Association between mode of delivery and pelvic floor dysfunction

BACKGROUND Normal vaginal delivery can cause significant strain on the pelvic floor. We present a review of the current knowledge on vaginal delivery as a risk factor for urinary incontinence and pelvic organ prolapse compared to caesarean section.

MATERIAL AND METHOD We conducted a literature search in PubMed with an emphasis on systematic review articles and meta-analyses. The search was completed in January 2014. We also included articles from our own literature archives.

RESULTS Compared to vaginal delivery, caesarean section appears to protect against urinary incontinence, but the effect decreases after patients reach their fifties. The risk of pelvic organ prolapse increases (dose-response effect) with the number of vaginal deliveries compared to caesarean sections. There are few reliable studies on the association between mode of delivery and anal incontinence, but meta-analyses may indicate that caesarean section does not offer protection after the postpartum period. Women with previous anal sphincter rupture during vaginal delivery are a sub-group with an elevated risk of anal incontinence. The degree of severity of pelvic floor dysfunction is frequently unreported in the literature.

INTERPRETATION The prevalence of urinary incontinence and pelvic organ prolapse is lower in women who have only delivered by caesarean section than in those who have delivered vaginally. For urinary incontinence this difference appears to level out with increasing age. There is no basis for identifying sub-groups with a high risk of pelvic floor injury, with the exception of women who have previously had an anal sphincter rupture. Caesarean section will have a limited primary preventive effect on pelvic floor dysfunction at a population level.

Urinary incontinence, anal incontinence and pelvic organ prolapse are together referred to as pelvic floor dysfunction. The International Continence Society has established a standardised terminology for these conditions, which is now in widespread use among researchers (1). Their prevalence is primarily studied in high-income countries (Table 1) (2). There is a significant degree of overlap between these conditions (2, 3), but the risk factors vary.

It is commonly assumed that pelvic floor dysfunction is partly attributable to injury associated with vaginal delivery. The proportion of caesarean sections has increased significantly in high-income countries in recent years (4), and in Norway from just under 2% in 1967 to 17% in 2010 (5). However, there are large variations between countries. For example, in 2011 the proportion of caesarean sections was 24% in the UK and 14% in the Netherlands (6). At two of our largest maternity institutions, Oslo University Hospital, Ullevål, and Haukeland University Hospital, caesarean sections represented 18.3% and 13.6% of the deliveries in 2013, respectively, whereas the national average was 16.4% (5). Such differences indicate that the proportion of caesarean sections is not dictated solely by objective medical factors – there must also be cultural differences between the institutions and in society at large (7).

We have reviewed the literature on vaginal delivery as a risk factor for pelvic floor dysfunction compared to caesarean section.

### Table 1 Prevalence of symptoms of pelvic floor dysfunction among women [2]

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urinary incontinence</td>
<td>25–45</td>
</tr>
<tr>
<td>Anal incontinence</td>
<td>11–15</td>
</tr>
<tr>
<td>Pelvic organ prolapse</td>
<td>5–10</td>
</tr>
</tbody>
</table>

1 Anal incontinence encompasses leakage of gas or liquid or solid faeces

MAIN MESSAGE

The prevalence of urinary incontinence and pelvic organ prolapse is lower in women who have only delivered by caesarean section than in those who have delivered vaginally. There is no basis for identifying sub-groups with a high risk of pelvic floor injury, with the exception of women who have previously had a pelvic sphincter rupture. Caesarean section will have a limited primary preventive effect on pelvic floor dysfunction at a population level.

Material and method

We conducted a search in PubMed of literature in English, last updated in January 2014 (Fig. 1). Since we wanted to investigate the risk following caesarean section under comparable conditions, we did not include articles containing material from low- and middle-income countries with conditions and frameworks for obstetrics that differ from those in high-income countries. Articles based on selected populations were excluded. Where there were articles based on the same...
A number of single research studies support the hypothesis that vaginal delivery is associated with a lower incidence of urinary incontinence, compared to caesarean section, both postpartum and later in life (9, 10). In a review article in which the underlying figures were reanalysed, it was estimated that the prevalence of urinary incontinence three months postpartum is on average 30% in women with spontaneous vaginal delivery, while for women who were delivered by caesarean section the corresponding figure is 15% (8). This is supported by other studies (9, 10).

