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ORIGINAL ARTICLE

Correlation of anorectal symptoms and endoanal ultrasound findings after obstetric anal sphincter injuries (OASIS)

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Abstract

Introduction Obstetric anal sphincter injuries (OASIS) predispose to development of anorectal symptoms that affect women's quality of life.

Methods A retrospective cohort study was conducted for all women with singleton vaginal deliveries who had a primary OASIS repair and attended the Postpartum Perineal Clinic between July 1st 2017 and December 31st 2020. This study was approved by the Research Ethics Board. The purpose of this study was (1) to determine correlation between endoanal ultrasound (EAUS) findings and anorectal symptoms quantified by the St. Mark's Incontinence Score (SMIS), (2) to determine the incidence of residual anal sphincter defects, and (3) to determine the rate of clinical overdiagnosis of OASIS. Pearson correlation coefficient was used to assess correlation between anorectal symptoms and EAUS findings.

Results A total of 247 participants with clinical diagnosis of OASIS met the inclusion criteria. A 3rd-degree tear was identified in 126 (51.0%) and 4th-degree tear was identified in 30 (12.1%) participants. In participants with sonographic evidence of OASIS, there was a statistically significant weak positive correlation between the size of residual defect and SMIS for both external anal sphincter (EAS) ($r = .3723$, $p < .0001$) and internal anal sphincter (IAS) ($r = .3122$, $p = .0180$). Residual defect in the anorectal sphincter of greater than 1 hour (> 30°) in width was present in 64.3% participants with 3rd-degree tear and 86.7% participants with 4th-degree tear. The rate of overdiagnosis was 36.8%.

Conclusion The size of residual defect of EAS and IAS has a weak positive correlation with anorectal symptoms, emphasizing the importance of EAUS for counselling regarding mode of subsequent delivery.

Keywords Obstetric anal sphincter injuries · Perineal trauma · Anal incontinence · Fecal incontinence · Anorectal symptoms · Endoanal ultrasound

Abbreviations

EAS	External anal sphincter
EAUS	Endoanal ultrasound
IAS	Internal anal sphincter
OASIS	Obstetric anal sphincter injuries
SMIS	St. Mark's Incontinence Score
SOGC	Society of Obstetricians and Gynecologists of Canada

Introduction

Obstetric anal sphincter injuries (OASIS) are third- and fourth-degree perineal lacerations, which involve partial or complete disruption of the anal sphincter complex and can extend into the anal mucosa [1]. These are severe perineal lacerations that occur in 4.2% of all vaginal deliveries in Canada [2]. OASIS are associated with significant maternal morbidity, and predispose to the development of anorectal symptoms, which include fecal urgency and anal incontinence. Anal incontinence is defined as involuntary loss of flatus or liquid and/or solid feces [3, 4]. Thirty to fifty percent of women with OASIS develop anal incontinence during their lifetime, which may be transient or permanent [5]. Complications of OASIS affect women's well-being and quality of life [5].

Postpartum follow-up is the standard of care for all women with OASIS, based on the Society of Obstetricians

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and Gynecologists (SOGC) guideline [6]. The Perineal Clinic at Mount Sinai Hospital in Toronto, Canada, is dedicated to women with OASIS and/or anal incontinence, urinary incontinence, perineal pain, or voiding dysfunction postpartum. The purpose of the follow-up visit is to assess recovery, check for presence of urinary and anorectal symptoms, assess sexual function, perform endoanal ultrasound, and to provide advice regarding the most appropriate subsequent mode of delivery [3].

Since clinical examination alone has poor sensitivity for detecting persistent anal sphincter defects at 12 weeks postpartum, endoanal ultrasound (EAUS) is the gold standard for morphological assessment of the anal sphincter complex [7]. EAUS can be utilized to determine the accuracy of clinical diagnosis of OASIS at the time of repair, assess anal sphincter integrity, and detect any persistent anal sphincter defects [8]. EAUS is used to differentiate intact anal sphincter complex (no injury), a scar (successful primary repair of OASIS), and residual defect (failed primary repair of OASIS). Intact anal sphincter complex is defined as normal architecture and symmetry along the entire length of the anal sphincter complex. A residual defect is a break in continuity of the muscle ring and/or loss of normal architecture of the anal sphincter complex. Presence of intact anal sphincter complex on EAUS in a patient with clinical diagnosis of OASIS indicates overdiagnosis [9].

