


Impact of episiotomy on the urogenital hiatus using transperineal ultrasound

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Aims: To analyze whether episiotomy affects the urogenital hiatal area and the difference in the hiatus at rest and during contraction, as an indirect measurement of the contractile capacity of the levator ani muscle.

Methods: We performed an observational, comparative, retrospective study of primiparous women who had normal vaginal deliveries. The urogenital hiatal area was compared in women with and without episiotomy. All women underwent transperineal ultrasound scanning after delivery, and all the images were analyzed offline by the principal investigator who was blinded to all clinical data. The urogenital hiatal area was measured at rest and during both Valsalva and contraction manoeuvres. The difference in the hiatus at rest and during contraction was also calculated. These scanning variables were compared between the study groups.

Results: In total, 194 women were analysed (101 with, and 93 without, episiotomy). There were no statistically significant differences between the groups regarding the area of the hiatus at rest ($P = 0.583$), on Valsalva ($P = 0.158$), and on contraction ($P = 0.468$), or in the difference in the hiatus at rest and during contraction ($P = 0.095$).

Conclusions: In normal vaginal delivery, neither the area of the urogenital hiatus nor its difference at rest and during contraction, as measured by ultrasound, were modified by performing an episiotomy.

1 | INTRODUCTION

Vaginal delivery is a critical moment that may cause permanent changes to the musculature of a woman's pelvic floor. Hyperdistention of the urogenital hiatus during the

passage of the fetal head may endanger the integrity of the levator ani muscle, resulting in its detachment, or avulsion at the pubis¹ or persistent elongation of its fibres, thereby increasing the size of the urogenital hiatal area in a phenomenon known as ballooning.² These anatomical injuries are associated with higher risks of pelvic organ prolapse.³

There are two portions of the levator ani muscle which play a particular role in childbirth: the pubovisceral muscle (with its puboanal, pubovaginal, and puboperineal parts)

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and the puborectal muscle.⁴ When the fetal head is crowning, the puborectal muscle elongates and rotates downward, but the part that undergoes the greatest rotation and downward elongation is the loop formed by the pubovisceral muscle in the direction of the perineal body.⁴ At this point, the fibres of the pubovisceral muscle are close to the area of the episiotomy. The pubovisceral muscle, next to the puborectal muscle, is responsible for closing the urogenital hiatus.⁵ The puborectal fibres are not affected by the episiotomy, although the fibres of the pubovisceral muscle may be affected, due to their proximity. For this reason, we used transperineal ultrasound to assess whether performing episiotomy might affect both the area of the hiatus and its reduction in contraction (in which the pubovisceral and puborectal muscles are involved) either directly by prolongation of the episiotomy or indirectly by releasing tension in the area.

The imaging techniques in both three-dimensional (3D) ultrasound scanning and magnetic resonance imaging allow these injuries to be highlighted and offer good reproducibility.^{6–8} Although the techniques are comparable, ultrasound scanning is advantageous in terms of its cost, comfort, and simplicity when performing a dynamic study. As a result, it is frequently used in daily clinical practice.^{9–10}

Many risk factors have been identified for levator ani injury, including age, obesity, and forceps delivery.¹¹ It remains unclear whether episiotomy should be considered separately because it is often related to other risk factors such as instrumentalisation.¹² Episiotomy was routinely performed in the past to protect the perineum, but doubts have been raised about its protective role,^{13,14} and today it is used only restrictively.¹⁵

Nevertheless, there is a need to assess the effect of episiotomy on the levator ani during normal vaginal delivery without the confounding effect of instrumental delivery. Although it does not seem to modify the avulsion rate,¹⁶ we know little of its effect on other anatomic and functional ultrasound variables. If significant differences are found in these variables between women with or without episiotomy, we may conclude that they are related to future symptomatology. For example, it is well known that ballooning is an independent predictor for the appearance of prolapse²; however, we do not know whether episiotomy favours prolapse or other anatomic and functional changes in the pelvic floor musculature.

In this study, we used transperineal ultrasound to assess the effect of episiotomy during normal vaginal delivery on the genital hiatal area at rest, on Valsalva, and during contraction. We also determined the difference in the hiatus at rest and during contraction as an indirect measurement of the contractile capacity of the levator ani muscle.

