Orocaecal transit time in health and disease

Few gastroenterologists would underrate the importance of gastrointestinal motility in the pathogenesis of gut symptoms, particularly as the majority of clinic patients have functional symptoms. While there have been genuine advances in the understanding of the neurohumoral control mechanisms of gut motility, clinical applications have been limited. Gastroenterologists have therefore shown great interest in simple and non-invasive methods of assessing gut transit. The rate of passage of barium during small bowel radiology is unreliable and lacks correlation with symptoms. Observations of the pulmonary excretion of $\text{H}_2$ after instillation of carbohydrate into the colon have stimulated good clinical research on small bowel transit in the last 20 years. The techniques are so easy and the rationale so beguiling, however, that an objective evaluation of oro-caecal transit time (OCTT) measurements is needed.

The techniques to measure OCTT in man include the breath hydrogen test and gamma scintigraphy. The results of the breath hydrogen test depend critically on the method used. Most work has been done using an iso-osmotic solution of lactulose which reaches the caecum in about 90 minutes. Reproducibility can be improved by combining the lactulose with a standardised liquid meal, but a sustained rise in breath hydrogen still occurs two to three hours earlier than in experiments done with solid meals containing unabsorbable carbohydrate such as baked beans. Some of this difference in OCTT is explained by the slower gastric emptying of a solid meal. Lactulose probably accelerates its own transit through its osmotic activity of holding fluid in the gut. To overcome this problem, trace amounts of $\text{C}-\text{lactulose}$ have been used and the endpoint taken as the appearance of $\text{C}^4\text{CO}_2$ in breath, but the OCTT was too variable unless lactulose 10 g was added as a carrier. Whatever carbohydrate substrate is used must be shown to eliminate extra-intestinal influences such as smoking and exercise. There are some minor differences in OCTT in women between the follicular and luteal phases of the menstrual cycle. Transit is appreciably slower in a healthy but elderly population. The practical difficulties include identifying the first sustained rise in breath hydrogen because of an unusually high baseline fasting level or the absence of a rise after a meal. A smaller, much earlier peak in breath hydrogen ascribed to a residue of the previous meal passing from the ileum into the caecum with the next meal taken is now believed to result from buccal fermentation of ingested carbohydrate. Indeed the early peak is abolished by a bacterial mouthwash and by duodenal intubation. The breath hydrogen test itself cannot provide evidence concerning colonic transit or gastric emptying, but Read has perfected a method of quantifying each element of whole gut transit by adding radio-opaque markers to a standard meal for faecal recovery and labelling the meal (mashed potato) with $\text{Tc}$-sulphur colloid to allow gastric emptying to be determined simultaneously by a scintillation detector positioned over the fundus of the stomach.

Gamma scintigraphy is an extension of this estimate of gastric emptying applied to the whole gut using a more sophisticated gamma camera. Different phases and components of a meal can be labelled, for instance $\text{I}-\text{I}-\text{b}ran$ or $\text{Tc}$-sulphur colloid potato, and images of its passage throughout the gastrointestinal tract are produced. By using differential labelling of the solid and liquid components it is clear that the two phases travel through the small bowel at a similar rate once they leave the stomach. The outstanding problem is how to delineate the area of interest for scanning acquisition accurately. For instance loops of small intestine may obscure the caecum and right colon, although advances in camera technology and software development will gradually overcome these difficulties. There is good correlation between the breath hydrogen test and gamma scintigraphy both for liquid and solid meals.

What are the practical applications of OCTT measurements? Its non-invasive nature has made it particularly suitable for evaluating new drugs which might affect gastrointestinal motility and already gamma scintigraphy is giving some useful physiological insights into normal digestion. Scanning has shown the ileum has considerable reservoir function, a labelled meal sometimes staying there until the next meal is ingested. The significance of OCTT measurements in the mechanisms of altered bowel habit is difficult to interpret without colonic data. The colon can cope with a four-fold increase in ileal fluid presented to it without diarrhoea developing. It is therefore unlikely that even a halving of transit time will have much effect unless there is colonic disease, a previous resection or dysmotility. In thyrotoxicosis there is a consistent shortening of transit time in all patients but very few report any bowel disturbance. Diarrhoea after small bowel resection correlates better with the amount of colon remaining. A sudden bolus of $0.5$ of ileal effluent may compromise the normal colon’s salvage function, however, and clearly any disturbance of colonic transit will be crucial too. The interplay between small and large bowel transit is complex. Read and colleagues have shown that painless balloon distension of the rectum slows OCTT in healthy controls. This may explain a slower OCTT in constipated subjects, and increased rectal sensitivity is a possible explanation for the unexpected finding of a slower than normal OCTT in patients with ulcerative colitis. It is only when delay of OCTT is gross, as in chronic or recurrent pseudo-obstruction, that symptoms develop, and small bowel bacterial overgrowth may further complicate the picture. It seems that the resting interdigestive migrating motor complex is particularly important in “cleansing” the colon and preventing this colonisation.

The irritable bowel syndrome has received particular attention. Most although not all studies have shown a more rapid OCTT in the diarrhoea variant of irritable bowel syndrome. Dynamic scintigraphy has shown that in normal subjects the intake of a meal results in release of a previously ingested radiolabelled bran meal from the distal ileum into the caecum, whereas this postprandial event may be reduced or absent in the irritable bowel syndrome patient with pain and bloating. Constipated irritable bowel syndrome patients have slower OCTT as well as delayed colonic transit.

The breath hydrogen test has proved invaluable in clinical practice for the detection of sugar malabsorptions and small bowel bacteria overgrowth, but its use for measuring OCTT, while a stimulating research tool for
non-invasive clinical investigation, has had limited clinical impact.  

Royal Liverpool Hospital  

5 La Brooy SJ, Male PJ, Reavis AK, Missewicz JJ. Assessment of the reproducibility of the lactulose H₂ breath test as a measure of mouth to caecum transit time. Gut 1983; 24: 893-6.  