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Bowel Dysfunction in Persons with Multiple Sclerosis

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1. Introduction

Information is presented pertaining to the characteristics of multiple sclerosis (MS) including bowel dysfunction that consists of constipation, fecal incontinence or both constipation and fecal incontinence. Bowel functions and its neural control, prevalence and symptoms of constipation and fecal incontinence that is characteristic of persons with MS together with a description of procedures for assessment and intervention strategies are presented. The outcomes of bowel interventions and their effects on the quality of life of persons with MS together with suggestions for further research are also presented.

2. Characteristics of Multiple Sclerosis

Multiple Sclerosis (MS) is an inflammatory and demyelinating autoimmune disorder (Herndon, 2003) that affects approximately 2.5 million people worldwide (Moses, Picone & Smith, 2008) that has an approximately 2:1 female to male ratio (Willer, Dyment, Risch, Sadovnick, & Ebers, 2003). This disease of the central nervous system (CNS) affects nerve pathways in the brain and spinal cord. MS is thought to be acquired through the complex interaction of genetic and environmental factors (Goodin, 2010). Environmental influences are thought to include low levels of ultraviolet radiation and vitamin D, viruses, and non infectious agents such as smoking and psychological stress (Milo & Kahana, 2010; Sloka, Silva, Pryse-Phillips, Meta & Wee Yong, 2011; Carlye, 1997; Mehta, 2010; Koch-Henrikson & Sorensen, 2010).

The onset of MS generally occurs during young adulthood (Weinshenker, 1993) and is usually characterized by an initial relapsing and remitting course followed by a progressive course (Wienshenker, 1998; Vukusic & Confavreux, 2007). As a result of impairment of the CNS bowel dysfunction is one of many symptoms experienced by persons with MS that consists of constipation and fecal incontinence. Constipation, defined as two or fewer bowel movements per week, the need to manipulate the rectum digitally to facilitate defecation all or most of the time, and/or use of laxatives, enemas, or suppositories more than once a week, has a prevalence rate between 43% and 73% in the MS population (Hinds, Eidelman & Wald, 1990; Nordenbo, Andersen, & Andersen, 1996). Fecal incontinence, defined as uncontrolled or involuntary emissions of flatus and/or stools, has a prevalence of between 51% and 53% in the MS population (Hinds et al. 1990; Nordenbo et al. 1996).

3. Bowel functions and neural control

Principal functions of the colon include 1) absorption of water and electrolytes from the chime, ingested food that is mixed with stomach secretions that pass into the small intestine and on to the large intestine, and 2) storage of fecal matter until it can be expelled (Guyton & Hall, 2006). Mixing movements known as haustrations promote absorption of fluid and dissolved substances causing the chime to become a semisolid slush. Haustral contractions propel the material in the colon toward the rectum. Beginning of the transverse colon and continuing to the sigmoid, mass movements mainly take over the propulsive role which occur only one to three times each day and most frequently for 15 minutes during the first hour after eating breakfast. Mass movements are facilitated by the gastrocolic and duodenocolic reflexes that result from distention of the stomach and duodenum via extrinsic nerves of the autonomic nervous system. When a mass movement forces feces into the rectum, the desire for defecation is normally initiated, including reflex contraction of the rectum and relaxation of the anal sphincters. Loss of fecal matter through the anus is prevented by tonic contraction of the internal and external anal sphincters. The external sphincter is controlled by nerve fibers in the pudendal nerve which is under voluntary conscious control. Defecation is initiated by defecation reflexes and is fortified by the parasympathetic defecation reflex that involves the sacral segments of the spinal cord. Conscious relaxation of the internal sphincter and forward movement of feces toward the anus normally initiate contraction of the external sphincter which prevents defecation and if kept contracted defecation reflexes die out after a few minutes and remain quiescent for several hours or until additional amounts of feces enter the rectum (Guyton & Hall, 2006).

The autonomic nervous system, consisting of sympathetic and parasympathetic nerve fibers, controls the visceral functions pertaining to gastrointestinal mobility and secretion and is activated mainly by centers located in the spinal cord, brain stem and hypothalamus (Guyton & Hall, 2006). Sympathetic nerves originate in the spinal cord between segments T-1 and L-2 and pass from here into the sympathetic chain and then to the tissue and organs that are stimulated by the sympathetic nerves. Sympathetic fibers from cord segments T-7 through T-11 pass into the abdomen. Sympathetic nerve endings secrete norepinephrine and have two major types of adrenergic receptors: alpha and beta. Alpha receptors cause intestinal relaxation, intestinal sphincter contraction, and bladder sphincter contraction. Beta receptors cause intestinal and uterus relaxation and bladder wall relaxation. Autonomic reflexes that inhibit gastrointestinal activity that severely block movement of food through the intestines are initiated by sensory signals that pass to the prevertebral sympathetic ganglia or to the spinal cord and then are transmitted through the sympathetic nervous system back to the gut (Guyton & Hall, 2006).

Parasympathetic fibers leave the CNS through cranial nerves III, VII, IX, and X; and the second and third sacral spinal nerves; and the first and fourth sacral nerves (Guyton & Hall, 2006). The vagus, cranial nerve X, supplies parasympathetic nerves to the proximal half of the colon. The sacral parasympathetic fibers congregate in the pelvic nerves which leave the sacral plexus at S-2 and S-3 levels and distribute their peripheral fibers to the descending colon, rectum, and external genitalia. Parasympathetic nerve endings secrete acetylcholine which increases the overall activity of the gastrointestinal tract by promoting peristalsis and relaxing the sphincters to allow rapid propulsion of contents along the tract and is associated with increases in rates of secretion by many of the gastrointestinal glands.

However, strong sympathetic stimulation inhibits peristalsis and increases the tone of the sphincters resulting in greatly slowed propulsion of food through the tract and sometimes decreases secretion as well (Guyton & Hall, 2006). Figure 1 illustrates bowel anatomy and neural components associated with bowel function.

