

Case report

Rupture of the spleen or splenic vessels (splenic emergency syndrome) in late pregnancy: A report of two autopsy cases

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Received 2 November 2006; received in revised form 12 April 2007; accepted 30 June 2007

Available online 28 August 2007

Abstract

Emergencies of splenic origin in pregnancy involving rupture of the splenic artery or hemorrhage are rare events that can present suddenly and unexpectedly. We report two cases of young women, both in the third trimester of gestation, who suffered sudden malaise while at home and were admitted to the ER. On arrival, both were in severe hemorrhagic shock due to gross hemoperitoneum and they died in the operating theatre during emergency surgery. To better clarify the causes and sequence of these mortalities, forensic autopsy was requested in each case. In the first (a 26-year-old primigravida in the 40th week of pregnancy), cadaveric section demonstrated the rupture of an aneurysm of the splenic artery. In the second (a 28-year-old multipara in the 33rd week of pregnancy), the clinical and anatomopathological data suggested splenic hemorrhage. In both cases histology showed a fibrodysplasia of the arterial wall involving the splenic artery in one case and the hilar branches in the other. In agreement with the data in literature, in such cases particular importance must be attributed to examination of the arterial wall. In pregnancy a synergic effect between hemodynamic and endocrine factors can cause degeneration of the arteries resulting in dramatic hemorrhage. From the forensic pathologist's viewpoint, these cases underline the importance of histopathological study of the splenic artery in the interpretation of the pathogenesis of splenic vessel rupture or hemorrhage.

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Keywords: Arterial fibrodysplasia; Pregnancy; Splenic artery aneurysm; Splenic emergency syndrome; Splenic rupture

1. Introduction

Insidious spontaneous rupture of the spleen or splenic vessels in pregnancy is a rare event and the pathogenetic factors are still largely unknown. The event carries a high maternal and fetal mortality rate and the clinical picture has been named “splenic emergency syndrome”, terminology that well describes such cases [1,2]. In fact, brisk intraperitoneal bleeding often causes an abrupt onset of shock, leading to sudden, unexpected death [3,4]. These cases therefore come under the observation of the forensic pathologist because the precise cause of death can only be determined by autopsy [1,5]. The forensic pathologist must evaluate any traumatic cause, even of a mild nature, especially in the context of familial

violence. Quite often, medical negligence may be hypothesized, due to failure to diagnose or to inappropriate medical care [6]. We report two cases of death of young women in the third trimester of pregnancy, caused by rupture of an aneurysm of the splenic artery in one case and by splenic hemorrhage in the other. A review of the literature on similar cases emphasizes the morphological changes of the splenic arteries that may be correlated with these events [1,3–5,7–9].

2. Case reports

2.1. Case # 1

2.1.1. Clinical summary

A 26-year-old woman, primigravida in the 40.5th week of pregnancy, suffered sudden malaise while at home, without loss of consciousness. Due to rapid, progressive deterioration of her condition, the patient was admitted to the local hospital two hours from the onset of the symptoms. She arrived in a state of hypovolemic shock. Intensive care procedures were performed,

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blood and plasma substitutes were transfused and ultrasound scans were urgently accomplished. No fetal movements were noted, but marked fetal bradycardia and hemoperitoneum were demonstrated. Cesarean section was immediately carried out and a dead fetus extracted. An abundant hemoperitoneum (2800 cm³) was evacuated and hemostasis achieved. A thorough inspection of the peritoneal cavity ensued with subsequent opening of the gastro-colic ligament. There was a sudden onset of cardiac arrest and resuscitation procedures were unsuccessful. Death occurred two hours after hospital admission. The patient history was negative for trauma and any other pathological findings during the clinical course of the pregnancy.

2.1.2. Pathological findings

At autopsy, only the abdominal examination was remarkable. Abundant blood (approximately 2 l) was present in the peritoneal cavity, and a voluminous blood clot occupying the splenic bed was noted. Retroperitoneal hemorrhage was present, extending to the pancreas, adrenal gland and left kidney. The spleen was in normal shape and weighed 400 g. The abdominal aorta and main branches were intact. The splenic artery was isolated inside an abundant hemorrhagic infiltrate and discontinuity of the wall at the level of the tail of the pancreas was noted. The vessel was removed and fixed in 10% buffered formalin. Examination revealed rupture of the arterial wall at the level of an aneurysm measuring 1 cm in diameter situated approximately 5 cm from the splenic hilus. Two other fusiform dilations were present along the course of the vessel towards the hilus. Samples of the arterial wall at the level of the aneurysms and of intact wall tracts were taken.

