

# Guidelines for the Management of Vasa Previa

This guideline has been prepared by the Diagnostic Imaging Committee and the Maternal Fetal Medicine Committee and approved by Executive and Council of the Society of Obstetricians and Gynaecologists of Canada.

## PRINCIPAL AUTHOR

Robert Gagnon, MD, Montreal QC

## DIAGNOSTIC IMAGING COMMITTEE

Lucie Morin, MD (Chair), Outremont QC

Stephen Bly, MD, Ottawa ON

Kimberly Butt, MD, Fredericton NB

Yvonne M. Cargill, MD, Ottawa ON

Nanette Denis, ARDMS, CRGS, Saskatoon SK

Robert Gagnon, MD, Montreal QC

Marja Anne Hietala-Coyle, RN, Halifax NS

Kenneth Ian Lim, MD, Vancouver BC

Annie Ouellet, MD, Sherbrooke QC

Maria-Hélène Racicot, MD, Montreal QC

Shia Salem, MD, Toronto ON

## MATERNAL FETAL MEDICINE COMMITTEE

Robert Gagnon (Chair), MD, London ON

Lynda Hudon, MD, Montreal QC

Melanie Basso, RN, Vancouver BC

Hayley Bos, MD, London ON

Marie-France Delisle, MD, Vancouver BC

Dan Farine, MD, Toronto ON

Kirsten Grabowska, MD, Vancouver BC

Savas Menticoglou, MD, Winnipeg MB

William Mundle, MD, Windsor ON

Lynn Murphy-Kaulbeck, MD, Allison NB

Annie Ouellet, MD, Sherbrooke QC

Tracy Pressey, MD, Vancouver BC

Anne Roggensack, MD, Calgary AB

Disclosure statements have been received from all members of the committees.

**Key Words:** Vasa previa, antenatal hemorrhage, intrapartum hemorrhage

## Abstract

**Objectives:** To describe the etiology of vasa previa and the risk factors and associated condition, to identify the various clinical presentations of vasa previa, to describe the ultrasound tools used in its diagnosis, and to describe the management of vasa previa.

**Outcomes:** Reduction of perinatal mortality, short-term neonatal morbidity, long-term infant morbidity, and short-term and long-term maternal morbidity and mortality.

**Evidence:** Published literature on randomized trials, prospective cohort studies, and selected retrospective cohort studies was retrieved through searches of PubMed or Medline, CINAHL, and the Cochrane Library, using appropriate controlled vocabulary (e.g., selected epidemiological studies comparing delivery by Caesarean section with vaginal delivery; studies comparing outcomes when vasa previa is diagnosed antenatally vs. intrapartum) and key words (e.g., vasa previa). Results were restricted to systematic reviews, randomized control trials/controlled clinical trials, and observational studies. Searches were updated on a regular basis and incorporated into the guideline to October 1, 2008. Grey (unpublished) literature was identified through searching the websites of health technology assessment and health technology assessment-related agencies, clinical practice guideline collections, clinical trial registries, and from national and international medical specialty societies.

**Values:** The evidence collected was reviewed by the Diagnostic Imaging Committee and the Maternal Fetal Medicine Committee of the Society of Obstetricians and Gynaecologists of Canada (SOGC) and quantified using the evaluation of evidence guidelines developed by the Canadian Task Force on Preventive Health Care.

**Benefits, Harms, and Costs:** The benefit expected from this guideline is facilitation of optimal and uniform care for pregnancies complicated by vasa previa.

**Sponsors:** The Society of Obstetricians and Gynaecologists of Canada.

## Summary Statement

A comparison of women who were diagnosed antenatally and those who were not shows respective neonatal survival rates of 97% and 44%, and neonatal blood transfusion rates of 3.4% and 58.5%, respectively. Vasa previa can be diagnosed antenatally, using combined abdominal and transvaginal ultrasound and colour flow mapping; however, many cases are not diagnosed, and not making such a diagnosis is still acceptable. Even under the best circumstances the false positive rate is extremely low. (II-2)

## Recommendations

1. If the placenta is found to be low lying at the routine second trimester ultrasound examination, further evaluation for placental cord insertion should be performed. (II-2B)

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## Key to evidence statements and grading of recommendations, using the ranking of the Canadian Task Force on Preventive Health Care

