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MEGARECTUM: PHYSIOLOGICAL OBSERVATIONS*

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The investigation of these children whose condition is often called 'megacolon' or 'colonic inertia' suggests to us that the important changes seem to be in the rectum, which merits consideration as a specific organ. It is surprising how normal the proximal colon remains and how well it packs the faeces into the accommodating rectum (Fig. 1) which after some years may reach up to the ribs. 'Dolichocolon' may also be largely a matter of radiological technique. Fig. 2 shows such an appearance, and Fig. 3 shows the effect of tannic acid in the barium enema. The colon empties effectively leaving only a residuum in the rectum.

Several organic and functional factors can initiate the syndrome we prefer to call megarectum. It presents clinically as gross constipation with eventual overflow incontinence and only leads to serious ill health if neglected for many years. The clinical picture and treatment have been discussed elsewhere (Nixon 1961a, b), and here it will suffice to reiterate the need for prolonged management and the need for training to a regular bowel habit. None of the cases discussed here had frank organic lesions such as anal stenosis or sacral nerve deficit.

One of us (R.P.C.) has made investigations of the pathophysiology; these support the concept of a rectum so enlarged that a normal bolus does not cause a sensory stimulus; therefore there is the need to teach defaecation as a habit to be performed regularly with voluntary efforts.

Barium enemas and sensation tests carried out some years ago (H.H.N.) by the method of Goligher and Hughes (1951) showed that treatment could reduce the size of the rectum and re-establish a normal sensory response. But recent cineradiography (Dr. Siddaway) has shown that in some clinically cured cases the rectum remains inert and is apparently emptied by the extrinsic force of raised intra-abdominal pressure on straining.

The present observations have also shown that a stage of enlargement may be reached at which distension causes relaxation of the external sphincter before any sensation is felt, a situation clearly conducive to soiling. Porter (1961, 1962) has reported similar findings in adults.

Investigations and Method

A distending balloon both produces the rectal stimulus and records the response of the rectal walls. An electrode in the striated muscle sphincter simultaneously records its responses throughout on the same paper. A tandem system of miniature balloons is used separately to determine whether expulsive waves produced in the sigmoid colon progress through the rectum.

The method as described is only suitable for children old enough to co-operate. The rectum is distended by injecting 50 ml. volumes of air through portex tubing (0·125 in. (0·32 cm.) internal diameter) into a rubber balloon that is capable of being expanded to 900-1,000 ml. without any significant rise in pressure. A Statham type pressure transducer (Solartron NT4/313 gauge 0-10 p.s.i.) is connected through a T-junction into the system. It records the distending pressure and the response of the rectal wall to this force. The balloon is placed in the rectal ampulla through a proctoscope.

A tandem system of miniature balloons (10 mm. long by 3 mm. diameter) connected by nylon tubing (0·024 in. (0·6 mm.) internal diameter) to Statham type transducers is used to record the pressure changes in the lumen of the bowel. These may be expulsive waves produced by the intraluminal injection of 10-20 ml. of 10% tannic acid solution or resting motility patterns.

A fine concentric needle electrode is inserted into the external sphincter or the pubo rectalis as required, guided by a finger in the anal canal. Leads are taken to an E.M.G. amplifier whose output feeds two channels: one feeds a cathode ray oscilloscope showing the E.M.G. wave form (to record this a paper speed of 25 in. (65·3 cm.)/sec. would be necessary); the other is fed through a wave transformer to give recordings suitable for the slow paper speed of 4 cm./min. at which the pressure waves are traced. It is the presence and amount of activity rather than individual muscle action potentials that are of interest here.

These records are made on a Rapidgraph multichannel recorder (see Fig. 5).

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FIG. 1.—Typical barium enema in rectal inertia. Megarectum extends down to anal canal and the colon above is virtually normal.

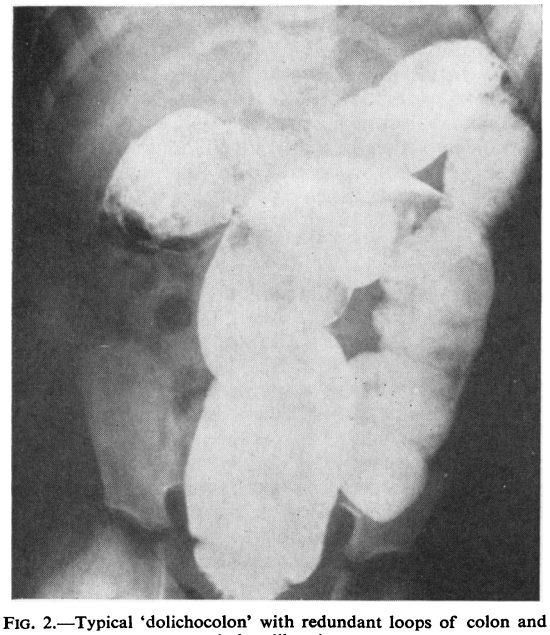

FIG. 2.—Typical 'dolichocolon' with redundant loops of colon and tubular dilatation.

