

Chapter 4

Risk Factors for Perineal Trauma

Jan Willem de Leeuw, Sari Räisänen, and Katariina Laine

Abstract Trauma to the perineum may inevitably occur during vaginal delivery. Smaller perineal trauma, without involvement of the anal sphincter muscles, usually has no long term sequelae. Ruptures of the anal sphincters, however, may predispose to the development of anal incontinence in later life and should therefore be avoided.

Knowledge of risk factors that may increase the risk of anal sphincter injuries (OASIS) may help to reduce the number of these injuries, but unfortunately most of these factors are, non-modifiable. Examples of these factors are nulliparity, duration of second stage of labour, high fetal birth weight, abnormal fetal presentation, previous OASIS or caesarean section.

The only direct modifiable risk factor for OASIS during delivery is the choice of instrument in case of operative vaginal delivery. In this, the use of vacuum extraction carries a significantly lower risk than the use of a forceps.

The importance of each risk factor is not solely dependent on the associated risk of trauma but depends also on the prevalence of each factor. For instance, nulliparity is probably the most common risk factor for OASIS, hence, a major risk factor for complex perineal trauma. However, it is important to realise that the vast majority of OASIS occur in women with a priori a relatively low risk. This implies that

J.W. de Leeuw (✉)
Ikazia Hospital, Rotterdam, The Netherlands
e-mail: jw.de.leeuw@ikazia.nl

S. Räisänen
University of Helsinki, Helsinki, Finland
e-mail: shraisanen@gmail.com

K. Laine
Oslo University Hospital, Ullevål, Norway
Department of Obstetrics, University of Oslo, Oslo, Norway
e-mail: kattiksen@yahoo.no

it is important that during every delivery the supervising obstetrician or midwife offers risk reducing interventions to the delivering woman, as will be explained in Chap. 5.

Keywords Parity • Vacuum extraction • Forceps delivery • Anal sphincter injury

Introduction

It is inevitable that during vaginal delivery trauma to the perineum may occur.

Most commonly the extent of perineal trauma is classified according to the RCOG classification suggested by Sultan [1] (Table 4.1).

In contrast to third and fourth degree ruptures [collectively known as Obstetric Anal Sphincter Injuries (OASIS)], first and second degree perineal tears are not considered to be a cause of long term sequelae as faecal incontinence.

OASIS is the most important risk factor for female anal incontinence. Prevention of high-grade complex perineal trauma is therefore of paramount importance.

Undoubtedly, recognition of risk factors for OASIS is the first step in its prevention. Based on this recognition, it is of paramount importance that birth attendants should be aware of the presence of such risk factors in an individual woman and take these into consideration when making decisions in an attempt to prevent or at least mitigate their background risk for OASIS. Unfortunately, many important risk factors are non-modifiable or avoidable, e.g. first vaginal birth. Moreover, the majority of complex perineal trauma happens to women considered to be “low risk”. Therefore, it is essential that every supervising obstetrician or midwife is able to undertake measures to prevent OASIS even in women considered to be at low risk for this type of trauma.

It is important to recognise that establishment of the currently known risk factors for OASIS is based on large population studies that have the power to discriminate between the associations of different risk factors with regard to the relatively uncommon outcome of OASIS.

Table 4.1 Classification of perineal ruptures according to [1]

Degree of perineal rupture	
First degree	Injury to perineal skin and/or vaginal mucosa
Second degree	Injury to perineum involving perineal muscles but not involving the anal sphincter
Third-degree	Injury to perineum involving the anal sphincter complex
Grade 3a	Less than 50 % of external anal sphincter thickness torn
Grade 3b	More than 50 % of external anal sphincter thickness torn
Grade 3c	Both external and internal anal sphincter torn
Fourth-degree	Injury to perineum involving the complete thickness of the anal sphincter complex and anorectal mucosa

In this chapter we present the most important risk factors for the occurrence of serious perineal trauma.

Parity

In virtually all studies concerning risk factors for serious perineal trauma, nulliparity is identified as one of the major risk factor for OASIS.

All these studies used multivariate analysis for the calculation of the individual risk factors with correction for many other obstetrical variables as fetal birth weight, mode of delivery, fetal position or duration of second stage of labour.

