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Magnetic resonance imaging and the coloproctologist

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Abstract A personal view of the clinical importance and usage of magnetic resonance imaging (MRI) in coloproctology is presented. The real advantage of this modality lies in the assessment of complex recurrent perirectal sepsis. Recent research shows a potential value of dynamic surface MRI in patients with functional disorders of evacuation.

Key words Magnetic resonance • Anal fistulae • Rectal cancer • Perirectal sepsis • Imaging

Introduction

The advent of endoanal and endorectal ultrasonography during the 1980s substantially changed our understanding of the anatomy of the anal sphincters. Its relatively routine usage became part of the coloproctological armamentarium for the assessment of obstetric sphincter damage and changed our understanding of the natural history of this condition. Moreover, it became a mandatory pre-operative assessment of low rectal cancers whose rostral extent lay within reach of the probe, influencing the utilization of local therapies for cure, neo-adjuvant radiotherapy in particular for improvement in long-term outcome and chemo-radiotherapy for clinical disease down-staging.

More recently, magnetic resonance imaging (MRI) both as a surface tool and as an endoluminal tool has developed for specialized usage by the coloproctologist in the assessment of benign and malignant anorectal disease. It has received recent attention as a dynamic modality for the demonstration of specific disorders of the pelvic floor and rectal evacuation although its exact place in pelvic floor dysfunction needs to be determined.

This short review assesses the indications and pitfalls of the use of MRI technology in the delineation of anorectal disease and dysfunction.

Defining anorectal anatomy

The recent introduction of high-resolution endoluminal MRI appears to have largely settled many of the traditional disputes concerning the anatomy of the internal and external anal sphincters (IAS and EAS) in man. The confusing anatomical studies which divided the sphincter into one [1, 2] or two [3, 4] components have been replaced by the 3-component model of the EAS as part of the puborectalis complex with a variable constitutive amount of overlap of the end of the IAS [5, 6].

This has been confirmed by the coronal views provided by MRI technology (and recently by computer-aided 3-dimensional reconstruction of axial ultrasound images). Variability in main sphincter overlap may be present in different anorectal diseases, perhaps accounting for poor clinical results in those undergoing either internal anal sphincterotomy or anal...
dilatation. Postoperative passive leakage has been linked to those patients where there is a small component of subcutaneous external anal sphincter and where either deliberate or inadvertent IAS damage results in a distal anal canal which is relatively unsupported [7]. An example of a transverse T1-weighted endoanal MR image showing the normal anatomy commensurate with the images obtained using US is shown in Fig. 1. Although there is some work assessing the normal age and gender variations in IAS and EAS, there is still much longitudinal work in this area which needs to be done [8]. Moreover, endoluminal imaging has failed to adequately define the anatomy of the perineal body which is of great clinical importance in those patients presenting with post-obstetric faecal incontinence and low rectocele [9, 10]. It may well be that this is partly responsible for the current state of confusion concerning the true incidence of anterior EAS defects in the post-natal population which are likely to be functionally significant [11, 12].

This type of anatomical work through imaging may not be strictly comparable (i.e. US vs. MRI) since both modalities tend to identify the intersphincteric space differently and US appears less reliable in determination of the outer limit of the EAS complex. The delineation of the IAS with MRI, particularly using T1-weighted sequences, is somewhat dependent upon the the anatomical association of the muscle with the adjacent longitudinal muscle and its inherent fibroelastic content, both of which create the impression of a thicker IAS as detected by MRI than that shown ultrasonographically [13, 14].

![Fig. 1 A transverse T1-weighted endoanal MR image showing the high intensity signal of the internal anal sphincter (short arrow) and the lower intensity external anal sphincter (long arrow). This image is comparable to that shown by an axial endoanal US image.](image)

MRI has been recently used to define the anatomy in special patients before and after surgery to correct congenital anorectal anomalies. Surface MRI has been extensively used in defining the level of congenital anorectal malformations, the presence or absence of fistulae, associated urological abnormalities and the nature of coincident spinal dysraphism [15-17]. This modality has been used in the postoperative assessment of patients particularly following posterior sagittal anorectoplasty with specific emphasis on the extent of development of the puborectalis sling which appears to correlate with functional outcome [18-20]. Recently, the endoanal receiver coil has been used in the assessment of the postoperative case where T1-weighted and STIR (short tau inversion recovery) sequences in the transverse and coronal views provide an impression of the amount of postoperative scarring and IAS/EAS defects, both correlating with clinical outcome [21, 22].

**Perirectal sepsis**

The majority of perirectal infection is simple and does not require specialized imaging [23]. The coloproctologist will be frequently referred patients who present with recurrent abscesses and fistulae as well as patients who have complex fibrosing perianal Crohn’s disease where clinical examination even under anaesthesia is difficult. The principal information in perirectal sepsis required by the colorectal surgeon includes the knowledge of the number of purulent collections and their relationship to the pelvic floor, the nature and course of primary and secondary tracks and if possible the position of any internal fistulous opening. Conventional fistulography although accurately defining the nature of tracks and collections cannot define their relationship to the pelvic floor which is critical in minimizing inadvertent sphincter injury. Endoanal ultrasonography suffers from a difficulty in distinguishing primary disease from burnt-out scar tracks and its acoustic shadowing may overcall certain intersphincteric collections as transsphincteric, placing more sphincters at risk if US is used solely in operative decision analysis.

Surface MRI has been shown to be highly accurate in assessing the complex anatomy of perirectal sepsis particularly in the re-operative case providing more of a gold standard in most studies than operative impression itself [24, 25]. Its use is recommended in all cases where there is unexpected recurrent sepsis, sepsis secondary to complex pathology (such as associated with low rectal/anal carcinoma or secondary to irradiation proctitis) and perianal infection associated with immunodeficiency (notably perianal lymphoma, leukemic infiltration and AIDS). Recently, gadolinium enhancement has been shown to increase the accuracy of this modality [26].

In those quiescent cases where the coloproctologist is contemplating a mucosal advancement anoplasty, pre-operative