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Review

Apprenticeship-based training in neurogastroenterology and motility

Dipesh H. Vasant^{1,2}, Amol Sharma¹, Jigar Bhagatwala¹, Lavanya Viswanathan¹ and Satish S.C. Rao¹

¹Division of Gastroenterology and Hepatology, Digestive Health Center, Augusta University, Medical College of Georgia, Augusta, Georgia, USA

²Division of Diabetes, Endocrinology & Gastroenterology, Manchester Academic Health Sciences Centre, University of Manchester, Manchester, United Kingdom

Correspondence:

Satish S.C. Rao

1120 15th Street, AD2226, Augusta University, Augusta, GA, 30912, USA

Office: +1-706-721-2238

Fax: +1-706-721-0331

E-mail: srao@augusta.edu

Abstract

Introduction: Although neurogastroenterology and motility (NGM) disorders affect 50% of patients seen in clinics, many gastroenterologists receive limited NGM training. One-month apprenticeship-based NGM training has been provided at ten centers in the USA for a decade, however, outcomes of this training are unclear. Our goal was to describe the effectiveness of this program from a trainees perspective.

Areas Covered: We describe the training model, learning experiences, and outcomes of one-month apprenticeship-based training in NGM at a center of excellence, using a detailed individual observer account and data from 12 consecutive trainees that completed the program. During a one-month training period, 302 procedures including; breath tests (BT) n=132, anorectal manometry (ARM) n=29 and esophageal manometry (EM) n=28, were performed. Post-training, all trainees (n=12) knew indications for motility tests, and the majority achieved independence in basic interpretation of BT, EM and ARM. Additionally, in a multiple-choice NGM written-test paper, trainees achieved significant improvements in test scores post-training (P=0.003).

Expert Commentary: One-month training at a high-volume center can facilitate rapid learning of NGM and the indications, basic interpretation and utility of motility tests. Trainees demonstrate significant independence, and this training model provides an ideal platform for those interested in sub-specialty NGM.

Keywords: Competency, Curriculum, Education, Neurogastroenterology, Motility, Training

1. Introduction:

Neurogastroenterology and motility (NGM) disorders account for almost one half of the patients seen by gastroenterologists [1, 2, 3]. Despite this, most gastroenterologists are not adequately trained in the evaluation and management of these disorders[4, 5, 6]. Recent surveys in the UK have highlighted this problem and the need to improve training [7, 8, 9]. In the USA, a defined curriculum outlines the standards for basic and advanced training in gastrointestinal motility[10]. Many programs now offer some training, although very few centers offer comprehensive and/or 'hands-on' motility training[11]. In order to enhance NGM training, the American Neurogastroenterology and Motility Society (ANMS) designated ten 'centres of excellence'. These centres have offered one-month apprenticeship-based clinical training programs and broad-range exposure to motility disorders for the last decade[6].

In this paper, we detail the specifics of the training model at an ANMS center of excellence, illustrate the individual account of an observer during a typical month of apprenticeship-based training. We also provide a summary of the outcomes reported by twelve trainees and their experiences over the past few years from this training program. Additionally, we discuss how such NGM training could be implemented at centers world-wide.

2. Materials and Methods:

2.1 The learning environment:

Located in southeastern United States, Augusta University's Medical College of Georgia was founded in 1828 and is the thirteenth oldest medical school in the country. In spring 2015, a unique, single-site, multidisciplinary, 43,000 square feet, purpose-built Digestive Health Center (DHC) opened. Within the DHC, the motility clinic is the largest and most advanced of its kind in the United States and is one of ten ANMS centers of excellence[12]. The motility laboratory performs over 3,200 motility procedures annually, encompassing 18 different motility tests.

2.2 NGM facilities and training resources

The NGM lab consists of five dedicated rooms. This includes a 300 square feet room with two beds for upper GI motility, two separate rooms for lower GI motility with attached bathrooms (one for diagnostic and one for therapeutic procedures) and two Breath Testing rooms. There is also a motility fellow/ trainees office, situated along the same corridor. This dedicated workspace with a computer and up-to-date software provides the facilities for the motility trainee to read, interpret, and report motility studies. It also serves as devoted space for data interpretation rounds with faculty mentors. The motility outpatient clinics with 15 consultation rooms occur on the same floor in close proximity to the nine-room endoscopy unit and motility lab. Trainees were provided with a reading list and access to a library of motility textbooks, handbooks and relevant literature.

