Clinical Ultrasound in Benign Proctology

2-D and 3-D Anal, Vaginal and Transperineal Techniques

Foreword by R.J. Nicholls
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A large proportion of the proctologist’s work includes common benign disorders of the sphincter and pelvic floor musculature and anorectal sepsis. Ultrasound has been part of the pretreatment assessment of these for many years. It adds to clinical examination and may supply the essential information on which the management decision is taken. Most importantly it gives an objective picture of the pathology, which is vital for discussion among clinicians and radiologists as part of the decision-taking process. Thus it supplies a permanent record not only useful for diagnosis and treatment but also for assessing outcomes after treatment. It may have special medicolegal value. The role of ultrasound in research has been considerable. For example, it has enabled a greater understanding of the anatomy of the sphincter and pelvic floor and it has made a major contribution to the assessment of incontinence and its management. It can give important information beyond the clinical examination in establishing the surgical anatomy of anorectal sepsis.

Ultrasonography has developed immensely during the last twenty years. In proctology, its initial application to rectal cancer has expanded owing to the invention of probes suitable for anal and pelvic floor imaging. The introduction of three-dimensional ultrasound and, latterly, transperineal sonography has increased the opportunities and sensitivity for static and now dynamic assessment.

This book is written by authors who have played a major part in the development of ultrasonography in proctology. Therefore, it carries the authority of understanding and experience. In dealing with all aspects of benign anal and pelvic disorders, the authors give an up-to-date account of its present role with indications of potential future developments. The text is detailed and is a mine of information that will be useful to all practitioners dealing with proctological conditions. It will therefore appeal not only to surgeons and radiologists but also to gastroenterologists and primary care physicians whether in established independent practice or in training. The bibliography is extensive and will be a most valuable resource to the reader. It is clearly written and the illustrations are of high quality and very informative.

Clinical Ultrasound in Benign Proctology will be of great value to all practitioners involved in coloproctology.

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Since the introduction of endoluminal ultrasound for the assessment of anorectal diseases in 1989 by Law and Bartram, the fundamental investigative algorithm for functional disorders, in particular, the management of fecal incontinence, has changed dramatically. This period of investigative ultrasonography, driven by radiologists throughout Europe and North America has changed our understanding and perspective of anorectal anatomy. It has also enabled the marriage of our knowledge of healthy and disordered anorectal physiology with the relevant imaging and has allowed surgical treatments and reconstructions to be directed using an advanced morphological interpretation. This approach has guided a sophisticated management of medical and surgical therapies towards complicated cryptogenic and inflammatory bowel disease-related perirectal sepsis, preventing recurrence and preserving continence.

In the area of evacuatory dysfunction presenting to specialized pelvic floor clinics, endoanal, transperineal and transintroital ultrasound has significantly contributed to the anatomic understanding and clinical significance of rectoceles, enteroceles, rectoanal intussusception and incipient rectal prolapse, providing clinical correlates for more directed operative therapies or audiovisual-based biofeedback treatments. The recent introduction of 3-dimensional reconstructive axial ultrasound has provided a more 'surgical' view of complicated fistula-in-ano which has correlated with more expensive and less available gold standard modalities such as enhanced magnetic resonance (MR) fistulography, resulting in a specialized approach towards this problem as well as delivering a better basis for medical therapies such as fibrin glue instillation or, in specialized circumstances, anti-TNF treatments in perianal Crohn’s disease. Three-dimensional ultrasound has also provided a coronal interpretation for incomplete sphincteroplasty in patients with persistent or recurrent fecal incontinence who present with suboptimal outcomes. It has also directed specialist coloproctological reoperation for those patients with objective prognostic indicators more likely to result in operative success. The recent introduction of simple transperineal sonography (although its interpretation is more involved) has created an opportunity in certain anorectal disorders to overcome some of the problems inherent to the endoluminal approach where it
may have a place in those patients with endoanal luminal distortion preventing the deployment of a probe assembly. Here too, in complex perirectal infections transperineal sonography can overcome the limited focal distance of the endoanal probe in defining laterally disposed extrasphincteric fistulae as well as demonstrating translevator extensions above the puborectalis floor where coupling of an endoanal probe is relatively poor. In this circumstance, transperineal sonography can also assist in delineating whether supralevaluator disease is an extension of perianal infection or whether it has a primary pelvirectal origin. Comparative studies are required between these newer modalities and conventional technologies such as enhanced MR imaging, where initial data suggests that transperineal ultrasound provides complementary information rather than competitive information. The indication *par excellence* for transperineal ultrasound is the dynamic real-time interpretation of compartment interaction in patients presenting with rectal evacuation disorders where colonic transit is normal by its use of simulated defecation maneuvers and forcible straining, although there is much work required here to assess the objective effects of hysterectomy as well as the categorized interpretation of transperineal images in patients with incident uterovaginal prolapse. What is clear is that there is an increasing onus on coloproctologists to understand, interpret and perform the range of anal ultrasonography available in patients with complex anorectal disorders and to correlate these findings with operative indications and with postoperative functional outcomes. Such a view provides stimulation for surgeons to become actively involved in the performance and accreditation of all forms of anorectal sonography. There is a need for close cooperation between radiologists and colorectal surgeons in the accreditation and training in this important modality as part of their wider colorectal apprenticeship. With this in mind, although there are several texts available discussing endoanal ultrasound, our approach here is novel, as it presents the operative techniques used based on ultrasonographic interpretations from the surgeons’ point of view.

