CHAPTER 11

Maternal mortality due to vascular dissections and ruptures in the Netherlands

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Submitted
ABSTRACT

Objectives: To assess incidence, clinical features, risk factors and substandard care in maternal deaths due to vascular dissection and rupture in the Netherlands.  
Study design: Data were collected as part of the nationwide confidential enquiry into the causes of maternal deaths in the period 1993-2008.  
Results: Vascular dissection was the most common cause of indirect maternal mortality with a Maternal Mortality Ratio of 0.74 per 100,000 live births (23/3,108,719). In 13 women the location was aortic and in four cases coronary. In six cases other locations were involved. Risk factors were present in 14 cases (61%), with hypertension occurring in 43% of cases (seven women with pre-existing hypertension, four with pregnancy induced hypertension). Substandard care was assessed in 13 cases (57%), mostly being a delay in diagnosis and inadequate assessment of complaints. The risk of vascular dissection or rupture increased with age, gestational age, multiparity, hypertension and connective tissue disease. In two cases Marfan’s syndrome was diagnosed.  
Discussion: Vascular dissection and rupture are rare in pregnancy, though carry a high risk of maternal and fetal morbidity and mortality. Symptoms are heterogeneous, differ in their presence and symptom-free episodes are sometimes present. Vascular dissections and ruptures are frequently only diagnosed postmortem. Autopsy is important to obtain insights in the pathophysiology. In pregnant women with sudden unexplained complaints a thorough analysis of risk factors should be made. The differential diagnosis should include vascular dissections if a patient presents with suggestive complaints. A high index of suspicion with early diagnosis of vascular dissection or rupture may improve the prognosis of the women and their newborns.

INTRODUCTION

Dissection and rupture of the aorta or its branches carry a high risk of maternal death. When it occurs before birth, it nearly always causes fetal death as well. Aortic, coronary, cerebral, and splenic artery involvement have been widely reported, but renal, ovarian and iliac arteries can also be involved. According to large older studies, about half the number of aortic dissections in women under the age of 40 occurred during pregnancy or puerperium. Consequently, it has been
concluded that pregnancy contributes to the pathogenesis of aortic dissections in young women. Oskoui and Lindsay, however, have challenged this association. Cardiovascular stress, cardiac changes in pregnancy and the decreasing peripheral vascular resistance increase the risk of arterial aneurysm and dissection during pregnancy. Also the high levels of female hormones during pregnancy are believed to affect the structure and integrity of major arteries. These changes in architecture of the components of the vessel wall may cause them to be more prone to aneurysmatic malformation and dissection. In the third trimester, significant compression of the aorta, vena cava and iliac arteries by the gravid uterus can occur in the supine position. It is supposed that this may lead to significant changes in the distribution of blood flow through the arteries proximal to the side of compression. The wide variation in blood pressure and changes in blood flow may induce structural effects upon arteries which prompt to aneurysm formation, vascular dissection and rupture. Moreover, in the literature, connective tissue diseases (Marfan’s syndrome, Ehlers Danlos type IV) are supposed to be responsible for the majority of cases. Factors leading to arterial aneurysm formation, rupture and dissection which are not specifically related to pregnancy include congenital abnormalities, inherited vascular diseases, arterial degeneration, inflammatory processes and trauma. In the Netherlands, a national ongoing confidential enquiry of maternal deaths is carried out by the Dutch Maternal Mortality Committee (MMC). Its purpose is to provide a systematic review of the main problems in overcoming maternal mortality. It highlights key areas requiring recommendations for health sector and community action. The recommendations should result in improvement of care. This may ultimately lead to further reduction of maternal mortality and serious morbidity. Cardiovascular disorders are the leading underlying cause of indirect maternal mortality in 46% of indirect deaths in the Netherlands. Of those cases, 45% were caused by vascular dissection or rupture. This review is part of the confidential enquiry and presents 23 cases of vascular dissection and rupture associated with pregnancy, to identify groups at high risk. A literature review was performed to evaluate clinical features, risk factors, diagnostic methods and management. Since pregnancy-related vascular dissections and ruptures are exceptional, most accounts in the literature consist of analyses from literature reviews, small case series and case-reports.
MATERI AL AND METHODS

Data were collected as part of the Dutch nationwide Confidential Enquiry into Maternal Deaths. All pregnancy related deaths reported to the MMC within 1 year after pregnancy between January 1993 and December 2008 in the Netherlands were included.