2.3 The trainers and the team

The motility team led by two physicians (SSCR/AS) also includes a nurse practitioner, motility fellows, a specialist dietician, two motility nurses, a nursing assistant and a post doctoral research fellow.

2.4 Observations from an NGM 'center of excellence':

To quantify and describe the learning experience during a typical month of apprenticeship-based training, a trainee (DHV) spent one-month at an ANMS 'center of excellence' shadowing two mentors. The trainee kept a log of all motility procedures and NGM clinic encounters that he was actively involved with during the training program, in order to facilitate the assessment of knowledge and competence at the end of the rotation. The visiting trainee was expected to make independent interpretations of motility procedures that were verified and validated by the mentors for accuracy and completeness.

The trainee's NGM competency during a typical month of laboratory and clinical activity was systematically documented and critically appraised. A formal face-to-face evaluation at the end of training consisted of an observed assessment of the interpretation of motility data on a random selection of breath tests, esophageal manometry, anorectal manometry and wireless motility capsule studies by two faculty members.

2.5 Training outcomes

1. In order to evaluate the outcomes following one-month of apprenticeship-based training at a single center, post-training evaluation forms that were prospectively collected and were provided to us by the ANMS as anonymous data for the purposes of this article. Data captured from these questionnaires included whether the program fulfilled learning objectives, trainee level of independence in the indications, interpretation, and performance of motility tests at the end of the one-month apprentice-based program, trainee opinions on the optimal duration of the program, overall rating and the trainees' opinions on GI motility, their career aspirations and the amount of time that should be dedicated to this field during training.
2. As a quantitative measure of clinical knowledge, data interpretation skills, and clinical application, the ANMS devised a 60-item written NGM exam. This exam derived from the ANMS syllabus for the training program was undertaken by all trainees pre and post training. Mean test scores were compared before and after apprenticeship-based training for all trainees.

2.6 Data Analysis:

Data were analyzed using a Microsoft excel spreadsheet. Pre and post-training exam test scores were compared statistically using paired t-tests on a standard software statistics package (Stats Direct v3.0, Cheshire, UK),

3 Results:

3.1 NGM Clinical Training Program (one-month):

The NGM clinical training program consisted of didactic lectures on 16 motility topics which have been developed nationally by the ANMS course directors. Trainees also participated in outpatient clinics, observation of the performance of 18 different motility procedures, both in the laboratory and during endoscopy, occasional inpatient consultations and participation in daily motility data interpretation rounds. Table 1 shows the weekly timetable at this center.

3.2 NGM teaching clinics:

Trainees participated in the comprehensive evaluation of patients with motility disorders in tertiary NGM outpatient clinics. Half-day motility clinics were set up as 'teaching clinics' twice weekly. These specialized clinics included out-of state patients, tertiary referrals and patients with complex functional and gastrointestinal motility problems. Trainees and nurse practitioners would become skilled in assimilating patient information, taking focussed histories and performing examinations, making differential diagnoses and management plans before presenting all cases to the attending physician at the bedside who would then revisit all the important components of the history, perform a detailed evaluation including physical examination and explained the rationale for the agreed management and investigation plan to the trainees/nurse practitioner and to the patient. The visiting trainee attended seven such clinics during the one-month period and observed the management of ninety clinic patients with a variety of complex NGM problems (Table 2). Several patients who were referred from out of state spent a whole week undergoing a series of tests and providing a comprehensive assessment of their underlying problem(s) and a care management plan.

3.3 Training in the motility laboratory:

Week 1: During the first week, the observer trainee (DHV) and three first year Gastroenterology fellows attended a tutorial with the motility faculty (SSCR/AS). The topics covered during this session included an introduction to high resolution esophageal and anorectal manometry including how to use the software, esophageal pH studies, hydrogen-methane breath tests and wireless motility capsule studies, with a case-based interactive approach. Trainees were taught the principles of interpretation of these different types of studies by working through cases with the faculty. Trainees made themselves familiar with the motility laboratory and indications for various tests, learnt how to use the equipment and computer software and were taught how to perform various motility tests, including how to calibrate, set up equipment and interpret these tests. Trainees were also encouraged to place probes and actively participate in the performance of studies.

Weeks 2-4: Experience was gained in high resolution esophageal impedance manometry, 24-hour ambulatory impedance pH study, hydrogen-methane breath

tests (Glucose, Lactose, Fructose and Fructan), high-resolution and high-definition anorectal manometry, biofeedback therapy, wireless motility capsule test, gastric emptying and colonic transit tests. Additionally, there was exposure to advanced procedures including impedance planimetry, functional luminal impedance planimetry (EndoFLIP), gastric barostat study, antroduodenal manometry, colonic manometry, rectal barostat study, and gut-brain-gut neurophysiological studies.