A large population based study using data from Californian hospitals with more than two million deliveries in the database showed that multiparous women had a much lower risk for OASIS compared to nulliparous women [2]. Several European population based studies corroborated the results of this study. In a study from the Netherlands using a national obstetric database containing almost 285,000 deliveries, a more than doubled risk for nulliparous women to sustain OASIS was found, a finding similarly confirmed by a large population based study from Finland [3, 4]. In a Norwegian study describing more than 1.6 million deliveries from 1967 to 2004, a much higher risk for nulliparous women delivering vaginally compared to multiparous women was described and this risk declined with each following delivery up to the sixth vaginal delivery [5]. The increased risk for nulliparous women is usually explained by the relative inelasticity of the perineum. It is also possible that with increasing parity, the vaginal outlet may be even wider resulting in decreasing risk for such complex trauma.

It is important to highlight that in the context of parity and perineal trauma it is more accurate to consider 1st vaginal birth rather than nulliparity. This is particularly relevant with the drive towards increasing vaginal birth after caesarean section (VBAC). Women having their 1st VBAC are by definition not nulliparous, nevertheless, they share the same risk profile for perineal trauma as a nulliparous woman aiming for a vaginal birth. Indeed their risk may be even higher due to the potential confounding effect of increasing fetal birth weight with parity (see section “[Previous Delivery by Cesarean Section](#)”).

Fetal Birth Weight

Fetal birth weight is associated with the risk for OASIS in almost every study on this subject. Several studies have studied fetal birth weight as a dichotomous variable with a fixed cut-off level.

An American study showed that a fetal birth weight of more than 4000 g was associated with a more than doubled risk for sphincter lesions during delivery (OR 2.17, 95 % CI: 2.07–2.27) [2].

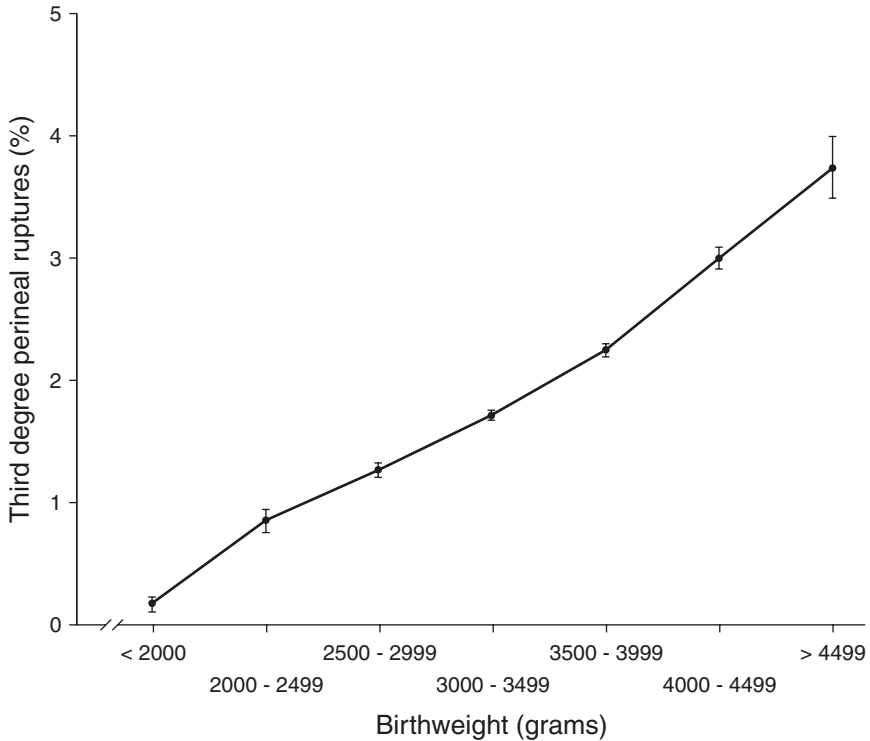


Fig. 4.1 Risk of third degree perineal ruptures per 500 g birth weight (Reprinted from de Leeuw et al. [3] with permission from John Wiley and Sons, Inc.)

