15.3.4 Investigation of gastrointestinal function

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15.3.4 Investigation of gastrointestinal function 2757 bladder wall thickening adjacent to the inflamed sigmoid colon, or enteric contrast within the bladder. FURTHER READING Ajaj W, Goyen M (2007). MR imaging of the colon: “technique, indica- tions, results and limitations”. Eur J Radiol, 61, 415–23. Halligan S, Taylor SA (2007). CT colonography: results and limita- tions. Eur J Radiol, 61, 400–8. Levine MS, Rubesin SE, Laufer I (2009). Barium studies in modern radiology: do they have a role? Radiology, 250, 18–22. Masselli G, Gualdi G (2012). MR imaging of the small bowel. Radiology, 264, 333–48. McLaughlin P, Maher M (2013). Nonneoplastic diseases of the small intestine: clinical, pathophysiologic, and imaging characteristics. AJR Am J Roentgenol, 201, W382–90. Pickhardt PJ, et al. (2011). Colorectal cancer: CT colonography and colonoscopy for detection—systematic review and meta-analysis. Radiology, 259, 393–405. 15.3.4 Investigation of gastrointestinal function Jervoise Andreyev ESSENTIALS There are two main reasons for investigating the gastro- intestinal (GI) tract: first, to identify diseases at an early stage (e.g. endoscopic screening for neoplasia); second, to diagnose and manage symptoms. A pathological process can potentially affect any part of the GI tract, but apart from mass lesions, pathological change per se hardly ever causes symptoms directly. Symptoms depend on whether critical physiological change has been triggered by the pathological insult. Individual symptoms or clusters of symptoms are not a re- liable indicator of the underlying cause, and different physio- logical changes can produce identical symptoms. Worrying symptoms indicative of significant GI tract pathology include ‘red flag’ symptoms (e.g. a palpable mass, rectal bleeding, weight loss) and other symptoms that are frequently missed by pa- tients and clinicians alike (e.g. steatorrhoea, nocturnal waking to defecate). Dietary intake requires systematic assessment. Routine inves- tigation should usually include thyroid function testing, vitamin B12 and vitamin D status, coeliac screen, iron studies, and inflam- matory markers. Endoscopy and cross-sectional radiology provide excellent anatomical

visualization but provide little information about the dynamic function and physiology of the GI tract, for which tests for specific physiological functions can be used. Failure to investigate adequately misses easily treated diagnoses and means ongoing symptoms for patients. For many patients with multiple comorbidities, there is often more than one cause for their GI symptoms, which will not improve unless all causes are identified and treated. Introduction The gastrointestinal (GI) tract is an extremely complex organ. It contains as many neurons as are found in the spinal cord. Specialized cells within the GI tract secrete a vast array of hor- mones, neurotransmitters, and enzymes. Within the GI tract lives a microbial—bacterial, viral, and fungal—population which contains substantially more DNA than is found in the rest of the human body. This microbial population is essen- tial for human health and normal intestinal function, but as yet how it interacts with its human host has barely started to be ex- plored. Keeping this microbial population under surveillance is an almost separate immune system to that found in the per- ipheral circulation and much remains to be understood as to how the intestinal immune system differentiates between useful commensals and dangerous pathogens. In addition, the GI tract has a vital role in nutrient metabolism, absorption, and in fluid homeostasis. It is extraordinary that of the order of 12 litres of fluid enters the GI tract daily yet rarely more than 200 ml is ex- creted. This is achieved through coordinated muscular activity, which allows mixing of nutrients for optimal digestion, propul- sion when mixed to appropriate areas for absorption, and excre- tion of waste. The normal physiology of the GI tract and some of the disorders of physiology which can occur are described in Fig. 15.3.4.1. Fig. 15.3.3.14 A pelvic CT scan showing an intramural abscess from diverticulitis. There is mural thickening of the sigmoid colon associated with a low-density intramural abscess (arrow). From Levy AD, Mortele KJ, Yeh BM (eds) (2015). Gastrointestinal imaging. By permission of Oxford University Press.

