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GENERAL GYNECOLOGY

Screening occult anal sphincter injuries in primigravid women after vaginal delivery with transperineal use of vaginal probe: a prospective, randomized controlled trial

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Abstract
Purpose Here we aimed to evaluate the incidence of obstetric anal sphincter injuries in spontaneous primigravid deliveries with mediolateral episiotomy beyond 36 gestational weeks.
Methods We performed a prospective, randomized controlled study including 201 primigravid women that delivered vaginally. Anal sphincter anatomy and integrity was evaluated before hospital discharge in all cases with transvaginal sonography (5–9 MHz) (Siemens Sonoline G50 and Voluson 730 Expert). The vaginal ultrasound probe is placed in the fourchette of the vaginal introitus to obtain the transverse section of the anal sphincter.
Results In the cases with sphincter defect, mean gestational week and second stage of labor were prolonged significantly ($p = 0.039$ and $p < 0.0001$, respectively). The mean perineal body distance in cases with sphincter injury, as detected by sonography, 2.18 ± 0.33 cm, is compared to 2.31 ± 2.43 cm in cases without injury. There was a significant difference between the two groups ($p = 0.0142$). Shoulder dystocia was significantly higher in cases with sphincter injury, compared to cases without injury ($p = 0.011$). No clinical findings were reported in 11.5 % of cases (Sonography findings 1A∓, 1B∓) and 3.5 % of cases had clinical and sonographic findings (Sonography findings 2A∓, 2B∓). "Occult tears" were considered as those cases not detected clinically, but detected by sonography (11.5 % of all cases). Two months after examination, a moderate incontinence (Wexner continence scale) was found in 71.5 % of cases with overt sphincter tear, which was significantly different to the non-overt sphincter tear group. Multiple logistic regression analyses for sphincter injuries identified prolonged second stage of labor and shoulder dystocia as two independent risk factors.
Conclusion Here, we found that only a portion of anal sphincter injuries can be detected after physical examination, with many of cases of "occult tears" escaping notice. These cases of occult anal sphincter injury are detectable by sonography with transperineal use of a vaginal probe. Based on these findings, we propose that this technique is convenient for obstetric, gynecologic and proctologic evaluation of sphincter anatomy.

Keywords Obstetrics · Occult anal sphincter injury · Primigravid · Ultrasound · Vaginal probe

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Introduction

Obstetric anal sphincter injury (OASI) is a major complication of vaginal delivery that can have a major impact on quality of life by resulting in anal incontinence. Many factors such as nulliparity, midline episiotomy, macrosomia, a prolonged second stage of labor, shoulder dystocia, occipitoposterior position, epidural analgesia and all types of assisted vaginal delivery (forceps and vacuum-assisted) have been associated with an increased risk of anal incontinence [1, 2]. Studies suggest that midline episiotomies are more likely to extend into the anal sphincters and result in increased incontinence to gas and stool, and that mediolateral episiotomies are protective against sphincter lacerations [3, 4]. However, some observational and randomized studies have shown that routine episiotomy causes an increase in the incidence of anal sphincter and rectal tears [5]. Obstetric trauma is the most common cause of anal sphincter injuries in women. The incidence of anal incontinence usually ranges from 0.5 to 3 %. Anal incontinence is a common but often unreported symptom following childbirth [6]. The incidence of overt obstetric anal sphincter injury is 0.4–19 % in all vaginal deliveries of midline or mediolateral episiotomy type [1, 7]. Until the past decade, anal incontinence received little attention from obstetricians and it was attributed largely to pudendal neuropathy [8]. The advent of anal endosonography allows the diagnosis of clinically undiagnosed tears. Tears of the anal sphincter are diagnosed clinically in up to 5 % of women at the time of delivery, but ultrasound studies conducted after delivery have shown the prevalence of occult tears to anal sphincter to be as high as 35–41 %. Clinically undiagnosed tears are associated with subsequent anal incontinence in up to 50 % of affected women [9].

The aim of this study was to evaluate the incidence of OASIs in spontaneous primigravid deliveries with mediolateral episiotomy beyond 36 gestational weeks. In addition, we conducted a randomized controlled trial to evaluate the benefit of adding an ultrasound examination using a transvaginal probe immediately after vaginal delivery to the standard clinical examination.

