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To give and to assist birth after cesarean

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General
introduction

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Cesarean rates are rising globally

An increasingly common challenge in modern obstetrics is pregnancy and delivery after a cesarean.^{1,2} A cesarean is a surgical procedure during which a fetus is delivered through an incision in the maternal abdomen and uterus. Cesareans have been part of human culture since ancient times, first applied in dead or dying women to retrieve the infant, either in hopes of saving the baby's life, or as required by religious proclamations. Up until the nineteenth century, it was a measure of last resort; the operation was not intended to preserve the mother's life. As safety of the procedure improved due to the progression in hygienic and surgical techniques, indications to perform cesareans shifted during the 1900s from saving infants' lives to saving mothers' lives as well.³ Since the 1940s, the trend towards medically managed pregnancy and delivery has steadily increased. Many new hospitals in which women gave birth and in which obstetrical operations were performed arose. Advances in anesthesia improved both the safety and the subjective experience of cesarean delivery, leading to a further increase in its use.³

At no point in history have cesarean rates been as high as they are today.⁴ Rates of cesareans reached 25% in Europe, and 32% of all births in the USA (figure 1) and continue to increase.⁴⁻⁶ Although cesarean delivery can effectively prevent maternal and neonatal morbidity and mortality, there is no evidence that a cesarean is beneficial for either a mother or a child if the procedure is not medically necessary. The World Health Organization stated that at population level, cesarean rates higher than 10% are not associated with a reduction in maternal and newborn mortality rates.⁷ Reasons for the steadily increasing cesarean rates that are repeatedly reported in international studies are the introduction of electronic fetal heart rate monitoring, fear of pain, concerns about genital damage after vaginal delivery, scientific studies on breech delivery, and convenience for health care providers as well as for mothers and families.^{4,8,9} However, the biggest contributor to the increase in cesarean rates since the first half of the 1980s is the repeat cesarean after a previous one.³

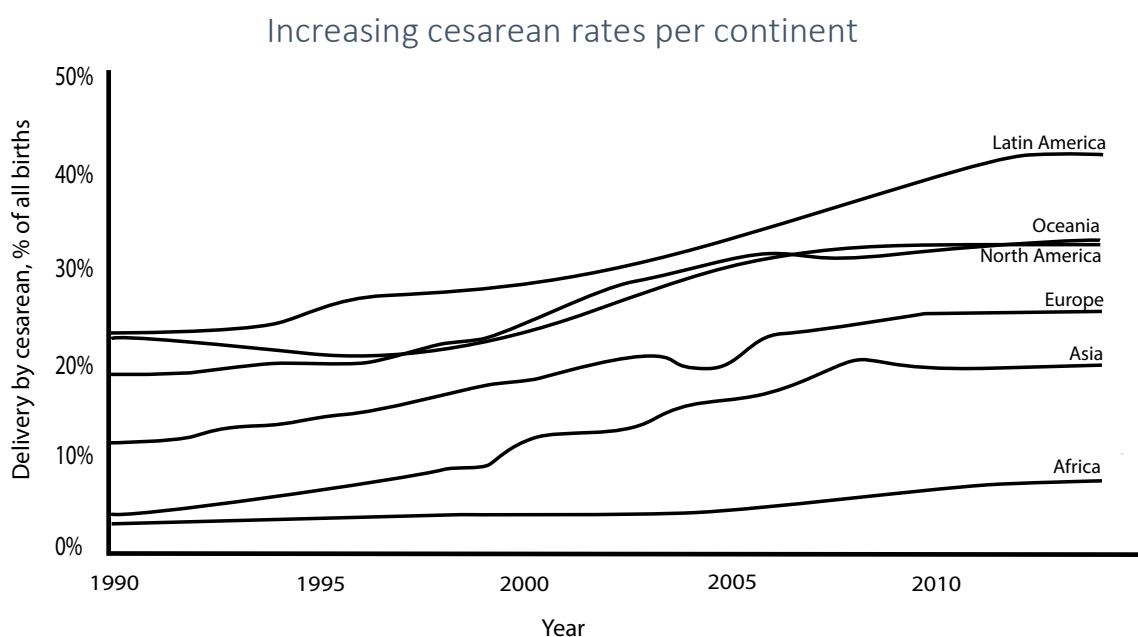


Figure 1. Global cesarean rates from 1990 - 2014. Adapted from Betrán AP, et al. PLoS ONE 2016

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For the largest part of the 20th century, the concept of ‘once a cesarean, always a cesarean’ prevailed. It emphasized that one of the consequences of a cesarean was the need for a repeat cesarean in a next pregnancy, because the incidence of uterine scar rupture during trial of labor after cesarean was thought to be significant and the resultant consequences were alarming.^{10,11} By the late 1980s, the concept was abandoned as reports showed that trial of labor after a cesarean is relatively safe.^{10,12,13} Nowadays, eligible women (ie. women without an absolute indication for repeat cesarean) are given the choice to deliver either by trial of labor after cesarean or by elective repeat cesarean after having had one cesarean before.^{13,14}

