

Anorectal Endosonography/ Elastography

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1. Introduction

Anorectal Elastography has been used in faecal/anal incontinence, inflammatory bowel disease (fistula and abscesses) and staging of colorectal carcinoma but to date, no prospective studies have been published. For Elastography of the anorectum, changes of the pressure of the external sphincter or inflation/deflation of the balloon are mandatory however, only small, additional changes of pressure are required. The ROI has to be sufficiently large to enable the Elastography image to display the elasticity of the sphincter relative to the surrounding tissues.

2. Faecal/anal incontinence

The basis for effective treatment of faecal/anal incontinence is an exact evaluation of individual anatomical and functional defects of the sphincter system and its surrounding structures. For this purpose, anorectal manometry and anorectal endosonography (EUS) are the mainstay of the diagnostic workup in such patients. Both rigid radial or longitudinal ultrasound endoscopes can be used. Based on the combined findings of these two methods and the clinical severity assessed with validated scores, four different types of incontinence can be distinguished: a predominantly sensory form, a mainly muscular form, a mixed form and a form with predominantly decreased rectal compliance and impaired reservoir function (small rectum disease). Each of these conditions needs different therapeutic

approaches. When EUS was introduced into the diagnostic work-up of incontinence, it was noticed that the great majority of patients with an otherwise non-classifiable idiopathic form of incontinence presented with morphologic/structural sphincter defects. In the group with the predominantly muscular form, EUS was found to be of particular importance, as it images inner (IS) and outer sphincter (ES) structures and the surrounding tissue with a high degree of sensitivity. In this group, a main cause of incontinence may be obstetric trauma with defects at the levels of the ES between the 10 o'clock and the 2 o'clock position. IS defects mainly arise from haemorrhoidectomy and/or other low rectum intervention. Scars in the EAS are mostly hypoechoic, those in the IS rather hyperechoic. Another group in this category, however, presents with normal EUS morphology, but pathological sphincter pressures. The second, predominantly sensory form presents with normal EUS and manometric findings. Sensations threshold tests, including the rectoanal inhibitory reflex (RAIR) are, however, often pathological. In the third form, usually both morphology and manometry findings are pathological, whereas in the last form of incontinence, EUS and manometry may or may not be pathological. In this form thickened IS may often be present and/or its contour may be disrupted.

Although EUS is regarded as an important tool in the evaluation of faecal incontinence yielding valuable morpho-

logic information, prognostic and therapeutic decisions cannot be based exclusively on such findings. In a recent comparative and prospective trial in irradiated and non-irradiated patients with faecal incontinence following surgery for rectal cancer, we found that the short and long term therapeutic outcome may be predicted by clinical rather than functional or morphologic parameters. In the search to obtain additional, clinically important information from EUS images, Elastography coupled to conventional sonography was recently introduced and shown to yield valuable information in a variety of disease conditions particularly from organs with inflammatory and/or malignant lesions. Differences in the tissue elasticity modulus can be imaged by Elastography and displayed with different colours e.g. red representing soft, green intermediate, and blue predominantly hard tissue structures (Fig. 1). Whereas in tumour and inflammatory tissues, Elastography was shown recently to yield additional valuable differential information in conjunction with the corresponding 2D images, the value of Elastography in the evaluation of patients with faecal incontinence is not yet clearly defined. In a prospective pilot trial we investigated N=30 patients with faecal incontinence (N=19 with lower anterior resection for colorectal cancer, N=6 with Crohn's colitis and N=5 with other conditions), to determine whether endosonographic Elastography of the SI/SE might give further important information in addition to clinical and functional (manometric) parameters and the conventional 2D EUS images. Clinical assessment of the degree of severity of incontinence was performed on a scale from 0 to 16 points (0-6 complete incontinence, 7-12 partial incontinence, > 13 normal continence) with a validated questionnaire; resting and squeeze pressures of the SI/SE were manometrically evaluated; 2D- and EUS coupled to Elastography was performed with a rigid rectal/anal probe (HITACHI EUB-8500). The evaluation was performed semi-quantitatively by simultaneous comparison of the 2D/Elastography images using an intensity scale from 0 (faint/absent) to 3 (strong). After a two-week high intensity biofeedback/pelvic floor exercise training, the patients were reassessed. The elasticity (red intensity) of the SI was significantly higher than that of the SE and vice versa. There was a negative correlation with the squeeze pressure (rs:-0451, $p < 0.031$), but not with the resting pressure. The red intensity of the ES was associated with a higher sensation threshold, the hardness of the ES was significantly higher in men than women, and decreased with increasing age in both genders. There was no correlation/association with the initial clinical severity and/or the short term therapeutic outcome. This investigation demonstrates that EUS-Elastography adds valuable additional

information of the SI/SE system with regard to its elasticity and/or hardness which may be associated with relevant clinical conditions. Further studies, however, are needed to corroborate these findings with special reference to therapeutic outcomes and decisions.