Microscopic examination of the sections stained by standard methods (*hematoxylin–eosin*, *Verhoeff's Elastin*, *Masson's Trichrome*) demonstrated that the aneurysmatic wall was composed of a fibro-muscular layer with fragmentation and duplication of the internal elastic lamina, myo-intimal thickening consisting of fibro-muscular hyperplasia, and fibrosis of the tunica media (Figs. 1 and 2). Marked adventitial fibrosis was also noted, as well as a focal intimal thickening,

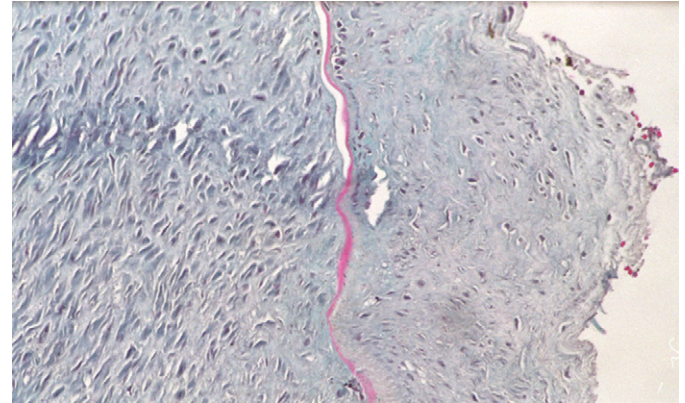


Fig. 2. Diffuse intimo-medial fibrosis (Masson's Trichrome stain, original magnification 400×—Case 1).

with chondro-mixoid matrix deposits. The microscopic examination of the brain, heart, lungs, liver and kidneys excluded pathological findings.

2.2. Case # 2

2.2.1. Clinical summary

A 28-year-old woman, multiparous, who had undergone two previous Cesarean sections, was in the 33.6th week of a complication-free gestation. One morning at home, she suddenly suffered violent abdominal cramps and later lost consciousness. She was admitted to the ER two hours after the onset of the symptoms in a state of hemorrhagic shock. Members of the family reported that she had had a slight fall, 24 h before hospitalization, with no apparent immediate or delayed consequences. There was no history of social or family violence problems. Ultrasound scanning showed abundant leakage of blood into the peritoneal cavity. The patient was immediately taken to the operating theatre where a cesarian section was performed with extraction of a live fetus. A specialist surgical team then inspected the peritoneal cavity, finding severe hemoperitoneum (approximately 2000 cm³) and gross blood infiltration of the retroperitoneum, extending from

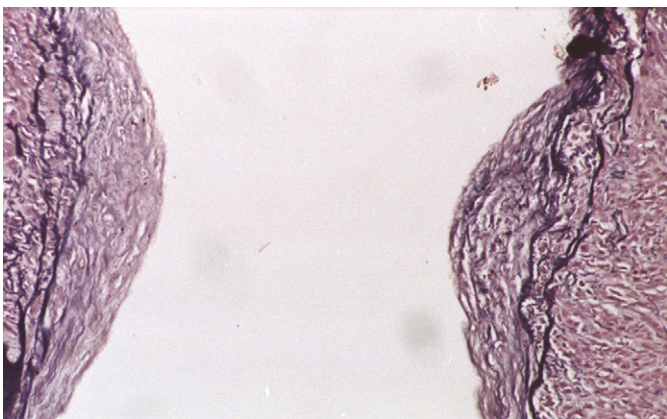


Fig. 1. Focal intimal thickening "kissing lesions" and reduplication of the internal lamina elastica (Verhoeff's elastin stain, original magnification 200×—Case 1).

