Received: 13 February 2023 | Revised: 9 May 2023 | Accepted: 11 June 2023

DOI: 10.1111/aogs.14620

AOGS Acta Obstetricia et Gynecologica Scandinavica

ORIGINAL RESEARCH ARTICLE

Ultrasound examination of the pelvic floor during active labor: A longitudinal cohort study

Torbjørn M. Eggebø[1,2,3] | Sigurlaug Benediktsdottir[4] | Hulda Hjartardottir[4] | Kjell Å. Salvesen[1,2] | Ingrid Volløyhaug[2,5]

[1]National Center for Fetal Medicine, Trondheim University Hospital (St. Olavs Hospital), Trondheim, Norway

[2]Institute of Clinical and Molecular Medicine, Norwegian University of Science and Technology, Trondheim, Norway

[3]Department of Obstetrics and Gynecology, Stavanger University Hospital, Stavanger, Norway

[4]Department of Obstetrics and Gynecology, Landspitali University Hospital, Reykjavik, Iceland

[5]Department of Obstetrics and Gynecology, Trondheim University Hospital (St. Olavs Hospital), Trondheim, Norway

Correspondence

Torbjørn M. Eggebø, National Center for Fetal Medicine, Trondheim University Hospital (St. Olavs Hospital), Trondheim, Norway.

Email: tme@lyse.net

Funding information

Icelandic Center for Research

Abstract

Introduction: There is limited evidence about changes in the pelvic floor during active labor. We aimed to investigate changes in hiatal dimensions during the active first stage of labor and associations with fetal descent and head position.

Material and methods: We conducted a longitudinal, prospective cohort study at the National University Hospital of Iceland, from 2016 to 2018. Nulliparous women with spontaneous onset of labor, a single fetus in cephalic presentation, and gestational age ≥37 weeks were eligible. Fetal position was assessed with transabdominal ultrasound and fetal descent was measured with transperineal ultrasound. Three-dimensional volumes were acquired from transperineal scanning at the start of the active phase of labor and in late first stage or early second stage. The largest transverse hiatal diameter was measured in the plane of minimal hiatal dimensions. The levator urethral gap was measured as the distance between the center of the urethra and the levator insertion using tomographic ultrasound imaging. Measurements of the levator urethral gap were made in the plane of minimal hiatal dimensions and 2.5 and 5 mm cranial to this.

Results: The final study population comprised 78 women. The mean transverse hiatal diameter increased 12.4% between the two examinations, from 39.4 ± 4.1 mm (±standard deviation) at the first examination to 44.3 ± 5.8 mm at the last examination ($p < 0.01$). We found a moderate correlation between the transverse hiatal diameter and fetal station at the last examination ($r = 0.44$, $r^2 = 0.19$; $p < 0.01$; regression equation $y = 2.71 + 0.014x$), and a weak correlation between the change in transverse hiatal diameter and change in fetal station ($r = 0.29$; $r^2 = 0.08$; $p = 0.01$; regression equation $y = 0.24 + 0.012x$). Levator urethral gap increased significantly in all three planes on both the left and right sides. Head position was not associated with hiatal measurements after adjusting for fetal station.

Conclusions: We found a significant, but only modest, increase of the hiatal dimensions during the first stage of labor. The risk of levator ani trauma will therefore be low

Abbreviations: 3D, three-dimensional; AoP, angle of progression; LUG, levator urethra gap; OP, occiput posterior.

during this stage. The change in transverse hiatal diameter was associated with fetal descent but not with head position.

