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Correlation between pelvic floor dysfunction on dynamic 3D ultrasound and vaginal delivery, parity, and age in women with obstructed defecation symptoms

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ABSTRACT – **Background** – Few studies have investigated the constipation or obstructed defecation symptoms identified by using imaging, as dynamic three-dimensional ultrasound and correlate vaginal delivery, parity, and age. **Objective** –The aim of this study was to assess the prevalence of pelvic floor dysfunctions in female patients with obstructed defection symptoms and to determine whether specific pelvic floor dysfunctions identified by dynamic three-dimensional ultrasonography (echodefecography) are correlated with vaginal delivery, parity, and age. The secondary goal is to report the prevalence of coexisting pelvic floor dysfunctions. **Methods** – This is a retrospective cohort study including patients with obstructed defecation symptoms underwent echodefecographyto evaluate pelvic floor dysfunctions in the posterior compartment and correlate with vaginal delivery, parity, and age. **Results** – Of 889 female: 552 (62%) had had vaginal delivery and 337 (38%) were nulliparous. The prevalence of dysfunctions identified by echodefecography (rectocele, intussusception, enterocele/sigmoidocele, and dyssynergia) was similar between the two groups and was not associated with number of deliveriesor age. However, the prevalence of sphincter defects showed higher rates in women with vaginal delivery and increased with the parity. Up to 33% of patients had coexisting dysfunctions. **Conclusion** – The prevalence of dysfunctions such as rectocele, intussusception, dyssynergia, and enterocele/sigmoidocele assessed by echodefecography in patients with obstructed defecation symptoms are found similar regardless of vaginal delivery, number of deliveries or stratified-age. In vaginal delivery, number of deliveries does impact on detection of sphincter defects and liability to fecal incontinence.

Keywords – Pelvic floor; intestinal constipation; obstructed defecation; vaginal delivery; dynamic 3D ultrasound.

INTRODUCTION

Pelvic floor dysfunction in women results in multiple clinical symptoms, depending on the compartment involved; for example, anterior compartment dysfunction is related to urinary incontinence and overactive bladder, apical compartment dysfunction is related to pelvic organ prolapse and sexual dysfunctions, and posterior compartment dysfunction is related to defecatory symptoms (fecal incontinence or constipation/obstructed defecation symptoms (ODS))[1-5].

Although several studies have found that pelvic floor dysfunction was correlated with mode of delivery in childbirth, parity, and age[6-8], numerous contrary and inconsistent results have also been reported[3,9-13]. Difference among study results may be due to heterogeneous populations studied, survey methods applied, definitions, and reference time, as well as the multifactorial nature of pelvic floor dysfunction[3-5].

Vaginal birth is the most frequent ethiologic factor of sphincter defects and associated fecal incontinence[14-17]. In addition, multifactorial risk factors, including age, body index mass, previous anal or colorectal surgery, radiation exposure and neurological conditions contribute to the development of fecal incontinence[18,19]. Furthermore, women with delayed onset incontinence symptoms can be associated with an occult sphincter defect[20]. Few studies have investigated the constipation or obstructed defecation symptoms due to specific pelvic floor dysfunction identified by using dynamic imaging in relation to vaginal delivery, parity, and age to determine associate dysfunctions. Thus, we aimed to assess the prevalence of pelvic floor dysfunctions in female patients with obstructed defection symptoms and to determine whether specific pelvic floor dysfunctions identified by dynamic three-dimensional (3D) ultrasonography (echodefecography) are correlated with vaginal delivery, parity, and age. The secondary goal is to report the prevalence of coexisting pelvic floor dysfunctions.

