Gut, 1992, **33**, 148–149

Leading article

Rectal and anal endosonography

Conventional ultrasound using an external transducer on the body wall has an important limitation. A balance has to be struck between the better resolution of a high frequency transducer and its focal length. To obtain really good images the transducer has to be as close to the organ of interest as possible. The idea of using an ultrasound transducer inside a body cavity, now known as endosonography, was first proposed and explored by Wild nearly 30 years ago.[1] Wild and Foderick were the first to image bowel wall and a rectal cancer using this technique. Prostatic endosonography was developed first, followed in the early 1980s by rectal wall scanning.[2] Although there has been increasing interest over the past decade, with the publication of outstanding images of normal anatomy, tumours, lymph nodes, and local recurrences and a series of excellent reports comparing the accuracy of endosonography with computed tomography, it remains the preserve of a minority of enthusiasts.

The equipment for anorectal endosonography is less expensive than the flexible endoscope mounted systems used in the upper gastrointestinal tract to image oesophagus, stomach, and pancreas.[3] Most of the pioneering work in the field has been carried out using a rigid rotating 7 mHz transducer which provides a continuous series of cross-sections through the rectum and pelvis.[4] The transducer is surrounded by a water filled balloon to give good acoustic contact with the gut wall, although occasionally soft villous polyps are better imaged by filling the rectum with fluid so that they are not compressed by the balloon. The transducer is best placed in position through a rectoscope, and a good rectal preparation with a disposable enema is essential. The examination takes only 10 to 15 minutes and sedation is not usually necessary, though for some patients with painful tumours intravenous pethidine and midazolam is a good substitute for an examination under anaesthesia. The normal ultrasound anatomy of the rectal wall has been established by laboratory and clinical studies,[5] and the appearances are very similar to those observed in the stomach and duodenum.[3] The principal technical problems are tight stenotic tumours, small cancers, and tumours at 15 cm or higher. A plastic cone placed over the transducer can be used for strictures and imaging the anal canal, but a view of only the lower end of a bulky stenotic cancer may be all that is possible.

The major applications of endosonography are staging primary rectal cancer, imaging unusual pelvic lesions, follow up after restorative surgery for recurrence, and more recently the scanning of the anal sphincter for injuries and fistula tracts.

Rectal cancers have traditionally been assessed preoperatively by digital examination.[6] Surgery remains the best radical form of treatment for rectal cancer, and survival depends on local extent of tumour invasion, lymph node spread, and surgical technique. Careful preoperative assessment of local invasion provides both prognostic information and will help determine the appropriate surgical or alternative management. Experienced clinicians can predict whether tumours are confined to or have spread through the rectal wall with an accuracy of around 75%, but the accuracy is only of the order of 50 to 60% with a less practised finger.[6] Depth of penetration within the rectal wall is poorly recognised by digital examination and some high rectal tumours are beyond the examining finger. The accuracy for assessing local invasion by endosonography varies from 85 to 95%,[4 7-11] and there is a good correlation between the lateral spread of a tumour measured by endosonography compared with histopathology.[7] Endosonography has been shown to be more accurate than digital examination and computed tomography in the same series of patients.[12] Magnetic resonance imaging gives a more accurate indication of the extent of tumour spread beyond the bowel wall and its relation to the pelvic floor than computed tomography.[13] No direct comparisons have yet been made with endosonography, but the high cost of magnetic resonance imaging and limited availability probably preclude its routine use.