KEYWORDS
birth, fetal descent, head position, hiatal dimensions, injury, labor, levator ani, obstetrics, pelvic floor, prolapse, ultrasound, urogynecology

1 | INTRODUCTION

The muscles of the pelvic floor are located between the coccygeal bone and the pubic bone; they attach to the perineal structures and support the uterus, bowel, and bladder. Muscular bands encircle the urethra, vagina, and anus as they pass through the pelvic floor.[1,2] Studies using three-dimensional (3D) transperineal ultrasound or magnetic resonance imaging have shown that levator avulsion, a uni- or bilateral detachment of the medial fibers of the levator ani muscle from the pubic bone, is strongly associated with pelvic organ prolapse later in life.[3] Such injuries are much more common after forceps than after vacuum-assisted and normal vaginal delivery, and are not seen after cesarean section, even when performed in the second stage of labor.[4,5]

Previous studies have found that hiatal dimensions, such as levator hiatal area and anteroposterior and transverse diameters increase throughout pregnancy.[6,7] Furthermore, smaller hiatal dimensions in pregnancy seem to be associated with longer second stage and operative vaginal or cesarean delivery.[8–10] Some studies have even suggested that smaller hiatal dimensions in pregnancy could put women at risk of levator avulsion during delivery.[11]

The levator urethra gap (LUG) is the distance between the center of the urethra and the levator insertion on the pubic bone. A LUG >25 mm is indicative for levator avulsion in women examined weeks to months after delivery, but measurements during labor have not been studied.[12] Computer models have shown an enormous stretch capacity in the pelvic floor muscles, and the medial fibers of the levator ani stretch nearly 2.5 times their original length during labor.[13] The main stretching occurs late in labor[14]; however, the levator ani muscle is funnel shaped, and the stretching may start early in labor. The fetal head is broader in the posterior part, and the stretching may be associated with fetal position. In this study we aimed to investigate changes in hiatal dimensions during the active first stage of labor and associations with fetal descent and head position.

2 | MATERIAL AND METHODS

We conducted a prospective cohort study at the National University Hospital of Iceland, from January 2016 to April 2018. Nulliparous women with spontaneous onset of labor, a single fetus in cephalic presentation, and gestational age ≥37 weeks were eligible, corresponding to group one in the 10-group classification system.[15] The primary aim of this study was to investigate fetal head descent and rotation longitudinally with ultrasound, and these results have been published previously.[16,17] A secondary aim was to study changes of the pelvic floor during active labor. No power analysis was performed because the design was a longitudinal descriptive study.

Two obstetricians carried out ultrasound examinations. The women were examined with 3D ultrasound twice. The first examination was at the start of the active phase of labor or at admission for women already in established active labor, and the last examination was performed in late first stage or early second stage. Active labor was defined as effaced cervix dilated ≥4 cm in women with regular contractions. On both occasions, transabdominal and transperineal ultrasound examinations measuring fetal descent and head position were performed. 3D ultrasound volumes of the pelvic floor were stored on the ultrasound device. All measurements were carried out between uterine contractions and without Valsalva maneuver or pelvic floor muscle contraction using a 3.5–7.5-MHz 3D curved multifrequency transabdominal transducer connected to a Voluson *i* (GE Medical Systems).

The fetal position was marked like a clock-face with half-hourly markings and categorized as occiput anterior (OA; ≥10 and ≤2 o'clock), left occiput transverse (LOT; >2 and <4 o'clock), occiput posterior (OP; ≥4 and ≤8 o'clock), and right occiput transverse (ROT; >8 and <10 o'clock) as described by Akmal et al.[18] Fetal station was measured as angle of progression (AoP) as previously described, see Figure 1.[19]

Several months later, the pelvic floor ultrasound volumes were transferred to a personal computer and analyzed by the second author using 4D View software (GE Medical Systems). She was blinded to information about fetal position and station, and she had been trained by an experienced examiner (last author). Figure 2 shows a 2D acquisition in the mid-sagittal plane and a 3D rendered volume at the level of minimal hiatal dimensions. The largest transverse hiatal diameter was measured from 2D images in the plane of minimal hiatal dimension as illustrated in Figure 3.[20] It was difficult to outline the posterior part of the hiatus late in labor when the fetal head was

Key message

The risk of levator ani trauma will be low during the first stage of labor as there is only a modest increase of both the transverse levator hiatal diameter and the levator urethra gap.

deeply engaged because of shadowing from the fetal skull. In these cases, we used the appearance of the symphysis as a proxy to define the plane of minimal hiatal dimensions.

