



The role of functional evaluation before anorectal surgery

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Introduction

The place of functional assessment of patients who are about to undergo anorectal surgery is controversial, but at the very least, objective manometric and/or morphological sphincter assessment provides a medicolegally useful baseline in procedures where there is a significant risk of sphincter injury. The opinions represented in this review are personal and experiential and reflect my own particular practice where approximately 20% of referred patients seen undergo reoperative reconstructive anal and/or perineal surgery. It is advisable that the colorectal trainee should familiarize himself with specialized physiological and imaging facilities available within his own institution and that he is able to grasp the rudimentary aspects of manometry and endosonography along with their interpretation. Given the direction of European and North American accreditation of consultant coloproctology, this would

represent a minimum examination requirement.

In broad terms, functional evaluation equates to a separable assessment, (where appropriate), of the physiology and pathophysiology encountered as well as the morphological determination in particular of sphincter integrity. These dual approaches are complementary and not competitive and although there is debate concerning their influence on surgical management and follow-up, (1) it is empirical that a more sophisticated assessment and understanding of patients where sphincter integrity is at risk has the potential of defining those likely to perform poorly even after standardized surgery and may, in the absence of a prospective evidence base, actually alter or modify surgical management.

Manometry Recommendations

In rudimentary terms, resting manometry defines internal anal sphincter (IAS) function with voluntary squeeze pressure reflective of external anal sphincter (EAS) power. These manometric values roughly correlate with disruptions in the IAS and/or EAS respectively and will be objective and reproducible values which may be of clinical and medicolegal significance in patients where the IAS is deliberately divided (open or closed IAS sphincterotomy or endoanal manipulation), where it is pharmacologically modified, or where it along with the EAS is transected (complex fistulectomy). Equally, there is justification in its use in patients where deliberate EAS sphincteroplasty is performed, as part of newer techniques designed to augment the IAS for principally passive incontinence, (such as autologous fat instillation, or prosthetic enhancement

procedures), or during the course of biofeedback therapies (2-5).

It is more likely that manometry will prove most useful in those patients presenting with some level of faecal incontinence, (or who are at risk of incontinence), rather than in those cases where the principal functional complaint is one of constipation or evacuatory difficulty (6). In the former setting, it is axiomatic that the clinical indications for preoperative manometry are contentious and there is currently little prospective evidence that it actually alters the surgical approach. In particular, our group has shown that there are fundamental differences between continent and incontinent outcomes in both resting and squeeze conventional manometry and vectorvolumetry in patients prospectively

followed through internal anal sphincterotomy for topically-resistant chronic anal fissure (7,8) and that this appears to correlate with the preoperative finding of a reduced coronal length in some patients of the subcutaneous portion of the EAS which constitutively overlaps the IAS termination using endoanal magnetic resonance (MR) imaging (9,10). In these patients, there is then a predictability concerning poor functional outcome after IAS division where the distal anal canal will be left relatively unsupported. Even though poor functional outcome can be predicted in this group of patients by a combination of manometry and imaging prior to deliberate IAS sphincterotomy, it is impractical to test all patients and a clinical selection will usually take place on those individuals deemed at highest risk. In this respect, Pescatori and colleagues have also shown that the determination of those patients with preoperative hypertonia and chronic anal fissure, (perhaps only half the cases tested), will benefit clinically from a standard IAS sphincterotomy but that those who have either hypo- or normotonia preoperatively may benefit functionally from a more limited sphincterotomy procedure (11). There is currently, however, no prospective evidence that such an approach should convert some patients, (for example multiparous females or those with anterior anal fissures), from sphincterotomy to fissurectomy and advancement anoplasty, (12) but given the fact that standardized sphincterotomy may be more extensive than intended particularly in the comparatively short female anal canal, (13) it would seem wise that such surgery be tailored for different clinical scenarios which will be aided by preoperative manometric studies (14).

Similarly, there is little data to suggest that preoperative manometry influences the utilization of restorative rectal procedures (15) or may define patients better treated with a neorectal reservoir as opposed to a straight coloanal anastomosis, (16,17) although there may be some merit in its employment in patients undergoing such procedures who have a history of prior inflammatory bowel disease (IBD)-related anorectal sepsis or by virtue of age (18). Subtle parametric variations have been

