Anal Sphincter Tears at Vaginal Delivery: Risk Factors and Clinical Outcome of Primary Repair

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Objective: **To determine risk factors for obstetric anal sphincter tears and to evaluate symptomatic outcome of primary repair.**

Methods: **Obstetric-procedure, maternal, and fetal data were registered in 845 consecutive vaginally delivered women. Risk factors for anal sphincter tears were calculated by multiple logistic regression. All 808 Swedish-speaking women who delivered vaginally were included in a questionnaire study regarding anal incontinence in relation to the delivery. Questionnaires were distributed within the first few days postpartum, and at 5 and 9 months postpartum.**

Results: **Six percent of the women had a clinically detected sphincter tear at delivery. Sphincter tears were associated with nulliparity (odds ratio [OR] 9.8, 95% confidence interval [CI] 3.6, 26.2), postmaturity (OR 2.5, 95% CI 1.0, 6.2), fundal pressure (OR 4.6 95% CI 2.3, 7.9), midline episiotomy (OR 5.5 95% CI 1.4, 18.7), and fetal weight in intervals of 250 g (OR 1.3 95% CI 1.1, 1.6). Fifty-four percent of women with repaired sphincter tears suffered from fecal or gas incontinence or both at 5 months and 41% at 9 months. Most of the symptoms were infrequent and mild.**

Conclusion: **Several risk factors for sphincter tear were identified. Sphincter tear at vaginal delivery is a serious complication, and it is frequently associated with anal incontinence. Special attention should be directed toward risk factors for this complication. Symptoms of anal incontinence should explicitly be sought at follow-up after delivery. (Obstet Gynecol 1999;94:21–8. © 1999 by The American College of Obstetricians and Gynecologists.)**

Anal incontinence after childbirth may be due to injury to the anal sphincter or its innervation, or both.[1–3] Recent studies have demonstrated a significant incidence of sphincter injuries after delivery, and the majority of these injuries are occult and only detectable with endoanal sonography.[1,4] Additionally, anal incontinence is seldom spontaneously mentioned by patients, and therefore there is a risk that these problems remain undetected.[5]

The incidence of clinically detected anal sphincter tears at delivery most often is reported to be less than 3%.[6–10] During recent years, the incidence of tears has increased in Sweden.[11] The reason for this is not clear, but it has been thought that altered obstetric routines, such as upright maternal delivery positions, could be one contributing factor. At our institution, the frequency of upright delivery positions has become increasingly popular, and today approximately 60% of all deliveries are performed in these positions. Gardeberg et al[12] have reported a seven-fold increased risk for sphincter tears in upright delivery positions without support of the pelvic floor.

The aims of the present study were to identify risk factors for obstetric anal sphincter tears, to evaluate the association between sphincter tears and upright delivery positions, and to study the symptomatic outcome of primary sphincter repair.

Materials and Methods

During a 10-week period, April 1 through June 9, 1995, at Danderyd Hospital, all deliveries were studied and analyzed with respect to risk factors for development of perineal and anal sphincter tears. During the same period all Swedish-speaking, vaginally delivered women were asked to participate in a prospective questionnaire study regarding incontinence symptoms that could be linked to childbirth.

Deliveries in the present study were performed according to Swedish obstetric routines in which most uncomplicated deliveries are handled by midwives. Obstetricians were called upon when necessary to as-

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sess complicated deliveries or to perform instrumental or cesarean deliveries. At least one staff obstetrician and one resident were always on call at the ward.

Perineal tears were classified into four degrees according to the international classification of diseases.[13] A first-degree tear involved the forchet, the perineal skin, vaginal epithelium but not the underlying fascia and muscles. A second-degree tear also involved the fascia, muscles, perineal body but not the anal sphincter. A third-degree tear involved the anal sphincter, but does not extend through the rectal mucosa. A fourth-degree tear was defined as extending through the rectal mucosa. Diagnosis of perineal tears was made by the attending midwife. When a sphincter tear was suspected, the obstetrician was called upon and the diagnosis of a sphincter injury was verified by physical examination. All sphincter tears were repaired primarily by the attending obstetrician. The operation charts from these interventions were reviewed retrospectively.