The anal sphincter complex is an important component in the anal continence mechanism. Presence of residual anal sphincter defect after primary repair is associated with anorectal symptoms [10]. Damage to IAS results in passive soiling and flatal incontinence, whereas damage to EAS results in fecal urgency and urge fecal incontinence [4].

Combined defect in IAS and EAS has the highest risk of anorectal symptoms compared to intact anal sphincter complex or isolated EAS defect [10]. There are currently no Canadian studies that have examined the relationship between subclassification of OASIS, residual defects present on EAUS, and anorectal symptomatology. The purpose of this study was (1) to determine correlation between EAUS findings and anorectal symptoms in women after primary OASIS repair at a large Canadian tertiary care centre, (2) to determine the incidence of residual anal sphincter defects on EAUS after primary OASIS repair, and (3) to determine the rate of clinical overdiagnosis of OASIS in our patient population. We hypothesized that the larger size of persistent anal sphincter defects would be associated with greater severity of anorectal symptoms in women with OASIS.

Materials and methods

A retrospective cohort study was conducted at the Division of Urogynecology at the Department of Obstetrics and Gynecology at the University of Toronto in Toronto, Ontario. This study was approved by the Research Ethics Board (REB-21-0117-C).

All women with singleton vaginal deliveries who had a clinical diagnosis of OASIS at the time of delivery with primary repair and had endoanal ultrasound performed by the senior investigator at the Postpartum Perineal Clinic at Mount Sinai Hospital at least 8–12 weeks postpartum between July 1, 2017 and December 31, 2020 were included in this study. Mount Sinai Hospital has a large maternal and infant program with approximately 7,500 deliveries annually [11]. Exclusion criteria consisted of women who had EAUS performed by other than the senior investigator, did not undergo EAUS, multiple gestations, history of previous OASIS, buttonhole tears, and rectovaginal fistula.

Consultation in the Postpartum Perineal Clinic at Mount Sinai Hospital was performed by a single urogynecologist and consisted of a symptom assessment, physical examination, EAUS, counselling, and management. Participants were asked about anorectal symptoms. Physical examination consisted of both vaginal and digital rectal examinations to assess resting tone and squeeze pressure. EAUS was performed by the senior author using a BK Medical 5052 machine employing an oil-filled 360° rotating endoprobe and automatic 3-dimensional acquisition. EAUS was performed in left lateral position and frequency of 6-15 MHz was used to obtain images at four levels: 1) puborectalis muscle, 2) deep external anal sphincter (EAS) and internal anal sphincter (IAS), 3) superficial EAS and IAS, and 4) subcutaneous EAS [12].

Ultrasound images were used to assess for break in normal continuity of the muscle ring of anal sphincter. The size of interruption in the muscle ring was measured according to hours on a clockface for EAS and IAS separately. The clockface had 12 hours (equal to 360°), with each hour equal to 30°. Muscle ring discontinuity measuring 1 hour (out of 12) in width was a defect equal to 30°. Muscle ring discontinuity measuring > 1 hour (out of 12) in width was a defect > 30°. Intact EAS and/or IAS was defined as normal continuity of the muscle ring of the anal sphincter without any disruption. A scar was be defined as disruption in EAS and/or IAS less than 1 hour (out of 12) in width. A residual defect was defined as either a partial or full-thickness break in normal continuity of EAS and/or IAS or excessive scarring that extended for more than 1 hour (out of 12) in width [13]. A defect was classified based on its location (EAS, IAS, or both). A defect in EAS was diagnosed as a hypoechoic area where muscle was

disrupted. A defect in IAS was diagnosed as a hyperechoic area where muscle was disrupted [12].

Retrospective data collection was performed using patient clinic charts to obtain the following information: demographic characteristics, risk factors for OASIS according to SOGC guideline [6], severity of anorectal symptoms, and findings on EAUS. Severity of anorectal symptoms was assessed using St. Mark's Incontinence Score (SMIS).

Clinical diagnosis of OASIS at the time of primary repair was compared to sonographic findings on EAUS. Standardized classification of OASIS was utilized, which ensured a thorough evaluation of anatomy [14].

GraphPad Prism 2022 statistical software was used to perform descriptive statistics appropriate for the variable type and distribution of data. Data was analyzed using descriptive statistics. Pearson correlation coefficient was used to assess correlation between anorectal symptoms and EAUS findings. The following interpretation of the strength of correlation was utilized: $r = 0$–.19 was considered "very weak," $r = .20$–.39 was "weak," $r = .40$–.59 was "moderate," .60–.79 was "strong," and .80–1.0 was "very strong" correlation [14]. A p-value of $\leq .05$ was considered statistically significant.