In the Norwegian population based study, fetal birth weight was studied with a subdivision of the cohort in groups of 500 g increment of the fetal birth weight with the group of women delivering babies with birth weights between 3000 and 3499 g serving as the reference group. Birth weights of 2500–2999 g and <2500 g were associated with 50 % and 80 % lower risk for sustaining an OASIS respectively [5]. In contrast, increasing birth weight was associated with a significantly higher risk for OASIS with a more than fourfold increased risk for women delivering a baby with a weight of 4500–4999 g. These results were corroborated by several other European studies. Fetal birthweight showed an almost linear association with the risk of OASIS in a Dutch population based study (Fig. 4.1) [3].

Studies addressing parity as a possible risk factor for nulli- and multiparous women separately found similar results [4, 6]. In all subgroups fetal birthweight appeared to be a stronger risk factor in multiparous women than in nulliparous women. Possibly, the risk associated with parity itself outweighs the risk of fetal birthweight leading to a weaker association of fetal birthweight in nulliparous women.

Almost all other studies on this subject have shown, with varying odds, that fetal birth weight is associated with an increased risk for OASIS. In this, one must bear in mind that all studies have used the actual fetal birthweight, established after delivery.

In daily practice, it will be the challenge to rely on estimated fetal birthweight to make a reliable calculation of the expected risk of OASIS during vaginal delivery.

Mode of Delivery

With regard to the risk of damage of the perineum during birth, the method of delivery is one of the most important issues to address.

To address the risk of the various methods a comparison has to be made between spontaneous vaginal delivery versus operative vaginal delivery, and between the different types of operative vaginal delivery, i.e. vacuum and forceps delivery.

In European population based studies operative vaginal deliveries were associated with an increased risk for OASIS compared to spontaneous vaginal deliveries. The risk for OASIS doubled with the use of vacuum extraction and was fourfold when the baby was delivered with the help of forceps [3, 4].

Studies from other continents showed similar results. Ampt et al. described a population based study from New South Wales, Australia of more than 500,000 deliveries and showed significantly increased risks for OASIS with vacuum and forceps deliveries in both nulliparous and multiparous women, with forceps deliveries carrying the highest risk [7].

Studies from the United States showed that vacuum extractions and forceps deliveries in the USA are also associated with an increased risk for OASIS. However, in the study of Handa et al. use of the vacuum extraction carried a larger risk for OASIS than forceps delivery [2].

The more recent study from Landy et al. showed results that were comparable to the European studies for women delivering their first baby, but showed a higher risk with the use of vacuum extraction in multiparous women [6].

For a direct comparison between vacuum extraction and forceps delivery in randomised clinical trials with regard to their risk for the occurrence of OASIS, we can rely on the results of the most recent Cochrane review on this subject. This review shows that the risk for OASIS in forceps deliveries is almost 90 % higher than in vacuum extractions (risk ratio 1.89; 95 % CI 1.51–2.37) [8].

Thus, operative vaginal deliveries are associated with an increased risk for OASIS in comparison with spontaneous delivery. In this, forceps delivery most probably carries a higher risk than vacuum delivery. Therefore, if the obstetric situation permits use of either instrument, vacuum extraction should be the preferred.

Duration of the Second Stage of Labour

The association of the duration of the second stage of labour with the occurrence of OASIS can be expressed in different ways.

