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Risk Factors for the Symptom of Anal Incontinence One Year after Vaginal Delivery in Primiparous Danish Women: A Prospective Cohort Study

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Abstract

Objectives: The aim of this study was to examine maternal and perinatal risk factors for anal incontinence (AI) one year after vaginal delivery in primiparous women with no AI before the pregnancy.

Methods: We performed a prospective questionnaire cohort survey, dealing with 571 primiparous women. The women completed a validated questionnaire assessing symptoms of AI after delivery and one year later. AI was defined as any episode of either flatus incontinence and/or incontinence for liquid stools and/or incontinence for solid stools. Univariate and multivariate logistic regression analyses were conducted.

Results: In univariate analyses, postpartum AI was significantly associated with AI during pregnancy ($p < 0.01$), obstetric anal sphincter injuries (OASIS) ($p = 0.01$), maternal lateral birth position ($p = 0.02$) and duration of stages one and two ≥ eight hours ($p = 0.03$). The association between AI and head circumference ≥ 38 cm was of borderline significance ($p = 0.05$). Logistic regression analysis confirmed that postpartum AI was associated with AI during pregnancy (odds ratio (OR) 2.8, 95% confidence interval (CI); 1.8-4.2), OASIS (OR 2.7, 95% CI; 1.3-5.6), head circumference ≥ 38 cm (OR 2.8, 95% CI; 1.1-7.3) and duration of stages one and two ≥ eight hours (OR 1.6, 95% CI; 1.0-2.4).

Conclusion: In this population of Danish primiparous women without AI before pregnancy, the study found that AI one year after delivery was significantly associated with AI during pregnancy, OASIS, duration of stage one and two ≥ eight hours and head circumference ≥ 38 cm.

Keywords: Postpartum anal incontinence; Pregnancy; Primiparous; Risk factors; Vaginal delivery

Abbreviations

AI: Anal Incontinence; BMI: Body Mass Index; CI: Confidence Interval; OASIS: Obstetric Anal Sphincter Injuries; OR: Odds Ratio

Introduction

The symptom of anal incontinence (AI) is defined by the International Urogynecological Association and the International Continence Society as a complaint of involuntary loss of fecal material or flatus [1]. It is a disturbing condition that may affect quality of life considerably [2]. The reported prevalence of AI in primiparous women ranges from 24-35% in late pregnancy and 19-25% one year postpartum in recent studies [3,4]. The majority of multiparas with AI report the onset of AI in relation to their first delivery and experiencing AI in the first years after delivery predicts persistent AI in the long term [5-7]. Studies suggest that factors such as incontinence during pregnancy, age over 35 years at first delivery, vaginal delivery, use of vacuum or forceps at delivery, occiput posterior presentation, birth weight and others may be potential risk factors for postpartum AI [3,8-11]. However, OASIS have been consistently associated with increased risk of AI postpartum [12,13]. A recent study by Evers et al. demonstrated a significant impact of OASIS on AI 5-10 years after the women's first delivery [14].

In order to identify patients who could be targeted for prevention strategies it is important to identify the risk factors that are associated with postpartum AI. The aim of this study was to examine maternal and perinatal risk factors for AI one year after a vaginal delivery in primiparous women

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Table 1: Risk factors for anal incontinence one year after delivery (n = 571).

	With AI n/N (%)	Without AI n/N (%)	P value
Caucasian	185/199 (93%)	343/367 (93%)	0.82‡
Age ≥ 30 years	87/203 (43%)	135/368 (37%)	0.15‡
BMI ≥ 25 kg/m^2	51/198 (26%)	92/357 (26%)	1.00‡
BMI ≥ 30 kg/m^2	18/198 (9%)	36/357 (10%)	0.71‡
Smoking	47/202 (23%)	76/368 (21%)	0.47‡
Singleton pregnancy	199/203 (98%)	360/368 (98%)	1.00§
AI in pregnancy	99/202 (49%)	97/366 (27%)	**< 0.01**‡
Any pregnancy complication†	55/203 (27%)	104/366 (28%)	0.74‡
Induction of labour	38/201 (19%)	68/368 (18%)	0.90‡
Oxytocin augmentation	105/200 (53%)	185/363 (51%)	0.73‡
Stage 1 ≥ 7 hours	113/201 (56%)	180/366 (49%)	0.11‡
Passive stage 2 ≥ 2 hours	23/201 (11%)	30/367 (8%)	0.20‡
Active stage 2 ≥ 2 hours	4/200 (2%)	5/368 (1%)	0.72§
Stages 1 and 2 ≥ 8 hours	120/201 (60%)	185/367 (50%)	**0.03**‡
Episiotomy	45/202 (22%)	80/365 (22%)	0.92‡
Any perineal lesion grade 1-4	140/203 (69%)	245/368 (67%)	0.56‡
Obstetric anal sphincter injuries (grade 3-4)	24/203 (12%)	20/368 (5%)	**0.01**‡
Shoulder dystocia	1/203 (0%)	2/368 (1%)	1.00§
Birth weight ≥ 4000 g	26/203 (13%)	43/368 (12%)	0.69‡
Birth weight ≥ 4500 g	5/203 (2%)	6/368 (2%)	0.53§
Head circumference ≥ 38 cm	14/200 (7%)	12/358 (3%)	0.05‡