Results

A total of 467 women were assessed in the Postpartum Perineal Clinic and completed EAUS during the study period. From these women, 220 women were excluded for the following reasons: EAUS performed outside of Mount Sinai Hospital and not by the senior investigator, presence of rectovaginal fistula, referred to the Postpartum Perineal Clinic not for OASIS, had history of previous OASIS, or had a buttonhole tear. A total of 247 participants with clinical diagnosis of OASIS were included into the analysis. Table 1 demonstrates demographic characteristics of study participants.

Incidence and overdiagnosis of OASIS

From 247 participants included into this study, 156 (63.2%) participants with clinical diagnosis of OASIS had sonographic evidence of OASIS on EAUS. Based on EAUS, 126 (51.0%) had sonographic evidence of a 3rd-degree tear: 60 (24.3%) had 3a tear, 39 (15.8%) had 3b tear, and 27 (10.9%) had 3c tear. Thirty (12.1%) had a 4th-degree tear.

Table 2 demonstrates correlation of clinical diagnosis at the time of primary OASIS repair to the sonographic findings on EAUS. Clinical diagnosis and sonographic findings of OASIS corresponded in 58.3% of women with

Table 1 Demographic characteristics of study participants with OASIS represented as means

	No (%)[a]
Total women with OASIS	247
Age, mean ± SD, years	34.28 ± 4.19
Race	
Caucasian	123 (49.80)
Black	7 (2.83)
Asian	83 (33.60)
Latin American	5 (2.02)
First Nations	0 (0)
Other	12 (4.86)
Unknown	17 (6.88)
Parity[b]	
1	209 (84.62)
2	38 (15.38)
3	3 (1.21)
4	2 (0.81)
BMI, mean ± SD, kg/m^2	25.00 ± 4.54
Breastfeeding	163 (65.99)
History of previous OASIS	0 (0)
Risk factors for OASIS[b]	
Maternal diabetes[c]	7 (2.83)
Perineal body length, mean ± SD, cm	2.70 ± 0.70
Infibulation	0 (0)
Macrosomia (birth weight > 4kg)	27 (10.93)
Birth weight ± SD, kg	3.43 ± 0.45
OP presentation	2 (0.81)
Postdates[d]	1 (0.40)
VBAC	8 (3.24)
Waterbirth	1 (0.40)
Epidural	218 (88.26)
Oxytocin augmentation	44 (17.81)
Abnormal fetal heart rate	14 (5.67)
Shoulder dystocia	27 (10.93)
Mode of delivery	
SVD	109 (44.13)
Total OVD	126 (51.01)
Vacuum	55 (22.27)
Forceps	71 (28.74)
Combination of vacuum and forceps	12 (4.86)
Episiotomy	
None	143 (57.89)
Episiotomy	134 (54.25)
Mediolateral	101 (40.89)
Midline	3 (1.21)
Type not recorded	30 (12.15)

[a]Unless otherwise specified, percentages are based on total women with OASIS.

[b]Based on Society of Obstetricians and Gynecologists (SOGC) guideline

[c]Includes both gestational and pre-gestational diabetes

[d]Gestational age > 40 weeks

BMI, body mass index; *SD*, standard deviation; *SVD*, spontaneous vaginal delivery; *OVD*, operative vaginal delivery; *OASIS*, obstetric anal sphincter injuries; *VBAC*, vaginal birth after Cesarean section

3rd-degree and 78.9% of 4th-degree perineal lacerations. Clinical diagnosis and sonographic findings of OASIS corresponded in 38.1% of women with 3a perineal laceration, 40.0% of 3b perineal laceration, and 40.0% of 3c perineal laceration. Clinical overdiagnosis of OASIS was present in 91 (36.8 %) participants.

Incidence of anorectal symptoms

Table 3 reports the incidence of anorectal symptoms by degree of perineal laceration diagnosed by EAUS. Anorectal symptoms were present in 48.1% of women with sonographic evidence of OASIS and 18.7% of women without sonographic evidence of OASIS. Anorectal symptoms were present in 46.0% of participants with sonographic evidence of a 3rd-degree tear: 35.0% participants with 3a perineal tear, 43.6% participants with 3b perineal tear, and 74.1% participants with 3c perineal tear. Anorectal symptoms were present in 56.7% of participants with sonographic evidence of a 4th-degree tear.