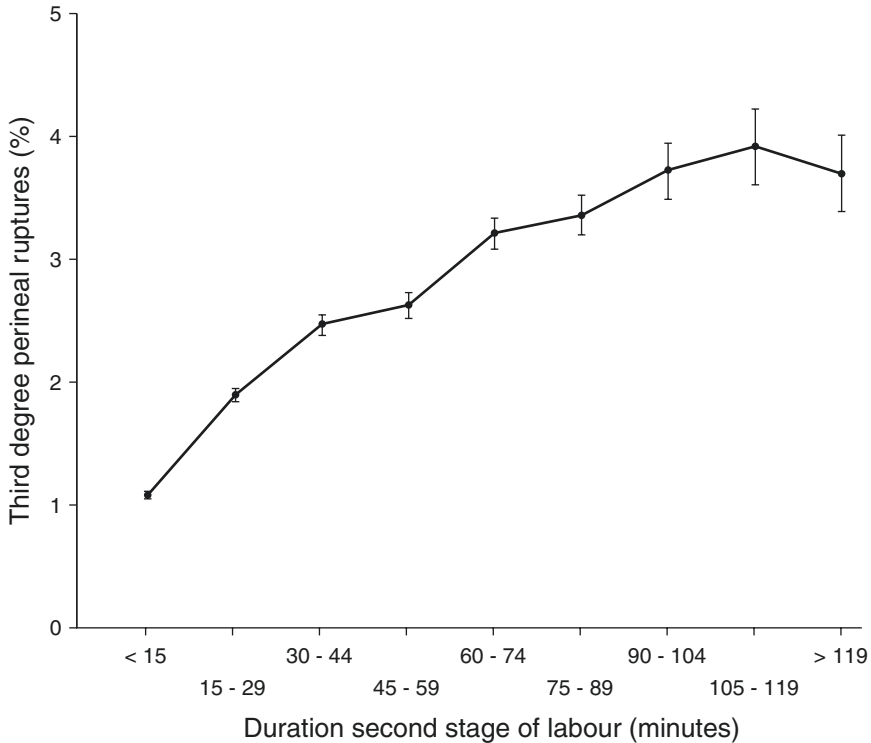


Fig. 4.2 Risk of third degree perineal ruptures per 15 min duration of second stage of labour (Reprinted from de Leeuw et al. [3] with permission from John Wiley and Sons, Inc.)

De Leeuw et al. showed an increase of the risk for OASIS of 12 % with every 15 min of pushing [3]. The actual rate of OASIS per 15 min duration of second stage is shown in Fig. 4.2.

These results were confirmed by the study of Räisänen et al. with an even stronger association [4]. In this study the risk of OASIS was doubled after more than 60 min of active pushing, compared to situations with an active second stage of less than 15 min in nulliparous women. In multiparous women the risk of OASIS showed a sevenfold increase with a second stage of more than 60 min.

Gottvall et al. expressed the association of the risk of OASIS with the length of second stage as a dichotomous variable. A second stage of more than 1 h was associated with a relative increase in risk for OASIS by 50 % [9].

The association of the length of second stage with the occurrence of OASIS needs to be handled with care for several reasons: Firstly, whether the use of upper time limits for the duration of second stage will lower the risk of anal sphincter damage in daily obstetric practice remains doubtful, as this will lead to an increase in operative vaginal deliveries which may carry an even larger burden for the anal sphincters; Secondly, some of the databases used for population studies do not discriminate between the second stage and the pushing phase; and finally, it is not

always feasible to know the exact time when the second stage starts because this is reliant on when full cervical dilation was diagnosed rather than when it actually happened.

Abnormal Fetal Positions and Presentations

Persistent abnormal fetal position, e.g. occipitoposterior position is associated with a more difficult delivery. Indeed, it is more likely to be associated with a caesarean section or operative vaginal delivery because of an arrest during first or second stage of labour compared to an occipitoanterior position. If the baby is delivered vaginally, abnormal vertex positions appear to be independently associated with OASIS. Baumann et al. reported in their population based study containing more than 40,000 nulliparous women from the state of Schleswig–Holstein in Northern Germany, an almost doubled risk for OASIS in this situation [10]. This increased risk is in line with the results of other studies [3, 4].

This association can be explained by the fact that with occipitoposterior position the head of the baby passes the vaginal introitus deflexed (and hence with wider diameters), causing more stretching of the vaginal introitus.

In only one study the possible association of vaginal breech delivery with the risk of OASIS was addressed where no association was found [3].

Even though abnormal fetal head positions may increase the risk of OASIS, it explains only a small number of all OASIS and deliveries because of its low prevalence [3, 11]. It is therefore in the individual patient a factor to consider, but has only a small contribution to the total number of OASIS.

Maternal Age

Maternal age at delivery may be associated with the risk of OASIS because of changes in the elasticity of perineal tissue throughout life [4]. With advancing age connective tissue may become relatively less elastic which may lead to higher risk for OASIS during vaginal delivery.

