Prevalence of Diastasis m. Rectus Abdominis and Pelvic Floor Muscle Dysfunction in Postpartum Women

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Abstract:

Objective: The aim of this study was to determine the prevalence of Diastasis of the rectus abdominis muscles (DRAM) and pelvic floor muscle dysfunction (PFMD) in postpartum women.
Design: The observational prospective study.
Participants: 150 of 180 women (83.3%) from 6 weeks to 6 months postpartum, with a mean age of 33.1 years.
Methods: For diastasis examination, inter recti distance (IRD) was measured by a linear 2D ultrasound probe, 4.5 cm above the navel, in its area and 4.5 cm below the navel when lying on the back at rest and under a load test. The degree of DRAM was classified into four grades. Urinary leakage symptoms were assessed by the International Incontinence Consultation Questionnaire (ICIQ - UI SF).

Results: The first degree of diastasis during the load test was 38.1% above the navel, 36.4% in the navel area, and 23.7% below the navel. The second degree of diastasis with load was 28.8% above the navel, 21.2% in the navel area, and 10.2% below the navel. PFMD showed 31.3% of women with mild symptoms of SUI, 32.2% of women with grade 1 cystocele.
Discussion: The average IRD distance at rest and during the load test confirmed the first grade of DRAM out of four degrees of severity. Moderate and medium DRAM occurred according to location in an average of one-third of the cases. The highest percentage of DRAM was above the navel, and the lowest percentage below the navel. PFMD was detected in an average of one-third of cases.

Introduction

Diastasis of the rectus abdominis muscles (DRAM) is defined as the increased separation of the medial edges of the two rectus muscles due to the stretching and laxity of the linea alba. It can be located along the entire length of the linea alba. [1] Diastasis often occurs during pregnancy and after childbirth. As the foetus grows, the mother's straight abdominal muscle stretches along the abdominal wall. The linea alba softens, which allows the abdomen m. rectus abdominis to move away from the midline. [2] At 12 months postpartum, 33% of women have recti abdominis diastasis greater than the width of two fingers. DRAM can be examined with a 2D ultrasound, calliper or centimetre scale. [3]

DRAM is an aesthetic but functional problem. It contributes to pain in the lower back and affects the stability of the torso. [4] The deep core stability exercise programme is effective in treating diastasis recti. [5-7] The 3 most frequently used interventions are strengthening exercises in the m. transversus abdominis (TrA), pelvic floor muscle training (PFMT), and the "Noble technique," which involves manipulation of the rectus muscle bellies, while the patient performs a partial sit-up. [8] Walton [9] used the supine strengthening programme and dynamic core stabilisation programme, including the addition of plank exercise to approximate the DRAM. Both programmes showed a significant reduction in DRAM.

Pregnancy and childbirth cause an excessive load on the muscles of the pelvis, pelvic floor and abdominal muscles. During vaginal delivery, the pelvic floor muscles stretch up to 3 times. Regeneration of muscles and nerves and connective tissue takes approximately 6 months. During birth, injuries to the perineum may occur, which can lead to stress urinary incontinence, overactive bladder with urgency urinary incontinence, anorectal dysfunction, or even postpartum prolapses often occur pelvic organ prolapse and reduced quality of life. [10-13]

At present, there are not enough studies to evaluate the prevalence of diastasis based on objective measurement by ultrasound (USG) and pelvic floor muscle dysfunction in postpartum women. [14-15]

Methods

Study design

The observational prospective study was carried out in the period from April 8, 2021, to April 29, 2022. All included probands signed an informed consent form. The research was approved by the local ethics committee (4168/2021/ODDZ-11065). The aim of this study was to investigate the prevalence of DRAM and pelvic floor muscle dysfunction (PFMD) in postpartum women.

Study Setting and Participants

Six weeks after childbirth, the patients were contacted by phone and invited for gynaecological and DRAM examinations in the gynaecological outpatient clinic. A complete postpartum history and information on pelvic floor muscle dysfunction were recorded. Diastasis was examined at rest and under a load test using a 2D USG.

Sample size calculation

We used an estimate based on a sample selection of proband numbers based on a test power of 0.80 and an alpha of 0.05 (type I error).

There were 180 births in the observed period, and the expected prevalence of diastasis was 30%; therefore, we needed at least 116 women to participate in the study.

All 180 women were contacted. Thirty women refused to participate in the study, so 150 women were enrolled. The final group consisted of 118 women. Thirty-two women were eliminated, so the loss was 21.3%. Two were excluded for obesity, 5 were not examined because of menstruation, 10 were excluded for ongoing postpartum physiotherapy, and 15 women did not show up for examination. (Figure1) Figure 1 Study Development Chart.