Quality of Evidence Assessment*	Classification of Recommendations†
I: Evidence obtained from at least one properly randomized controlled trial	A. There is good evidence to recommend the clinical preventive action
II-1: Evidence from well-designed controlled trials without randomization	B. There is fair evidence to recommend the clinical preventive action
II-2: Evidence from well-designed cohort (prospective or retrospective) or case-control studies, preferably from more than one centre or research group	C. The existing evidence is conflicting and does not allow to make a recommendation for or against use of the clinical preventive action; however, other factors may influence decision-making
II-3: Evidence obtained from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of treatment with penicillin in the 1940s) could also be included in this category	D. There is fair evidence to recommend against the clinical preventive action
III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees	E. There is good evidence to recommend against the clinical preventive action
	L. There is insufficient evidence (in quantity or quality) to make a recommendation; however, other factors may influence decision-making

\*The quality of evidence reported in these guidelines has been adapted from The Evaluation of Evidence criteria described in the Canadian Task Force on Preventive Health Care.<sup>34</sup>

†Recommendations included in these guidelines have been adapted from the Classification of Recommendations criteria described in the The Canadian Task Force on Preventive Health Care.<sup>34</sup>

- Transvaginal ultrasound may be considered for all women at high risk for vasa previa, including those with low or velamentous insertion of the cord, bilobate or succenturiate placenta, or for those having vaginal bleeding, in order to evaluate the internal cervical os. (II-2B)
- If vasa previa is suspected, transvaginal ultrasound colour Doppler may be used to facilitate the diagnosis. Even with the use of transvaginal ultrasound colour Doppler, vasa previa may be missed. (II-2B)
- When vasa previa is diagnosed antenatally, an elective Caesarean section should be offered prior to the onset of labour. (II-1A)
- In cases of vasa previa, premature delivery is most likely; therefore, consideration should be given to administration of corticosteroids at 28 to 32 weeks to promote fetal lung maturation and to hospitalization at about 30 to 32 weeks. (II-2B)
- In a woman with an antenatal diagnosis of vasa previa, when there has been bleeding or premature rupture of membranes, the woman should be offered delivery in a birthing unit with continuous electronic fetal heart rate monitoring and, if time permits, a rapid biochemical test for fetal hemoglobin, to be done as soon as possible; if any of the above tests are abnormal, an urgent Caesarean section should be performed. (III-B)
- Women admitted with diagnosed vasa previa should ideally be transferred for delivery in a tertiary facility where a pediatrician and blood for neonatal transfusion are immediately available in case aggressive resuscitation of the neonate is necessary. (II-3B)
- Women admitted to a tertiary care unit with a diagnosis of vasa previa should have this diagnosis clearly identified on the chart, and all health care providers should be made aware of the

potential need for immediate delivery by Caesarean section if vaginal bleeding occurs. (III-B)

J Obstet Gynaecol Can 2009;31(8):748–753

## INTRODUCTION

These guidelines describe the risk factors for vasa previa and associated conditions, and identify the various clinical presentations and management of vasa previa. A brief review of the diagnostic tools available to make the antenatal diagnosis of vasa previa and a suggested management plan are also described.

Vasa previa is a condition in which the umbilical vessels, unsupported by either the umbilical cord or placental tissue, traverse the fetal membranes of the lower segment above the cervix.<sup>1</sup> The reported incidence varies from 1 in 1275 to 1 in 5000.<sup>2,3</sup> Vasa previa usually occurs in association with velamentous insertion of the umbilical cord, bipartite placenta, or succenturiate lobe. In the presence of a velamentous insertion of the cord with the placenta in the lower uterine segment, the incidence of vasa previa has been reported to be 1 in 50.<sup>3</sup> The clinical implications of vasa previa were first outlined in a 1949 case report.<sup>4</sup> A pregnant woman was admitted with spontaneous rupture of membranes followed by vaginal bleeding, cessation of fetal movements, and loss of fetal heart activity. Following delivery, examination of the placenta did not show any evidence of placental abruption, but a torn umbilical vein, along with a velamentous insertion of the umbilical cord, was clearly described. It was speculated that the cause of fetal death was exsanguination. Soon after, Evans<sup>5</sup> confirmed that a

## ABBREVIATIONS

HbF	fetal hemoglobin
IVF	in vitro fertilization
MRI	magnetic resonance imaging

velamentous insertion of the umbilical cord is a prerequisite for vasa previa and that the most common causes of fetal death are exsanguination and/or asphyxia. McNair in 1921<sup>6</sup> and Vogt<sup>7</sup> in 1943 obtained living infants by abdominal delivery. Since fetal loss was 73% with the fetal vessel rupture, they concluded that Caesarean section is indicated in cases discovered early in labour with the membranes intact, but the operation should be considered only before the vessels rupture. More recently, Oyelese et al.<sup>8</sup> reported that significant reduction in fetal mortality from this condition depends on a high index of suspicion leading to antenatal diagnosis and elective delivery by Caesarean section.