Hypothalamic centers can control gastrointestinal activity. Thus, autonomic centers in the brain stem act as relay stations for control of activities initiated at higher levels of the brain. Higher areas of the brain can alter all or portions of the autonomic system to cause constipation.

4. Constipation

Constipation can be primary or secondary (Candelli, Nista, Zocco, & Gasbarrini, 2001). Primary constipation, also known as idiopathic or functional constipation, is considered when no definite cause is found and specific diseases cannot be demonstrated. Constipation is considered secondary when specific causes are recognized such as poor fiber diet, intestinal neoplasm, drugs, or specific diseases such as multiple sclerosis. Constipation in MS patients can be caused either by slow colonic transit, abnormal rectal function, or abnormal pelvic floor function (Chia, Fowler, Kamm, Henry, Lemieux & Swash, 1995; DasGupta & Fowler, 2003; Weber, Grise, Roquebert, Hellot, Mihout, Samson, Beuret-Blanquart, Pasquis &Denis, 1987).

Slow transit constipation is characterized by prolonged delay in the transit of stool through the colon due to a primary dysfunction of the colonic smooth muscle or its nerve innervations (Rao, 2007). Symptoms may include straining during defecations, lumpy or hard stools, sensation of incomplete evacuation of stool, sensation of anorectal obstruction of stool, and manual maneuvers to facilitate defecation. Pathologic conditions include phasic colonic motor activity; diminished gastrocolonic response following a meal; the high amplitude, prolonged duration, propagated contractions are decreased; and the velocity of propagation is slower, waves have a greater tendency to abort prematurely, and their amplitude is also decreased (Rao, 2007). Weber et al. (1987) in a study of 16 MS patients reported that transit times of radiopaque markers led to an objective confirmation of constipation in 13 of the 15 patients. Interruption of sympathetic innervations from the dorsolumbar spinal cord via the superior mesenteric ganglion and vagal parasympathetic innervations to the right colon together with sympathetic innervations from the dorsolumbar spinal cord via the inferior mesenteric ganglion and parasympathetic innervations from the sacral spinal cord via the erigentes nerves to the left colon were proposed to explain the decreased transit observed in MS patients (Weber et al. 1987). Wald (1986) reported that prolonged transit time throughout the entire colon among MS patients responded poorly to treatment compared to those characterized by slow transit restricted to the left colon or delay only through the anorectal structures.

Abnormal rectal function, also known as dyssynergic defecation, obstructive defecation, anismus, pelvic floor dyssynergia, or outlet obstruction, is characterized by difficulty to expel stool from the anorectum (Rao, 2007). Symptoms include the need to strain excessively, feeling of incomplete evacuation, abdominal fullness or bloating, and need to use fingers to facilitate defecation (Rao, Tuteja, Vellema, Kempf & Stessman, 2004). Dyssynergic defecation may be caused by paradoxical anal contraction or involuntary anal spasm during defecation

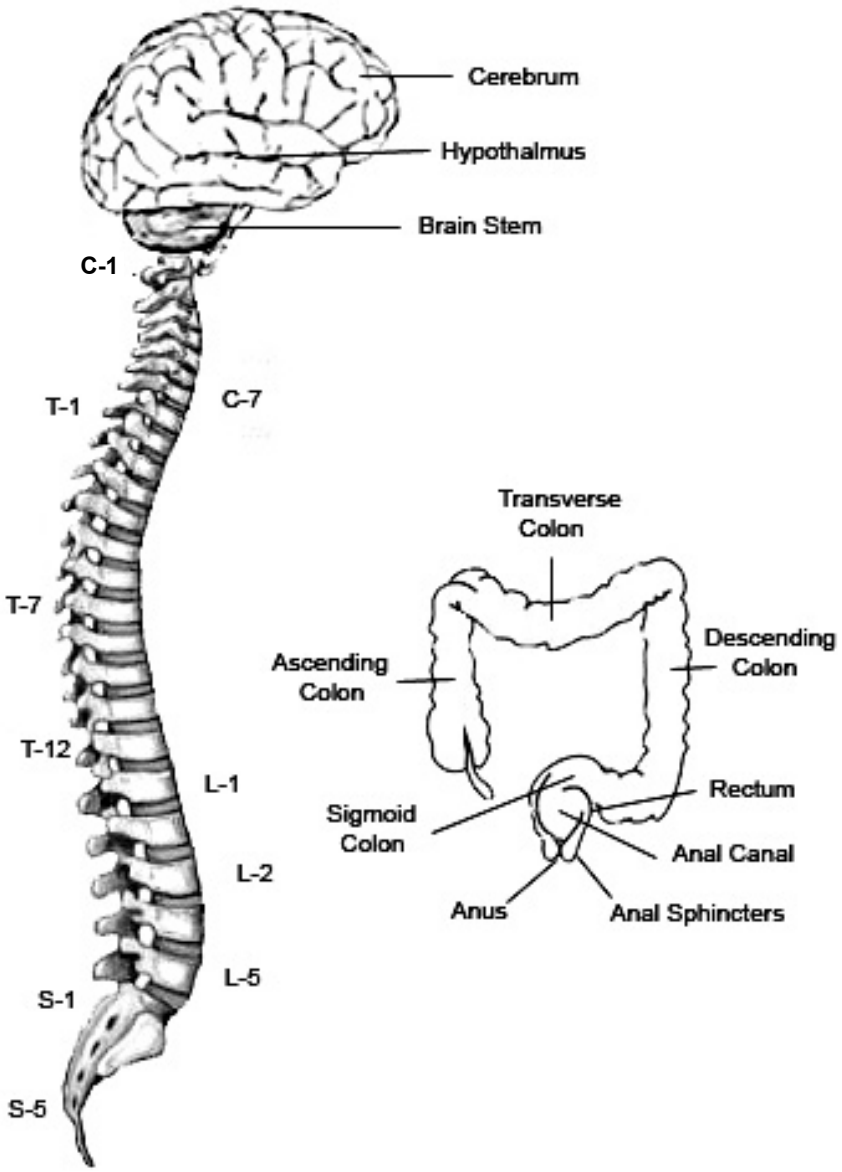

Fig. 1. Bowel anatomy and neural components associated with bowel function

(Rao, 2007). Munteis, Andreu, Martinez-Rodriquez, Ois, Bory & Roquer, (2008) reported that 32 MS patients with constipation compared to 22 patients without neurological or gastroenterologic abnormalities had significantly lower squeeze maximal sphincter pressure and higher anal inhibitory reflex, conditions that impede defecation. Women with pelvic organ prolapse and who reported chronic straining to defecate reportedly have a high risk

for constipation (Arya, Novi, Shaunik, Morgan & Bradley, 2005). The authors theorized that chronic straining may produce weakness of the pelvic floor resulting in pudendal nerve injury with loss of tonicity of pelvic floor muscles and subsequent development of prolapse.