Maternal death was defined according to the World Health Organization’s (WHO) International Classification of Diseases, tenth revision (ICD-10): “the death of a woman while pregnant or within 42 days of termination of pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes”. Indirect deaths are those resulting from previously existing disease or disease that developed during pregnancy and was not due to direct obstetric causes, but which was aggravated by physiologic effects of pregnancy. Late maternal death was defined as the death of a woman from direct or indirect obstetric causes more than 42 days but less than 1 year after termination of pregnancy.

The Maternal Mortality Ratio (MMR) is defined as the number of direct and indirect maternal deaths per 100,000 live births up to 42 days after termination of pregnancy.

The precise method of data assessment was described in earlier publications. In another report, all indirect causes of maternal mortality are described. We focused on the following variables: location of the dissection, age, gestational age, general and obstetric history, presence of vascular and connective tissue disorders, mode of delivery, neonatal outcome, autopsy results, and substandard care factors.

RESULTS

Overall 23 maternal deaths due to vascular dissection and rupture were identified. The MMR was 0.74 per 100,000 live births in this period (23/3,108,235). The location of the vascular dissection or rupture was aortic in thirteen cases (57%) and coronary in four (17%). In six cases (26%) it concerned different other locations. Five women were not indigenous but originated from Sub Saharan Africa (n=1), Morocco (n=1) or Surinam/Dutch Antilles (n=3). Other characteristics of the overall group are listed in Table 1.
Vascular dissection

Table I. Characteristics of maternal deaths due to vascular dissection in the Netherlands 1993-2008

<table>
<thead>
<tr>
<th>Factor</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;35 years</td>
<td>14 (61%)</td>
</tr>
<tr>
<td>&gt;35 years</td>
<td>9 (39%)</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
</tr>
<tr>
<td>Nulli-</td>
<td>6 (26%)</td>
</tr>
<tr>
<td>Multi-</td>
<td>16 (70%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>1 (4%)</td>
</tr>
<tr>
<td><strong>Gestation</strong></td>
<td></td>
</tr>
<tr>
<td>&lt;14 weeks</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>14-28 weeks</td>
<td>3 (13%)</td>
</tr>
<tr>
<td>28-42 weeks</td>
<td>19 (83%)</td>
</tr>
<tr>
<td><strong>Death</strong></td>
<td></td>
</tr>
<tr>
<td>During pregnancy</td>
<td>14 (61%)</td>
</tr>
<tr>
<td>After pregnancy</td>
<td>9 (39%)</td>
</tr>
<tr>
<td>Within 24 hours</td>
<td>2</td>
</tr>
<tr>
<td>Within 1-7 days</td>
<td>2</td>
</tr>
<tr>
<td>Between 7 and 42 days</td>
<td>3</td>
</tr>
<tr>
<td>Late deaths (&gt;42 days)</td>
<td>2 (%)</td>
</tr>
<tr>
<td><strong>Deliveries</strong></td>
<td></td>
</tr>
<tr>
<td>9 (39%)</td>
<td></td>
</tr>
<tr>
<td><strong>Mode of deliver</strong></td>
<td></td>
</tr>
<tr>
<td>Vaginal birth</td>
<td>4 (44%)</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>5 (56%)</td>
</tr>
<tr>
<td><strong>Death in non-Caucasian immigrants</strong></td>
<td></td>
</tr>
<tr>
<td>5 (22%)</td>
<td></td>
</tr>
<tr>
<td><strong>Autopsy performed</strong></td>
<td></td>
</tr>
<tr>
<td>22 (96%)</td>
<td></td>
</tr>
<tr>
<td><strong>Admission to intensive care unit</strong></td>
<td></td>
</tr>
<tr>
<td>4 (17%)</td>
<td></td>
</tr>
<tr>
<td><strong>Perinatal mortality</strong></td>
<td></td>
</tr>
<tr>
<td>13 (57%)</td>
<td></td>
</tr>
<tr>
<td><strong>Fetal mortality &lt;24 weeks</strong></td>
<td>2 (13%)</td>
</tr>
</tbody>
</table>