section 15 Gastroenterological disorders 2758 Clinical context Defining abnormal GI function and the need for investigation In health, the GI tract allows the human being to thrive. Therefore, investigations are required if the human is not thriving, is losing weight, or starts to develop abnormal GI symptoms especially when empirical therapy to correct them is ineffective. The purpose of in- vestigations therefore, must be twofold: first to identify why the GI tract is behaving abnormally, and second, but equally critically, to define which treatment(s) are likely to be most effective at improving the patient’s outcome. Patients want disease processes to be diag- nosed accurately, but once a diagnosis of a disease is made, they often feel that their symptom burden and its effect on their quality of life are not addressed optimally. The role of investigations must be to enhance health gain for the patient. Why do GI symptoms occur? It is often poorly appreciated why people experience abnormal GI symptoms. However, the answer is simple. Abnormal symptoms are caused by an alteration in normal GI functioning, that is, a change in normal GI physiology. It is widely assumed that abnormal GI symptoms develop as a result of pathological change, processes which can involve inflammation, oedema, ulceration, atrophy, cell death, and infection. However, this is profoundly unhelpful as pathological change very rarely—if ever—causes symptoms directly. A pathological insult can potentially affect any part or all of the GI tract. Different parts of the GI tract have very different physio- logical roles. Therefore, for example, a pathological disease process affecting the proximal small bowel may have a very different effect to that in the distal small bowel (Fig. 15.3.4.2). Completely different physiological functions are at risk at the two sites within the GI tract. Pathological damage in the proximal small bowel may particularly affect carbohydrate malabsorption, while the same type of change in the distal small bowel may predominantly affect reabsorption of bile acids. However, both carbohydrate

malabsorption and bile acid malabsorption may be characterized by identical symptoms, namely episodes of loose stool, bloating, and cramps. So, when investigating GI function, it is important to understand that while some pathological changes may lead indirectly to clinical symptoms, others remain subclinical. Whether the patient develops symptoms depends on whether critical physiological change has been triggered by the pathological insult or not. This explains why different pathological processes can produce identical symptoms. Even clusters of symptoms do not reliably define the underlying cause for those symptoms as the GI tract only responds to pathological damage in a limited variety of ways. Consider a very common clinical problem such as iron deficiency anaemia. Clearly, exclusion of GI tract malignancy as a cause for this is very important, however, the diagnostic process often stops at that point. Yet for the symp- tomatic patient, while they are no doubt reassured that they do not have cancer, identifying the reversible cause for iron deficiency (e.g. small-bowel bacterial overgrowth, coeliac disease, or hookworm in- festation) will have a greater impact on their long-term quality of life than undergoing a normal colonoscopy. Even if GI pathological changes cannot currently be reversed, for example, after therapeutic irradiation for cancer in the pelvis, there is no reason why symptoms cannot be treated through identification and correction of the physiological deficits that are induced by those pathological changes. Using the examples of proximal and distal small-bowel physiological change previously cited, interventions to improve symptoms such as prescribing an antidiarrhoeal might be helpful, but why not investigate the patient in detail so as to be able Normal gut function aims to optimize nutrient absorption by balancing ... FLUID SECRETION FLUID REABSORPTION CONTRACTILITY PERMEABILITY ILEOCAECAL VALVE *altered microbiota *vitamin and bile acid malabsorption *altered motility *bacterial overgrowth *fat malabsorption *pancreatic insufficiency *carbohydrate malabsorption UPPER GASTROINTESTINAL TRACT *altered motility *altered fermentation *altered sphincter control LOWER GASTROINTESTINAL TRACT ANY INSULT CAN CAUSE Fig. 15.3.4.1 The pictorial representation of the physiology of the gastrointestinal tract. The effect of disordered physiology is shown on the right-hand side; the conditions seen in the small bowel are drawn in pink, and in the large bowel in blue. The diagnostic process has two aims: (1) to identify and treat the insult leading to physiological change and (2) to identify and treat any altered physiology which causes abnormal symptoms. Why gastrointestinal symptoms? Any insult Pathological change Cell death Atrophy Ischaemia Oedema Inflammation Fibrosis Affects specific gastrointestinal physiological functions depending on the affected site Symptoms Fig. 15.3.4.2 The physiological model for the development of abnormal gastrointestinal symptoms.