†Diabetes, preeclampsia, intrauterine growth restriction (IUGR), preterm labour, abruption of placenta, polyhydramnios, other complications.
‡ Pearson's Chi-squared test
§ Fisher's exact test

with no AI before the pregnancy.

Material and Methods

We performed a prospective questionnaire cohort survey and included all primiparous women aged > 17 years who delivered their first child at the Department of Obstetrics and Gynecology, Copenhagen University Hospital Glostrup, Denmark, between June 2003 and July 2005. The women were approached and informed about the study by a health care professional, two to three days after the delivery and filled out the first questionnaire (baseline). A similar second questionnaire was mailed to the participants one year after delivery. Non-responders were contacted once more after two to three weeks. Patients who did not understand written Danish, patients with AI before the pregnancy, patients who gave birth by cesarean section, patients who did not complete the second questionnaire, patients who did not answer first or second part of the questionnaires, patients who were pregnant or had giving birth again one year after the first delivery and patients who gave birth to a stillborn baby were excluded.

The questionnaire was tested for content validity and test-retest reliability. The content validity of the questionnaire was evaluated in interviews with five different women, who filled out the questionnaire before the study began. Retests were performed in 35 women after a test-retest period of two weeks. The questionnaire had a good test-retest reliability, with the lowest kappa-value of 0.54 in one of the categorical variables. The remaining kappa-values varied from 0.61 to 1.0. The kappa values concerning the questions about AI varied from 0.65 to 0.73, and the lowest value derived from the question about incontinence for solid stools.

Both the first and second questionnaire consisted of two parts. The first part comprised questions regarding sociodemographic characteristics and life style factors, and the second part included questions regarding AI. The second questionnaire that was mailed to the women one year later also comprised questions about a new pregnancy. At baseline questions about AI referred to symptoms during the last three months before the start of the pregnancy and symptoms during pregnancy and the questionnaire one year later addressed the symptoms during the preceding three months. The questions about AI dealt with the occurrence of incontinence for flatus, liquid or solid stools. The first questionnaire filled in right after the delivery comprised these questions: "Have you experienced involuntary leakage of flatus (gas) or stools?" [yes/no] in the last three months before the pregnancy, "Have you experienced involuntary leakage of flatus (gas)?", [yes/no] during the pregnancy, "Have you experienced involuntary leakage of liquid stools?" [yes/no] during the pregnancy and "Have you experienced involuntary leakage of solid stools?" [yes/no] during the pregnancy. The second questionnaire one year after delivery comprised these questions: "Have you experienced involuntary leakage of flatus (gas)?", [yes/no] during the preceding 3 months, "Have you experienced involuntary leakage of liquid stools?" [yes/no] during the preceding 3 months or "Have you experienced involuntary leakage of solid stools?" [yes/no] during the preceding 3 months.

AI was defined as at least one episode of either flatus incontinence and/or incontinence for liquid stools and/or incontinence for solid stools [1]. This was the primary outcome of the study. Bother score and frequency of AI symptoms were not calculated in the present

Table 1a: Risk factors for anal incontinence one year after delivery (n = 571) (continued).