Results

Normal Responses. The previous findings of Gaston (1948), Goligher and Hughes (1951) and Porter (1962) have been confirmed and the normal values established for the smaller rectum of children of different age-groups (Schapiro, 1948).

The following responses to rectal distension are noted.

(1) Initially the rectal wall resists the distending volume and then accommodates to accept it at a higher resting pressure.

(2) The striated muscle sphincter (which unlike other striated muscle shows electrical activity even 'at rest') increases its activity as the rectal pressure rises and then returns to normal as the rectum accommodates.

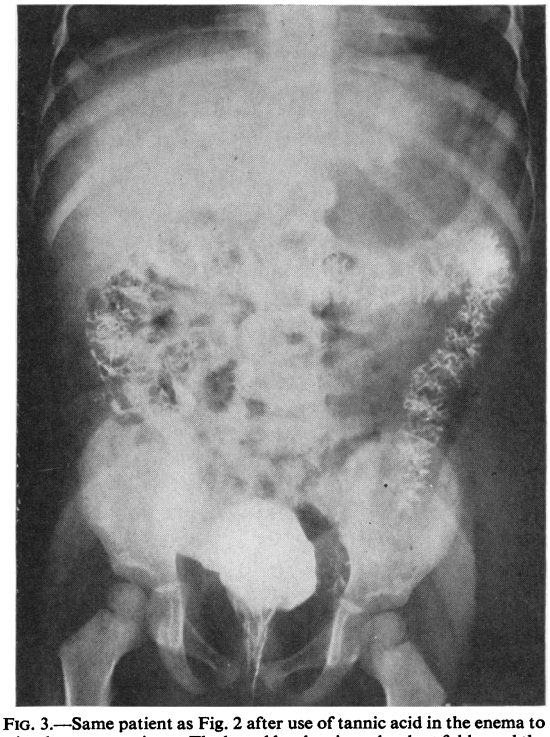

FIG. 3.—Same patient as Fig. 2 after use of tannic acid in the enema to stimulate contraction. The bowel has lost its redundant folds, and the only significant residue is in the rectum.

(3) The smooth muscle sphincter relaxes and then returns to a level of tone just below the resting level. In Hirschsprung's disease this sphincter does not show this response. However, the function of this part of the sphincter was not recorded in the following investigations.

Progressive distension produces the following:

(1) A progressive rise in rectal pressure and a subjective awareness of a full rectum.

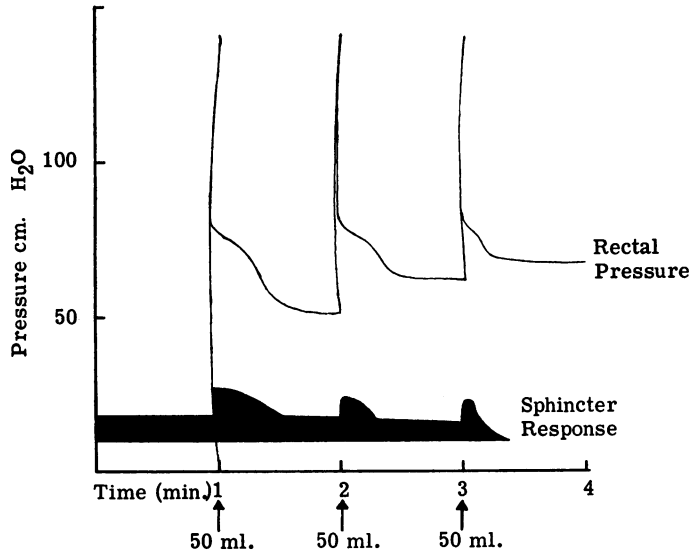

FIG. 4.—Diagram of type of response to progressive distension of rectum; basal pressure rises and external sphincter responses diminish with eventual inhibition.

(2) A progressive *diminution* in the amount of activity induced in the striated muscle sphincter by each increment until complete inhibition occurs (Fig. 4).

(3) A progressive fall in activity of the smooth muscle of the internal sphincter.

Accommodation to increments in the stimulating balloon takes about one minute. The accommodated pressure can be plotted against volume and a gradient obtained. A rise in pressure of 7 to 10 cm. water was obtained for each 50 ml. increment in four normal subjects. Two points can be fixed on this line: (i) The pressure at which continuous rectal sensation occurs (subjective); (ii) The pressure at which inhibition of the striated muscle sphincter occurs (objective). This is between 60-75 cm. water with a volume of 100-150 ml. in a child of 5-11 years. It is always preceded by the rectal sensation (Table 1).

TABLE 1

	Cases				
	1	2	3	4	5
Inhibition pressure (cm. H_2O) ..	64	60	68	60	60
Inhibition volume (ml.)	150	150	150	150	100

N.B. Reflex inhibition of the sphincter muscle may be overcome by voluntary contraction of the pelvic floor if the child is restless.

Relief of rectal distension, i.e. in this experiment, emptying the balloon, produces a sustained burst of activity in the striated muscle sphincter (Porter's 'closing reflex').

Findings in Megarectum. Three groups could be recognized apparently related to increasing clinical severity and length of history.

