Factors that influence the development of avulsion of the levator ani muscle in eutocic deliveries. 3-4D transperineal ultrasound study.

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Abstract

Introduction

Levator ani muscle (LAM) lesions are the most frequent injuries of the pelvic floor during delivery. 10-36% of women report this lesion during their first delivery. Many risk factors have been proposed but very few evaluate the aspects that can influence during natural vaginal delivery.

Method

A prospective observational trial was conducted involving 74 primiparous women following vaginal delivery. Maternal, fetal and obstetric characteristics were analyzed. A transperineal three or four-dimensional (3D-4D) ultrasound was offered six months after delivery in order to evaluate avulsions and anomalies of the hiatus.

Results

74 women were included, 3 of them did not show up for ultrasound evaluation. 62 (87,3%) demonstrated no avulsion in comparison with 9 (12,7%) who did. 5 of these lesions were unilateral and 4 bilateral. Mean newborn weight was 3193gr in the "no avulsion group" versus 3470gr in the "avulsion" group (p=0,025).

Discussion

According to the results, the most important riskfactor established, for avulsion during natural childbirth, was the newborn weight. This contrasts with many other authors who have established that birth weight has no impact on these lesions.

Conclusions

The most important factor intervening in the avulsion of LAM during natural vaginal delivery is the newborn weight. Patients with diagnosed avulsions present an enlarged urogenital hiatus during valsalva and maximal contraction.

Key words: Eutocic delivery, avulsion, childbirth, levator ani muscle.

Introduction

Vaginal delivery is an important factor related to lesions, muscular or ligamentous, in the pelvic floor. These lesions could contribute in the development of urinary incontinence and pelvic organ prolapse[1]. LAM's avulsion is the most frequent muscular injury found after vaginal delivery. Avulsion is defined as a discontinuity between puborectalis muscle and the inferior pubic rami as consequence of its maximum stretch during the 2nd stage of labor[2, 3].
Currently, the diagnosis of LAM avulsion is based on 3D/4D ultrasound assessment or MRI[2, 4, 5].

It has been established that 10-36% of primiparous women will present LAM trauma during delivery[6, 7]. Multiple risk factors have been related[8]. The objective of this study is to assess the most relevant risk factors related to LAM lesions in natural vaginal delivery.

Method

A prospective observational study was conducted involving 74 primiparous women with natural vaginal delivery at term (37-42 gestational weeks) between October 2013 and January 2014 at Hospital Universitario Virgen de Valme – Seville.

None of the patients had history of pelvic floor surgical interventions. The totally of deliveries initiated spontaneously, terminated in vaginal natural delivery and were conducted by proven experienced midwives. All women who request analgesia were provided with epidural anesthesia (6ml 0,2% ropivacaine bolus and 0,125% ropivacaine plus fentanyl 1mcg/ml for maintenance at 12ml/h). The delivery was assisted in a dorsal lithotomy position. Episiotomy was used in a restrictive fashion when maximum perineum distention was reached. All the patients included were required to sign an informed consent. Pregnancies with maternal-fetal pathology were excluded.

The obstetric parameters included were: maternal age, gestational age at delivery, body mass index, weight gain during pregnancy, type of analgesia, time for epidural anesthesia, length of second stage of labor, perineum tears, episiotomy, fetal head circumference and fetal weight.

Ultrasound study was achieved 6 months post delivery using a Toshiba Aplio 500® (Toshiba Medical Systems Corp., Tokyo, Japan) with 3D abdominal PVT-675MV (90º angle). An experienced explorer, who had no knowledge of the deliveries characteristics, performed the ultrasound evaluation. Images were obtained while in dorsal lithotomy and empty bladder[9,10]. Ultrasound analysis assessed the pelvic floor at rest, during valsalva and at maximal contraction.

Avulsion injury was defined as the abnormal insertion of LAM, which was identified using a minimal dimension axial plane (MDP) with double 2,5mm slice interval above[11] (image 1). The urogenital hiatus area was calculated according to MDP during rest, valsalva and maximal pelvic floor contraction[12].

Quantitative variables were resumed evaluating means, standard deviations and qualitative variables with percentages. T student and U Mann-Whitney test (Shapiro-Wilk test) were used to evaluate independent samples and samples with asymmetrical distribution respectively.
Qualitative variables were evaluated by contingency tables, Chi-square test and not asymptotic methods as Monte Carlo and Exact test. Statistical analysis was performed using IBM SPSS 22 program.

