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Acral necrosis and upper brachial plexus palsy after prenatal fetal thrombosis

DOI 10.1515/crpm-2015-0025
Received March 27, 2015. Accepted June 5, 2015. Previously published online July 2, 2015.

Abstract: Intrauterine fetal thrombosis is an extremely rare event with a devastating outcome. The etiology of the condition often remains unclear. A 29-year-old 2nd gravida 1st para presented with mild preeclampsia at 34 weeks of gestation with pathological cardiotocography (CTG), but normal resistance indices in the umbilical and the uterine arteries. The fetal middle cerebral artery (MCA) displayed a significantly reduced pulsatility index (PI). An immediate cesarean section was performed and a male neonate with a birth weight of 2300 g was delivered. Immediately after birth, a progressive necrosis of the neonate's 4th right final finger link and a palsy of the right brachial plexus were observed. MRI and ultrasound imaging did not display mechanical injuries. The Doppler ultrasound showed a thrombus in the right common carotid and subclavian artery with poststenotic decreased blood flow of the right middle cerebral artery. Further analysis did not reveal inherited or acquired thrombophilias of the neonate. The puzzling prenatal finding of a markedly decreased PI in the MCA as well as the initially suspected postnatal diagnosis of traumatic plexus injury were clarified by the diagnosis of the thrombosis.

Keywords: Doppler ultrasound; fetal plexus injuries; intrauterine gangrene; middle cerebral artery (MCA); plexus palsy; preeclampsia; prenatal diagnosis; prenatal thrombosis; upper limb ischemia.

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Introduction

Intrauterine fetal thrombosis is an extremely rare event during pregnancy with disastrous, potentially lethal outcomes.

The pathophysiology often remains unclear but might be associated with inherited thrombophilias, autoimmune diseases, asphyxia, dehydration, and placental dysfunction associated with intrauterine growth retardation and preeclampsia [1, 2].

Brachial plexus palsy is frequently seen in neonates after spontaneous delivery and is associated with increased fetal birth weight and mechanical lesions due to traumatic traction during labor. Cesarean sections, therefore, have a protective effect to avoid plexus injuries.

Case description

A 29-year-old 2nd gravida 1st para was admitted to our hospital at 34 $^{2}/_{7}$ weeks of gestation with mild preeclampsia. Maternal laboratory blood parameters were normal, except for an elevated ratio of the angiogenic markers sFlt-1 and PlGF ratio indicative of preeclampsia [3]. Except for the mild preeclampsia first diagnosed 1 week before admission, the course of the pregnancy was uneventful. No pathological results were found at the 2nd trimester ultrasound screening at 23 $^{6}/_{7}$ weeks of gestation. The resistance and pulsatility indices in uterine artery Doppler were also normal at this time.

The patient's 1st childbirth 7 years before had been an uncomplicated spontaneous delivery after 40 weeks of gestation with a healthy neonate of 3630 g birth weight. The family history for thrombophilia was unremarkable.

At the time of admission, ultrasound examination showed an intact singleton pregnancy with an appropriate for gestational age fetus and normal amniotic fluid volume. Doppler ultrasound resistance indices of the uterine and umbilical artery were within the normal range. Unexpectedly, the MCA displayed a significantly reduced pulsatility index (PI) [4]. These findings are presented in

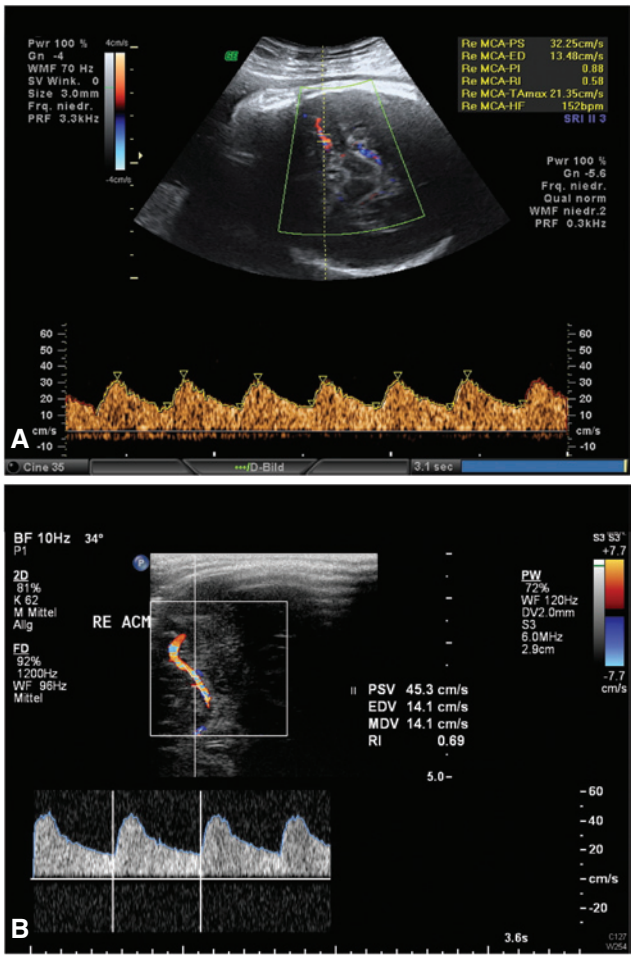

Figure 1: Pre- and postnatal Doppler ultrasound of the MCA.
(A) Prenatal transabdominal Doppler ultrasound examination of the right middle cerebral artery (MCA) at 34+2 weeks of gestation, displaying a significantly reduced resistance index (RI=0.58).
(B) Postnatal transcranial Doppler ultrasound examination at day 4 after delivery, displaying Vmax (45.43 cm/s) and RI (0.69).