Materials and methods

The study was conducted at the Department of Obstetrics and Gynecology of a tertiary hospital of Istanbul, Turkey, where approximately 16,000 women deliver each year. Between July 2009 and January 2010, 201 primigravid women were included in the study. The study was approved by the local ethical committees and all participants provided written informed consent. The study population included primigravid women who were delivered vaginally with mediolateral episiotomy beyond 36 gestational weeks. We excluded women with a history of chronic intestinal disease (Crohn's disease, ulcerative colitis), bowel incontinence, significant medical illness, perineum injury, and those who underwent any surgical procedure involving the anal canal prior to the current pregnancy.

Before ultrasonographic examination, demographic data and obstetric details were recorded, including: maternal age, gestational week, birth weight, duration of second stage of labor, degree of perineal injury, use of forceps and vacuum delivery, and presence of shoulder dystocia. After vaginal delivery, the obstetrician assessed the perineum by inspection and palpation. Clinically diagnosed anal sphincter tears were repaired end-to-end with 2.0 absorbable polyglycolic acid sutures (Vicryl1, Johnson & Johnson, Hamburg, Germany) by the obstetrician in charge. The vagina and perineum were repaired anatomically. Postoperatively, women received dietary advice to avoid constipation. Anal sphincter anatomy and integrity was evaluated before hospital discharge in all cases with sonography using a vaginal probe (5–9 MHz) (Siemens Sonoline G50 and Voluson 730 Expert). With the woman in the dorsal lithotomy position, the vaginal ultrasound probe was gently placed in the fourchette of the vaginal introitus to obtain the transverse section of the anal sphincter (Fig. 1). The probe was gradually inclined until the best view of the concentric muscle layers was achieved. The sagittal section was obtained by turning the vaginal ultrasound probe through 90° (Fig. 1). The internal sphincter was identified as a concentric hypoechoic band surrounding the anal mucosa. The external sphincter was identified lateral to the internal sphincter as a concentric band of mixed echogenicity. The intact rectal mucosa is a star-like image on the transverse section (Fig. 1). Special attention was paid to the integrity of both the internal and external anal sphincters. The combined thickness of the internal and external sphincters at the 12 o'clock position was measured in all patients. An echogenic or echolucent disruption in the sphincter(s) seen on one or more images was defined as a gap (Fig. 2a, b).

No surgical procedures were performed in cases where injuries were detected only by ultrasound examination. All participants were invited to undergo a follow-up ultrasonographic examination 2 months after delivery. Incontinence was scored using a Wexner continence scale. Participants completed questionnaires that addressed current complaints by telephone at 6 months postpartum. Those cases with complaint were referred to the general surgery clinic.

Data were analyzed using MedCalc 11.3.5 software. The Kolmogorov–Smirnov test was used to check the data

