989;**34**:606-611
- [8] Heaton KW, Radvan J, Cripps H, Mountford(women) 5RA, Braddon FE, Hughes AO. Defecation frequency and timing, and stool form in the general population: A prospective study. *Gut*. 1992;**33**:818-824
- [9] Johanson JF, Sonnenberg A, Koch TR. (whites) clinical epidemiology of chronic constipation. *Journal of Clinical Gastroenterology*. 1989;**11**:525-536
- [10] Jewell DJ, Young G. Interventions for treating constipation in pregnancy. *Cochrane Database of Systematic Reviews*. 2001;(2):CD001142
- [11] Tabbers MM, Dilorenzo C, Berger MY, et al. Evaluation and treatment of functional constipation in infants and children: Evidence-based recommendations from ESPGHAN and NASPGHAN. *Journal of Pediatric Gastroenterology and Nutrition*. 2014; **58**(2):265-281
- [12] Milla PJ. Endothelins, pseudo-obstruction and Hirschsprung's disease. *Gut*. 1999;**44**:148-149
- [13] Chang SH, Park KY, Kang SK, Kang KS, Na SY, Yang HR, et al. Prevalence, clinical characteristics, and management of functional constipation at pediatric gastroenterology clinics. *Journal of Korean Medical Science*. 2013;**28**(9): 1356-1361
- [14] Higgins PD, Johanson JF. Epidemiology of constipation in North America: A systematic review. *The American Journal of Gastroenterology*. 2004;**99**:750-759
- [15] Johanson JF, Kralstein J. Chronic constipation: A survey of the patient perspective. *Alimentary Pharmacology & Therapeutics*. 2007;**25**:599-608
- [16] Caperell K, Pitetti R, Cross KP. Race and acute abdominal pain in the pediatric emergency department. *Pediatrics*. 2013;**131**(6):1098-10106
- [17] Di Lorenzo C. Childhood constipation: Finally some hard data about hard stools! *The Journal of Pediatrics*. 2000;**136**(1):4
- [18] Youssef NN, Di Lorenzo C. Childhood constipation: Evaluation and

treatment. *Journal of Clinical Gastroenterology*. 2001;**33**(3):199-205

[19] Hunt RH, Dhaliwal S, Tougas G, Pedro C, Labbé J-F, Paul H, et al. Prevalence, impact, and attitudes toward lower gastrointestinal dysmotility and sensory symptoms, and their treatment in Canada: A descriptive study. *Canadian Journal of Gastroenterology*. 2007;**21**(1):31-37

[20] Russell B, Buswell M, Norton C, Malone JR, Harari D, Harwood R, et al. Supporting people living with dementia and fecal incontinence. *British Journal of Community Nursing*. 2017;**22**(3): 110-114

[21] Klaus JH, Nardin VD, Paludo J, Scherer F, Bosco SM. The prevalence and factors associated with constipation in elderly residents of long-stay institutions. *Revista Brasileira de Geriatria e Gerontologia*. 2015;**18**(4): 835-843

[22] Coyne KS, Cash B, Kopp Z, et al. The prevalence of chronic constipation and fecal incontinence among men and women with symptoms of overactive bladder. *BJU International*. 2011;**107**: 254-261

[23] Kinnunen A. Study of constipation in a geriatric hospital, day hospital, old people's home and at home. *Aging (Milano)*. 1991;**3**:161-170

[24] Nyam DC, Pemberton JH, Ilstrup DM, Rath DM. Long-term results of surgery for chronic constipation. *Diseases of the Colon and Rectum*. 1997;**40**:273-279. [Erratum, *Dis Colon Rectum* 1997;**40**:529]

[25] Ashraf W, Park F, Lof J, Quigley EM. An examination of the reliability of reported stool frequency in the diagnosis of idiopathic constipation. *The American Journal of Gastroenterology*. 1996;**91**:26-32

[26] Camilleri M, Thompson WG, Fleshman JW, Pemberton JH. Clinical management of intractable constipation. *Annals of Internal Medicine*. 1994;**121**: 520-528

[27] Rao SS, Welcher KD, Leistikow JS. Obstructive defecation: A failure of rectoanal coordination. *The American Journal of Gastroenterology*. 1998;**93**: 1042-1050

[28] Preston DM, Lennard-Jones JE. Severe chronic constipation of young women: 'Idiopathic slow transit constipation'. *Gut*. 1986;**27**:41-48

[29] Bouras EP, Tangalos EG. Chronic constipation in the elderly. *Gastroenterology Clinics of North America*. 2009;**38**:463-480

[30] Elkhayat HA, Shehata MH, Nada A, Deifalla SM, Ammar MS. Impact of constipation on psychosocial functioning and quality of life of children: A cross-sectional study. *Egyptian Pediatric Association Gazette*. 2016;**64**(3):136-141

[31] van Dijk M, Benninga MA, Grootenhuis MA, Onland-van Nieuwenhuizen AM, Last BF. Chronic childhood constipation: A review of the literature and the introduction of a protocolized behavioral intervention program. *Patient Education and Counseling*. 2007;**67**(1-2):63-77

[32] Kianifar H, Hebrani P, Behdani F, Dadpour MN, Karami H, Mehdizadeh A. Quality of life and psychiatric comorbidity in children and adolescents with functional constipation: A case-control study. *Govaresh*. 2016;**21**(3):193-198

[33] Bemporad JR, Kresch RA, Asnes R, Wilson A. Chronic neurotic encopresis as a paradigm of a multifactorial psychiatric disorder. *The Journal of Nervous and Mental Disease*. 1978;**166**(7):472-479