Incidence of residual anal sphincter defects

Residual EAS defect > 1 hour was present in 69.2% all participants: 65.1% of participants with sonographic evidence of 3rd-degree tear and 86.7% of participants with sonographic evidence of 4th-degree tear. Residual IAS defect > 1 hour was present in 51.8% participants with sonographic evidence of 3c perineal tear and 63.3% participants with sonographic evidence of 4th-degree tear.

Table 2 Correlation of clinical diagnosis at the time of primary OASIS repair to sonographic findings on endoanal ultrasound

Clinical diagnosis at the time of primary OASIS repair No (%)[a]	Sonographic findings on EAUS					
	Not OASIS $n = 91$	3rd degree total $n = 126$	Subclassification 3rd degree			4th degree $n = 30$
			3a $n = 60$	3b $n = 39$	3c $n = 27$	
2nd degree underdiagnosis ($n = 3$)		3 (100%)	0 (0%)	2 (66.7%)	1 (33.3%)	0 (0%)
3rd degree total ($n = 206$)	86 (41.7%)	120 (58.3%)				0 (0%)
3a ($n = 42$)	21 (50.0%)		16 (38.1%)	3 (7.1%)	2 (2%)	
3b ($n = 10$)	1 (10.0%)		4 (40.0%)	4 (40.0%)	1 (10.0%)	
3c ($n = 10$)	2 (20.0%)		3 (30.0%)	1 (10.0%)	4 (40.0%)	
3rd degree unspecified ($n = 144$)	62 (43.1%)		36 (25.0%)	27 (18.8%)	19 (13.2%)	
4th degree ($n = 38$)	5 (13.2%)	3 (7.8%)	1 (2.6%)	2 (5.2%)	0 (0%)	30 (78.9%)

EAUS, endoanal ultrasound; *OASIS*, obstetric anal sphincter injuries

[a]Unless otherwise specified. Percentages are based on total women with clinical diagnosis with that type of perineal laceration.

*Diagnosis of perineal laceration based on clinical findings is consistent with findings on EAUS.

Table 3 Incidence of anorectal symptoms based on sonographic findings on endoanal ultrasound

Symptoms	Sonographic findings on EAUS Group; no. (%) of patients[a]					
	Not OASIS $n = 91$	3rd degree; $n = 126$			4th degree; $n = 30$	*P* value
		3a $n = 60$	3b $n = 39$	3c $n = 27$		
Asymptomatic	74 (81.3%)	39 (65.0%)	22 (56.4%)	7 (25.9%)	13 (43.3%)	0.006
Fecal urgency	5 (5.5%)	9 (15.0%)	11 (28.2%)	11 (40.7%)	10 (33.3%)	0.053
Total fecal incontinence	4 (4.4%)	6 (10%)	7 (17.9%)	7 (25.9%)	7 (23.3%)	0.22
Hard stool	0 (0%)	1 (1.7%)	2 (5.1%)	2 (7.4%)	1 (3.3%)	
Soft stool	4 (4.4%)	5 (8.3%)	5 (12.8%)	5 (18.5%)	6 (20%)	
Flatal incontinence	16 (17.6%)	19 (31.7%)	14 (35.9%)	17 (63.0%)	15 (50%)	0.031

[a]Unless otherwise specified. Percentages are based on total women with this type of perineal laceration.

EAUS: endoanal ultrasound

Correlation between EAUS findings and anorectal symptoms

Figures 1 and 2 demonstrate correlation between severity of anorectal symptoms expressed as SMIS and the extent of residual EAS and IAS defects in women with sonographic evidence of OASIS. There was a weak positive correlation present ($r = .3723$) between the size of residual defect of EAS and SMIS ($p < .0001$). There was also a weak positive correlation present ($r = .3122$) between the size of residual defect of IAS and SMIS ($p = .0180$).

Discussion

This study confirms that the extent of residual anal sphincter defect has a weak positive correlation to the degree of anorectal symptoms measured using SMIS, emphasizing the importance of EAUS for counselling and planning future mode of delivery. Several other studies have demonstrated a significant positive correlation between SMIS and the size of residual defect on EAUS [9, 15, 16]. It is known that anal continence is partially dependent on normal anal sphincter anatomy and function; while IAS is responsible for maintaining anal continence at rest, EAS is responsible for maintaining continence during voluntary anal squeeze and periods of increased intra-abdominal and intra-rectal pressures [4], hence a structural defect of the anal sphincter complex may compromise its function postpartum.