### **PROPOSED ETIOLOGY**

There are three theories postulated with respect to velamentous insertion of the cord and vasa previa:

1. Initially there is a satisfactory implantation of the umbilical cord vessels on the decidua basalis, but with growth and expansion of the fetus and the placenta it becomes inadequate; the chorion frondosum surrounding the insertion regresses to become the chorion laeve resulting in velamentous insertion.
2. In velamentous insertion, the richest vascularization shifts to the decidua basalis, site of the future placenta, resulting in the vessels extending to the margin of the placenta.
3. Restricted intrauterine space or limitation of fetal mobility is responsible for the abnormal morphology in both fetus and placenta.<sup>9</sup>

A velamentous insertion of the cord is a prerequisite for vasa previa.<sup>10</sup>

### **RISK FACTORS**

The incidence of vasa previa has been reported as high as 1 in 202 following IVF compared with 1 in 2200 in non-IVF pregnancies, with a likelihood ratio of 7.75.<sup>1,11,12</sup> Other significant risk factors for vasa previa include second trimester placenta previa, with an odds ratio of 22.86, and bilobed and succenturiate-lobed placentas with an odds ratio of 22.11.<sup>1</sup> Fetal anomalies that may be associated with increased risk include renal tract anomalies, spina bifida, single umbilical artery, exomphalos, and, to a lesser extent, prematurity, antepartum hemorrhage, and fetal growth restriction.<sup>1</sup>

### **CLINICAL PRESENTATION**

Before the wide use of transvaginal ultrasound, the classical modes of presentation included vessel rupture at amniotomy, vessel rupture before rupture of membranes, vessel rupture after rupture of membranes,<sup>13</sup> vessel

compression, and vessels palpable on vaginal examination. Ideally, in this day and age, vasa previa should be detected antenatally by vaginal ultrasound and colour Doppler before there is fetal bleeding. Unfortunately, the most frequent presentation is still vaginal bleeding occurring at the time the membranes rupture, the bleeding being most often attributed to a placenta previa, placental abruption, or "heavy show." Bleeding of even 100 mL is sufficient to cause fetal shock and death.<sup>14</sup> Variable-type fetal heart rate decelerations could also occur with extrinsic cord compression secondary to velamentous insertion, and, if prolonged, could lead to fetal asphyxia and death.<sup>15</sup> A sinusoidal fetal heart rate may be a terminal event during fetal hemorrhage.<sup>16,17</sup>

### **ANTENATAL DIAGNOSIS**

The antenatal diagnosis of vasa previa can be made by ultrasound, MRI, amnioscopy, palpation of the vessels by digital vaginal examination, and by identification of fetal blood in vaginal blood intrapartum. A velamentous cord insertion near the cervix can be diagnosed antenatally by transvaginal sonography. In women at high risk, transvaginal ultrasound with colour Doppler can be used during the routine second trimester ultrasound to screen for vasa previa. The placental cord insertion can be identified in up to 99% of ultrasound examinations performed at 18 to 20 weeks.<sup>18,19</sup> Diagnostic criteria for vasa previa using transvaginal ultrasound include the presence of a linear sonolucent area over the internal os of the cervix with absent Wharton's jelly.<sup>20</sup> When using colour Doppler or power colour Doppler, blood flow can be demonstrated through these umbilical vessels, and the Doppler waveforms are typical of umbilical cord Doppler flow waveforms. Since a normal loop of cord maybe mistaken for vasa previa, it is important to ascertain that the vessel is not displaced with maternal movement. Visualization of vasa previa may be difficult with transvaginal sonography alone. Fetal vessels may run at an unfavourable insonation angle of 90 degrees to the relatively fixed transducer. If transvaginal visualization by colour coded Doppler is not possible, the transabdominal route may allow for a more favourable insonation angle (insonation: exposure of a tissue and/or organ to ultrasound waves) and better visualisation of blood flow. Furthermore, only the combined use of transabdominal and transvaginal ultrasound allows the diagnosis of placental type, placental situation, and the cord insertion.<sup>24</sup> The presence of an amniotic sheet carrying fetal vessels maybe observed only when using the combined approach. Furthermore, pregnancy-associated varicosities of the uterine vessels may be mistaken for aberrant placental vessels.<sup>25</sup> In this case, exact localization by a combined approach may avoid an erroneous diagnosis of vasa previa.