5. Fecal incontinence

Fecal incontinence is characterized by an urgent need to defecate and loss of stool. Major factors causing fecal incontinence among MS patients include the lack of voluntary control of the external anal sphincter, rectal hyperreactivity, reduced rectal tone and contractility causing fecal impaction and rectal distension, and reduced or lost anal sensibility (Chia, et al. 1995; Hennessey, Robertson, Swingler & Compston, 1999; Krogh & Christensen, 2009). Studies among persons with MS have shown that fecal incontinence is associated with reduced rectal sensation, a markedly reduced external sphincter function, weakness of pelvic floor musculature and an inability to close the anorectal angle (Nordenbo, et al. 1995; Waldron et al. 1993). Causes of fecal incontinence unrelated to MS include diarrheal infections due to viral, bacterial, and protozoal agents (Walker, 2006); food allergy (Walker, 2006); or pudendal nerve damage associated with childbirth (Swash, Snooks & Chalmers, 1987).

6. Assessment of bowel dysfunction

Bowel problems particularly fecal incontinence is often withheld from sharing the problem with health care providers due to feelings of embarrassment or shame (Khan, Pallant, Shea & Whishaw, 2009; Powell & Rigby, 2000; Wald, 2007). Therefore, since bowel dysfunction is relatively common among persons with MS it is important for health care providers to ask their MS patients in a careful supportive manner about their bowel function as accurate assessment of the presenting bowel problem is key to the successful treatment and management of bowel dysfunction (Irwin, 2003). Important bowel assessment information needed by the health care provider can be obtained through periodically patient-administered surveys and/or through patient interviews. A description of several patient-administered survey questionnaires are described below.

6.1 Instruments used to assess bowel function/dysfunction

Patient-administered questionnaires regarding their bowel function or dysfunction can provide health care providers with information that can assist them in determining appropriate treatment, counseling, or needed referrals. Periodic assessments are important to determine if the current treatment is effective or in need of change. Periodic assessments are also needed because of possible change in the patient's disability status that may increase bowel problems (Wiesel, Norton, Glickman, & Kamm, 2001). Several patient-administered questionnaires are described below.

6.1.1 The Bowel Function Questionnaire for Persons with Multiple Sclerosis (BFQ-MS)

The BFQ-MS, developed for persons with MS, is a patient-administered scale that consists of 15 items pertaining to constipation, 13 items pertaining to fecal incontinence and 20 items pertaining to both constipation and fecal incontinence (Gulick, 2010). The questionnaire

items inquire about one's medical/surgical background that may be related to bowel dysfunction; medications with constipating or diarrheal effects; symptoms (frequency, consistency, time spent on the toilet, amount of time once the urge is felt before defecation occurs, skin breakdown around anus or perineum, pain/discomfort on defecation, flatulence, strain to defecate, feel bowel is not empty after defecation); nondrug interventions; drug interventions; and improvement or worsening over time. The items are rated on a Likert scale that ranges between 0 and 5 with higher scores indicating a worsening of bowel problems. Cronbach alpha reliability coefficients for the Constipation, Fecal Incontinence, and both Constipation and Fecal Incontinence subscales were 0.70, 0.68, and 0.69, respectively. The three subscales demonstrate satisfactory validity as they were able to differentiate symptom and treatment differences between the three types of bowel dysfunction.

6.1.2 The Quality of Life Scoring Tool Relating to Bowel Management (QOL-BM)

The QOL-BM, originally developed for use with spinal cord injured patients (Slater, 2003), was tested for reliability and validity with a sample of 502 persons with MS (Gulick, 2011). Principal component analysis and Varimax rotation factor analysis of the 11-item scale used with MS patients resulted in two factors: Management and Relationships. The 6-item Management subscale consists of items related to severity of bowel difficulty, convenience/inconvenience of bowel care, and satisfaction with bowel care. The 5-item Relationships subscale consists of items related to worry about bowel accidents, personal relationships and social activity. Internal consistency reliability for the total scale was 0.90 and was 0.86 for the Management subscale and 0.83 for the Relationships subscale suggesting satisfactory reliability. Discriminant validity was shown for the total and subscales based on the MS patient's disability level ($p < .05$).

6.1.3 Constipation Symptom Assessment Instrument (PAC-SYM)

The PAC-SYM is a constipation symptom assessment scale consisting of 12 items that measure stool symptoms, rectal symptoms and abdominal symptoms (Frank, Kleinman, Farup, Taylor & Miner, 1999). Items are rated on a 5-point Likert scale from absence of symptoms (0) to very severe (4). Internal consistency (Cronbach's alpha = 0.89) and test-retest reliability (intraclass correlation = 0.75) were high. Within subject change over a 6-week period demonstrated significantly improved scores. The PAC-SYM scale has been used with opium-induced constipation patients (Slappendel, Simpson, Dubois & Keininger, 2006) and with women with pelvic organ prolapse and constipation (Arya et al. 2005).