Handa et al. showed in their study that women under the age of 18 had a smaller chance to sustain OASIS and that women older than 35 years had a larger chance to sustain OASIS, both compared to women between the age of 18 and 35 years [2]. This trend of risk increase with advancing age was also found by Baghestan et al. [5]

Studies that have made a subdivision between nulliparous and multiparous women showed conflicting results. Räisänen et al. showed that with advancing age the risk for OASIS was increased compared to the risk in nulliparous women younger than 20 years [4]. In the study of Landy et al. advancing age was associated with OASIS only in nulliparous women [6]. The results of the study of Ampt et al. showed that in multiparous women, advancing age was associated with the risk of

OASIS up to the age of 40. In nulliparous women this association was found only in women until the age of 30. After the age of 30 in nulliparous, and after the age of 40 in multiparous women, no further increase in risk for OASIS was found [7].

In conclusion, advancing age may be associated with an increasing risk of OASIS during vaginal delivery, but this association may differ between nulli- and multiparous women and is only of relative importance because of its relatively weak association.

Maternal Body Mass Index

Body mass index (BMI) is investigated in only few studies probably because weight and height are not routinely registered in all maternity registries.

A BMI between 20 and 25 is considered normal and the group of women with a BMI below 25 served as reference group in most studies that addressed this factor.

In the study of Hamilton from the USA defining high-risk risk clusters for OASIS, increasing BMI was negatively associated, although not strongly, with the risk of OASIS (OR 0.97; 95 % CI:0.95–0.99) [11].

Lindholm and Altman found in their study, describing more than 200,000 women who delivered in Sweden between 2003 and 2008, that increasing BMI was associated with a significant decrease in risk of OASIS [12]. Women with a BMI >35 had a 30 % lesser chance to develop OASIS compared to the reference group of women with a BMI <25. Landy et al. showed a significant negative association of BMI with the risk of OASIS only in nulliparous women with a BMI 30–34 compared with women with a BMI <25. In multiparous women no association was found in their study [6].

Explanations of the inverse relation of BMI with OASIS are speculative. Lindholm and Altman hypothesized that higher cholesterol levels in women with higher BMI may be protective to oxytocin overstimulation during the second stage of labour by modulation of oxytocin receptor efficacy in uterine smooth muscle.

Pain Relief During Delivery

Although epidural analgesia serves as the most widespread method of pain relief for women during the first stage of delivery in modern obstetrics, other methods are still in use in different countries e.g. nitrous oxide gas or pethidine.

The effect of epidural analgesia for pain relief on the risk of OASIS is still a matter of debate because of conflicting results in different studies from different countries.

In the study of Baumann et al. epidural analgesia was associated with a decrease of more than 30 % of the risk of OASIS without a subdivision for parity [10]. Landy et al. found a similar association of decreased risk for both nulliparous and multiparous women [6].

The population-based study from Baghestan et al. from Norway found no association of the use of epidural with the risk of OASIS [5].

The studies of Räisänen et al. and Ampt et al. confirmed this effect for nulliparous women only [4, 7]. In these studies the risk of OASIS appeared to be increased for multiparous women delivering with epidural analgesia.

Räisänen et al. have reported also on the effect of nitrous oxide gas on the risk of OASIS. In both nulliparous and multiparous women, the use of nitrous oxide gas was associated with a slightly decreased risk of OASIS [4].

The differences between the different studies mentioned may arise from differences in maternity-related practices between the different countries and may be caused by confounding through unknown factors that were not recorded in the various studies or registration systems used.

Induction of Labour and Oxytocin Use

The results in studies on effect of induction of labor and oxytocin on prevalence of OASIS are conflicting which again may be due to a difference in individual practices between the different studies. For instance, induction of labour may be used more often in women with intra-uterine growth retardation or post-term pregnancy in some countries or units compared to others.

Ampt et al. combined induction and augmentation of labour and found a decreased risk of OASIS in nulliparous women but no association in multiparous women [7].

Induction of labour was also addressed in the studies from Baghestan et al. and de Leeuw et al. [3, 5]. In both studies induction of labour was associated with an small increased risk of OASIS. In none of the studies a proper explanation for this association was given and given the conflicting results, this factor is probably a confounding factor associated with other obstetric factors. Induction of labour was not associated with OASIS in a large, population based study from Norway [11].

Previous Delivery with Sphincter Injury

As OASIS occurs predominantly in nulliparous women, the chances that these women will conceive and have to deliver again is reasonable. In the process of proper counselling, it is therefore important to know whether these women have an increased risk of recurrence.

