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Anal sphincter tears: prospective study of obstetric risk factors

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Objective To evaluate intrapartum risk factors for anal sphincter tear.

Design A prospective observational study.

Setting Delivery unit at the University Hospital in Göteborg, Sweden.

Participants 2883 consecutive women delivered vaginally during the period between 1995 and 1997. Information was obtained from patient records and from especially designed protocols which were completed during and after childbirth.

Main outcome measures Anal sphincter (third and fourth degree) tear.

Results Anal sphincter tear occurred in 95 of 2883 women (3·3%). Univariate analysis demonstrated that the risk of anal sphincter tear was increased by nulliparity, high infant weight, lack of manual perineal protection, deficient visualisation of perineum, severe perineal oedema, long duration of delivery and especially protracted second phase and bear down, use of oxytocin, episiotomy, vacuum extraction and epidural anaesthesia. After analysis with stepwise logistic regression, reported as odds ratio, 95% confidence interval, the following factors remained independently associated with anal sphincter tear: slight perineal oedema (0·40, 0·26–0·64); manual perineal protection (0·49, 0·28–0·86); short duration of bear down (0·47, 0·24–0·91); no visualisation of perineum (2·77, 1·36–5·63); parity (0·59, 0·40–0·89); and high infant weight (2·02, 1·30–3·16). Analysis of variance showed that manual perineal protection had a stronger influence on lowering the frequency, and lack of visualisation of perineum and infant weight had a stronger influence on raising the frequency, of anal sphincter tears in nulliparous compared with parous women.

Conclusions Perineal oedema, poor ocular surveillance of perineum, deficient perineal protection during delivery, protracted final phase of the second stage, parity and high infant weight all constitute independent risk factors for anal sphincter tear. Such information is essential in order to reduce perineal trauma during childbirth.

INTRODUCTION

Vaginal delivery is the major cause of anal incontinence in women[1,2]. Recent studies using anal endosonography have revealed occult sphincter injury after vaginal delivery even in the absence of sphincter tears diagnosed at birth[3]. However, women suffering from overt third or fourth degree injury are at particular risk and even if these tears are recognised and repaired at birth the outcome is often unfavourable[2,4–6]. Approximately 30%–50% of these women suffer from chronic anal incontinence, dyspareunia, faecal urgency or perineal pain[4–7]. Therefore, attention should be focused primarily on improvements of obstetric practice to minimise perineal trauma and, subsequently, reduce the number of severe sphincter lacerations[1,2].

The incidence of sphincter injury is estimated to 0·5%–2·5% in centres where mediolateral episiotomy is practised[2]. In Sweden we have experienced a gradual increase of the incidence of these injuries from 0·7% in 1982[4], to 2·9% in 1996 (Official Statistics of Sweden, Medical Birth Registry, Stockholm, Sweden). Such a marked increase of sphincter tears cannot be attributed to altered frequency of previously recognised risk factors[5,8–14] as no major change has occurred with regard to instrumental delivery, high birthweight, nulliparity, episiotomy, epidural anaesthesia, shoulder dystocia or fetal presentation. There has been a major shift, however, in obstetric practice where alternative birth positions predominate, the woman is encouraged to choose her own

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way of delivery, and manual perineal protection is not practised to the same extent as before. Our hypothesis was that these modifications in obstetric practice, including reduced ocular surveillance of perineum, lack of manual perineal protection, complicated birth positions and deficient support and assistance at delivery, are associated with an increased risk of sphincter lacerations.

Most previous studies are retrospective and detailed information about obstetrical practice, progress of delivery or birth position is often lacking. In this study we report 2883 consecutive deliveries which were followed prospectively with meticulous registration of the process of labour. The aim was to find novel risk factors and based on that information, ultimately, strategies for prevention of severe sphincter tears.

METHODS

Delivery was assisted by midwives under ordinary circumstances, instrumental deliveries were all performed by obstetricians, and in case of a perineal laceration in proximity to the anal sphincter the midwives consulted the obstetrician for assessment of the extent of injury. Rupture of the anal sphincter (partial or complete) was diagnosed as third degree and a complete tear combined with laceration of the anal canal or rectum as a fourth degree tear, but in our statistical analysis, no distinction was made between third and fourth degree lacerations. The study was not started until all midwives/obstetricians at the unit were well informed.

