Beyond the short term effects of caesarean delivery and gynaecological surgery
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Chapter 9
Summary and general discussion
SUMMARY
The work presented in this thesis focuses on uterine rupture after trial of labour and possibilities for sonographic evaluation of the caesarean scar in pregnancy to identify women at risk for uterine rupture, risks of maternal and neonatal complications in pregnancies after previous caesarean section and strategies for the prevention of postsurgical adhesion formation after gynaecological surgery. Below we summarize the main findings of each chapter.

Chapter 2 describes the value of lower uterine segment thickness measurement in the prediction of uterine defects, either complete rupture or dehiscence at birth, during trial of labour in women who had undergone a previous caesarean section. The most important finding of reviewing existing publications and performing meta-analysis is the strong negative correlation between lower uterine segment thickness and risk of uterine defect. We found that a full lower uterine segment thickness of 3.1–5.1 mm and a myometrium thickness of 2.1–4.0 mm provided a strong negative predictive value for the occurrence of a defect during trial of labour. A full lower uterine segment thickness of 2.0–3.0 mm and a myometrium thickness between 0.6 and 2.0 mm provided a strong positive predictive value for the occurrence of a defect. Performance of measurement of myometrial and full lower uterine segment thickness were very similar, indicating these two methods were found to be equivalent.

In Chapter 3 the course and outcome of consecutive pregnancies in women with a history of planned caesarean section and emergency caesarean section in first births is studied. Our data suggested a moderately increased risk of postpartum haemorrhage and a small to moderately increased risk of uterine rupture and stillbirth as a long-term effect of prior planned caesarean delivery on second births. Contractions before caesarean section lower the risk of adverse maternal outcomes such as uterine rupture and postpartum haemorrhage in a consecutive pregnancy. Our findings support the hypothesis that a caesarean section with a thick lower uterine segment leads to more problems in subsequent deliveries than a caesarean section with a thin laboured lower uterine segment.

Chapter 4 shows a highly increased risk of neonatal birth trauma after attempted operative vaginal birth after caesarean, compared with emergency repeat caesarean section indicated by non-progressive labour. The risk of wet lung syndrome and neonatal convulsions was slightly higher after repeat caesarean. We found similar rates of low Apgar score, meconium aspiration, death during labour and death within 28 days after birth. When considering maternal outcomes, postpartum haemorrhage occurred more often after attempted operative vaginal delivery, whereas uterine rupture is more often seen in women delivering by caesarean section. Rates of blood transfusions were similar. Maternal death did not occur. The adverse outcomes in the attempted operative vaginal delivery group were equally common when operative vaginal delivery failed or when it
succeeded. Women should be counselled before attempting operative vaginal birth after caesarean of the 1% risk of neonatal birth trauma and almost 7% risk of postpartum haemorrhage.

Chapter 5 investigates the safety of trial of labour after spontaneous start of labour at term compared to elective repeat caesarean after 39 weeks in women with a history of a term caesarean section after balancing covariates by propensity score matching. In the unmatched cohort, 74% of the women having a trial of labour succeed to deliver vaginally. After balancing covariates by propensity score matching, we found short-term maternal and neonatal outcomes such as uterine rupture, haemorrhage, low 5-minute Apgar score, birth trauma and meconium aspiration to occur more often in the group attempting a trial of labour compared to elective repeat caesarean. Wet lung occurred more often in the elective repeat caesarean group. The overall numbers of adverse maternal and neonatal outcomes were low. The results of this analysis are applicable for the comparison of the outcomes of a spontaneous trial of labour and an elective repeat caesarean after 39 weeks in women without a history of vaginal birth. Some women will require a labour induction, for these women risks might be higher than reflected in our data, since induction of labour is associated with higher rates of failed trial of labour and uterine rupture. The contrary is applicable for women with a history of caesarean section and a previous vaginal birth. Risk may be lower since the rates of successful trial of labour are higher after previous vaginal birth.

