Clinical, radiological and physiological assessment of anorectal function

Heman Joshi

Oliver Jones

Abstract

Faecal continence is defined by the ability to perceive, retain and evacuate bowel contents at socially convenient times. It may be associated with urgency, occur as a passive event, or be mixed. This is reliant upon normal function of the main involved organs (i.e. rectum, pelvic floor and anal sphincters) together with their associated sensorineural pathways. Incontinence may occur as a result of dysfunction in any one of these systems or due to factors such as systemic disease, emotion, bowel motility and stool consistency. The act of defaecation is a conscious process that involves interplay between motor and sensory elements, initiated by higher cortical function.

Incontinence and evacuatory dysfunction are investigated using specialized tests that assess sphincter function and structure (anorectal manometry, endoanal ultrasound), anorectal and pelvic floor function (defaecating proctography, nerve conduction studies) and luminal integrity and colonic function (transit studies and endoscopy).

Keywords Anal sphincter; anorectal investigations; continence; defaecation; pelvic floor; rectum

Introduction

Faecal incontinence is defined as the involuntary loss of faecal material. It is common, with a prevalence in the community estimated at 1.4% and rising to 7% in the elderly.[1,2] Constipation and related functional bowel disorders have been formally defined by the Rome III collaboration.[3] They affect up to 25% of the population and comprise a symptom complex associated with infrequent defaecation, hard stools, difficulty in emptying, straining and a feeling of incomplete evacuation.[4]

Maintenance of continence is a complex process that involves coordination between multiple neuronal reflexes, sensory and motor pathways, and the key pelvic organs, namely the rectum, pelvic floor and anal sphincters.[5,6] An abnormality of any part of the pathway can be associated with dysfunctional defaecation, manifesting as constipation at one end of the scale, or as faecal incontinence at the other. However, a mixed picture, associated with obstructive defaecation syndrome, is a not uncommon presentation.

Heman Joshi *BSc MRCS(Eng) is a Research Fellow in Pelvic Floor Surgery at Oxford University Hospitals Trust, Oxford, UK. Conflicts of interest: none declared.*

Oliver Jones *DM FRCS is a Consultant Surgeon at Oxford University Hospitals Trust, Oxford, UK. Conflicts of interest: none declared.*

Several techniques are available that allow assessment of the anatomy and physiological function of the key parts of the pathway. The most important initial step in assessment involves a detailed history (including obstetric history and previous proctological surgery) and physical examination.

Clinical assessment

General physical and abdominal examination is important. Assessment of fitness may be a major determinant of how far to pursue investigations and treatment, particularly surgical interventions. Patients with obesity and diabetes are more prone to pelvic floor problems but also the complications of intervention. Optimization of underlying medical problems should be encouraged. In extreme obesity correction of this may be more important than any efforts directed to the pelvic floor, even if considering surgery for obesity.

In the UK it is traditional to examine patients in the left lateral position to assess the perineum and anorectum. The limitation of this assessment is that inspection of the vaginal introitus is compromised and the consequences of gravity are less obvious, even allowing for straining and bearing down. For this reason, examination with the aid of the gynaecological couch has much to advocate it and is routine in many parts of Europe. The traditional all-fours approach in the USA gives good access for anal procedures in the clinic but is less helpful at assessing prolapse.

Careful inspection of the perineum will identify obvious scarring and deformity as a result of previous surgery or parturition. Morphology of the perineum has been described by Nivatongs and it may be useful to record this.[7,8] The anus may be gaping from obstetric injury or pelvic neuropathy or tight with evidence of spasm or a bulky internal sphincter. The presence of soiling, excoriation, tags, and piles is relevant. It is essential to include a dynamic component to the examination, asking the patient to bear and push down. Here we observe the nature of movement and if it appears coordinated and appropriate. Understandably many patients are reluctant to unleash the full effort in doing this for fear of incontinence and it can be worth repeating at the end of the examination as the individual becomes relaxed. The amount of perineal descent should be noted as well as the presence of vaginal prolapse.

Palpation around the anus will give the impression of sphincter bulk, spasm and signs of obstetric or surgical trauma. Digital rectal examination is undertaken gently and it is valuable to ask the patient to bear down again, squeeze and relax. An impression of paradoxical contraction of the puborectalis muscle may also be detected. Digital examination allows assessment of: the sphincter bulk; any evidence of previous damage to and the quality of the perineal body and posterior vaginal wall; and any rectocele. With the finger above the sphincter mechanism it is again useful to ask the patient to bear down and in this position one may become aware of a poorly supported anterior rectal wall and the presence of internal rectal prolapse as the descending intussusceptions strikes the examining finger. A bulky retroverted fibroid uterus may also be felt to intrude significantly into the rectum at this level.