After the delivery, the subjects were informed and asked to participate in the questionnaire study. If they agreed, a first questionnaire was filled out concerning symptoms existing before the pregnancy. A second and a third questionnaire concerning the same symptoms at 5 and 9 months, respectively, after the delivery were sent by mail to the subjects. The forms were filled out by the subjects and returned to us. If there was no response in 2–3 weeks, a second and third attempt was made by sending a new questionnaire by mail.

The questionnaires included previous medical history and symptoms of gas and fecal incontinence. Regarding incontinence symptoms, subjects were asked two questions: 1) Do you experience incontinence of flatus, ie, do you have involuntary leakage of intestinal gas? and 2) Do you experience incontinence of fecal contents, ie, do you have involuntary leakage of stool? The subjects had four alternative answers to each of these questions: no; yes, less than once a week; yes, more than once a week; and yes, daily.

During the study period, 974 women were delivered. One hundred and twenty-nine (13.2%) were delivered by cesarean and were not included in the present study. Women who did not speak or read Swedish ($n = 37$) were excluded from the questionnaire study. Thus, 845 women were included in the study of risk factors for sphincter tears and 808 subjects were asked to participate in the questionnaire study.

All delivery records were studied and the following parameters were registered: age, height, weight at the beginning and end of the pregnancy, number of previous vaginal deliveries, gestational age, medical problems or complications during pregnancy, cervical opening on admission, duration of labor, delivery position of the subjects, presentation of the fetus, use of augmentation, analgesia, fundal pressure, instrumental delivery, episiotomy, and induction of labor. Weight, length, and head circumference of the baby also were registered.

Table 1. Maternal Characteristics

Variable	Women with sphincter tear ($n = 54$)	Women without sphincter tear ($n = 791$)
Age (y)	3 ± 4	31 ± 5
Weight—first trimester (kg)	6 ± 8	64 ± 10
Weight—at birth (kg)	74 ± 9	77 ± 11
Height (cm)	166 ± 6	168 ± 6
Preceding vaginal deliveries		
Para 0	49 (91)	348 (44)
Para I	4 (7)	300 (38)
Para II	1 (2)	111 (14)
Para ≥III	0 (0)	32 (4)

Data are expressed as mean ± standard deviation or *n* (%).

Because some women came to the delivery department early and were advised to return home whereas other women arrived late in labor and delivered on admittance, not all labor parameters could be found in the delivery charts for all patients. This decreased the total available subjects to less than 845 for some of the studied parameters.

The first questionnaire was answered by 88% (709 of 808). The second questionnaire was answered by 80% (643 of 808) after a mean time of 145 (range, 122–239) days after the delivery. The third questionnaire was answered by 77% (620 of 808) after a mean time of 284 (range, 254–349) days after the delivery. Women who answered all three questionnaires ($n = 620$) were included in the questionnaire study. Women who did not participate in the questionnaire study did not differ in the maternal and fetal characteristics or in intervention during delivery.

Maternal characteristics are described in Table 1. Three patients had diabetes type I, and another patient had gestational diabetes; otherwise no subject suffered from diabetes or neurologic or anorectal disease.

Obstetric parameters and interventions during labor are found in Table 2. Gestational age was determined by ultrasonography in the second trimester (16–19 weeks). Duration of labor was defined as the time from cervical dilatation of 4 cm to the delivery of the fetus. Without respect to station of the leading fetal part below the level of the ischial spine, duration of second stage of labor was defined as the time from a fully dilated cervix to the delivery of the fetus. Oxytocin (Syntocinon; Sandoz, East Hanover, NJ; 10 IU/500 mL NaCl) was used for augmentation of labor. As a routine, women in the first stage of labor are encouraged to be