6.1.4 The Brief Fecal Incontinence Score

The Brief Fecal Incontinence Score is a 7-item scale that measures frequency of stool, stool consistency, flatulence, altered lifestyle, drug and nondrug interventions, and inability to defer defecation for 15 minutes (Vaizey, Carapeti, Cahill & Kamm, 1999). A five-point Likert rating scale from Never (0) to Daily (5) is used. The scale correlated closely with clinical assessment ($r=0.79$), showed high test-retest reliability ($r=0.87$), and showed sensitivity to change from pre-surgery to 6-weeks post-surgery ($p<0.004$) suggesting good reliability and validity. The scale has not reportedly been used with MS patients.

6.2 Patient interview regarding bowel function/dysfunction

One or more of the survey questionnaires could be used prior to conducting an interview with the patient. Suggested questions to be asked during the patient interview are described in Table 1. General questions are presented and depending on the individual's response more detailed questions can be explored.

A follow-up to the interview questions includes a physical assessment, described below, to determine if abnormalities of the anorectum and perineum can be detected.

6.3 Physical assessment and laboratory tests pertaining to bowel dysfunction

The following examinations are recommended to assist in identifying underlying causes of bowel dysfunction (Hinds & Wald, 1989; Irwin, 2002; Namey & Halper, 2000).

1. Abdominal assessment by palpating along the course of the colon to detect any mass or tenderness
2. Rectal and pelvic exam to look for prolapse, rectocele, hemorrhoids, fissures, and fecal impaction
3. Digital assessment of resting anal tone and external sphincter pressures
4. Digital assessment to obtain stool sample for testing for occult blood
5. Puborectalis function by hooking the examining finger posteriorly onto the puborectalis bar and feeling the muscle contract when the patient squeezes and relaxes when asked to strain
6. Check perineum for skin condition
7. Blood work should include blood glucose, electrolytes, calcium, and if necessary, thyroid function (Hinds & Wald, 1989)

Information obtained from the interview, physical assessment and blood work should guide the development of an individualized bowel program.

7. Interventions to control bowel function/dysfunction

7.1 Basic bowel program: Constipation

Development of the bowel program should be comprehensive and individualized to include the physical abilities of the patient, availability of care, the chosen lifestyle and preferences of the patient and education of the patient and caregiver (Coggrave, Wiesel & Norton, 2006). The approach to treating bowel problems in MS should be guided by an evaluation of likely pathophysiology of the bowel symptoms (Hay-Smith, Siegert, Weatherall & Abernethy, 2007). Simple and conservative approaches of a bowel program include appropriate diet and fluid intake, awareness of medications that may have a constipating or diarrheal effect, active or passive exercise, and toileting regime.

7.1.1 Diet and fluid intake

Good nutrition is vital for one's overall health and for a 1800 calorie diet the recommendations include a daily intake of 1 ½ cups of fruit, 2 ½ cups of dark green/orange/red vegetables, 6 ounces of grains, 5 ½ ounces of meat and beans, 3 cups of milk, 24 grams of oils, and 20-30 grams of fiber (Dietary Guidelines for Americans-2010). A

1. Tell me about your bowel movements during the past week.	
2. How frequently do you move your bowels during the week? Is this your typical pattern? Are you satisfied with this pattern?	
3. Are your bowel movements usually liquid, loose, soft, hard, lumpy or does the stool consistency vary?	
4. Now ask questions shown below according to reported stool consistency.	
Stools usually Liquid or Loose	**Stools Usually Hard or Lumpy**
1. Do you lose some or all of the stool before making it to the toilet? If yes, when and where does this occur?	1. Do you strain to pass your stool? If yes, what is the frequency?
2. What things have you done to help control loss of stool. Tell me about them.	2. Do you feel your bowel is not empty or need to go again quickly? If yes, what is the frequency?
3. Do you use medications to help you control loss of stool or bowel leakage? Tell me about them.	3. What things have you done to help you move your bowels? Tell me about them.
4. Do you have any food allergies? If yes, tell me about them.	4. Do you use laxatives, suppositories, or enemas to help with bowel care? Tell me about them.
Additional background questions to ask pertaining to possible causes of bowel dysfunction and toileting facilities	
1. How long have you experienced your bowel problem?	
2. What medications are you currently taking other than laxatives or anti-diarrheal agents?	
3. Tell me about the foods you usually eat and the type and amount of beverage each day.	
4. Do you experience pain or discomfort when moving your bowels?	
5. Do you need assistance from other persons to help you with bowel care?	
6. Are toilet facilities readily available and comfortable?	
7. How much does your bowel problem bother you and interfere with every day activities?	
8. Are there conditions that may be related to your current bowel problem?	
Surgical procedures: abdomen, rectal, anal, or perineum	
Difficult childbirth (woman)	
Medical conditions such as colitis, Crohns disease	
Failure to heed the urge to move your bowels	
Sexual abuse	
Medications with constipating or diarrheal effects	
9. Is there a family history of bowel problems?	
10. Is there anything else you'd like to tell me about your bowel problem?	

Table 1. Interview Regarding Bowel Functions/Dysfunctions

common cause of constipation is a diet low in fiber. Fiber may be soluble that dissolves easily in water and takes on a gel-like texture in the intestine or insoluble fiber that passes through the intestine almost unchanged. Together, the bulk and soft texture of fiber helps

prevent hard, dry stools (Rigby & Powel, 2005). However, based on a meta-analysis of studies of the effect of fiber treatment on bowel function, Muller-Lissner (1988) concluded that there is no justification for claiming rye bran, a form of insoluble fiber, given to patients with constipation can return stool output and transit time to normal since there may be a motility disorder of the colon which is primary or secondary to an underlying disease or an altered lifestyle that is responsible for constipation.