All motility studies conducted in the laboratory were independently reviewed and interpreted by the visiting trainee (DHV) and by the motility fellow (JB/LV). Trainee reports were in turn reviewed by faculty mentors. Interesting findings were discussed and provisional reports were compared for learning purposes, before being finalised by the faculty members (SSCR/AS) who often provided feedback on the trainee's interpretation at the end of the day. During the one month attachment the observer trainee and motility fellow were involved with reporting 302 motility procedures. During the month, the most commonly performed procedures were hydrogen-methane breath tests, biofeedback therapy, anorectal manometry and esophageal manometry (Figure 1).

3.4 Observations from NGM training in endoscopy:

During weekly motility endoscopy lists, there were also opportunities for trainees to assist where possible in endoscopic interventions on patients with motility disorders, for example in botox injections, obtaining aspirates for small intestinal bacterial cultures, achalasia balloon dilatations, placement of colonic and small bowel manometry catheters, wireless (Bravo) pH capsule and feeding tube placements.

3.5 Other learning opportunities during one-month apprenticeship-based training:

During NGM clinical training, motility trainees also participated and presented cases at the dysphagia conference and the bi-monthly pelvic floor conference. Motivated trainees were also given opportunities to participate in clinical research projects in the motility unit and were invited to attend weekly research team meetings. The observer trainee took the opportunity to conduct a clinical research project examining the clinical utility of high definition (3D) anorectal manometry in the evaluation of pelvic floor disorders and its comparative utility with high resolution anorectal manometry. Along with a post-doctoral Fellow, the trainee served as an independent

interpreter of the data and wrote-up the findings as abstracts that were submitted for an international meeting [13, 14]. This work was presented at Digestive Disease Week in 2017.

3.6 Training outcomes from apprenticeship-based NGM training

Feedback forms from previous trainees (n=12) from institutions all over the United States that completed the program at this center were analyzed. The majority (8/12 trainees) were year 3 fellows, 11/12 were interested in a career in GI motility and 12/12 confirmed they would be performing GI motility procedures in their future practice. All twelve trainees learning objectives were fulfilled at the end of the program, all twelve confirmed they would 'definitely' recommend this program to another colleague or fellow and 6/12 (50%) rated their experience with the program as 'outstanding', 5/12 (42%) rated it 'excellent' and 1 trainee rated the program as 'very good'. Trainees' responses regarding their level of independence in the indications, interpretation and performance of motility studies after the program are summarized in Figures 2-4. The majority of trainees (10/12, 83%) felt that the one-month duration of the program was 'adequate', whereas two participants recommended extending the program to two-months. Given the choice, most trainees (9/12, 75%) feel that 3 months of the GI fellowship should be devoted to motility, whereas only one trainee suggested 2 months, another suggested 4 months and one suggested 6 months.

Qualitative feedback from several trainees suggested the provision of a library of motility studies with self-assessment answers would be beneficial.

3.7 Comparison of written test scores before and after training

All trainees that completed the program at this test center had a mean test score of 39/60 (65%) at baseline which significantly improved at the end of training (45/60, 75%), 95% CI = -9.47144 to -2.750782, $t=-4.2$, $P=0.003$ (Figure 5).

4. Discussion:

During a typical month of outpatient and laboratory activity at a high-volume ANMS center of excellence, the visiting trainee was exposed to a wide variety of complex cases, novel technologies, over three hundred motility procedures. When the

trainee's exposure to NGM procedures were compared to outcomes and experiences of previous trainees, it was notable that the procedures that were most frequently encountered (breath tests, high resolution anorectal manometry and high resolution esophageal manometry) were amongst those that trainees felt most comfortable to practice independently at the end of the program.

The data presented here suggest that after a one-month apprenticeship-based program at a high-volume center working with expert NGM sub-specialist clinicians, gastroenterology trainees have a good working knowledge of the indications, learn the basic skills on how to interpret a variety of motility investigations, and gain a comprehensive approach towards evaluating patients with NGM problems. Most trainees (9/12, 75%) who completed one-month apprenticeship training at this particular NGM training center went on to pursue academic medicine as directors of motility at various teaching institutions across the USA and Canada. By contrast, previously published post-program evaluation data from 90 trainees (data obtained from all ANMS training centers nationally) from trainees that have completed the one-month ANMS training program, suggest that around a third of trainees pursued academic medicine [6].

