

ORIGINAL PAPERS

Does correlation exist between anorectal manometry and endoanal ultrasound findings in healthy subjects according to age?

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ABSTRACT

Background: different studies have demonstrated the correlation between anorectal manometry and endoanal ultrasonography data in patients with fecal incontinence, but there is no almost interest describing the same in healthy subjects according to age.

Aims: to study the possible correlation between anorectal manometry and endoanal ultrasonography data in a homogeneous group of healthy women, also according to age.

Material and methods: prospective observational study of a healthy subjects cohort (n = 14). Homogeneous group of healthy volunteer women divided in 2 subgroups according to age.

Results: there was no proved correlation between the internal anal sphincter's measurement and the resting pressure in the whole sample as well as the analysis according to age. Neither there was any proved statistically significant correlation between the external anal sphincter's thickness and the squeeze pressure, in the whole sample and by groups.

Conclusions: it does not exist statistically significant correlation between the thickness of the sphincters and its function in a healthy subjects homogeneous group, neither in 2 groups according to age.

Key words: Anorectal manometry. Endoanal ultrasonography. Healthy volunteers. Fecal incontinence.

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INTRODUCTION

Fecal incontinence is kept by several anatomical and physiological mechanisms that allow, working properly, to control and decide the most adequate moment for stools. When these mechanisms does not work properly, fecal incontinence strikes, a physical and social trouble that causes rejection and dropping out (1,2).

To assess patients with fecal incontinence is essential the use of endoanal ultrasound and anorectal manometry, obtaining information about the anatomy of the anal sphincter complex, its possible injuries and its working order. The value of the sphincters' thickness can be obtained using endoanal ultrasound, and resting pressure and squeeze pressure are registered using anorectal manometry. Resting pressure, as well as contractility, decreases with age (3,4).

Different studies attempted to demonstrate the correlation between anorectal manometry and endoanal ultrasonography data in patients with fecal incontinence. Some of them stated a good correlation between defects of the internal anal sphincter (IAS) and the anal resting pressure, and between defects of the external anal sphincter (EAS) and the voluntary anal contraction (5-7). Therefore, it demonstrated that patients with severe ultrasonographic injuries presented lower resting and squeeze pressures in anorectal manometry (8).

The thickness of IAS increases with age while the resting pressure decreases (7,9). In patients with fecal incontinence and elderly population, the thickness of IAS is increased but it is only compensatory in elderly patients (10).

In spite of the correlation between these data have been demonstrated in patients with fecal incontinence, there is no almost interest describing the same in healthy subjects according to age. Moreover, the studied groups are not homogeneous because men and women are included, and some groups of healthy controls include low prevalence age for fecal incontinence.

The main objective was to study the possible correlation between anorectal manometry and endoanal ultrasound data in a homogeneous group of healthy women, and also to study its correlation according to age.

MATERIAL AND METHODS

Data was obtained from the healthy volunteers group of a running study to characterize the cerebral areas which control the anorectum in fecal incontinence using functional magnetic resonance imaging (11).

It is a prospective observational study of a healthy subjects cohort (n = 14), from Barcelona Metropolitan Area, representing a total population of 300,000.

The median age of included women was 52 years old (range: 45-61). Only 2 women had not vaginal childbirth in their obstetric history.

Inclusion criteria

We included adult healthy women between 18 and 65 years old with normal continence in their study. Included subjects were divided in 2 groups according to age –group 1: median: 49 years (range: 45-51), group 2: median: 57 years (range: 55-61)–, with 7 subjects in each group.

Study protocol

All subjects of the study were clinically assessed according to a established standard research protocol which includes clinical assessment –(personal details, general characteristics of the subjects and complete fecal continence, studied by structured clinical interview with validated tests (Rome Criteria Adaptation)– and a physiological and anatomical study about sphincterian anal apparatus. The same complementary tests were performed in the 14 healthy volunteers and in the same order, during the same day: at first, endoanal ultrasound, and then, anorectal manometry.

