

# Complete Obstetric Anal Sphincter Tear and Risk of Long-term Fecal Incontinence: A Cohort Study

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**BACKGROUND:** Women with anal sphincter injuries have an increased risk of developing fecal incontinence despite surgical intervention.

**OBJECTIVE:** The aim of this study was to evaluate the long-term risk of fecal incontinence after primary anal sphincter reconstruction and its impact on quality of life.

**DESIGN:** This was a cohort study.

**SETTINGS:** This study was performed at Aarhus University Hospital.

**PATIENTS:** Women with complete anal sphincter rupture (exposed) from 1976 to 1991 and a control group of parous women (nonexposed) were included.

**MAIN OUTCOME:** The primary outcomes measured were fecal incontinence, Wexner score, St Mark incontinence score, and quality of life.

**RESULTS:** A total of 363 women were included (125 exposed and 238 nonexposed). The mean age was 50.4 years (95%CI: 49.8–51.0), with 22.2 years (95% CI: 21.7–22.6) of follow-up. At the time of follow-up, 49% of exposed women and 74% of nonexposed women were continent. Complete anal sphincter tear increases the risk of fecal incontinence twofold (relative risk = 2.00; 95%CI: 1.52–2.63). No other risk factors were identified. The mean Wexner score was 1.7 (95%CI: 1.3–2.1) vs 1.1 (95%CI: 0.7–1.4) ( $p = 0.02$ ), and the mean St Mark score was 2.8 (95% CI: 2.1–3.4) vs 1.4 (95%CI: 1.0–1.9) ( $p < 0.001$ ) in the exposed and nonexposed groups. Severity of

fecal incontinence had a significant impact on the quality of life independent of exposure.

**LIMITATION:** The cohort is relatively young; a short postmenopausal period limits the assessment of hormonal status and the effect of postmenopausal hormone replacement therapy.

**CONCLUSION:** Complete obstetric anal sphincter tear increases the long-term risk of fecal incontinence twofold. When present, the severity of the incontinence symptoms is minor and the risk of incontinence for solid stool is not increased in comparison with the general population. Anal sphincter rupture is the only independent risk factor for fecal incontinence. The severity of fecal incontinence had the same impact on quality of life in both groups.

**KEY WORDS:** Anal sphincter injury; Fecal incontinence; Quality of life.

Childbirth is an important causative factor in the higher prevalence of incontinence in women. Anal sphincter injury during childbirth is associated with higher maternal morbidity, and, if fecal incontinence is present, there could be substantial social implications and impacts on the quality of life. Obstetric anal sphincter injuries are recognized in 0.5% to 9% of all vaginal deliveries,<sup>1,2</sup> with a higher incidence in primiparous women.<sup>3,4</sup> A prolonged second stage of labor, instrumental vaginal delivery, episiotomy, high birth weight, shoulder dystocia, induction of labor, epidural analgesia, persistent occipitoposterior position, and increased maternal age are well-known obstetric risk factors for a third- or fourth-degree perineal tear at the time of delivery.<sup>1–6</sup> Up to half of the women with primary reconstruction of the anal sphincter after an obstetric injury experience some alteration in bowel continence, most commonly flatus incontinence, despite surgical intervention.<sup>7–12</sup> However, persistent incontinence of solid stool is rare.<sup>9</sup>

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The causes of the increased prevalence of fecal incontinence in women of greater age have been discussed. Parity may be of the greatest importance.<sup>2,9,13–15</sup> Vaginal delivery is associated with traction and/or compression to the pudendal nerves.<sup>16,17</sup> This injury can be reversible but does persist in some women, which may accumulate with subsequent vaginal deliveries and possibly lead to fecal incontinence regardless of sphincter injury.<sup>18</sup> Transitory fecal incontinence after a complete sphincter tear may be a predictor of fecal incontinence after a subsequent delivery<sup>19–22</sup> and of persistent flatus incontinence.<sup>2,9</sup> Furthermore, age and age-related neuropathy may be a contributory cause in women who present with late-onset fecal incontinence or in whom the symptoms worsen with time.<sup>19,20</sup> The presence of estrogen and progesterone receptors in the female anal sphincters, pelvic muscles, and urogenital ligaments supports a hormonal impact<sup>23–25</sup> on the development of fecal incontinence after menopause, but this correlation is still controversial.<sup>26,27</sup>

The objective of this study was to evaluate the long-term risk of fecal incontinence after primary anal sphincter reconstruction and its impact on quality of life. This study was conducted in a cohort including women with or without a complete anal sphincter rupture at the time of delivery at Aarhus University Hospital from 1976 to 1991.