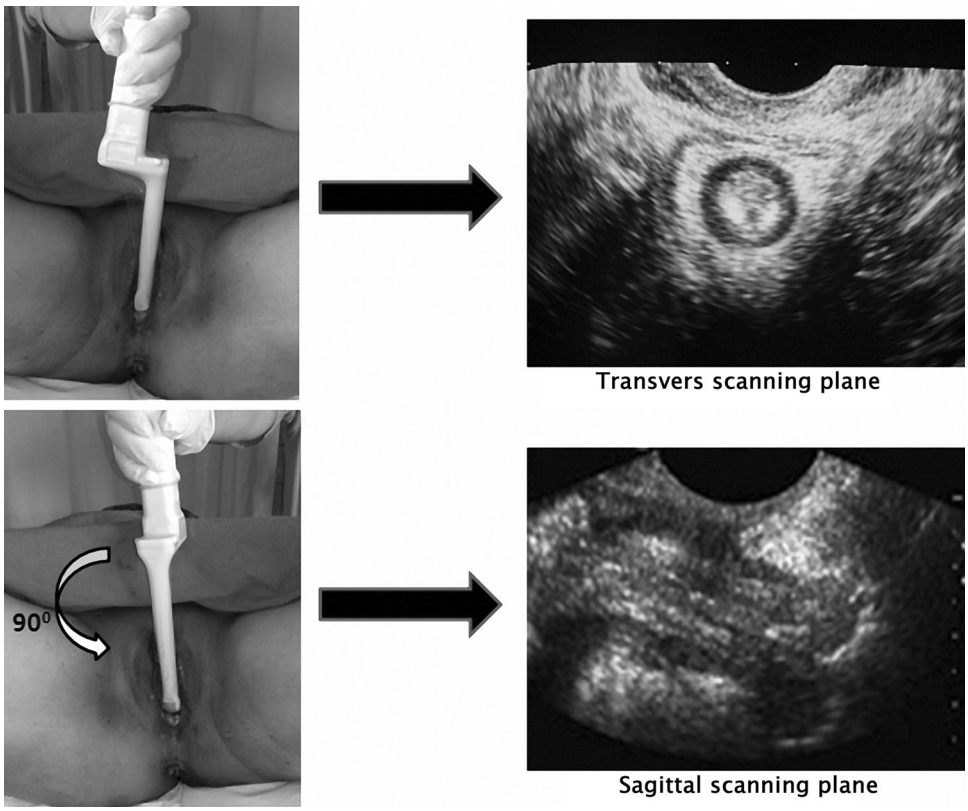

Fig. 1 Ultrasonographic evaluation of the anal sphincter. Transvaginal probe is gently placed in the fourchette of the vaginal introitus to obtain the transverse section of the anal sphincter. Normal anatomical structures and layers can be visualized on the ultrasonography image. The sagittal section is obtained by turning the probe through 90°

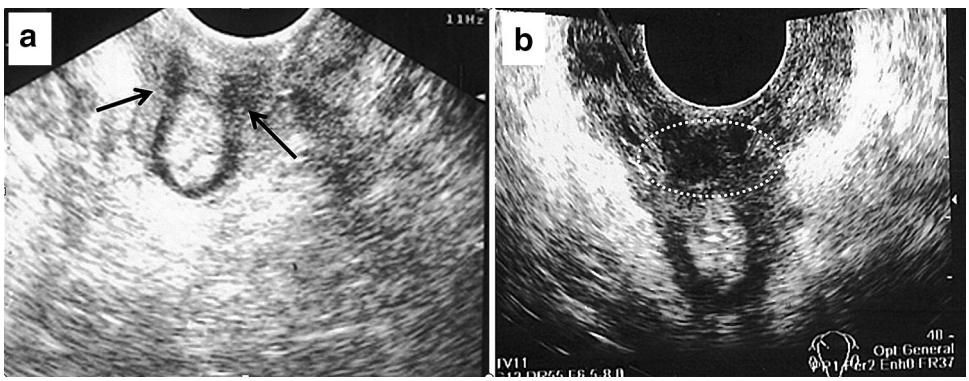

Fig. 2 **a** Transverse cross-sectional view of an 'occult' external sphincter tear. Internal anal sphincter and rectal mucosa appears normal but the circular continuity of the external anal sphincter is damaged at the level of the 1–11 o'clock positions. In this case, no defect was observed clinically. **b** Transverse cross-sectional view of a third-degree perineal laceration. The circular continuity of the internal and external anal sphincter is damaged at around the 12 o'clock position

normality. According to these results, either a two-sided independent samples *t* test or Mann–Whitney U test was used to compare the differences between variables. The Chi square test was used for comparison of categorical data, and the Fisher exact test for appropriate data. Multiple logistic regression analysis was used to detect the sphincter injury determinants. Values were expressed as mean ± standard deviation (SD). A p value of <0.05 was considered statistically significant.

Results

A total of 201 women were enrolled in this study. The median age of participants was 22.88 ± 3.72 years, median gestational age was 39.14 ± 1.39 weeks, and median birth weight was 3.18 ± 0.38 kg. Delivery was performed by an obstetrician in 153 (76.1 %) cases and by midwives in 48 (23.9 %) cases. The mean perineal body distance measured after labor was 2.34 ± 0.40 cm.