	With AI n/N (%)	Without AI n/N (%)	P value
Fetal presentation at birth			
- Occiput anterior presentation	196/201 (98%)	350/367 (95%)	0.21‡
- Occiput posterior presentation	2/201 (1%)	6/367 (2%)	0.72§
- Breech presentation	1/201 (0%)	6/367 (2%)	0.43§
- Other presentations	2/201 (1%)	5/367 (1%)	1.00§
Birth position			
- Lithotomy position	124/167 (74%)	242/309 (78%)	0.32‡
- Lateral position	31/167 (19%)	34/309 (11%)	**0.02**‡
- Standing position	2/167 (1%)	6/309 (2%)	0.72§
- Squatting position	7/167 (4%)	10/309 (3%)	0.60‡
- Knee elbow position	1/167 (1%)	9/309 (3%)	0.18§
- Other positions	2/167 (1%)	8/309 (3%)	0.51§
Vacuum extraction	45/203 (22%)	73/368 (20%)	0.51‡
Gestational age < 37 weeks	27/203 (13%)	55/367 (15%)	0.58‡
Epidural analgesia	35/201 (17%)	76/362 (21%)	0.31‡
Pudendal analgesia	9/200 (5%)	8/362 (2%)	0.13‡
Infiltration analgesia	6/200 (3%)	5/360 (1%)	0.21§
Removal of placenta	3/198 (2%)	8/357 (2%)	0.75§
Intrauterine palpation	5/198 (3%)	18/357 (5%)	0.15‡

†Diabetes, preeclampsia, intrauterine growth restriction (IUGR), preterm labour, abruption of placenta, polyhydramnios, other complications.
‡ Pearson's Chi-squared test
§ Fisher's exact test

study. The aim of the study was not to examine the severity of AI.

The following variables were obtained from the first part of the questionnaires: ethnicity, maternal age at baseline, body mass index (BMI) one year after delivery and smoking one year after delivery. The following variables were obtained from medical records: singleton or multiple pregnancy, any pregnancy complication (gestational diabetes, preeclampsia, intrauterine growth restriction (IUGR), preterm labour, placental abruption, polyhydramnios and other complications), induction of labour, oxytocin augmentation, duration of first stage of delivery, duration of passive and active second stage of delivery, episiotomy, any perineal lesion grade one to four, OASIS, shoulder dystocia, birth weight, head circumference, fetal presentation at birth (occiput anterior, occiput posterior, breech or remaining presentations), birth position (lithotomy, lateral, standing, squatting, knee-elbow or other), vacuum extraction, gestational age at birth, analgesia (epidural, pudendal, infiltration), removal of placenta and intrauterine palpation. In Denmark, instrumental deliveries are usually performed with vacuum extractors and forceps are rarely used. OASIS were diagnosed clinically and graded according to International Classification of Diseases, 10th edition [15].

First stage of delivery was defined as the period from labor with full cervical effacement until full dilation. Passive second stage of delivery was defined as the period from full dilation of the cervix prior to involuntary expulsive contractions. Active second stage was defined as the period from onset of involuntary expulsive contractions and active maternal effort until the delivery. Shoulder dystocia was defined as the need for additional maneuvers, such as McRobert's procedure, shoulder rotation, release of posterior arm et cetera.

Statistical Analysis

Differences in proportions were analysed with chi-square test or Fisher's exact test. Fisher's exact test was used in comparisons with any expected frequency below one or if the expected frequency was less than five in more than 20% of the cells. A multivariate logistic regression model was created using AI one year after delivery as dependent variable. Risk factors that had a significant or borderline significant association with AI in the univariate statistical tests were included as independent variables. No power calculation was done prior to the study, because of the observational study design.

A p-value of < 0.05 was considered statistically significant. Statistical Package for the Social Sciences, ver. 22 (SPSS Inc., Chicago, IL, USA) was used for statistical analyses.

Ethical Approval

Verbal and written consent was obtained from each participating woman. The Danish Data Protective Agency and the local ethical committee approved the study (KA 02777).

Results

One thousand eight hundred and three women delivered their first child at the Department of Obstetrics and Gynecology, Copenhagen University Hospital Glostrup, Denmark, between June 2003 and July 2005. One hundred and eighty-seven women did not read or understand Danish, 8 women were under the age of 18 and 4 women gave birth to a stillborn baby and were excluded. A total of 1604 women (89%) met the inclusion criteria and were eligible to participate. Three hundred and thirty-five women were, unfortunately, not asked to participate for different reasons, and 63 women refused to participate. Hence, the first questionnaire was distributed to 1206 women. Of these, 1018 completed the first questionnaire and received a similar, second questionnaire one year

Table 2: Logistic regression analysis of risk factors for anal incontinence.