## MATERIAL AND METHODS

Between January 1, 1976 and October 30, 1987, all delivering women at the Department of Gynaecology and Obstetrics, Aarhus University Hospital, who sustained obstetric tears of the anal sphincter were identified by the use of the Danish National Patient Registry<sup>28</sup> according to the *International Classification of Diseases, 8th Edition*, and the Danish classification system of surgical procedures. Of the 41,200 deliveries during this period, 210 had recognized obstetric sphincter injury (0.5%) (Fig. 1). All records of the women with obstetric sphincter injury were reviewed. The 58 women with partial anal sphincter rupture were excluded, leaving 152 women with a diagnosed and surgically confirmed complete anal sphincter rupture, with or without involvement of the anal mucosa. These women were included in the cohort as the exposed group. The women who delivered immediately before and after the women with complete obstetric anal sphincter rupture were identified and included as the nonexposed group, resulting in a total of 304 women in this study. None of the nonexposed women had recognized anal sphincter injuries. None of the exposed or nonexposed women had fecal incontinence before inclusion in this study.

In 1989, all exposed and nonexposed women were asked to complete a postal questionnaire regarding their continence status. Unreturned questionnaires were categorized

as nonresponders. Overall, 121 exposed and 242 nonexposed women returned a complete questionnaire.

Reassessment and further inclusion were performed in 1992, with the initial inclusion period extended until November 1, 1991. Then, 70 new exposed and 144 new nonexposed women were included by the use of the same inclusion and exclusion criteria, expanding the cohort to 191 exposed and 386 nonexposed women. All new and previously included patients were assessed by the same questionnaire used in 1989. Overall, 182 exposed and 363 nonexposed women returned a complete questionnaire.

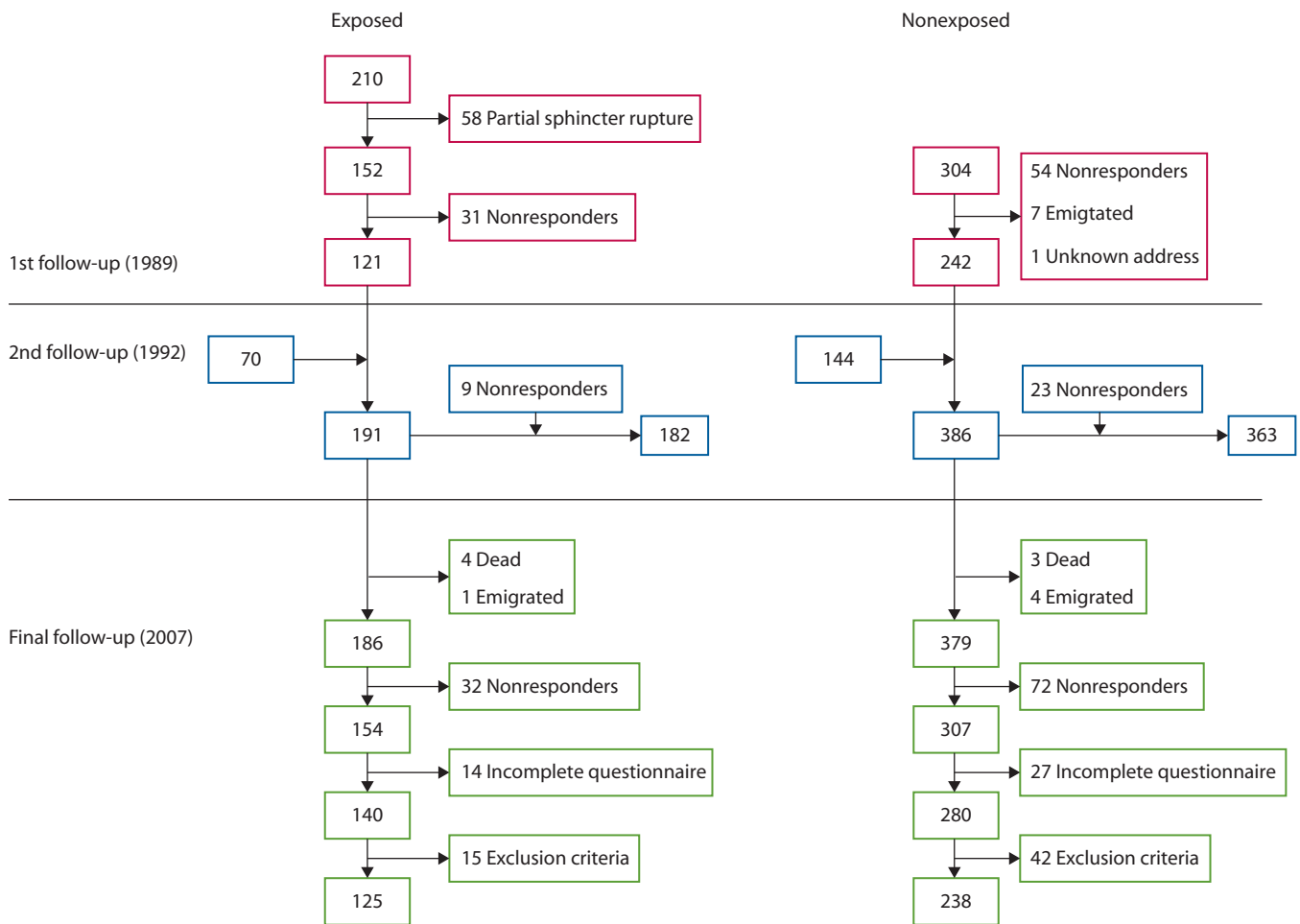
At the final follow-up in 2007, all included women were reassessed with the same questionnaire and by the Wexner continence grading scale,<sup>29</sup> St Mark incontinence score,<sup>30</sup> and a symptom-specific quality-of-life questionnaire.<sup>31</sup> Women who did not answer the questionnaire after a third reminder letter were considered nonresponders.