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METHODS

This is a retrospective cohort study from January 2011 through August 2019 and was conducted at the colorectal unit of the tertiary hospital. This clinical study was approved by the Research Ethics Committee of the University Hospital. We collected data on a group of consecutive female patients with obstructed defecation symptoms, like excessive straining at defecation, unsuccessful attempts to evacuate, incomplete evacuation and digitations despite of increasing dietary fiber concentration (approximately 20 g/day during 2 months), and who had a persistent score greater than 6 on the Cleveland Clinic Florida (CCF) Constipation Scale[21] underwent echodefecography to assess pelvic floor dysfunction in the posterior compartment and identify rectocele, intussusception, dyssynergia, enterocele/sigmoidocele and sphincter defects. Patients were excluded if they had undergone cesarian section or had slow-transit constipation diagnosed by colonic transit radiopaque markers, or organic colorectal diseases identified by clinical examination or colonoscopy.

Patient data from a prospective database were reviewed.

3D dynamic anorectal ultrasonography (echodefecography)

Each patient underwent echodefecography performed by a single colorectal surgeon with experience in evaluating pelvic floor anatomy and dynamic imaging methods. The technique was performed by a 3D ultrasound device (Pro-Focus, endoprobe model 2052, B-K Medical, Herlev, Denmark) placed in the rectum, with proximal-to-distal 6.0-cm automatic scans. By moving two crystals on the extremity of the transducer, axial and longitudinal images were merged into a single cube image, recorded, and analyzed in multiple planes[22]. Patients received a rectal enema 2 hours before and were examined in the left lateral position. Images were acquired by three automatic scans andeach one lasted 50 seconds.

In the first acquisition, the patient was remained at rest and was assessed the anal canal anatomy and identified the sphincter defects.

In scan 2, the transducer was inserted at 6.0 cm from the anal verge, and the patient followed the sequence for 50 sec: to rest 15 seconds, strain maximally for 20 seconds, and then relax again for 15 sec. The transducer should follow the movement of the puborectal muscle and the external anal sphincter during straining to identify presence of normal relaxation, non-relaxation, or paradoxical contraction (dyssynergia).

In scan three, it was injected 60–120 mL of ultrasonic gel into the rectum and the transducer was positioned at 7.0 cm from the anal verge. The patients followed up the same sequence above in order to identify and quantify dysfunctions associated with evacuation, including rectocele depth (grade I, II, or III), intussusception and sigmoidocele/enterocele (grade II or III).

Study variables

All patients had obstructed defecation symptoms and CCF constipation score greater than six and assessed for the presence of fecal incontinence symptoms (defined as the uncontrolled passage of feces or gas over at least 1 month's duration in an individual of at least 4 years of age who had previously achieved control)[19] and included the CCF incontinence score to determine the severity of symptoms[23].

Women who participated in this study were categorized as nulliparous or having undergone vaginal delivery. The vaginal delivery group were further categorized according to the number of deliveries (1, 2, 3, or ≥4). Age was categorized as 20 to 39 years, 40 to 59 years, and 60 years or older.

The prevalence of each pelvic floor dysfunctions in the posterior compartment, including grade II or III rectocele, intussusception, dyssynergia, enterocele/sigmoidocele, and sphincter defect, as identified by echodefecography was recorded, and associations with vaginal delivery, parity, and age were evaluated as well as was reported the prevalence of coexistingpelvic floor dysfunctions.

Statistical analysis

The primary outcome of our study was the prevalence of posterior pelvic floor dysfunctions (rectocele, intussusception, anismus, enterocele/sigmoidocele, and sphincter defect) in nulliparous women and those with 1, 2, 3, or ≥4 vaginal deliveries and in the age groups 20–39, 40–59 or ≥60 years. The secondary outcomes of our study were the associations between posterior pelvic floor dysfunctions and these variables.

Data were presented as mean ± SD or number of patients and percentage, as appropriate. Group comparisons were made using *t* tests for continuous variables and χ^2 tests for categorical variables. Chi-square for trend tests was used to test the association between the prevalence of posterior pelvic floor dysfunctions (rectocele, intussusception, anismus, enterocele or sigmoidocele, and sphincter defect) and number of deliveries or age category. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were used to describe associations between risk factors and the prevalence of posterior pelvic floor dysfunction (rectocele, intussusception, anismus, enterocele/sigmoidocele and sphincter defect) in bivariate analyses. Comparisons were considered significant if $P<0.05$.