The LUG was measured as the distance between the center of the urethra and the levator insertion (Figure 3) using tomographic ultrasound imaging. Measurements were made in three separate planes, in the plane of minimal hiatal dimensions and 2.5 and 5 mm cranial to this.[12]

2.1 | Statistical analyses

Normally distributed independent variables were compared with *t* test. Changes in transverse hiatal dimensions and LUG between the first and last examination were analyzed with paired samples *t* test. Stratified analyses were carried out for women with the fetus in OP vs non-OP position and the occiput on the left vs. the right side. Associations between the transverse hiatal diameter and fetal position and fetal station were analyzed with multivariable logistic regression analyses. The relationship between continuous variables was analyzed with linear regression and Pearson correlation coefficient. Data were analyzed with the statistical software package SPSS statistics version 28.0 (IBM). Values of $p < 0.05$ were considered significant.

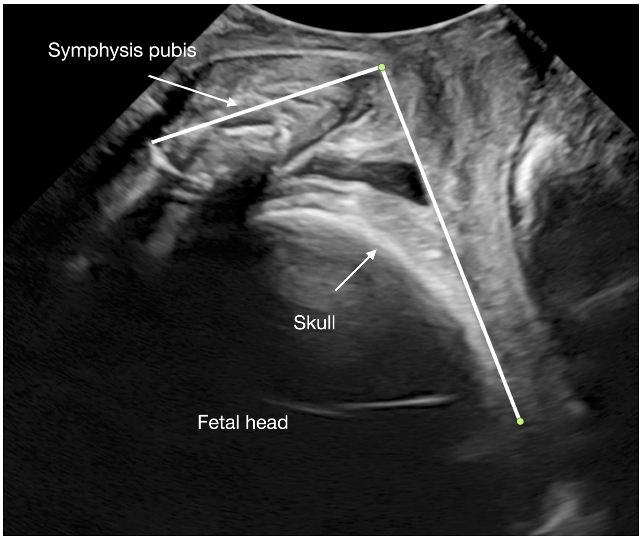

FIGURE 1 Angle of progression was measured as the angle between a longitudinal line through the symphysis pubis and a line from the inferior edge of the symphysis pubis tangentially to the fetal skull contour.

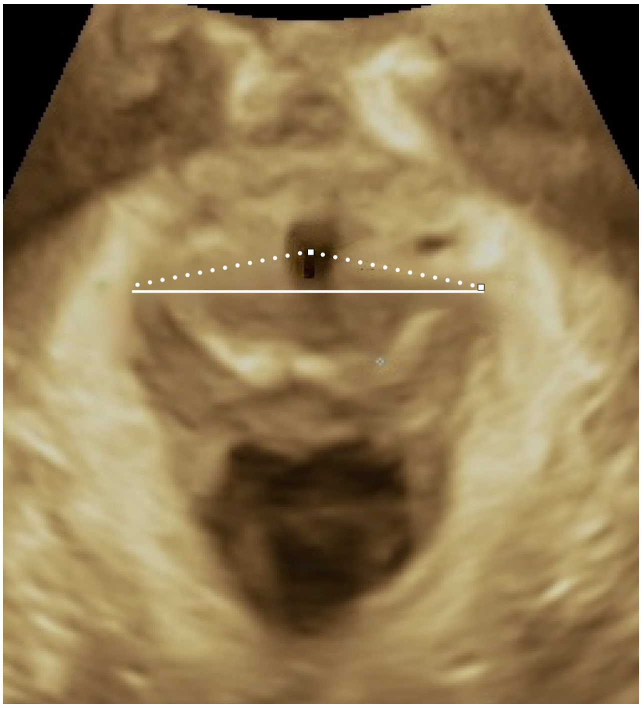

FIGURE 3 The largest transverse hiatal diameter was measured in the plane of minimal hiatal dimensions as illustrated with the continuous line, and the levator urethral gaps (LUGs) were measured as the distance between the center of the urethra and the levator insertion (dotted lines). The LUGs were also measured at planes 2.5 mm and 5 mm more cranial.