How does this look following the postpartum period? In a review article the prevalence of stress incontinence is estimated to be 23% for those who give birth vaginally, compared to 10% in the caesarean section group more than one year after the birth (11). A number of single research studies support these findings (12–30). A study of 4,200 women conducted six years after the delivery showed that those who had only given birth vaginally and those who had given birth both vaginally and by caesarean section had an approximately equal prevalence of urinary leakage (26% and 28% respectively) (14). However, the prevalence among those who had only given birth by caesarean section was 14%. Correspondingly in 15,300 Norwegian women we found a prevalence for urinary leakage of 24% in the group that had only given birth vaginally and of 16% in the caesarean section group (11). In one Swedish study, however, it was found that vaginal delivery gave a hazard ratio of 3.1 (95% CI 2.5–3.8) for subsequent surgery for stress incontinence compared to caesarean section (38). Several factors can weaken or strengthen the correlation between mode of delivery and urinary incontinence. As mentioned above, an important factor is women’s age at the time of investigation. In the EPINCONT study we found that women aged over 50 years no longer had any protective effect from having delivered by caesarean section for each of their births (15). This was also true for moderate and severe incontinence. These findings have since been confirmed by others (12, 39).

Other factors that may have a negative influence are older age at first birth (40) and primiparity (41). It appears that a woman must give birth to all her children by caesarean section in order to achieve protection against long-term incontinence (14, 23). Incontinence in pregnancy increases the risk of later incontinence, both postpartum and later in life (9, 18, 21, 42), but this is nevertheless not a predictor of benefit from giving birth by caesarean section to protect against urine leakage (9, 43).

### Results

The search results are described in Fig. 1. There was a large degree of heterogeneity in the studies, and therefore we did not find it appropriate to reanalyse the raw data.

#### Urinary incontinence

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Anal incontinence

The results are less clear for anal incontinence. Meta-analyses are difficult to conduct because of large differences between studies with regard to prevalence of anal incontinence and data collection methodology (44).

The short-term effects of mode of delivery in the first year after birth were investigated in a meta-analysis (45), which found a significant odds ratio for anal incontinence of 1.3 (95% CI 1.04–1.7) for spontaneous delivery compared to caesarean section. A single research study supports this conclusion (29). However, several other single research studies found no differences between the two groups in the postpartum period (33, 46, 47).

With regard to permanent consequences, there are no convincing differences between the two modes of delivery. In a cohort study of almost 4,000 women, no significant difference was found in the prevalence of faecal incontinence based on mode of delivery either six or twelve years after the birth (23, 48). The conclusion is the same in several other studies (13, 22, 24, 37, 49). There are studies that indicate that caesarean section may protect against faecal or anal incontinence beyond the postpartum period, but they are in a minority (20) and frequently have methodological defects such as low statistical power, which meant that the findings were not significant (25, 50, 51).

A key question with regard to anal incontinence is whether this occurs primarily in the subgroup with anal sphincter rupture. In a Norwegian study of women with anal sphincter rupture postpartum, the prevalence of anal incontinence was 38% (52). A crucial problem both in research terms and clinically is that diagnosis and recording of anal sphincter rupture can vary in quality. A systematic review article concluded that third or fourth grade perineal tear (i.e. anal sphincter rupture) was the only aetiological factor in delivery that was clearly associated with anal incontinence (53). In a study investigating faecal incontinence, the prevalence was the same in the caesarean section group and in the group that had delivered vaginally without clinically diagnosed anal sphincter rupture (8% in both groups) (33). However, the prevalence was significantly higher in a group of women with anal sphincter rupture following vaginal delivery (17%). Other studies also indicate that vaginal delivery in itself is not a risk factor for anal incontinence if the anal sphincter is undamaged (54–56).

Obstetric factors may be significant for the correlation between mode of delivery and anal incontinence. It is considered that episiotomy should not be performed routi-
nely (54, 57–60). Operative vaginal deliv-
ery using forceps or vacuum extraction
increases the risk of anal sphincter rupture
(54, 61–64) and thereby the risk of anal incontinence (54, 65). A Norwegian study shows that anal sphincter injury during the first delivery provides an odds ratio of 4.3 (95% CI 3.8–4.8) for repeated anal sphinc-
ter injury at the next delivery (66).