RESULTS

All 1222 female patients who had obstructed defecation symptoms and underwent echodefecography were evaluated. Of these, 333 women who had undergone cesarian section were excluded. A total of 889 women participated in this study (mean age, 55±15.2 years). Of these, 552 (62%) had had at least one vaginal delivery and 337 (38%) were nulliparous. The mean age was statistically significant higher in women with at least 1 vaginal birth (59±12.9 years; range, 20–90 years) than in the nulliparous group (mean age, 49±16.4 years; range, 20–90years). Nulliparous women had undergone a significantly greater number of previous anorectal surgical procedures (7%, 24/337) than the vaginal delivery group (3%, 16/552), $P=0.043$.

No difference was found in the proportion of women with fecal incontinence symptoms between the nulliparous group (7.4%, 25/337; 17 of the 25 women with fecal incontinence in this group had no defect) and those who had at least one vaginal delivery (6%,33/552; 11 of the 33 women with fecal incontinence in this group had no defect) $P=0.40$. The overall median score on the fecal incontinence scale was 3 (range, 2–5).The frequency of fecal incontinence symptoms increased with age in both groups (TABLE 1).

The most prevalent pelvic floor dysfunctions were rectocele and dyssynergia for both nulliparous and those who had vaginal delivery (TABLE 2), as well as for every age group (TABLE 3). Furthermore, it was also identified 20% to 33% of patients with rectocele grade II/III plus dyssynergia; 20% to 29% of rectocele grade II/III plus intussusception, 10% to 22% of rectocele grade II/III plus intussusception without dyssynergia and 1.5% to 16% of rectocele grade II/III plus sphincter defect (TABLE 4).

TABLE 1. Prevalence of fecal incontinence symptoms in relation to age in nulliparous women (N=337) with obstructed defecation syndrome and who had undergone vaginal delivery (N=552).

	Age			*P*
	20–39 y	40–59 y	≥60 y	
	n (%)	n (%)	n (%)	
Nulliparous				
All patients	108 (32.1)	143 (42.4)	86 (25.5)	
Fecal incontinence (yes)	0 (0)	0 (0)	25 (29)	0.001
Vaginal delivery				
All patients	40 (7.2)	245 (44.4)	267 (48.4)	
Fecal incontinence (yes)	0 (0)	11 (4.5)	22 (8)	0.01

The prevalence of dysfunctions in the posterior compartment, including rectocele, intussusception, enterocele/sigmoidocele, and dyssynergia was similar between nulliparous and in those women gave birth vaginally (TABLE 2). Furthermore, higher parity and the increasing age did not increase the prevalence of those dysfunctions in both nulliparous women or in those with vaginal delivery (TABLE 3).

However, women with vaginal delivery had statistically significant sphincter defects than nulliparous (*P*=0.0001). In addition, the proportion of women with sphincter defects increased significantly with age in women with vaginal delivery but not in nulliparous women (*P*=0.002; TABLE 3).

DISCUSSION

In this study, we used dynamic 3D endoanal ultrasonography (echodefecography) to identify pelvic floor dysfunctions.[27] Echo-

TABLE 2. Prevalence of pelvic floor dysfunctions assessed by dynamic 3D ultrasound in relation to parity in women with obstructed defecation syndrome (N=889).