2 | MATERIALS AND METHODS

This was an observational retrospective study of primiparous women with normal vaginal deliveries. It was performed by re-analyzing data sets obtained in an earlier study of postpartum pelvic floor assessment by ultrasound in normal vaginal deliveries.¹⁶ Women included in the 2011 birth register of our hospital, a tertiary institution with 1911 deliveries in 2011, were recruited by telephone. Instrumental deliveries were excluded, because episiotomy is a routine procedure in this situation. All episiotomies were right mediolateral and were indicated when there was suspicion of fetal suffering or an imminent risk of severe perineal tearing. All participants gave their consent to participate, and the Clinical Research Ethics Committee of our institution approved the study (ref. 10/11). A total of 298 women were contacted by telephone: 104 could not be located or did not attend the appointment, leaving a total sample of 194 women.

Women were interviewed and underwent transperineal four-dimensional (4D) ultrasound using a GE Voluson E8 BT09 (GE Medical Systems, Zipf, Austria) with a 4.0–8.0 MHz RAB probe. Data were analyzed using 4D View, Version 9.1 (GE Medical Systems). Women were scanned between 179 and 364 days after delivery, and the volume was measured with patients in the lithotomy position with an empty bladder.

A midsagittal section of the pubic symphysis, urethra, vagina, anal canal, and lower portion of the levator ani muscle was obtained by 2D ultrasound (Fig. 1.). Then, 4D ultrasound was activated and the patient was asked to perform a maximum pelvic floor muscle contraction and a maximum Valsalva manoeuvre. The urogenital hiatus was measured as the smallest dimension, from the posterior border of the symphysis pubis to the internal border of the pubovisceral-puborectal muscle (Fig. 2), with the volume reconstructed. The area was measured using the rendered volume at rest and during both the Valsalva and the contraction manoeuvres. The difference in the hiatus at rest and on maximum pelvic floor muscle contraction was also recorded. Data were analyzed offline by an investigator blinded to all clinical data.

Ultrasound, demographic, and pregnancy data were recorded in an Excel database and statistical analysis was performed with IBM SPSS, Version 19.0 (IBM Corp., Armonk, NY). The comparison of means between groups was performed by the Student's *t*-test, after checking for normal distribution of the variables; otherwise a Mann-Whitney *U* test was used. Analysis of variance (ANOVA) was used for multiple comparison of quantitative variables between groups. For the study of categorical variables, Fisher's exact and chi-square tests were used as appropriate. Finally, a multivariate analysis was performed with the three measurements of the urogenital hiatus and the difference in the hiatus

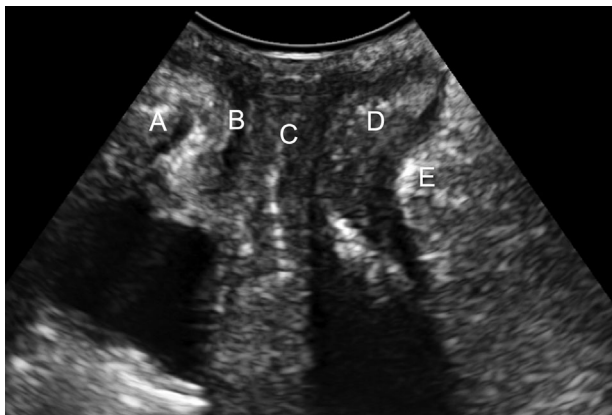


FIGURE 1 Identification of the midsagittal plane on two-dimensional transperineal ultrasound, showing the plane on two-dimensional transperineal ultrasound and the pubic symphysis (A), urethra (B), vagina (C), anal canal (D), and levator ani muscle (E). (2) Axial plane on four-dimensional imaging at the level of maximal hiatus contraction

at rest and during contraction as co-variables. For all tests, $P < 0.05$ was considered statistically significant.

3 | RESULTS

A total of 194 women were analyzed. 101 underwent episiotomy, and the remaining 93 did not. The mean age of the sample was 29 ± 5 years (range 16-42 years) and the mean body mass index (BMI) was 27.82 ± 3.93 kg/m² (range 18.3-42.31 kg/m²). Mean fetal weight was 3132.47 ± 443.69 g (1670-4360 g) and mean fetal head circumference was 34.57 ± 1.59 cm (range 28-39 cm). The mean duration of the second stage of labour was 89.41 min \pm 56.09 (13-330 min), and 79.4% received peridural anaesthesia. Overall, no significant differences were found between the groups with and without

episiotomy regarding demographic features and pregnancy data, except for BMI (Table 1).

