RESEARCH

Does perineal body thickness affect faecal incontinence in multiparous patients?

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Background. Obstetric trauma is the most common cause of faecal incontinence in multiparous women. The literature has shown that women with obstetric trauma to the anal sphincter have decreased perineal body thickness (PBT).
Objective. To determine the role of PBT in the assessment of this type of faecal incontinence in multiparous patients.
Methods. Forty-four women with faecal incontinence, and 36 asymptomatic women who had had two or more previous deliveries, were investigated with endoanal ultrasonography from January to December 2016. The patients were divided into three groups on the basis of PBT: <10 mm, 10 - 12 mm and >12 mm. The degree of faecal incontinence was measured using the Wexner faecal incontinence score. Sphincter angle defect was separately measured for each patient.
Results. The mean (standard error) age of all of our 80 patients was 46.9 (1.3) years (range 26 - 77 years), and the mean PBT in incontinent patients was 8.78 (2.84) mm, and 12.65 (16.76) mm in asymptomatic subjects ($p<0.001$). The mean Wexner score was 8.6 (range 2 - 20) in incontinent patients. External anal sphincter defect angles were negatively correlated with PBT ($p=0.045$). For 89% of the patients, there was a history of vaginal delivery, and 62.5% had undergone one or more prior episiotomies during delivery. A PBT <10 mm was associated with sphincter defect in most incontinent patients.
Conclusion. PBT plays a significantly important role in faecal incontinence, so it is recommended that it should be one of the factors involved in anal incontinency evaluations.

Faecal incontinence is the involuntary loss of faeces at an unexpected moment or place. Flatus may also be included in the definition. It is a social and hygienic problem affected by anatomical and physiological factors. Faecal incontinence has an incidence of about 1 - 10% in the adult population.[1] It occurs principally in the elderly and female population, and can have a devastating effect on a woman's quality of life. Unfortunately, women do not report their symptoms; therefore, the actual incidence of the problem is unknown.[2] Obstetric trauma is the most common cause of faecal incontinence in women, but its aetiology can be congenital, neurological or idiopathic.[3,4]

It remains to be established whether obstetric trauma after two or more vaginal deliveries is a risk factor for developing incontinence later in life. Although the risk of new injury and defecatory symptoms occurring in subsequent normal deliveries is small (4%), 42% of asymptomatic women who have a pre-existing occult defect may develop impaired continence following a subsequent vaginal delivery, within 2 months of this delivery.[1] This impaired continence could be the result of a change in diet and bowel habits, ageing, anorectal surgery, haemorrhoids or irritable bowel syndrome.

Anatomically, in women, the perineal body separates the anal canal from the urogenital diaphragm in the median plane where the deep bulbospongiosus and superficial transverse perineal muscles meet the external anal sphincter (EAS).[3,4] The presence of a considerably bulky, tensile perineal body can be confirmed by the presence of a normal anal sphincter complex. A perineal body thickness (PBT) ≤10 mm is considered abnormal, according to the endosonographic perineal body measurement described by Zetterström *et al.*[5]

Anal endosonography is the gold standard in imaging the sphincter, and has superseded conventional electromyography mapping in the diagnosis of anal sphincter defects.[1] Endoanal ultrasound (EAUS) has revolutionised our understanding of the pathophysiology of faecal incontinence. Since its invention by Low and Bartram in 1989,[6] EAUS has been found to be superior to other diagnostic tools, with 100% sensitivity in detecting sphincter defects.[7] At the proximal anal canal, in 98% of women the EAS is shorter interiorly compared with the posterior area.[8,9] Where the EAS fibres slope anteriorly, an apparent anterior anal sphincter defect (ASD) may be detected, with a liability of obstetric injury in the internal anal sphincter (IAS).[1]

In the distal anal canal, the IAS is thin; therefore, we measured the PBT, anterior anal sphincter defect and anal sphincter defect angle (ASDA) at the level of the mid-anal canal, which can be clearly delineated by the presence of the most prominent hypoechoic ring of the IAS.[1]

The aim of this study was to determine the role of PBT in the assessment of a group of multiparous patients who had undergone

deliveries more than once, and had developed obstetric faecal incontinence, as well as in those who had not developed this problem.

Patients and methods

One hundred and twenty multiparous patients, with and without faecal incontinence, underwent EAUS for evaluation of PBT, ASD, ASDA and anal manometry between January and December 2016, in a prospective clinical study at the colorectal subspecialty department in Shahid Faghihi Hospital, Shiraz, Iran.