Table 1 Comparison of the cases according to the presence of ultrasonographic defect

	No defect on USG ($n = 171$)	Defect on USG ($n = 30$)	p value
Age	22.73 ± 3.80	23.73 ± 3.10	0.174
Gravity	1.11 ± 0.32	1.07 ± 0.25	0.539
Birth weight	3159.6 ± 352.9	3263.3 ± 526.0	0.173
Gestational age at delivery (weeks)	39.06 ± 1.40	39.63 ± 1.27	**0.039**
Maternal weight at delivery	67.04 ± 7.31	67.76 ± 6.36	0.610
Duration of second stage of labor (min)	19.88 ± 8.20	28.66 ± 9.09	**<0.0001**
Postpartum perineal body distance (cm)	2.37 ± 0.40	2.19 ± 0.33	**0.014**
Use of vacuum extraction	4 (2.3 %)	1 (3.3 %)	0.747
Presence of shoulder dystocia	1 (0.6 %)	2 (6.7 %)	**0.011**

Bold values are stastically significant $p < 0.05$

In 171 cases (85.1 %), transvaginal sonography revealed no clinical findings, whereas 30 cases (14.9 %) had a sphincter defect. In the cases with sphincter defect, mean gestational week and second stage of labor were prolonged significantly ($p = 0.039$ and $p < 0.0001$, respectively). The mean perineal body distance in cases with sphincter injury (as determined by sonography) was 2.18 ± 0.33 cm, compared to 2.31 ± 2.43 cm in cases without injury was; there was a significant difference between the two groups ($p = 0.0142$). Shoulder dystocia was significantly higher in cases with sphincter injury ($p = 0.011$). Eighty percent of deliveries with sphincter injury (24 cases) were performed by an obstetrician and 20 % of deliveries (6 cases) with sphincter injury by midwives. The characteristics of these two groups are summarized in Table 1.

The degree of perineal laceration according to clinical diagnosis and ultrasonographic diagnosis are shown in Tables 2 and 3, respectively. Twenty-three cases (11.5 %) had no clinical findings (Sonography findings 1A∓, 1B∓) and 3.5 % of cases (7 cases) had clinical and sonographic findings (Sonography findings 2A∓, 2B∓). "Occult tears" were consider to be those cases with no clinical findings but positive sonography findings (11.5 %, 23 cases). Table 4 presents the incontinence degree at 2 months postpartum.

Table 5 demonstrates the incontinence degree in cases with overt and occult sphincter tears. Two months later, in 71.5 % of cases with overt sphincter tear (5 cases), a moderate incontinence was found by the Wexner continence scale, which was significantly different to the overt group ($p < 0.0011$).

Multiple logistic regression analyses for sphincter injuries identified prolonged second stage of labor and shoulder dystocia as two independent risk factors ($p < 0.0001$ and $p = 0.0232$, respectively).

Table 2 The degree of perineal injury detected by transvaginal ultrasonography

Degree of injury	n	Percentage (%)
0	171	85.1
1A+	5	2.5
1A−	18	9.0
2A−	4	2.0
2B+	1	0.5
2B−	2	1.0
Total	201	100.0

0: no defect; 1A+: external partial defect (more than a quarter of the region); 1A−: external partial defect (less than a quarter of the region), 1B+: internal partial defect (more than a quarter of the region); 1B−: internal partial defect (less than a quarter of the region); 2A+: external complete defect (more than a quarter of the region); 2A−: external complete defect (less than a quarter of the region); 2B+: internal complete defect (more than a quarter of the region); 2B−: internal complete defect (less than a quarter of the region)

Table 3 The degree of perineal injury detected by clinical examination

Degree of perineal injury	N	Percentage (%)
2. Degree	194	96.5
4. Degree	1	0.5
3A	1	0.5
3B	3	1.5
3C	2	1.0
Total	201	100.0

2. Degree: involves the skin and muscles of the perineum. Not involve anal sphincter. 3. Degree: laceration involves anal sphincter complex. 4. Degree: laceration involves rectal mucosa. 3A: laceration involves <50 % of the external anal sphincter. 3B: laceration involves more than 50 % of the external anal sphincter. 3C: laceration involves internal anal sphincter

Table 4 Incontinence degree of cases at 2 months postpartum

Incontinence degree	*N*	Percentage (%)
0	185	92.0
1	2	1
2	3	1.5
3	1	0.5
4	2	1
5	1	0.5
6	5	2.5
7	1	0.5
8	1	0.5
Total	201	100