Aortic dissection or rupture

Thirteen cases with aortic dissection or rupture were identified. The mean maternal age at time of occurrence was 32.5 years (range 22-42). Nine women were multiparous (69%), three were nulliparous (23%) and in one, parity was unknown. In three women, aortic dissection presented in the first or second trimester and in five women (39%) in the third trimester. Five women died postpartum (39%): two spontaneous vaginal deliveries and three caesarean sections occurred. Four mothers gave birth to a total of five liveborn infants, in the fifth mother perimortem caesarean section was performed unsuccessfully.
Seven (54%) women presented with either pregnancy induced hypertension ($n=3$) or superimposed hypertension ($n=4$). No pre-eclampsia was diagnosed. One woman had a history of Marfan’s syndrome with severe dilatation of the ascending aorta (59 mm at 24 weeks gestation). One woman was diagnosed with Marfan’s syndrome postmortem and one had a family history of Marfan’s syndrome but was screened negative before her pregnancy. Her family rejected autopsy. Other reported histories were obesity ($n=3$), excessive smoking ($n=2$), Morbus von Willebrand (Iia) ($n=1$), pancreatitis ($n=1$), cholecystectomy ($n=1$), ovariectomy ($n=1$), hyperhomocysteinemia ($n=1$) and pregnancy after In Vitro Fertilisation ($n=1$).

The most frequent primary complaint was chest pain in six women, followed by (intra)scapular pain, back pain and dyspnea in four women. Other symptoms included vomiting, nausea, sweating and palpitations. In one case, there were no complaints previous to collapse. Only in two cases aortic dissection or rupture was diagnosed before death. Other clinically suspected diagnoses were pulmonary embolism ($n=4$) and seizure ($n=1$). Autopsy was performed in 11 women. In 10 cases a definitive diagnosis of aortic dissection was confirmed. According to the Stanford classification, seven women had type A aortic dissection involving the ascending aorta, two type B aortic dissection involving the descending aorta and from one the classification was not reported. In the majority of cases ($n=9$) cardiac tamponade lead to death, the remaining cases died because of haemorrhagic or ischaemic complications.

Substandard care analysis revealed delay in diagnosis and/or treatment in nine women. In four cases, no diagnostic tests were performed despite complaints. In three cases, diagnostic analysis was incomplete and limited to ECG, arterial blood gasses, chest X-ray, ventilation-perfusion scan and a transesophageal echocardiography. In one case there was a therapeutic delay: despite symptomatic progressive dilatation of the aortic arc, treated with beta-blockage, cardiothoracic surgery was delayed. At 34 weeks gestation caesarean section was performed, and a operative aortic procedure was planned for 2 months postpartum. However, she developed complaints and collapsed 3 days postpartum, and an emergency aortic procedure was unsuccessfull. Remarkably, six women had a symptom-free episode, leading to discharge from hospital in three cases without a definitive diagnosis.

**Coronary dissection or rupture**

Four cases of coronary dissection or rupture were identified. Three women were multiparous, one was primipara. In two cases maternal death occurred postpartum.
In the other two cases maternal death occurred in the second and third trimester respectively. In one woman coronary dissection was suspected and treatment was started before her death. In the other three women the coronary dissection was only diagnosed postmortem during autopsy. All four cases presented with different symptoms and two women had typical anginous pain. One woman had an unrevealing medical history, one had an obstetric history with pre-eclampsia, one had pre-existing hypertension and obesity and one had only obesity.