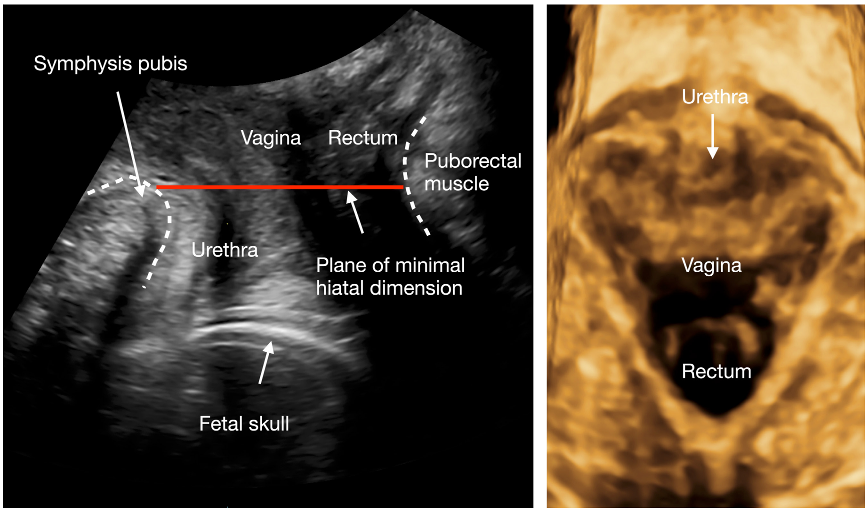

FIGURE 2 Two-dimensional acquisition in the mid-sagittal plane (left image) and three-dimensional rendered volume at the level of minimal hiatal dimensions (right image). The image was acquired in late first stage of labor.

2.2 | Ethics statement

The women were informed about the study on admission to the labor ward, and written consent was obtained before inclusion. The study was approved by the Landspitali Ethics Committee on November 13, 2015 (reference number 26/2015).

3 | RESULTS

The original study population comprised 100 women, but one woman withdrew her consent, two women were only examined once, and in 19 women the imaging quality was unsatisfactory, leaving 78 women in the final population. Characteristics of the study population are shown in Table 1.

The mean duration from the first examination to delivery was 9.8 h, and it was 131 min from the last examination to delivery. The mean ± standard deviation (SD) cervical dilatation was 5 ± 1.2 cm at the first examination and 9 ± 1.3 cm at the last examination and corresponding mean ± SD AoPs were 100 ± 11.0 degrees and 121 ± 18.0 degrees. The mean ± SD transverse hiatal diameter increased 12.4% between the two examinations, from 39.4 ± 4.1 mm at the first examination to 44.3 ± 5.8 mm at the last examination ($p < 0.01$). We found no correlation between the transverse hiatal diameter at the first examination and the fetal station measured as AoP ($r = 0.09$; $p = 0.46$). However, at the last examination we found a moderate correlation ($r = 0.44$, $r^2 = 0.19$; $p < 0.01$; regression equation $y = 2.71 + 0.014x$) (Figure 4). We found a weak correlation between the change in transverse hiatal diameter and change in AoP between the first and last examinations ($r = 0.29$; $r^2 = 0.08$; $p = 0.01$; regression equation $y = 0.24 + 0.012x$).

The transverse hiatus diameter was 4.2% longer in OP positions than in in non-OP positions at the first examination, 40.1 ± 4.5 mm vs 38.5 ± 3.6 mm, respectively ($p = 0.10$). At the last examination the transverse hiatal diameter was 7.6% shorter in OP positions (41.9 ± 5.0 mm) than in non-OP positions (45.1 ± 5.8 mm; $p = 0.03$). The corresponding fetal station was higher in OP positions (AoP 108 ± 17.7 degrees vs AoP 126 ± 16.0 degrees, respectively) and the transverse hiatal diameter was not associated with fetal position after adjusting for AoP ($p = 0.48$).

The mean LUG increased significantly in all three planes on both the left and right sides from the first to the last examinations (Table 2). The LUG was >25 mm in the reference plane at the first examination in four women on the left and in three women on the right side. At the last examination the LUG was >25 mm in the reference plane in 20 women on the left side and in 18 women on the right side. The LUG was >25 mm at one or both sides in all three planes in 16 women at the last examination. In some planes we measured a significantly longer LUG on the left side compared with the right side (Table 3).

