Anal Sphincter Imaging in Fecal Incontinence Using Endosonography

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Clinical anal examination, manometry (resting and squeeze pressures), and single-fiber electromyography were compared with endosonography of the anal sphincters in 14 patients with fecal incontinence. Technical aspects of the procedure and normal imaging of the puborectal muscle and both sphincters were defined. Defects in both sphincters were seen in nine patients. The defect is visualized as a clear discontinuity in the muscular ring. Compared with the conventional studies, anal endosonography gave significant information in six patients (four male patients after perianal surgery and two women), showing sphincter defects in five patients and integrity of the sphincters in another one. This information obtained by endosonography was important in understanding the type and extension of the lesion and deciding upon the surgical repair. Anal endosonography is an imaging technique of the sphincters that can assess their integrity in fecal incontinence. [Key words: Ultrasound; Anal sphincters; Fecal incontinence; Manometry; Electromyography]

Cuesta MA, Meijer S, Derksen EJ, Boutkan H, Meuwissen SGM. Anal sphincter imaging in fecal incontinence using endosonography. Dis Colon Rectum 1992;35:59–63.

Major causes of fecal incontinence are related to traumatic sphincter disruption or neurogenic disorders, mostly resulting from pudendal nerve damage owing to laborious deliveries.[1] Because the majority of affected people are multiparous women, a combination of both causes may be possible.[2]

In the case of a defect in the sphincters, detection is essential; surgical repair can restore continence in approximately 80 percent of the patients.[3] To assess the cause of fecal incontinence, anal manometry and concentric needle electromyography are methods frequently used in clinical examination of the sphincters.[4]

Recently, some authors studied direct imaging of these sphincters by anal endosonography (AES) and concluded that it will be an important diagnostic tool.[5,6] This was why we studied AES in a group of 14 patients with fecal incontinence. The results were correlated with anal examination, anal manometry, and electromyography of the pelvic floor musculature, looking for significant improvement of the diagnosis.

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MATERIALS AND METHODS

In a 12-month period (December 1989 to December 1990), we studied 14 patients (10 women and 4 men) with fecal incontinence. Patient characteristics are listed in Table 1. In five of the ten women, a history of sphincter rupture existed. (Four had obstetric lesions; one had Crohn's disease and became incontinent after drainage of a perianal abscess.) The other five women were multiparous, with a history of laborious deliveries but without clinical evidence of sphincter rupture. Four male patients became incontinent after surgery for perianal processes (fistulotomy in two, hemorrhoidectomy in one, and lateral sphincterotomy because of fissure-in-ano in one), with severe scar tissue.

Anorectal function investigations consisted of the following: 1) medical history; 2) examination of the anal region: a) inspection of the anus at rest and during straining, looking for scars or other deformities, and b) digital examination at rest and during squeezing to assess the continuity of the sphincter and its pressure; 3) anal manometry performed with the patient in the left lateral position; maximal basal pressure (MBP; normal value, 40–80 mm Hg) and squeeze pressure (MSP; normal value, >60 mm Hg) were measured using the open-tip "low compliance" perfusion technique[7]; 4) electromyography of the pelvic floor musculature (single fiber electromyography; SFE)[8]; and 5) endosonography of the anal sphincters.