	Odds ratio	95% CI	P value
AI in pregnancy	2.8	1.8-4.2	**< 0.01**
Obstetric anal sphincter injury (grade 3-4)	2.7	1.3-5.6	**0.01**
Head circumference ≥ 38 cm	2.8	1.1-7.3	**0.03**
Stages 1 and 2 ≥ 8 hours	1.6	1.0-2.4	**0.03**
Lateral birth position	1.7	1.0-3.0	0.06

CI = Confidence Interval

after the delivery. Eight hundred and fifty-nine women completed the second questionnaire, but 60 women were excluded due to a new pregnancy. One hundred and eighty-three women gave birth by cesarean section and were excluded from analysis. Forty-one women had reported AI before the pregnancy and were also excluded. Four women were excluded because they did not answer the second part of the questionnaire regarding AI. Accordingly, 571 women were included in the final study group.

The 571 primiparous women in the final study group had an age that ranged from 18 to 41 years with a median of 28 years and interquartile range of 25 to 31 years. The prevalence of any anal incontinence one year after delivery was 36% with 203 of the 571 women reporting any anal incontinence during the preceding three months (flatus 24%, liquid stool 18% and solid stool 3%).

Table I presents background and potential risk factors for AI one year after delivery. In univariate analyses, the study found that AI one year after delivery was significantly associated with AI during pregnancy, OASIS, stages one and two ≥ eight hours and lateral birth position. The association between AI and head circumference ≥ 38 cm was of borderline significance. The remaining variables did not differ significantly between the two groups. No forceps deliveries were registered in this study.

Table II presents the results of the logistic regression analysis of associations between the significant or borderline significant risk factors of the univariate analyses (AI during pregnancy, OASIS, head circumference ≥ 38 cm, duration of stages one and two ≥ eight hours and lateral birth position) and AI one year after delivery.

Discussion

The aim of the study was to examine maternal and perinatal risk factors for AI one year after a vaginal delivery in primiparous women with no AI before the pregnancy. This study found that the most important risk factors for subsequent AI were AI during pregnancy, OASIS, duration of stage one and two ≥ eight hours and head circumference ≥ 38 cm. This may be considered clinically important considering the degree to which AI impacts quality of life in the affected women.

Several different risk factors for postpartum AI have been reported previously [3,8-11]. Study design, definition of AI, mode of delivery, parity, and length of observational period after delivery show great variation from study to study. Previous studies are inconsistent as to whether caesarean delivery is protective against postpartum AI [9,13,16]. A Cochrane review [17] has showed that cesarean delivery is not effective in preventing postpartum AI and this was also found in the authors' previous cohort study [4]. Interestingly, in the present study, perinatal factors like vacuum extraction, episiotomy, occiput posterior presentation or macrosomia were not associated with the occurrence of AI one year after delivery. However, head circumference ≥ 38 cm was associated with subsequent AI in multivariate analysis, but previous studies have not found the same association [11,12].

It appears that changes during pregnancy itself may be responsible for some cases of AI postpartum. It has been suggested that hormonal, mechanical and neuromuscular changes during pregnancy contribute to an impaired pelvic floor function [5]. The study found that AI during pregnancy was associated with AI one year after delivery. This is in accordance with other observational studies [3,8,18]. A Cochrane review seeking to determine whether pelvic floor muscle exercises can prevent or treat AI during pregnancy or after delivery was inconclusive due to few data [19]. A newly published randomized controlled trial, however, showed that regular postpartum pelvic floor muscle exercises may be an effective treatment for postpartum anal incontinence [20]. Whether this is true for pelvic muscle exercises before or during pregnancy remains to be demonstrated and, clearly, more research is needed in this area.

The study found that OASIS were significantly associated with AI one year after delivery, which is in agreement with previous short and long term studies [3,18,21] as well as a recent systematic review [12]. Notably, the present study found no association between the risk factors of OASIS (vacuum extraction, birth weight, occiput posterior presentation [22]) and postpartum AI. It has been discussed whether OASIS are related to the subsequent development of AI or if it is only a surrogate marker for other obstetric factors thought to be associated with AI. The likely co-existence of different risk factors could hinder the interpretation of the effect of a single perinatal risk factor [12,13]. Even so, OASIS should be regarded as an important risk factor for postpartum AI. In this study women with OASIS were not diagnosed by imaging technique like endoanal ultrasound, and some OASIS may have been unnoticed if they were not identified immediately postpartum.