- [34] Nolan T, Debelle G, Oberklaid F, Coffey C. Randomised trial of laxatives in treatment of childhood encopresis. *Lancet*. 1991;**338**(8766):523-527
- [35] Young MH, Brennen LC, Baker RD, Baker SS. Functional encopresis: Symptom reduction and behavioral improvement. *Journal of Developmental and Behavioral Pediatrics*. 1995;**16**(4): 226-232
- [36] van der Plas RN, Benninga MA, Redekop WK, Taminiau JA, Buller HA. Randomized trial of biofeedback training for encopresis. *Archives of Disease in Childhood*. 1996;**75**(5): 367-373
- [37] Droney J, Ross J, Gretton S, Welsh K, Sato H, Riley J. Constipation in cancer patients on morphine. *Supportive Care in Cancer*. 2008;**16**(5):453-459
- [38] Fallon MT, Hanks GW. Morphine, constipation and performance status in advanced cancer patients. *Palliative Medicine*. 1999;**13**(2):159-160
- [39] Sykes NP. The relationship between opioid use and laxative use in terminally ill cancer patients. *Palliative Medicine*. 1998;**12**(5):375-382
- [40] Ma Y, Shen Y, Liu X. Functional constipation and bladder capacity and severity of enuresis in children: A correlation study. *International Journal of Clinical and Experimental Medicine*. 2018;**11**(2):806-811
- [41] Verghese TS, Futaba K, Latthe P. Constipation in pregnancy. *The Obstetrician and Gynaecologist*. 2015; **17**(20):111-115
- [42] Derbyshire E, Davies J, Costarelli V, Dettmar P. Diet, physical inactivity and the prevalence of constipation throughout and after pregnancy. *Maternal & Child Nutrition*. 2006;**2**: 127-134
- [43] Fragakis A, Zhou J, Mannan H, Ho V. Association between drug usage and constipation in the elderly population of greater Western Sydney Australia. *International Journal of Environmental Research and Public Health*. 2018;**15**(2): 226
- [44] Gallegos-Orozco JF, Foxx-Orenstein SSM, Stoa JM. Chronic constipation in the elderly. *The American Journal of Gastroenterology*. 2012;**107**:18-25
- [45] Bharucha AE, Pemberton JH, Locke GR. American gastroenterological association technical review on constipation. *Gastroenterology*. 2013; **144**(1):218-238
- [46] Drossman DA. Functional gastrointestinal disorders: History, pathophysiology, clinical features, and Rome IV. *Gastroenterology*. 2016;**150**: 1262-1279
- [47] Ternent CA, Bastawrous AL, Morin NA, Ellis CN, Hyman NH, Buie WD. Practice parameters for the evaluation and management of constipation. *Diseases of the Colon and Rectum*. 2007; **50**(12):2013-2022
- [48] Loening-Baucke V. Functional faecal retention with encopresis in childhood. *Journal of Pediatric Gastroenterology and Nutrition*. 2004; **38**:79-84
- [49] Benninga M, Candy DC, Catto-Smith AG, Clayden G, Loening-Baucke V, Di Lorenzo C, et al. The Paris consensus on childhood constipation terminology (PACCT) group. *Journal of Pediatric Gastroenterology and Nutrition*. 2005;**40**:273-275
- [50] Chua HC, Nieh CC. The Effect of Lifestyle Modification in Treatment of Constipation in Older Adult. *MedCrave Group LLC*; 2016
- [51] Basilisco G, Coletta M. Chronic constipation: A critical review. *Digestive and Liver Disease*. 2013;**45**:886-888

- [52] Knowles CH, Scott M, Lunniss PJ. Outcome of colectomy for slow transit constipation. *Annals of Surgery*. 1999; **230**:627-638
- [53] Redmond JM, Smith GW, Barofsky I, Ratych RE, Goldsborough DC, Schuster MM. Physiological tests to predict long-term outcome of total abdominal colectomy for intractable constipation. *The American Journal of Gastroenterology*. 1995; **90**: 748-753
- [54] Young-Fadok TM. Raising the bar: Laparoscopic resection of colorectal cancer. *Surgical Endoscopy*. 2001; **15**: 911-912
- [55] Pelsang RE, Rao SS, Welcher K. FECOM: A new artificial stool for evaluating defecation. *The American Journal of Gastroenterology*. 1999; **94**: 183-186
- [56] Koutsomanis D, Lennard-Jones JE, Roy AJ, Kamm MA. Controlled randomised trial of visual biofeedback versus muscle training without a visual display for intractable constipation. *Gut*. 1995; **37**:95-99
- [57] Enck P. Biofeedback training in disordered defecation: A critical review. *Digestive Diseases and Sciences*. 1993; **38**:1953-60.7:95-9
- [58] Ayas S, Leblebici B, Sozay S, Bayramoglu M, Niron EA. The effect of abdominal massage on bowel function in patients with spinal cord injury. *American Journal of Physical Medicine & Rehabilitation*. 2006; **85**(12):951-955
- [59] Harrington KL, Haskvitz EM. Managing a patient's constipation with physical therapy. *Physical Therapy*. 2006; **86**(11):1511-1519
- [60] Holey LA, Lawler H. The effects of classical massage and connective tissue manipulation on bowel function. *British Journal of Therapy and Rehabilitation*. 1995; **2**(11):627-631
- [61] Ron Y, Avni Y, Lukovetski A, et al. Botulinum toxin type-a in the therapy of patients with anismus. *Diseases of the Colon and Rectum*. 2001; **44**:1821-1826