During the follow-up period, 4 exposed and 3 nonexposed women died, and 1 exposed and 4 nonexposed women emigrated. In total, 186 exposed and 379 nonexposed women were followed up. Of these, 32 exposed and 72 nonexposed women did not return the questionnaires (nonresponders), and 14 exposed and 27 nonexposed women were excluded because their returned questionnaires were incomplete. A total of 420 women, 140 exposed (75%) and 280 nonexposed (74%), remained included. However, 57 (15 exposed/42 nonexposed) met the exclusion criteria, which included a history of anorectal disease, neurological diseases, herniated disc, diabetes mellitus, a previously recognized complete or incomplete sphincter tear (nonexposed), postoperative complications to anal sphincter reconstruction (exposed), rerupture at subsequent delivery (exposed), anorectal surgery, or IBD. The final cohort included 125 exposed and 238 nonexposed women.

By evaluating hospital records, the surgical procedure classification, and the Danish National Patient Registry, all data including postoperative complications to the anal sphincter reconstruction, birth weight, shoulder dystocia, use of oxytocin and prostaglandins, instrumental delivery (Kjelland forceps or vacuum), mediolateral episiotomy, subsequent surgical procedures performed, medical history, and inclusion and exclusion criteria were recorded.

### Diagnosis and Treatment of Complete Obstetric Anal Sphincter Tear in the Cohort

In all women, complete anal sphincter tears were confirmed and treated by a dedicated and trained senior obstetric registrar or consulting obstetrician at the time of delivery. Sphincter reconstruction was performed by an end-to-end technique using 2 or 3 single “figure-of-eight” 0-0 Vicryl sutures. No antibiotics were used prophylactically. The women were not allowed to sit for the first 4 postoperative days, and a mild laxative was administered



**FIGURE 1.** Flowchart of the cohort. In 1989, 121 exposed and 242 nonexposed women were included in the cohort. Reassessment and further inclusion were performed in 1992, when 70 new exposed and 144 new nonexposed women were included, expanding the cohort to 191 exposed and 386 nonexposed. One hundred eighty-two exposed and 363 nonexposed women returned a complete questionnaire. At final follow-up, 125 exposed and 238 nonexposed women were included as the final cohort.

until the first defecation. After 4 days, pelvic floor exercises were initiated, and the women were encouraged to continue this exercise after discharge.

Postoperative complications were observed in 17 (11.2%) of the women undergoing reconstruction: 16 had an infection, 6 developed a hematoma, and 4 were resutured before discharge.