Chapter 6 discusses the developing trends in the Netherlands and the possible reduction of the number one reason for caesarean section in labouring women: Labour dystocia or so called non-progression of labour. The adverse maternal and neonatal events in a subsequent pregnancy due to non-progression are low. Our data suggest a protective effect of prior caesarean section on antenatal death in a low risk population. The explanation for the protective effect of caesarean section in a low risk population is not immediately apparent, although differences in timing of delivery and differences in obstetric management could be an explanation, at least in part, for this effect.

The successful vaginal birth after caesarean-rate after trial of labour in our low risk cohort are encouraging (60%) and justify counselling for trial of labour even with a history of caesarean section due to non-progression as the majority of women attempting trial of labour will succeed. This way further unnecessary increase of repeat caesarean section can be prevented. Preventing the first birth caesarean section should have the fullest attention of the obstetrician in order to decrease caesarean section rates or at least maintain a caesarean section rate that is medically justifiable. In the last decades maternal characteristics such as increased age, increased maternal weight, racial diversity, medical interventions such as induction of labour, epidural analgesia and changes in obstetric practices have caused a longer duration of labour. There should be growing awareness that certain restraint in
diagnosing failed induction, accepting longer duration of first and second stage as long as foetal and maternal conditions are not compromised, can prevent unnecessary caesarean delivery.

Chapter 7 reviews literature and a meta-analysis of different surgical techniques aiming to reduce adhesion formation including a large variety of technical aspects. None of the different techniques or approaches evidently showed a reduction of the main adhesion-related complications: adhesive small bowel obstruction and infertility. The incidence of adhesive small bowel obstruction, established by reoperation, was not significantly different in any comparison. The clinical suspicion of adhesive small bowel obstruction was lower following laparoscopy compared with open surgery in one study. The incidence of adhesions was lower following laparoscopy than laparotomy and when the peritoneum was left open compared with peritoneal closure. However, the evidence for a lower incidence of adhesions was limited to a single small randomized controlled trial and conflicting results were found in the qualitative assessment of lower quality studies. The pregnancy rate was significantly higher in one study after sub serous fixation of sutures compared with standard sutures in a small low-quality randomized controlled trial. Summarizing the results of suturing or not suturing the peritoneum in caesarean section, both techniques seem acceptable considering short-term complications but non-closure might decrease incidence of adhesions.

In Chapter 8 a small prospective randomized controlled study to evaluate sprayable polyethylene glycol (PEG) anti-adhesion barrier on adhesion formation in women undergoing laparoscopic treatment of benign gynaecologic disease involving ovaries, pelvic side-walls, fallopian tubes or uterus is discussed. 16 patients were randomly assigned to receive either the adhesion barrier or no adhesion prevention. Incidence and severity of adhesions were scored at eight sites in the pelvis and reassessed by second look laparoscopy. From this study, PEG anti-adhesion barrier seems effective in the prevention of de novo adhesions in common gynaecological laparoscopic procedures, but especially in fertility enhancing procedures. Furthermore, there was a significant difference in change of Local Adhesion Barrier Scoring System (LABS score) favouring patients treated with PEG adhesion barrier. Although only a small number of patients could be included in this trial, our findings support those of earlier studies demonstrating that PEG spray is a highly efficacious site-specific barrier for laparoscopic use. Meta-analysis of pooled data from present study and two previous randomized controlled trials also showed a significant reduction in the total incidence of adhesions. Complete adhesion prevention is of particular importance as it is the only means of providing a definitive protection against all adhesion related complications, such as infertility, adhesive small bowel obstruction and inadvertent enterotomies.
GENERAL DISCUSSION AND CLINICAL IMPLICATIONS

Part One
This thesis emphasises the important task for obstetricians to reduce the number of caesarean sections in first births. There is a worldwide increase of caesarean section in nulliparous women, and this has consequences for their remaining reproductive life. It will increase risks during pregnancy and delivery such as placenta previa or accreta, uterine rupture and haemorrhage. Risks will increase in case of multiple repeat caesarean sections. (1) Women need to be properly counselled considering the number of children they want to bear.

