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Papers

Clinical Application of Anorectal Physiology

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Physiological investigation of the anorectal region by pelvic floor electromyography and intraluminal pressure changes can be of importance in the assessment of a number of clinical situations. Electrical activity is routinely determined by inserting a fine concentric needle electrode into the puborectalis and the subcutaneous sphincter, posteriorly through the perianal skin without local anæsthesia. Pressure changes are recorded along fine, perfused, open-ended catheters from the rectum and anal canal and displayed on light-sensitive paper.

The anal canal at rest, with its supporting voluntary sphincters, is very much a dynamic structure. Floyd & Walls (1953) first demonstrated continuous tonic activity in the pelvic floor muscles, and Parks *et al.* (1962) showed this tone to be constantly fluctuating to balance postural changes. The pressure recorded from the anal canal at rest is mainly the result of internal sphincter activity (Gowers 1877) and it must be emphasized that from the functional point of view the internal and the external sphincter can act quite independently of each other, despite the fact that they are arranged anatomically as 'a tube within a tube'.

Anal Incontinence

It is important that clinicians agree as to what they mean when discussing incontinence, as differences in terminology can lead to confusion and sometimes the wrong treatment. Incontinence can be divided into three distinct groups:

True incontinence is the passage of fæces per annum either without the patient's knowledge (i.e. sensory deficit), or without adequate voluntary contraction (i.e. mechanical deficit), or both.

Partial incontinence is the passage of flatus or mucus per annum either without the patient's knowledge (i.e. sensory deficit), or without adequate voluntary contraction (i.e. mechanical deficit), or both.

'Overflow' incontinence is the result of distension of the rectum, with reflex relaxation of the anal sphincters, as occurs for instance with simple fæcal impaction, when mucus and liquid fæces leak past solid impacted fæces.

In most cases true incontinence implies impairment of both internal and external sphincters.

A maximal contraction effort from a 65-year-old patient with true incontinence revealed practically no increase in the activity of the puborectalis; but, whereas the subcutaneous sphincter exhibited a good excitatory response, the muscle fatigued after 30 seconds, instead of 1 minute as is

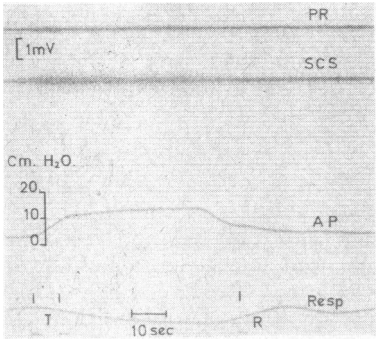

Fig 1 *A maximal contraction effort (T-R) in a patient with true incontinence. PR – puborectalis, SCS – subcutaneous sphincter, AP – anal pressure*

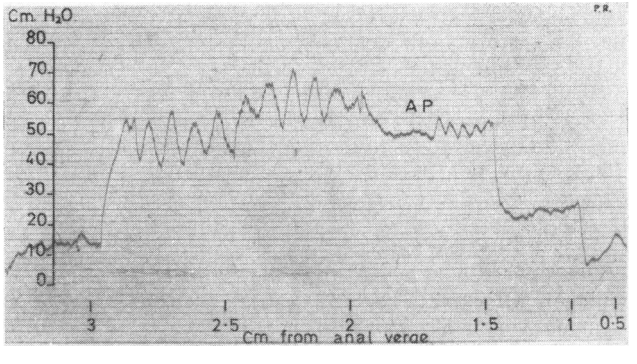

Fig 2 *A patient with partial incontinence showing reduced anal canal pressure (AP) in the distal 1.5 cm*