The incidence of OASIS is believed to have increased over several decades in the Nordic countries [23]. Hence, there has been a European focus on prevention of OASIS by the use of episiotomy and perineal protection in the last couple of years [10,24,25]. Using manual perineal support is a low-cost intervention and requires no extra resources or equipment, except for training of the existing personnel. Some studies have showed a reduction in the occurrences of OASIS following the introduction of such interventions [10,25,26]. Other studies, however, have not demonstrated any significant effects [27,28]. A Cochrane review of techniques that may reduce perineal trauma in the second stage of labor, found moderate-quality evidence suggesting that warm compressions and massage may reduce OASIS, while the effect of manual techniques (hands on versus hands off) was unclear. There were insufficient data to examine the importance of other perineal techniques [29]. Further high-quality studies are needed on this subject.

Postpartum AI was significantly associated with duration of stages one and two ≥ eight hours in the study. Most studies, that include duration of labor, have primarily assessed the duration of stage two [9,11,21]. A systematic review determining the risk factors of postpartum AI [12] did not find any association between AI and total duration of labor. The duration of stages one and two in the present study was defined as time from full cervical effacement until delivery and could be considered an inaccurate variable, as the examination and evaluation of the cervical status during labor can be difficult. Also, some women might have come to the labor ward after the beginning of stage one. Thus, this result should be interpreted with caution.

AI one year after delivery was significantly associated with lateral birth position in univariate analysis, but not in multivariate analysis. It could be speculated that it may be more difficult for the health care personnel to protect perineum in this position. No other similar studies reporting on the association between birth position and postpartum AI was found. However, a Swedish study from 2015 found that lateral birth position had a small protective effect against OASIS compared to sitting position in nulliparous [30]. Thus, the association between birth position and anal incontinence remains unclear.

The authors consider it a strength that the study was designed as a prospective cohort study allowing an assessment of pre-existing and perinatal factors affecting the prevalence of AI one year after vaginal delivery. Women who had AI before pregnancy and women with cesarean delivery were excluded from the final study group. The focus of the current analyses has been on associations and not causation due to the observational design of the study. It has been indicated that questions regarding AI tend to have low response rates due to the sensitive information [31]. The response rate in this study, however, is comparable or better than that of similar studies at baseline and follow up one year after delivery [3,18,21].

Albeit, the study had some limitations. AI was defined as any episode of either flatus or fecal incontinence. At baseline the questions about AI referred to symptoms during pregnancy and the questionnaire one year later addressed the symptoms during the preceding three months. Thus, the study relies upon maternal recall of events and recall bias might potentially have reduced the reporting of AI symptoms, especially in the first questionnaire. On the other hand, the liberal definition of the symptom AI could lead to a high prevalence and may have introduced confounders. Bother score and frequency of AI symptoms were not calculated in the present study, because the registration of the severity of AI was outside the scope of this study. Also, the questionnaire was not compared with a current standard like the questionnaire from St. Marks's Hospital [32]. This can make it more difficult to compare the present study with similar studies. However, the modified questionnaire was tested and validated and had a good test-retest reliability. Small numbers of events were observed for some variables with small differences between the two groups, and the study sample size may have been too small to demonstrate important differences. Finally, it was a weakness that OASIS were not diagnosed by imaging techniques.

This study does not comprise instrumental deliveries with forceps because these are rarely used in Denmark. Hence, it can be difficult to apply the results to countries where forceps are used in greater extent. Forceps deliveries tend to be associated with altered continence, OASIS and vaginal trauma [16,33,34].

The clinical implications of this study are that every effort should be used to prevent OASIS and there should be focus on prolonged duration of stages 1 and 2. Women with AI during pregnancy should be offered follow up and pelvic floor exercises after delivery. Future studies are needed to examine issues like prevention of OASIS, pelvic floor exercises during pregnancy, perineal support, prolonged duration of stages 1 and 2 and maternal position during labor.

In this population of Danish primiparous women without AI before the pregnancy, the study found that AI one year after delivery was significantly associated with AI during pregnancy, OASIS, duration of stage one and two ≥ eight hours and head circumference ≥ 38 cm. Thus, the study identified risk factors that are either amenable to modification or useful to recognize women at higher risk of AI after vaginal delivery.

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Disclosure

The authors report no conflict of interest.

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