The following information was obtained from records and the especially designed protocols: age; parity; time passed after previous birth; previous episiotomy; previous sphincter tear; time of first stage of labour (start of delivery defined as cervix dilated ≥ 3 cm); time of second stage of labour; time of bear down; time from point when the presenting part was visible during contraction to delivery; time from presenting part visible during and between contractions until delivery; number of uterine contractions from passage of the fetal head through perineum to delivery of the infant; delivery position (there were three pre-determined positions: lateral, semi-recumbent or kneeling); use of manual perineal protection, ocular surveillance of perineum (excellent/partial/no ocular surveillance); degree of perineal oedema (slight/moderate/severe); manual assistance during delivery of the fetal head and/or shoulders; year when the midwife graduated; professional experience (counted in years) of the midwife; use of vacuum extraction/forceps; expeditious delivery due to fear of fetal asphyxia; the woman's ability to relax between contractions (slight/acceptable/no relaxation); use of oxytocin during first stage and/or second stage; mode of anaesthesia or other methods to relieve pain (epidural, nitrous oxide, acupuncture, pudendal blockade, local anaesthesia and/or warm towels placed towards perineum), vaginal/perineal tear including third/fourth degree laceration; episiotomy; indication for episiotomy; suture technique; fetal presentation; the infants weight and head circumference.

Data analysis

The association between the above factors and the occurrence of anal sphincter tears was tested with univariate logistic regression. Stepwise logistic regression analysis was used to suggest the predictor variables, which consisted of apparently independent and significant predictors of sphincter tears. Odds ratios with 95% confidence intervals were calculated. All factors were processed by stepwise logistic regression analysis, including those factors that were not significantly associated with outcome in the univariate model. Analysis of variance was used to compare outcomes between nulliparous and multiparous women. Statistical software (SAS, Version 6·12) was used for the analysis. Differences between women who were included and those who were not included were analysed using Wilcoxon rank-sum test, and proportions were compared using Fisher's exact test.

RESULTS

All women ($n = 3723$) who planned for a vaginal delivery at Sahlgrenska University Hospital in Göteborg were recruited prospectively between 1995 and 1997, including multiple births and breech deliveries. A total of 2883 women were admitted corresponding to 77·4% of all those admitted during the time period. Those who were not included tended to be women for whom detailed information was not completed by the hospital unit.

No significant differences were found between women recruited and not recruited concerning: maternal age, gestational age, duration of delivery, use of oxytocin, occurrence of sphincter tears and birthweight. Parity was lower and the rate of episiotomy higher in women not included, but the differences were small. The use of vacuum extraction was twice as high in the group not included, compared with the study group (Table 1). However, the rate of anal sphincter tear in those delivered by vacuum was similar in those who were included (10·6%) and not included (9·1%), suggesting that not only vacuum deliveries with a low risk of sphincter laceration were selected to the study group.

The obstetric characteristics of the cases included are given in Table 2. Anal sphincter tear occurred in 95/2883 women (3·3%), including 88 cases of third degree and seven of fourth degree tear. There was no significant association between sphincter tears and the following variables: age of woman; number of contractions between passage of the head and delivery of the

Table 1. Comparison between women included in the study and those who were excluded. Values are given as % or mean (SD), unless otherwise indicated.

	Women		
	Included (n = 2883)	Excluded (n = 840)	P
Gestational age at birth (weeks)	39·3 (2·2)	39·2 (2·1)	0·32
Maternal age (years)	30·2 (4·9)	30·3 (5·2)	0·64
Parity	1·8 (1·0)	1·7 (0·9)	0·02
Birthweight (g)	3519 (546)	3483 (596)	0·41
Duration of delivery (hours)	6·6 (4·0)	6·8 (4·0)	0·20
Use of oxytocin during first stage of delivery	28·2	30·6	0·19
Use of oxytocin during second stage of delivery	45·3	47·5	0·27
Rate of third/fourth degree tears	3·3	2·5	0·26
Rate of episiotomy	11·2	14·4	0·01
Rate of vacuum extraction	5·5	11·8	0·001

infant; manual assistance for delivery of shoulders; professional experience of the midwife; expeditious delivery due to suspected asphyxia; the woman's ability to relax between contractions; fetal presentation; and head circumference. Most women (90·2%) were delivered in the three pre-determined positions, but birth position did not appear to be a risk factor (Table 3).