We did not find any associations between the transverse hiatal diameters and occiput position to the left or right nor any correlation between the LUG and occiput position to the left or right at the first or the last examination. The birthweight was not significantly correlated with hiatal measurements ($r = 0.11$ for the first examination and $r = 0.05$ for the last examination). The duration of the second stage was not significantly associated with hiatal measurements ($r = -0.17$ for the first examination and $r = -0.14$ for the last examination), or with AoP ($r = -0.19$ for the first examination and $r = -0.13$ for the last examination).

TABLE 1 Characteristics of the study population.

Maternal characteristics	Median or *n*	Range or %
Maternal age (years)	26	18–40
BMI at first visit (kg/m^2)	23	17–36
Gestational age (days)	280	259–293
Labor characteristics		
Oxytocin augmentation	35	44.9
Epidural analgesia	55	70.5
Spontaneous deliveries	57	73.1
Instrumental deliveries	13	16.7
Cesarean sections	8	10.3
Duration of active labor (hours)	9.9	2.2–26.0
Duration of second stage (minutes)	93	24–366
Duration of pushing phase (minutes)	62	13–188
Newborn characteristics		
Birthweight (g)	3544	2478–4998

4 | DISCUSSION

We observed a modest increase of 12.4% in the transverse hiatal diameter during the active first stage of labor. The mean transverse hiatal diameter was 4.4 cm at 9-cm cervical dilatation and a further increase of 127% is needed for a fetal head with a biparietal diameter around 10 cm to pass through the birth canal. Most stretching must occur during the second stage.

Krofta et al. constructed a 3D model of the female pelvic floor and fetal head, and simulated a vaginal birth with cardinal movements.[13] They found that the levator ani muscle was elongated nearly 2.5 times from its resting position and that the stress values were highest close to the insertion in the pubic bones at the onset of fetal head extension.

Garcia Mejido et al. examined women longitudinally with 3D transperinal ultrasound and found that the main stretching occurred at the fourth plane of Hodge, which corresponds to the level of the pelvic floor.[14]

The mean AoP at the last examination in our study was 126 degrees in non-OP positions corresponding to the clinical station +1.[21] We found that the transverse hiatal diameter was shorter in OP positions than in non-OP positions late in labor, but this was explained by higher mean station in OP positions.

One study examined the pelvic floor in primiparous women with ultrasound 2–4 days after delivery and found partial or complete

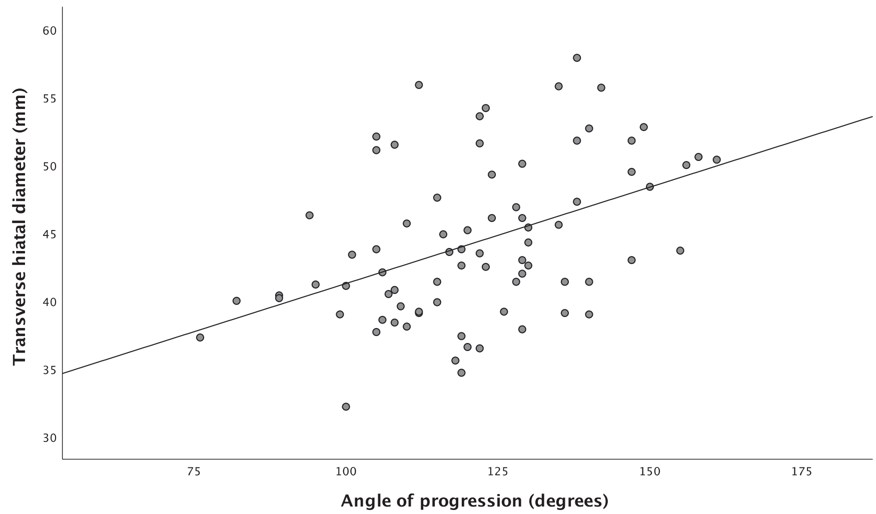

FIGURE 4 Association between transverse hiatal diameter and fetal station measured as angle of progression at the last examination. ($r=0.44$, $r^2=0.19$; regression equation $y=2.71+0.014x$).