Most of the trainees in the present study agreed that the one-month duration of this program is 'adequate', the post-program evaluation data suggest that it is not possible to achieve independence in performing more complex procedures such as antroduodenal manometry and biofeedback therapy within this timeframe. Trainees view this program as an adjunct to motility training within post-doctoral fellowship training and the majority suggested that at least 3 months of Gastroenterology fellowship should be dedicated to learning NGM.

In addition to the educational outcomes of the program, motivated trainees were given opportunities to undertake relevant clinically orientated research projects during the month which led to a presentation at an international conference [13], further attesting to the plausibility of a comprehensive clinical training that can be achieved through a dedicated one-month apprenticeship-based program.

One of the limitations of our study include the lack of baseline data collected from previous trainees on their exposure to NGM training during their fellowship and their baseline level of competency prior to the program. It is therefore difficult to determine

whether the level of independence achieved at the completion can be solely attributed to the program itself. However, both the positive feedback from trainees and the improved performance in the ANMS written test before and after training suggests that the program itself strongly influenced the outcomes. Moreover, the observed trend toward a higher level of 'independence' in motility procedures, was observed in the procedures most commonly performed, again suggesting that this exposure during the month of training was important in achieving the observed positive outcomes. Whilst all trainees at this center received training in wireless motility capsule (n=16 procedures during a typical month), data for independence with this technique was not obtained due to use of an old feedback form which predated the advent of this test.

Another limitation to our study is responder bias. The proportion of trainees at this ANMS center of excellence were highly motivated and interested in the subspecialty with all but one with future plans on pursuing a career in NGM. All indicated their intent to perform GI motility procedures in their future practice. This may not be the makeup of trainees during the one-month apprenticeship program at other ANMS centers of excellence, which may partially account for the observed higher numbers of trainees pursuing academic medicine from this training center compared to the numbers reported by trainees from other ANMS training centers nationally [6].

One of the key questions that emerges from our study is how best to assess competency progression in NGM training. The curriculum-based ANMS exam is one way of testing baseline knowledge and interpretation skills and whilst the improvement in test scores may be a reflection of learning, the use of the same test at the end, even after concealing the answers, may have led to some trainees learning the correct answers rather than the application of newly acquired knowledge. Another assessment method was the end of program face-to-face assessment of trainee interpretation of motility data with faculty members which had clear educational benefits, particularly in terms of verbal feedback. This is probably one of the best methods currently available. However, even this method of evaluation is susceptible to variability in the difficulty of the cases encountered during the one-month apprenticeship and subject to discrepancies in evaluation amongst faculty. Finally, the current standards defined by the core GI training curriculum to achieve expertise in NGM (level 2 training) are based upon achieving set numbers of

procedures [10]. Based upon these recommendations and the number of procedures observed during a typical month of apprenticeship-based training (Figure 1), achieving level 2 standards in anorectal manometry (n=30), biofeedback therapy (n=10), esophageal pH metry (n=25) would take just over a month of apprenticeship-based training, whereas level 2 standards in esophageal manometry (n=50) would take approximately two months of apprenticeship-based training to achieve and antroduodenal manometry (n=25) would take even longer [10]. However, antroduodenal manometry is not offered at all centers of excellence and its clinical utility remains controversial. A combination of the above approaches described above may be the best available at present. Competency-based medical education in NGM is critical. Recent developments in this field and their relevance to the issues discussed here are covered in more depth in the commentary.

In summary, observations from an ANMS center of excellence in United States suggest that one-month apprenticeship-based training program at a high-volume center can facilitate rapid learning of the indications, interpretation and utility of the most commonly performed motility tests and appears to provide an ideal platform for all gastroenterology trainees. The optimal duration of NGM training remains unclear and whilst better methods of assessing competency progression in NGM are currently being developed, our data support that a further, extended period of training is required in order to sub-specialize in the full-range of NGM diagnostics and therapeutics.

5. Expert Commentary:

The need for 'special training modules' and development of NGM as a sub-specialty was identified a decade ago [6, 24, 25]. Unfortunately, training in NGM has largely been overshadowed by other competing areas of the gastroenterology curriculum including; endoscopy[6], hepatology, inflammatory bowel disease and nutrition, for which advanced training modules are now available in most countries.