The univariate analysis (Table 3) demonstrated that the estimated risk of anal sphincter tear was increased by nulliparity, long duration of the first stage of labour and especially of the second stage, bearing down or the very last phase of the pushing phase. Risk of tearing was increased by lack of manual perineal protection, no visualisation of perineum, severe perineal oedema, vacuum extraction, use of oxytocin, epidural anaesthesia, episiotomy and high infant weight (Table 3). All factors were processed by stepwise logistic regression analysis, including those factors that were not significantly associated with outcome in the univariate model (Table 4). Slight perineal oedema, short duration of bearing down, manual perineal protection, and parity all reduced the risk of sphincter tear whereas no visualisation of perineum and high infant birthweight independently increased the risk.

Table 4 shows the comparison in outcomes between nulliparous and multiparous women. Significant interactions were found between anal sphincter tears and no visualisation of perineum, manual perineal protection and birthweight. Manual perineal protection had a stronger influence on lowering the frequency of anal sphincter tears in nulliparous women. No visualisation of perineum and high birthweight had a stronger influence of raising the frequency of anal sphincter tears in nulliparous than in parous women.

Table 2. Obstetric characteristics of women included in the study. Values are given as n (%).

	Nulliparous (n = 1296)	Parous (n = 1587)
Vacuum extraction	123 (9·5)	36 (2·3)
Forceps delivery	4 (0·3)	1
Epidural anaesthesia	561 (43·3)	211 (13·3)
Episiotomy		
Mediolateral	215 (16·6)	85 (5·3)
Midline	19 (1·5)	4 (0·2)
Fetal presentation		
Vertex	1232 (95·0)	1504 (94·8)
Breech	21 (1·6)	25 (1·6)
Occiput posterior	43 (3·3)	58 (3·6)
Parturient position		
Semi-recumbent	800 (61·7)	720 (45·4)
Kneeling	143 (11·0)	253 (19·5)
Lateral	278 (21·4)	423 (26·6)
Other	74 (5·7)	191 (12·0)
Multiple birth	26 (2·0)	24 (1·5)

DISCUSSION

The prospective design of the study was a prerequisite in order to obtain critical information concerning mode of delivery and the way labour was assisted. Such data are usually not possible to retrieve from standard birth records and much effort was put into the preparation of the protocols with active participation of the staff to ensure high quality of the acquired information. The aim was to recruit all women admitted consecutively during the study period to avoid selection bias, but only 77·4% of those admitted were entered into the study due to shortage of staff during busy hours and the cumbersome nature of the study protocols. Analysis of those excluded from the study showed that this group was comparable to the study group with regard to most important characteristics. There was, however, a somewhat higher frequency of vacuum deliveries among the

Table 3. Univariate analyses of the association between intrapartum variables and sphincter tear. Values are given as n/n_{Total} (%), unless otherwise indicated.

