

Evidence for motor neuropathy and reduced filling of the rectum in chronic intractable constipation

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Abstract

Subtotal colectomy with ileorectal anastomosis is now frequently offered to patients with slow transit constipation who have severe symptoms and no response to more conventional medical treatment. If this operation is to be successful, the underlying problem should be delay in the progress of contents through the colon but no mechanical or functional obstruction in the small bowel or rectum. We have used a recently described technique of prolonged ambulant manometry and electromyography to investigate anorectal function in these patients. Pressure data were collected using a 2 mm diameter intrarectal probe carrying microtransducers, and external anal sphincter activity was assessed by a pair of silver-silver chloride surface electrodes. Fourteen control subjects and eight patients with colonic inertia were studied. Sampling reflexes, indicative of rectal filling, occurred at mean (SEM) rates of 7.4 (2.0)/hour in controls but were significantly reduced in patients (2.4 (0.3)/hour ($p < 0.01$)). Recurrent rectal motor complexes were seen to occur in both groups at intervals of 76 (1.8) minutes in controls and 64.9 (7.2) minutes in patients ($p < 0.1$), and with amplitudes of 42.4 (2.1) mmHg and 9.2 (0.7) mmHg ($p < 0.001$), respectively. External sphincter electromyographic spike activity did not differ between groups. Our results support the concept of reduced transit of faeces to the rectum from the colon over a 24 hour period in slow transit constipation and suggest that a motor neuropathy may also be present in the rectum.

Patients with chronic intractable constipation are generally young women with distinct symptoms that often cause major disruption to their lifestyle, in whom spontaneous defecation does not occur or occurs only once or twice monthly.¹⁻⁴ Transit studies using inert markers usually show diffuse impairment of movement throughout the colon,^{4,5} but some patients have predominantly rectosigmoid delay.⁶ The latter may be the result of pelvic floor dysfunction producing an outlet obstruction,^{7,8} and treatment directed towards overcoming this functional obstruction has been reported.⁹⁻¹² Patients with colonic inertia but normal pelvic floor function are often resistant to conventional medical treatment and there have been increasing reports of the use of colectomy to alleviate symptoms in this group.¹³⁻¹⁸ The best results are obtained after subtotal colectomy and ileorectal anastomosis^{15,18} but longterm relief of symptoms is not always achieved.¹⁵⁻¹⁷ This failure may be secondary to the presence of abnormal function

at more proximal levels of the gut^{5,19,20} or residual abnormal motility in the retained rectum. We have investigated the hypothesis that there is reduced transit of faeces into the rectum in this condition and have also looked at the possibility that the rectum itself is diseased. Studies were performed for up to 24 hours' duration in the patient's normal environment.

Methods

SUBJECTS

Eight subjects with chronic intractable constipation were selected. Each suffered from slow transit constipation as defined by the use of inert radio-opaque markers.²¹ None of these patients had pelvic outlet obstruction as diagnosed by integrated dynamic proctography.⁷ All had severe symptoms and had not responded to the multiple laxative and enema regimens that had been tried over the course of many years. The mean (SEM) age of the patients was 34 (3.8) years and all were women. Twelve control subjects also took part in the study. All gave informed consent. None had a history of gastrointestinal problems or was taking drugs with effects on the gastrointestinal tract. The mean (SEM) age of this group, of whom eight were men and four women, was 29.3 (2.4) years, which was comparable with controls ($p > 0.2$). No obvious differences were noted with regard to the data obtained in the men and women in the control group.

At the beginning of the test all subjects attended the unit for 20-30 minutes when the apparatus was applied and appropriate signals verified. Tests were performed in all cases on unprepared bowel. Subjects were asked to defecate before the test if possible and during most studies the need to defecate did not create problems. Studies usually began at 9 am and ended at approximately the same time on the following day. After insertion and application of the apparatus, the external equipment was placed in a shoulder bag, which was carried by the patient (Fig 1). During the study all subjects were completely ambulant and were able to sleep at home without difficulty. They recorded all physiological events and meal times in a diary. Patients were encouraged to socialise and perform normal daily activities. Defecation was not prohibited but rarely occurred; if it did the test was repeated.