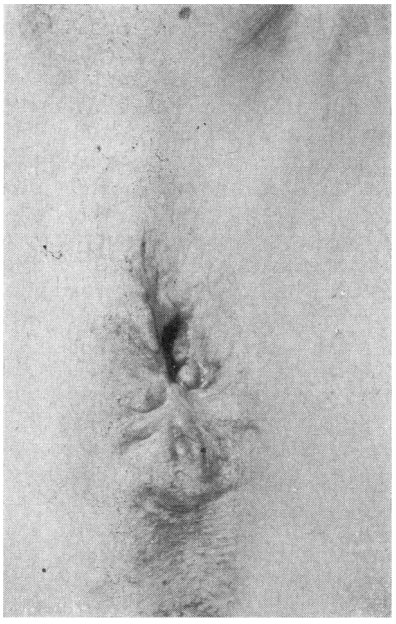

Fig 3 *A patient with true incontinence following a pull through operation for anal atresia. The rectal opening is sited anterior to the sphincters and to the left of the midline*

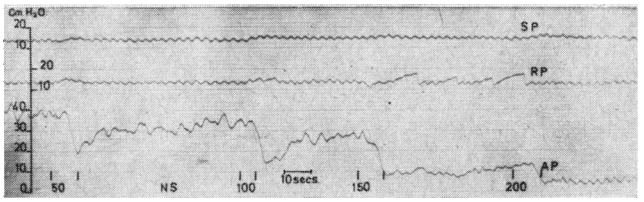

Fig 4 *The normal sequence of events on serially inflating a rectal balloon with 50 ml of air. SP – sigmoid pressure, RP – rectal pressure, AP – anal pressure, NS – normal sensation*

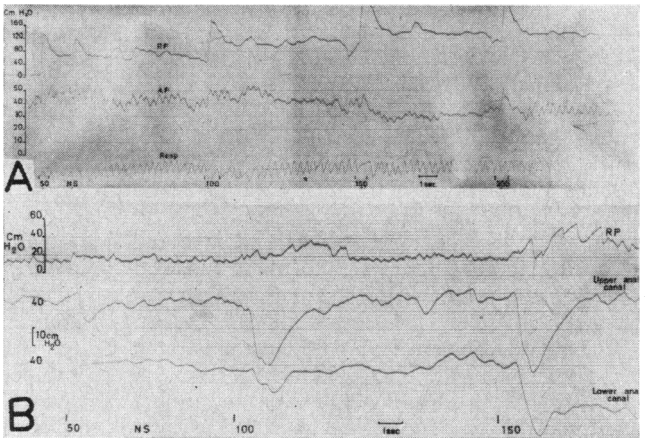

Fig 5A, *Hirschsprung's disease is characterized by the absence of the rectosphincteric reflex. RP – rectal pressure, AP – anal pressure, NS – normal sensation.* B, *internal sphincter dysfunction. Compare baseline pressures with Fig 4. RP – rectal pressure, NS – normal sensation*

normal (Fig 1). The maximum normal resting anal canal pressure is from 70 to 100 cmH_2O, employing the recording system described above, and this can be doubled during a contraction effort. In this patient the resting pressure was negligible, denoting an incompetent internal sphincter.

In partial incontinence it is the internal sphincter that is at fault. For example, in Fig 2 the distal 1.5 cm supports a much reduced pressure, which has effectively shortened the functioning anal canal. This patient had an anal stretch 4 months previously and recovered her internal sphincter tone within 6 months of the procedure. None of the 9 similar patients so examined by the author has required any specific treatment.

Electromyographic exploration of the perineum is useful in determining the presence of muscle in patients with congenital abnormalities or who are incontinent after attempted correction. A 17-year-old boy who had a pull-through operation for anal atresia as a baby and has been truly incontinent ever since, has the rectal opening too far anteriorly and to the left of the midline (Fig 3). It was possible to palpate a mass of tissue posterior to the opening which could be seen to contract when the overlying skin was pricked with a pin. Electrode exploration confirmed that this mass was functioning muscle to a depth of 2 cm. No activity could be elicited elsewhere around the rectal opening. It was therefore apparent that when the rectum was pulled down at the time of his operation it did not pass through the sphincters and explains his true incontinence. He had a successful sphincteroplasty.