The exclusion criteria were patients who were nulliparous and primiparous; those with previous radiation, low colorectal anastomosis, diabetes mellitus, ulcerative colitis, Crohn's disease and neurological disease; those with chronic constipation or diarrhoea, hypo- or hyper-thyroidism, hypo- or hyper-parathyroidism; and those who had undergone perineal or prolapse surgery such as sphincteroplasty, sphincterotomy, perineoplasty or pelvic floor repair.

Age, obstetric history and degree of incontinence were recorded for each patient. The degree of faecal incontinence was measured using Wexner's incontinence scale (0 - 20). The patients were placed in the left lateral decubitus position. As a standard protocol, we started our examination with anal manometry, followed by EAUS. In this study, perineal body thickness, anal sphincter maximum squeezing pressure, mean resting pressure (MRP), external anal sphincter defect (EASD) and external anal sphincter defect angle (EASDA) were evaluated.

For more detailed evaluation, the patients were subdivided into three groups according to PBT <10 mm, 10 - 12 mm and >12 mm.

Anal manometry

This was performed by a special-purpose sphinctometer system (Promedico, Germany, Version 1.51). This device allows quick and precise measurements of anal sphincter muscle tone during relaxation and squeezing condition. The measured value can be read off the device after inserting a specific sensor in the anal canal. The sphinctometer's effective range is between 0 and 300 mmHg.

Endoanal ultrasound

A two-dimensional EAUS machine using a Bruel and Kjaer medical ultrasound scanner (Herlev, Denmark) Merline Type 1101, with a 2050 model of 360-degree rotating endoprobe transducer, was used. The transducer frequency range was 3.75 - 20 MHz. EAUS was performed by an endoprobe covered with the middle finger of a disposable latex surgical glove, with ultrasound gel applied to both surfaces and introduced into the rectum. The ultrasound picture was controlled by two buttons in the proximal part of the endoprobe handle in the upward and downward direction through the anal canal, in a panoramic view.

Sonographically, the anal canal is divided into three levels: the upper level, determined by the U-shaped puborectalis muscle sling that opens anteriorly; the middle level, where the IAS is at its greatest thickness; and the lower level, which is determined by maximum thickness of the subcutaneous EAS and thinnest IAS.

Digit-assisted EAUS

A gloved lubricated finger was inserted into the vagina, touching the posterior wall with gentle pressure, while the endoprobe was in the anal canal; during the process, the EASD, external anal sphincter defect angle (EASDA) and PBT were evaluated at the mid-anal canal level[5,10,11] on a frozen ultrasound picture. No bowel preparation was done before the procedure.

The EASD is a homogenous hypoechoic or mixed echogenicity defect within the external muscle ring, scarring presenting as a change in echogenicity, which was not described as a defect.[5] The EASDA is described as the maximum angle of separation of the edge of the defect, and measured from the centre of the probe.[5,10] The PBT is defined as the distance between the sonographic reflection of the gloved index finger and the inner border of the IAS at the mid-anal canal level.[3,5]

Endoanal manometry was performed by the colorectal nurse specialist, and EAUS was performed by a single operator who was a colorectal surgeon, and the results were evaluated by two experienced endoanal sonographic colorectal surgeons. The study was approved by the ethics committee of Shiraz University of Medical Sciences (ref. no. 10834).

Statistical analysis

All statistical analyses were performed using Statistical Package for Social Sciences software version 15 (SPSS, USA). Quantitative data were analysed by t-test or analysis of variance. The correlation between groups for the categorised variables was analysed by χ^2 tests or the Pearson or Spearman correlation test. A p value <0.05 was considered statistically significant.

Results

Only 80 patients fulfilled the inclusion criteria (multiparous patients who voluntarily accepted the study procedure and completed the consent form), and these were categorised into two groups. Group 1 comprised 44 patients who had already presented with faecal incontinence due to obstetrical injuries. Group 2 consisted of 36 subjects who were asymptomatic (Table 1).

Post hoc calculation by power analysis on the effect size of 1.13 (for PBT difference) showed 85% power for at least 36 cases in each group. In our study, 80 multiparous women with a mean age of 46.9 years (range 26 - 77 years) who had had two or more previous deliveries underwent EAUS and PBT measurement.