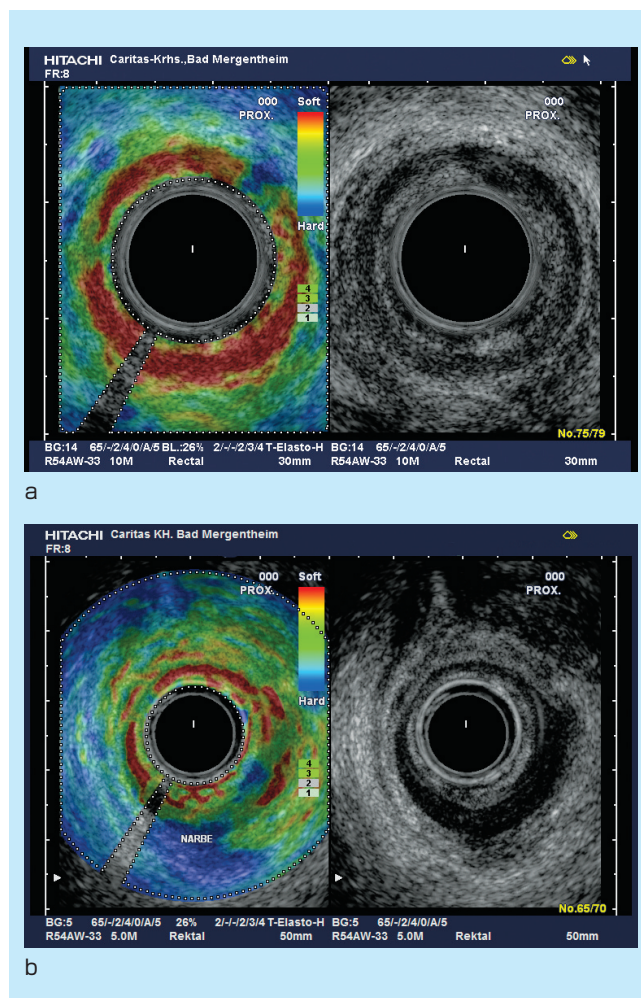


Fig. 1 : Sphincter defects

Differences in the tissue elasticity modulus of the internal anal sphincter can be imaged by Elastography with different colours e.g. red representing normal soft tissue, whereas predominantly harder tissue structures are seen in blue in the upper right quadrant, representing postoperative changes (a) and in the six o'clock position (b). Narbe = Scar.

3. Fistula and abscess

Up to now there is only casuistic experience of Elastography in patients with inflammatory bowel disease but preliminary results are convincing. Acute and chronic fistula might be differentiated by evaluating the stiffness of the surrounding tissue. Perineal ultrasound can be complementary.

4. Colorectal carcinoma

Up to now there is only casuistic experience of Elastography in patients with colorectal carcinoma. The hard (blue) carcinoma can be displayed in comparison to the surrounding softer (red) tissue (Fig. 2). Elastography is helpful and reproducible in detecting diffuse and circumscribed lymph node infiltration (Fig. 3).

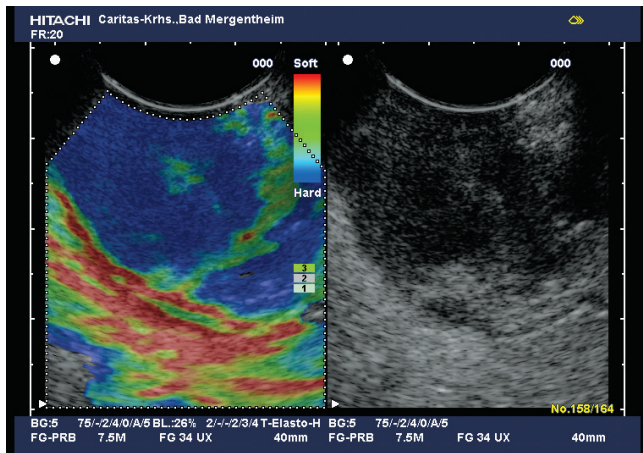


Fig. 2 : Colorectal carcinoma

The hard (blue) carcinoma can be displayed in comparison to the surrounding softer (red) tissue which is helpful in cancer staging to detect or exclude tumour growth beyond the rectal wall.