TABLE 2 Levator urethral gap at the first and last examination.

	First examination	Last examination	*p* value
Right LUG reference plane (mm), *n* = 68	21.2 ± 2.3	22.9 ± 3.3	<0.01
Left LUG reference plane (mm), *n* = 68	22.1 ± 2.3	23.8 ± 3.8	<0.01
Right LUG 2.5 mm cranial (mm), *n* = 68	20.4 ± 2.3	22.7 ± 3.4	<0.01
Left LUG 2.5 mm cranial (mm), *n* = 68	21.8 ± 2.0	23.4 ± 3.8	<0.01
Right LUG 5 mm cranial (mm), *n* = 68	20.2 ± 2.2	22.1 ± 3.3	<0.01
Left LUG 5 mm cranial (mm), *n* = 67	21.4 ± 1.9	23.7 ± 3.9	<0.01

Note: Values are mean ± standard deviation, and are compared with paired *t*-test.
Abbreviation: LUG, levator urethral gap.

TABLE 3 Levator urethral gap at the right and left side.

	Right side	Left side	*p* value
First examination reference plane (mm) *n* = 75	21.3 ± 2.4	22.2 ± 2.3	0.02
Last examination reference plane (mm) *n* = 75	22.9 ± 3.2	23.8 ± 3.8	0.13
First examination 2.5 mm cranial (mm) *n* = 75	20.5 ± 2.3	21.8 ± 2.0	<0.01
Last examination 2.5 mm cranial (mm) *n* = 71	22.7 ± 3.4	23.5 ± 3.8	0.22
First examination 5 mm cranial (mm) *n* = 71	20.3 ± 2.4	21.6 ± 2.0	<0.01
Last examination 5 mm cranial (mm) *n* = 70	22.2 ± 3.5	23.8 ± 3.9	0.01

Note: Values are mean ± standard deviation, and are compared with *t* test.

levator muscle avulsion in 24% and hematoma in 9%. The trauma was bilateral in 48%, right sided in 24%, and left sided in 28%.[22] Similar to our findings, this study could not identify any association between head position at delivery and the affected body side.[22] Another study found that unilateral avulsions were more common on the right side, 80% right sided and 20% left sided, without giving any explanation of the difference.[23] We found a longer LUG on the left side, but the side difference was not associated with head position and may be due to slight tilting of the ultrasound probe at examination.

Dietz et al. suggested using LUG >25 mm as a diagnostic criterion for levator avulsion.[12] We measured the LUG >25 mm at one or both sides in all three planes in 16 women at the last examination. We think it is unlikely that a levator avulsion occurred before the expulsive phase, and this is more likely an expression of the elasticity of the muscle. Unfortunately, we did not examine the status of the levator after delivery. Furthermore, it could be that Icelandic women have a different cut-off for avulsion, as differences have been found in other populations.[24]

García Mejido et al. reported four cases of unilateral right avulsion among 21 women with vaginal births (two vacuum deliveries and two forceps deliveries).[14]

We found a significant increase of the transverse levator hiatal diameter and LUG with progression of labor. Still, the mean transverse levator hiatal diameter was 4.4 cm at the last examination, and the clinical interpretation is that major levator stretching occurs during the second stage of labor. The risk of levator ani trauma will therefore be low in the first stage of labor. This is also supported by studies showing no levator avulsion in women with intrapartum cesarean section even in the second stage.[5,25,26]

Strengths of the study are the prospective design during active labor, and that fetal position and station were objectively examined with ultrasound at the same time as the pelvic floor was assessed.

Limitations are the small study population and that the women were not examined during the expulsive phase or after delivery. We do not have information about levator trauma on ultrasound or clinical signs of prolapse after delivery. In some women the first examination was late in labor because of late admission to the labor ward. We examined women between contractions, and more stretching may occur during contractions. It is a major limitation that we could not examine the posterior part of the levator hiatus in all cases as the result of shadowing from the fetal head. We therefore used the appearance of the symphysis pubis as a proxy to define the plane of minimal hiatal dimensions. Still, we were able to measure both the transverse levator hiatal diameter and the LUG. In future studies, the examiner should be aware of this problem and try to identify the levator muscle as it passes behind the rectum. It is also a limitation that we did not include any measurements of the bony pelvis. A small increase in the subpubic arch angle has been found during pregnancy,[27] and it could be interesting to study eventual changes in the subpubic arch angle during active labor in future studies.

