Vasa previa and placenta associated complications

*Diagnosis and risk assessment*

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Citation for published version (APA):
CHAPTER 1

General introduction
GENERAL INTRODUCTION

For women, to carry out a full term pregnancy and to deliver a healthy baby depends on several factors. The development and growth of the fetus is crucial and obviously cannot be accomplished without the placenta and umbilical cord. The placenta is a highly specialized organ of the pregnancy that supports the normal growth and development of the fetus. Development of the placenta is accurately regulated to ensure exchange of nutrients and waste products between the circulatory systems of the mother and fetus. The umbilical cord connects the placenta and the fetus and makes transport of these nutrients and waste products between them possible.

Impaired functioning of the placenta is seen in many diseases such as pregnancy induced hypertension and pre-eclampsia. These complications can result in suboptimal growth of the fetus, preterm delivery and higher rates of neonatal intensive care unit admissions. But also morphological anomalies of the placenta and the umbilical cord can lead to maternal morbidity and poor perinatal outcome.

This thesis on anomalies of the umbilical cord and placenta will focus on vasa previa, placenta previa, placental abruption, postpartum hemorrhage and retained placenta.

A normally developed placenta consists of the basal plate (the maternal side of the placenta) and the chorionic plate (the fetal side of the placenta) and weighs about 600 grams at delivery in the term period of pregnancy. The umbilical cord rises from the chorionic plate and in the majority of the pregnancies the origin is in the center part of the placenta. An abnormal umbilical cord insertion implies an insertion which is towards the placental edge and can be stratified as eccentric (>2cm from the placental edge), marginal (<2cm from the placental edge) or velamentous.

**Vasa previa**

In velamentous cord insertion the umbilical cord inserts outside the chorionic plate directly into the fetal membranes, it is seen in approximately 0.5% of all pregnancies. In velamentous cord insertion, fetal vessels deriving from the umbilical cord run through the fetal membranes before entering the placenta and are partially unsupported by either the Wharton’s jelly -a specialized tissue that acts as supportive and protective structure substituting for the adventitia of the umbilical vessels- or placental tissue. Pregnancies with a velamentous cord insertion are associated with adverse perinatal outcomes such as intra-uterine fetal demise, small for gestational age neonates and preterm delivery <37 weeks of gestation.
Velamentous cord insertion can result in vasa previa when the fetal vessels that run through the membranes traverse the cervical internal os. Vasa previa can be divided into two subtypes; type I is a single lobed placenta with a velamentous cord insertion covering or close to the cervix and type II is a multi-lobed placenta with connecting fetal vessels running over the cervical internal os.\(^8\) (Figure 1a and b) Compression of these vessels by the presenting part may lead to fetal heart decelerations and bradycardia on the cardiotocogram.\(^9, 10\) Theoretically in case of rupture of membranes, vasa previa can rupture simultaneously, thus potentially causing fetal blood loss with serious neonatal morbidity or neonatal death.

Placenta previa
Whereas the majority of the placentas are located high on the anterior or posterior wall of the uterus, placental tissue can also cover the cervix, a condition which is called placenta previa. Placenta previa is seen in 0.4-0.8% of all pregnancies and is classified according to ultrasound imaging as complete (with placental tissue completely covering the internal cervical os) or incomplete (traditionally also called partial or marginal, with placental tissue reaching to but not covering the internal cervical os).\(^11-13\) Especially a complete placenta previa is associated with emergency delivery by Cesarean section and maternal morbidity such as antepartum hemorrhage and blood transfusion, need for hysterectomy postpartum and adverse perinatal outcomes as preterm delivery, anaemia and respiratory distress syndrome.\(^11\)
Chapter 1

**Placental abruption**

Placental abruption refers to the premature dehiscence of a normally inserted placenta from the uterine wall. It is associated with significant perinatal morbidity and accounts for 12% of all perinatal deaths in the United States. Diagnosis of placental abruption is difficult, since the clinical presentation includes not very specific symptoms such as vaginal bleeding and abdominal pain. Early diagnosis of placental abruption can potentially be obtained by intensive surveillance and may improve the outcome of children involved in these pregnancies, by closely monitoring women who are at risk. Advanced maternal age, multiparity, chronic hypertension, smoking, cocaine use, previous Cesarean delivery, uterine surgery and short interpregnancy interval are reported risk factors for placental abruption.

**Retained placenta and postpartum hemorrhage**

In addition to prenatal complications regarding the placenta, the placenta can also cause postpartum complications. In the normal situation the placenta detaches from the uterine wall spontaneously and is delivered shortly after delivery of the neonate. Although there is no universal consensus for the length of time allotted, several guidelines suggest to use 30 minutes after delivery of the neonate as the length of time before an intervention is advised. Interventions can involve manual or operative removal of the placenta and can potentially increase postpartum hemorrhage and infections. This is of importance, since postpartum hemorrhage is still one of the leading causes of maternal morbidity and mortality in developed and third world countries despite improvements in prevention and management.

**Background**

At the time the research in this thesis was initiated, the literature on vasa previa was mainly restricted to case-reports, reviews and small case-series. The focus in these studies particularly lay on the outcome of vasa previa, which appeared to depend on prenatal diagnosis. Unfortunately since vasa previa is a rather rare complication, publication bias seemed to be a significant problem with mostly publication of case reports reporting adverse neonatal outcome such as fetal demise in ruptured vasa previa. Studies evaluating the prenatal diagnosis of vasa previa and its outcome objectively were not readily available. It has been hypothesized that prenatal recognition of vasa previa by ultrasound screening enables elective delivery of the fetus by Cesarean section, thus avoiding potential neonatal morbidity or fetal demise. Different researchers and patient associations advocated to start a screening program on vasa previa for all pregnant women based on the available literature.

Placenta associated complications such as placenta previa, placental abruption and postpartum hemorrhage due to retained placenta have been studied previously to a greater
or lesser extent. But the consequences for women regarding future pregnancies after suffering placental abruption or severe postpartum hemorrhage due to retained placenta were not clear. Consequently, prenatal and perinatal care in women with a history of placental abruption, severe postpartum hemorrhage and/or retained placenta is not clearly defined in guidelines and therefore varies worldwide. In addition, for women with placenta previa several recommendations can be found regarding timing of delivery (most often a preterm elective Cesarean section) and administration of antenatal corticosteroids for fetal lung maturation, but there still is a lack of consensus.

**Objectives and outline of this thesis**

The objectives of this thesis were to systematically assess the established screening criteria for the development of a screening program regarding vasa previa. We also identified factors that predict the risk of emergency delivery in women with placenta previa and we investigate the consequences of a history of placental abruption, severe postpartum hemorrhage and retained placenta for potential future pregnancies.

**Part 1. Vasa previa**

*In the first part of this thesis we focus on vasa previa and investigate the possibilities for a potential screening strategy.*

- **Chapter 2** What is the diagnostic accuracy of ultrasound in the prenatal diagnosis of vasa previa?
- **Chapter 3** What is the incidence of vasa previa and what are risk indicators for vasa previa?
- **Chapter 4** Screening, diagnostiek en beleid bij vasa previa – concept richtlijn.

**Part 2. Placenta associated complications**

*In the second part of this thesis we focus on placenta previa, placental abruption and retained placenta with hemorrhage postpartum.*

- **Chapter 5** What are risk factors for emergency delivery in women with placenta previa?
- **Chapter 6** What is the incidence and recurrence rate of placental abruption?
- **Chapter 7** What is the incidence and recurrence rate of severe postpartum hemorrhage and/or retained placental tissue?

**Chapter 8** General discussion and implications for further research
REFERENCES