Results

74 women were studied. 3 were excluded because of absenteeism to ultrasound evaluation. 62 cases (87,3%) did not show avulsion. 9 cases (12,7%) revealed avulsion, 5 of these were unilateral and 4 bilateral.

Table 1 demonstrates the different obstetric parameters evaluated according to the presence or not of avulsion. No significant differences were found between groups.
Table 2 collects data related to the studied patients. Neonatal weight was the only parameter that demonstrated statistically significant difference comparing deliveries with or without avulsion. Mean newborn weight was 3193gr in the no avulsion group in contrast to 3470gr found in the avulsion group. Our data shows that cases with avulsion presented an enlarged 2^{nd} stage of labor (>110 minutes), although, no significant differences have been able to establish this as a risk factor for pubovisceral muscle lesions.
Table 3 contrasts "avulsion group" versus "no avulsion group" according to the urogenital hiatus area. The avulsion group showed an increased urogenital hiatus area and antero-posterior and latero-lateral distance compared to the no avulsion group. Such differences emphasize during valsalva or maximal pelvic floor contraction.

Discussion

Avulsion of the levator ani muscle entails several future dysfunctions of the pelvic floor in women. [1, 13, 14] Nowadays, no screening method has been proved to predict these lesions.[15] Knowledge of the associated risk factors could help to prevent LAM injury. Forceps delivery is the most important risk factor related to avulsion. Using transperineal ultrasound, injuries have been demonstrated in 35-64% of these cases[8,16, 17, 18, 19].
Among other risk factors, there is evidence that an enlarged second stage of labor over 110 minutes associates an OR of 2,27 for LAM injuries[8, 17,20]. Fetal head circumference appears to be an independent risk factor.[8, 14] Circumferences over 35,5cm reveals OR of 3,34 for LAM avulsions[8]. Nevertheless, other authors have not proved such association[21]. According to our results, this relationship have not been proven either.
Although several risk factors for avulsion have been described, protective factors, as epidural anesthesia, have also been proposed[17]. This last association has not been proven by our results either[14].
Other factors, such as maternal age and body mass index (BMI), have been proposed to be associated with LAM injuries although there is not enough evidence to confirm this. Several authors have established that advanced maternal age is associated with an increased risk of LAM injuries during their first vaginal delivery[21, 24]. Other authors have not proved such relationship[13, 15, 20]. In contrast, it has been proposed that women with low BMI are less exposed to LAM injuries, although this has not been proven[8]. Our results were not able to demonstrate these associations.
According to this trial, the most important risk factor associated with avulsions, during vaginal delivery, is estimated fetal weight[14]. This fact does not agree with other authors who reject this relationship[13, 17, 25, 26].

Pubovisceral muscle injuries showed an increased urogenital hiatus area at rest, valsalva and maximal contraction. The increased area of the hiatus has been described previously and has demonstrated an envidence level II[14, 19,26-28].
Finally, this trial determines that the most important factor associated with LAM injuries during vaginal delivery is the estimated fetal weight and, in case of avulsion, hiatus area is increased at rest, valsalva and maximal contraction.

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Table 1. Obstetric data.

	Mean (± TD) o %		**P**
	No Avulsion (n=62)	**Avulsion (n=9)**	
Maternal mean age	28.15 (±5.56)	28.33 (±5.52)	**NS**
Gestational age	39.24 (±1.04)	38.44 (±1.51)	**NS**
BMI	23.27 (±3.26)	23.58 (±3.81)	NS
Weight gain during pregnancy	11.95 (±4.68)	12.83 (±4.54)	NS

Induced labor	10 (16.1%)	0 (0%)	NS

No statistical significance (NS). Statistical significance (*)

Table 2. Data related to delivery according to Avulsion.