5 | CONCLUSION

We found only a modest increase of both the transverse levator hiatal diameter and the LUG during the first stage of labor. The risk of levator ani trauma will therefore be low during this stage. The change in transverse hiatal diameter was associated with fetal descent but not with head position.

AUTHOR CONTRIBUTIONS

TME: planning, statistical analyses, and writing. SB: planning, examination of participating women, created the 3D rendering, measuring the diameters and the urethral gaps, and writing of the paper. HH: planning, examination of participating women and writing. KÅS: planning and writing of the paper. IV: instructing 3D rendering and measuring, writing of the paper, and final responsibility for the manuscript.

ORCID

Torbjørn M. Eggebø https://orcid.org/0000-0002-3162-9595
Hulda Hjartardottir https://orcid.org/0000-0003-4984-7635
Kjell Å. Salvesen https://orcid.org/0000-0002-1788-4063
Ingrid Volløyhaug https://orcid.org/0000-0001-9392-1674

REFERENCES

1. Lawson JO. Pelvic anatomy. I. Pelvic floor muscles. *Ann R Coll Surg Engl*. 1974;54:244-252.
2. Shobeiri SA, Rostaminia G, White D, Quiroz LH. The determinants of minimal levator hiatus and their relationship to the puborectalis muscle and the levator plate. *BJOG*. 2013;120:205-211.
3. Cattani L, Decoene J, Page AS, Weeg N, Deprest J, Dietz HP. Pregnancy, labour and delivery as risk factors for pelvic organ prolapse: a systematic review. *Int Urogynecol J*. 2021;32:1623-1631.
4. Friedman T, Eslick GD, Dietz HP. Delivery mode and the risk of levator muscle avulsion: a meta-analysis. *Int Urogynecol J*. 2019;30:901-907.
5. Volloyhaug I, Morkved S, Salvesen O, Salvesen KA. Forceps delivery is associated with increased risk of pelvic organ prolapse and muscle trauma: a cross-sectional study 16-24 years after first delivery. *Ultrasound Obstet Gynecol*. 2015;46:487-495.
6. van Veelen GA, Schweitzer KJ, van der Vaart CH. Ultrasound imaging of the pelvic floor: changes in anatomy during and after first pregnancy. *Ultrasound Obstet Gynecol*. 2014;44:476-480.
7. Staer-Jensen J, Siafarikas F, Hilde G, Bo K, Engh ME. Ultrasonographic evaluation of pelvic organ support during pregnancy. *Obstet Gynecol*. 2013;122:329-336.
8. Siafarikas F, Staer-Jensen J, Hilde G, Bo K, Ellstrom EM. Levator hiatus dimensions in late pregnancy and the process of labor: a 3- and 4-dimensional transperineal ultrasound study. *Am J Obstet Gynecol*. 2014;210(484):e481-e487.
9. Guntinas A, Galocha C, Madurga R, Kirk J, Usandizaga R, Angel R-ZM. Application of pelvic floor ultrasound during pregnancy to detect patients at risk of cesarean section due to failure of labor progression in a Spanish population. *Eur J Obstet Gynecol Reprod Biol*. 2022;269:102-107.
10. van Veelen GA, Schweitzer KJ, van Hoogenhuijze NE, van der Vaart CH. Association between levator hiatal dimensions on ultrasound during first pregnancy and mode of delivery. *Ultrasound Obstet Gynecol*. 2015;45:333-338.
11. Siafarikas F, Staer-Jensen J, Hilde G, Bo K, Ellstrom EM. The levator ani muscle during pregnancy and major levator ani muscle defects diagnosed postpartum: a three- and four-dimensional transperineal ultrasound study. *BJOG*. 2015;122:1083-1091.
12. Dietz HP, Abbu A, Shek KL. The levator-urethra gap measurement: a more objective means of determining levator avulsion? *Ultrasound Obstet Gynecol*. 2008;32:941-945.
13. Krofta L, Havelkova L, Urbankova I, Krcmar M, Hyncik L, Feyereisl J. Finite element model focused on stress distribution in the levator ani muscle during vaginal delivery. *Int Urogynecol J*. 2017;28:275-284.
14. Garcia Mejido JA, Suarez Serrano CM, Fernendez Palacin A, Aquise Pino A, Bonomi Barby MJ, Sainz Bueno JA. Evaluation of levator ani muscle throughout the different stages of labor by transperineal 3D ultrasound. *Neurourol Urodyn*. 2017;36:1776-1781.
15. Robson MS. Can we reduce the caesarean section rate? *Best Pract Res Clin Obstet Gynaecol*. 2001;15:179-194.
16. Hjartardottir H, Lund SH, Benediktsdottir S, Geirsson RT, Eggebo TM. When does fetal head rotation occur in spontaneous labor at term: results of an ultrasound-based longitudinal study in nulliparous women. *Am J Obstet Gynecol*. 2021;224:514.e1-514.e9.
17. Hjartardottir H, Lund SH, Benediktsdottir S, Geirsson RT, Eggebo TM. Fetal descent in nulliparous women assessed by ultrasound: a longitudinal study. *Am J Obstet Gynecol*. 2021;224:378.e1-378.e15.
18. Akmal S, Tsoi E, Howard R, Osei E, Nicolaides KH. Investigation of occiput posterior delivery by intrapartum sonography. *Ultrasound Obstet Gynecol*. 2004;24:425-428.
19. Barbera AF, Pombar X, Perugino G, Lezotte DC, Hobbins JC. A new method to assess fetal head descent in labor with transperineal ultrasound. *Ultrasound Obstet Gynecol*. 2009;33:313-319.
20. Falkert A, Endress E, Weigl M, Seelbach-Gobel B. Three-dimensional ultrasound of the pelvic floor 2 days after first delivery: influence of constitutional and obstetric factors. *Ultrasound Obstet Gynecol*. 2010;35:583-588.
21. Tutschek B, Torkildsen EA, Eggebo TM. Comparison between ultrasound parameters and clinical examination to assess fetal head station in labor. *Ultrasound Obstet Gynecol*. 2013;41:425-429.