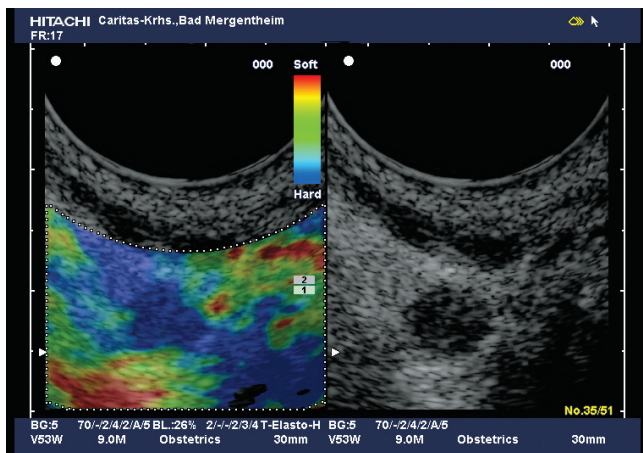
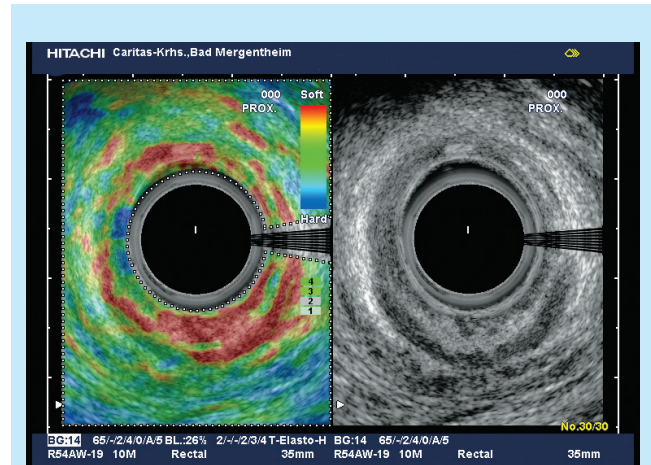
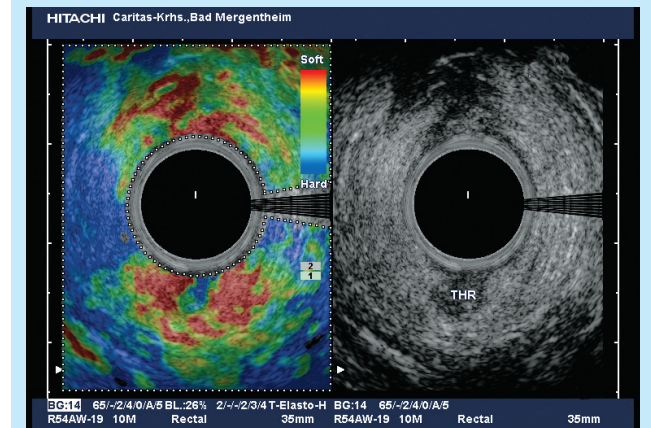


Fig. 3 : Lymph node infiltration

Elastography is helpful and reproducible in detecting diffuse and also circumscribed lymph node infiltration. Note the hard (blue) lymph node infiltration in the six o'clock position.



a



b

Fig. 4 : Haemorrhoids

Normal haemorrhoidal plexus display soft tissue (a, red). Thrombosis is harder (b, blue).

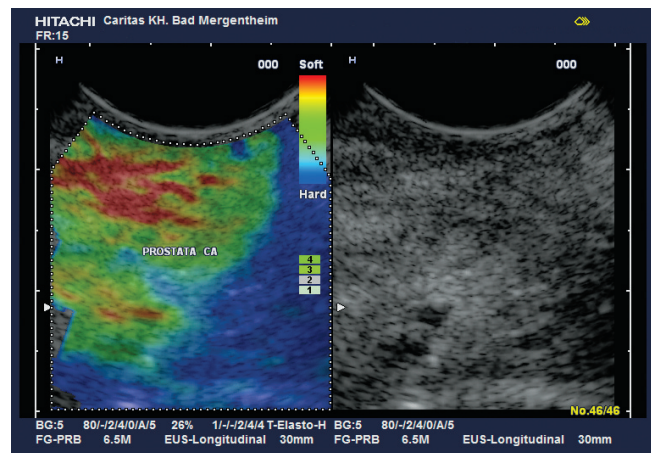


Fig. 5 : Prostate carcinoma (PROSTATA CA)

Prostate carcinoma diffusely infiltrating the peri-rectal tissue. Elastography defines the demarcation of hard (blue) neoplastic infiltration from non-neoplastic peri-rectal tissue (green - red).