Endoanal ultrasound

Endoanal ultrasound was performed by using a Ultrasound Scanner Brüel & Kjaer® (Nacrum, Denmark) with a radial endoscopic probe and a 7 MHz transducer. A transparent plastic cone with a diameter of 17 mm covered the transducer head, obtaining 360° images. Due to its water composition, the IAS was visualized as a circular hypoechogenic band, in the lower part of the anal canal. In the middle part, the EAS was seen as a thicker circular echogenic band just outside the IAS. The puborectalis muscle was visualized in the upper anal canal and it had the same

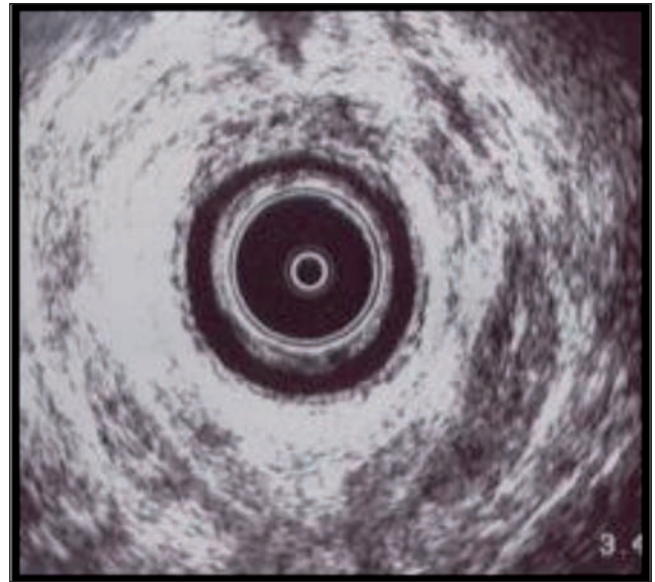


Fig. 1. Endoanal ultrasound image showing normal anal sphincters.

echogenic appearance as the EAS, but the muscular fibres does not continue anteriorly, like a “U” (12,13). Figure 1 shows a normal endoanal ultrasound photo. In each exploration we obtained 3 photos of the anal canal: upper, middle and lower. Also, we measured the thickness of the IAS, the EAS (including longitudinal muscle), and the right (RPR) and left (LPR) puborectalis muscle. Measurements were obtained in 2D by a single observer (D.P.) in all cases in the middle anal canal (maximum thickness point), always to the right (at 9 o’clock in gynecological position).

Anorectal manometry

The explorations were performed by a single observer using a four channels continuous water-perfused catheter with a radial array of anal sensors connected to a polygraph (PC Polygraph HR Synectics Medical®) and to a software data system (Pentium-II-software Polygram 98 AFT, Medtronic® INC., MN, USA). The subject was in left-side position; the catheter was introduced into the rectum and then slowly withdrawn down the anal canal to the anus. The anorectal resting pressure was registered in one centimeter intervals to set the final pressure. The anorectal squeeze pressure was fixed after inviting subjects to realize a voluntary anal contraction.

Ethical considerations

This study was presented and approved by the “Comité de Ética de Investigación Clínica” (CEIC) on 2007 July 2nd (code 2007/2721/I). During the study per-

formance, national and international guidelines (Deontological Code, Helsinki Declaration) and legal normative about data confidentiality (Ley Orgánica 15/1999 de 13 de Diciembre de Protección de Datos de Carácter Personal) had been carried out. All subjects were informed about objectives and procedures of the study, before signing the written informed consent.

Sample assessment

We considered to study the relation between the anal sphincters size and anorectal manometry in healthy volunteers, according to age. To assess the necessary sample, we studied the results of the only similar study recently published in which IAS was measured in healthy women and their differences with age (14). In this study, the found difference between both groups (young women vs. elderly women) was 1.4 mm (standard deviation: 0.7 mm). If the statistical power is 80% and the type I probability error is 0.05, we need a minimum of 5 subjects to detect differences. Therefore, including 7 subjects in each group allows to take on an error margin if there are not enough data.

Statistical analysis

Data were collected prospectively in a specially designed data base for the study. The quantitative variables are represented by absolute numbers, median and range, in parenthesis. The quantitative variables were compared by non parametric tests (U Mann-Whitney test). The correlation study between continuous variables was done with the Spearman Test. We show the Spearman correlation coefficient (R) and the statistical signification (p). A p value less than 0.05 was considered as a statistically significant difference. Statistical analysis was performed using SPSS® software.

RESULTS

Endoanal ultrasound

Lower, middle and upper anal canal was visualized in all subjects, measuring, in millimeters (mm), the internal

anal sphincter (IAS), the external anal sphincter (EAS), the right puborectalis muscle (RPR) and the left puborectalis muscle (LPR).

The median of the IAS in the overall group was 3.3 mm (range: 2.3-5.1) and the median of the EAS was 7.6 mm (range: 4.6-10). The median of the RPR was 10.3 mm (range: 6.6-12.4) and the median of the LPR was 11.1 (range: 7.9-13.3).

As it is shown in table I, matched by age, we did not observe significant differences between endoanal ultrasound measures. Our results are in the normality rates. Apart from normal muscular thickness, any sphincter injuries were observed in the study subjects.

