Is there a myoelectrical abnormality in the irritable colon syndrome?[1]

I. TAYLOR, C. DARBY, P. HAMMOND, AND P. BASU

From the Department of Surgery and Bioengineering, University of Liverpool, Liverpool

SUMMARY   Although recent work has suggested that an abnormality of the 0·05 Hz (3 c/m) slow wave electrical activity exists in the distal colon of patients with the irritable colon syndrome, it is not established whether this is related to altered bowel habit alone, or whether it is specific to the irritable colon syndrome. We have therefore studied 10 patients referred with this disorder and compared their colonic myoelectrical pattern with 10 patients suffering from assorted disorders with similar symptoms—for example, chronic pancreatitis, diverticular disease, ulcerative colitis, etc. Transit time, stool weights, percentage motility, and slow wave electrical activity were measured in each patient. The two groups were well matched for age and patients with similar symptoms in the two groups had similar values for transit time and percentage motility. There was a statistically significant increase in the 3 c/m electrical activity in patients with the irritable colon syndrome unrelated to the degree of diarrhoea or constipation. It would appear, therefore, that the abnormally high incidence of 3 c/m electrical activity in the colon is specific to the irritable colon syndrome and not merely a feature of altered bowel habit.

The irritable colon syndrome is one of the commonest diagnoses encountered in gastroenterology outpatients departments. It has been estimated that 50-70% of all patients with digestive complaints are suffering from this disorder (Kirsner and Palmer, 1958). In recent years motility studies have helped in the understanding of colonic function but have not found a routine place in the diagnosis of motility disorders (Chaudhary and Truelove, 1961; Wangel and Deller, 1965; Waller and Misiewicz, 1972). The irritable colon syndrome still remains a diagnosis chiefly made on the basis of symptomatology and by the exclusion of organic disorders with similar symptoms.

Recently, a more specific abnormality in the colonic myoelectrical rhythm has been suggested (Snape *et al.*, 1977). In the normal human colon *in vivo*, two electrical slow wave rhythms have been demonstrated; a predominant rhythm with a frequency between 6-9 c/m (0·1-0·15 Hz) and a less frequently observed rhythm with a frequency of approximately 3 c/m (0·05 Hz) (Taylor *et al.*, 1974). In patients with the irritable colon syndrome, how-ever, there appears to be an increased incidence of this 3 c/m rhythm (Snape *et al.*, 1977), although it is not yet known how specific this abnormality is to the irritable colon syndrome. The purpose of this study was to establish whether this myoelectrical disorder is related to altered bowel habit alone or whether it is truly specific to the irritable colon syndrome.

Methods

Ten patients referred with the irritable colon syndrome and 10 patients suffering from pain and altered habit due to a variety of other causes were studied (Table). All patients in the irritable colon syndrome group had a history of abdominal pain and a disturbance of bowel habit for more than one year. The pain was variable but most frequently in the left iliac fossa. The disturbance of bowel habit consisted of frequent loose motions (between four to 15 per day) or constipation usually with the passage of small 'pellety' motions. All the patients had been extensively investigated and organic disease excluded.

The patients in both groups were studied during symptomatic phases. The patient in the irritable colon syndrome group who regularly alternated between severe diarrhoea and constipation was

Table   *Age and disease distribution*

Non-ICS group	ICS group
Diverticular disease (2)	Pain with predominant (4) constipation
Ulcerative colitis (2)	Pain with predominant (5) diarrhoea
Chronic pancreatitis (1)	Pain with alternating (1) diarrhoea and constipation
Post-vagotomy diarrhoea (2)	
Chronic constipation (1)	
(Adult Hirschprungs disease)	
Coeliac disease (1)	
Anxiety state (1)	
Mean age 37·8 ± 3·7 (±1 SEM) (5F 5M)	Mean age 38·8 ± 3·7 (8F 2M)

studied during a period when constipation was the predominant symptom.