 to prescribe treatments which target the underlying cause for the symptom? This has the benefit that it allows the patient to under- stand why the symptom is occurring and to make lifestyle changes to reduce the risk of this happening. Carbohydrate malabsorption is abolished by reducing dietary intake of the nonabsorbed mono- or disaccharide or appropriate enzyme replacement with probiotics or presynthesized orally ingested disaccharidases while symptoms of bile acid malabsorption will not occur if people follow low-fat diets and/or use bile acid sequestrants. Understanding that GI symptoms are due to altered physiology helps focus investigations much more coherently, and this is per- haps best exemplified by the largest group of patients consulting with GI disorders in primary and secondary care, those potentially having ‘irritable bowel syndrome’. It has been clear for 30 years that in the large number of people referred with irritable bowel syndrome-like symptoms but characterized by intermittent or con- stant loose stool, up to 80% have organic, treatable pathology which is very unlikely to be due to colorectal cancer or inflammatory bowel disease (Table 15.3.4.1). So, the

traditional approach of lower GI endoscopy—which excludes only colorectal cancer and inflammatory bowel disease—before any other investigations, is inappropriate in this patient group, delays diagnosis and treatment, risks unneces- sary complications, and wastes significant amounts of money for both healthcare systems and patients. Taking a history to guide investigations Booking investigations must be guided by the history. Discussing GI symptoms can be very difficult for patients so history taking to help elicit GI symptomatology accurately requires a sensitive and systematic approach. It is useful to establish clearly at the outset what the patient considers as 'normal' (i.e. their premorbid GI bowel function) and when the current symptoms developed from that 'normal' state. The greatest problem in obtaining an accurate history is the poor agreement about the meaning of specific terms. For ex- ample, 'indigestion' may encompass reflux, regurgitation, dys- phagia, dyspepsia, bloating, or even flatulence. Many patients will term frequency of defecation if increased above normal lev- els as 'diarrhoea' even when the stool consistency is completely normal. A critical marker of reversible GI tract pathology— intermittent or constant steatorrhoea—is rarely identified as such by patients or clinicians and is often mistaken for diarrhoea. Table 15.3.4.2 describes the causes for diarrhoea and steatorrhoea. The two conditions need to be investigated differently. Some pa- tients will deny symptoms because they are too embarrassed or feel nothing can be done. For example, (faecal) 'incontinence' is considered by many as highly stigmatizing and so will be denied, while asking about 'accidents', 'soiling', or 'leakage' may elicit an admission that it occurs. So, caution and rigor is needed in interpreting what the patient is saying. Dietary habits frequently contribute to the development of ab- normal GI symptoms. Careful questioning in six areas can often pay dividends:

1. Is the alcohol intake excessive?
2. What is the fibre intake (excessive/inadequate)?
3. Could lactose-containing foods/drinks trigger the symptoms?
4. Is diarrhoea triggered by the intake of richer, fattier foods?
5. Could nutritional supplements (e.g. excess selenium causing nausea, diarrhoea, and halitosis) trigger symptoms?
6. Is the diet balanced? Discussion aids and physical examination Using simple tools to clarify what the patient means can be very illu- minating. Disordered GI function may have many ramifications for patients, so completing a holistic needs assessment questionnaire Table 15.3.4.1 Common missed organic causes for patients misdiagnosed with diarrhoea-predominant irritable bowel syndrome. These data suggest that in patients with appropriate symptoms, that SeHCAT scanning, breath testing, stool for faecal elastase, and a coeliac screen are important first-line investigations and that endoscopic assessment should be a second-line test in a patient with no alarm symptoms Diagnosis % with this condition Best diagnostic tests for this condition Infectious diarrhoea <1 Stool culture Inflammatory bowel disease <1
7. Inflammatory markers (e.g. CRP, faecal calprotectin)
8. Colonoscopy/capsule endoscopy/enteroscopy
9. Radiological assessment Cancer <1
10. Colonoscopy
11. Radiological assessment Coeliac disease <4
12. Serum tissue transglutaminase levels
13. Duodenal bulb biopsy
14. Trial of a gluten free diet