	Sphincter tear incidence	OR (95% CI)
Parity		
≥ 2 previous deliveries	4/489 (0·8)	1·0
1 previous delivery	25/1098 (2·3)	2·38 (0·98–8·16)
Nulliparity	66/1296 (5·1)	6·51 (2·36–17·95)
Infant weight (kg)		
< 3000	6/415 (1·4)	1·0
3000–4000	66/1965 (3·4)	2·37 (1·02–5·50)
> 4000	23/503 (4·6)	3·27 (1·32–8·10)
Duration of first stage of labour		
< 3 h	14/750 (1·9)	1·0
3 h < 6 h	36/1218 (3·0)	1·60 (0·86–2·99)
6 h < 9 h	24/549 (4·4)	2·40 (1·23–4·69)
9 h < 12 h	14/257 (5·5)	3·03 (1·42–6·44)
≥ 12 h	7/109 (6·4)	3·61 (1·42–9·15)
Duration of second stage of labour		
< 30 min	16/1358 (1·2)	1·0
30–59 min	25/595 (4·2)	3·68 (1·95–6·94)
60–89 min	20/343 (5·8)	5·19 (2·66–10·13)
≥ 90 min	34/587 (5·8)	5·16 (2·82–9·42)
Duration of bear down		
< 10 min	5/535 (0·9)	1·0
10–19 min	10/678 (1·5)	1·59 (0·54–4·67)
20–29 min	9/446 (2·0)	2·18 (0·73–6·56)
30–39 min	18/298 (6·0)	6·81 (2·50–18·55)
40–49 min	10/229 (4·4)	4·84 (1·64–14·32)
50–59 min	13/203 (6·4)	7·25 (2·55–20·61)
≥ 60 min	30/494 (6·1)	6·85 (2·64–17·81)
Time from presenting part visible in vulva during contraction to delivery		
< 5 min	5/417 (1·2)	1·0
5–9 min	13/623 (2·1)	1·76 (0·62–4·96)
10–14 min	12/497 (2·4)	2·04 (0·71–5·84)
15–19 min	11/287 (3·8)	3·28 (1·13–9·56)
20–24 min	10/271 (3·7)	3·16 (1·07–9·34)
≥ 25 min	40/736 (5·4)	4·74 (1·84–12·10)
Manual perineal protection		
Yes	71/2569 (2·8)	1·0
No	24/314 (7·7)	2·91 (1·80–4·70)
Visualisation of perineum during last phase of bear down		
Excellent	52/2010 (2·6)	1·0
Partial	27/745 (3·6)	1·37 (0·86–2·20)
No visualisation	14/118 (11·9)	4·91 (2·64–9·13)
Perineal oedema		
Slight	39/2110 (1·9)	1·0
Moderate	40/623 (6·4)	3·57 (2·28–5·58)
Severe	15/145 (10·3)	6·00 (3·23–11·14)
Mediolateral episiotomy		
No	74/2564 (2·9)	1·0
Yes	21/323 (6·5)	2·34 (1·42–3·85)
Vacuum extraction		
No	78/2724 (2·9)	1·0
Yes	17/159 (10·7)	4·06 (2·34–7·05)
Use of oxytocin during first stage		
No	53/2069 (2·6)	1·0
Yes	42/814 (5·2)	2·07 (1·37–3·13)
Use of oxytocin during second stage		
No	31/1576 (2·0)	1·0
Yes	64/1307 (4·9)	2·57 (1·66–3·96)
Epidural anaesthesia		
No	53/2111 (2·5)	1·0
Yes	42/772 (5·4)	2·23 (1·48–3·38)
Fetal presentation		
Normal	89/2735 (3·3)	1·0
Occiput posterior	6/102 (6·1)	1·88 (0·80–4·40)
Breech	0/46 (0)	–

Table 4. Risk factors significantly associated with the occurrence of anal sphincter tear as analysed with logistic multiple regression (columns 2 and 3). The difference between nulliparous and multiparous women was analysed with analysis of variance and expressed as main effect (difference in the level of the association (Main)) and interaction effect (difference in the slope of the interaction (Inter)) in columns 4–7.

	OR (95% CI)	P	Main	P	Inter	P
No visualisation of perineum	2·77 (1·36–5·63)	0·0001	–0·011	0·19	–0·134	0·0001
Slight perineal oedema	0·40 (0·26–0·64)	0·0001	–0·038	0·006	0·029	0·057
Pushing time < 30 min	0·47 (0·24–0·91)	0·0001	–0·018	0·08	0·004	0·82
Parity	0·59 (0·40–0·89)	0·0156	—	—	—	—
Manual perineal protection	0·49 (0·28–0·86)	0·0105	–0·056	0·007	0·044	0·039
Infant weight (kg)	2·02 (1·30–3·16)	0·0126	0·079	0·07	–0·028	0·024

women who were excluded which may have constituted significant bias, as vacuum deliveries during busy hours (not included) may be associated with a higher risk of sphincter tear than vacuum deliveries that took place during less busy circumstances (included). A similar occurrence of sphincter tear in both groups suggests, however, that the study group was likely to be representative.