Autopsy was carried out in all four cases of coronary dissection or rupture. In three cases, death was caused by coronary dissection; followed by infarction, arrhythmia or post procedural stent thrombosis. In the fourth, a teenager, obduction showed rupture of a mycotic coronary artery. The left anterior descending (LAD) artery was involved in two cases with one case of left main stem (LMS) disease. In one case dissection was located in the circumflex artery.

Substandard care was present in two cases. Although no diagnosis was made in one case, the general practitioner and pediatrician did not refer the patient to an obstetrician or other specialist. In the second case the obstetrician did not treat hypertension sufficiently.

**Vascular dissection or rupture in other locations**

Six other locations of vascular dissection or rupture were found. Locations involved were: splenic artery (n=3), hepatic artery, iliac artery, and carotid artery. Four women were multiparous and two were primiparous. Three died in the third trimester and two postpartum. Two women had pregnancy induced and one woman had pre-existing hypertension. None had pre-eclampsia. Three women were diabetic (1x mellitus, 2x gravidarum) and one smoked. One woman was diagnosed with Morbus von Recklinghausen. One woman had an unrevealing history and in one history was unknown.

In four cases, the physicians could not make a diagnosis until autopsy revealed the cause of death. Only in one case the clinical diagnosis was confirmed, in the second case dissection of the splenic artery was diagnosed during laparotomy. In five cases massive abdominal haemorrhage was the mode of death, in the sixth woman a carotid artery dissection led to cerebral oedema and compression.

In two out of six cases substandard care was identified. In one case, a patient discontinued her antihypertensive medication due to side effects, the frequency of
antenatal visits was insufficient. A diagnostic delay by the obstetrician was present in one case, and by an internal medicine specialist in another.

**DISCUSSION**

**Vascular dissection or rupture in pregnancy**

This is one of the largest reviews on vascular dissections and ruptures associated with pregnancy. The most common location of vascular dissection or rupture was the aorta ($n=13$), followed by the coronary ($n=4$) and splenic arteries ($n=3$). Most occurred in the third trimester or puerperium. Pedowitz and Perell reviewed 127 cases culled from the literature and found, as we did, that the majority of cases occurred in the third trimester or the puerperium.$^1$ Contrary to what one would expect, the stress of labour seems a relatively benign factor in the cause of rupture. This finding is confirmed by our data, for we did not find any intrapartum death.

Hypertension, including chronic, pregnancy induced and superimposed hypertension, is a major risk factor. It leads to arterial degeneration and is the most commonly associated factor in acute aortic dissection in pregnant and non-pregnant women.$^{14,15}$ In our study, the prevalence of hypertension is 48%. In the study by Pedowitz and Perell also 48% (19/40) of the women had hypertension.$^1$ In the literature, types of hypertension are not further specified, therefore it is not clear whether chronic hypertension poses higher risks than pregnancy induced hypertension alone.

Whereas vascular dissections and ruptures are associated with high maternal and fetal mortality rates, varying maternal and fetal outcomes are reported in the literature. Pedowitz et al. reported 96 maternal deaths in 120 cases with vascular aneurysms (80%).$^1$ Wollf reported 73 cases and found 26% maternal mortality within 1 hour, 66% within 48 hours and 92% within 10 weeks of dissection.$^{16}$ However, Immer et al. reported 57 cases of aortic dissection associated with pregnancy, all received surgery and 50 survived.$^{17}$ They reported 16 fetal deaths (28%) and three with poor outcome (5%).