However, the need for NGM specialist knowledge and training is increasing. Over the past decade there have been significant advances in NGM diagnostic testing and understanding of disease mechanisms, which have led to new disease classifications and therapies. Here, we discuss the implications of the advances in this field in terms of meeting increasing clinical demands, the requirement for GI

curricula to keep up with the new developments in this field and review emerging concepts in motility training.

The one-month apprenticeship based model which is described in this article is an attractive approach to delivering NGM training. Whilst a one-month NGM rotation during training may not equate to competence as an advanced NGM clinician, it is likely to help produce a more well-rounded gastroenterologist, and given the short duration, is unlikely to detract from other competing sub-specialty areas of the curriculum. Moreover we would argue that such training is important because all gastroenterologists frequently encounter patients with NGM disorders.

Recent surveys support our conclusions by highlighting the consequences of deficiencies in NGM training, whereby a majority of GI clinicians in UK are unable to independently interpret motility studies, and often struggle to provide therapeutic recommendations [7, 8, 9, 15]. Consequently, there is little doubt that training in NGM would be invaluable for all GI trainees, as well as improve the quality of patient care.

The UK data is particularly interesting given that ninety-eight GI physiology units have been identified as centers that perform GI motility procedures [8], suggesting a lack of training despite good availability of potential training centers. This almost certainly is a reflection of the absence of minimum standards in NGM related procedures and motility data interpretation in the UK gastroenterology curriculum. We can infer from this data that delivery of core training (such as during one month rotations), not only requires a dedicated team that perform a minimum number of upper and lower GI procedures, but also, NGM training requires formal recognition by the national training bodies as a core mandatory requirement, with clearly defined minimum standards.

Recently some efforts have been made to address these training deficiencies in the UK by raising awareness at the Association of Gastrointestinal Physiologists annual BSG symposium, the BSG trainees section who have included 'manometry: a fool's guide' in a trainees education weekend, and the NGM section committee who have since hosted a weekend workshop to cover these topics. Internationally, the European Society of Neurogastroenterology and motility (ESNM) have also recently held a successful three-day 'hands-on' motility course for twenty selected trainees.

Whilst raising awareness via these educational forums will undoubtedly improve exposure, given the complexity of motility disorders and the technological advances and the steep learning curves for achieving competency in interpretation of motility procedures, similar to endoscopy training [15, 16, 17, 18, 19], a dedicated training program is essential.

Competency based medical education is currently a hot topic in gastroenterology and more recently, an emerging concept in NGM. Indeed recent studies have suggested that competency-based training in motility should not be purely based on the number of procedures or the amount of time spent in training, but based on objective measures of performance [16, 17, 18, 19, 20, 21, 22]. With this in mind, Yadlapati et al. recently developed and piloted a high resolution esophageal manometry 'interpretation exam' with eight interpretation skills per case and suggest that this computer-based assessment tool could be applied in clinical practice to judge competency of trainees [22]. This competency-based approach appears promising and is likely to be available to be used in conjunction with workplace based assessments including direct observed procedural assessments (DOPs) [15].

The steep learning curve in high resolution manometry interpretation has recently been studied in trainees [18, 21]. This was also experienced first-hand by the observer trainee, who under the mentorship of the experienced faculty members and senior trainees at the host institution, learnt how and when to override some of the automated analyses, and how slight adjustments in the measurement points on high-resolution pressure topographies improved the diagnostic accuracy of the final interpretation and report. Regrettably, the UK national survey has however, suggested an over-reliance on computer generated and technical reports, often without interpretation by a trained sub-specialist clinician [8]. Recent publications have shown that this approach could potentially run the risk of variable standards, misinterpretation, incorrect diagnoses, and the need to repeat tests [16, 17, 18, 19, 23].

A concerted effort is required by the NGM sections of various European GI societies and the ESNM to facilitate such training. This should include mandatory core standards in GI motility training within curricula and to learn from a decade of experience from USA. Once core and advanced curriculum standards have been

defined, high-volume tertiary centers could be developed as 'centers of excellence' in NGM in their respective countries.

6. Five-year view:

Over the next five years, the need for specialist NGM knowledge, technical skills and ability to interpret complex data is likely to increase further and it is important that coverage during GI training reflects this worldwide. Delivery of this training will require inclusion of NGM in core curricula and dedicated NGM attachments. Implementation of novel, web-based competency assessment tools will complement apprenticeship-based training in NGM during short attachments and ensure that measureable standards are met at the end of the programme. Competency assessment tools could be developed for several different types of motility procedures to document trainees' learning curves, complement procedure logs and would be a step towards a much needed, robust certification pathway, for both core and advanced level training in NGM.