The addition of high fiber foods to one's diet has mixed results. A study of 41 women with pelvic floor disorder given slow increases of high-fiber cereal until 28 grams were reached over a 42 day period resulted in withdrawal of 11 patients largely due to inability to tolerate the fiber diet (Shariati, Maceda & Hale, 2008). The 30 patients who completed the study reported significant decreases in adominal pain and bloating, painful bowel movements, rectal bleeding, incomplete bowel movements, consistency of stool, straining or squeezing, laxative use, vaginal and/or perineal splinting. Increasing fiber to one's diet should be introduced slowly in order to control for symptoms of bloating and gas. The addition of yoghurt containing Lactobacillus GG along with a fiber rich diet can decrease gastrointestinal symptoms associated with a fiber rich diet (Hongisto, Paajanen, Saxelin & Korpela, 2006). A list of fiber foods together with the standard serving size and grams of fiber identified by the USDA and USDHHS (2010) are presented in Table 2.

7.1.2 Medications that can adversely affect bowel dysfunction

Control of various MS-related symptoms or other non-MS conditions such as hypertension may require medications that have constipating affects. A list of these medications is shown in Table 3. Patients need to be queried about the medications that they currently are taking to determine if any of them have constipating and/or diarrheal effects.

7.1.3 Physical activity to promote bowel function

Body movement through exercise helps promote peristalisis of the colon, that may reduce the likelihood of constipation (Petajan , Gappmaier, White, Spencer, Mino & Hicks, (1996). Exercise may be passive or active depending on the disability status of the person with MS. Physical activity may be increased according to functional level by performing activities of daily living, pursuing more active recreation and eventually developing a structured exercise program (Petajan & White, 1999). Several studies with persons with MS given aerobic training and fitness (Petajan et al. 1996) or extended outpatient rehabilitation program (Di Fabio, Soderberg, Choi, Hansen & Schapiro,1998) demonstrated improvement in the study participants' bowel functioning. A study by Gulick and Goodman (2006) evaluated the effect of everyday activities performed in and around the home among 123 persons with MS ranging between mild to severe disability. After controlling for disability level, bowel and bladder symptoms increased with increased levels of physical activity.

7.1.4 Toileting regime to assist in bowel evacuation

A number of activities related to toileting can aid defecation. Planning the toileting routine during the first hour following breakfast takes advantage of increased peristalsis of the colon which moves the chime/feces into the sigmoid colon and rectum (Guyton & Hall, 2006). Patients who are able to sit safely and tolerate sitting on a commode or toilet for short

Food	Standard Portion Size	Dietary Fiber in Standard Portion (g)
Grains		
Bran ready-to-eat cereal (100%)	1/3 cup (about 1 ounce)	5.6-8.1
Plain rye wafer crackers	2 wafers	5.0
Bran ready-to-eat cereals (various)	1/3-3/4 cup (about 1 ounce)	2.6-5
Whole wheat English muffin	1 muffin	4.4
Soybeans, green, cooked	½ cup	3.8
Shredded wheat ready-to-eat cereal	½ cup (about 1 ounce)	2.7-3.8
Whole wheat spaghetti, cooked	½ cup	3.1
Oat bran muffin	1 small	3.0
Pearled barley, cooked	½ cup	3.0
Vegetables		
Artichoke, cooked	¼ cup hearts	7.2
Green peas, cooked	1/2 cup	3.5-4.4
Mixed vegetables, cooked	½ cup	4.0
Sweet potato, baked in skin	1 medium	3.8
Greens (spinach, collards, turnip greens), cooked	½ cup	2.5-3.5
Sauerkraut, canned	½ cup	3.4
Potato, baked, with skin	1 small	3.0
Broccoli, cooked	½ cup	2.6-2.8
Fruit		
Asian pear	1 small	4.4
Raspberries	½ cup	4.0
Blackberries	½ cup	3.8
Prunes, stewed	½ cup	3.8
Figs, dried	¼ cup	3.7
Apple, with skin	1 small	3.6
Banana	1 medium	3.1
Orange	1 medium	3.1
Strawberries	1 cup	3.0
Guava	1 fruit	3.0
Dates	¼ cup	2.9
Lentils and Nuts		
Beans (navy, pinto, black, kidney, white, great northern, lima), cooked	½ cup	6.2-9.6
Split peas, lentils, chickpeas, or cowpeas, cooked	½ cup	5.6-8.1
Soybeans, mature, cooked	½ cup	5.2
Almonds	1 ounce	3.5

Table 2. Selected Food Sources Ranked by Standard Food Portion and Amounts of Dietary Fiber

Drugs with Constipating Effects
Analgesics (including non-steriodal anti-inflammatory drugs)
Antacids (e.g., aluminum and calcium compounds)
Anticolinergics (e.g., Oxybutynin, Ditropan(R))
Anticonvulsants (e.g., oxcarbazepine, Trileptal(R))
Antidepressants (e.g., selective serotonin reuptake inhibitors)
Antihypertensives (e.g., clonidine, Catapres(R))
Antimotility (e.g., Loperamide, Imodium(R))
Anti-Parkinsonism (e.g., Sinemet, Carbidopa, Lodosyn(R))
Antispastic (eg.Clonide, Catapres(R))
Diuretics (e.g., hydrochlorothiazide)
Hematinics (e.g., Iron)
Laxatives (long term use)
Opiates (e.g., Morphine, Codeine)
Psychotherapeutic drugs (e.g., Thioridazine, Mellaril(R))
Drugs with Diarrheal Effects
Antacids containing magnesium
Antibiotics
Antidepressant (e.g., Sertraline, Zoloft(R))
Antihypertension (e.g., Captopril, Capoten(R))
Chemotherapy drugs
Nonsteroidal anti-inflammatory drugs, Ibuprofen, Motrin®

Table 3. Medications Containing Constipating or Diarrheal Effects

periods and lean forward to bring pressure onto the colon may promote defecation (Lewicky-Gaupp et al. 2008; Pierce et al. 2001). Toilet facilities must be readily accessible and comfortable. The need for toilet assistance from caretakers as well as their attitude towards bowel care needs to be assessed (Irwin, 2003).

7.2 Other components of a bowel program: Constipation

Some persons with MS may benefit from other forms of bowel control depending on their disability level and comfort of the particular procedure. These include abdominal massage, biofeedback, anal stimulation, digital removal of feces, and rectal or trans-anal irrigation. Various laxatives may be used and/or enemas. Gastroenterology referrals may be indicated for some persons with MS.