22. Kimmich N, Birri J, Zimmermann R, Kreft M. Association between the side of levator Ani muscle trauma and fetal position at birth - a prospective observational study. *Z Geburtshilfe Neonatol*. 2021;225:134-139.
23. Dietz HP, Bhalla R, Chantarasorn V, Shek KL. Avulsion of the puborectalis muscle is associated with asymmetry of the levator hiatus. *Ultrasound Obstet Gynecol*. 2011;37:723-726.
24. Greenbaum H, Klein L, Alcalay M, Kassif E, Weisz B, Eisenberg VH. The optimal cutoff value for levator-urethra gap measurements using tomographic ultrasound imaging in avulsion diagnosis is population specific. *Neurourol Urodyn*. 2020;39:1401-1409.
25. Chan SS, Cheung RY, Yiu AK, et al. Prevalence of levator ani muscle injury in Chinese women after first delivery. *Ultrasound Obstet Gynecol*. 2012;39:704-709.
26. Cassado Garriga J, Pessarrodona Isern A, Espuna Pons M, et al. Four-dimensional sonographic evaluation of avulsion of the levator ani according to delivery mode. *Ultrasound Obstet Gynecol*. 2011;38:701-706.
27. Martelli F, Youssef A, Capogna MV, et al. Longitudinal changes of subpubic arch angle throughout pregnancy. *Gynecol Obstet Invest*. 2020;85:100-106.

How to cite this article: Eggebø TM, Benediktsdottir S, Hjartardottir H, Salvesen KÅ, Volløyhaug I. Ultrasound examination of the pelvic floor during active labor: A longitudinal cohort study. *Acta Obstet Gynecol Scand*. 2023;102:1203-1209. doi:10.1111/aogs.14620