Normal lymph nodes and slightly enlarged reactive or inflammatory nodes are not usually imaged by endosonography. The presence of an echo-poor lesion in the perirectal tissues usually indicates a metastasis with a probability of around 80%.[11 14] False positives occur because endosonography cannot characterise tissues or distinguish between malignant reactive and inflammatory echo-poor nodes. Nodes can also be confused with blood vessels and they cannot be distinguished from islands of tumour in the mesorectum but outside the rectal wall. False negatives are the result of micrometastases in normal sized nodes which are not detected. The accuracy of endosonography in predicting N1 node involvement is from 73 to 83%.[11 14] Size is important and the probability of a node being affected rises if it is greater than 0·5 cm in diameter.[14]

Since endosonography is an accurate and objective method of assessing local invasion, it is the investigation of choice in the pretreatment staging of patients with superficial tumours amenable to local treatment and in the assessment of more advanced tumours in elderly unfit patients in whom there may be an alternative to major surgery and a colostomy. Endosonography may not always be able to identify apparent fixation caused by inflammation rather than tumour spread but it can confirm that a tumour is fixed as a result of invasion into surrounding structures. Computed tomography provides a better overall assessment of the pelvis in patients with advanced disease.[15]

Most patients (some 80%) fall into neither of these groups, however, and it is not yet known whether the findings at endosonography affect management in sufficient numbers to warrant the additional time and expense of the examination.[16] In those patients entered into trials of preoperative radiotherapy, staging is altered by radiotherapy such that the stage at surgery is not necessarily that at presentation. Endosonography would provide a more objective assessment of local extent than digital examination and is potentially cheaper and more readily available than computed tomography and magnetic resonance imaging. Images could be recorded on hard copy or video for later reassessment and comparison between participating centres.

Local recurrence occurs in 3–30% of patients after rectal surgery and the median time of diagnosis is two years.[17] True suture line recurrence is rare and more usually local recurrence in the pelvis eventually presents at the anastomosis. A number of small studies have shown that early local recurrences can be diagnosed by endosonography when other investigations are negative.[18] The optimal timing of

postoperative examinations has not been determined. Endosonography is a potentially cheap and readily available technique for postoperative follow up. It is not yet known whether early detection by this procedure improves survival, and it may not be cost effective assuming an average local recurrence rate of 10% and that some patients willl have distant metastases. Further studies comparing endosonography with postoperative pelvic imaging by computed tomography and magnetic resonance imaging are required, but will need large numbers and would be expensive to organise.

Anal endosonography is a more recent application. The water filled balloon is replaced with a water filled plastic nose cone and the anal canal can be imaged without causing discomfort from stretching or distorting the anatomy by compression. The ultrasound anatomy of the anal sphincter is now being determined. Traumatic gaps in the internal and external anal sphincters can be recognised perhaps replacing electromyographic mapping in preoperative assessment of sphincter injuries.[19] Anal endosonography may give some useful information about fistula tracts and the location of perianal abscesses[20]: thus far, however, digital examination seems to be more accurate.

It is surprising that rectal and anal endosonography is not more widely used. Compared with other methods of imaging it is relatively inexpensive and can be carried out in the clinic, adding very little extra time to a conventional sigmoidoscopy. Perhaps the problem is that ultrasound equipment is usually the preserve of radiologists and endosonography is more likely to be used by surgeons. Colorectal surgeons have not yet been convinced that it improves staging or follow up, despite the fact that their urology colleagues use it for prostatic imaging. Whilst endosonography may at the moment be a technique before its time, it will become an indispensable part of the armamentarium of any good colorectal unit in the future.