#### Incontinence Score and Quality of life

Fecal incontinence was defined as the uncontrolled passage of flatus, liquid or solid stool.<sup>32</sup> Fecal incontinence was graded by the severity of the incontinence, the Wexner continence grading scale,<sup>29</sup> and St Mark score.<sup>30</sup>

The quality of life was evaluated by health-related quality-of-life scales developed by T.H. Rockwood to address issues related specifically to fecal incontinence.<sup>31</sup> The scales ranged from 1 to 4, with 1 indicating a lower functional status for the quality of life, as recommendations in the latest revised edition.<sup>31,33</sup>

#### Statistical Methods

The effect of complete anal sphincter rupture on binary outcomes was estimated by relative risk (risk ratio) with 95% CIs, and significance was tested with the  $\chi^2$  test. The second stage of labor (<60 minutes /  $\geq$ 60 minutes), instrumental delivery, birth weight (<4000 g /  $\geq$ 4000 g), BMI (< 30 /  $\geq$ 30), induction of labor (yes / no), and fetal presentation (normal / abnormal) were dichotomized before the final analysis. Normally distributed continuous outcomes were tested with the 2-sample *t* test. The potential interactions of risk factors on the exposure status ( $\pm$  anal sphincter rupture) and fecal incontinence were explored by stratified analysis. Multivariate regression analyses were performed to identify independent risk factors for the development of fecal incontinence.

Informed and written consent was obtained from all patients, and the study was approved by The Central Denmark Region Committees on Biomedical Research Ethics.

## RESULTS

A total of 363 women, 125 exposed and 238 nonexposed, were included in the final analysis. Their mean age was 50.4 years (95% CI: 49.8–51.0), and the mean final follow-up period, which was counted from the date of delivery, was 22.2 years (95% CI: 21.7–22.6). The distribution of the demographic data, obstetric characteristics, and parity are shown in Table 1 and Table 2.

The participants at the final follow-up were compared with dropouts who participated in the first and/or second evaluations. No difference was observed between the dropouts and participants with respect to the exposure status, continence status, distribution of the severity of fecal incontinence, or age (data not shown).

### Risk and Potential Risk Factors for Developing Fecal Incontinence in the Long Term

At the time of the final follow-up, the exposed group had a significantly higher incidence of fecal incontinence compared with the nonexposed group ( $p < 0.001$ ) (Table 3). Sixty-four (51%) exposed and 61 (26%) nonexposed women reported fecal incontinence, with the majority having flatus incontinence. When fecal incontinence was present, there was no significant difference in the severity of incontinence symptoms between the exposed and nonexposed groups ( $p = 0.14$ ).

A complete anal sphincter tear increased the risk of fecal incontinence twofold (relative risk (RR) = 2.00; 95% CI: 1.52–2.63). When interactions between continence status and selected risk factors were tested in bivariate analyses, there was no indication of an association between continence status and menopausal status, BMI, birth weight, fetal presentation, mode of delivery or labor induction (Table 4). Women with a mediolateral episiotomy had an increased risk of fecal incontinence (RR = 1.46, 95% CI: 1.06–2.01,  $p = 0.02$ ). Postmenopausal replacement therapy showed a trend toward a protective effect against fecal incontinence (RR = 0.66, 95% CI: 0.41–1.06;  $p = 0.06$ ). Regression analyses using the variables of subsequent deliveries, total parity, or age showed no increased risk of fecal incontinence. Multivariate regression analyses adjusting for risk factors did not significantly change the results from the bivariate analyses, with the exception of mediolateral episiotomy and postmenopausal replacement therapy (Table 4): the impact of mediolateral episiotomy and postmenopausal replacement therapy on fecal incontinence was not present in the multivariate analyses. The regression analysis of subsequent deliveries and parity, adjusting for each of the risk factors, showed no significant change in the crude analysis.

### Continence Grade at the Time of the Final Follow-up

The Wexner score was significantly higher in the exposed group compared with the nonexposed group (mean 1.7

(95% CI: 1.3–2.1) vs mean 1.1 (95% CI: 0.7–1.4);  $p = 0.02$ ). In the participants with reported fecal incontinence, the mean Wexner scores were 3.5 (95% CI: 3.0–4.0) and 4.1 (95% CI: 3.3–5.0) in the exposed and nonexposed groups ( $p = 0.22$ ). Two exposed and 8 nonexposed women reported a Wexner score  $\geq 8$  (Fig. 2). The mean St Mark scores were 2.8 (95% CI: 2.1–3.4) in the exposed group and 1.4 (95% CI: 1.0–1.9) in the nonexposed group ( $p < 0.001$ ). There was no significant difference in St Mark score when evaluating the exposed and nonexposed groups with incontinence symptoms (mean score: 5.7 (95% CI: 4.9–6.6) and 6.0 (95% CI: 4.8–7.1);  $p = 0.75$ ). Thirteen percent of the exposed and 14% of the nonexposed women reported daily or weekly urgency ( $p = 0.64$ ).