Table 2. Obstetric Characteristics

Variable	Women with sphincter tear (n = 54)	Women without sphincter tear (n = 791)
Gestational age (d)	286 ± 8	281 ± 10
Cx opening on admission (cm)	4 ± 2	4 ± 3
Duration of labor (h)	10.8 ± 5.3 (n = 42)	7.6 ± 4.8 (n = 480)
Duration of first stage of labor (h)	9.2 ± 4.8 (n = 42)	6.6 ± 4.4 (n = 480)
Duration of second stage (h)	1.5 ± 1.3	0.9 ± 0.9 (n = 781)
Delivery positions		
Kneeling	17 (31)	441 (56)
Standing	3 (6)	61 (8)
Squatting	0	2 (0.2)
Sitting	25 (46)	220 (28)
Lithotomy	7 (13)	25 (3)
Lateral	2 (4)	42 (5)
Upright position*	20 (37)	504 (64)
Induction of labor	3 (6)	66 (8)
Prostaglandin	2 (4)	47
Oxytocin	1 (2)	15
Amniotomy	0	4
Augmentation of labor		
<30 mL/h	4 (7)	39
30–60 mL/h	9 (17)	125
>60 mL/h	28 (52)	28
Instrumental delivery	12 (22)	33
Vacuum extractor	12	31
Forceps	0	2
External fundal pressure	30 (57) (n = 53)	115 (15)
Episiotomy	6 (11)	9 (1)
Midline	6	7
Mediolateral	0	2
Analgesia		
N_2O	46 (85)	580 (74)
Epidural	19 (35)	144 (18)
Paracervical block	8 (15)	93 (12)
Pudendal block	2 (4)	17 (2)
Morphine	0	9 (1)
TNS	9 (17)	87 (11)
Acupuncture	2 (4)	6 (1)

Cx = cervix; N_2O = nitrous oxide; TNS = transcutaneous nerve stimulation.

Data are expressed as mean ± standard deviation or n (%).

*Upright position was defined as one of kneeling, standing, or squatting delivery positions.

Table 3. Fetal Characteristics

Variable	Women with sphincter tear (n = 54)	Women without sphincter tear (n = 791)
Fetal weight (g)	3740 ± 413	3610 ± 791
Fetal length (cm)	51 ± 2	50 ± 2
Fetal head circumference (cm)	35 ± 1	35 ± 1
Fetal presentation		
Vertex occipito-anterior	54 (100)	774 (98)
Vertex occipito-posterior	0	12 (1.5)
Breech	0	5 (0.5)

Data are expressed as mean ± standard deviation or n (%).

active, walk and be in an upright position, but this was not documented in our protocol. Fetal characteristics are found in Table 3.

Maternal, fetal, and obstetric risk factors for sphincter tears were analyzed using logistic regression in a univariate model.[14] Using a 5% significance level, variables were analyzed by using multivariate logistic regression in a forward stepwise procedure.[14]

Gestational age at delivery was dichotomized at the postmaturity limit (294 days). Duration of labor more than 12 hours was defined as pathologic, and the data were dichotomized at this limit. Duration of second stage of labor more than 1 hour was defined as pathologic, and the data were dichotomized at this limit. Fetal weight was treated as a continuous variable, presented in changes of 250 g.

The association between interventions (one or more of fundal pressure, instrumental delivery, and episiotomy) and delivery positions was tested in a χ^2 analysis. McNemars test was used when analyzing changes of symptoms over time. The frequency of anal incontinence at 9 months after delivery was compared with the frequency before delivery and at 5 months after delivery.

The study was approved by the Local Ethics Committee at Karolinska Hospital, Karolinska Institutet, Stockholm. All subjects were informed by oral and written sources and gave their consent by filling out the questionnaires.

Results

Clinically diagnosed anal sphincter tears (third- or fourth-degree tears) were registered in 6% (54 of 845) of the women. Of the third-degree tears, 18% (nine of 54) involved the whole muscle and 82% (42 of 54) partial tears of the muscle.