	Nulliparous n (%)	Number of vaginal deliveries				Total n (%)
		1	2	3	≥4	
		n (%)	n (%)	n (%)	n (%)	
All patients	337 (38)	135 (15)	140 (16)	111 (12)	166 (19)	552 (62)
Rectocele grade II/III	169 (50)	77 (57)	90 (64)	58 (52)	87 (52)	312 (56)
Intussusception	105 (31)	41 (30)	53 (38)	44 (40)	69 (41)	207 (37.5)
Dyssynergia	179 (53)	80 (59)	72 (51)	53 (48)	80 (48)	285 (52)
Enterocele/sigmoidocele	16 (5)	7 (5)	6 (4)	6 (5)	9 (5)	28 (5)
Sphincter defect	17 (5)	21 (15)	40 (29)	35 (31)	57 (34)	153 (28)

TABLE 3. Prevalence of pelvic floor dysfunctions assessed by dynamic 3D ultrasound in relation to age in nulliparous women (N=337) with obstructed defecation syndrome and those who had undergone vaginal delivery (N=552).

	Age			*P*
	20–39 y	40–59 y	≥60 y	
	n (%)	n (%)	n (%)	
Nulliparous				
All patients	108 (32.1)	143 (42.4)	86 (25.5)	
Rectocele grade II/III	46 (43)	86 (60)	37 (43)	0.08
Intussusception	30 (28)	32 (34)	29 (34)	0.36
Anismus/non-relaxation	62 (57)	78 (55)	39 (45)	0.16
Enterocele/sigmoidocele	3 (3)	6 (4)	7 (8)	0.08
Sphincter defect	4 (4)	8 (6)	5 (6)	0.48
Vaginal delivery				
All patients	40 (7.2)	245 (44.4)	267 (48.4)	
Rectocele grade II/III	24 (60)	148 (60)	140 (52)	0.08
Intussusception	14 (35)	83 (34)	110 (41)	0.12
Anismus/non-relaxation	21 (53)	136 (56)	128 (48)	0.16
Enterocele/sigmoidocele	3 (8)	7 (3)	18 (7)	0.27
Sphincter defect	4 (10)	62 (25)	87 (33)	0.002

TABLE 4. Prevalence of concurrente pelvic floor dysfunctions assessed by dynamic 3D ultrasound in relation to parity in women with obstructed defecation syndrome (N=889).

	Nulliparous n (%)	Number of vaginal deliveries				Total n (%)
		1	2	3	≥4	
		n (%)	n (%)	n (%)	n (%)	
All patients	337 (38)	135 (15)	140 (16)	111 (12)	166 (19)	552 (62)
Rectocele grade II/III plus intussusception	68 (20)	35 (26)	41 (29)	30 (27)	45 (27)	151 (27)
Rectocele grade II/III plus dyssynergia	94 (28)	45 (33)	40 (28)	22 (20)	40 (29)	147 (27)
Rectocele grade II/III plus intussusception without dyssynergia	33 (10)	19 (14)	25 (18)	24 (22)	25 (15)	93 (17)
Rectocele grade II/III plus sphincter defect	05 (1.5)	13 (10)	23 (16)	16 (14)	23 (14)	75 (14)

defecography with a 360° rotational transducer with automatic scanning and high frequencies for high-resolution images has the advantage of being able to provide anatomical details of the anal sphincter and identify the defects. It is well tolerated because each acquisition lasts only 55 seconds. This technique was standardized and validated in previous studies in comparison with conventional defecography[22,24]. Using this technique, we examined a representative sample of female adults treated for ODS at a tertiary care center and found prevalence of pelvic floor dysfunctions ranging from 4% to 64%, depending on the specific type of dysfunction identified. Overall, rectocele and anismus were the most prevalent types.

Kepenekci et al.[5] reported a cross-sectional research with a large population distributed with a wide age range, with a questionnaire regarding symptoms. The authors found that age, childbirth and multiple parity increased the risk of both defecatory and urinary symptoms. Therefore, it has been stated that there is not enough evidence for elective cesarean by patient's preference to prevent PFD. Al-Mufti et al.[25] have investigated obstetric consultants to find out the mode of delivery and they found that 17% would choose an elective caesarean delivery, including 31% of female desired elective caesarean section to avoid any pelvic floor damage[25].