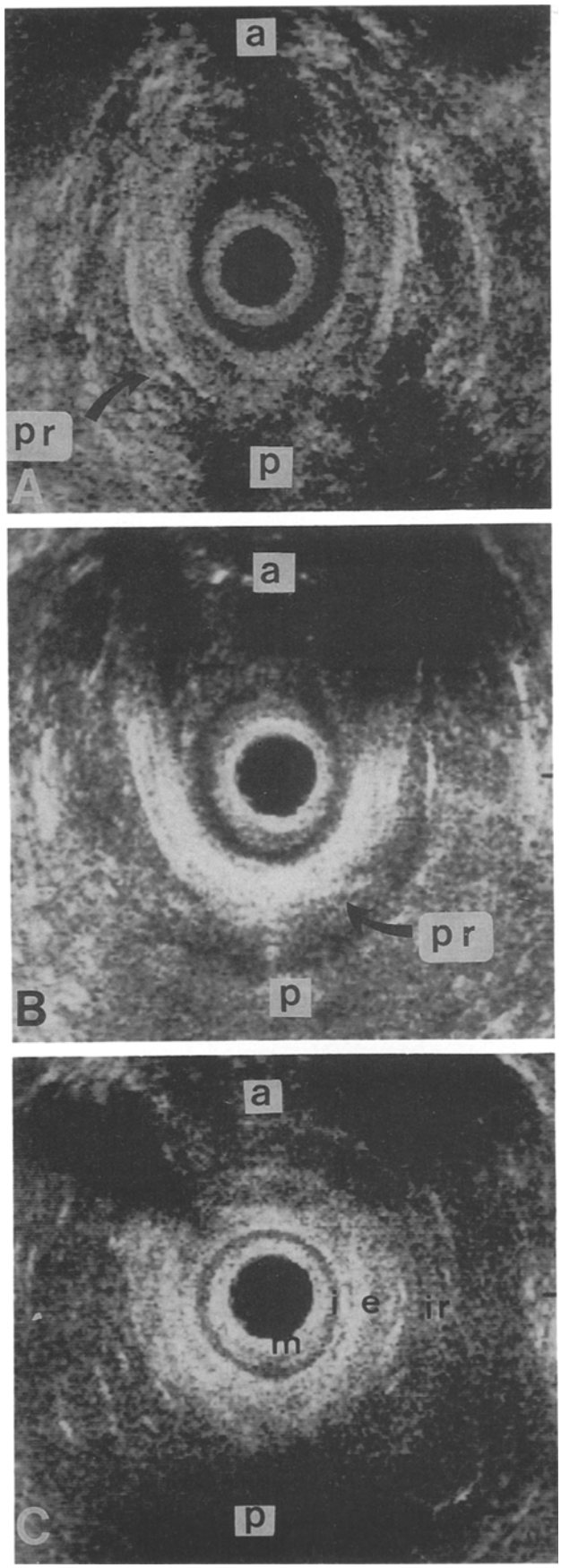
Endosonography of the anal sphincters was performed with an ultrasound scanner type 1846 (Bruel and Kjaer, Naerum, Denmark) with a 7-MHz

Table 1.
Characteristics of Patients

Patient No.	Age (yr)	Sex	History	Anal Investigation	Manometry: Basal and Squeeze Pressures	SFE	AES*
1	64	M	Hemorrhoidectomy	Open anus	50 200	Normal	Defect IS
2	35	F	Total rupture delivery	Anterior defect	10 10	Normal	Anterior defect IS + ES
3	60	M	Fistulectomy	Scar deformity	30 100	Normal	Defect IS + scar ES
4	61	F	Difficult deliveries, hemorrhoidectomy	Possible anterior defect	20 20	Normal	Anterior defect IS + ES
5	55	M	Lateral sphincterotomy	Scar deformity	30 160	Normal	Defect IS + partly ES
6	71	F	Multiple deliveries	Weakness in sphincter, rectocele	20 40	Pudendal dysfunction	Normal
7	37	F	Anterior fistulectomy	Anterior defect?	30 15	Normal	Anterior defect IS + ES
8	70	F	Multiple deliveries	Weakness in sphincter, rectocele	20 40	Pudendal dysfunction	Normal
9	30	F	Difficult delivery	Anterior defect?	20 20	Pudendal dysfunction	Anterior defect IS + ES
10	46	M	Fistulectomy	Scar deformity	140 140	Normal	Defect IS + partly ES
11	23	F	Abscess drainage, Crohn's disease	Deformity fistula	40 20	Normal	Fistula-in-ano, no sphincter defect
12	30	F	Anterior episiotomy	Anterior defect	25 40	Pudendal dysfunction	Anterior defect IS + ES
13	54	F	Multiple deliveries	Weakness in sphincter, rectocele	40 80	Normal?	Normal
14	57	F	Multiple deliveries, right hemicolectomy; ACa	Weakness in sphincter	30 80	Normal	Normal