described in an IAS-related function, the rectoanal inhibitory reflex (RAIR), in patients with chronic constipation and faecal incontinence (19,20) which appear to correlate with functional outcome ; most notably nocturnal urgency, following low anterior resection (21). Preoperative determination of poor rectoanal inhibition, (such as incomplete or delayed wave recovery), may define those patients at functional risk who undergo such surgical procedures where there is likely to be prolonged endoanal distraction and it remains to define whether such a parametric assessment of patients' manometric function will be predictive for the role of such a neorectal reservoir in patients undergoing low restorative proctectomy (22). Here, parametric differences in the nature of the RAIR wave in different anorectal disorders has at least suggested that the IAS, (as represented by the RAIR), be protected at all costs in restorative surgery and has explained some of the functional problems which have resulted following the newer techniques of haemorrhoidal surgery where the IAS has been inadvertently damaged since it is not separated from the haemorrhoidal complex. (23,24) Such procedures include stapled haemorrhoidopexy and Ligasure haemorrhoidectomy where a small percentage of patients with incontinence have been reported with attendant IAS damage. Further practical examples of this selective pre-procedural manometric approach may include use of the Altmeier's procedure in rectal prolapse where the author has found that an absent preoperative RAIR predicts for postoperative incontinence even after successful prolapsectomy (25).

It would also seem logical to selectively utilize manometry in some patients at risk of incontinence who are about to undergo repeat surgery for a complicated high trans-sphincteric or extrasphincteric fistula-in-ano, perhaps defining those cases who might benefit from a non-operative approach such as the instillation of fibrin glue (26) or from a more minimalist procedure such as long-term seton drainage. Here too, surgical decision making of modifications of prolonged seton therapy which deliberately



employ IAS preservation might be manometrically based, (27-29) with some early evidence to suggest that they preserve function without compromising fistula cure. The same selective approach to the use of manometry may be made in those patients undergoing sphincter repair for incontinence (30,31) or having some of the more complicated procedures such as artificial anal sphincter implantation, (33, 34) as well as in those who are undergoing total anorectal reconstruction, transendoscopic microsurgical removal of large, high tumours and as a simple objective non-invasive follow-up during trial sacral neuromodulation (35, 36). There is in all of these specialized cases where manometry is advised, no real evidence to favour the newer software vectorvolumetry over simple manometric measures, (like resting and maximal squeeze pressures), although there is a high correlation of the different parameters between the two techniques. (37,38) Equally, there is no strong evidence to utilize squeeze fatigue in routine assessment. The latter has been shown to be deranged in functional neurological disorders such as Parkinson's disease, (39) multiple sclerosis and in spinal cord injury (40) where manometric function may be useful to define

sphincter recovery in those patients who have been treated by defunctioning colostomy. This latter approach can also provide some objective data to assist in the timing of stoma closure in patients with extraperitoneal rectal trauma as well as in adult patients presenting with incontinence years after surgery for anorectal anomalies.

In the age of imaging, neurophysiologic testing has fallen away as part of routine coloproctologic practice. Pudendal nerve terminal motor latency (although easy to perform) has not had an established impact on clinical practice although its presence (particularly bilaterally) is associated with worse outcome after sphincteroplasty procedures (41). Needle electromyography (concentric or single fibre) has virtually disappeared from proctologic practice but simple contact EMG or plug electrodes may prove of use to define EAS activity in those who have been diverted for rectal trauma or severe sepsis where restoration of intestinal continuity is contemplated or in the decision making for anorectoplasty in imperforate anus (42). The surface and plug approaches are of course an integral non-invasive analysis of EAS function in the use of biofeedback therapies (43,44).

Imaging Recommendations

Because of the greater availability of imaging modalities such as endoluminal ultrasonography in many hospitals, imaging tests have become readily utilized although their use should be selective and complementary (45). The principal place of sphincter imaging has been in the field of faecal incontinence and in the preoperative delineation of the extent of perirectal sepsis in complex fistula-in-ano. Latterly, in complicated fistula, ultrasonography has been improved by real-time hydrogen peroxide use (46) or by ultrasonic enhancers (47) as well as by 3-dimensional reconstruction, (48) the software for which has been considerably advanced by incorporation of crystal movement within the probe housing. This has resulted in far less image degradation and in relative real time use for intraoperative display using the newer endoanal probes (49).

In faecal incontinence, endoanal sonography has delineated the presence of significant associated anomalies, such as deep-seated perirectal sepsis (50) and overly zealous sphincterotomies particularly where the anal canal is short (51) and it has eliminated the need for neurophysiologic sphincter mapping. The correlation between endosonographically defined EAS and IAS defects and surgical findings is proven (52) with recent 3-D reconstructed imaging suggesting that poor functional outcome may result from rostrally incomplete EAS repairs where the initial angle of the observable defect is directly proportional to its coronal length (53). Latterly, our group has been using intraoperative transperineal sonography in such cases to confirm that the rostral extent of the repair is adequate. In redo sphincteroplasties, the surgeon can decide with this preoperative information



how aggressively to mobilize the EAS without denervating or devascularizing it based on the preoperative images as well as when to add an anterior levatorplasty. Its use is also invaluable in those patients presenting with passive incontinence secondary to IAS injury where there is some preliminary evidence that IAS bulking agents like silicone (54), carbon beads, (55) collagen (56) or autologous fat (57) improve resting function.