15. HLA testing Pancreatic insufficiency 6
16. Faecal elastase levels
17. Trial of pancreatic enzyme replacement
18. Radiological imaging Small intestinal bacterial overgrowth 4–78
19. Glucose/lactulose hydrogen, methane breath testing
20. Small-bowel aspirate and culture Bile acid malabsorption 32
21. SeHCAT scan Carbohydrate malabsorption/maldigestion 35–64
22. Hydrogen breath testing for monosaccharide and disaccharide deficiency
23. Small-bowel biopsy for assessment of mucosal levels of monosaccharidases and disaccharidases

section 15 Gastroenterological disorders 2760 (Fig. 15.3.4.3) before their first appointment is a useful start- ing approach. Patients often volunteer information on question- naires which they may fail to voice during consultations. There are a number of validated questionnaires asking about GI symptoms. The Gastrointestinal Symptom Rating Scale is particularly helpful in focusing the consultation on the symptoms troubling the patient. The Bristol Stool Chart (Fig. 15.3.4.4) is often invaluable in helping a patient explain their bowel function. To explore the impact of diet, asking the patient to complete a 7-day record of everything they eat and drink for assessment by a trained dietitian can some- times be helpful. Input from the patient's partner or family during the consultation frequently improves the quality of the information Table 15.3.4.2 Diarrhoea and steatorrhoea: the differential diagnosis and most useful diagnostic investigations Condition Diagnostic investigation of choice Diarrhoea Autonomic neuropathy Autonomic testing Bile acid malabsorption SeHCAT scan Carbohydrate malabsorption

1. Hydrogen breath testing for monosaccharide and disaccharide deficiency
2. Small-bowel biopsy for assessment of mucosal levels of monosaccharidases and disaccharidases Constipation with overflow Plain abdominal X-ray Dietary/alcohol problems Careful dietary history Drug side effects Careful drug history Endocrine abnormalities Measurement of renal function/glucose levels/glycosylated haemoglobin/thyroid function tests/morning cortisol levels/short Synacthen test/parathyroid levels Infection Stool for culture Urine dip sticks and midstream sample for culture Chest X-ray Neoplasia
3. Colonoscopy
4. Radiological assessment
5. Gut hormone screen plus chromogranin A and B Inflammatory bowel disease
6. Inflammatory markers (e.g. CRP, faecal calprotectin)
7. Colonoscopy/capsule endoscopy/enteroscopy
8. Radiological assessment Laxative abuse/factitious diarrhoea Low stool osmolality <290 mosmol/kg High stool magnesium levels >45 mmol/litre Stool sample for laxative screen Mesenteric ischaemia Digital subtraction angiography Microscopic colitis Colonoscopically directed biopsies Radiation enteropathy History of previous radiotherapy and typical symptoms Rapid transit Radiopaque marker study Short bowel syndrome Contrast small-bowel meal with measurement of residual small-bowel length Small-bowel bacterial overgrowth
9. Glucose hydrogen, methane breath testing

10. Small-bowel aspirate and culture Stricture formation Endoscopy/radiology Steatorrhoea Bile acid malabsorption SeHCAT scan Intra- and extrahepatic bile duct disease Radiological imaging Intestinal lymphangiectasia Trial of a low-fat/low-long-chain triacylglycerol diet Lymphangiography Pancreatic insufficiency
11. Faecal elastase levels
12. Trial of pancreatic enzyme replacement
13. Radiological imaging Small-bowel bacterial overgrowth
14. Glucose hydrogen, methane breath testing
15. Small-bowel aspirate and culture Free fatty acid malabsorption Trial of a low-fat/low-long-chain triacylglycerol diet Neuroendocrine tumour Serum gut hormone and chromogranin A and B levels Small-bowel disease (e.g. lymphoma/Crohn's disease/coeliac disease/ amyloidosis/cystic fibrosis/tuberculosis/chronic parasite infection (e.g. giardiasis) Typical changes on blood test/radiology/endoscopy/biopsy/stool culture Drug therapy (e.g. use of Benecol/Orlistat/Lanreotide/Octreotide) Careful history