Inspection and digital rectal examination are followed by inspection using rigid sigmoidoscope, excluding mucosal disease

and occasionally allowing assessment of a high take-off rectal intussusceptions; however the return in pelvic assessment is limited. A short proctoscope is valuable in assessment of piles and mucosal prolapse particularly with the patient straining. A good impression of full-thickness internal prolapse can also be obtained as the proctoscope is delivered through the anus.[8]

Physiology of continence

Internal and external anal sphincters

The internal anal sphincter demonstrates sinusoidal 'slow-wave' activity with a frequency of 20–40 cycles/minute and is the main contributor to resting anal pressure, measured at between 50 and 120 mmHg in a healthy individual. Much of this resting pressure is attributable to myogenic tone, an intrinsic property of sphincteric smooth muscle independent of neural input. Additional excitatory input to the internal sphincter comes from sympathetic neural input, whilst parasympathetic nerves to the sphincter are inhibitory and mediated via nitric oxide.[9] Isolated damage to the internal anal sphincter typically causes predominantly passive faecal incontinence (leakage).

Whilst the external anal sphincter does make a small contribution to resting tone, its primary role is that of voluntary contraction of the anal sphincter which can be recruited consciously or as a reflex during times of additional risk of incontinence such as when lifting a heavy object or coughing (see below). A normal external sphincter may generate an additional pressure of between 50 and 200 mmHg. Damage to the external sphincter is strongly associated with urge faecal incontinence (the sensation of being unable to 'hold on').

Puborectalis and the pelvic floor

The puborectalis plays a key role in continence. It is thought to achieve this function due to its sling-like anatomy and its effect on the anorectal angle when it is contracted. Sir Alan Parks proposed a 'flap-valve' mechanism of continence – namely that in a situation of increased intra-abdominal pressure (e.g. sneezing, coughing or straining), the puborectalis keeps the valve shut by driving the anterior rectal wall against the upper anal canal, and thereby prevents the passage of stool into the lower anal canal.[10] Other authors have demonstrated in radiological studies that during the Valsalva manoeuvre, the relation between the anterior rectal wall and the anorectal angle is not clearly defined; some studies have shown little difference in the anorectal angle between incontinent patients and a normal control group.[11] It is likely that the puborectalis functions as a further deeper sphincter mechanism and complements the activity of the external anal sphincter. Indeed, it has been shown that the puborectalis sling can maintain continence even in the presence of internal and external sphincter dysfunction.[11]

Physiology of evacuation

An awareness of the need to defaecate occurs in the superior frontal gyrus and anterior cingulate gyrus of the cerebral cortex, as a result of a critical level of rectal filling. The process is initiated by faecal matter, which has moved into the lower rectum, causing distension. This leads to stimulation of pressure receptors on the pelvic floor (puborectalis), which in turn triggers the rectoanal inhibitory reflex.

The upper internal anal sphincter relaxes enabling anorectal sampling to occur. When the anal canal is deemed to have solid contents, and a decision to defaecate is made, relaxation of the pelvic floor occurs in conjunction with a rise in intra-abdominal pressure. The rise in intra-abdominal pressure occurs as a consequence of the Valsalva manoeuvre, in association with tensing of the anterior abdominal wall musculature and closure of the glottis. Optimal evacuation is achieved when the subject is in the squatting position which, assisted by hip flexion, further straightens the anorectal angle and allows more effective propulsion of faecal residue.[12] In the Western world, defaecation in the sitting position is socially preferred with reduced effect on the anorectal angle. The net result is relaxation of puborectalis, straightening of the anorectal angle and slight pelvic floor descent. The external anal sphincter relaxes and rectal contents are evacuated. Further propulsive contractions of the rectum occur until it is fully empty. Once evacuation is complete, the pelvic floor rises and both sphincters and puborectalis contract as part of a 'closing reflex'.

Electrophysiology

Neurophysiological assessment of the anorectum includes electromyography of the sphincter mechanism, and nerve conduction studies to assess the pudendal and spinal nerves.

Electromyography involves the placement of needle electrodes into the puborectalis or external sphincter to assess the state of the muscle and its innervating nerve as a function of its electrical activity during the resting and contractile phase. The procedure can be painful and unpleasant. Increasing adoption of endoanal ultrasound has meant that electromyography is rarely used.

Pudendal nerve terminal motor latency (PNTML) is assessed by stimulation of the nerve, as it enters the ischio-rectal fossa at the ischial spines. Prolonged PNTML is associated with idiopathic faecal incontinence, rectal prolapse, solitary rectal ulcer syndrome and sphincter defects.

The maintenance of anal continence is a very complex process dependent on several processes including colonic motility, stool consistency, sensation, rectal compliance, local reflexes, pelvic floor and sphincter function.

Colonic motility and stool consistency

Even patients with normal sphincters will suffer urgency or actual incontinence if they develop severe diarrhoea (as can occur with ulcerative colitis). It is little surprise, therefore, that in many patients with diarrhoea and incontinence, significant improvements in control will be seen with the use of constipating medications.[13]

Rectal sensation and compliance

The rectum plays a key role in continence, by functioning as a site for temporary storage of faeces. A normal rectum can accommodate significant volumes of faecal residue with minimal alteration in measured rectal pressures. This is termed rectal compliance. Recent animal studies have identified unique receptors, termed rectal intra-ganglionic laminar endings (rIGLEs), which act as slowly adapting mechanoreceptors responsive to tension and rapid distension.[14]

Rectal compliance is often altered in patients with faecal urgency, constipation and incontinence. Extreme alterations in