All participants who reported fecal incontinence were asked about their subjective perception of it. Incontinence of flatus, liquid stool and solid stool was reported as moderate or very bothersome by 44%, 50%, and 83% of the exposed group, irrespective of the frequency. A similar result was found in the nonexposed group, with prevalence rates of 32%, 44%, and 83%.

### The Change in the Continence Status During Follow-up

A total of 185 women, including 63 exposed and 122 nonexposed women, returned a complete questionnaire for all 3 evaluations. Of the women who reported continence at the first 2 evaluations, 70% of the exposed and 86% of the nonexposed women remained continent at the final follow-up. In addition, 67% of the exposed and 89% of the nonexposed women reporting incontinence at the 2 first evaluations had similar or worse symptoms at the final follow-up.

### Quality of Life

Fecal incontinence was found to have the same impact on the quality of life in all 4 domains independent of exposure status. There was no significant difference in the mean score of the “depression / self-perception” domain ( $p = 0.60$ ), the “lifestyle” domain ( $p = 0.47$ ), the “coping / behavior” domain ( $p = 0.48$ ), and the “embarrassment” domain ( $p = 0.64$ ) when comparing the exposed and the nonexposed group (Fig. 3). When evaluating the 4 domains according to the severity of incontinence, there was a significant decrease in the quality of life with increasing severity of incontinence symptoms in the “lifestyle,” “coping / behavior,” and “embarrassment” domain, regardless of the exposure status. Incontinence of solid stool had the highest impact on the quality of life in all these domains. The “depression / self-perception” domain score was not significantly reduced as the severity of the incontinence increased.

### General Health at Final Follow-up

All participants were asked to evaluate their general health on a scale ranging from 1 to 5, with 5 being excellent and 1

**TABLE 1.** Demographic and obstetrical characteristics of the study population

Characteristics	Exposed (n = 125)	Nonexposed (n = 238)	p <sup>a</sup>
<b>Demographic</b>			
Age, mean	49.5 (48.5–50.4)	50.9 (50.1–51.7)	0.03
Follow-up, y, mean	22.1 (21.4–23.0)	22.2 (21.6–22.8)	0.89
BMI <sup>b</sup>	23.9 (23.0–24.9)	24.1 (23.6–24.6)	0.75
Postmenopausal at final follow-up <sup>c</sup>			
No	71 (58)	108 (46)	0.04
Yes	52 (42)	126 (54)	
Postmenopausal hormone replacement therapy			
No	38 (73)	91 (72)	0.91
Yes	14 (27)	35 (28)	
Parity at time of inclusion			
Primiparous	102 (82)	106 (45)	<0.001
Multiparous	23 (18)	132 (55)	
Parity at time of final follow-up			
Primiparous	17 (14)	18 (8)	0.06
Multiparous	108 (86)	220 (92)	
<b>Obstetrical</b>			
Fetal presentation <sup>d</sup>			
Cephalic presentation	106	216	0.05
Abnormal presentation	19	20	
Mode of delivery <sup>d</sup>			
Spontaneous vaginal delivery	81	208	<0.001
Vacuum extraction ± forceps	44	28	
Mediolateral episiotomy <sup>e</sup>			
No	19	119	<0.001
Yes	104	119	
Labor induction <sup>f</sup>			
No	64	153	<0.001
Yes	60	62	
Duration of second stage of labor <sup>g</sup>			
<60 min	62	203	<0.001
>60 min	40	26	
Birth weight, g <sup>h</sup>	3696 (3615–3776)	3470 (3397–3544)	<0.001

Values are presented as mean (95% CI) or n (%).

<sup>a</sup>p value: t test for continuous variable and  $\chi^2$  test for categorical variable.

<sup>b</sup>Five missing cases and 12 missing controls.

<sup>c</sup>Two missing cases and 4 missing controls.

<sup>d</sup>Two missing controls.

<sup>e</sup>Two missing cases.

<sup>f</sup>One missing case and 23 missing controls.

<sup>g</sup>Twenty-three missing cases and 9 missing controls.

<sup>h</sup>One missing control.

being poor. Overall, there was no difference in the general health between the exposed and nonexposed women (exposed: 3.8 (95% CI: 3.7–4.0) vs nonexposed: 3.7 (95% CI: 3.7–3.8),  $p = 0.29$ ). The evaluation of general health in the participants with incontinence symptoms showed no significant difference between the 2 groups (exposed: 3.8 (95% CI: 3.6–4.1) vs nonexposed: 3.5 (95% CI: 3.4–3.7)) ( $p = 0.07$ ).