7.2.1 Abdominal massage

Abdominal massage reportedly aids peristalsis of the colon to enhance the mass movement of the gut and increases the strength of the contractions and propulsion force through sensory stimulation of the parasympathetic division (McClurg, Hagen, Hawkins & Lowe-Strong, 2010). This stimulation increases the mobility of the muscles to the gut, increases digestive secretions and relaxes the sphincters in the rectoano region. McClurg, using abdominal massage instruction over a four week period given to 15 MS patients compared to 15 MS patient controls with an EDSS disability score between 2.5-6.0 (mean = 3.5) resulted in improved frequency of defecation from 2 to 4.5 defecations per week, decreased time

spent defecating from 10 minutes to 6 minutes for the experimental group compared to 12 to 10 minutes per day for the control group. Consistency of stools for both the experimental and control groups was softer at the end of the four week period compared to baseline.

7.2.2 Biofeedback for constipation

Biofeedback represents a number of behavioral modification techniques, which, when applied to treatment of constipation and fecal incontinence, may include sphincter exercises, bowel habit retraining, counseling, health education and use of medications (Wiesel, Norton, Roy, Storrie, Bowers & Kamm, 2000). In a study of 18 persons with MS given biofeedback instruction for anorectal dysfunction, improvement was shown in 8 (44.4%) of the MS patients given biofeedback who had milder manometric abnormalities (squeeze maximal sphincter pressure, anal inhibitory reflex, and paradoxical contraction of the puborectal musculature) and limited disability (Munteis et al. 2008).

7.2.3 Anal stimulation

The defecation reflex can be stimulated by dilating the anus with a lubricated gloved finger. This procedure stimulates the anal sigmoid reflex which causes the colon to contract, the anus relaxes, and fecal contents can be pushed out and is most effective if performed when the patient is in a sitting position (Pierce, et al. 2001).

7.2.4 Digital removal of feces

Digital removal of feces may be performed by patients themselves or by nurses who have received specialized training in the performance of digital removal of feces (Kyle, et al. 2005). However, this procedure should only be used as the last resort and after all other methods of bowel evacuation have failed (Powell & Rigby, 2000). Because of the invasive nature of the procedure patient consent is needed for health care providers to perform the procedure.

7.2.5 Rectal or trans-anal irrigation

This procedure involves a process of facilitating evacuation of feces from the bowel by passing water or other liquids in to the bowel via the anus in a quantity sufficient to reach beyond the rectum (Coggrave, 2008). The infused water distends the rectal wall and stimulates the stretch receptors to stimulate defecation (Pellatt, 2007).

7.2.6 Laxatives, suppositories and enemas

Persons with MS use a range of interventions to help manage the symptoms of constipation, fecal incontinence and/or both constipation and fecal incontinence, with varying degrees of success. A list of medications used for constipation together with their action and either precautions or contraindications (Curry Jr. & Butler, 2006) are presented in Table 4. Close monitoring of the frequency and duration of laxative use can be beneficial in determining whether normal bowel habits are reestablished between bouts of constipation or if a more severe condition exists (Curry & Butler, 2006).

7.2.7 Gastroenterology referrals

Although most patients with chronic constipation can usually be treated successfully in the primary care setting, some patients may require referral to a gastroenterologist. Reasons for referral include suspicion of defecatory disorders such as pelvic floor dyssynergia, lack of sufficient response to empiric treatment, and worsening of symptoms despite treatment (Bleser, 2006). Objective testing for bowel dysfunction include Anorectal Manometry, the Balloon Expulsion Test, Defecography and Colonic Transit Studies.

Anorectal Manometry is used to assess basal pressure in the rectum and anal canal, squeeze maximal sphincter pressure, rectal sensation, simulated defecation, inhibitory reflex, and presence of paradoxical contraction of the puborectal musculature (Munteis et al. 2008). The Balloon Expulsion Test is used to quantify the ability of a patient to evacuate a water-filled (usually 50 ml) balloon. It can serve as a functional marker in biofeedback programs for pelvic floor retraining (Gill, Chia, Henry & Shorvon, 1994; Locke III, Pemberton & Phillips, 2000). Defecography includes the scintigraphic method used to evaluate anorectal angulation and pelvic floor descent during evacuation. Barium defecography is performed in conjunction with a standard enema. These tests can determine failure of the anorectal angle to open and degree of pelvic floor descent during defecation (Locke, Pemberton & Phillips, 2000). Colonic Transit Studies are used to determine the rate at which fecal residue moves through the colon using radiopaque markers (Locke, Pemberton & Phillips, 2000). The test provides quantitative information about colonic transit, enables the identification and characterization of transit abnormality, and allows assessment of the severity of the problem (Ringel, 2003).

Medication	Action	Precautions or Contraindications
Bulk-forming Methylcellulose, Citrucel® Carboxymethyl cellulose sodium Malt soup extract, Maltsupex® Partially hyrdrolyxe guar gum Benerfiber® Polycarbophi, FiberCort®	Contain natural and semisynthetic hydrophilic polysaccharides and cellulose derivative that dissolve in the intestinal fluid to facilitate passage of the intestinal contents and stimulate peristalsis. Doesn't affect absorption of nutrients.	Abdominal cramping and flatulence may occur. Avoid taking a bulking agent within 1 to 2 hours of taking other medications. Drink at least 8 oz of fluid with each dose. Acts within 12 to 24 hours
Emollients/ Stool Softeners Docusate sodium, Colace® Docusate calcium Docusate potassium	Increase the wetting efficiency of intestinal fluid, promotes a softer stool, helps prevent painful defecation and straining.	May cause diarrhea and mild abdominal cramping. Avoid use if nausea, vomiting, or abdominal pain exist. Acts within 24 to 72 hr.
Lubricants Mineral Oil	Soften fecal contents by coating them, thus preventing colonic absorption of fecal water.	Excessive use may impair absorption of vitamins A, D, E, and K. Acts in 6 to 8 hours.