Anorectal manometry

The resting pressure median in all the group was 65.5 mmHg (range: 38-106) and the squeeze pressure median was 165.8 mmHg (range: 101-267). Matched by age, we did not observe significant differences (Table II). These results are in the normality rates according to the defined values of "Grupo Español de Motilidad Digestiva" (GEMD), according to age and gender (15).

There was no proved correlation between the internal anal sphincter's measurement and the resting pressure in the whole sample (Fig. 2, R: -0.194 p = 0.507), as well as the analysis according to age (group 1: R: 0.143 p = 0.760 and group 2: R: -0.571 p = 0.180). Neither there was no proved statistically significant correlation between the external anal sphincter's thickness and the squeeze pressure, in the whole sample (Fig. 3, R: -0.116 p = 0.693) and by groups (group 1: R: -0.655 p = 0.11, group 2: R: 0.214 p = 0.645).

DISCUSSION

Endoanal ultrasound and anorectal manometry are basic explorations in the fecal incontinence study, because they are additional tests in the exhaustive evaluation of the sphincterian apparatus (6,9). Previous studies in fecal incontinence patients show more or less correlation between ultrasonographic and manometric results (5-7,16). In spite of it, in the current study we could not demon-

Table I. Differences between endoanal ultrasound values

	Group 1 n = 7	Group 2 n = 7	P*
IAS (mm)	2.7 (2.3 – 4.6)	2.9 (2.4 – 5.1)	0.620
EAS (mm)	7.5 (4.6 – 8.9)	8.2 (6.2 – 10)	0.209
RPR (mm)	11 (6.6 – 15)	10 (7.9 – 12.4)	1.0
LPR (mm)	10 (7.9 – 14)	11 (8.9 – 14)	0.710

Values are median and range, in parenthesis. *U Mann-Whitney test.

Table II. Differences between anorectal manometry values

	Group 1 n = 7	Group 2 n = 7	p*
Maximum resting pressure (mmHg)	66 (47-99)	65 (38-106)	0.805
Squeeze pressure (mmHg)	138 (128-233)	162 (101-267)	0.902

Values are median and range, in parenthesis. *U Mann-Whitney test.

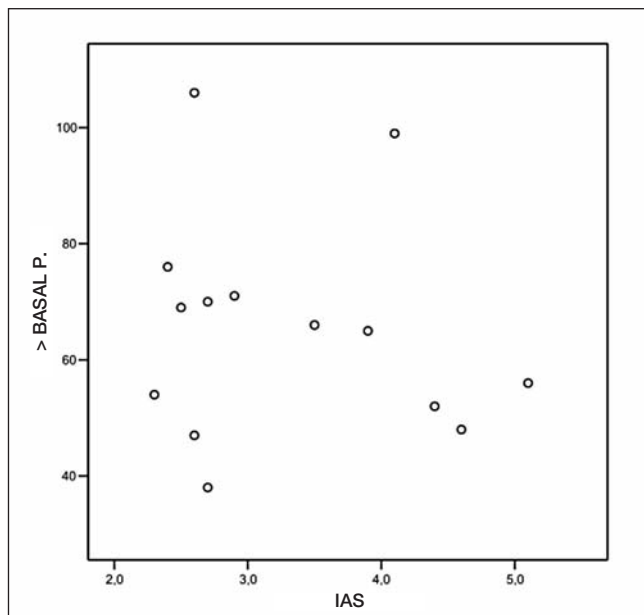


Fig. 2. Correlation between IAS thickness (mm) measured by endoanal ultrasound and anal resting pressure (mmHg) measured by anorectal manometry ($R: -0.194$ $p = 0.507$), in 14 healthy subjects.