The following assessments were made in each patient:

1. *Symptom score*   Using a standard questionnaire, each patient was allocated a score for pain, diarrhoea, and constipation. The score ranged between 0 when the patient was symptom free for the specific symptom to a maximum symptom score of 5.

2. *Stool weight*   This was calculated as the mean weight (in g per day) over a five-day collection period.

3. *Transit time*   This was calculated using Hinton's method (Hinton *et al.*, 1969). Twenty radioopaque pellets were taken by the patient and the transit time calculated as the time taken for 80% of the pellets to pass as measured by radiography of the faeces.

4. *Percentage motility*   This was measured using thin, open-ended tubes as previously described (Taylor *et al.*, 1974). The percentage motility was calculated as the percentage of total recording time that intraluminal pressure waves were present.

5. *Electrical activity*   This was measured by means of an intraluminal suction electrode as previously described (Taylor *et al.*, 1974). The recordings were obtained from the rectosigmoid region between 12-18 cm from the anus. The electrical signals were amplified (frequency response 0·02 Hz to 1 Hz) and displayed on a chart recorder. The pressure and electrical recordings were carried out at the same time of the day in each patient, some two hours after lunch. No specific bowel preparation was given. The recordings were continuously monitored on a chart recorder for one hour. A pneumogram was also included to recognise any artefact caused by respiration. The recordings were analysed visually by counting the number of electrical slow waves in each minute of recording on the chart recorder (one minute markers). Particular note was made of the following parameters:

1. *Percentage motility*   This was the proportion of total recording time that intraluminal pressure waves were present.

2. *Percentage incidence of 3 c/m slow wave activity*   This was calculated as the proportion of the electrical recording during which regular 3 c/m electrical activity was visually recognised.

The values are presented as the mean ± 1 standard error of the mean (SEM).

Results

The two groups of patients were matched for age (Table). The symptom scores for constipation and diarrhoea were similar in the two groups, although the pain score in patients with the irritable colon syndrome tended to be higher.

STOOL WEIGHT AND TRANSIT TIME
There was no statistically significant difference in the stool weight per day and transit time between the two groups (Fig. 1). In each group three patients
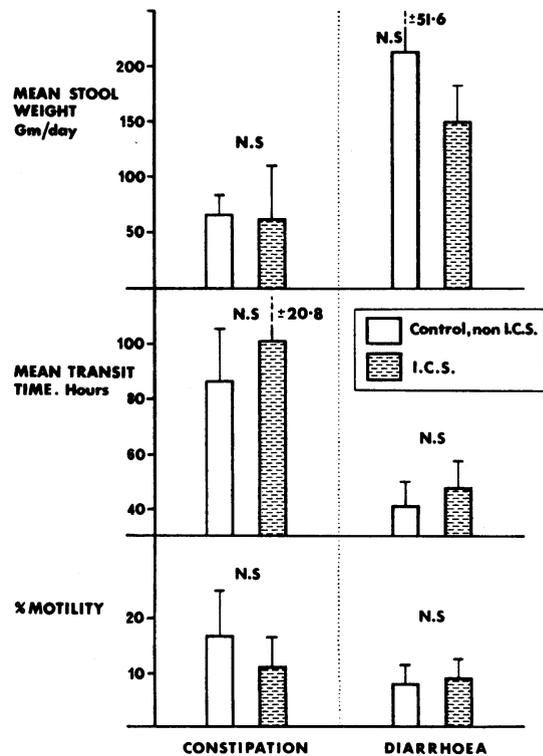

Fig. 1   *The mean stool weight, transit time, and percentage motility in the irritable colon group and the non-ICS groups of patients. Note that there was no statistically significant difference in these values for both constipation and diarrhoea in the two groups.*

had a grossly delayed and three a very rapid transit time. In the irritable colon syndrome (ICS) group the mean stool weight for the patients with diarrhoea and constipation was 151 ± 21.8 and 64.5 ± 26.4 g/day respectively. In the non-ICS group the values were 214 ± 51.6 and 68.0 ± 5.7 g/day. The mean transit time in patients with constipation was 87.0 ± 16.5 h in the non-ICS group and 103.8 ± 20.8 h in the irritable colon syndrome group, whereas in patients with diarrhoea it was 40.1 ± 6.7 h in the non-ICS and 47.3 ± 9.3 h in the irritable colon syndrome group.