Other studies[9-13] did not find evidence that vaginal delivery is responsible for pelvic floor dysfunction. Panelists at a State-of-the-Science Conference sponsored by the National Institutes of Health determined for maternal outcomes related to pelvic floor function, weak-quality evidence did not favor either route of delivery. In our population, which included only women with ODS despite of diet management, the prevalence of dysfunctions such as rectocele, intussusception, anismus, and enterocele/sigmoidocele was similar in nulliparous patients compared with those who had had vaginal delivery, and higher parity did not increase the frequency of such dysfunctions. Thus, the results of our study are consistent with evidence that vaginal delivery, parity, and age do not have deleterious effects in the prevalence of pelvic floor dysfunctions related to ODS.

However, we did find that vaginal delivery was significantly related to sphincter defects, and the prevalence of sphincter defects increased with the number of vaginal deliveries and with age. Several series have found that vaginal delivery is the most frequent cause of direct anal sphincter trauma in women[19,26,17]. Sphincter defects were found in 15 to 34%, depending on the number of vaginal deliveries. We did not collect data concerning whether the delivery was spontaneous, or whether an episiotomy or operative delivery (forceps and vacuum) was performed. In the nulliparous group, the sphincter defect found in 7.4% was due to anorectal surgery with sphincter division. However, the proportion of subjects with fecal incontinence symptoms was low and similar in VD and nulliparous women. Thus, our results support that the nulliparous have the same risk of developing pelvic floor dysfunctions related to defecation as patient who had had vaginal delivery. Nulliparous women are not exposed to the deleterious effects of vaginal delivery on sphincter muscle. However, they are at risk for fecal incontinence after surgery with sphincter division.

Studies using various methods have reported multiple risk factors for fecal incontinence, including diabetes mellitus, diarrhea, irritable bowel syndrome, urinary incontinence, diarrhea, age and inflammatory bowel disease[18,19]. However, the evidence of vaginal delivery as a risk factor remains controversial[4,5]. Additionally, the data are unclear as to the status of episiotomy or operative delivery (forceps and vacuum) as risk factors for fecal incontinence, as well as for an increasing intensity of symptoms[28,29].

Consistent with the literature data[30], the symptoms of fecal incontinence were correlated with age in both groups in our study. Overall, 6% of women had had vaginal delivery and 7% of nulliparous complained of fecal incontinence coexisting ODS and the majority of them had no sphincter defect. These patients deserve a separate algorithm of care and the biofeedback therapy or posterior tibial nerve stimulation may be offered them.

We excluded patients who had undergone caesarian section because we did not have access to information concerning obstetrical history, and all cesarean procedures were performed only if potential obstetrical risk factors, such as any stage of labor or fetal macrosomia, were absent. Additionally, we excluded patients with diagnostic of slow-transit constipation.

An advantage of our study was that we were able to study echodefecography findings in addition to assessing fecal incontinence symptoms in a group of women with persistent ODS symptoms despite clinical management and a score greater than 6 on the CCF Constipation Scale. Anatomic and dynamic defects need to be assessed in addition to symptoms in order to clarify the diagnosis and choose appropriate treatment of functional disorders. In this study, up to 33% of patients had a coexisting diagnosis of grade II/III rectocele plus dyssynergia and the biofeedback therapy should be the first option of treatment. These patients are more likely to benefit of surgery if biofeedback is unsuccessful. Furthermore, a group of patients, up to 22% had rectocele grade II/III plus intussusception without dyssynergia and these should be considered for treatment with a transanal stapled technique or combined tech-

niques. However, 14% of female with previous vaginal delivery had sphincter defect plus rectocele grade II/III and for these patients, a more specific treatment plan should be established to avoid late onset fecal incontinence.

So, we recommend patients should be investigate with image, like 3D ultrasound, to identify the dynamic dysfunctions related to obstructed defecation as well as detect sphincter defect and correlate with symptoms to have an algorithm of treatment according to the coexisting disorders to ensure the best outcome for these patients.