On ultrasound, the mean hiatal area was 13.91 ± 3.25 cm² (range 9-33 cm²) at rest, 11.27 ± 2.96 cm² (range 4.58-24.23 cm²) during contraction, and 17.27 ± 5.97 cm² (range 8.45-61.09 cm²) on Valsalva.

As Table 2 shows, however, there were no statistical differences between the two groups in the hiatal area measurements at rest, on Valsalva or on contraction, or in the difference between the hiatus at rest and during contraction.

The hiatal area on Valsalva was 16.65 cm² in women with an episiotomy and 19.97 cm² in women without.

The multivariate study confirmed that none of the measurements of the urogenital hiatus were significantly related with the presence of the episiotomy.

4 | DISCUSSION

The main indications for episiotomy are suspicion of fetal suffering, instrumentalization of childbirth through forceps, or imminent risk of severe perineal tearing. Severe tearing may lead to deeper muscular injuries affecting the levator ani¹⁷ and third and fourth degree tears of the anal sphincter are also associated more with levator ani lesions.¹⁸ Thus, episiotomy is a preventive manoeuvre whose true effect on the musculature of the urogenital hiatus (ie, the levator ani muscle) is poorly understood. In this study, we found that episiotomy did not alter the anatomical and functional parameters of the urogenital hiatal area, as measured by transperineal ultrasound.

Instrumental delivery is known to be a risk factor for injury to the levator ani, and is itself often associated with episiotomy.¹¹ However, in an observational study of 194 women without instrumental delivery, we found that episiotomy was not an independent risk factor for avulsion

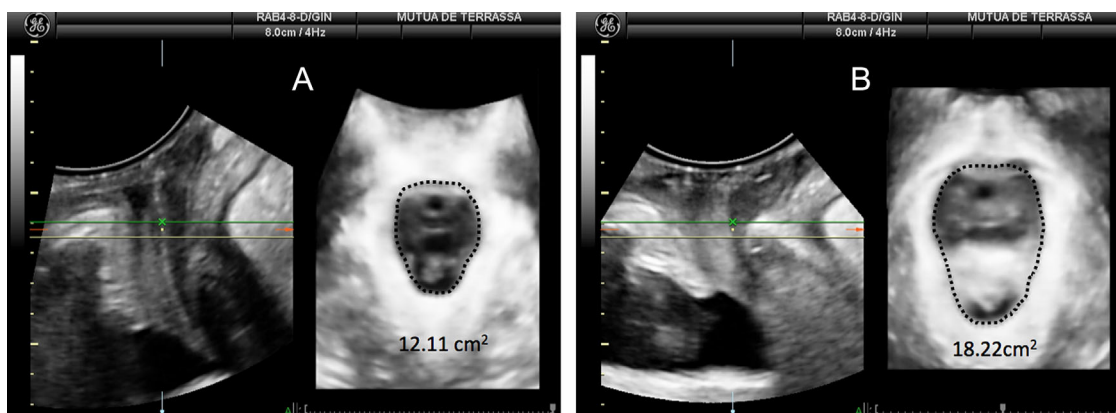


FIGURE 2 Measurement of the hiatus area at rest (A) and on maximum Valsalva (B). The area was measured from the posterior border of the symphysis pubis to the internal border of the pubovisceral-puborectal muscle (dotted line)

TABLE 1 Demographic and pregnancy data of study groups

	Episiotomy (N = 101)	No episiotomy (N = 93)	P
Age (years)	29.90 ± 4.87	29.27 ± 15.221	0.384*
BMI (kg/m ²)	27.13 ± 3.76	28.56 ± 3.99	0.011*
Gestational age (weeks)	39.52 ± 1.85	39.24 ± 1.71	0.281*
Fetal weight (g)	3190 ± 428.01	3068.981 ± 453.90	0.056*
Fetal head circumference (cm)	34.74 ± 1.57	34.39 ± 1.61	0.125*
Second stage of labor (min)	88.3 ± 57.1	90.6 ± 55.2	0.780*
Epidural anaesthesia (%)	81.20	77.40	0.517**
Levator ani avulsion (%)***	10.9	15.1	0.401**

Data shown as mean ± SD or %. BMI, body mass index.

*ANOVA; **Chi-square test; ***assess by ultrasound.

of the levator ani.¹⁶ This supports the argument that episiotomy does not have major impact on the detachment of the pubovisceral-puborectal part of the levator ani. As in our previous study with regard to avulsion, the results presented here show that there are no differences in the size of the urogenital hiatus as measured by ultrasound.