**Aortic dissection or rupture**

The essential feature of aortic dissection is a tear in the intimal layer, followed by formation and proliferation of a subintimal haematoma. The dissecting haematoma
occupies a substantial circumference of the aorta. This produces a false lumen or double-barreled aorta, which can reduce blood flow to major arteries. If dissection involves the pericardial space, cardiac tamponade and cardiac failure may result which is the most common cause of death in type A aortic dissections. Other principal complications are acute myocardial infarction, aortic rupture followed by massive hemorrhage, and end-organic ischaemia due to malperfusion. Dissections of the thoracic aorta have been classified anatomically by two different methods. The more commonly used system is the Stanford classification, which is based on involvement of the ascending aorta and simplifies the DeBakey classification. Type A involves the ascending aorta (DeBakey types I and II); type B does not (DeBakey type III). The distinction is of great importance with regard to treatment. Type A dissection requires immediate surgical correction, since conservative treatment is associated with increasing mortality rates reaching 80% in the first week after the diagnosis. For patients with type B dissection, conservative medical treatment is usually recommended in the absence of rupture or malperfusion. Type A dissections are more frequently reported than type B dissections corresponding with our results (seven versus two). In 89% of the cases, the proximal tear occurs within the ascending aorta. Aortic dissections in pregnancy are usually thoracic in location. This was confirmed in our study (77%). Svensjo et al. reported 279 autopsies of lethal dissections and ruptures of the thoracic aorta in men and women. Hypertension was found to be the most important risk factor. Other risk factors include Marfan’s Syndrome and disorders of connective tissue such as Ehlers Danlos syndrome (EDS) type IV and Turner’s syndrome. In the literature, Marfan’s syndrome is responsible for up to 50% of reports published on aortic dissections. In women with Turner syndrome, the risk for aortic dissection or rupture during pregnancy may be 2% or higher. In patients with EDS type IV about 40% have dissection and rupture of different arteries by 40 years of age. In our study, Marfan’s disease was diagnosed in 15% (2 cases). In contrast to what one would expect from literature, our study did not comprise cases with Ehlers Danlos or Turner. In literature there may be a high incidence of complications due to selection and publication bias. Also cystic medial degeneration of the aorta, a bicuspid aortic valve, aortic coarctation, blunt trauma, pregnancy itself and manipulations of and operations on the thoracic aorta have been associated. The risk factors most probably relate to a combination of inherited and acquired weakening of the aortic media and intimal disease.
We found most substandard care due to delay in diagnosis or insufficient diagnostic testing. Clinical manifestations of aortic dissection or rupture - classically expressed through severe ripping chest, intrascapular and/or abdominal pain - were frequently underestimated. Only in two cases, dissection was diagnosed before death. The differential diagnosis includes acute coronary disease and pulmonary embolism. During pregnancy also amniotic fluid embolism, abruptio placentae, uterine rupture are to be considered as frequent causes of chest or abdominal pain. A normal electrocardiogram and normal cardiac enzymes are helpful in excluding acute coronary disease. A ventilation perfusion scan or CT-scan will help in ruling out pulmonary embolism. In case of aortic dissection, a chest radiograph occasionally shows mediastinal enlargement and left pleural effusion. Transesophageal echocardiography is needed to diagnose aortic dissection. The diagnostic accuracy of transesophageal echocardiography is reported to be up to 99%. Magnetic Resonance imaging is also used in the diagnosis with a sensitivity and specificity of 95%. The choice of imaging method depends on patient’s presentation, local availability of imaging equipment and radiological staff expertise.

An aortic diameter of 40 mm or more, progression of dilatation and cardiovascular compromise are reported as risk factors for cardiovascular events in pregnancy. Immer et al suggested that if aortic root enlargement >40 mm is found, a beta-receptor blocking drug should be administered. Elective fetal lung maturation should be induced after 26 weeks gestation. Hospitalization of high risk patients should be considered between 28 and 32 weeks. It is recommended to perform caesarean section with regional anaesthesia to prevent blood pressure peaks, which may induce dissection. Aortic root surgery should be done a few days after delivery, but pregnancy and the postpartum period by themselves increase the maternal mortality risk of surgery up to five fold. In case of acute aortic dissection is generally recommended that, before 28 weeks of gestation, dissection should be repaired and pregnancy could continue. When the fetus is beyond 32 weeks of gestation, caesarean delivery followed by aortic repair in a single operative session can be considered. Between 28 and 32 weeks of gestation, aortic repair is performed and caesarean delivery is reserved for fetal distress.