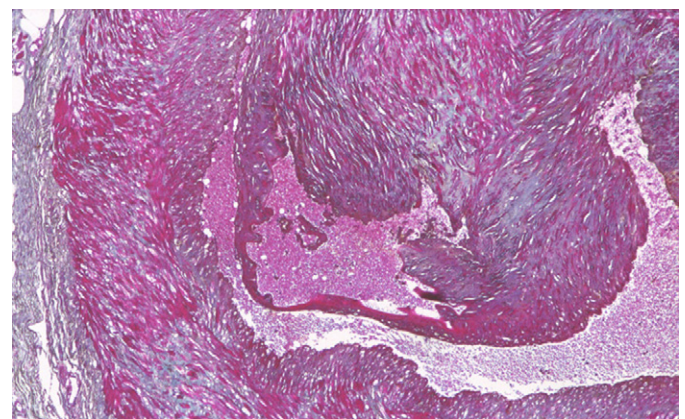


Fig. 3. Focal myo-intimal thickening with intramural hemorrhage and structural disarray of the tunica media of a hilar artery (Masson's Trichrome stain, original magnification 50×—Case 2).

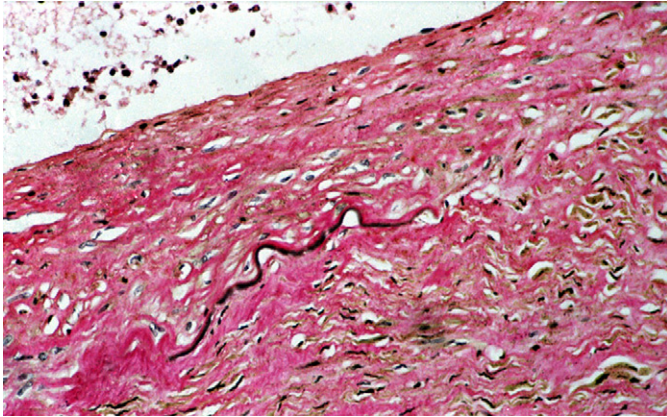


Fig. 4. Intimal thickening and fragmentation of the internal lamina elastica and intimo-medial fibrosis (Verhoeff's Elastin stain, original magnification 400 \times —Case 2).

the celiac tripod region up to the duodenum and along the pancreas and, on the left side, up to the adrenal gland and parieto-colic insertion. The spleen exhibited a rupture extending from the hilus to the inferior pole. Splenectomy and hemostasis were performed, and eight units of whole blood were transfused, as well as plasma expanders and atropine. Her condition became unstable during surgery and she died in the operating theatre after three hours of unsuccessful resuscitation manoeuvres.

2.2.2. Pathological findings

Cadaveric section showed no free blood in the peritoneal cavity. However, there was evidence of retroperitoneal hemorrhage and the surgical procedures performed. There was no discernible evidence of chest or upper abdominal trauma. The dissection of the cutaneous and muscular tissue of the back and flank excluded indices of blunt trauma. Histopathological findings revealed rupture of the splenic capsule close to the hilus.

The forensic pathologist obtained further sections from the surgical splenectomy material for direct examination. These sections were examined after staining with *hematoxylin–eosin*, *Masson's Trichrome*, *Verhoeff's Elastin*.

Microscopic examination of the spleen showed recent hemorrhagic infiltrates but no signs of organization or accumulation of intraparenchymal fibrin in the perivascular site or along the fibrous structures. Examination of the hilar branches of the splenic artery disclosed marked fragmentation and duplication of the internal elastic lamina, intimal fibromuscular dysplasia and fibrosis of both the media and adventitia. The tunica media was diffusely thinned and composed predominantly of collagen fibres with scanty, often vacuolated muscle cells (Figs. 3 and 4). The spleen did not show disorders or reactive lesions. The microscopic examination of the brain, heart, lungs, liver and kidneys excluded pathological findings related to the vascular tree.

3. Discussion

The cases we describe demonstrate classic “splenic emergency syndrome” occurring in the third trimester of

pregnancy, during labor or postpartum. The events most frequently reported in literature giving rise to this dramatic picture are rupture of a splenic artery aneurysm (SAA) and, more rarely, cases of “spontaneous” rupture of the spleen.

Aneurysm of the splanchnic arteries is an uncommon form of vascular disease but has a considerable clinical importance owing to its tendency to rupture. SAA are the most common among splanchnic artery aneurysms (from 60 to 71% of cases) but are in third place among aneurysms of the abdominal region, after those of the infra-renal aorta and the iliac artery. SAA are frequent above all in women (78.8%) [1]. More than 50% of aneurysmatic ruptures in women under the age of 40 years are correlated to pregnancy and the arteries most often involved are, in declining order, the aorta, cerebral arteries, splenic artery, renal artery, coronaries and ovarian artery [7].

