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Repeatability of anorectal manometry in healthy volunteers and patients

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ABSTRACT

Background: Anorectal manometry is used extensively in the assessment of patients with disorders of the pelvic floor. The present study investigated the repeatability of anorectal manometry in healthy volunteers and patients.

Patients and methods: A total of 30 healthy volunteers (15 men and 15 women) and 10 patients with fecal incontinence (4 men and 6 women) underwent perfusion manometry and volumetry. Intraindividual variability was evaluated using the intraindividual correlation coefficient (ICC). Interindividual variability was expressed as the standard deviation from the calculated mean values.

Results: We found a high intraindividual correlation for the squeezing pressure (ICC 0.75–0.95), vector volume (ICC 0.88–0.97), and rectal perception (ICC 0.82–0.98). The anal resting pressure showed moderate repeatability (ICC 0.60–0.72). However, with regard to sphincter asymmetry, rectal compliance, and the rectoanal inhibitory reflex, a wide range of variability was found. In the female volunteers, the squeezing pressure and vector volume were lower than in those in the male volunteers. The anal pressure, vector volume, thresholds for urgency, and the maximum tolerable volume were lower in the incontinent patients than in the healthy volunteers.

Conclusions: The squeezing pressure, vector volume, and rectal perception allow a reliable analysis of anal sphincter function. Sphincter asymmetry, rectal compliance, and the rectoanal inhibitory reflex were of limited diagnostic value.

1. Introduction

Anorectal manometry is used extensively in research and in the clinical assessment of patients with disorders of the pelvic floor. A frequent indication is fecal incontinence, which affects 15% of the elderly population in industrial countries [1–5]. Manometry serves as key tool in therapeutic decision making and is essential in the evaluation before anorectal surgery (e.g., ultra-low rectal surgery, transanal endoscopic microsurgery, ileoanal anastomosis, closure of ileotomy). In addition, manometry allows for surveillance of the treatment response, such as biofeedback training, electrical stimulation, or surgery [6–8].

Anal function disturbances are commonly believed to be due to a reduction in anal sphincter pressure. Other factors can include changes in anorectal sensation, rectal compliance, anal vector volume, sphincter asymmetry, and the rectoanal inhibitory reflex. Anorectal manometry and volumetry allow

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an objective evaluation of these parameters. However, several techniques and different probes have been described [9–12]. Because of this variability in equipment and technique, the published data have been difficult to compare and have shown a large variability [13]. Nevertheless, it has not been clear whether this divergence has been related to methodologic inequalities or an intraindividual day-to-day variability [14,15].

Thus, the aim of the present study was to prospectively assess the intraindividual repeatability of anorectal manometry, vector volume manometry, and volumetry in both healthy volunteers and patients with fecal incontinence.

2. Patients and methods

2.1. Healthy volunteers

A total of 30 healthy volunteers (15 men and 15 women; median age 25 y, range 21–30) underwent standardized anorectal manometry, vector volume manometry, and volumetry. None of the volunteers had a history of fecal incontinence (Cleveland Clinic Incontinence Score [16] 0 points), previous delivery, or anorectal or gynecologic surgery. None of the women was pregnant. Six manometric assessments were achieved on two separate occasions (2-wk interval) three times every 4 h starting at 9 AM. All subjects provided written informed consent.

2.2. Patients

A total of 10 patients with fecal incontinence (4 men and 6 women; median age 43 y, range 31–69) underwent standardized anorectal manometry, vector volume manometry, and volumetry. In this group, the median Cleveland Clinic Incontinence Score was 15 points (range 12–17). Additional information is given in Table 1. Two manometric assessments were achieved on separate occasions (2-wk interval) at 1 PM. The patients provided written informed consent.

2.3. Manometric analysis

All tests were performed by one investigator, using the same equipment in the same clinic. A digital rectal examination was done before the anorectal manometry. Anal function was assessed with the subject in the right lateral position using three-dimensional anal vector volume manometry, as previously described [17]. Because reliable and reproducible results require some degree of uniformity, all patients were prepared with an enema. Perfusion manometry was performed with a 5-mm-thick, flexible, polyvinyl catheter with eight lateral exit orifices for eight perfusion channels. Using a high pressure pump (MUI Scientific, Mississauga, ON, Canada), the capillaries were perfused with distilled water at a rate of 4 mL/min (0.5 mL water/min/channel). The intraluminal pressures were measured at the exit orifices, recorded using conventional transducers, transformed into a digital signal (Medtronic Software, Minneapolis, MN), and processed using a personal computer.

Table 1 – Characteristics of patients with fecal incontinence.

Diagnosis	n	Cleveland clinic score	Previous surgery
Ulcerative colitis	4	13, 14, 15, 15	Ileoanal pouch
Cohn's disease	3	13, 14, 15	Fistulectomy
Rectal prolapse	1	12	Rectopexy
Anal atresia	1	15	Anorectal pull-through
Impalement injury	1	17	Sphincteroplasty

Table 2 – ICC in male healthy volunteers ($n = 15$), female healthy volunteers ($n = 15$), and patients with fecal incontinence ($n = 10$).

	Male volunteers	Female volunteers	Incontinent patients
Resting pressure	0.60	0.70	0.72
Squeezing pressure	0.79	0.75	0.95
Resting vector volume	0.88	0.90	0.95
Squeezing vector volume	0.93	0.91	0.97
Initial perception	0.82	0.75	0.95
Urgency	0.82	0.85	0.92
Maximum tolerable volume	0.98	0.92	0.98
Asymmetry index (at rest)	0.31	0.30	0.62
Asymmetry index (squeezing)	0.31	0.30	0.62
Rectal compliance	0.21	0.30	0.70
Rectoanal inhibitory reflex			
25 mL	0.31	0.30	0.62
50 mL	0.41	0.10	0.75

Squeezing pressure, resting and squeezing vector volume, and rectal perception were highly repeatable in both healthy volunteers and patients; anal resting pressure showed moderate repeatability; and the other parameters showed low repeatability.

2.3.1. Stationary perfusion manometry

Stationary perfusion manometry was performed to determine the resting and squeezing pressures. After insertion of the lubricated catheter into the anal canal, the probe was slowly retracted in 5-mm intervals and positioned into the middle of the high pressure zone. After adaptation, the site of the maximum resting pressure corresponded to the zone of highest anal canal pressure using all 8 channels. The maximum squeezing pressure was then measured at the same site using pelvic floor contraction [18,19].

2.3.2. Vector volume perfusion manometry

Vector volume perfusion manometry was used to assess the vector volume and radial asymmetry of the sphincter. After reinsertion of the probe into the rectum, the catheter was continuously retracted manually at increments of 1 cm/s. Pull-through manometry was then repeated with the patient voluntarily squeezing. Medtronic Polygram software (Medtronic Software) was used to analyze the pressures during pull-through. The vector volume reflects the sphincter pressure related to the total length of the pressure zone. Radial asymmetry was determined by three-dimensional assessment of