* IS = internal sphincter; ES = external sphincter.

rotating transducer type 1850 (focal length, 1–4 cm). The especially hard plastic cone, with a diameter of 2 cm, was used to cover the rotating probe, providing a homogenous acoustic coupling in the anal canal. The lubricated cone was inserted in the anal canal with the patient in the gynecologic position, and serial images were obtained on slow withdrawal at 4, 3, 2, and 1 cm from the anal verge to visualize the puborectal muscle (4.3 cm) and the external (3.2 cm) and internal (2.1 cm) sphincters. The different echogenic patterns of the sphincters permit their visualization.[5,6] The normal endosonography of the sphincters shows a striated puborectalis and an external sphincter in contin-



uation with a mixed linear echogenicity, showing some thinning anteriorly, especially in women. In some cases, it is difficult to assess the edge of the external sphincter in relation to the ischiorectal space. The internal sphincter, as a continuation of the circular muscle coat of the rectum, shows a pattern of plain muscle fibers with a uniform hypoechogenicity (Figs. 1A–C). The average time taken for AES was 10 minutes.

RESULTS

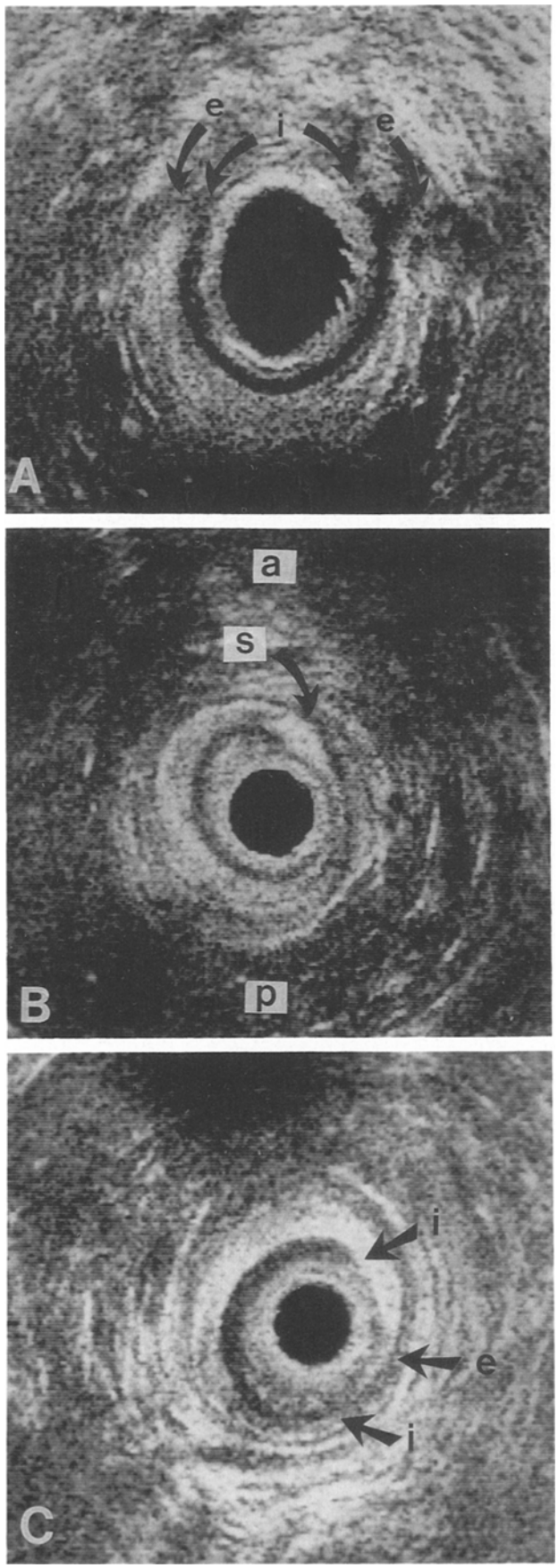
AES showed a defect in the internal and external sphincters in eight of nine patients with a history of sphincter rupture (five women and four men). These defects were seen as an interruption in the continuity of the ultrasonic layers of the muscular ring. In some patients, a scar in the defect and, in others, an asymmetry of the rest of the sphincter were visualized (Figs. 2A–C).