**Coronary dissection or rupture**

Spontaneous coronary dissection is an infrequent event that occurs mainly in young, otherwise healthy women with few or no conventional risk factors for coronary artery disease. It commonly concerns pregnant women, or those in the...
postpartum period.\textsuperscript{25} Coronary artery dissection accounted for 16-27\% of the case reports on pregnancy-related acute myocardial infarction.\textsuperscript{26,27} Associated risk factors are hypertension, positive family history of coronary artery disease, smoking and hypercholesterolemia.\textsuperscript{28,29} We reported obesity in two and super imposed hypertension in one out of four patients. These conditions can be confirmed as risk-factors.

From 1952 to 2008, a total of 83 pregnancy-associated coronary artery dissections have been reviewed, and 72\% (60/83) occurred in the postpartum period.\textsuperscript{28,29} In our study two out of four had coronary dissection postpartum. The LAD was involved in 78\% (65/83) of patients. In 23\% (19/83) the dissection included the left main stem (LMS) and in 36\% (30/83) multivessel dissections were evident. Additional to LAD and LMS we also report on involvement of the circumflex artery. Whereas Koul reported a mortality of 38\%, Appleby did report 100\% survival rate. This was explained by contemporary guidelines, advances in medical and interventional strategies, a higher index of suspicion by admitting physicians and a lower threshold for urgent cardiac catheterization.\textsuperscript{28,29} Conversely, we report four lethal coronary dissections and ruptures.

Clinical presentation of spontaneous coronary dissection is variable and may range from asymptomatic to acute myocardial infarction and sudden death. Predominantly the first symptom is chest pain, only presenting first in one of our cases. While short term mortality appears high, survival throughout the initial event predicts a good prognosis.\textsuperscript{25,29} Urgent angiography is crucial to ascertain the diagnosis and to facilitate the choice of therapy.

No clear consensus exists on the optimal treatment strategy for these patients. Treatment ranges from a conservative medical approach to percutaneous coronary interventions (PCI) including angioplasty and stenting, coronary bypass grafting and even cardiac transplantation, indicating lack of evidence for the best option. Initial treatment of coronary artery dissection should probably consist of heparin, nitroglycerin and immediate catheterization.\textsuperscript{30} The use of thrombolytic agents in pregnancy is best avoided in patients in whom dissection is suspected. Choice of treatment mostly depends on the hemodynamic status of the patient, angiographic findings and the area of myocardium at risk. With the advent of PCI there seems to be a trend towards more invasive interventions in case of coronary dissection. As a consequence: more women with pregnancy-related coronary dissection are referred urgently for angiography and percutaneous intervention.
Other types of vascular dissections or ruptures

Splenic artery aneurysm (SAA) rupture occurs more frequently during pregnancy and the rate ranges from 20-50%. In autopsies from our cases, aneurysmatic findings were only described in the case of the splenopancreatic vascular anomaly. SAAs are found predominantly in multiparous women and it appears that pregnancy has a strong association with SAA formation. All three of our cases of splenic artery rupture occurred in multiparous women.

Clinical features are sharp abdominal pain, either in the epigastrium or more often localized in the left upper quadrant with associated pain in the tip of the left shoulder (Kehrs sign). This is associated with nausea, vomiting, hypotension and sudden collapse. Hypovolemic shock is the most suggestive feature of rupture. An emergency scan may reveal free fluid in the upper abdomen. Often the diagnosis is only made at surgery, or, like in two of our cases at autopsy. Immediate resuscitation and cessation of haemorrhage is essential for maternal and fetal survival. Splenectomy is often performed. It is essential to involve the general or vascular surgeon.

To our knowledge, there is only case report of pregnancy related dissecting aneurysm of the main hepatic artery. Both mother and fetus died. Muller and Kim described a dissecting aneurysm involving the distal celiac and proximal common hepatic arteries in a woman after spontaneous abortion. Other cases of hepatic artery dissection or rupture were associated with previous surgery, hypertension and arterial disease as medial degeneration and fibromuscular dysplasia. Epigastric pain is often the only symptom. The classical clinical triad (Quincke) of epigastric pain, upper gastrointestinal hemorrhage, and jaundice is only present in approximately 30% of patients. Our case presented with severe sharp back pain and nausea followed by hypovolemic shock. The final diagnosis is often made at autopsy, as in the only case we found with a ruptured hepatic artery. When dissection or rupture of the hepatic artery is suspected, selective angiography or contrast-enhanced CT is usually required for diagnosis and surgical planning. Management can only be medically in uncomplicated cases of hepatic artery dissection, preferably percutaneous embolization or surgery of the vascular lesion would be performed.