In a prospective trial, a sensitivity of 100%, a specificity of 99.8%, a positive predictive value of 83%, and a negative predictive value of 100% have been reported using this approach to diagnose a velamentous insertion of the cord.<sup>18</sup> In a series of 12 069 pregnancies screened, Baulies et al.<sup>1</sup> were able to diagnose up to 78% of occurrences vasa previa in asymptomatic pregnant women antenatally, which is the ideal time to reduce the risk of fetal bleeding and death. Although vasa previa can be diagnosed antenatally, missing the diagnosis is possible even when the ultrasound is performed under the best circumstances in tertiary centres.

It is important to note that in 89% of the cases of vasa previa, one of the following risk factors is present: placenta previa, low lying placenta, and bilobate or succenturiate placenta.<sup>22</sup> In all cases diagnosed antenatally, antenatal glucocorticoids should be administered at 28 to 32 weeks, and elective Caesarean section performed prior to the onset of labour should result in live healthy newborns.<sup>23</sup>

In one of the most important studies by Oyelese et al.,<sup>8</sup> 155 cases of vasa previa were considered. A comparison of women who were diagnosed antenatally and those who were not shows respective neonatal survival rates of 97% and 44%, and the rates of neonatal blood transfusion were 3.4% and 58.5%, respectively. The authors concluded that given the vital importance of antenatal diagnosis of vasa previa, every second trimester ultrasound examination should evaluate placental cord insertion; also, transvaginal ultrasound should be systematically performed for all women who are pregnant following IVF since they are a group at particularly high risk for vasa previa. Other groups at risk include those with low or velamentous insertion of the placenta cord, bilobate or succenturiate placenta, and those having third trimester vaginal bleeding. If vasa previa is suspected, colour Doppler should be used to facilitate the diagnosis. Although it is not possible to detect every case of vasa previa, antenatal ultrasonography can be used to identify some asymptomatic women before delivery. When technically feasible, evaluation of the internal os should be done for women at risk for vasa previa. Differential diagnosis includes chorioamniotic separation, normal cord loop, marginal placental vascular sinus, varicosities of the uterine veins, and amniotic band.<sup>26,27</sup>

MRI is an accurate tool with which the antenatal diagnosis of vasa previa can be made<sup>28,29</sup>; however, it is expensive and not widely available, and thus, at present, is not a method that can be used in most obstetric practice to diagnose vasa previa.

### Summary Statement

A comparison of women who were diagnosed antenatally and those who were not shows respective neonatal survival rates of 97% and 44%, and neonatal blood transfusion rates

of 3.4% and 58.5%, respectively. Vasa previa can be diagnosed antenatally, using combined abdominal and transvaginal ultrasound and colour flow mapping; however, many cases are not diagnosed, and not making such a diagnosis is still acceptable, because even under the best circumstances the false positive rate is extremely low. (II-2B)

### Recommendations

The recommendations were made according to guidelines developed by the Canadian Task Force on Preventive Health Care (Table).

1. If the placenta is found to be low lying at the routine second trimester ultrasound examination, further evaluation for placental cord insertion should be performed. (II-2B)
2. Transvaginal ultrasound may be considered for all women at high risk for vasa previa, including those with low or velamentous insertion of the cord, bilobate or succenturiate placenta, or for those having vaginal bleeding, in order to evaluate the internal cervical os. (II-2B)
3. If vasa previa is suspected, transvaginal ultrasound colour Doppler may be used to facilitate the diagnosis. Even with the use of transvaginal ultrasound colour Doppler, vasa previa may be missed. (II-2B)

### INTRAPARTUM DIAGNOSIS AND CONFIRMATION OF HbF

Since routine screening for vasa previa is not necessarily done, the first manifestation of vasa previa can be intrapartum vaginal bleeding.<sup>21</sup> The unprotected vessels are predisposed to rupture at any time during pregnancy but particularly during labour. Vessel rupture may occur during spontaneous rupture of membranes, but it usually occurs during amniotomy. As bleeding from vasa previa is of fetal origin, associated fetal morbidity and mortality are extremely high, ranging from 50% to 60% with intact membranes to 70% to 100% with ruptured membranes. If a pregnant woman has an antenatal diagnosis of vasa previa and has premature rupture of membranes or starts labouring, immediate delivery by Caesarean section is required. If the diagnosis is suspected during labour, it is essential that in the event of intrapartum bleeding, fetal bleeding is excluded. In cases of variable type fetal heart rate decelerations with intact membranes during labour, careful vaginal examination and palpation of the membranes to rule out pulsating fetal vessels is suggested.