There is a wide variation of residual anal sphincter defects in literature ranging from 21% to 91.5% [9, 15, 16]. In our study, residual anal sphincter defects were present in 69.2% of participants with sonographic evidence of OASIS. Similarly, a retrospective study of 250 women by Luciano et al. found a high incidence of residual anal sphincter defects of 60% [17]. Persistent anal sphincter defects could be due to inadequate primary repair, choice of suture materials, suture breakdown, postpartum wound infection, and wound-healing issues [18].

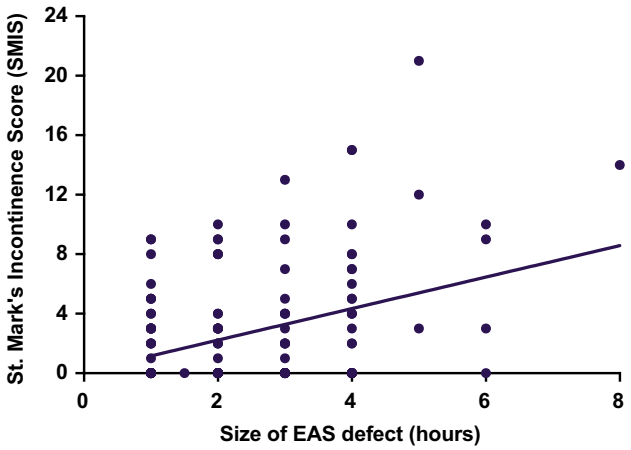

Fig. 1 Correlation (shown with regression line) between severity of anorectal symptoms expressed as SMIS and extent of residual EAS defect in 156 participants with evidence of EAS defect on EAUS expressed in hours. There was a weak positive correlation present ($r = .3723$) ($p < .0001$). *OASIS*: obstetric anal sphincter injuries; *EAS*: external anal sphincter; *SMIS*: St. Mark's incontinence score

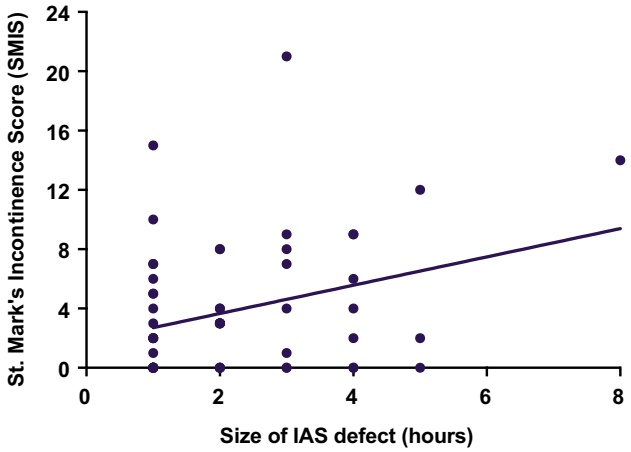

Fig. 2 Correlation (shown with regression line) between severity of anorectal symptoms expressed as SMIS and extent of residual IAS defect in 57 participants with evidence of IAS defect on EAUS expressed in hours. There was a weak positive correlation present ($r = .3122$) ($p = .0180$). *OASIS*: obstetric anal sphincter injuries; *IAS*: internal anal sphincter; *SMIS*: St. Mark's incontinence score

Anorectal symptoms in the first 12 months postpartum can be multifactorial [19]. Although patients with residual anal sphincter defects may be asymptomatic immediately postpartum, anal sphincter function may deteriorate with age, and symptoms may become apparent later in life [20, 21]. In the study by Lyciano et al., menopause was identified as the only independent factor associated with severity of fecal incontinence rather than the extent of residual anal sphincter defect [17]. A small cohort study of 17 women with OASIS revealed that 24% of women with OASIS had worsening anal incontinence at 2 years and 4 years postpartum [22]. A prospective cohort study of 344 women with mean follow-up of 3.2 ± 1.6 years demonstrated that 10% of women who were asymptomatic at 9 weeks postpartum developed de novo anal incontinence at 3 years postpartum due to persistent anal sphincter defects [23]. This highlights the importance of EAUS to detect residual anal sphincter defects regardless of the presence of symptoms postpartum; the finding of which helps to counsel women with regard to the possibility of anorectal symptoms later in life.