15.3.4 Investigation of gastrointestinal function 2761 obtained. Having precise data significantly enhances the choice of investigations. An appropriate physical examination is required. In patients who are acutely ill, this must include careful recording of their vital signs, while lying and standing blood pressures can be a useful measure of severity of dehydration. The ready availability and accuracy of flexible sigmoidoscopy requested urgently if required has meant that examination with rigid sigmoidoscopy has become largely unnecessary. Requesting investigations Before requesting investigations, a clinical decision needs to be made whether they are required urgently or whether they can be requested routinely. Is the expertise present to perform the appro- priate investigation safely and is the appropriate multidisciplinary team available to review and interpret the result? In addition, if mul- tiple investigations are required, should they all be requested at the same time or should they be requested sequentially? The guiding principle in so much of medical practice, Occam's razor, is often interpreted to suggest that 'diagnostic parsimony should be employed', in other words that the simpler the hypoth- esis for the cause of the symptoms, the more likely it is to be true. Occam's razor, however, is extremely unhelpful for determining the cause of GI symptoms especially in those who have complex dis- eases. In that situation, Hickam's dictum that 'patients can have as many diseases as they damn well please' is much more appropriate. Basic investigations should usually include haematological and biochemical profiles including thyroid function, vitamin B12 and vitamin D status, a coeliac screen, iron studies, and inflammatory markers. Useful additional blood tests to consider when investigating abnormal GI function are listed in Table 15.3.4.3. Specific investigations should be tailored for the principal symp- toms and should reflect an understanding of the potential aetiolo- gies. There are two different types of tests available to the clinician: (1) tests which look at anatomical structure and (2) tests which examine dynamic and physiological function. Holistic Needs Assessment: Concerns Thermometer (over 25yrs) PREFERRED NAME: "I am coping well" YES PRACTICAL CONCERNS RELATIONSHIP CONCERNS EMOTIONAL CONCERNS SPIRITUAL/REUGIOUS CONCERNS SECONDLY, using the concerns list opposite, for each item please tick YES or NO to indicate if it has been a concern for you during the past week (including today). Please tick DISCUSS if you wish to speak further about your concern. No distress 0 1 2 3 4 5 6 7 8 9 10 Extreme distress FIRSTLY, please circle the number (0–10) that best describes how much distress you have been experiencing in the past week (including today). Caring responsibilities My appearance Bathing or dressing Breathing difficulties Passing urine Constipation Diarrhoea Eating or appetite Fatigue, exhaustion or extreme tiredness Feeling swollen

High temperature or fever Getting around (e.g. walking) Indigestion Sore or dry mouth Nausea or vomiting Pain Sexual concerns Dry, itchy or sore skin Sleep problems Tingling in hands or feet Changes in how things taste Hot flushes Memory or concentration Wound care after surgery Other medical condition or disability Other concerns: YES NO Housing or Finances Transport or parking Work or Further Information needs Relationship with my children Relationship with my family Relationships Loneliness or isolation Sadness or depression Sadness or depression Anger or frustration Guilt Hopelessness Difficulty making plans Sexual concerns Loss of faith or other spiritual concern Loss of meaning of purpose in life Feeling regret about the past NO Discuss YES PRACTICAL CONCERNS NO Discuss YES NO PATIENT IDENTIF1ER: PATHWAY POINT: DATE:
Fig. 15.3.4.3 An example of a holistic needs assessment questionnaire. Adapted with permission from the NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for Distress Management V.2.2018.

section 15 Gastroenterological disorders 2762 Tests investigating anatomical structure Anatomical examination using increasingly sophisticated tech- niques can be performed either endoscopically or by cross-sectional imaging using radiation, ultrasonography, or magnetic resonance imaging. Technological innovation means that imaging devices including ultrasound systems, microscopes, and Doppler probes are increasingly incorporated into endoscopes and laparoscopes. However, while endoscopic assessment allows high-quality visu- alization of the interior of the lumen of the GI tract, and allows sam- pling of tissues under direct vision, it offers no objective data about any structure which is beyond the field of vision (e.g. outside the lumen wall), nor does it offer accurate information about function. It usually requires specific preparation before it is performed, for example, fasting or bowel cleansing, which in their own right may cause alteration in function. It can also be misleading: for example, if inflammation is seen, that may not be the cause of the patient’s symptoms. In complex scenarios, luminal endoscopy can be com- bined with minimally invasive surgical techniques (laparoscopy) to give a more complete anatomical picture. Advances have allowed increased resolution of the human body when using cross-sectional imaging techniques. However, the im- ages achieved even with the sophisticated contrast media available still need to be interpreted correctly taking the clinical context into account, a process which requires considerable experience and skill. While anatomical abnormalities can be imaged and reimaged easily, Bristol Stool Chart Type 1 Separate hard lumps, like nuts (hard to pass) Sausage-shaped but lumpy Like a sausage but with cracks on the surface Like a sausage or snake, smooth and soft Soft blobs with clear-cut edges Fluffy pieces with ragged edges, a mushy stool Watery, no solid pieces. Entirely Liquid Type 2 Type 3 Type 4 Type 5 Type 6 Type 7 Fig. 15.3.4.4 The Bristol Stool Chart. Table 15.3.4.3 Potentially useful laboratory tests to investigate abnormal luminal GI function Type of test Name of the test Notes Haematology Full blood count Erythrocyte sedimentation rate INR May be abnormal in malabsorption Glycosylated haemoglobin level Associated with visceral neuropathy and small-bowel bacterial overgrowth Biochemistry Urea and electrolytes Liver function tests Vitamin B12 Vitamin D Red blood cell folate Ferritin Transferrin saturation Coeliac screen HLA serotyping HLA