Inclusion criteria

Women from six weeks to up to 6 months after birth and over 18 years old were included.

Exclusion criteria

The following comprise the exclusion criteria: psychiatric illness, postpartum depression, non-cooperation, neurological disease conditions after a stroke, a history of brain injury, significant visual and hearing damage confirmed by neurological examination, serious internal, orthopaedic or oncological diseases, and disagreement with inclusion in the study.

Data Collection

Outcome measures
Objective examination of DRAM

For DRAM examination, inter-rectus distance (IRD) was measured by a linear probe 2D USG. Localisation was measured as follows: 4.5 cm above the navel, in the navel area and 4.5 cm below the navel. Diastasis was evaluated at rest and during the load test by lifting the lower limbs. We evaluated the severity of DRAM as follows: 1st degree = moderate, IRD width (2.1–3 cm), 2nd degree = medium, IRD width (3.1–5 cm, 3rd degree = severe, IRD width (5–7 cm), and 4th degree = very severe (7–9 cm). [16-18] The device used for the examination was a GE Voluson S6.

Examination of urogenital prolapse and avulsion injury

During the Valsalva manoeuvre, we evaluated the presence of pelvic floor defects (descensus/prolapse of pelvic organs, cystocele, rectocele/enterocele) and their degree. We diagnosed the avulsion injury using 3D/4D USG TUI software with GE Voluson S6.

The staging for pelvic organ prolapse (POPQ) was as follows: Stage 0—No prolapse; Stage I—Most distal portion of the prolapse is more than 1 cm above the level of the hymen; Stage II—The most distal portion of the prolapse is between 1 cm above the hymen and 1 cm below the hymen. Stage III: The most distal portion of the prolapse is more than 1 cm beyond the plane of the hymen but everted at least 2 cm less than the total vaginal length; and Stage IV—Complete eversion or eversion at least within 2 cm of the total length of the lower genital tract .[19]

According to severity, we distinguished 3 degrees of cystocele. Grade 1 (mild) is defined as a slight descent of the bladder into the vagina, during which the patient usually does not experience any difficulties. Cystocele of the second degree (the bladder reaches the introit of the vagina) and of the third degree, in which the bladder exits the vagina. [19]

A rectocele is defined as a herniation of the rectum through the rectovaginal septum into the vaginal lumen. According to the severity of the anatomical changes, three degrees of rectocele were distinguished: I—a protrusion is defined as a small formation in the rectal wall and is detected only during a digital examination; II—the rectocele reaches the threshold of the vagina; and III—the rectocele extends outside the vagina. [19]

We can identify a levator avulsion injury using USG TUI imaging in the axial plane as an evident discontinuity between the pubovisceral muscle and the pelvic wall and quantify the cranioventral and ventrodorsal extent of the damage. [19]

Urine incontinence symptoms

The International Consultation on Incontinence Questionnaire (ICIQ-UI SF) was used. It monitors the frequency and amount of urine leaked in the first two questions. The third question looks at how much urine leakage affects patients' daily lives. The ICIQ – UI SF score is the sum of the questions (0—no leakage, 21—very severe urine leakage). [20]

Data Analysis

Descriptive and inferential statistics were used for the data analysis. The degrees of di-

astasis were evaluated as percentages. Data are presented as mean and standard deviation (SD). The data had a normal distribution; p-values were obtained using a t-test. A significant value was considered $p < 0.05$. The calculations were performed using IBM SPSS Statistics for Macintosh version 28.0 Armonk, NY: IBM Corp.

Results

Table 1 Demography

The average age of the women was 33.1 years. BMI confirmed normal weight. The average child's weight was 3617.2 g. The mean ICIQ - UI SF core was 2.6, indicating mild UI symptoms. (Table1)

Table 2 Number and type of births

The types and numbers of births are described in Table 2. The highest percentage of patients had 1 birth, while the lowest had 5 births. The highest percentage of patients had 1 spontaneous birth, and the lowest had 5 spontaneous births.

One elective caesarean section had the highest percentage of patients (26.3%), and 3 elective caesarean sections had the smallest percentage (1.7%). Of the patients, 21.2% had 1 acute caesarean section, and 1.7% had 2 elective caesarean sections. Twins and Triplets: 1.7% women 3.4% women had twins, and 0.8% women had triplets. (Table 2)

Table 3 Problematic situations during childbirth and PFMD

Vacuum extraction was performed on 0.8% of the women, and forceps were used on 8.5% of women with epidural analgesia. Of the women, 19.5% had Kristeller´s expression, 24.6% had episiotomy and 7.6% had perineal injuries.