Carotid artery rupture and dissection in pregnancy is very rare. Few case reports are written. Dissections of carotid, vertebral and basilar arteries are named: cervicocerebral artery dissections. Cervicocerebral artery dissections may account for up to 15-20% of strokes in patients under 30-45 years. Mechanisms leading to
carotid artery dissection are different kinds of neck manipulations including laryngoscopy, axial rotation and hyperextension of the neck under general anesthesia and even vomiting and vigorous nose blowing. Risk factors are migraine, hyperhomocysteinemia, recent systemic infection, connective tissue disorders such as Marfan’s syndrome, Ehler-Danlos syndrome and vascular wall disorders such as fibromuscular dysplasia and cystic medial necrosis. Similar to our patient, postpartum headache and acute ischaemic stroke are the most common symptoms. To our knowledge only one antepartum case of carotid dissection is reported. Waidelich summarized eight postpartum cases of carotid dissections and assumed parturition might aggravate it. Additional to changes of the vascular wall, elevated bloodflow and cardiac output during pregnancy, and expulsive efforts during the second stage of labour have been proposed as aggravating factor. Maternal mortality was described ten days postpartum in one of the eight cases. As in our case cerebral oedema led to death.

Diagnosis of carotid artery dissection or rupture depends on neurologic examination and is confirmed by Doppler ultrasound, CT-angiography, or preferably magnetic resonance angiography. Therapeutical options are anticoagulant therapy, trombolytic therapy, endovascular stenting and surgical repair. Nolte et al. reported one postpartum case of dissection and rupture of both iliac arteries. The woman had an unremarkable pregnancy and delivery and died eleven days postpartum. The authors suggest that pregnancy and the hormone excess are an initiator of arterial degeneration. The case we noted, vacuum extraction was performed, because of prolonged second stage of labour. Other risk factors are endurance athletics, connective tissue diseases, fibromuscular dysplasia and alpha-1-antitrypsin deficiency. Therapeutic options include conservative management, stenting and surgical reconstruction.

RECOMMENDATIONS

A pregnant woman presenting with an acute sharp tearing or ripping intrascapular, chest or back pain, particularly in the case of chronic hypertension, should be suspected for aortic dissection or rupture. Because of their rarity, vascular dissections and ruptures are almost never considered in the differential diagnosis of obstetrical complications which produce a similar picture. In many instances, rupture of an arterial aneurysm will initially simulate other less serious disease
processes, thus delaying the correct diagnosis until a tragic event occurs. Diagnosis may be particularly difficult when cases of arterial dissection appear in unusual locations. A high index of suspicion with early diagnosis and treatment of a vascular dissection or rupture are imperative in order to give optimal chances of survival to the mother and fetus.

In pregnant patients, the presence of a viable fetus demands a multidisciplinary approach, requiring the cooperation of radiologists, cardiothoracic and vascular surgeons, anesthetists, obstetricians and neonatologists. Since symptoms are often mild in the beginning, a thorough analysis of risk factors, should be made. If a patient presents with suggestive complaints and risk factors are present, this should trigger to exclude the diagnosis. Pregnant women with preexisting risk factors, such as connective tissue disease, aortic root dilatation, hypertension, or a positive family history of vascular dissection or rupture, should preferably be seen preconceptionally. Then a plan can be made to lower risks in pregnancy, such as surgical correction of the aortic root, lowering of blood pressure and help to quit smoking. Patients with risk factors such as aortic root enlargement, Ehler Danlos, Marfan and Turner, should be counseled preconceptionally about their increased risks during pregnancy.
REFERENCES