0: complete continence; 1–5: mild; 6–10: moderate; >10: heavy; 20: complete incontinence

Table 5 Continence degree differences between cases with overt and occult sphincter tears

Continence degree	Tear degree		*p* value
	Occult tear	Overt tear	
Complete continence	15 (65.2 %)	0	
Mild incontinence	6 (26.1 %)	2 (28.5 %)	0.705
Moderate incontinence	2 (8.7 %)	5 (71.5 %)	**0.0011**

Bold value is stastically significant $p < 0.05$

Discussion

Obstetric trauma is a major cause of anal incontinence in women and has a prevalence of 0.5–3 % globally. The incidence of overt obstetric anal sphincter injury is 0.4–19 % in all vaginal deliveries by midline or mediolateral episiotomy type [1, 7]. Until the past decade, anal incontinence received little attention from obstetricians and it was largely attributed to pudendal neuropathy [8]. The advent of anal endosonography now allows the diagnosis of clinically undiagnosed tears. Tears of the anal sphincter are diagnosed clinically in up to 5 % of women at the time of delivery, but ultrasound studies conducted after delivery have shown the prevalence of occult tears to anal sphincter to be as high as 35–41 %. Clinically undiagnosed tears are associated with subsequent anal incontinence in up to 50 % of affected women. A major problem in this issue is that these lacerations are not occult, and that overt lacerations are classified mistakenly as second degree [9]. Fernando et al. [10], observed that 33 % of obstetric consultants classified external anal sphincter injuries as second-degree perineal lacerations. In our 201 case study, 153 cases (76.1 %) were delivered by the trainee doctors and 48 cases (23.9 %) were delivered by midwives. We established that 80 % of the cases with sphincter injury (24 cases) were delivered by a trainee doctors. The reason for this is the study was conducted in a trainee and research hospital, where most labors deliver by trainee doctors. Furthermore, management of third and fourth-degree lacerations after vaginal delivery was designated at RCOG guideline in 2001 [11].

Some observational and randomized studies, as well as some review articles, have shown that routine episiotomy causes an increase in the incidence of anal sphincter and rectal tears [12, 13]. The American College of Obstetricians and Gynecologists concluded that restrictive episiotomy should be the preferred routine episiotomy (Practice Bulletin 2006) [14]. In our research, however, we did not perform median episiotomy; routine mediolateral episiotomy was performed in all 201 cases. The incidence of third- and fourth-degree laceration of perineum observed by both clinically and ultrasonography technique was 3.5 % in our study. This rate is similar to that described in the literature (0.4–19 %) [1, 7]. The tears not seen clinically and detected by only ultrasonography technique were termed occult tears, and their incidence was 11.5 %, which is lower than that typically reported in the literature. According to the literature data, the tear rate increases from between 0.4 and 19 % to 35 and 41 % by ultrasound techniques [9]. In our study, this rate increases from 3.5 % to only 11.5 %, which is likely due to us not having performed median episiotomies.

Prolongation of the second stage of labor makes the pelvic floor more fragile and edematous, thus increasing the probability of perineal trauma [15]. In this study, the second stage of labor was significantly prolonged in those cases with sphincter injuries ($p < 0.0001$).

Operative labors, including forceps and vacuum extraction, are independent risk factors for anal sphincter injuries [15, 16]. In this research, we did not find out any significant difference between occult and overt sphincter tears for operative labors ($p = 0.747$).

Some studies have shown that shoulder dystocia is associated with the increase of perineal and anal sphincter injuries, whereas other studies have found this not to be the case [17, 18]. Here, we observed that shoulder dystocia was significantly higher in those cases with sphincter injuries ($p = 0.011$).

In a retrospective study made by Gupta et al. [18], labors delivered by obstetricians and with a birth weight >4 kg were identified as independent risk factors for sphincter injury. We did not find a statistically significant difference in terms of birth weight between the groups with sphincter injury and without sphincter injury ($p = 0.173$).

We measured perineal body distance in all cases just after delivery and 2 months after delivery. In 71.5 % of cases with overt sphincter tear, who also had short perineal body distance after delivery, a moderate incontinence was found by the Wexner continence scale, which was statistically significant ($p = 0.0011$).