All clinically diagnosed sphincter tears were repaired primarily. Eighty-five percent (46 of 54) of these repairs were done in the delivery room, and 6% (three of 54) in the operation theater; in 9% (five of 54) it was unclear in which of these locations the repair was done.

All repairs were performed with absorbably sutures (polyglycolic acid or polygalactin). In 80% (43 of 54) the sphincter was repaired with figure-of-eight sutures, in 2% (one of 54) interrupted sutures were used, and in the remaining women the sutured method was unclear (not specified). Antibiotics were given to 4% (two of 54) of the women postoperatively, and 78% (42 of 54) received laxatives for 3–5 days postoperatively.

In the univariate analysis, anal sphincter tears were

Table 4. Factors Associated With Anal Sphincter Tears at Delivery

Risk factor	Univariate analysis OR (95% CI)	Multivariate analysis OR (95% CI)
Nulliparity	12.4 (4.9, 31.5)	9.8 (3.6, 26.2)
Gestational age >294 d	3.3 (1.4, 7.4)	2.5 (1.0, 6.2)
Duration of first stage of labor	1.1 (1.1, 1.2)	
Second stage of labor >1 h	2.6 (1.5, 4.5)	
Duration of labor >12 h	2.6 (1.5, 4.5)	
Oxytocin augmentation	4.1 (2.2, 7.8)	
Epidural anesthesia	2.3 (1.3, 4.1)	
Sitting position	2.2 (1.3, 3.9)	
Lithotomy position	4.6 (1.9, 11.1)	
Kneeling position	0.4 (0.2, 0.7)	
Upright position	0.3 (0.2, 0.6)	
Fundal pressure	7.6 (4.3, 13.6)	4.6 (2.3, 7.9)
Use of instruments	6.5 (3.2, 13.6)	
Midline episiotomy	14.0 (4.5, 43.2)	5.5 (1.4, 18.7)
Fetal weight (in steps of 250 g, continuous)	1.1 (1.0, 1.3)	1.3 (1.1, 1.6)

OR = odds ratio; CI = confidence interval.
Variables presented in "chronologic" order in relation to labor.

significantly associated with nulliparity, postmaturity, duration of first stage of labor, pathologic duration of second stage of labor, pathologic duration of labor, oxytocin augmentation, and epidural anesthesia (Table 4). Maternal birth positions were significantly associated with sphincter tears in the sitting and lithotomy positions, but inversely significantly associated in the kneeling position (Table 4). Of interventions toward the end of labor, external fundal pressure, instrumental delivery, and midline episiotomy were associated with sphincter tears. Fetal weight also was associated with sphincter tears (Table 4). Remaining maternal and fetal factors or different types of interventions during labor were not associated with anal sphincter tears in univariate analyses.

When analyzing the above identified risk factors in a multivariate model, nulliparity, postmaturity, fundal pressure, midline episiotomy, and birth weight were independently associated with sphincter tears (Table 4). Interventions, defined as one or more of fundal pressure, instrumental delivery, and episiotomy, were relatively less used in association with the upright positions (kneeling, standing, or squatting) than in nonupright position (lithotomy or sitting) ($P < .001$).

The frequency of preexisting symptoms of anal incontinence in relation to parity are presented in Table 5. Forty-six of the 54 women with a clinically detected sphincter injury completed all questionnaires to be included in the questionnaire study. Of these women, 4% (two of 46) had fourth-degree tears, 15% (seven of 46) had third-degree tears involving the complete sphincter, and 80% (37 of 46) had tears involving just parts of the sphincter. Before pregnancy, 2% (one of 46) had symptoms of fecal incontinence and an additional 13% (6 of 46) had gas incontinence only. At 5 months after primary sphincter repair, 4% (two of 46) had symptoms of fecal incontinence and an additional 50% (23 of 46) had symptoms of gas incontinence only. At 9 months after the primary repair, 2% (one of 46) had symptoms of fecal incontinence and an additional 39% (18 of 46) of gas incontinence only (Table 6). Of women having symptoms before pregnancy, three had undergone one previous vaginal delivery, one had two previous deliveries, and three were nulliparous.