MANOMETRY

Anorectal pressure changes were recorded using a fine flexible probe (Gaeltec Ltd), 1.2 m in length with an external diameter of 2 mm. The

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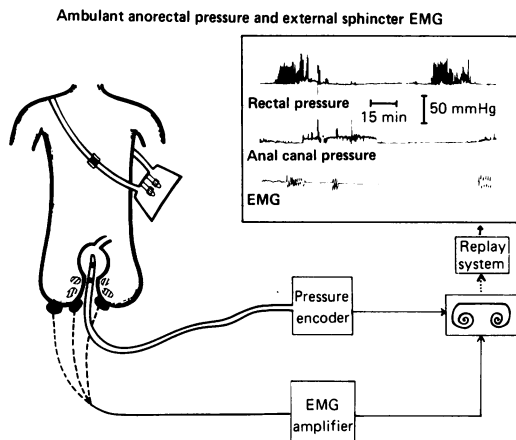
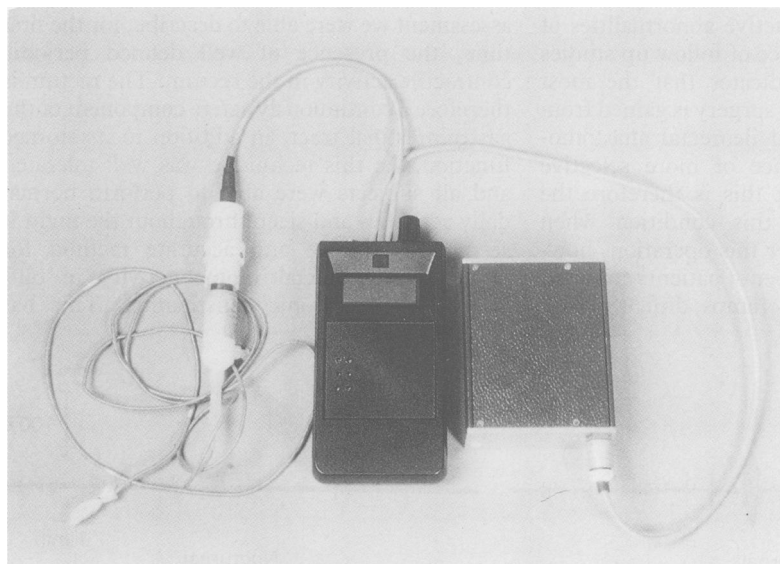


Figure 1: Schematic illustration of the ambulant anorectal and electromyographic apparatus. The pressure sensitive microtransducers on the anorectal probe are seen lying in the rectum and anal canal. Three silver-silver chloride electrodes are attached to the perianal skin. The pressure encoder, electromyographic (EMG) amplifier, and cassette recorder are carried in the shoulder bag during the course of the study. An example of the subsequent trace for analysis is shown.

probe carried two pressure-sensitive strain gauge microtransducers spaced 10 cm apart (Fig 2). The probe was positioned with the subject in the left lateral position so that the proximal transducer was in the rectum and the distal one in the mid-anal canal (1.5–2 cm from the anal verge). The probe was then tethered to the buttock to avoid movement of the sensors, and the position was checked by asking the patient to perform a maximum squeeze of the anal sphincter muscle. The probe was taped so close to the anal verge as to make movement of the anal sensor virtually impossible, and the position of this sensor was always checked before the end of the study. The output from the microtransducer was encoded in pulse mode and recorded in digital form on magnetic tape (Fig 1). This record was later decoded to an analogue trace to allow analysis of data.

Figure 2: Gaeltec pressure probe (2 mm OD) shown to the left of the illustration with microtransducers $\times 3$ (in white) spaced 10 cm apart. The encoder box and cassette recorder are also shown.