PERCENTAGE MOTILITY (Fig. 1)
There was a higher percentage motility in both groups in those patients who presented with constipation ($17.2 \pm 7.9\%$ in the non-ICS and 11.5 ± 5.5 in the irritable colon syndrome group) rather than with diarrhoea ($8.6 \pm 3.0\%$ in the non-ICS and $9.1 \pm 2.0\%$ in the irritable colon syndrome group). However, there was no statistically significant difference in overall percentage motility in the two groups.

ELECTRICAL ACTIVITY
The number of slow waves with a frequency of 3 c/m observed during each recording were counted and expressed as a percentage of total recording time (Fig. 2). In the irritable colon syndrome group the

3 c/m rhythm had an incidence of $43.9\% \pm 15.8$ in the patients with predominant constipation and $51.1\% \pm 4.7$ in the patients with predominant diarrhoea. This does not represent a statistically significant difference for symptoms. These values were statistically significantly higher than the corresponding values for either constipation ($13.2\% \pm 6.8$) or diarrhoea ($9.2\% \pm 3.7$) in the non-ICS group (Fig. 3).

The proportion of 3 c/m electrical waves which had corresponding 3/min pressure waves were also calculated in the two groups. In patients with the irritable colon syndrome this relationship was found for $42.8\% \pm 8.3$ of electrical waves, whereas in the non-ICS group it was not observed for regular periods of time.

Discussion

The irritable colon syndrome is a disorder of colonic motility but measurements of intraluminal pressure changes alone are not sufficiently specific to be of diagnostic value. Although some barium enema changes have been described in this syndrome (Lumsden *et al.*, 1963) a more acurate diagnostic aid is needed rather than relying simply on exclusion of all other diseases. Recently, a good deal of interest has centred on the myoelectrical changes in colonic smooth muscle both in the normal (Taylor
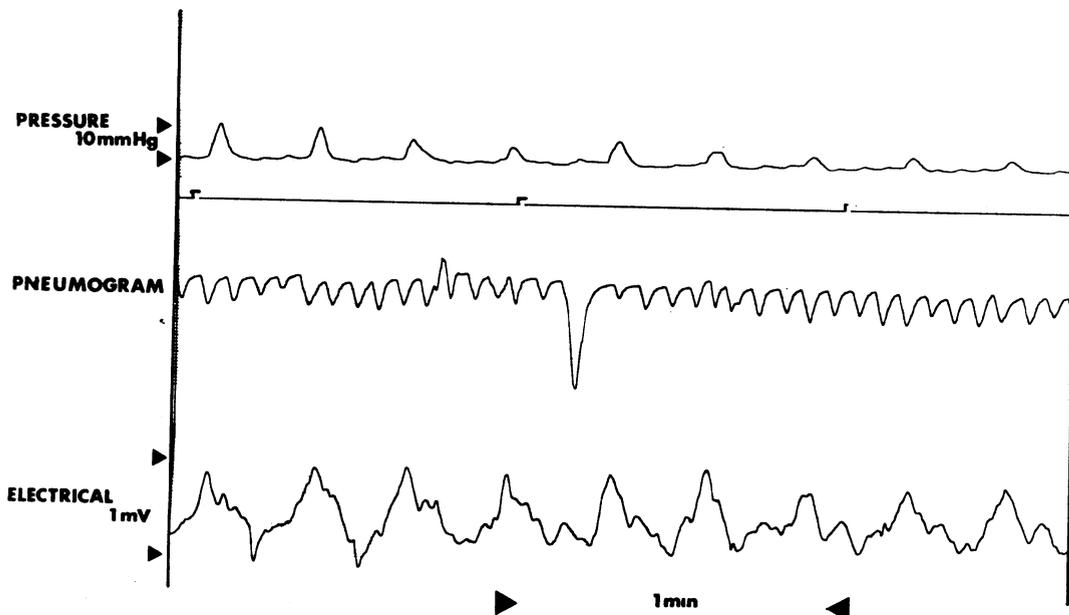