Table 5. Preexisting Anal Incontinence in Relation to Vaginal Parity

Preceding vaginal parity	Frequency of anal incontinence before pregnancy
0 para	7% (22/301)
I para	9% (21/222)
II para	19% (15/77)
≥ III para	5% (1/20)

Of the 789 women without a clinically detected sphincter tear, 574 completed all questionnaires to be included in the questionnaire study. Twenty-three percent (132 of 574) of the women had no tear at all, 77% (441 of 574) had first- or second-degree tears, and 0.2% (one of 574) had a tear of unknown degree (they did not have a third- or fourth-degree tear and no primary repair was performed). Before pregnancy, 1% (five of 574) of women had symptoms of fecal incontinence and an additional 8% (48 of 574) of gas incontinence only. At 5 months after delivery, 2% (nine of 574) had fecal incontinence, and an additional 22% (126 of 574) had symptoms of gas incontinence only. At 9 months after

Table 6. Symptoms in Women With Clinically Detected Anal Sphincter Tears

Symptoms	Before pregnancy* (%) ($n = 46$)	5 mo postpartum† (%) ($n = 46$)	9 mo postpartum (%) ($n = 46$)
No symptoms	85	46	59
Fecal incontinence‡			
<1/wk	2	0	2
>1/wk	0	4	0
Daily	0	0	0
Gas incontinence§			
<1/wk	9	22	28
>1/wk	2	24	9
Daily	2	4	2

* Change of anal incontinence before pregnancy and 9 months after delivery, $P = .006$.
† Change of anal incontinence from 5 to 9 months after delivery, $P = .11$.
‡ Some of these women were incontinent also of gas.
§ None of these women were incontinent of feces.

Table 7. Symptoms in Women Without Clinically Detected Anal Sphincter Tears

Symptoms	Before pregnancy* (%) (n = 574)	5 mo postpartum† (%) (n = 574)	9 mo postpartum (%) (n = 574)
No symptoms	91	77	76
Fecal incontinence‡			
<1/wk	0.7	1	1
>1/wk	0.2	0.3	0.3
Daily	0	0.2	0
Gas incontinence§			
<1/wk	6	12	15
>1/wk	2	8	6
Daily	1	2	2

* Change of anal incontinence before pregnancy and 9 months after delivery $P < .001$.

† Change of anal incontinence from 5 to 9 months after delivery $P = .69$.

‡ Some of these women were incontinent of gas.

§ None of these women were incontinent of feces.

delivery, 2% (10 of 574) had fecal, and an additional 22% (129 of 574) had gas incontinence only (Table 7). Of the 53 women having symptoms before pregnancy, 20 were nulliparous, 18 were primiparous, 14 had had two previous deliveries, and one had had four previous deliveries.

Discussion

One factor that initiated the present study was the increasing incidence of obstetric sphincter tears during the last decade.[11] The present study confirms a high incidence (6%), which is in contrast to several previous studies in which an incidence of less than 3% has been reported.[6–10] However, an incidence of up to 24% was reported by other authors.[15,16] The reason for the increasing number of reported sphincter tears and the differences between the studies is unclear. The classification of sphincter tears is probably one explanation. The most commonly used classification[13] presents a wide definition of third-degree tears involving the sphincter. According to this classification, third-degree tears may include lesions to a minor part of the sphincter or a complete tear of the sphincter with intact rectal mucosa. The majority of the third-degree tears in the present study were partial injuries. However, the definition we have used has been used in several previous studies.[10,17–23]

Obstetric practice in Sweden has changed substantially during recent years. Upright delivery positions have become increasingly common, and concerns about its relation to sphincter tears have been raised. In a recent article studying two different types of upright birth positions, a higher incidence of sphincter tears in the group without pelvic floor support compared with the group with support was reported.[12] In the present study, we could not find any indication that upright delivery positions increased the risk for sphincter tears. On the contrary, kneeling position was associated with a decreased risk, and the nonupright positions were associated with an increased risk for sphincter tears in the univariate analyses. However, these findings may be caused by the fact that interventions are more common in nonupright delivery positions, and no association between delivery positions and sphincter tears was found in the multivariate analysis.