Non-indicated caesarean section should be discouraged and women having an indicated planned caesarean section should be counselled about the increased adverse maternal and neonatal outcomes in the subsequent pregnancies and the increased risk of caesarean section in future pregnancies.

In our opinion, the only possible preventable caesarean section, the non-indicated caesarean section left out of consideration, is the non-progressive labour indicated caesarean section. Advocating patients when maternal and foetal conditions allow, caution diagnosing failed induction before 6 cm and adjusting the 50 years old partogram to modern standards should have a high priority. There is less potential in preventing caesarean sections indicated by non-reassuring foetal status. Due to improved foetal monitoring, the amount of caesarean sections indicated by non-reassuring foetal status is increasing. Ensing et al showed a significant increased risk for emergency Caesarean section in foetal distress, which increased from 1.9% in 1999 to 2.9% in 2009 (p<0.0001) resulting in a significant change of asphyxia but without a significant change in mortality rates (2)

Our data on labour before a caesarean section can contribute to counselling strategy especially in terms of pregnancies with a higher risk of caesarean section such as twin and breech deliveries. Going into labour before the scheduled caesarean delivery doesn’t seem to harm, it seems to lower the risk of adverse maternal outcomes such as uterine rupture and postpartum haemorrhage in a consecutive pregnancy.

The chances of having a successful trial of labour after a first birth caesarean section in a subsequent pregnancy is high in the Netherlands: 74% overall and 60% for women with a caesarean section indicated by non-progressive labour. Gilbert et al calculated that it is more cost effective to have a trial of labour instead of an elective repeat caesarean section (in the USA). Especially if women tend to have more than two pregnancies, vaginal birth after cesarean is a more cost-effective route of delivery. Under baseline circumstances, trial of labour is less expensive and more effective than an elective repeat caesarean section when considering long-term consequences when the likelihood of success is
47.2% or more. Even though vaginal birth after caesarean may cost less, it also comes at a cost: the short-term neonatal and maternal adverse events are clearly higher in this group compared to elective repeat caesarean section. Operative vaginal delivery after prior caesarean section should be undertaken cautiously, due to increased risk of birth trauma 0.95% vs. 0.07% when undertaking elective repeat caesarean section (aOR 15.0 95% CI 5.9-38).

Ideally we would like to identify women with a high probability of vaginal birth after caesarean and low risk of adverse events and counsel them accordingly with the aim to encourage trial of labour. The women with a high probability of emergency caesarean and high risk of adverse events should be counselled and offered a repeat caesarean section. One of the efforts to separate women with high risk from low risk women is sonographic assessment of the uterine scar. From our meta-analysis and reviews of literature, there is a good clinical potential in measuring the uterine scar to identify women at risk for rupture or dehiscence. Clinical implementation trials are currently on going: a pragmatic randomized trial in France and a double-blinded prospective study in the Netherlands. (5,6)

The protective effect of a prior caesarean on antenatal death in a low risk population needs to be explored more thoroughly. It could be a type 1 error, then results are not reproducible; if indeed there is a protective effect it is most probably an effect of obstetric care and management.

Part two
The focus of adhesion management is prevention and prevention of adhesion formation starts with not performing unnecessary surgery, including preventable caesarean deliveries. If surgery cannot be prevented, good surgical techniques are the next step in preventing adhesion formation. The risk for adhesion-related complication is highest following abdominal and pelvic surgery.

Surgical techniques aiming to reduce adhesion formation included a large variety of technical aspects. The incidence of adhesions seems lower after laparoscopy compared to laparotomy, limited extent and severity of coagulation, sub serous suture fixation and non-closure of the peritoneum. These findings emphasize the importance of limiting peritoneal ischaemia and foreign body material in surgery.

PEG gel appears beneficial in reducing adhesion formation after gynaecological surgery, compared with no treatment. Our findings have been confirmed in a recent Cochrane review and meta-analysis. (7) However, the actual effect on the patient centred outcomes are lacking in our trial and other available studies. The effects that adhesion and adhesion prevention agents themselves have on pelvic pain, live birth rate and quality of life should be explored in greater detail.
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