Medication	Action	Precautions or Contraindications
Saline Laxatives (Osmotics) Magnesium citrate, Citroma® Magnesium hydroxide, Milk of Magnesium® Magnesium sulfate, Epson Salts® Polyethylene Glycol, MiraLAX® Lactulose	Produce both secretory and motor reactions that draw water into the intestine, to increase intraluminal pressure which in turn increases intestinal motility.	Indicated for acute evacuation of the bowel. Take on an empty stomach as food will delay its action. May cause abdominal cramping, diuresis, nausea, vomiting, and dehydration. Acts within 30 minutes to 3 hours.
Stimulants Senna, Senokot® Bisacodyl Castor oil	Increase the propulsive peristaltic activity of the intestine by local irritation of the mucosa or by a more selective action on the intramural nerve plexus of intestinal smooth muscle, thus increasing motility. Stimulate secretion of water and electrolytes in either the small or large intestine or both.	Used for simple constipation, but not to be used for more than 1 week unless ordered by a physician. May cause severe cramping, electrolyte and fluid deficiencies, enteric loss of protein, malabsorption resulting from excessive hypermotility and catharsis, and hypokalemia. Usually acts within 6 to 12 hours or may require up to 24 hours.
Suppositories Glycerin Dulcolax	A hyperosmotic laxative that irritates the lining of the intestine. Draws water into the rectum to stimulate a bowel movement. Has a direct stimulating effect on the network of nerves in the large intestine. Provides lubrication to promote elimination of stool.	Do not use if abdominal pain, feel sick, or have vomiting. Take plenty of fluids while taking the medication. Usually acts within 30 minutes
Enemas Mineral Oil Fleet Enema	Lubricates the colon and allows for added cleansing. Pulls water from the body into the bowel which helps to soften the stool and cause a bowel movement.	Enema solutions can cause fluid and electrolyte disturbances in the blood if used on a chronic basis. May cause anal irritation, diarrhea, gas, nausea, stomach, cramps. Acts within 5 to 15 minutes.

Table 4. Medications used to Manage Constipation

7.3 Components of a bowel program: Fecal incontinence

As was noted for the Bowel Program described for constipation, the development of the bowel program for fecal incontinence should be comprehensive and individualized to include the physical abilities of the patient, availability of care, the chosen lifestyle and preferences of the patient and education of the patient and caregiver (Coggrave, et al. 2006). Except for fecal incontinence caused by viral, bacterial or protozoal infections, treatment for fecal incontinence commonly experienced by MS patients should entail a conservative approach. These include dietary considerations, medications that have diarrheal effects, toileting routine, incontinent pads, biofeedback, antidiarrheal medications and possibly anal plugs or sacral nerve stimulation.

7.3.1 Dietary considerations

Persons with MS could benefit from monitoring their food intake through use of a food diary to determine if certain foods may be related to fecal incontinence. A food diary should list what and how much one eats and when one has an incontinent episode to determine if a pattern between certain foods and incontinence occur. Known foods that have been associated with fecal incontinence include milk, egg, peanut, tree nuts, fish, shellfish, soy seeds, wheat, fruits and vegetables (Sicherer, 2011). Avoidance of fatty foods, foods rich in simple sugars, spicy foods, and caffeine may be helpful in controlling fecal incontinence (Walker, 2006). Hinds and Wald (1989) suggest reducing fiber intake if incontinence of solid stool occurs.

7.3.2 Medications associated with fecal incontinence

Medications given to control various MS-related symptoms and/or conditions unrelated to MS may contain diarrheal properties. Table 3 lists several of these medications.

7.3.3 Toileting regime to control fecal incontinence

Although patients are strongly encouraged to establish a daily time for defecation (DasGupta & Fowler, 2003) fewer than five percent of MS patients with fecal incontinence reported using a daily time for defecation (Gulick, 2010). Hinds and Wald (1989) suggest establishing a routine schedule of enemas or suppositories (e.g., once a week) to keep the rectum empty.

7.3.4 Use of incontinent pads

Incontinence pads have been shown to be used by approximately one third of MS patients who experience fecal incontinence (Gulick, 2010). Use of these pads can conceal the incontinence problem from others particularly if the quantity of lost stool is small. When soiling of the pad occurs, it needs to be changed in order to prevent skin breakdown of the perineum and/or buttocks that can result in incontinence dermatitis and/or pressure ulcers (Whitely, 2007).

7.3.5 Biofeedback for fecal incontinence

This intervention may be helpful by improving the strength of pelvic floor muscles and rectal sensory perception to improve anorectal coordination (Nordenbo, et al. 1996).

Biofeedback retraining is more successful in persons with MS with limited disability and a non-progressive disease course (Wiesel, et al. 2000).

7.3.6 Antidiarrheal medications

These medications remain the main treatment for fecal incontinence. In taking antidiarrheal medications patients need to be cautioned about the potential adverse effects of dehydration. Antidiarrheal medications have been shown to be used by approximately one third of MS patients who experience fecal incontinence (Gulick, 2010). Commonly used antidiarrheal medications (Walker, 2006) are shown in Table 5.

Medication	Action	Precautions and/or Contraindications
Loperamide, Imodium®	Slows intestinal motility, allowing absorption of electrolytes and water through the intestine and decreased gastro-intestinal secretion.	Occasional dizziness and constipation may occur. Infrequent occurrence of abdominal pain, abdominal distention, nausea, vomiting, dry mouth, fatigue, and hypersensitivity reactions.
Bismuth Subsalicylate, Kaopectate®	Reduces the frequency of unformed stools, increases stool consistency, relieves symptoms of abdominal cramping, and decreases nausea and vomiting.	Mild tinnitus is a dose-related side effect that may be associated with moderate to severe salicylate toxicity. Discontinue drug if tinnitus occurs. The drug may interact with other medications, such as aspirin, tetracycline and quinolone antibiotics.
Diphenoxylate/ Atropine, Lomotil®	Slows intestinal contractions and peristalisis allowing the body to consolidate intestinal contents and prolong transit time, thus allowing the intestines to draw moisture out of the intestinal material to stop the formation of loose or liquid stools.	Discontinue drug if one experiences extreme thirst, decreased urination, muscle cramps, or weakness.
Racecadotril Acetorphan Hidrasec®	Acts as a peripherally acting enkephalinase inhibitor that has an antisecretory effect by reducing secretion of water and electrolytes into the intestine	Shown to promptly and significantly reduce total stool output in 48 to 72 hours after initiation of treatment. Is well tolerated in adults and children.