In complex perianal fistula, the basic requirements for adequate surgical treatment include the definition of the site of an internal opening (or openings) and the relationship of the primary and secondary tracks to the main levator plate. The indications for imaging of fistula-in-ano are selective with only about 15% of cases requiring such specialized approaches (58). Important secondary effects of destructive perirectal sepsis include the delineation of IAS and/or EAS damage requiring definitive surgical repair or enhancement, obliteration of the perineal body needing secondary perineoplasty, the presence of an ano- or rectovaginal fistula, horseshoeing in the anteroanal or retrorectal spaces and definition of a primary pelvirectal origin of the sepsis (59). In the latter situation, if an ischiorectal abscess breaks through the levator plate with supralelevator extension then the treatment is drainage via the ischiorectal space, whereas primary supralelevator disease breaking through the pelvic floor and presenting in the ischiorectal fossa when drained will inevitably result in a high extrasphincteric fistula. Suspicion of such cases will require where available, surface MR imaging as an endorectal probe assembly (either ultrasound or MR) will couple poorly above the puborectalis and be unable to make this important distinction. This being said, I would recommend specialized imaging (depending on what is available in any given institution) when a fistula unexpectedly recurs, when there is suspicion that the fistula is high (i.e. exceeds a third of the coronal length of the anal canal), when a rectovaginal fistula is suspected or where injudicious sphincter damage will result in impaired function by virtue of past history (e.g. multiparity, known pre-existent EAS damage or multiple

anorectal surgery). It is hard to be dogmatic here, but the most sensitive approach is probably by hydrogen peroxide-enhanced endoanal sonography (45) with recent evidence to suggest an advantage for 3-D reconstruction in the definition of the site of the internal

opening although this new modality provides comparatively poor delineation of secondary abscess collections and tracks (60). More recently, our group and others have shown that simple transcutaneous sonography has proven very useful in the separation of perineal from perianal sepsis, in the tracing of distant tracks and sinuses which exceed the focal distance of an endoluminal probe assembly, in the definition of anovaginal and anovestibular fistulae (61-63) and in the demarcation of intrarectal foreign bodies as a primary cause of sepsis. In our initial experience there is a high sensitivity for transperineal sonography in definition of the site of the internal opening and its anatomical relationship to the puborectalis but only moderate sensitivity and positive predictive value for ancillary abscesses (particularly if gas containing) and secondary tracks (*unpublished results*). These approaches then, (endoanal sonography, enhanced or reconstructed, transperineal ultrasound and surface MR imaging), will be complementary and not competitive with the coloproctologist referred complicated or recurrent cryptogenic and non-cryptogenic cases utilizing them in tandem to create an overall 3-dimensional blueprint of the anatomy of these tracks (and their secondary destructive effects which in their own right may require delayed reconstructive surgery) for optimal surgical outcome both in terms of fistula cure and functional continence preservation.

Recently, transperineal ultrasound has been used in dynamic real-time mode to assess those patients presenting with evacuatory difficulty in particular, but also with other functional disorders. This modality has been described for assessment of the anterior pelvic compartment in the diagnosis of stress urinary incontinence either by a transperineal (64) or a transintroital (65) approach. What is clear is that those patients who present with defaecation difficulty have a multiplicity of problems

which span across all 3 pelvic floor compartments in the main (66) and that in order to successfully eradicate the main symptomatology, a multidisciplinary approach with coloproctologists, gynaecologists, urologists and biofeedback technologists is required (67). Traditionally, defaecography, (or an extended defaecographic technique employing opacification of the small bowel, vagina, bladder, urethra and even the peritoneal cavity), has been used to dynamically assess evacuation using comparatively high dose radiation in the interpretation of cinedefaecation for the assessment of rectoceles, rectal prolapse, perineal descent and rectoanal intussusception (68). The technique is cumbersome, somewhat subjective and impractical in some young patients and has largely been replaced by dynamic MR imaging (69,70). Latterly, open-architecture stand-alone MR units have been used to diagnose evacuation in a more physiological position particularly in the diagnosis of conditions like rectal prolapse which only appear at the very end of defaecation effort (71). Obviously, these open architecture MR imaging units are not widely available. More recently, our group (and others) have been successfully using hand-held transperineal probes in dynamic mode during forcible straining and contrast evacuation sonography to assess the dynamic interplay between the pelvic floor compartments (72-74).