Fig. 2 *Electrical and pressure recordings from the rectosigmoid in a patient with the irritable colon syndrome. The top trace shows a 3/min pressure activity, corresponding with 3 c/m electrical activity (bottom trace). A pneumogram is included. The 3 c/m electrical activity is the predominant slow wave rhythm.*
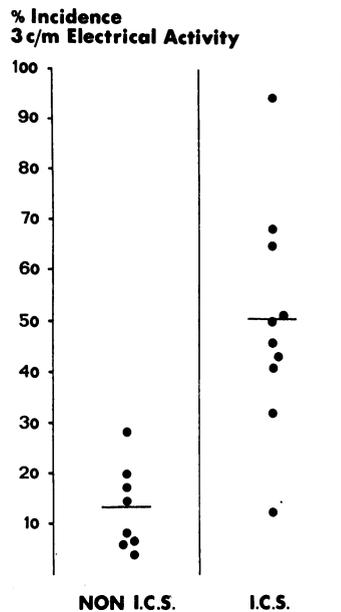
% Incidence
3 c/m Electrical Activity

Fig. 3 *The percentage incidence of 3 c/m electrical activity in each patient in the non-ICS (mean 13·7 ± 2·7) and irritable colon syndrome group (mean 50·5 ± 7·1). Two patients in the non-ICS group are excluded since no 3 c/m electrical activity was observed on the recording.*

et al., 1975b) and the pathological colon (Taylor and Duthie, 1976). One interesting observation is the high incidence of the 3 c/m slow wave electrical rhythm in the rectosigmoid of patients suffering from the irritable colon syndrome. Normally, when estimated visually, this rhythm is present for approximately 15% of the recording time, although its incidence can be increased by pentagastrin (Taylor *et al.*, 1974) and diminished by glucagon (Taylor *et al.*, 1975a). Hence, this electrical rhythm appears to be sensitive to the hormonal environment and it is interesting that patients with the irritable colon syndrome frequently have increased symptoms after eating (Connell *et al.*, 1965) and after administration of cholecystokinin (Harvey and Read, 1973). The incidence of 3 c/m electrical activity was similar in the group of patients with assorted bowel pathology (non-ICS group) to that previously reported in normal subjects.

The 3 c/m electrical waves are also frequently associated with pressure waves in a 1:1 ratio. It is known that these pressure waves are segmental in origin and hence non-propulsive and may correspond to the increased haustral (or segmental) pattern recognised on barium enema in patients with the irritable colon syndrome (Lumsden

et al., 1963). We are unable to explain the lack of regular runs of 3/min pressure waves in the non-ICS group in this study, as it is known that in normal subjects this pressure pattern constitutes a significant proportion of total percentage motility.

In this study an attempt was made to establish the specificity of the 3 c/m rhythm in the irritable colon syndrome. Theoretically, this rhythm could be an empirical one associated with an altered bowel habit (either diarrhoea or constipation) and not specifically to the irritable colon syndrome. However, when patients with a miscellaneous collection of disorders resulting in altered bowel habit are matched for age, symptoms, transit time, stool weight, and percentage motility with patients suffering from the irritable colon syndrome a statistically significant increase in 3 c/m electrical activity was found in the irritable colon group. Also there appeared to be a significantly higher proportion of electrical waves associated with 3/min pressure waves. It may be that in the irritable colon syndrome the amplitude of the slower electrical waves is greater with less superimposition of faster electrical waves, making them more obvious on visual analysis. We are at present looking into this possibility, utilising an automatic spectrum analyser (Darby *et al.*, 1977) to enable a completely objective analysis of the date to be carried out. Nevertheless, the high incidence of 3 c/m electrical activity appears to be specific to this condition and its measurements may help in understanding the pathophysiology of this condition and possibly as an aid to diagnosis.

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