DQ2 or DQ8 >95% of coeliac patients CRP Triglyceride levels Morning cortisol level If low requires Synacthen test IgG4 ? Autoimmune pancreatitis Amylase/pancreatic lipase 7α-hydroxy-4-cholesten-3-one (C4) ? Bile acid malabsorption Gut hormones, chromogranin A and B ? Neuroendocrine tumours Cancer markers Carcinoembryonic antigen/CA125/CA19-9 Antibodies to intrinsic factor Vitamin B12 deficiency

15.3.4 Investigation of gastrointestinal function 2763 again almost no information is provided about function and espe- cially in younger patients, imaging techniques which involve ion- izing radiation increase the risk of subsequent radiation-induced malignancy. Tests investigating gastrointestinal dynamic function and physiology While assessment of anatomy may be useful, assessing GI motility, peristalsis, and sphincter behaviour help define neuromuscular dis- orders of the digestive tract. However, remarkably frequently, the abnormalities detected in the various tests do not clearly relate to patients' symptoms. Some people argue this may partly be because many of these tests have historically been performed without agree- ment as to the best methodology. Investigations which measure the effect of enzymes or analyse the gaseous by-products of bacteria can also be useful ways to assess function. The range of tests is discussed in the following subsections. Oesophagus When there is no obvious anatomical abnormality, oesophageal manometry can accurately diagnose achalasia, diffuse oesophageal spasms, and nutcracker oesophagus and suggest the presence of scleroderma. Ambulatory oesophageal pH monitoring is the gold standard for the diagnosis of acid and nonacid gastro-oesophageal reflux. Catheter-free radio telemetric systems where available are now the diagnostic method of choice. Stomach Measuring gastric emptying can be performed by scintigraphic emptying of a test meal, by breath testing using stable isotopes, ultra- sonography, magnetic resonance scanning, or by wireless motility capsule. The results often differ from one another. The type of standard meal may need to be varied between patient groups. The presence of Helicobacter pylori infection can be assessed either by direct sampling of the gastric antral mucosa, by looking for helicobacter antigen in stool, or performing breath testing using13C, a stable isotope. Pancreas Many tests can accurately diagnose advanced pancreatic insuffi- ciency. The noninvasive tests are unreliable in those with early, mild disease. Some specialized invasive tests can reliably detect mild pan- creatic insufficiency but are only available at a few quaternary re- ferral centres. Stool chymotrypsin and elastase-1 concentrations if very low (<15 μg/g stool) indicate likely significant pancreatic exocrine insuf- ficiency, while if normal (>500 μg/g stool) makes exocrine insuffi- ciency very unlikely. Measures of these stool enzymes in between the extremes are unreliable measures of pancreatic function. A 10-day therapeutic trial of pancreatic enzyme replacement (10 000–30 000 PhEur units of lipase with each and every snack—including all drinks except black tea, black coffee, and water, and 30 000–50 000 PhEur units with each main meal) can be helpful if the stool enzyme levels are not clear cut. More formal assessment tests such as the Lundth meal are essentially obsolete although some units still con- sider performing a secretin/cholecystokinin stimulation test with or without MRI assessment of the pancreatic duct. Small intestine Small-bowel transit time is difficult to quantify and can be affected by many factors. When a measurement is required, scintigraphy, hydrogen breath testing, and wireless capsule are the favoured methods. These are perhaps preferred over transit studies using radiopaque markers which require radiation exposure from serial abdominal radiographs. Glucose hydrogen breath testing will identify 65% of patients with small intestinal bacterial overgrowth. The addition of methane ana- lysis will identify a further 25% of patients. Small-bowel aspiration with positive culture is particularly helpful at guiding appropriate antibiotic usage but is rarely performed routinely. A trial of broad- spectrum antibiotics