NEIL MORTENSEN

Department of Surgery and Gastroenterology,
John Radcliffe Hospital,
Oxford

1 Wild JJ. The use of ultrasonic pulses for the measurement of biologic tissues and the detection of tissue density changes. *Surgery* 1950; **27**: 183–8.
2 Dragsted J, Gammelgaard J. Endoluminal ultrasonic scanning in the evaluation of rectal cancer. *Gastrointest Radiol* 1983; **8**: 367–9.
3 Tio TL, Tytgat GNJ. Endoscopic ultrasonography in the assessment of intra- and transmural infiltration of tumours in the oesophagus, stomach and papilla of vater and in the detection of extra oesophageal lesions. *Endoscopy* 1984; **4**: 220–5.
4 Hildebrandt U, Fiefel G. Preoperative staging of rectal cancer by intrarectal ultrasound. *Dis Colon Rectum* 1985; **28**: 42–6.
5 Beynon J, Foy DMA, Temple LN, Channer JL, Virjee J, Mortensen NJMcC. The endoscopic appearances of normal colon and rectum. *Dis Colon Rectum* 1986; **29**: 810–3.
6 Nicholls RJ, York Mason A, Morson BC, Dixon AK, Kelsey Fry I. The clinical staging of rectal cancer. *Br J Surg* 1982; **69**: 404–9.
7 Beynon J, Foy DMA, Roe AM, Temple LN, Mortensen NJMcC. Endoluminal ultrasound in the assessment of local invasion in rectal cancer. *Br J Surg* 1986; **73**: 474–7.
8 Romano G, Derosa P, Vallone G, Rotondo A, Grassi R, Santangelo M. Intrarectal ultrasound and computed tomography in the pre and post operative assessment of patients with rectal carcinoma. *Br J Surg* 1985; **72** (suppl): S117–9.
9 Saitoh N, Okui K, Sarashina H, Suzuki M, Arai T, Nunomura M. Evaluation of echographic diagnosis of rectal cancer using intrarectal ultrasonic examination. *Dis Colon Rectum* 1986; **29**: 234–42.
10 Rifkin MD, Wechsler RJ. A comparison of computed tomography and endorectal ultrasound in staging rectal cancer. *Int J Colorectal Dis* 1986; **1**: 219–23.
11 Hildebrandt U, Fiefel G, Schwarz HP, Scherr O. Endorectal ultrasound; instrumentation and clinical aspects. *Int J Colorect Dis* 1986; **1**: 203–7.
12 Beynon J, Mortensen NJMcC, Foy DMA, Channer JL, Virjee J, Goddard P. Pre-operative assessment of local invasion in rectal cancer: digital examination, endoluminal sonography or computed tomography? *Br J Surg* 1986; **73**: 1015–7.
13 Hodgman CG, MacCarty RL, Wolff BG, May GR, Berquist TH, Sheedy PF, *et al.* Pre-operative staging of rectal carcinoma by computed tomography and 0·15T magnetic resonance imaging. *Dis Colon Rectum* 1986; **29**: 446–50.
14 Beynon J, Mortensen NJMcC, Foy DMA, Channer JL, Rigby H, Virjee J. Pre operative assessment of mesorectal lymph node involvement in rectal cancer. *Br J Surg* 1989; **76**: 276–9.
15 Zheng G, Eddleston B, Schofield PF, Johnson RJ, James RD. Computed tomographic scanning in rectal carcinoma. *J R Soc Med* 1984; **77**: 915–20.
16 Holdsworth PJ, Johnston D, Chalmers AG, Chennells P, Dixon MF, Finan PJ, *et al.* Endoluminal ultrasound and computed tomography in the staging of rectal cancer. *Br J Surg* 1988; **75**: 1019–22.
17 Phillips RKS, Hittinger R, Blesovsky L, Fry JS, Fielding LP. Local recurrence following 'curative' surgery for large bowel cancer: 1 The overall picture. *Br J Surg* 1984; **71**: 12–6.
18 Beynon J, Mortensen NJMcC, Foy DMA, Channer JL, Rigby H, Virjee J. The detection and evaluation of locally recurrent rectal cancer with rectal endosonography. *Dis Colon Rectum* 1989; **32**: 509–17.
19 Law PJ, Kamm MA, Bartram CJ. Anal endosonography in the investigation of faecal incontinence. *Br J Surg* 1991; **78**: 312–4.
20 Law PJ, Talbot RW, Bartram CI, Northover JMA. Anal endosonography in the evaluation of perianal sepsis and fistula in ano. *Br J Surg* 1989; **76**: 752–5.