Despite our findings are descriptive and relevant because of the current lack of clarity regarding vaginal delivery, number of parity, stratified-age and increased prevalence of pelvic floor dysfunctions. There are several limitations in the current study that should be considered when analyzing the results, including the lack of obstetrical and delivery information concerning the patients who had undergone vaginal delivery, as well as a lack of information on other risk factors (forceps or vacuum delivery, large neonatal size, posterior cephalic positions and prolonged second stage of labor) that might be related to symptoms as well as to the ultrasound findings. Additionally, we had to rely on self-report data from the patients to obtain information on each individual's delivery, which could have occurred decades ago.

CONCLUSION

This study demonstrates that the prevalence of dysfunctions such as rectocele, intussusception, dyssynergia, and enterocele/sigmoidocele assessed by echodefecography in patients with obstructed defecation symptoms are found similar regardless of the risk factors as vaginal delivery, number of deliveries or stratified-age. Aside from defects resulting from anorectal surgery, vaginal delivery, number of deliveries does impact on detection of sphincter defects and liability to fecal incontinence.

Authors' contribution

Murad-Regadas SM: conception and design. Vilarinho AS, Borges L, Veras LB and Macedo M: acquisition of data. Murad-Regadas SM, Vilarinho AS, Borges L, Veras LB, Macedo M and Lima DMR: analysis and interpretation of data. Murad-Regadas SM and Vilarinho AS: drafting the article. Murad-Regadas SM and Lima DMR: revising it critically for important intellectual content. Murad-Regadas SM, Vilarinho AS, Veras LB, Borges L, Macedo M, and Lima DMR: final approval.

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Murad-Regadas SM, Vilarinho AS, Borges L, Veras LB, Macedo M, Lima DMR. Correlação entre disfunção do assoalho pélvico na ultrassonografia 3D dinâmica e parto vaginal, paridade e idade em mulheres com sintomas de defecação obstruída. Arq Gastroenterol. 2021;58(3):302-7.

RESUMO – **Contexto** – Poucos estudos investigaram pacientes portadoras de defecação obstruída identificados por exames de imagens, como ultrassonografia tridimensional dinâmica, correlacionando parto vaginal, paridade e idade. **Objetivo** – O objetivo deste estudo foi avaliar a prevalência de disfunções do assoalho pélvico em pacientes do sexo feminino com sintomas de defecação obstruída e determinar se disfunções específicas do assoalho pélvico identificadas por ultrassonografia tridimensional dinâmica (ecodefecografia) estão correlacionadas com parto vaginal, paridade e idade. O objetivo secundário é relatar a prevalência de disfunções do assoalho pélvico coexistentes. **Métodos** – Este é um estudo de coorte retrospectivo incluindo pacientes com sintomas de obstrução da defecação submetidas à ecodefecografia para avaliar disfunções do assoalho pélvico no compartimento posterior e correlacionar com parto vaginal, paridade e idade. **Resultados** – De 889 mulheres: 552 (62%) tiveram parto vaginal e 337 (38%) eram nulíparas. A prevalência de disfunções identificadas pela ecodefecografia (retocele, intussuscepção, enterocele/sigmoidocele e dissinergia) foi semelhante entre os dois grupos e não foi associada ao número de partos ou à idade. No entanto, a prevalência de defeitos esfincterianos apresentou taxas mais elevadas em mulheres com parto vaginal e aumentou com a paridade. Até 33% dos pacientes apresentavam disfunções coexistentes. **Conclusão** – A prevalência de disfunções como retocele, intussuscepção, dissinergia e enterocele/sigmoidocele avaliada pela ecodefecografia em pacientes com sintomas de defecação obstruída são semelhantes independentemente do parto normal, número de partos ou idade estratificada. No parto vaginal, o número de partos tem impacto na detecção de defeitos esfincterianos e na possibilidade de incontinência fecal.

Palavras-chave – Assoalho pélvico; constipação intestinal; evacuação obstruída; parto vaginal; ultrassom dinâmico 3D.

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