Table 1. International terms and abbreviations

Term	Definition
TOL(AC)	Trial of labor (after cesarean)
TOL-percentage	Number starting vaginal delivery / number with previous cesarean x 100%
VBAC	Vaginal birth after cesarean
VBAC-percentage	Number that delivers vaginally / number with previous cesarean x 100%
ERCS	Elective repeat cesarean section
Uterine rupture	Tear in the uterine wall resulting in communication between the uterine and peritoneal cavities

Table 2. Maternal and neonatal complications of trial of labor and planned repeat cesarean after one cesarean

Complication	Trial of labor	Planned repeat cesarean
Maternal		
Uterine rupture	0.47%	0.03%
Blood transfusion	0.90%	1.20%
Febrile morbidity	6.50%	7.20%
Deep vein thrombosis	0.04%	0.10%
Hysterectomy	0.22%	0.43%
Maternal mortality	0.004%	0.01%
Neonatal		
Transient tachypnea of the newborn	3.60%	4.20%
Asphyxia	0.89%	0.32%
Perinatal mortality	0.13%	0.05%

Both options for delivery after cesarean have risks and benefits

Trial of labor after cesarean differs from labor that is not preceded by a cesarean for several reasons, most notably the risk of rupture of the uterine scar. Based on the source of information, the incidence of uterine rupture during trial of labor after one previous cesarean is estimated to be between 0.20 and 1.50%.¹⁴ Of all cases of women with uterine rupture, 25% result in severe neonatal and/or maternal morbidity with markedly increased mortality rates.¹⁵ The fact that the risk of uterine rupture is increased during trial of labor after cesarean legitimizes the choice for an elective repeat cesarean.¹⁶

At the risk of sounding cynical, one might consider the decision for either trial of labor after cesarean or elective repeat cesarean, as to choose between two evils. Both options have certain medical risks (see table 2).¹⁷ It should be mentioned that risk estimates of both delivery options might be biased for the fact that numbers are not resulting from intention to treat analyses, but from studies based on the actual route of delivery. Cesarean deliveries are associated with a higher maternal risk of deep vein thrombosis, hysterectomy, and postpartum febrile morbidity as compared to vaginal delivery. Long term maternal effects of cesareans include a risk of postmenstrual spotting and chronic pain at the incision site.^{18,19} On the other hand, trial of labor carries a higher risk of perinatal asphyxia and mortality. Most morbidity associated with trial of labor occurs when there is a need to convert to a cesarean, and not when the trial of labor succeeds.¹³ For example; hysterectomy and endometritis are more common in women with failed trial of labor than in successful vaginal delivery after cesarean (0.5% versus 0.1% and 7.7% versus 1.2%, respectively) and most cases of perinatal asphyxia follow uterine rupture and not uncomplicated vaginal delivery.²⁰ Risks associated with pregnancy and delivery after cesarean, such as abnormal placentation, hysterectomy and blood transfusion, increase with increasing number of cesareans.²¹ The likelihood of having a vaginal delivery in the future declines with every repeat cesarean.^{13,14} This means that the decision for either trial of labor or elective repeat cesarean in a pregnancy after a first cesarean, also affects the conduct of a possible next pregnancy and delivery.

In conclusion, trial of labor has relatively good shortterm and longterm maternal and neonatal outcomes if it succeeds, but has increased risks for mother and child when it fails and an emergency cesarean is needed, as compared to planned repeat cesarean.²² Therefore, although absolute risks of adverse outcomes are small, trial of labor has higher relative rates of shortterm maternal and neonatal morbidity and mortality when compared to elective repeat cesarean.²³ A recent economic evaluation showed that trial of labor in the end is more cost effective, especially for those likely to have a successful trial of labor.²⁴ Thus, key in the trial of labor versus elective repeat cesarean debate is the prediction of who will be successful in achieving vaginal birth.

To predict trial of labor success chance in individual women, studies and guidelines focused on clinical risk factors for unsuccessful trial of labor. Quantitative information on what the influence of patient characteristics is on trial of labor success chance provides an estimation of success chance of vaginal delivery, enabling woman to make an informed choice.^{13,14,25–28} Qualitative information on how women choose the preferred mode of delivery and how gynecologists confronted with women in trial of labor clinically manage these patients should complement these quantitative prediction models and is topic of recent studies.^{29,30} The aim of this thesis is to gain more insight in the prediction of trial of labor success chance by

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integrating clinical risk factors with aspects of human decision-making. Therefore, in part 1 of this thesis, we explore influencers of vaginal birth success chances and women's preferences concerning delivery after cesarean. In part 2, we explore two main aspects of assisting birth after cesarean; gynecologists decision-making during trial of labor after cesarean and the association of certain management options with trial of labor outcomes. To conclude the thesis, the overall findings are discussed and clinical implications as well as suggestions for further research are given. In the remainder of this introduction, we present the scopes of part 1 and part 2 in more detail.