Because the hormonal changes that occur during post-term pregnancies convert the physical features of the perineal connective tissue, prolongation of pregnancy to the post-term period is associated with an increase in sphincter injuries, which is in-line with the findings of our study; mean gestational week was statistically higher in those cases with sphincter injuries ($p = 0.039$).

Several studies have investigated the effect of epidural anesthesia and local analgesia upon both the perineal tissue and labor; however, data are contradictory between these studies [19, 20]. In our study, epidural anesthesia was not performed but local analgesia was used for all patients because of the mediolateral episiotomy.

Overt obstetric anal injuries are normally evident in the delivery room and are usually treated surgically. Conversely, occult anal sphincter injuries typically remain undiagnosed until the presence of persistent anorectal complaints. These complaints can be extremely disturbing and some studies showed that the impact of the injury has an important role in decision for future pregnancies and mode of delivery in subsequent pregnancies [21]. Anal endosonography has a role in mapping post-traumatic defects of the anal sphincter complex and the sonographic appearance has been validated by anatomical comparison. Therefore, anal endosonography is now considered to be the gold standard in the management of anal sphincter injuries. Recently, endoanal ultrasonography has been used for evaluating sphincter anatomy in some studies [22–25]. Faltin et al. [26], used endoanal ultrasonography to evaluate perineum after delivery and found that it facilitates the diagnosis of sphincter injury in a prospective randomized controlled study. Whereby, they saw there was a significant decrease in the risk of heavy incontinence with quick reparation. Endoanal ultrasound probes are expensive and generally absent from delivery rooms; however, there have been reports showing that obstetricians could evaluate anal sphincter anatomy by transperineal use of a vaginal probe [27, 28]. Valsky et al. [29] showed that also 3D technique can be used to evaluate sphincter anatomy transperineally. Sixty primiparous women underwent 3D-TPS 3–42 (mean 10.6) months after surgical repair of third-or fourth-degree postpartum sphincter tears with the overlapping technique. The highlights of our study according to this study [29] are the technique we use is easily accessible, cheap, exists almost in every delivery room and 'occult sphincter tears' could be detected immediately after birth and before episiotomy repair in primigravid women.

In our prospective randomized controlled study, we also performed transperineal use of vaginal probe in primigravid women after delivery to evaluate the anal sphincter complex. We determined that not all sphincter injuries could be seen by clinical examination and that some sphincter injuries could therefore remain underdiagnosed. In total, we identified sphincter injury in 30 of 201 patients (15 %). Seven injury patients (3.5 %) were determined by clinical examination and these were termed "overt injuries". However, 23 injury patients (11.5 %) were identified only after ultrasonography (and not by clinical examination), which we termed "occult injuries". Thus, we observed that the incidence of sphincter injury diagnosed by clinical examination (3.5 %) could be increased to 15 % with the use of ultrasonic examination.

Conclusion

In our study, especially in primigravida labors, we observed that not all anal sphincter injuries after delivery are detectable by clinical examination and that some 'occult' sphincter injuries may be overlooked. We noticed that these occult sphincter injuries could be detected with by ultrasonography using a transvaginal probe. Although endoanal ultrasound examination is typically used in general surgery clinics associated with proctology, it is not practical for endoanal ultrasound examination to be used in delivery rooms. However, anal sphincter anatomy can be successfully revealed with the use of a transperineal transvaginal probe, thus making it possible to screen for occult injuries, degree of overt injury, and renovation of overt injuries. We propose that this simple technique is applicable to obstetric, gynecologic and proctologic evaluation of sphincter anatomy. We recommend that this technique would be useful to evaluate the anal sphincters in patients with suspected perineal injury and patients who had risk factors during their delivery process.

In addition, we observed that prolongation of the second stage of labor and shoulder dystocia are risk groups for sphincter injury. However recently, the meaning of occult tears is undetected, but healing process probably due to fibrosis may be a reason of anal incontinence issues in the forthcoming years. EMG workouts for the anal sphincter and further research in women that have occult injuries may provide further information about the long-term prospects for clinical use of transvaginal ultrasound examination.

Conflict of interest There is no conflict of interest and this research received no specific grant from any funding agency in the public, commercial, or not for profit sectors.

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