## DISCUSSION

This study was designed to assess the long-term functional outcome of primary anal sphincter reconstruction after obstetric injury in a cohort of women with complete anal sphincter rupture compared with a selected nonexposed group. To the best of our knowledge, this

study represents the largest published longitudinal study to date on this issue.

This study demonstrated that a complete obstetric anal sphincter injury followed by primary anal sphincter reconstruction increases the risk of developing long-term fecal incontinence twofold, when flatus incontinence is included in the definition. However, the severity of the fecal incontinence is similar to that observed in the nonexposed women. Long-term continence after anal sphincter reconstruction was achievable in 49% of the exposed women, and the risk of long-term incontinence of solid stool was not increased compared with the nonexposed group or the general population. The majority of women with fecal incontinence reported flatus incontinence.

**TABLE 2.** Childbirth during the study period

	Exposed (n = 125)		Nonexposed (n = 238)	
	Inclusion	Final follow-up	Inclusion	Final follow-up
Deliveries, n (%)				
1	102 (82)	17 (13)	106 (45)	18 (8)
2	22 (17)	74 (59)	100 (42)	127 (53)
3	1 (1)	25 (20)	20 (8)	60 (25)
>3	0	9 (7)	12 (5)	33 (14)
Cesarean section				
Before inclusion	6		4	
After inclusion	4		4	
Subsequent deliveries				
None		32		109
1		65		91
2		22		27
3		6		9
> 3		0		2

According to the literature, up to 60% of women who sustain an obstetric anal sphincter tear will subsequently develop fecal incontinence.<sup>12,34,35</sup> A retrospective cohort study conducted by Samarasekera et al<sup>10</sup> showed that 53% of the women with primary reconstruction and 19% of women with vaginal deliveries reported fecal incontinence after 14 years of follow-up. After a 10-year observation period in a retrospective case-control study, Mous et al<sup>34</sup> showed that 61% of women with sphincter reconstruction and 22% of women undergoing vaginal delivery reported anorectal concerns. In a 5-year prospective cohort study, the prevalence of fecal incontinence was 53% among women with an obstetric anal sphincter tear compared with 35% of women with vaginal deliveries.<sup>9</sup> Our findings of 51% of the women with anterior anal sphincter reconstruction and 26% of nonexposed women reporting fecal incontinence after 22 years of follow-up are consistent with these results.

A good functional result of the initial sphincter reconstruction appears to be an important long-term prognostic factor. Pollack et al<sup>9</sup> showed that "the presence of anal incontinence after the first delivery was the strongest risk factor and could be used as a predictor of persistent

anal incontinence at 5-year follow-up," regardless of anal sphincter rupture. In another study by Bravo Gutierrez et al,<sup>12</sup> women with poorer short-term function at the 3-year follow-up were more likely to have fecal incontinence at the 10-year follow-up. These results are in agreement with the findings in the present study. We found that the majority of women who were continent postpartum and in the short term remained unaltered during the follow-up period, whereas persistent fecal incontinence symptoms in the short term appeared to be a predictor for long-term incontinence, because more than two-thirds of the women continued to be incontinent regardless of sphincter reconstruction.

Women with persistent fecal incontinence postpartum or late-onset fecal incontinence symptoms may have an anatomical defect or disruption of the anal sphincter. Several studies have reported a high incidence of sphincter defects, up to 70%, in women with late-onset incontinence.<sup>4</sup> Sultan et al<sup>2</sup> reported persistent morphologic sphincter defects in up to 85% of women with a primary repaired sphincter injury when evaluated by endoanal ultrasonography. The misclassification of an obstetric anal sphincter injury may be prevalent. Fernando et al<sup>36</sup>

**TABLE 3.** Continence status at time of evaluation

	Exposed			Nonexposed		
	1989 (n = 97) <sup>a</sup>	1992 (n = 173) <sup>b</sup>	Final follow-up (n = 125)	1989 (n = 231) <sup>c</sup>	1992 (n = 329) <sup>d</sup>	Final follow-up (n = 238)
Continent	62 (64)	81 (47)	61 (49)	195 (84)	291 (88)	177 (74)
Flatus incontinent	17 (18)	48 (28)	43 (35)	27 (12)	28 (9)	34 (14)
Liquid stool	11 (11)	24 (14)	18 (14)	8 (3)	5 (2)	21 (9)
Solid stool	7 (7)	20 (12)	3 (2)	1 (0.4)	5 (2)	6 (3)

Values are presented as n (%).