These results confirmed the results of the clinical and manometric investigations performed in four female patients with anterior lesions of both sphincters. In the other female patient, affected with perineal Crohn's disease, low pressures were recorded on manometric study, but AES showed intact sphincters. The four male patients had normal squeeze pressure results, but AES showed sphincter defects in all of them. All five patients with idiopathic fecal incontinence had several grades of pudendal nerve dysfunction, but, in one patient, AES showed an unsuspected anterior defect in both sphincters. Nine patients with a sphincter lesion on AES have been operated on, after confirming the defect, by the overlapping suture technique. Eight of them regained continence after the operation (with postoperative control time varying from 8 weeks to 12 months).

DISCUSSION

Intraluminal endosonography is an established evaluation method for local staging of anorectal

Figure 1. A. AES in upper anal canal (4 cm) of male patient showing normal puborectal muscle (pr) and pelvic floor musculature around it (a = anterior; p = posterior). B. AES in upper anal canal (4 cm) of female patient showing normal puborectal muscle (pr) and pelvic floor musculature around it (a = anterior; p = posterior). C. AES in lower anal canal (2 cm) of female patient showing normal internal (i) and external (e) sphincters (a = anterior; p = posterior; m = mucosa; ir = ischiorectal space).



carcinoma.[9,10] Endosonography of the perineum in the case of abscesses and fistulas related or not related to Crohn's disease will give information concerning the localization of the fistulous tract.[5,11] In the study of anal incontinence, a complete clinical examination, anal manometry (resting and squeeze pressures), and evaluation of the innervation of the pelvic floor musculature by single-fiber electromyography are usually the investigations performed.

After this evaluation, the patient is classified as having idiopathic incontinence owing to neurologic disorders or as a consequence of a sphincter lesion.[12] Sometimes there is no clear correlation between these data and the clinical findings in patients in whom the surgeon suspects the existence of a sphincter defect. This lack of a correlation is important because direct sphincter repair in general has better results than the postanal repair employed in cases of neurogenic incontinence.[3] For that reason, quadrant manometry of the sphincters and electromyographic mapping of the external sphincter were introduced to assess unsuspected defects of the sphincters.[4] Recently, endosonography has been introduced as a technique to assess the integrity of the sphincters.[5,6,13,14]

Law *et al.*[13] studied the correlation between AES and conventional investigation methods and showed that this technique was simple and reliable and permitted recognition of previously unsuspected damage to the external sphincter in idiopathic incontinence. Additionally, an association of the decreased resting pressure in neurogenic incontinence with decreased internal sphincter thickness was found. Speakman *et al.*[14] found a correlation between AES and electromyographic mapping of the sphincters, with AES having the advantage of visualizing the defect.

Our series showed the same trend; defects in the external sphincter were found in the four male patients despite normal squeeze pressure results.

Figure 2. A. AES in lower anal canal (2 cm) of female patient showing an anterior defect in the internal (i = defect limits) and external (e = external limits) sphincters. B. AES in lower anal canal (2 cm) of male patient showing an anterolateral defect in both sphincters with a scar tissue (s) after a fistulotomy. Also, asymmetry of the sphincters can be observed (a = anterior; p = posterior). C. AES in lower anal canal (2 cm) of male patient showing a lateral defect in the internal (i = defect limits) and external (e = external limits) sphincters after a lateral sphincterotomy.