There is no doubt that dysfunction of the levator ani muscle may have a negative effect on aspects such as urinary and anal continence, pelvic organ prolapse, delivery, and sexuality. In each of these areas, the muscle's action (ie, distention or contraction) is crucial. Therefore, in addition to a static assessment (ie, at rest) a dynamic or functional assessment measuring the hiatal area in contraction or on Valsalva, and the difference in the hiatus at rest and during contraction is also essential. Our ultrasound images showed that these variables were not affected, thus corroborating the results obtained by Bo et al in their assessment of vaginal resting pressure, pelvic floor muscle strength, and endurance in women with and without episiotomy.¹⁹ In any case, using only ultrasound variables we cannot state conclusively that the measurements of the urogenital hiatus are directly related to the muscle function of the levator ani. Further studies are needed to confirm these data.

An interesting consideration is the assessment of the hiatus during the Valsalva manoeuvre. Given that enlargement of the hiatal area beyond 25 cm² is an independent risk factor for prolapse, or ballooning,² our results suggest that the

risk of prolapse was low in our cohort, regardless of whether an episiotomy was performed. These data should be analyzed with caution because although we performed a maintained Valsalva manoeuvre we did not meticulously observe the 6 s time requirement proposed by some authors for obtaining an "effective Valsalva."²⁰ Nevertheless, episiotomy in primiparous patients with normal vaginal delivery does not appear to cause ballooning. Probably, the pathological values recorded in the urogenital hiatus area when performing the Valsalva manoeuvre were more associated with difficult births. But we stress that the sample was not calculated for this purpose and so more prospective studies are needed to corroborate these data.

Our finding that the hiatal area was not altered at rest and during manoeuvres and that its size did not differ at rest and during contraction indicates that episiotomy does not increase the risk of pelvic floor dysfunction after a normal delivery. However, further studies are required to corroborate our findings, not least because we did not consider any associated symptomatology (eg, urinary or anal incontinence, or prolapse), and we did not include examination of the pelvic floor.

The relation between episiotomy and pelvic floor dysfunction is not well known and the information regarding for example, its association with lesions of the anal sphincter^{21,22} or the presence of dyspareunia or perineal pain,^{23,24} is often contradictory. Five to 10 years after delivery

TABLE 2 Hiatus area comparison between study groups

	Episiotomy (N = 101)	No episiotomy (N = 93)	P
Rest hiatus area (cm ²)	13.68 ± 2.5	14.17 ± 3.9	0.583*
Valsalva hiatus area (cm ²)	16.65 ± 4.9	19.97 ± 6.9	0.158*
Contraction hiatus area (cm ²)	11.29 ± 2.3	11.5 ± 3.5	0.468*
Difference in the hiatus at rest and during contraction (cm ²)	2.39 ± 1.8	2.91 ± 2.1	0.095*

*Mann-Whitney U Test.

Handa et al did not link episiotomy to pelvic floor dysfunction²⁵ and Bo et al could found no differences in the incidence of stress incontinence in patients with or without episiotomy.¹⁹ Another study reported a higher incidence of incontinence associated with episiotomy,²⁶ but their data were obtained from a survey with a low sample size which, as the authors noted, may well have affected the result. In a prospective study, Aytan et al assessed the relationship between episiotomy and prolapse and found no differences between women with and without episiotomy.²⁷ Using the Pelvic Organ Prolapse Quantification System they found significant changes in the distal posterior vaginal wall, perineal body, and total vaginal length (to the detriment of the episiotomy group), but not in prolapse. By contrast, Cam et al found that episiotomy seemed to prevent central defects in the anterior vaginal wall, though their results were limited by the study's retrospective design.²⁸

Our study has certain limitations. The first, is its retrospective design and the fact that the sample size was calculated not to assess differences in the hiatus area but to assess avulsion. Second, only anatomical and ultrasound criteria were assessed, with no consideration of clinical criteria. Third, the exact time of the episiotomy was not specified. Finally, because we did not include instrumental deliveries, these data are only valid for patients with normal vaginal delivery.

5 | CONCLUSION

In normal low-risk vaginal delivery, episiotomy did not alter either the urogenital hiatal area or the difference in its size at rest and during contraction, as assessed by ultrasound, was altered by episiotomy.

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