Elfaghi et al. were the first to address this issue and found that a history of OASIS resulted in a more than fourfold increased risk in the subsequent delivery. This risk appeared to be related to the extent of OASIS in the first delivery, as the risk of recurrence was even higher after a fourth degree rupture in the first delivery [13].

This association was later confirmed by the studies from Baghestan et al. and Jangö et al. with comparable odds ratios [14, 15]. The latter study confirmed that the degree of OASIS in the first delivery was an independent risk factor for recurrence. The risk of recurrence was relatively 70 % higher after a 4th degree tear in the first delivery compared to a 3rd degree tear in the first delivery.

A possible explanation for the association of a history of OASIS with a higher risk of recurrence in the next delivery might be scarring of the perineum and anal sphincter muscles. Scar tissue may be more vulnerable to damage after stretch leading to a higher risk of recurrence of OASIS. The fact that OASIS in itself is an independent risk factor for recurrence is important in the counselling process of women and for the attending physician or midwife in the next delivery. In daily practice many women with a history of OASIS will be anxious to experience this type of trauma again.

Previous Delivery by Cesarean Section

Women who deliver vaginally after a prior caesarean section (CS) were considered to be the same as nulliparous women with regard to their risk for OASIS. However, this may be dependent on the reason leading to the CS in the first delivery.

Räisänen et al. found that the risk of OASIS in the delivery after a CS in the first delivery was 42 % higher compared to women who had delivered vaginally in their first pregnancy [16].

The risk of OASIS in the pregnancy after prior CS was compared to the risk for nulliparous women to sustain OASIS by Baghestan et al. in 2010. Women delivering vaginally after prior CS had a significantly higher risk than nulliparous women to sustain anal sphincter injury, a result that was confirmed by Räisänen et al. in 2013 and Hehir et al. in 2014 [16, 17].

So, a CS in the first pregnancy is most probably an independent risk factor for OASIS during the next vaginal delivery. As stated by Räisänen et al. this may be explained by the fact that a relative fetopelvic disproportion leading to CS in the first delivery may also predispose to OASIS in the subsequent delivery since 40 % of the increased incidence of OASIS risk could be explained by fetal birthweight.

Maternal Ethnicity

Studies on the association of maternal ethnicity are often flawed by unclear definitions of ethnicity and lack of consistency of different subdivisions with regard to one ethnic group between different studies.

In two studies from the American continent comparisons were made between “white” women and women with other ethnicities [2, 6]. Handa et al. found that Asian women were at a higher risk to sustain OASIS compared to white women,

with Indian women having the highest risk. In this study black women had a significantly lower risk of OASIS, compared to white women. However, Landy et al. were unable to confirm the latter result. In their study, only Asian women or women of the Pacific Islands were at higher risk for OASIS compared to white women.

Two Scandinavian studies also addressed the possible association of ethnicity with the risk of OASIS [5, 18]. Both studies compared the risk of different ethnic groups with the risk of European or Swedish women.

In both studies, African and Asian women were at a higher risk of OASIS compared to European or Swedish women. However, in both studies no further subdivision within the groups of Asian and African women was made e.g. in both Scandinavian studies the African women were in fact almost entirely women from East-African countries like Somalia, Eritrea and Ethiopia. A large number of these women were infibulated and the de-infibulation, performed before delivery may not have been completely protective. Whether the calculated risk for OASIS for African women in these studies also applies to women from West-Africa remains doubtful.

Synthesis and Conclusions

Many maternal, fetal and labour-related factors are associated with the risk of sustaining OASIS during vaginal delivery. Unfortunately many of these factors are non-modifiable, i.e. parity, fetal birth weight and obstetric history. Indeed, in daily practice, the choice of the instrument used in operative vaginal delivery may be the only modifiable risk factor.

Of all factors, nulliparity and *type of* instrumental delivery are the most important, because they are the most commonly occurring factors and in this carry the largest risk.

Knowledge of risk factors for OASIS and awareness among supervising midwives and physicians of the presence of these factors is an important step in the prevention of OASIS.

But it is important to realise that the vast majority of OASIS occur in women with a priori relatively low risk. Up to this date it appears to be impossible to make a proper calculation of the risk of OASIS or predict the occurrence of OASIS in the individual patient [19]. This implies that it is important that during every delivery the supervising physician or midwife offers risk reducing interventions to every delivering woman. Interventions that will be explained in Chap 5.

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