Clinical assessment of the lesion was difficult because of severe scar tissue. In the female group with a history of trauma of the sphincters, the correlation between standard studies and endosonography was found in four of five patients. In the group of five patients with "idiopathic" fecal incontinence, an unsuspected anterior defect in both sphincters was found in one patient.

Patterns of lesions of the sphincters are usually clear. A defect is visualized as a discontinuity of the muscular ring. Indirect signs, such as the presence of scars and asymmetry of the sphincters, can also be observed.

In conclusion, AES is the only technique that can visualize the integrity of the sphincters in cases of fecal incontinence, permitting their adequate assessment. AES is reliable and causes minimal discomfort, especially compared with needle electromyography. In addition, it seems to offer decision-making information concerning the type of surgical correction to perform.

REFERENCES

1. Snooks SJ, Swash M, Henry MM, *et al.* Risk factors in childbirth causing damage to the pelvic floor innervation. Int J Colorectal Dis 1986;1:20–4.
2. Jacobs PP, Scheuer M, Kuijpers JH, Vingerhoets MH. Obstetric fecal incontinence: role of pelvic floor denervation and results of delayed sphincter repair. Dis Colon Rectum 1990;33:494–7.
3. Browning GG, Motson RW. Anal sphincter injury: management and results of Parks sphincter repair. Ann Surg 1988;199:324–8.
4. Browning GG, Motson RW, Henry MM. Combined sphincter repair and postanal repair for the treatment of complicated injuries to the anal sphincters. Ann R Coll Surg Engl 1988;70:324–8.
5. Law PJ, Talbot RW, Bartram CI, Northover JM. Anal endosonography in the evaluation of perianal sepsis and fistula in ano. Br J Surg 1989;76:752–5.
6. Law PJ, Kamm MA, Bartram CI. A comparison between electromyography and anal endosonography in mapping external anal sphincter defects. Dis Colon Rectum 1990;33:370–3.
7. Felt-Bersma FJ, Klinkenberg-Knol EC, Meuwissen SG. Anorectal function investigations in incontinent and continent patients: differences and discriminatory value. Dis Colon Rectum 1990;33: 479–86.
8. Neill ME, Swash M. Increased motor unit fibre density in the external sphincter muscle in ano-rectal incontinence: a single fiber EMB study. J Neurol Neurosurg Psychiatry 1980;43:343–7.
9. Gildman S, Glimelius B, Norming L, Pahlman L, Seligson U. Transanorectal ultrasonography in anal canal carcinoma. Acta Radiol 1988;29:337–41.
10. Orrom WJ, Wong WD, Rothenberger DA, Jensen LL, Goldberg SM. Endorectal ultrasound in the preoperative staging of rectal tumors: a learning experience. Dis Colon Rectum 1990;33:654–9.
11. Tio TL, Mulder CJ, Wijers OB, Sars PR, Tytgat GN. Endosonography of peri-anal and pericolorectal fistula and/or abscess in Crohn's disease. Gastrointest Endosc 1990;36:331–6.
12. Henry MM, Snooks SJ, Barnes PR, Swash M. Investigation of disorders of the anorectum. Ann R Coll Surg Engl 1985;67:355–60.
13. Law PJ, Kamm MA, Bartram CI. Anal sphincter imaging in faecal incontinence using endosonography: demonstration of unsuspected defects. Oral communications to the Spring Meeting of the British Society of GE. March 1990. Gut 1990;31:A605.
14. Speakman CT, Burnett SJ, Kamm MA, Bartram CI. External anal sphincter defects: simultaneous evaluation using electromyography and anal endosonography. Oral communication to the Spring Meeting of the British Society of GE. March 1990. Gut 1990;31:A605.