In the construction of this atlas, we are indebted to the invaluable assistance of Paola De Nardi for the coordination of the text and figures.
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Introduction

Since endoluminal ultrasonography was first introduced in 1989 for the assessment of anal and rectal disorders by Law and Bartram, [1] it has become a staple of the coloproctological armamentarium. Following its introduction, Beynon and colleagues [2] correlated images with individual rectal and anal wall layers, (mucosa, submucosa, muscularis propria, longitudinal muscle and perirectal fat), principally for estimation of tumor infiltration of the rectum. This work was independently followed by Burnett and Bartram [3] and by Papachrysotomou et al. [4] defining the constitutive variations in normal anal anatomy with age and gender and showing a ‘natural’ increase in thickness of the internal anal sphincter (IAS) with advancing age.

Recently, 3-dimensional reconstruction of stacked axial images obtained with an automated puller (or incorporated into in-built probe housing) has attempted to correlate manometrically defined high-pressure zones with anatomical separations in the external anal sphincter (EAS) and with the puborectalis component of the levator ani complex [5]. This technology has also clarified the anatomical disposition of the component parts of the EAS into a 3-tiered structure, (subcutaneous, superficial and deep), which has settled a long-standing argument concerning this muscle [6] and which has been validated by endoanal magnetic resonance imaging (MRI) in the display of high-resolution coronal images [7, 8]. In addition, this technique has shown the constitutive anatomy of the longitudinal muscle [9] which has clinical relevance in the spread of perirectal sepsis [10].

Our group has extended the use of surgeon-performed ultrasonography to transperineal (transcutaneous) assessment of the perineum and pelvic floor for definition of the anterior, middle and posterior pelvic compartments in dynamic use for patients presenting with the symptom complex of evacuatory dysfunction [11, 12]. In an additional recent use, Wedemeyer and colleagues [13] and Mallouhi et al. [14] have demonstrated its clinical value in the determination of the course of complex tracks in Crohn’s-related and cryptogenic...
perirectal sepsis respectively. Our group is currently conducting a prospective trial comparing hydrogen peroxide-enhanced endoanal ultrasonography with transperineal sonography in never operated and recurrent cryptogenic fistula-in-ano to assess the accuracy of surgeon-performed ultrasound in the determination of fistula anatomy, the delineation of the site of the internal fistula opening, the presence of significant anteroanal and retrorectal horseshoeing and the validation of Goodsall’s rule in fistula orientation [15]. There has also been specific utilization of ultrasound in the pre- and postoperative assessment of patients presenting with fecal incontinence and in the follow-up of reparative sphincteroplasty [16] as well as in the determination of the tumor depth and nodal status of rectal and anal tumors to guide the selected use of curative local excision, preoperative adjuvant radiation or neoadjuvant chemoradiation [17, 18].

This review provides recommendations for surgeon-performed endoluminal and transperineal sonography in clinical proctological practice with specific clinical examples.

**Ultrasound in Perianal Abscess and Fistula-in-Ano**

Although the vast majority of perianal sepsis does not require specialized imaging [19], the referral practice to specialist colorectal surgeons of complex and recurrent perirectal infection dictates its use and its expert interpretation for the preoperative detection of the site of internal fistula openings and the relationship of primary and secondary tracks and abscess collections to the main sphincter muscle mass. Familiarity with the technique and technical aspects and interpretation of the images produced by hand-held ultrasonography becomes essential in a tertiary colorectal practice [20].

The indications for and type of preoperative imaging in perirectal sepsis are controversial. In those cases of cryptogenic sepsis, recurrence after surgery has been shown to be most usual when an internal fistula opening has either not been recognized or identified, as well as if there has been poor recognition of the presence and course of secondary tracks and/or abscess collections or no appreciation at the first operation of horseshoeing in either the anteroanal or retrorectal spaces [21]. It is generally recommended that specialist imaging is valuable in those cases where primary sepsis is deemed to be complex, (i.e. where a track or collection occupies more than half of the coronal length of the anorectal sphincters), when recurrence occurs unexpectedly following initial surgery by an experienced surgeon, when sepsis is thought not to be of cryptogenic origin (e.g. Crohn’s disease, Behçet’s syndrome or in immunodeficiency-related infection) and when there is a translevator extension or a primary extraspincteric or supraspincteric track as defined by Parks et al. [22]. In those cases with a translevator component, a distinction should be made between cases with a primary ischiorectal origin which have broken through the levator plate, (where ischiorectal drainage will be successful) and those patients where the origin of the sepsis