<sup>a</sup> Twenty-four missing values (n = 121).

<sup>b</sup> Nine missing values (n = 182).

<sup>c</sup> Eleven missing values (n = 242).

<sup>d</sup> Thirty-four missing values (n = 363).

**TABLE 4.** Association between demographic characteristics and fecal incontinence

	RR (95% CI)	Adjusted RR <sup>a</sup> (95% CI)
Descriptive data		
Obstetric anal sphincter tear	2.00** (1.52–2.63)	1.84** (1.40–2.43)
Age	0.98 (0.96–1.00)	1.0 (0.92–1.09)
Age group		
<45	Reference	
45–49	0.86 (0.60–1.23)	0.85 (0.50–1.45)
50–54	0.83 (0.56–1.23)	0.86 (0.37–2.01)
55–60	0.50*** (0.29–0.86)	0.51 (0.14–1.86)
>60	0.82 (0.44–1.53)	0.93 (0.15–5.86)
BMI	0.82 (0.47–1.45)	0.86 (0.50–1.46)
Postmenopausal	0.88 (0.66–1.18)	1.25 (0.89–1.75)
Postmenopausal hormone replacement	0.66 (0.41–1.06)	0.71 (0.44–1.13)
Obstetric risk factors		
Obstetric anal sphincter tear	2.00** (1.52–2.63)	1.98** (1.42–2.77)
Birth weight	0.68 (0.44–1.05)	0.64 (0.40–1.03)
Mode of delivery	1.27 (0.92–1.74)	0.90 (0.60–1.35)
Labor induction	1.03 (0.76–1.39)	0.91 (0.66–1.26)
Mediolateral episiotomy	1.46**** (1.06–2.01)	1.16 (0.81–1.66)
Duration of second stage	1.32 (0.94–1.86)	1.07 (0.73–1.57)
Fetal presentation	1.30 (0.88–1.92)	1.04 (0.66–1.65)
Delivery data		
Subsequent deliveries		
0	Reference	
1	1.16 (0.83–1.62)	
2	1.51 (1.01–2.25)	
3	1.34 (0.69–2.62)	
>3	1.68 (0.41–6.87)	
Total parity		
1	Reference	
2	0.78 (0.50–1.23)	
3	0.88 (0.54–1.45)	
>3	1.07 (0.63–1.83)	

<sup>a</sup> Each variable is adjusted to the remaining variables in the category.

\*\*  $p < 0.001$ ;

\*\*\*  $p = 0.01$ ;

\*\*\*\*  $p = 0.02$ .

showed that 33% of the consulting obstetricians and 22% of trainee obstetricians in the United Kingdom considered a complete or partial tear in the external anal sphincter to be a second-degree injury.

The low incidence of obstetric sphincter injuries when this cohort was assembled is representative of that period of time.<sup>37,38</sup> The incidence of complete obstetric anal sphincter injuries may have been underestimated in this period. However, because we excluded all women with perineal trauma from the nonexposed group, the risk for misclassification bias should be minimized. Furthermore, all included women in the exposed group were confirmed as having a complete anal sphincter rupture at the time of surgery.

Neuropathy of the pudendal nerves caused by vaginal delivery is another described factor in the development of long-term fecal incontinence. The cumulative effect of multiple vaginal deliveries on fecal incontinence is ambiguous. In some studies, multiple vaginal deliveries have been shown to be an independent risk factor in

the development of fecal incontinence.<sup>9,13</sup> According to the Royal College of Obstetricians and Gynaecologists in 2007,<sup>39</sup> the estimated risk of developing fecal incontinence or worsening symptoms with subsequent delivery varies from 17% to 24%. Faltin et al<sup>35</sup> showed in a large retrospective cohort study with 19 years of follow-up that subsequent delivery did not increase the risk of incontinence in women with or without a sphincter tear. Our results support the results of Faltin et al,<sup>35</sup> because we found no association between long-term fecal incontinence and subsequent deliveries, regardless of anal sphincter reconstruction.