In order to exclude or confirm fetal bleeding, various tests are available for detection of fetal hemoglobin, such as alkali denaturation tests (Apt, Ogita, Loendersloot), hemoglobin electrophoresis, and the Kleihauer-Betke test.<sup>30</sup> The Kleihauer-Betke test and hemoglobin electrophoresis are

both reliable and sensitive, i.e., they are able to identify the presence of HbF in concentrations down to a minimum of 0.01%. However, both tests are too slow to be clinically useful in the diagnosis of vasa previa. Alkali denaturation tests, on the other hand, have been shown to be reliable and fast, but they are quite insensitive. Ideally, all obstetric units should have facilities for one of the confirmatory tests for HbF, but this is not necessarily practical; in reality, most cases of fetal bleeding are diagnosed after an emergency Caesarean section done for fetal bradycardia or sinusoidal fetal heart rate tracing or after investigation of stillbirth through Kleihauer-Betke test.

### MANAGEMENT OF VASA PREVIA

Antenatal diagnosis and aggressive neonatal resuscitation have been associated with a marked improvement in survival in the presence of vasa previa.<sup>8,23,31,32</sup> Since aberrant vessels might regress from the cervix in ~15% of women,<sup>33</sup> serial transvaginal ultrasound with colour Doppler flow is recommended.

When the diagnosis is made antenatally, the safest form of delivery is elective Caesarean prior to the onset of labour. Consideration should be given to hospitalization at about 30 to 32 weeks and administration of corticosteroids to promote fetal lung maturation. Hospitalization allows proximity to the operating room for emergency Caesarean section if the membranes rupture. Approximately 10% of women will rupture their membranes before the onset of labour, so this risk is significant. However, in selected asymptomatic patients, there may be a role for outpatient management, especially if the patient has no signs of labour or uterine activity and has a long, closed cervix on transvaginal sonography. Delivery should occur at an institution where there are adequate facilities for neonatal resuscitation that might include emergency blood transfusions. Ideally, the surgeon should be aware of the position of the fetal vessels before surgery so he or she can plan the incision to avoid lacerating these vessels.

The optimal gestational age at delivery is difficult to establish. However, because of the high fetal mortality rate, the average gestational age at delivery in large series has been 34 to 35 weeks, at which time respiratory distress syndrome is still prevalent. Therefore, administration of antenatal glucocorticoid between 28 and 32 weeks is suggested once a diagnosis has been made. The largest published series suggests that delivery by elective Caesarean section at 35 to 36 weeks' gestation, prior to the formation of lower uterine segment is reasonable, thereby avoiding the risk of membrane rupture and fetal exsanguination. When there has been bleeding from the fetal vessels, the fetal prognosis is generally considered to be poor. The safest and quickest

form of delivery is usually an immediate Caesarean section. The neonate is often severely anemic, and immediate transfusion may be lifesaving. It is ideal to have group-specific or group O Rh negative irradiated blood available for immediate transfusion of the neonate.<sup>14</sup> Collaboration with the pediatrician is crucial. Aggressive resuscitation of the neonate even when there has been significant fetal hemorrhage may improve the fetal prognosis considerably. Using this approach, up to 97% survival has been reported.<sup>8</sup> When the fetus is dead, induction of labour and a vaginal delivery are appropriate.

### Recommendations

4. When vasa previa is diagnosed antenatally, an elective Caesarean section should be offered prior to the onset of labour. (II-1A)
5. In cases of vasa previa, premature delivery is most likely; therefore, consideration should be given to administration of corticosteroids at 28 to 32 weeks to promote fetal lung maturation and to hospitalization at about 30 to 32 weeks. (II-2B)
6. In a woman with an antenatal diagnosis of vasa previa, when there has been bleeding or premature rupture of membranes, the woman should be offered delivery in a birthing unit with continuous electronic fetal heart rate monitoring and, if time permits, a rapid biochemical test for fetal hemoglobin, to be done as soon as possible; if any of the above tests are abnormal, an urgent Caesarean section should be performed. (III-B)
7. Women admitted with diagnosed vasa previa should ideally be transferred for delivery in a tertiary facility where a pediatrician and blood for neonatal transfusion are immediately available in case aggressive resuscitation of the neonate is necessary. (II-3B)
8. Women admitted to a tertiary care unit with a diagnosis of vasa previa should have this diagnosis clearly identified on the chart, and all health care providers should be made aware of the potential need for immediate delivery by Caesarean section if vaginal bleeding occurs. (III-B)

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