Pelvic organ prolapse
Most of the studies indicate that caesarean section protects against prolapse, both in the short (67, 68) and long term (20, 24, 35, 38, 69–72), but in a Danish registry-based study no difference was found (73).

A large multi-centre study reported signifi-

cantly less anatomical prolapse (measured using standardised methods of gynaecologi-

cal examination) in women who had only
delivered by caesarean section compared to those who had only delivered vaginally (odds ratio 0.11; 95% CI 0.03–0.38) (71). When it came to reported symptoms of pro-
lapse there was the same tendency, but the findings here were not significant (odds ratio 0.84; 95% CI 0.69–1.02) (71). These

discoveries are supported by others (24, 38, 69). Several studies point to a dose-response effect of vaginal delivery for the risk of pro-
lapse (38, 69–71, 74). The effect does not appear to decrease in older age groups (38).

Discussion
Overall the research indicates that caesarean section may protect against urinary inconti-

nence in women of fertile age, but the effect does not persist when the women become

clder and the prevalence of incontinence is highest. For anal incontinence, anal sphinc-
ter rupture is of primary significance and not

vaginal delivery per se. Strategies to prevent such ruptures are far more important than

using caesarean section to avoid anal inconti-

nence. The risk of pelvic organ prolapse

following vaginal delivery is well document-

ed, and here we also see a dose-response effect for number of children.

Knowledge of how pelvic floor dysfunc-
tion occurs is useful for the development of preventive strategies and treatment. Caes-

arean section in itself cannot be called a good prevention strategy since this procedure

hould still have many negative consequences for mother and child (37, 75). However, pelv-
ic floor training is well documented for preventing urine leakage and also appears to

have an effect on prolapse symptoms, and the financial and medical costs of this treat-

ment are low (76, 77).

There is an interplay of many factors in the development of pelvic floor dysfunction:
symptoms can change over time and vary

with lifestyle factors and other diseases. This complex interaction is instructively demonstrated by Delancey and colleagues (Fig. 2, Fig. 3) (78).

Significant changes have taken place in the indication for caesarean section in the past

30–40 years. An increase in obesity (also among pregnant women) and increasing age

at first delivery have a bearing on the development of pelvic floor dysfunction. It is not yet clear how mode of delivery has a part to

play in this.

It is argued that an optimal caesarean section

rate is around 10–12%, based on a balance between risk and benefits for both mother and child (79). In most high-income countries the current rate is above this level and the proportion of caesarean sections is rising. In a global perspective the effort to improve maternal health should be prioritised in countries where access to obstetrics (includ-

ing necessary caesarean sections) is low. Further development of obstetric methods in high-income countries, for example to pre-

vent anal sphincter ruptures, is a strategy which will also be of benefit to women in

low-income countries.

Our search strategy does not conform to the stringent requirements of a systematic review article. We believe nonetheless that the literature in this field is well covered in this review. The main weakness of our study is the variable quality of the underlying data. Although epidemiological studies in this field have greatly improved methodologi-

cally in the last decade, there are still a num-

ber of challenges – not least in terms of definition and recording of the conditions in question. There is also a significant variation in the degree of severity of the three condi-

tions discussed here. Many studies make a poor distinction between mild symptoms that women can live with and conditions requiring treatment.

Conclusion
A normal vaginal delivery causes significant

strain on the pelvic floor and can result in some women of fertile age developing urinary incontinence. Vaginal delivery is an even greater risk factor for pelvic organ prolapse. Vaginal delivery without anal sphin-
ter rupture is not thought to increase the risk of anal incontinence.

Caesarean section as a primary method of prevention at population level does not have a beneficial value that is proportional to the effort and the negative consequences it entails. We do not have sufficiently reliable data to be able to identify subgroups at high risk of pelvic floor injuries – those who could benefit from delivery by caesarean section.

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fessor and head of research. Her PhD dealt with the association between pregnancy and delivery for urinary incontinence. The author has completed the ICMJE form and reports no conflicts of interest.

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