(a) *The Enlarged Rectum.* The threshold for inhibition was raised, and a larger volume and higher pressure were needed to produce otherwise normal responses (Table 2).

(b) *The Expanded Rectum.* These required a loading volume before any rise in rectal pressure occurred. The reflex responses were present but were usually diminished and the pressure/volume gradient was frequently low (Table 3).

(c) *The Inert Rectum.* All these had a low pressure /volume gradient (less than 5 cm. water/50 ml. increment) and had altered responses. Sphincteric inhibition occurred before rectal sensation arose, a

TABLE 2

	Cases			
	1	2	3	4
Inhibition pressure (ml.) ..	76	84	86	76
Inhibition volume (ml.) ..	250	350	250	350

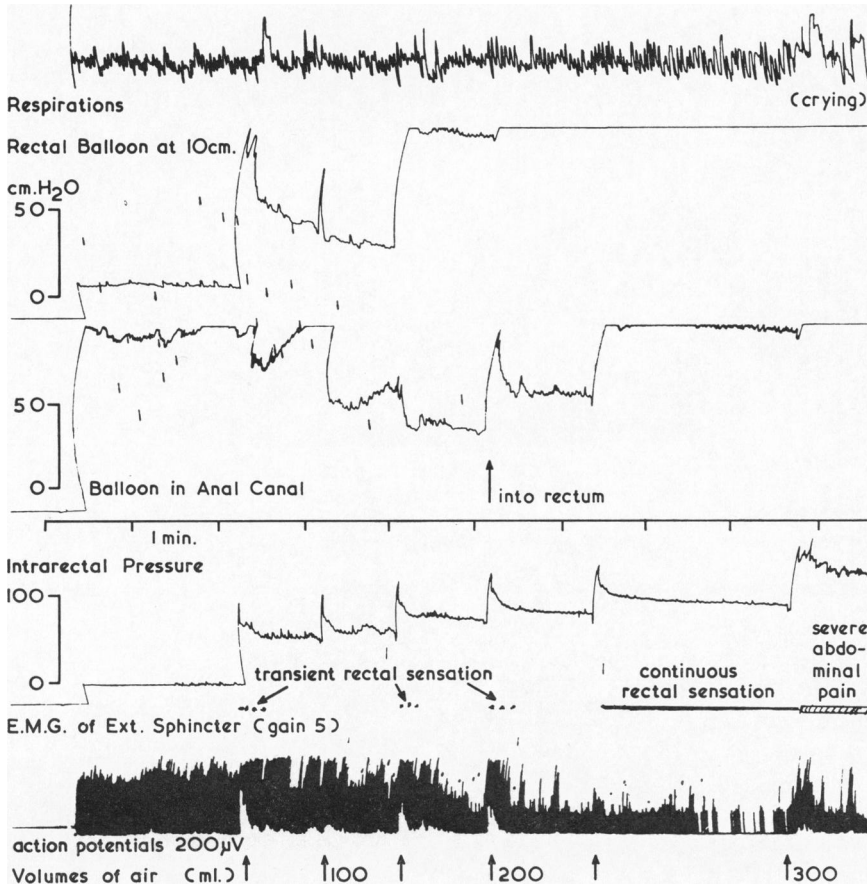

FIG. 5.—Tracing obtained from one of these patients. It demonstrates the progressive rise of intrarectal pressure and diminution of activity in the external sphincter, and between these two records are marked in the child's statement of the presence of rectal sensation. Discomfort caused crying and demonstrates at the far right hand side of the graph how this voluntary activity produces a return in sphincter activity and raised pressure (the record of the two further balloons in rectum and anal canal are not relevant to this investigation but demonstrate the kind of tracing obtained).

situation clearly conducive to soiling. In many no record could be obtained of expulsive waves progressing from the sigmoid to the rectum.

Comments

Some of the cases attended a surgical clinic (H.H.N.) (though almost all were managed without operation) and others a psychiatric clinic (Dr. I. Berg). A larger proportion of those attending the surgical clinic showed the more severe disturbances of physiology, but the findings were otherwise similar (Table 4).

TABLE 3

Loading Volume (ml.)	No. of Cases
100	3
150	5
200	2
'Loaded' with faeces	3

TABLE 4

Rectum	Cases Attending Clinics	
	Surgical (age 5-11 yrs.)	Psychiatric (age 3-12 yrs.)
Inert	6	5
Expanded	4	9
Enlarged	1	3
Normal	1	5
Total	12	22

Of the 11 cases of inert rectum all were over 8 years of age except one of 6 years and one of 4 years, in both of whom severe symptoms had been present from the early months of life. It seems that the duration of overloading is important in producing this condition.

Summary

Pathophysiological investigations of children with the megarectum syndrome are reported. Disordered responses are discussed and the possibility of clinical 'cure' without a return to normal physiology is noted.

Our thanks are due to the Research Committee of the Hospital for a grant for apparatus and to enable one of us (R.P.C.) to undertake the investigations. We are also grateful to our colleagues Dr. I. Berg and Dr. M. Siddaway for their co-operation and to the Department of Medical Illustration for the illustrations.

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