Key Issues:

- Recent studies have identified limited training opportunities in neurogastroenterology and motility, particularly in the UK, where there are currently no minimum standards for motility procedures in the curriculum.
- Exposure to intensive, one-month, apprenticeship-based training in neurogastroenterology and motility at a center of excellence develops core skills in comprehensively evaluating and managing complex gastrointestinal motility disorders.
- Similar training models in the UK and elsewhere internationally could significantly enhance learning, improve gastroenterology training, and fulfil the unmet gaps in the training curriculum.

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** of considerable interest

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Figure legends:

Figure 1: The number of motility procedures reported on by the motility fellow during the observed one-month period (total n=302)

Figure 2: Trainees level of independence in the indications for motility tests post-training

Figure 3: Trainees level of independence in the interpreting motility tests post-training

Figure 4: Trainees level of independence in performing motility studies post-training

Figure 5: Performance on written test paper before and after apprenticeship-based NGM training

Table 1: Weekly timetable during apprenticeship-based training in NGM

Monday	8 – 10 am Motility clinics – shadow Dr. Rao & Meet Dietician	10 –12 noon Motility Lab, Observe procedures: esophageal HREPT, balloon distention, pH, Breath test	1 –4 pm Anorectal Manometry & Biofeedback And Translumbal NCV	4 –5 pm Data interpretation Rounds & didactic - Dr. Sharma
Tuesday	7 – 8 am Problem/Core Conference	8 –12 noon Observe motility procedures	1 –3 pm Esophageal Balloon distention & Barostat Studies/review videos	3 –5 pm Data interpretation Rounds w/Dr.Rao
Wednesday	7 – 8 am Pathology/Radiology/ Motility/Interdisciplinary Conference (didactic)	8–10 am Motility Clinic - shadow Dr. Sharma	10 –12 noon Small bowel/colonic Manometry – Dr. Rao	1 –4 pm Observe procedures in motility lab Gastric Barostat/biofeedback/ Brain-gut interaction 4 –5 pm Didactic Dr. Sharma
Thursday	8 am – 12 noon Motility clinic (shadow Dr. Rao)		1 –4 pm Observe motility & anal ultrasound & esophogram defecography/scintigraphy	4 –5 pm Data interpretation – Rounds – Dr. Rao 5 –6 pm GI Fellows Research Conference/Journal Club
Friday	7:30 – 9:00 am Research Lab meeting (optional)	9 –10 am Didactic – Rao	10 –12 noon Motility lab procedures & wrap-up w/patients undergoing weekly work-up Gastric scintigraphy and smartpill	1 –3 pm Review Motility videos/DVDs 3 –5 pm Data Interpretation Rounds – Rao/Sharma

Table 2: Examples of cases and clinical problems observed in NGM teaching clinics

Assessment of patients with fecal incontinence including bedside clinical assessment for evidence of neuropathy
Approach to opiate induced constipation, narcotic bowel syndrome and centrally mediated abdominal pain syndromes
Assessment of chronic refractory constipation and clinical evaluation for pelvic floor dyssynergia
Investigation and management of dysphagia and esophageal dysmotility disorders including achalasia, esophago-gastric outflow obstruction and hypercontractility disorders.
Unexplained symptoms including gas/bloating, suspected small intestinal bacterial overgrowth and small intestinal fungal overgrowth
Investigation and management of suspected and confirmed Gastroparesis
Dysmotility in benign joint hypermobility syndrome
Dysmotility and malnutrition secondary to Scleroderma
Assessment of refractory Gastroesophageal reflux disease including patients with suspected extra-oesophageal reflux, the role of prolonged pH monitoring and oropharyngeal pH studies
Recurrent effortless vomiting and Rumination syndrome
Dysmotility following bariatric surgery
Chronic diarrhoea, post cholecystectomy biliary gastritis and bile salt malabsorption
Motility disorders secondary to neurological diseases including Parkinson's disease, syringomyelia and transverse myelitis
Irritable Bowel Syndrome patients with constipation, diarrhoea and mixed sub-type
Psychological comorbidities in patients with functional gastrointestinal disorders
Assessments of patients with rectal pain with notable cases of levator ani syndrome, post-inflammatory rectal hypersensitivity in distal ulcerative colitis and solitary rectal ulcer syndrome.
Food intolerances including lactose, fructan and fructose
Functional dyspepsia and gastroparesis
Investigation and management of patients with symptoms of both upper and lower motility disorders and the role of the wireless motility study.