Anal canal pressures - sampling reflexes

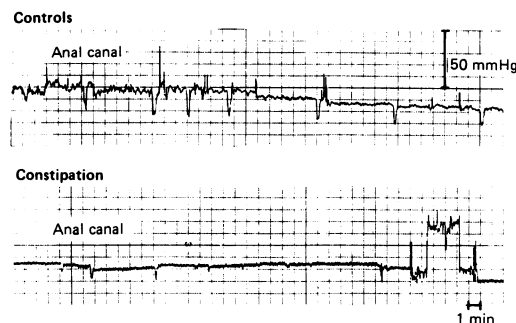


Figure 3: Anal canal pressure traces showing the presence of repeated sampling responses in both groups.

Two differential electrodes were placed on either side of the anal margin overlying the external sphincter muscle and an indifferent electrode was positioned immediately posterolateral to these to reduce electrical interference with the signal. The perianal skin was dried and shaved before the electrodes were applied. Each electrode was taped firmly to the perianal skin using adhesive tape. Recorded electrical signals were amplified with a purpose made high gain amplifier and subsequently recorded on magnetic tape in the same portable recorder as the pressure data (Fig 1).

DATA ANALYSIS

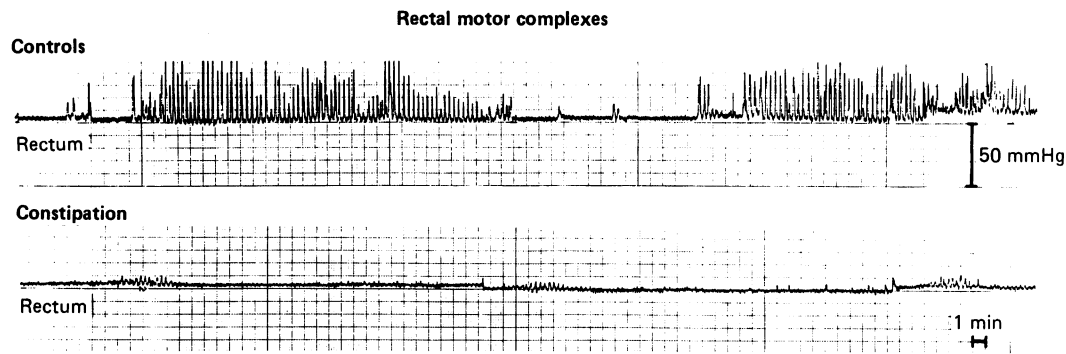
All traces were analysed by visual inspection. The number of spontaneous drops in anal canal pressure, equivalent to sampling responses, were counted during every hour of recording in the anal canal pressure traces (Fig 3). Sampling responses were defined as in Duthie and Bennett's original description,²² in which resting anal sphincter pressure dropped spontaneously, with or without a rise of rectal pressure, and returned quickly to basal values over the following 30–60 seconds. Rectal motor activity was assessed by measuring the amplitude and interval frequency of periodic rectal motor complexes with a contractile frequency of 2–3/minute (Fig 4). These complexes have recently been described by our group²³ in control subjects and are the most consistent feature of rectal motor activity in ambulant studies. Finally, external sphincter activity was measured by counting the number of spike potentials for each 10 minute period of recording for the duration of the study (Fig 5).

Statistical analysis of the significance of differences between groups was calculated using the Student's *t* test for unpaired data.