The following pelvic floor muscle dysfunctions were detected in our group: 31.3% of the women had mild UI symptoms and 16.1% had dyspareunia. Of the women, 32.2% had grade 1 cystocele, 22.0% had grade 1 rectocele and 8.5% had mild avulsion. (Table 3)

Table 4 DRAM at rest

At rest, the average IRD distance confirmed grade 1 DRAM.

The highest percentage of DRAM (70.3%) was above the navel, 44.9% in its area and 16.9% below the navel. The 1st and 2nd degrees occurred most above the navel and least below the navel. Grade 3 occurred most frequently in the navel area. (Table 4)

Table 5 DRAM during load test (lifting the lower limbs).

During the load test, the average IRD distance confirmed grade 1 DRAM.

The highest percentage of DRAM (68.6%) was above the navel, 60.1% in its area and 33.9% below the navel. The 1st and 2nd degrees occurred most above the navel and least below the navel. Grade 3 occurred most frequently in the navel area. (Table 5)

Discussion

The aim of the study was to determine the prevalence of DRAM and PFMD in postpartum women.

We determined the prevalence of diastasis according to severity (1st–4th degree) and location (above the navel, in the navel area and below the navel). The latest classifications for diastasis assessment were used (12-14). We also noticed a minimal increase in the IRD distance. The average IRD at rest and during the load test distance confirmed grade 1 DRAM. The average IRD at rest was 2.69 cm above the navel, 2.21 cm in the navel area and 1.28 cm below the navel, showing an average of the first degree of diastasis severity. A slight increase in diastasis was observed during the load test. The highest percentage of DRAM was above the navel, a lower percentage in its area, and the lowest percentage was below the navel. Grade 1 and 2 DRAM occurred most above the navel and least below the navel. Grade 3 DRAM occurred most frequently in the navel area. PFMD was detected in an average of one-third of cases. The following pelvic floor muscle dysfunctions were detected in our group: 31.3% of women had mild symptoms of UI; 16.1% had dyspareunia; 32.2% had grade 1 cystocele; 22.0% had grade 1 rectocele; and 8.5% had mild avulsion.

Bo et al. [21] evaluated the function, PFMD and DRAM in a prospective cohort study of 300 pregnant nulliparas. The evaluation methods included pelvic floor muscle strength and endurance, assessed by a perineometer. Prolapse was assessed using palpation and the POP-Q questionnaire.

The ICIQ UI SF was used to assess the symptoms of incontinence. A group of women with and without DRAM was compared at 21 weeks of gestation and 6 weeks postpartum, followed by 6 and 12 months postpartum. Women with DRA did not have weaker pelvic floor muscles or more SUI or POP compared to women without diastasis. In our group, only minimal UI symptoms and urogenital prolapses were detected.

He [22] examined abdominal wall muscle elastography, including straight abdominal muscle (RA), external oblique muscle (EO), internal oblique muscle, and transverse abdominis muscle (TrA), in 36 patients with DRAM postpartum and 24 healthy nulliparas. He measured IRD distance via USG, muscle thickness and shear wave speed (SWS) from 10 locations. The maximum diameter of m. recti abdominis detachment was located in the navel (4.59 ± 1.14 cm) in patients with DRA. The SWS value was significantly lower in the RA group and higher in the TrA muscle in patients with DRA compared to the control group. However, SWS in both muscles (RA and TrA) showed a significant correlation with IRD. The application of SWE to the abdominal wall muscles in patients with DRA is possible. We evaluated diastasis only by USG above the navel, in its area and below the navel. However, it would be appropriate to supplement the above measurements.

Strengths and limitations, recommendations for further research

The strengths of the study are the objective measurement of DRAM using 2D ultrasound and the use of standardised measuring tools, including ICIQ-UI SF. A limitation of this study was the small sample size, as it was not a multicentre study. For further research, we recomend the use of abdominal wall muscle elastography for DRAM assessment. For clinical practice, this study implie that healthcare professionals should inform the patients with DRAM to complete an exercise program for DRAM reduction in collaboration with a physiotherapist.