Constipation

Of the many causes of constipation it is intended only to discuss those due to local functional disorders of the anorectum. Gowers (1877) was the first to notice that temporary relaxation of the internal sphincter followed rectal distension. Many workers have since confirmed this finding but as yet no mechanism has been established to explain this rectosphincteric reflex. In a normal patient each addition of 50 ml of air into a rectal

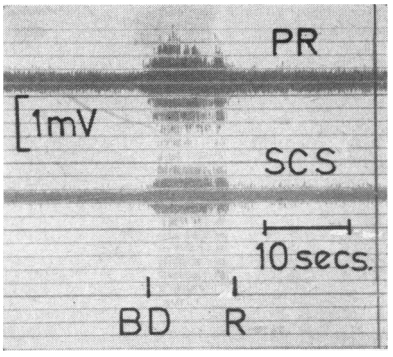

Fig 6 *Overactivity on bearing down (BD). PR – puborectalis, SCS – subcutaneous sphincter*

balloon results in a fall in anal canal pressure, which returns, after a few seconds, to a lower baseline than before, until, finally, atmospheric pressure is reached after approximately 200 ml of air (Fig 4). The rectal pressure has altered little throughout the period of balloon inflation reflecting the normal capacity of the rectum to accommodate to an increasing volume of content.

Callaghan & Nixon (1964) first demonstrated the absence of the rectosphincteric reflex in patients with Hirschsprung's disease, and in fact small contraction waves often result in a slight increase of pressure during each inflation (Fig 5A). The rectal pressure rises steeply after each inflation reflecting the lack of accommodation in the aganglionic segment. Hirschsprung's disease is the only condition in which this reflex does not occur and this was confirmed in 12 patients examined by the author.

Dysfunction of the internal sphincter may produce long-term constipation and clinically mimic Hirschsprung's disease. Although the rectosphincteric reflex is present, the pressure returns to the initial baseline after 1–2 seconds (Fig 5B). The pressure in the distal anal canal has fallen after rectal distension with 150 ml of air, but there was no alteration in baseline pressure from the proximal anal canal.

It is possible that the reason these patients are constipated is because the internal sphincter fails to relax long enough to allow rectal contents to pass into, and through, the anal canal. Internal sphincter dysfunction should always be suspected in patients with severe, long-term constipation and in whom Hirschsprung's disease and other disorders have been excluded. This condition has been little recognized in the past and the logical aim of treatment would be to overcome the internal sphincter resistance by either dilatation or internal sphincterotomy. To date insufficient patients have been seen to offer any definite guide-lines.

Solitary Ulcer Syndrome

Rutter (1974) reported characteristic electromyographic findings in patients with solitary ulcers. He noted that instead of the puborectalis becoming inhibited during a bearing down effort, there was considerable overactivity (Fig 6). This he postulated as being a major predisposing factor in the development of this condition, whereby the anterior rectal wall is repeatedly and forcefully thrust down on to a solid bar of muscle, resulting in mucosal trauma and ulceration. The symptoms of straining at stool for maybe up to one hour at a time and repeated several times during the day, tenesmus, perineal pain, backache, rectal bleeding and mucus discharge were seen in varying degrees in all of the 12 patients examined by the author. Electromyographic exploration confirmed Rutter's findings in 11 out of the 12 patients.

Treatment is aimed at breaking the vicious circle whereby a feeling of rectal fullness results in attempted defæcation against the contracting puborectalis producing œdema of the anorectal wall and a further feeling of rectal fullness. If patients can be persuaded to stop straining the ulcer will heal, otherwise their symptoms will continue and eventually the puborectalis will give way and result in perineal descent, a not uncommon finding in rectal clinics. The anterior rectal wall is not now being thrust down on to a solid bar of muscle and so the ulcer heals. The site of the previous ulcer often corresponds to an anterior mucosal prolapse which is frequently seen in patients with a descending perineum (Parks *et al.* 1966) and it is interesting that the histology of the solitary ulcer and prolapsed rectal mucosa is identical. This progression of events helps to explain why the solitary ulcer syndrome is rare over the age of 50, but rectal prolapse of varying degrees is commonly seen.

Summary

Electromyographic and manometric study of the anorectal region is playing an increasing part in the diagnosis and management of a number of functional anorectal disorders. There are still many unsolved problems in this field, but with the rapid advances in medical electronics and clinical measurement, the coming years should see many of these questions answered.

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