In literature, a 25% mortality rate is reported for ruptured SAA, an extremely high mortality rate of 70% among pregnant women, and an even higher fetal mortality rate of 90% [3]. Rupture most often occurs in the third trimester (69%) or during labor (13%) [7].

The pathogenic mechanisms hypothesized for SAA and aneurysms of the splanchnic include: congenital malformation, inherited systemic and vascular connective tissue disorders, vascular trauma, inflammatory processes and degenerative arterial disease. Arteriosclerosis is rarely a primary causative factor. In cases of SAA in pregnancy, specific vascular diseases have rarely been reported. The effects of the estrogen and progesterone on the arterial wall, as well as hemodynamic stress (increased blood flow, portal congestion, splenic arteriovenous shunting) have been postulated as possible mechanisms determining or predisposing to the formation or rupture of SAA in pregnancy. [7,8].

Owing to the rarity of histopathological observations, in any case conducted just when the lesions are in an advanced state, we can only speculate about the pathogenesis of these alterations of the arterial wall that lead to the formation or rupture of aneurysms or to spontaneous arterial dissection [5]. Hypotheses are currently being revised on the basis of theoretical, mathematical and experimental models [10] that have revealed new aspects of the complex structure of the vascular wall [11]. Recent studies highlight that the vessel wall is in a continual state of self-maintenance and self-regulation including remodelling that occurs in response to hemodynamic stress. Studies suggest remodelling of the vessel wall causes similar histological lesions, regardless of the pathogenic factors [12].

An excessive rise in blood pressure or arterial flow can injure the vascular wall, inducing arterial fibromuscular dysplasia (FMD), frequently associated with cervical artery dissection [13] and sometimes with splenic artery aneurysms [9]. The most common form is medial fibromuscular dysplasia, which accounts for more than 95% of cases. Histological features include disruption of the internal elastic lamina, irregular thinning and focal absence of the media, intramural hemorrhage and arterial dissection lacking an inflammatory response. Medial dysplasia causes stenosis or aneurysm. The renal arteries are most often affected, resulting in renovascular

hypertension [14,15]. FMD in the splenic arteries has been reported in multiple involvements of the visceral arteries [16,17].

We have already pointed out that many cases of FMD are secondary to increased blood pressure or arterial flow, but lesions similar to those of FMD have also been observed in some infectious diseases [12]. These findings, together with the occurrence of FMD in a patient with Marfan's syndrome, and in conjunction with previous reports of FMD in a variety of connective tissue disorders, suggest that FMD, like cystic medial necrosis, may be a non-specific disease entity [18].

The above considerations seem to support the hypothesis that the arterial wall may react by means of a series of non-specific alterations to a number of precursors such as hemodynamic alterations, genetic factors, infectious diseases and aging [19].

However, histological evaluation of SAA rupture in pregnancy has rarely been reported and in any case, assessment of such evidence is difficult due to the disrupted vascular structure and its correspondence with late stage lesions. Degenerative processes of the arterial wall include disruption of the internal elastic lamina, fragmentation of the elastic fibers and fibrodysplasia of the media, seemingly prevalent in young pregnant women [20].

SAA rupture in pregnancy was observed in case 1, featuring fibrodysplastic type alterations of the arterial wall, but absence of systemic vascular or connective tissue disease.

In the forensic pathology field, assessment of SAA rupture in late pregnancy can rely on direct histopathological evidence demonstrating alterations of the splenic arterial wall leading to spontaneous rupture of the vessel.

The forensic pathologist faces greater difficulties in the case of splenic hemorrhage, needing to make a differential diagnosis between traumatic (frequent) and "spontaneous" (rare) rupture of the spleen.