Conclusion

The average IRD at rest and during the load test confirmed grade 1 DRAM out of 4 degrees of severity. Moderate and medium DRAM occurred according to location in an average of one-third of cases. The highest percentage of DRAM was above the navel, with a lower percentage in its area and the lowest percentage below the navel. PFMD was detected in an average of one-third of cases. We found minimal symptoms of UI, as well as 1 asymptomatic stage of cystocele, rectocele and mild avulsion.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Figure 1 Enrolment flow diagram

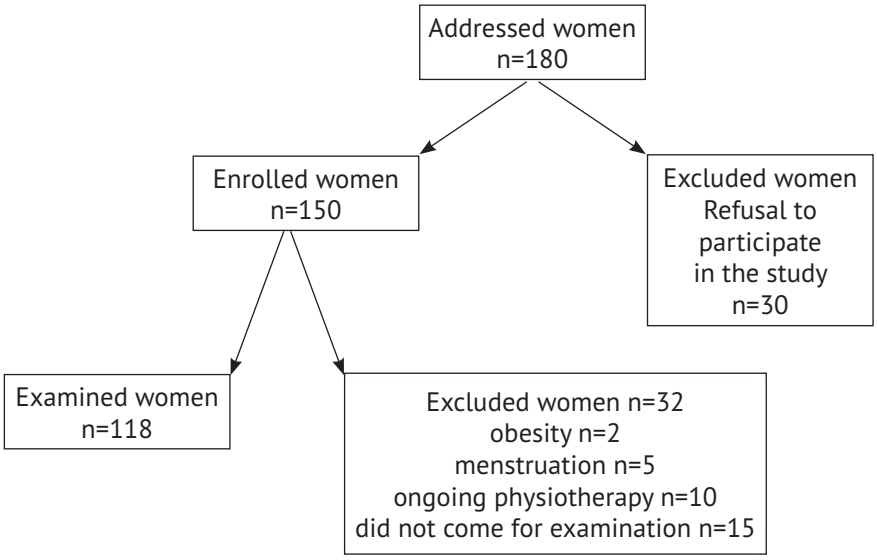

Table 1 Demography

N=118	Mean	SD
Age	33.1	1.5
Weight	67.3	14.4
Height	1.6	0.0
BMI	23.9	4.5
Child's weight	3617.2	580.3
ICIQ UI SF	2.6	4.4
OAB Life quality	95.5	9.3

Table 3 Problematic situations during childbirth and PFMD

%	No	Yes
Vaccum extractor	99.2	0.8
forceps	98.3	1.7
epidural analgesia	91.5	8.5
Kristeller´s expression	80.5	19.5
episiotomy	75.4	24.6
perineal injuries	92.4	7.6
SUI symptoms	68.7	31.3
Dyspareunia	83.9	16.1
cystocele	67.8	32.2
Retrocele/enterocele	77.1	22.0
Avulzion	91.5	8.5

Table 2 Number and type of births

%	0	1	2	3	4	5
Number of births	0	40.7	34.7	16.1	5.9	2.5
Spontaneous childbirth	30.5	33.9	22.0	9.3	2.5	1.7
Cesarean section elective	66.1	26.3	5.9	1.7		
Caesarean section acute	77.1	21.2	1.7			
Twins	96.6	3.4				
Triplets	99.2	0.8				

Table 4 DRAM at rest

DRAM	IRD 4.5 cm above the navel		IRD in the navel area		IRD 4.5 cm below the navel	
Mean	2.6		2.2		1.2	
SD	1.0		1.2		0.7	
Percentile 25	1.9		1.3		0.7	
Percentile 50	2.6		1.9		1.0	
Percentile 75	3.3		3.0		1.2	
Occurrence in numbers / %						
Without DRAM	35	29.7%	65	55.1%	98	83.1%
With DRAM	83	70.3%	53	44.9%	20	16.9%
Severity of DRAM						
0	35	29.7%	65	55.1%	98	83.1%
1. degree (2,1-3cm)	42	35.6%	26	22.0%	17	14.4%
2. degree (3,1-5cm)	39	33.1%	23	19.5%	2	1.7%
3. degree (5-7 cm)	2	1.7%	4	3.4%	1	0.8%

Table 5 DRAM during load test (lifting the lower limbs)

DRAM	IRD 4.5 cm above the navel		IRD in the navel area		IRD 4.5 cm below the navel	
Mean	2.6		2.6		1.7	
SD	0.9		2.5		0.9	
Percentile 25	1.9		1.6		0.9	
Percentile 50	2.5		2.3		1.5	
Percentile 75	3.2		3.0		2.5	
Occurrence in numbers / %						
Without DRAM	37	31.4%	47	39.8%	78	66.1%
With DRAM	81	68.6%	71	60.1%	40	33.9%
Severity of DRAM						
0	37	31.4%	47	39.8%	78	66.1%
1. degree (2,1-3cm)	45	38.1%	43	36.4%	28	23.7%
2. degree (3,1-5cm)	34	28.8%	25	21.2%	12	10.2%
3. degree (5-7 cm)	2	1.7%	3	2.5%		