Results

All subjects tolerated the presence of the anorectal probe and surface electrodes without complaint. None had trouble sleeping and all performed normal daily activities both outside and in the home. None experienced pain or tenesmus due to the presence of the anorectal probe. Subjects had a mean of 23.25 hours of recorded activity for analysis. Overall, the patients and controls behaved in a similar fashion with regard to the effect on anorectal motility of

Figure 4: Rectal pressure traces showing evidence of recurrent rectal motor complexes in both groups, but with much reduced amplitude in the constipated subjects.



physiological events such as exercise, passage of flatus, micturition, and other activities normally encountered during an average day. Details of changes associated with these events have been previously documented by our group.²⁴

The data obtained in both the patient and control subjects are given in the Table. There was a significantly reduced incidence of sampling equivalents (Fig 3) in patients with slow transit constipation, controls showing approximately three times the amount of sampling seen in the constipation group. The degree of external anal sphincter activity (Fig 5) did not differ between groups as assessed by the number of spike potentials occurring every 10 minutes during the complete course of the study (Table).

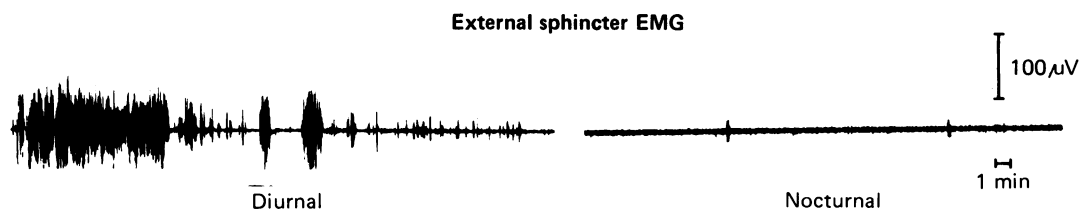
Regularly recurring episodes of rectal motor activity with contractile frequencies of 2–3/minute (rectal motor complexes) were identified in both groups (Fig 4). There was, however, a noticeably significant reduction in amplitude noted in the patient group throughout the course of each individual study (Table). While there was a tendency for these motor complexes to occur more frequently in the patients, this difference did not reach significance (Table).

Discussion

Patients with slow transit constipation complain of severe incapacitating symptoms often simulating intestinal obstruction but in the absence of a mechanical cause. They generally show no response or have developed tolerance to medical laxative treatment. These patients can be offered colectomy after appropriate investigation to exclude functional obstructive abnormalities of the pelvic floor. Experience of follow up studies from various centres indicates that the most satisfactory outcome after surgery is gained from a subtotal colectomy and ileorectal anastomosis,^{15,18} and in the absence of more selective studies of colonic transit this is therefore the operation of choice in this condition when surgery is indicated. After this operation, however, a considerable number of patients continue to complain of abdominal cramps, difficulty with

defecation, and abdominal bloating despite achieving an improvement in overall symptoms.^{16,17} A number of recent studies have stressed the importance of assessment of the upper gastrointestinal tract in these patients^{19,20} as those with diffuse abnormalities will be more likely to have persistent problems. A recent review documented the presence of proximal functional disorders in 25% of patients with chronic idiopathic constipation.¹⁹ It is also important, however, to determine if rectal function is normal in these patients, as if the rectum is also involved in the disease process it may act as a persistent distal obstructing factor. Traditional short motility studies performed in the laboratory have provided limited information regarding rectal motor activity. Most patients with slow transit constipation show increased rectal compliance and reduced rectal sensation,^{4,25,26} the latter having been correlated directly with a poor outcome in a recent study.²⁶ Read *et al* have shown reduced rectal contractile activity in response to rectal distension in severe constipation²⁵ but patients were studied in the left lateral position in laboratory surroundings while distension of the rectum was achieved by inflating a balloon. While there has been some evidence that the motor response to pharmacological stimulation²⁷ and to meals²⁸ was diminished in the sigmoid colon in these patients, little additional information has been documented with regard to rectal motor activity. In a previous report by our group, anorectal function was studied in normal ambulant subjects over a prolonged period outside the laboratory setting,²³ and using this more physiological type of assessment we were able to describe, for the first time, the presence of well defined periodic contractile activity in the rectum. The rectum is therefore a continuously active component of the gastrointestinal tract, in addition to its storage function. As this technique was well tolerated and all subjects were able to perform normal daily activities and sleep throughout the night it seemed a suitable and accurate method for monitoring anorectal motor activity in outpatients with chronic constipation. This has

Figure 5: External anal sphincter electrical activity showing repetitive spike bursts both by day and by night, which are seen to be of greater degree during the day. This trace was representative of both groups.



