OBSTETRICS

Modifiable risk factors of obstetric anal sphincter injury in primiparous women: a population–based cohort study

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OBJECTIVE: To determine modifiable risk factors and incidence of obstetric anal sphincter injury (OASIS) in primiparous women.

STUDY DESIGN: We performed a population-based retrospective cohort study, using data from the Danish Medical Birth Registry. The population consisted of primiparous women with a vaginal delivery in the time period 2000-2010. Univariable and multivariable logistic regressions were used to determine risk factors of OASIS. Main outcome measures were incidence of OASIS in first vaginal delivery, odds ratios for possible risk factors: age, body mass index, birthweight, head circumference, gestational age, presentation, induction of labor, oxytocin augmentation, epidural, mediolateral episiotomy, vacuum extraction, forceps, shoulder dystocia, and year of delivery.

RESULTS: Of 214,256 primiparous women with a vaginal delivery, 13,907 (6.5%; 95% confidence interval [CI] 6.4–6.6%) experienced an OASIS. The incidence of OASIS increased in the time period (adjusted odds ratio [aOR], 1.02; 95% CI, 1.02–1.03; $P < .0001$, per year). We found a protective effect of epidural analgesia (aOR, 0.84; 95% CI, 0.81–0.88; $P = .0001$). Vacuum extraction without episiotomy was a significant risk factor of OASIS (aOR, 2.99; 95% CI, 2.86–3.12; $P < .0001$), and episiotomy was protective in vacuum-assisted deliveries compared with vacuum-assisted deliveries without episiotomy (aOR, 0.60; 95% CI, 0.56–0.65; $P < .0001$). Birthweight was found to be an important nonmodifiable risk factor (aOR, 2.76; 95% CI, 2.62–2.90; $P < .0001$).

CONCLUSION: Epidural analgesia in itself was protective against OASIS. Vacuum extraction increased the risk of OASIS, although mediolateral episiotomy was protective when applied in deliveries assisted by vacuum extraction.

Key words: anal sphincter rupture, incidence, risk factors

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Obstetric anal sphincter injury (OASIS) is a serious complication to vaginal delivery and is the leading cause of anal incontinence (involuntary loss of flatus, liquid or solid stool) in women.[1-3] Anal incontinence at long-term follow up has been reported in up to 57% of women with OASIS.[3] The incidence of OASIS in the Nordic countries has been increasing,[4] therefore, it is desirable to identify possible modifiable risk factors of OASIS in order to prevent OASIS and the possible consequences. Previous reports have identified several important risk factors of OASIS such as primiparity,[5-17] excessive birthweight,[5-13,15,16,18,19] vacuum extraction[5-9,11-13,16,18,19] and forceps,[5-8,12,13,16,18,19] whereas mediolateral episiotomy and epidural analgesia has been reported with conflicting effects.

The use of mediolateral episiotomy in the Nordic countries is restricted since liberal use has been reported to cause more perineal trauma, suturing, and healing complications.[20] Median episiotomy has been abandoned because of the increased risk of OASIS.[5,8,14,18,19] Mediolateral episiotomy has previously been reported as a risk factor,[8,21] a protective factor,[5,7,9,21-23] and as an insignificant factor.[6,10,12,16] Some studies have found that mediolateral episiotomy is protective against OASIS if vacuum extraction is used.[6,23] The effect of epidural has been reported to be protective,[19,22] insignificant,[6,10,12,16,21] or even a risk factor[13,22] in different studies and populations.

The aim of the study was to identify modifiable risk factors and incidence of OASIS in a large population of primiparous women.

Materials and Methods

We performed a population-based cohort study where data were retrieved from the Danish Medical Birth Registry (MBR). Primiparous women with a vaginal singleton delivery at term (fully 37 weeks of gestation) in the time period 2000-2010 (n = 214,256) were included. An OASIS was classified according to the Royal College of Obstetricians and Gynaecologists classification.[24] A third-degree OASIS was defined as a partial or complete disruption of the anal sphincter muscles, which may involve only the external anal sphincter or both the external anal sphincter and the internal anal sphincter. A fourth-degree OASIS was defined as a disruption of

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the anal sphincter muscles in combination with a tear of the rectal mucosa. OASIS was identified by the *International Classification of Diseases* 10 codes O70.2 and O70.3, which have been validated in the Danish MBR by comparison with medical records.[25]

We had information on maternal age, maternal prepregnant body mass index (BMI) (reported from 2004), calendar year of delivery, grade of OASIS, birthweight, head circumference, gestational age, presentation, induction of labor, oxytocin augmentation, epidural, mediolateral episiotomy, vacuum extraction, forceps, and shoulder dystocia. All these factors were regarded as potential risk factors of OASIS. We considered induction of labor, oxytocin augmentation, epidural, mediolateral episiotomy, vacuum extraction, and forceps as modifiable factors.