Table 5. Medications used to Manage Fecal Incontinence

7.3.7 Anal plug

The anal plug has been developed to prevent loss of stool and is a disposable device for patients with anorectal incontinence. In a study of 10 patients with incontinence to gas and both liquid and solid stool the use of variable anal plugs for three consecutive weeks resulted in one patient withdrawing from the study due to discomfort of the anal plug, and for the remaining subjects there were no episodes of incontinence during 82% of time in which anal plugs were used with a median time of 7 to 12 hours depending on type of plug (Mortensen & Humphreys, 1991). Norton and Kamm (1999) evaluated two sizes of anal plugs each of which was tested for a two week period in a sample of 20 ambulatory and self-caring patients with intractable fecal incontinence for solid or liquid stool. Results indicated that the majority 14 (70%) could not tolerate a plug due to discomfort but for those that could tolerate the plug, it was highly successful at controlling fecal incontinence. Patients with neurogenic bowel dysfunction and have attenuated anorectal sensation may tolerate the presence of the anal plug (Emmanuel, 2010). Research is needed to determine if the use of anal plugs are helpful in controlling fecal incontinence in persons with MS.

7.3.8 Sacral Nerve Stimulation

Sacral nerve stimulation (SNS) for patients with severe fecal incontinence undergo implantation with a quadripolar electrode and pulse generator placed subcutaneously in the gluteal area (Tjandra, Chan, Yeh & Murray-Green, 2008). Compared to a control group who received medical therapy that comprised bulking agents, pelvic floor exercises, and dietary management, fecal incontinence was greatly improved with chronic SNS immediately after implantation and was sustained during the 12 month follow-up period in a randomized study of non-MS patients with severe fecal incontinence (Tjandra et al. 2008). Adverse events with SNS included pain at implant site which resolved after percutaneous aspiration and excessive tingling in the vaginal region. Research is needed to determine if the use of SNS is helpful in controlling fecal incontinence in persons with MS.

8. Outcome of various management strategies for bowel dysfunction in persons with MS

Possibly due to the multiplicity of causes of bowel dysfunction in persons with MS the outcome from the various treatment/intervention approaches have not yielded very satisfactory results. In a study of bowel dysfunction among persons with MS, Gulick (2010) noted that 54.1% (99/183) reported their constipation had worsened over time; 38.6% (22/57) reported their fecal incontinence worsened over time; and 71.8% (117/163) who experienced both constipation and fecal incontinence reported their constipation problem had worsened over time. Additionally, a survey of MS respondents who reportedly used a wide range of strategies to manage their bowel problems indicated that few of them were rated as very helpful (Norton & Chelvanayagam, 2010).

Many conditions and treatments that accompany MS over its long term illness trajectory may as a single entity or in combination lead to bowel dysfunction. These conditions frequently include ambulation difficulty, spasticity, fatigue, depression, urinary incontinence and various medications. In addition to MS related causes of bowel dysfunction there may be other health problems unrelated to MS that can cause bowel dysfunction.

Studies clearly acknowledge the adverse impact that bowel dysfunction has on the quality of life of persons with MS as the various bowel problems greatly interfere with the person's physical and social activities, family relationships, which also lead to the development of considerable emotional distress (Gulick, 1997; Norton & Chelvanayagam, 2010; Nortvedt, Riise, Frugard, Mohn, Bakke, Skar, Nyland, Glad & Myhr, 2007; Wollin, Bennie, Leech, Windsor, & Spencer, 2005). With regard to bowel dysfunction, persons with MS report that fecal incontinence has a significantly greater negative impact on their quality of life than constipation (Gulick, 2011; Norton & Chelvanayagam, 2010). Of the various MS related symptoms, respondents in the study by Norton and Chelyanayagam reported that bowel dysfunction and bowel management had the greatest negative impact on their quality of life.

9. Conclusion

Bowel dysfunction consisting of constipation and/or fecal incontinence is common in persons with MS. Causes of bowel dysfunction may be due to neurological lesions in the CNS or by non-neurological causes. The relapsing-remitting or progressive MS course may result in acute or chronic symptoms of constipation and/or fecal incontinence. Subjective and objective assessments of bowel symptoms using a team of specialists to determine the causes, appropriate treatment/intervention with ongoing monitoring of the condition is essential. Further studies with persons with MS are needed to determine the effectiveness of treatments/interventions given to improve bowel functions among those with bowel problems while controlling for confounding issues. Further study is also needed to determine the effectiveness of using objective laboratory procedures to identify or rule out specific causes of bowel problems.

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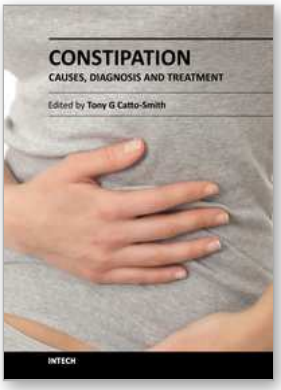

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Constipation is common in both adults and children. Estimates would suggest a median prevalence of around 12-16% in the general population. While regarded as a minor nuisance in some cases, its consequences can be severe, with a substantial impact on quality of life. Secondary faecal soiling has a profound psychological effect at all ages. This book provides contributions from authors with a range of backgrounds which clarify the pathogenesis, diagnosis, and therapy of constipation for the general population and also for certain high risk groups.

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