An atraumatic hemorrhage in a non-diseased spleen, i.e., a "true spontaneous rupture" must be regarded as an extremely rare, and also controversial event [4]. However, pregnancy is numbered among the conditions that can result in atraumatic rupture of the spleen. The risk of splenic rupture appears to be directly proportional to the number of pregnancies and maternal age, being more frequent in multiparous and older mothers. The greatest incidence is in the third trimester and during breastfeeding [2]. Splenic rupture in the course of pregnancy is localized, in decreasing order of frequency, at the level of the postero-lateral margin of the spleen, the inferior pole and at the hilus [6]. The etiology of spontaneous splenic ruptures in pregnancy often remains a mystery for forensic pathologists. In absence of disease processes, various factors linked to pregnancy have been suggested, such as hypervolemia, increased splenic volume, a reduced volume of the peritoneal cavity due to expansion of the uterus, and muscle contractions during labor. Other authors have suggested that an anomalous position of the spleen or a short splenic stalk might have a role predisposing to rupture, as these congenital factors could foster an anomalous compression of the diaphragm during coughing or vomiting episodes [2,6].

Rupture of the spleen can occur as a result of any grade of trauma, even minimal, in presence of pathological processes. Trivial trauma can induce delayed and occult ruptures, the latter being sometimes minimal or having a chronic evolution. The suspicion of a non-accidental lesion, and in particular of domestic violence, must always be considered. A complete clinical history should be obtained even in emergency situations to determine recent or previous trauma associated with accidental injuries or interpersonal violence. A careful search must be made for signs of trauma especially in the upper abdominal region. In all cases, a pathological cause of splenic rupture must be considered and thoroughly investigated. In our case of a 28-year-old multiparous, in the third trimester of pregnancy, there was an episode of trivial trauma (an accidental fall 24 h before hospitalization). However, there were no visible signs of recent or previous trauma at autopsy. Histological examination of the spleen showed recent hemorrhage, with no signs of organization or presence of fibrin, and mural alterations of branches of the splenic artery at the level of the hilus. These alterations were consistent with FMD. The issue that needs further clarification is the possible pathogenetic significance of these alterations of the arterial wall in splenic hemorrhages in pregnancy.

Recurrent rupture of arterial vessels at the site of a local vascular abnormality, "similar to congenital weak spots in the arteries at the base of the brain", is another of the hypotheses formulated to explain the origin of "spontaneous (idiopathic) rupture" of the spleen [2].

The presence of localized aneurysms at the level of the splenic artery branches at the hilus, the intrasplenic radicles, or more than one of these divisions, has frequently been observed at angiography in portal hypertension. Multiple, eccentric, fusiform aneurysms form at these sites and tend to be more spherical at or near the bifurcations, similar to intracranial berry aneurysms. Such aneurysms have also been observed in cases with only mild or absent portal cirrhosis [21]. In systemic diseases such as polyarteritis nodosa, vasculitis can cause rupture of a small splenic aneurysm [2]. Among other localizations, Campman et al. [22] report a case of fulminant lung hemorrhage resulting from pulmonary FMD.

In view of the high frequency of SAA in pregnancy and the correlated morphological changes in the splenic arteries, the hypothesis of a local vascular lesion of FMD type, intraparenchymal or of the hilar vessels, must also be taken into account as a possible pathogenetic factor of "spontaneous" splenic hemorrhages in the course of pregnancy. Thus, in such cases we stress the great importance of a complete macro and microscopic examination of these vessels to point out alterations of the vessel walls. Resuscitation and attempts to arrest the hemorrhage by immediate surgical intervention are the only ways to try to ensure the survival of both mother and fetus. For the obstetrician, it is imperative to involve the general or vascular surgeon as soon as a ruptured SAA is suspected. This ensures the provision of the best surgical management for the patient.

In cases of splenic emergency syndrome affecting a young pregnant woman, despite prompt and appropriate medical care,

the outcome is often fatal for both mother and the child. The sudden, unexpected death is devastating to survivors, and in desperation to find an explanation for the tragedy, the forensic pathologist is often asked to assess the medical care and to determine if there has been malpractice associated with an incorrect or delayed diagnosis or if a botched surgical procedure may have been a contributory factor in the fatal outcome. The forensic pathologist must remember that, from the clinical standpoint, the splenic emergency syndrome in pregnancy is a rare and unexpected event, with a high incidence of fetal and maternal mortality (70%), especially in the third trimester of pregnancy [2]. Claims of medical malpractice will not be a factor in the majority of cases of splenic emergency syndrome due to its inherent poor prognosis, even with prompt and optimum diagnosis and management.

Acknowledgments

The authors would like to thank Prof. Mary V.a Pragnell and Janet S. Barber Duval (MSN, RN) for their help in the preparation of the manuscript.

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