Although residual anal sphincter defects have a significant association with anorectal symptoms, women with an intact anal sphincter complex or adequate primary repair may also experience anorectal symptoms postpartum. In this study,

20.1% of women without sonographic evidence of OASIS reported experiencing anorectal symptoms. Fecal incontinence is multifactorial and has been reported in 4–40% of women postpartum [24, 25]. A prospective cohort study of 1507 participants by Brown et al. revealed that fecal incontinence is present in 7% of women antepartum and 17% of all women in the first 12 months postpartum. Although women with OASIS were more likely to experience postpartum fecal incontinence, this accounted for only 6.9% of all women with fecal incontinence persisting beyond 3 months postpartum [19]. Almost a third of women in a prospective study by Patton et al. with adequately repaired anal sphincter complex post-OASIS experienced fecal incontinence [16]. Furthermore, Caesarean section may not be completely protective against anorectal symptoms, since 13.1% of women delivered by Caesarean section experienced fecal incontinence in the first 12 months postpartum as pregnancy itself may contribute to development of anal incontinence [19]. Anorectal symptoms in postpartum women may be attributed to weakness of the pelvic floor musculature itself rather than the integrity of the anorectal sphincter complex, which has been associated with weight gain during pregnancy, prolonged second stage, fetal macrosomia, and operative vaginal delivery [26, 27]. Cerro et al. demonstrated that pelvic floor muscle strength is inversely correlated to anorectal symptoms, since voluntary contraction of the pelvic floor musculature results in increased pressure in the proximal anal canal [9]. Furthermore, branches of the pelvic nerve can sustain denervation during vaginal delivery and subsequent re-innervation, which can affect fecal continence by altering distal colonic motility, resulting in content flowing freely into rectum [16, 26, 27]. Other risk factors for anorectal symptoms include changes in the anatomy of the puboviscerals muscle after vaginal delivery [28], and presence of irritable bowel syndrome [19].

This study presented an overdiagnosis rate of 36.8%, which is comparable to the overdiagnosis rates of 7–32% reported in literature [11, 15, 29, 30]. A possible explanation for overdiagnosis is the fear and anxiety regarding missed OASIS, as well as mistaking the superficial transverse perineal muscle with EAS, as was discussed in the 2017 study by Sioutis et al. [29]. It is imperative that accurate diagnosis is made to avoid unnecessary treatment at the time of delivery, postpartum, and at subsequent deliveries. While more than 60% of women with prior OASIS prefer to have a vaginal delivery [15], there is evidence that women with prior OASIS are more likely to have an elective Caesarean section [31]. Performing EAUS for all women with clinical diagnosis of OASIS was useful in this study for counselling regarding mode of subsequent delivery. Women with overdiagnosis were reassured that they did not have sonographic evidence of OASIS, thus making elective Caesarean section for future deliveries for the indication of OASIS an unnecessary choice for these women.

This study has several strengths. This is a single-centre Canadian study that examines correlation between EAUS findings and anorectal symptoms in women with primary OASIS repair using a standardized anorectal symptom scale. Furthermore, this is the first study that provides Canadian data regarding subclassification for 3rd-degree tears and anorectal symptoms. Mount Sinai Hospital is a large tertiary care centre in Canada with a multidisciplinary team of obstetricians and gynecologists, family physicians, midwives, and learners. This centre provides high volume obstetrical care to a diverse patient population. This study had very few exclusion criteria, and the findings are generalizable to many populations. Since all participants were examined by a single urogynecologist with specialized training and experience in diagnosis and management of OASIS, interpretation of EAUS images in this study was consistent.

This study has several limitations, as there was no control group of primiparous women without OASIS for comparison of symptoms postpartum. Moreover, the anal resting tone and squeeze pressure were obtained using a digital rectal examination rather than anorectal manometry. To avoid bias in our study, a single urogynecologist performed all digital rectal examinations.

Future research needs to focus on other potential mechanisms of anal incontinence in women post-OASIS, which could be used to improve the understanding of multifactorial nature of anal incontinence.

Conclusion

This study highlights the importance of adequate diagnosis and primary repair of OASIS. The weak correlation between the extent of anal sphincter defect and anal symptoms postpartum confirms the importance of EAUS as a gold standard to assess the extent of the sphincter defect. These findings guide in counselling women regarding the mode of delivery in subsequent pregnancies, as well as concerning the possibility of having anal incontinence later in life.

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Each author's participation in the manuscript

Maria Giroux: data collection, data analysis, manuscript preparation
Nawazish Naqvi: project development, data collection
May Alarab: project development, data collection, manuscript preparation

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Declarations

Conflicts of interest None.

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