5. Perineal ultrasound

In addition to the established technique of endorectal ultrasound (ERUS) perineal ultrasound (PNUS) is rarely applied in daily routine and only few studies deal with this complementary technique. PNUS is painless and easy to perform to detect and classify perineal fistula and abscesses. Anatomic knowledge of the perineal region is mandatory.

6. Limitations

There are also some limitations using endorectal ultrasound with Elastography. Limitations are mainly caused by air (as shown in Fig. 7), cysts and fluid collections leading to the so-called “tricolour artefact”, calcifications and most importantly depth penetration.

7. Conclusions

Elastography is a new diagnostic tool and initial work has shown that the technique is a valuable adjunct to anorectal endosonography.

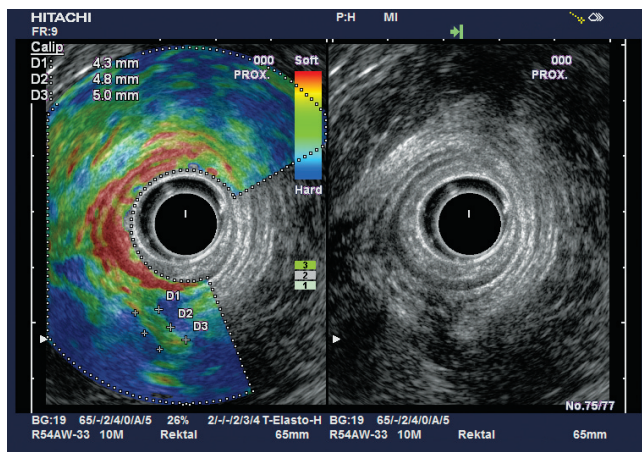


Fig. 6 : Fistula

Elastography is useful in the diagnosis of acute (soft) or chronic (stiff) fistula. Elastography is especially useful in the finding of diffuse inflammation and early fistula delineation, between markers.

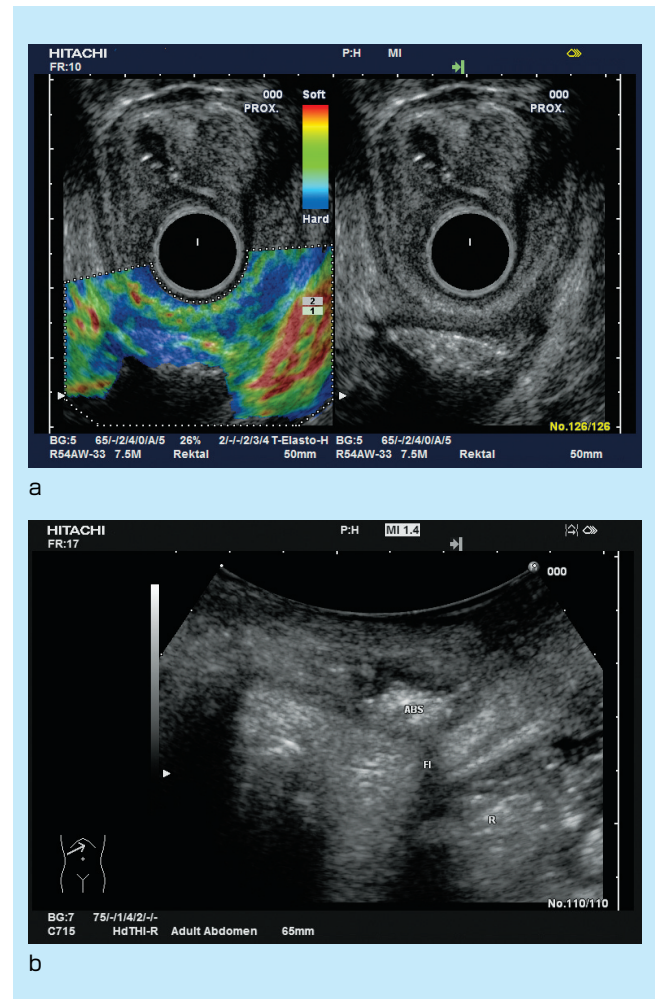


Fig. 7 : Fistula and abscess

Endorectal (a, ERUS) and perineal ultrasound (b, PNUS) in a patient with fistula (FI) and extrasphincteric abscess (ABS) formation. The rectum is also indicated (R). Note that the fistula is obliquely penetrating the external sphincter. Due to the oblique course of the fistula the variable setting of perineal ultrasound is advantageous.