Assessing the potential risk factors, we found that anal sphincter injury was the only independent risk factor for developing fecal incontinence. The lack of an association of postmenopausal state, postmenopausal replacement therapy, and age with fecal incontinence should be considered with caution, because the cohort is relatively young and the women had a short postmenopausal period, reflected by the mean age of 50.4

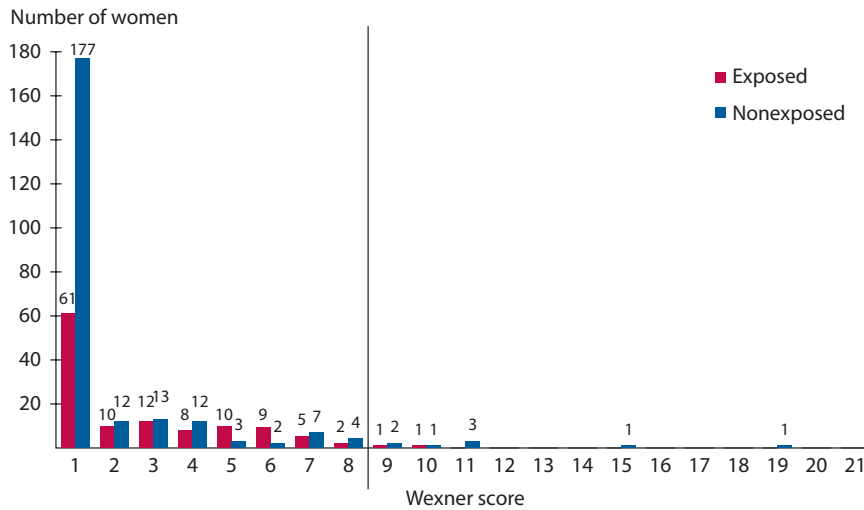


FIGURE 2. Wexner score at final follow-up.

years. Postmenopausal hormone replacement therapy may have a protective effect, but the statistical precision precludes any firm conclusion. In a large, newly published systematic review by Bols et al,<sup>40</sup> third-degree and fourth-degree sphincter rupture was the only causative factor shown to be associated with fecal incontinence postpartum. These results confirm that an independent risk factor for obstetric sphincter injury is not necessarily an independent risk factor for the development of fecal incontinence.

Persistent fecal incontinence affects the quality of life. The scores on the quality-of-life scales were significantly lower in women with fecal incontinence, indicating a poorer disease-specific quality of life. Bravo Gutierrez et al<sup>12</sup> evaluated the quality of life 10 years after an anterior sphincter reconstruction in 130 women and

found a similar result, with a significant reduction in the quality of life in those who had fecal incontinence. Faltin et al<sup>35</sup> found that "the impact of fecal incontinence on quality of life was similar in women having sustained an anal sphincter tear and in controls," which is in concordance with our results.

**CONCLUSION**

This large prospective study showed that women with a complete obstetric anal sphincter injury have a twofold increased risk of developing long-term fecal incontinence compared with women undergoing uncomplicated vaginal deliveries, but that the severity of the incontinence symptoms is minor and the risk of incontinence for solid stool is not increased. Anal

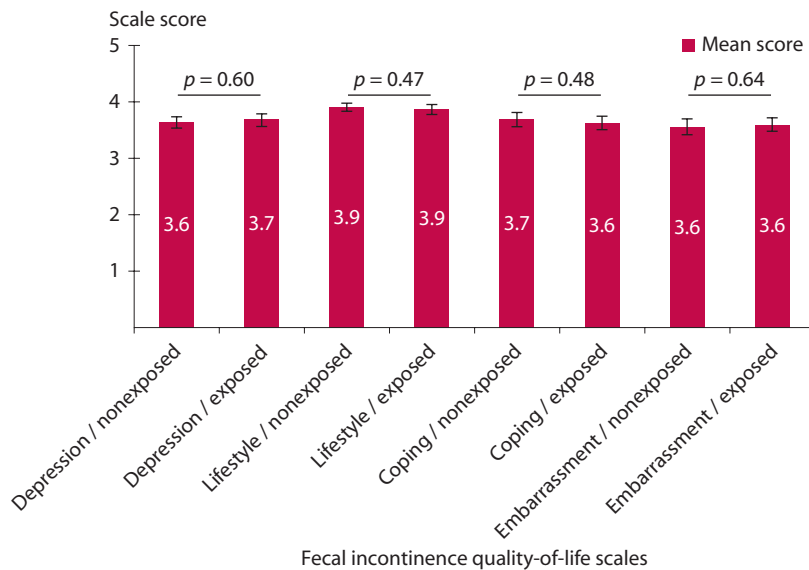


FIGURE 3. Quality-of-life score.

sphincter rupture is the only independent risk factor for fecal incontinence that was identified, but short-term fecal incontinence may be a predictor of persistent fecal incontinence in the majority of women. The impact of fecal incontinence on the quality of life was only correlated with the severity of the incontinence symptoms. Future studies are needed to evaluate the anal sphincter function after reconstruction in postmenopausal and in older women.

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