Nulliparity was the most important risk factor for sphincter tears in the present study (Table 4). This finding agrees with several previous studies.[18,20,22–25] However, the reason for this susceptibility among nulliparas at delivery has yet to be answered. Differences in the elasticity and strength of connective tissue between nulliparous and parous women could be one explanation. There are few studies on those differences. A previous report by Petersen and Uldbjerg[26] demonstrated that the content of hydroxyproline and the strength of the collagen in the uterine cervix of multiparas is reduced.

Gestational age was associated with an increased risk for sphincter tears, which has been reported by Crawford et al.[19] However, neither Sorensen et al[18] nor Combs et al[25] found such an association. We have no definite explanation for our finding. Gestational age was found to be an independent risk factor, and an increased fetal weight is thus not the only explanation. Hormonal changes during pregnancy might alter connective tissue properties. The longstanding effect of gravitational forces on the pelvic floor could also associate with changes in connective tissue.

An interesting finding was the association between external fundal pressure and sphincter tears. Fundal pressure involves a force, put by an attendant upon the abdominal wall and the uterine fundus, directed in the length axis of the uterus. It has potential to create a powerful expelling force. Fundal pressure is used toward the end of the second stage of labor when the power of the uterine contractions is insufficient and there is maternal or fetal distress. The effect of fundal pressure on the perineum and anal sphincter has been studied previously only minimally. In a pilot study by Cosner,[27] fundal pressure in combination with episiotomy was reported to have an increased risk for sphincter tears. Fundal pressure also is mentioned in a report from the World Health Organization.[28] The recommendation of this report was not to use fundal pressure routinely until its effect on the pelvic floor is better documented. A problem with using fundal pressure is that the strength of the force is difficult to control.

Table 8. Outcome of Primary Repair in Previous Studies

Study	Number of evaluated sphincter tears	Incidence of fecal incontinence	Incidence of gas incontinence	Incidence of unspecified anal incontinence
Haadem et al, 1988[17]	59	7%	25%	
Nielsen et al, 1992[35]	24			7%
Crawford et al, 1993[19]	35		17%	
Sorensen et al, 1993[18]	34			15%
Sultan et al, 1994[20]	34	9%	32%	
Fornell et al, 1996[10]	51	16%	24%	
Tetzschner et al, 1996[21]	72	17%	25%	
Walsh et al, 1996[22]	81	7%	12%	

Another possible problem might stem from the anatomy of the birth canal. The axis of the birth canal is slightly J-shaped with the bottom of the "J" represented by the rectum, anal canal, and the perineum. The main part of the applied power will thus be directed into this area.

Midline episiotomy is known to be closely connected to a risk for development of third- and fourth-degree obstetric tears.[25,29–31] In spite of this knowledge, midline episiotomy is still frequently used, with a reported incidence of 50% in the United States.[32] Prevailing arguments in favor of this technique are better healing conditions and less postoperative complaints.[29] At our institution, where the overall incidence of episiotomy was low (2%), all but two were midline, the association with sphincter tears was strong in the multivariate analysis. Even though our sample was small, we believe that midline episiotomy preferably should not be used.

Mediolateral episiotomy was found by Poen et al[23] to have a decreased risk for sphincter tears among nulliparous but not among parous women. In our study, only two women had a mediolateral episiotomy and thus no conclusions can be made concerning the mediolateral technique. Both these women were nulliparous, and none had a sphincter tear.