(e.g. rifaximin 550 mg twice daily or ciproflox- acin 500 mg twice daily or doxycycline 200 mg day 1, 100 mg days 2 onwards for 7–10 days) without any investigations is sometimes advocated but carries risks of unnecessary treatment and its com- plications; and if the antibiotic is not effective, does this mean that bacterial overgrowth is absent or that the organism is resistant? Mono- and disaccharide malabsorption is common. Protocols for fructose, lactose, galactose, and sucrose breath testing are described. If positive, exclusion diets can be prescribed, otherwise these disac- charides are sometimes replaced either by coadministration of these carbohydrates with the appropriate probiotics which contain the required enzymes or with the coadministration of presynthesized enzymes. Type of test Name of the test Notes Stool tests Faecal elastase If low possibly diagnostic of untreated Coeliac disease, pancreatic insufficiency or small intestinal bacterial overgrowth Faecal chymotrypsin Faecal α1 antitrypsin Protein-losing enteropathy Faecal lactoferrin GI tract inflammatory marker Faecal calprotectin GI tract inflammatory marker Stool for culture and sensitivity Helicobacter pylori antigen Faecal occult blood testing Urine Urinary 5-hydroxyindoleacetic acid (5-HIAA) Table 15.3.4.3 Continued

section 15 Gastroenterological disorders 2764 Probably, the most reliable assessment tool of small-bowel func- tion is the selenium homocholic acid taurine (SeHCAT) scan, which assesses for the condition ‘bile acid malabsorption/diarrhoea’ which affects 1% of the population. Colon Scintigraphy correlates well with results obtained using radiopaque markers. However, scintigraphy may be particularly useful in demonstrating regional colon transit. Pelvic floor and rectoanal dynamics Barium defecography has been largely replaced by magnetic res- onance defecography. Dynamic imaging and new scanners allow studies in the seated position which provide detailed information about anatomical structures and how they integrate with function. Conclusion Understanding that abnormal GI symptoms arise as a result of al- tered physiological processes provides a rational approach to dealing with symptoms, particularly those that are complex. If abnormal symptoms are identified clearly, all relevant differential diagnoses are considered, and appropriate investigations performed, then ab- normal results allow treatments to be applied systematically. Such an approach has been shown to be effective in clinical studies and can easily be taught. All investigations carry a risk and inconvenience for the patient, from the test itself, from the possibility of false-negative or false- positive results, from how the result is interpreted, from further investigations which it instigates, or from treatments which are then prescribed. In an era where more complex investigations are being ordered and the results reviewed by nonmedically qualified practi- tioners or nonspecialists, it is essential that all those requesting and reviewing tests work within their competency and understand when they need to seek additional advice, and where the sources of that advice are. FURTHER READING Andreyev HJN, et al. (2015). Guidance: the practical management of the gastrointestinal symptoms of pelvic radiation disease. Frontline Gastroenterol, 6, 53–72. Camilleri M, et al. (2008). American Neurogastroenterology and Motility Society consensus statement on intraluminal measure- ment of gastrointestinal and colonic motility in clinical practice. Neurogastroenterol Motil, 20, 1269–82. Grace E, et al. (2013). Review article: small intestinal bacterial overgrowth-prevalence, clinical features, current and develop- ing diagnostic tests, and treatment. Aliment Pharmacol Ther, 38, 674–88. Jellema P, et al. (2009). Systematic review: accuracy of symptom-based criteria for diagnosis of irritable bowel syndrome in primary care. Aliment Pharmacol Ther, 30, 695–706. Slattery SA, et al. (2015). Systematic review with meta-analysis: the prevalence of bile acid malabsorption in the irritable bowel syn- drome with diarrhoea. Aliment Pharmacol Ther, 42, 3–11. Svedlund J, Sjödin I, Dotevall G (1988). GSRS—a clinical rating scale for gastrointestinal symptoms in patients with irritable bowel syn- drome and peptic ulcer disease. Dig Dis Sci, 33, 129–34.

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