Some of the risk factors presently found to be associated with sphincter tear confirm previous reports: high birthweight[5,14]; episiotomy[11,15,16]; vacuum extraction[9,11,17]; epidural anaesthesia[14]; and use of oxytocin[11]. However, stepwise logistic regression analysis revealed that only high birthweight remained an independent risk factor. Surprisingly, vacuum extraction was not an independent risk factor[11]. A comparison showed that vacuum deliveries differed from nonvacuum deliveries in the sense that duration of the first stage, second stage and bearing down were longer, and manual perineal protection was not provided as often, suggesting that vacuum delivery *per se* does not contribute as a cause of sphincter tear. This agrees with recent reports[5,13,14,17], implying that modification of obstetric practice may indeed reduce the risks of the vacuum procedure. The use of forceps was too low in our population to allow analysis of its importance as a risk factor of anal sphincter tear.

Lack of manual protection or suboptimal visualisation of the perineum and perineal oedema were also significantly associated with the occurrence of anal sphincter tears in both the univariate and multiple logistic regression analysis. The duration of the second stage of labour has previously been reported to be unrelated to sphincter tears[11,18,19]. However, in the paper by Bek and Laurberg[11] there was an association with an unadjusted odds ratio of 4·06 (2·5–6·6) which was adjusted to 1·6 (0·9–2·3) in the multiple logistic regression analysis. This is in agreement with our data where only the association between duration of bearing down and sphincter tear remained significant in the logistic regression model (Table 4), whereas the duration the entire second phase was not an independent factor of importance. It is also reasonable to assume that the very last phase of second stage is most critical with respect to perineal trauma, and our study is the first to distinguish the different sub-phases of the second stage.

It is interesting to note that the risk of sphincter tear increased after a phase of pushing exceeding 30 min (Tables 3 and 4). The study does not provide information on whether the risks are reduced by earlier delivery by use of oxytocin at that point or instrumental delivery.

In order to allow analysis of the importance of delivery position, more than 90% of women gave birth in one of three positions. We did not, however, find any correlation between delivery position and outcome. According to a recent meta-analysis of four studies[20], the risk of sphincter tear was lower in upright, compared with recumbent position, during second stage of labour. In a previous study[21] we found a markedly higher occurrence of sphincter lacerations in upright standing, compared with upright sitting delivery positions. Further studies are needed to clarify the impact of delivery positions on perineal lacerations.

There are data to suggest that nulliparous women are at particular risk of sphincter injury during delivery (high risk of third/fourth degree tears and occult sphincter injury) whereas the risk of additional injury during subsequent deliveries may be rather limited[3,22]. We used analysis of variance to assess the comparative effects of risk factors in parous and nulliparous women in the present study. A stronger influence of perineal protection, visualisation of perineum and high birthweight on the frequency of sphincter tear in nulliparous compared with parous women was found. Apparently, high birthweight is not as important a risk factor in parous women, which agrees with a recent report[14] which also used a model of stepwise logistic regression.

Our data also suggest that visualisation and manual protection of perineum are important in preventing sphincter injury, especially in nulliparous women. Two decades ago this information would have been considered as common sense to most practitioners and midwives in Scandinavia. There is, however, so far no evidence for this assumption, and according to policies dictated by

the World Health Organisation[23] and the Cochrane Pregnancy and Childbirth database[24], manual protection of the perineum is not specifically recommended.

Unfortunately, the present data do not provide information on how perineal guarding should be performed in practical terms. In a recent uncontrolled study[25], the deliveries at the University Hospital in Turku, Finland were compared with those at the University Hospital in Malmö, Sweden. In Turku the perineum was actively protected by use of Ritgens manoeuvre, whereas in Malmö a more passive approach was practised. The frequency of anal sphincter tear was 13 times higher in Malmö than in Turku. A recently published randomised study[26] by McCandlish compared the approach of 'hands-on' with 'hands-poised' during delivery of the head. No difference with regard to sphincter tear was noted. It is important to point out, however, that hands-on was practised also in the hands-poised group when considered necessary. Therefore, that study is not in contradiction with our study demonstrating that no visualisation of perineum or complete lack of perineal protection was associated with an increased risk of sphincter tear. Further randomised controlled trials are needed to find out the optimal way of protecting the perineum during childbirth.

Perineal oedema, poor ocular surveillance of perineum/lack of manual perineal protection, protracted final phase of second stage and high infant weight all constituted independent risk factors of sphincter tears. Such information may be useful for finding novel strategies for the prevention of perineal trauma during childbirth.

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