We found an increased risk for sphincter tears with increased fetal weight. We have chosen to analyze this variable as a continuous variable in steps of 250 g, which gave us an odds ratio of 1.3. Analyzed in steps of 500 or 1000 g, the odds ratio was 2.1 and 4.4, respectively. Our finding is in accordance with several previous studies,[20,22,23,30,33] and is quite understandable, given that increased size of the fetus might predispose for sphincter injuries.

Instrumental delivery is known to increase risk for sphincter tears, and this risk is more pronounced with forceps compared with vacuum delivery.[20,34] In the present study, all but two instrumental deliveries were by vacuum extraction. We found an association between instrumental delivery and sphincter tears using univariate but not multivariate analysis. The reason may be the low number of instrumental deliveries. However, any intervention that substantially accelerates the last part of the second stage of labor could be harmful to the tissues of the pelvic floor.

In a previous study by Sultan et al,[1] 35% of nulliparous and 4% of parous women sustained an occult sphincter injury at delivery. The clinical detection rate of sphincter tears in the same study was 3% of all vaginal deliveries. This raises an important problem. Most delivery institutions do not have access to endoanal ultrasonography needed to assess the sphincters immediately postpartum. Thus, the majority of obstetric practitioners must rely on their clinical experience and judgment and therefore be aware of the risk of undetected sphincter tears at clinical examination.

The symptomatic outcome of primary repair in the present study must be considered as reasonable, even though 41% of treated women reported symptoms. The majority of these women reported minor and infrequent bouts of gas incontinence, and only one of the 46 woman experienced fecal incontinence at 9 months (Table 5). Our frequency of incontinence after primary repair is lower than in several previous studies (Table 8). We are not sure about the reason. It is noteworthy that several of the sphincter injuries in the present study were minor. However, when comparing the symptomatic outcome in women with partial and complete sphincter tears, numbers were too small to find any significant difference.

The frequency of anal incontinence was more than twice as high in the sphincter injury group compared with the non–sphincter injury group at 5 months (54% compared with 23%). At 9 months, there was still a difference, but injury group showed improvement (41% of the injury group was incontinent compared with 24% of the noninjury group). The frequency of anal incontinence did not change between 5 and 9 months (Tables 6 and 7). However, the injury group showed a tendency to less severe symptoms (Table 6). This improvement between 5 and 9 months is in contrast with the findings reported by Haadem et al,[36] who did not find any

improvement after 3 months. In the present study we found not only a decrease of incidence, but also a decrease in severity of incontinence. Several reasons for the improvement over time can be hypothesized. Pudendal latencies are frequently prolonged after delivery,[2] but this prolongation is spontaneously normalized in a majority of patients. The improvement could also be explained by the compensation of puborectalis and pelvic floor muscles in accordance with a theory by Nielsen et al[35] or by the tradition of breast-feeding for at least 6 months in Sweden. Estrogen receptors are present in the pelvic floor,[37,38] and estrogen levels are depressed during breast-feeding and might result in impaired continence.

The technique used to repair anal sphincter tears is not standardized at our institution. Most commonly used are a few sutures in figures-of-eight, approximating the ends of the ruptured sphincter muscle. If the anorectal mucosa is ruptured, it is most commonly repaired with interrupted sutures. We have had extensive discussions about the best way to suture obstetric sphincter tears. Important aspects include material of the sutures, the technique of suturing, the importance of restoring the perineal body and the perineum, who should perform the primary repair (the obstetrician or a colon and rectal surgeon), use of preoperative antibiotics, diet restrictions, and use of laxatives after the repair. There is no uniform consensus, and we have not found any prospective studies in the literature on these issues.

In Sweden, all delivered women are routinely followed up at 2–3 months postpartum. Our results imply that it is important to specifically ask for symptoms of anal incontinence at this follow-up. In our practice, fecal incontinence is further evaluated with specific investigation techniques such as endoanal ultrasonography, anorectal manometry, and pudendal nerve terminal motor latency. Women with incontinence to flatus are encouraged to start or continue pelvic floor training and to seek medical advice if the symptoms do not resolve or deteriorate.

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