Part 1. To give birth after cesarean

Clinical influencers of success chance

Women eligible for vaginal birth after cesarean are counseled by their obstetrician to support them in choosing the intended mode of delivery. To help pregnant women, their partners, and their health care professionals, studies initially focussed on predicting success chance of trial of labor, and subsequently on validation of the developed prediction models.²⁵⁻²⁸ These models are based on clinical characteristics, such as maternal ethnicity and estimated fetal weight. Several factors are mentioned to influence success chance negatively, amongst which advanced maternal age, induction of labor, a short interdelivery interval and a previous preterm cesarean.¹⁴ Because the evidence of the influence of the latter two is questionable, we aim to clarify the supposed influence of interpregnancy interval and prematurity in a first cesarean in order to determine to what extent they contribute to the success chance.

Chapter 2 describes the effect of the interval between a cesarean delivery and a next trial of labor on the success rates of trial of labor after cesarean in a 10-year nationwide cohort.

Chapter 3 describes the effect of a preterm cesarean on trial of labor in a subsequent term pregnancy in a 10-year nationwide cohort.

Large variation in intended mode of delivery after a previous cesarean

Large variation exists globally in rates of women choosing for trial of labor after cesarean; 30% for the United States, 36% for the United Kingdom, and 70% for the Netherlands.^{17,31,32} This large spread is remarkable and is unlikely to be explained only based on medical risk factors at patient level such as previous delivery characteristics, demographics, and current pregnancy characteristics. This prompts the question how women are counseled and what priorities exist amongst women facing the decision on how to deliver after cesarean. Research that has been undertaken to gain more understanding on why women choose either trial of labor or planned repeat cesarean, demonstrates that not only clinical risk factors play a role in weighing both modes of delivery but also non-medical factors, such as the experience of the previous cesarean, emotions as fear and anxiety and the feeling of responsibility to give birth vaginally.^{31,33,34} Still, in antepartum counseling, health care professionals act as information providers with limited discussion of women's preferences.³⁵ Antepartum counseling on the mode of delivery needs to become a confluence of on the one hand informing the women and her partner on medical risks, and on the other hand being informed about the non-medical aspects that play a role, leaving both options open for discussion.^{14,36} Therefore, we aim to gain more understanding of the factors that influence women when making a decision on the

intended mode of delivery. Knowing more about the preferences and views that women hold will enable us to develop tools to enhance shared decision-making in antepartum counseling.

Chapter 4 aims at better understanding the priorities that exist among women facing the decision between trial of labor or elective repeat cesarean after a cesarean, using Q-methodology as a mixed methods approach.

Part 2. To assist birth after cesarean

Large variation in trial of labor after cesarean success

Not only does the rate of women choosing for trial of labor vary geographically, also the percentage of women succeeding to have a vaginal delivery after cesarean vary based on the location a woman gives birth.^{37,38} A recent Dutch report unveiled large variation in success rates of trial of labor amongst Dutch hospitals; rates varied from roughly 50% to 90% for women with comparable medical risk factors (figure 2).³⁷ A comparable variation has been described for the United States.¹⁷ A repeat cesarean performed during trial of labor can have several reasons, including (the suspicion of) uterine rupture, non progression of labor or the suspicion of fetal distress. These differences in rates of trial of labor successes poses questions on how gynecologists assist birth after cesarean and on how they indicate a repeat cesarean is needed.



Figure 2. Successful trial of labor after cesarean rate in 17 Dutch hospitals in 2010. Adapted from Vankan E. et al, AOGS 2016.

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Timely recognition of uterine rupture and a rapidly performed cesarean reduces associated maternal and neonatal morbidity and mortality. However, symptoms of uterine rupture or imminent rupture, such as vaginal blood loss, maternal hypotension or an abnormal foetal heart rate pattern, are unspecific and could have other causes that do not necessarily demand emergency cesarean.¹⁴ Besides suspicion of uterine rupture, reasons for performing repeat cesarean during trial of labor are non-progression of labor and suspected fetal distress. Determining whether or not labor is prolonged proves to be arbitrary and analysis of the fetal heart rate pattern is subject to intra- and inter-observer disagreement.^{39,40} Thus, many factors add to the uncertainty in deciding whether or not to opt for a repeat cesarean during trial of labor after a previous cesarean. Yet, clinical guidelines for gynecologists include relatively brief paragraphs on intrapartum management and lack an overview of outcomes of different options of intrapartum management.^{13,14}

In order to understand why women with comparable risk factors have different chances of vaginal delivery after cesarean and ultimately to reduce practice variation and to intervene in the globally rising cesarean rate, we aim to qualitatively explore how gynecologists reach decisions regarding whether to advise continuing labor or to perform repeat cesarean. In order to assist gynecologists in their decision-making processes, we aim to provide data on outcomes of different management options in case of failure of labor to progress.

Chapter 5 aims to increase understanding of gynecologists' decision-making during trial of labor, using interview data in the context of constructivist grounded theory.

Chapter 6 compares neonatal and maternal outcomes of different scenarios in trial of labor after cesarean; attempted operative vaginal delivery and emergency repeat cesarean in an 8-year nationwide cohort.

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