The technique is comparatively simple when compared with endoluminal sonography, although its interpretation is much more difficult requiring a substantial learning curve. No specific preparation is required and it is wise if facilities exist to videotape the procedure for retrograde and orthograde scrolling. Dynamic transperineal ultrasonography (DTP-US) is performed using a curvilinear 7.5 or 10 MHz probe after liberal application of acoustic gel to the perineum and instilling 50 mL intravaginally as well as a similar amount into the rectum. For the diagnosis of both enterocele and peritoneocele, it is advisable that the patient ingest 100 mL of water soluble Gastrografin (Schering,® UK) diluted 1:1 with tap water one hour prior to the examination. The examination of the anus is made with the

transducer initially applied transversely to the perineal body with identification of the axial view of the anus using the landmark of the hypoechoic ring of the internal anal sphincter in an image which is similar to that obtained in the mid-anal canal using endoanal ultrasonography. The transducer is then turned 180° to obtain a sagittal view of the contrast-filled rectum with extension of the hypoechoic internal anal sphincter appearing above and below the anal canal in profile. The anorectal junction is well seen with the bright hyperechoic elliptical bundle of the puborectalis sling demonstrable in relief. In the sagittal mode the examination should proceed to identify the brilliantly hyperechoic pubis and is then worked back by downward movement of the transducer against the perineum to locate the hypoechoic bladder and the urethrovesical junction; the position and movement of which will be dependent upon the filling status of the bladder at the time of the investigation (75).

The anal canal has already been identified in the initial ultrasound sweep for landmarks but is now examined in more detail during forcible straining and simulated evacuation of the intrarectal acoustic gel. Here definitive diagnoses may be made of rectocele, rectoanal intussusception (including its grade), perineal descent and rectal prolapse. The technique has provided a number of specific landmarks for the determination of the anorectal angle (ARA) as well as for specific movement during straining of the anorectal junction (ARJ) using the pubococcygeal line akin to that seen in conventional defaecography, where bony landmarks are more obvious with DTP-US since they can sometimes be obscured in proctography by film glare. Although it is recognized that these measurements have no clinical significance and are quite complex to perform with moderate interobserver variation, they do provide some validation of the DTP-US technique when compared with defaecography in patients presenting with evacuatory difficulty, where our group has shown a high correlation between ARA and ARJ values both at rest and during maximal straining using the two modalities in blinded fashion (76). In general, ARA during straining is



greater and ARJ is higher at rest with defaecography; a finding probably related to the inherent positional differences using the two techniques (77). The exact indications for DTP-US (and its non-dynamic counterpart) are still being configured, where comparative studies are required to ascertain its ability to match clinical grades of uterovaginal prolapse (78) as well as the standardization of its parameters after hysterectomy. This being said, it is an accurate modality in the delineation of rectocele and enterocele without attendant irradiation which may be used intraoperatively and in the early postoperative phase (79).

In summary, the widespread availability of anorectal manometry and endosonography has resulted in a profusion of scientific papers concerning its use and interpretation in proctologic practice, however, there is little objective evidence that its unselected use alters clinical and operative management. In my practice manometry has a limited role as an objective marker of functional outcome following sphincteroplasty or in some selected cases of anorectal reconstruction. The hope for the future is that parametric assessment of IAS and EAS function will predict cases who

may benefit from the construction of neorectal reservoirs undergoing restorative proctectomy, that it will better establish the suitability for restoration of intestinal continuity after faecal diversion and that it will result in predictive indices for those undergoing IAS augmentation procedures or sacral neuromodulation. Imaging has an established place in the definition of EAS defects in faecal incontinence and currently defines the role of sphincteroplasty; an operation that may be in somewhat of a decline. Its use in complex perirectal sepsis is clear, but the astute colorectal surgeon understands the limitations of endosonography in high primary fistula-in-ano and in its destructive aftermath. In order to provide high quality coloproctological care in complex cases, a more sophisticated blend of transperineal sonographic techniques and surface MR imaging may be required. The place of DTP-US in the myriad of functional problems presenting to the coloproctologist or specialist pelvic floor clinic needs to be defined but it does appear to be accurate in the distinction of those patients with rectoceles who also have enteroceles and who are unlikely to benefit from simple endorectal or transvaginal repairs.

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