Table 1. Data from patients in clinical continent and incontinent groups shown by mean (SE)

Patient characteristic	Incontinent (n=44)	Continent (n=36)	p-value
Age (years)	47.9 (1.8)	45.7 (1.8)	0.395
Squeezing pressure (mmHg)	65.1 (5.1)	91.7 (5.7)	0.001
Mean resting pressure (mmHg)	18.4 (2.0)	30.6 (1.9)	<0.001
PBT (mm)	8.78 (0.4)	9.91 (0.2)	0.035
Digital angle degree of anal sphincter defect (º)	104.9 (5.78)	91.64 (5.41)	0.14

SE = standard error; PBT = perineal body thickness.

PBT and symptoms of faecal incontinence

The mean Wexner score among incontinent patients was 8.6 (0.7) (range 2 - 20). The mean duration of incontinence was 50.3 (12.1) months. EAUS showed a PBT ≤10 mm for 48 (60%) out of 80 patients. Twenty-four (30%) patients had a PBT 10 - 12 mm, and 8 (10%) had a PBT >12 mm. The means of resting pressure and squeezing pressure were significantly different between continent and incontinent patients. PBT showed positive significant correlations with MRP (r=0.336; p=0.001), squeezing pressure (r=0.45; p=0.045) and age (r=0.297; p=0.009) and a negative relationship with Wexner score (r=−0.219; p=0.051), duration of disorder (r=−0.293; p=0.008) and EASDA (r=−0.301; p=0.045) (Table 2). From these figures, the significant results derived for the positive relationship between PBT and age, and negative relationship between PBT and duration of disorder, are clinically interesting.

Twenty-two patients in the group with PBT <10 mm were incontinent, with a sphincter defect, and 8 of the 22 had a Wexner score of 10 - 20. Six incontinent patients with PBT 10 - 12 mm had a sphincter defect, and 3 of these had a Wexner score of 10 - 20. Three incontinent patients with PBT >12mm had an EASD, and 2 of these had a Wexner score of 10 - 20. There were no significant differences among the three groups in Wexner score or EASDA in incontinent patients. However, squeezing pressure was significantly different among these three groups (analysis of variance F=4.93, p=0.01).

When patients were divided into two groups based on EASD, 45 patients showed a defect, while 35 did not, and PBT was significantly different between the groups (absolute mean difference (standard error (SE)) = 1.23 (0.5); p=0.015). Furthermore, MRP was significantly different (absolute mean difference (SE) = 8.23 (3.0); p=0.008), but squeezing pressure was not significantly different (p=0.138).

An EASDA in the range of 40 - 195° (mean 100.8°) was found in 56.25% of the patients, and was distributed across the groups as follows: 29 (60.42%) of 48 patients with a PBT <10 mm, 12 (50%) of 24 patients with a PBT 10 - 12 mm, and 4 (50%) of 8 patients with a PBT >12 mm (χ^2=0.847; p=0.65).

An increased EASDA was found in 41 (90.9%) of 45 women with a defective anal sphincter who were incontinent. Fourteen patients with an increased EASDA were not clinically incontinent, and there was no significant difference between continent and incontinent patients (p=0.14).

Discussion

Our study evaluated faecal incontinence, PBT and EASD in multiparous women. The study demonstrated that in a group of incontinent women, a sonographically 'thin' perineal body (PBT <10 mm) was associated with an ASD in 73.3% of the cases. This result is in agreement with previously published findings in parous patients.[5]

Incontinence is a multifactorial condition, including changes in stool consistency and volume, decreased anorectal sensation and angle, lack of a compliant reservoir, disruption of anal sphincter integrity, pudendal nerve neuropathy and mental function. It is defined by two mechanisms – direct injury (more often during the first delivery, after which 35% of women develop occult sphincter injury, and may experience symptoms of urgency and transient incontinence), and traction neuropathy of the pudendal nerves (42% with subsequent vaginal deliveries and with a sphincter defect may develop impaired continence).[12-15] It is now established that occult or unrecognised mechanical disruption to the anal sphincter is a major aetiological factor.[1] In our study, the mean number of vaginal deliveries was 3 (range 2 - 15), while in a study by Zettersröm et al.,[5] it was 2.3 (range 1 - 6). In a study by Titi et al.,[11] it was 2 (range 1 - 3). In our results, some patients had undergone one or more prior episiotomies during delivery that may have greatly contributed to an anterior external sphincter defect and affected PBT (Table 3).

Zetterström et al.[5] measured the PBT (12.2 (SE 3.5) mm) in asymptomatic primigravida subjects without EAUS evidence of sphincter injury in their first trimester, and defined this as normal PBT, while PBT ≤10 mm was considered abnormal, and was found in 93% (39 of 42) of incontinent women with an obstetric trauma to the anal sphincter.