Twenty four hour physiological measurements in ambulant subjects (values mean (SEM))

	Controls	Patients	p Value
Sampling responses/hr	7.4 (2.0)	2.4 (0.3)	<0.01
Rectal motor complex:			
Amplitude (mmHg)	42.4 (2.1)	9.2 (0.7)	<0.001
Interval period (mins)	76 (1.8)	64.9 (7.2)	NS
Electromyography:			
Spike potentials/10 mins	12.8 (3.2)	11.6 (2.9)	NS

indeed proved to be the case. The present study has shown that two important physiological events which have a direct bearing on rectal filling and contractility, the sampling reflex and phasic rectal motor complexes, are significantly abnormal in patients with slow transit constipation.

The sampling response, as described by Duthie and Bennett,²² reflects a reflex lowering of upper anal canal pressure in response to material arriving in and filling the rectum to allow appreciation, discrimination, and a subsequent decision as to whether to proceed with evacuation. It is possible to identify these spontaneous reductions in anal canal pressure occurring at rates of approximately 7.5 times per hour in normal subjects using prolonged ambulant recordings.²⁴⁻²⁹ It is unlikely that these sampling responses are due to movement of the probe in the anal canal as the amplitude and duration of the response was consistent with previous reports and with the recto-anal inhibitory response produced by balloon distension of the rectum. Furthermore, the pressure trace in all subjects returned to the baseline pressure recorded before the event, which would seem unlikely if free movement of the tube were possible. In contrast to control subjects, the results of this study have shown that patients with colonic inertia have a much reduced frequency of these responses. Given that the latter are secondary to rectal filling with faeces or flatus and that previous work has shown that the recto-anal inhibitory response is intact in chronic constipation,^{4, 25, 26} this study provides definite evidence of diminished transit of content not only through the colon, as suggested by marker studies, but also from the colon into the rectum. These results support the clinical finding of absence of rectal faecal impaction in most patients with this disorder.^{4, 25}

Secondly, we have shown that while patients with intractable constipation show episodic rectal motor complexes similar to control subjects, these motor complexes are significantly reduced in amplitude. This may have important implications in this disorder if it can be presumed that these rectal contractile events, which are of considerable magnitude in control subjects, play a role in transit or defecation, or both. Distinctive histological changes have now been well described in the resected colons of these patients.³⁰ It is possible that the same neurological abnormalities may also affect the nerve plexus of the rectum. Whether the motor deficit described in this study is a primary aetiological factor or merely a secondary result of chronic laxative abuse³¹ is debatable but its importance with regard to retaining the rectum after colectomy remains valid. Seven of eight patients

in this study showed obvious stunting of rectal motor complexes of the degree shown in Figure 4. It is possible that patients with severe constipation requiring colectomy who show these findings during a prolonged ambulant study may benefit more from a total proctocolectomy and construction of a pelvic pouch³²⁻³⁴ or a modified Duhammel procedure as used in the treatment of the aganglionic rectum in Hirschsprung's disease. It would be advisable, however, to exclude abnormalities in small bowel function before considering such procedures. Indeed, in view of recent reports,^{19, 20} we consider that all patients with intractable constipation should have assessment of small intestinal function before any form of surgical resection.

We have been able to use a relatively non-invasive, home-based, socially acceptable investigation of anorectal function in patients with slow transit constipation to provide physiological evidence consistent with reduced filling of the rectum in this disorder. Our results also show that rectal motor function is impaired in these patients. This may have important implications for the extent of resection required when surgery is indicated in selected patients with chronic constipation. Follow up of those patients who may require colectomy will be necessary to establish if these findings correlate with outcome.

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