	Mean (±TD) o %		**p**
	Without Avulsion (n=62)	**Avulsion (n=9)**	
Epidural analgesia	54 (87.1%)	6 (66.7%)	NS
Time of epidural anesthesia (minutes)	341.74 (±153.97)	435.83 (±199.58)	NS
Length 2nd stage of labor (minutes)	92.18 (±65.39)	121.67 (±64.66)	NS
Episiotomy	23 (37.1%)	3 (33.3%)	NS
Perineal tears (PT)	30 (48.4%)	7 (77.8%)	NS
PT I grade	14 (46.7%)	3 (42.9%)	NS
PT II grade	13 (43.3%)	3 (42.9%)	NS
PT III grade	3 (10%)	1 (14.3%)	NS
Head Circumference (cm)	34.29(±1.31)	34.33(±1.03)	NS
Neonatal weight (g)	3193.47 (±343.62)	3470.56 (±289.82)	0.025*

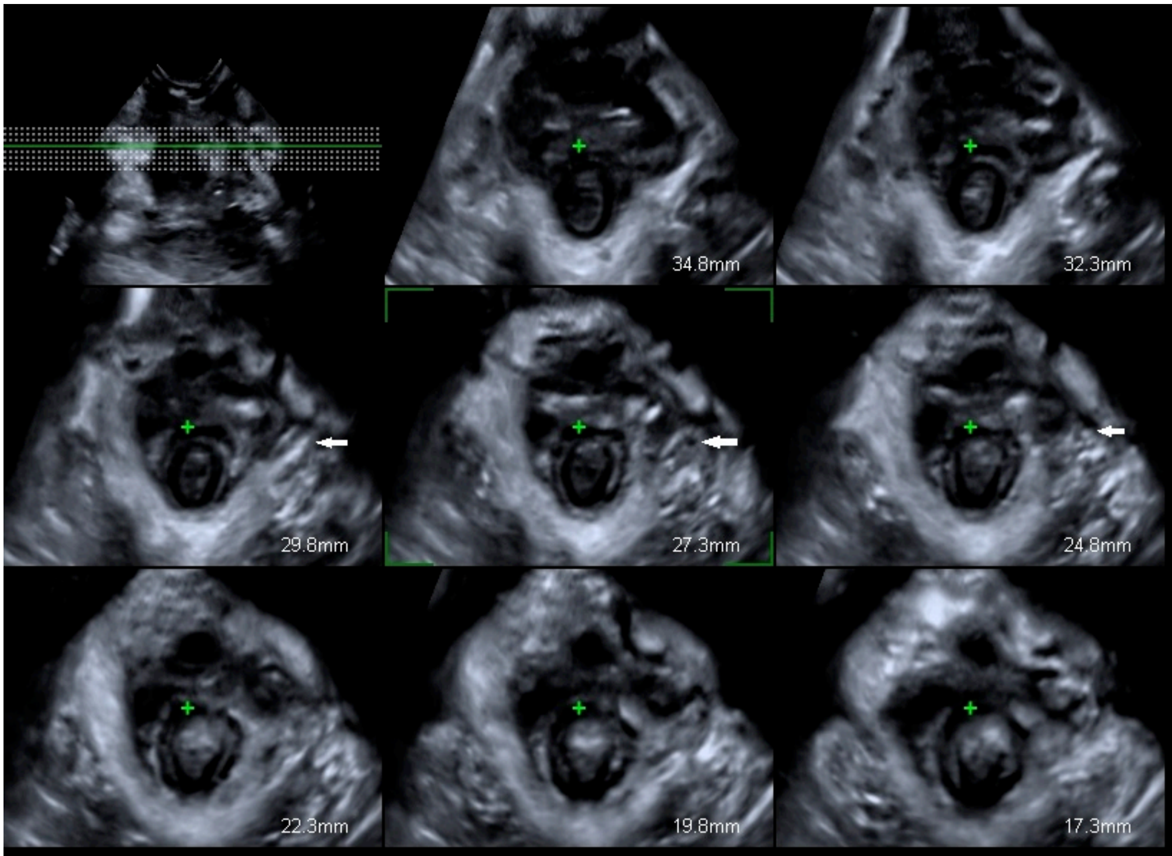
No statistical significance (NS). Statistical significance (*)

Table 3. Urogenital hiatus area according to avulsion.

	Mean (±TD)		**p**
	Without Avulsion (n=62)	**Avulsion (n=9)**	
Urogenital hiatus area (cm^2)			
Rest	16.24 (±2.93)	18.23 (±4.24)	NS
Valsalva	18.51 (±3.94)	23.16 (±5.24)	0.002*
Maximum contraction	15.47 (±3.08)	19.05 (±4.62)	0.003*

No statistical significance (NS). Statistical significance (*)

Image 1: LAM injuries identified in the three central slices of multislice ultrasound study.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