In our results, the PBT was significantly different between continent and incontinent patients, although some overlap between the groups did occur. There were significant relationships between PBT and MRP and squeezing pressure, which was not found in the study by Titi et al.[11] The IAS is responsible for 50 - 85% of the resting tone[16] even in the presence of an intact EAS; this relationship may explain the importance of the IAS in obstetric damage.[16]

An EASD was shown in 56% of patients during EAUS. We also found that there was a significant negative correlation between PBT and EASD, which means that a thin perineal body is associated with a large angle of sphincter defect. Thinning of the perineal body is a well-known clinical finding among incontinent women with a sphincter defect.

PBT was divided into three groups. PBT <10 mm was found in 48 (60%) multiparous patients, and 30 patients (62.5%) were incontinent in this group. Although this percentage is lower than those found by other studies,[2,5,11] in those studies all submitted patients were suffering from symptoms of incontinence, while in our current study 36 (45%) of the patients were asymptomatic, demonstrating that there is an overlap with asymptomatic patients.

It should be noted that the other studies [2,5,11] did not use the same exclusion criteria as those in our study, where perineal surgical repair, rectal surgery for prolapse and rectocele, and nulliparous

Table 2. Correlation between PBT measurements and other parameters

Parameter	PBT (r)	P-value
MRP	0.336*	0.001
Squeezing pressure	0.45*	<0.001
Wexner score	−0.219†	0.051
Duration of disorder	−0.293†	0.008
Age	0.297*	0.009
EASDA	−0.301†	0.045

PBT = perineal body thickness; MRP = mean resting pressure; EASDA = external anal sphincter defect angle.
*Pearson correlation coefficient.
†Spearman correlation coefficient.

Table 3. Possible aetiological factors for patients with anal sphincter defects, by PBT

Factor (n)	≤10 mm	10 - 12 mm	>12 mm	p-value
Incontinent	30	8	6	0.031
Episiotomy	30	12	8	0.165
Abortion	4	4	1	
Sphincter defect	29	12	4	0.655

PBT = perineal body thickness.

women were excluded, so the real significance of the PBT effect was not demonstrated.

Eighteen percent of incontinent patients had a PBT between 10 and 12 mm, and 13.6% had a PBT >12 mm. Therefore, the largest group of incontinent patients with a sphincter defect was found to have a PBT <10 mm, while the smallest group had a PBT >12 mm; this is similar to the results of Zetterström *et al.*'s[5] study. In our results, 22 patients in the group with reduced PBT were incontinent with a sphincter defect, and 8 of these had a Wexner score of 10 - 20; 6 incontinent patients with a PBT of between 10 and 12 mm had a sphincter defect, and 3 of these had a Wexner score of 10 - 20. Therefore approximately two-thirds of women with incontinence had a reduced PBT.

A significant negative correlation was found between PBT and age. Primary degeneration of the IAS could be the cause of thinning in the sphincter muscles of elderly patients.[17] Titi *et al.*[11] evaluated 90 women with faecal incontinence, and found no evidence of increasing EASD, with a thinner perineal body, with age. In some studies, there was no significant relationship between the perineal body and the Wexner score, i.e. the degree of faecal incontinence.[2,11,18] The reasons for this are not clear. Mechanisms that maintain continence are multifactorial, and certainly in our study there were patients with a thin PBT who remained continent.

Continence is an interesting and complicated process, and patients' clinical data may show different results from laboratory-observed variables (endoanal manometry and EAUS). In the management of incontinence, anal physiology plays an important role, and biofeedback therapy in patients may improve physiological function and increase the power of the anal muscles to achieve continence. In our experience, patients with an adequate perineal body may represent a group who respond better to conservative measures, such as biofeedback therapy or sacral nerve stimulation, with its unknown mechanism, to cure incontinence, rather than immediate recourse to surgery. However, this has yet to be formally validated.

Conclusion

Faecal incontinence is a common but usually unrecognised medical problem in women, especially after traumatic vaginal deliveries.[14,15] In our study, 56% of patients had a sphincter defect demonstrable by EAUS. There was no significant correlation between PBT and Wexner incontinence score. Finally, the routine addition of PBT measurement to EAUS in the evaluation of faecal incontinence may be worthwhile. We believe that PBT measurement is simple to perform, and should be included in the assessment of incontinence, which remains a multifactorial and complex problem.

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