Univariable and multivariable logistic regression analyses were performed to determine the association between risk factors and OASIS. In the multivariable logistic regression analysis, BMI was excluded since it was not significant and a large proportion of the values were missing (40.9%). Odds ratios (ORs) and the corresponding 95% confidence intervals (95% CIs) were calculated. The continuous risk factors were included linearly. We investigated the interaction between episiotomy and vacuum extraction as well as between calendar year and the possible modifiable risk factors. Tests and *P* values were based on the maximum likelihood principle. *P* values less than .05 were considered significant. Statistical analyses were performed using SAS version 9.2 (SAS Institute, Cary, NC).

The study was approved by the Danish Data Protection Agency (no. 2012-41-0362).

TABLE 1
Demographic data

Potential risk factors	Anal sphincter injury, n = 13,907	No anal sphincter injury, n = 200,349
Maternal factors		
Maternal age, y; median (IQR)	28 (26–31)	28 (25–31)
Prepregnant BMI, kg/m^2[a]; median (IQR)	22.8 (20.8–25.7)	22.6 (20.6–25.4)
Calendar year of delivery, median (IQR)	2005 (2002–2008)	2005 (2002–2008)
Fetal factors		
Birthweight, g[b]; median (IQR)	3700 (3400–4000)	3460 (3170–3760)
Head circumference, cm[c]; median (IQR)	35 (34–36)	35 (34–36)
Gestational age, d; median (IQR)	283 (278–289)	282 (275–287)
Presentation[d]		
Occiput anterior	12,667 (91.5%)	188,636 (94.5%)
Occiput posterior	667 (4.8%)	5583 (2.8%)
Breech presentation	17 (0.1%)	744 (0.4%)
Other	498 (3.4%)	4620 (2.3%)
Obstetric factors		
Induction of labor	1998 (14.4%)	25,107 (12.5%)
Oxytocin augmentation[e]	5599 (40.3%)	60,691 (30.3%)
Epidural	3356 (24.1%)	44,193 (22.1%)
Episiotomy	2281 (16.4%)	30,427 (15.2%)
Vacuum extraction	5323 (38.3%)	33,665 (16.8%)
Forceps	43 (0.3%)	238 (0.1%)
Shoulder dystocia	285 (2.0%)	1310 (0.6%)

Distribution of potential risk factors of OASIS in primiparous women with vaginal delivery (n = 214,256).

BMI, body mass index; *IQR*, interquartile range.

[a] BMI was reported in 126,732 women; [b] Birthweight was reported in 213,501 infants; [c] Head circumference was reported in 210,048 infants; [d] Presentation was reported in 213,432 deliveries; [e] Oxytocin augmentation was reported in 235,566 deliveries.

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RESULTS

Of 214,256 women with a first vaginal delivery in 2000-2010, 13,907 (6.5%; 95% CI, 6.4–6.6%) had an OASIS. Of these, 11.5% (n = 1599) had a fourth degree OASIS. Table 1 shows distribution of the potential risk factors in women with and without OASIS. Univariable analyses (Table 2) showed that all factors included in the analysis were significant risk factors, except breech presentation, which was a significant protective factor.

We found an interaction between vacuum extraction and mediolateral episiotomy ($P < .0001$). In 18.2% (n = 38,988) the delivery was assisted by vacuum extraction. In vacuum-assisted deliveries, 28.7% (n = 11.178) had a mediolateral episiotomy. If vacuum extraction was used without episiotomy (n = 27,810), 14.9 % had an OASIS (n = 4143; 95% CI, 14.5–15.3%), whereas the risk of OASIS if vacuum extraction was used in combination with mediolateral episiotomy was 10.6% (n = 1180; 95% CI, 10.0–11.1%). The interaction between vacuum extraction and mediolateral episiotomy shows, that when vacuum extraction is used, mediolateral episiotomy is protective against OASIS (adjusted odds ratio [aOR], 0.60; 95%