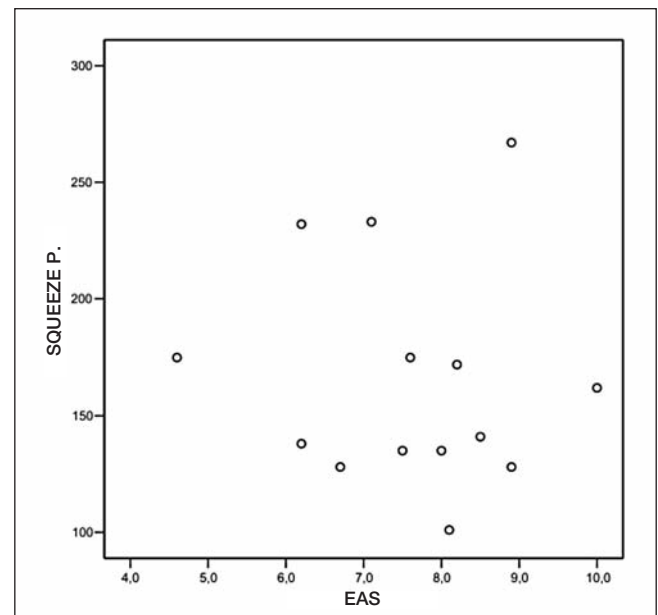


Fig. 3. Correlation between EAS thickness (mm) measured by endoanal ultrasound and squeeze pressure (mmHg) measured by anorectal manometry ($R: -0.116$ $p = 0.693$), in 14 healthy subjects.

strate a statically significant correlation between the thickness of the sphincters and the pressures measured in a homogeneous group of healthy women according to age.

Up to 14% of population can be affected by fecal incontinence, representing a health, social and economic high impact. Furthermore, it is a physical and social trouble that causes rejection and dropping out (1,2). Fecal incontinence affects, probably, more women than men, because obstetric injuries are the main lesion mechanisms of the anal sphincters (17). We know that, after obstetric trauma, up to 44% of postdelivery women can present a variable sphincterian dysfunction; 33% of these are going to have different grades of fecal incontinence (18,19). Moreover, the anal canal is significantly longer in men than women (3,20) and the female sphincter has a variable natural defect occurring along its anterior length (21). The shorter anterior anal sphincter (external and internal) could justify the higher incidence of pelvic floor dysfunction in females (22).

In adults, the normal IAS measures 3-4 mm and the EAS is 6-7 mm, approximately, both thicker in women. However, there are some studies defending that sphincters' evaluation using ultrasound is reliable for IAS measurement only. EAS images are not so clear because the more hyperechoic muscle show less contrast with the surrounding hyperechoic fatty tissue, obtaining different measurements by several observers (12,23). In spite of it, endoanal ultrasound is a safe technique that allows the evaluation of anorectal muscular structures, its integrity and indemnity. The EAS normality rates are more variable, but it is normal if thickness is about 6-7 mm.

Previous studies in patients with fecal incontinence correlates, more or less, the ultrasonographic findings and the manometric results (5-7). However, some authors observed that fecal incontinence is not associated with loss of sphincter volume, being poor the correlation between anal pressures and ultrasonography measurements (16). Despite of this correlation, manometry more closely correlates with the fecal incontinence scores than ultrasound measurements (24). Ultrasonographic parameters as the presence of an EAS defect and its length, EAS maximum thickness and IAS ring quality, can be predictive of anal sphincter function. However, EAS ring quality, perineal body thickness and defect angle are not significant (25). There was no correlation between endoanal ultrasound or anorectal manometry sphincter findings and clinical outcome. In long-term follow-up, approximately half of patients improve regardless of the results of endoanal ultrasound or anorectal manometry, or whether surgery is performed (26). Moreover, manometric abnormalities are not always corrected with the successful treatment of fecal incontinence (2,27).

The aim of the current study was to contribute data in subjects without fecal incontinence. So, in the healthy volunteers recruiting was very important to get the most possible homogeneous sample, not in previous studies (28). We selected a healthy women group, without sphincters injuries, into a few dispersed age range. We decided recruiting women because it's the group that most frequently consults to the specialist explaining fecal incontinence symptoms. The results of the complementary tests were normal in all the studied subjects, as well ultrasonographic exploration as manometric tests. In ma-

nometry, pressure measurements are variable: lower in women than men, and in elderly patients (2).

We could not correlate endoanal ultrasonography values with manometry ones. It could be that the correlation showed in patients with fecal incontinence was because sphincterian distortions, changing thickness and function values (28,29).

In our results, we emphasize that, despite of all subjects are continent, pressure rates were in the lower normality limit. These results cannot be explained due to a pudendal neuropathy, because the neurophysiological study was normal, so we do not know the reason certainly.

The sample size is the main limitation of the study. We know that 14 subjects is a small sample, but not insufficient. We made a sample assessment (after neuroimaging study) according to a recent study, but making bigger the assessed sample was not enough to observe statistical differences between IAS thickness measurements according to age. We have to enhance the difficulty of healthy subjects recruiting in a study like this (29). In fact, the strength of the study is the unique sample of subjects, including just women in a non variable age range, obtaining a very homogeneous sample, comparable with the group of fecal incontinence patients.

In conclusion, it there is not a statistically significant correlation between the thickness of the sphincters and its function in a homogeneous group of healthy subjects, neither in 2 groups according to age.

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