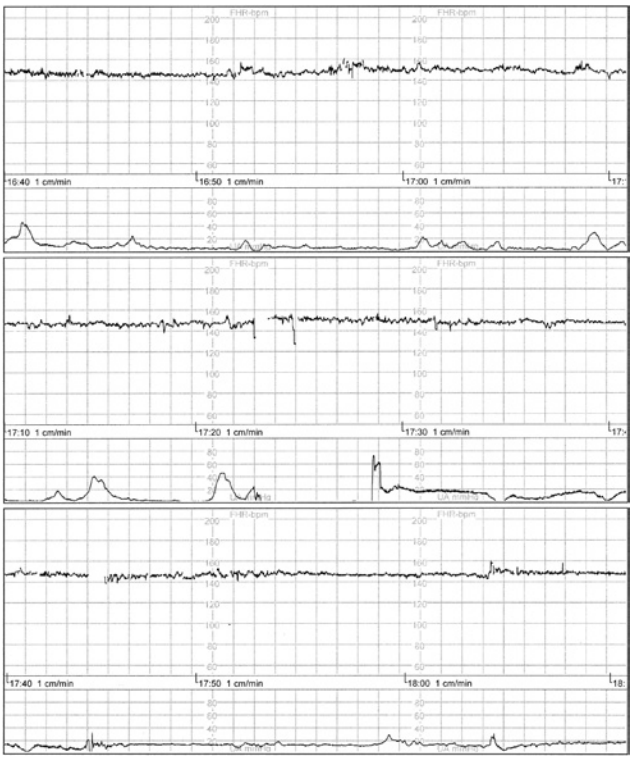

Figure 2: Prenatal CTG with minimal variability.

Figure 1. Fetal heart rate tracings displayed a minimal variability (Figure 2). An immediate cesarean section was performed.

A male infant in skull presentation was delivered atraumatically. The amniotic fluid was clear. The neonate's birth weight was 2300 g (48th percentile), the height was 49 cm (85th percentile), and the head circumference was 31.5 cm (39th percentile). Apgar scores at 1, 5, 10 min were 9, 9, and 10, respectively. Blood gas analysis of the umbilical artery showed no signs of acidosis (pH 7.26, base excess –2.2). Breathing support by continuous positive airway pressure was administered for several hours. There were no signs of infection.

Immediately after birth, upper brachial plexus palsy was diagnosed. Furthermore, the infant's 4th digit of the right hand displayed progressive ischemia. Figure 3 presents the necrosis of the neonate's digit 3 weeks after delivery. To prevent further necrosis, an anticoagulation therapy with 6.0 mg unfractionated heparin twice daily was started. Via Doppler ultrasound, the neonate's vessels of the upper body were evaluated for thrombosis, dissection, and other abnormalities on day 4 of life. Herein, a subtotal thrombotic stenosis of the right common carotid artery as well as in the right subclavian

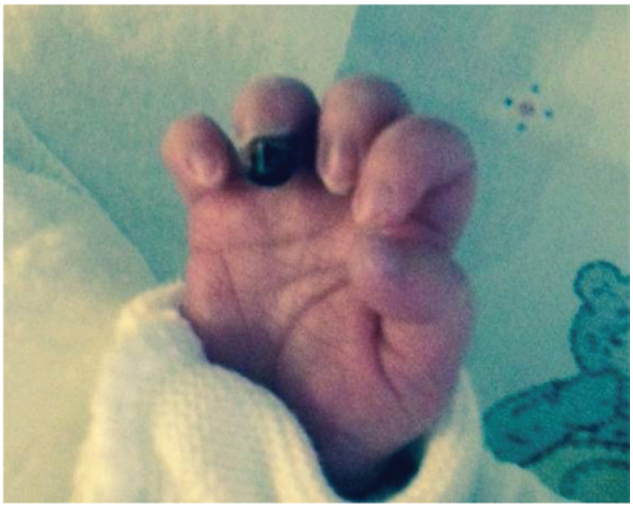

Figure 3: Necrosis of the neonate's outer finger limb of the 4th digit 3 weeks after delivery. The middle finger link is well perfused.

artery was detected. The left carotid artery was normal in size and well perfused. The right vertebral artery showed intracranial collateralization with the post-stenotic right internal carotid artery, but an asymmetric blood flow of the right middle cerebral artery was still visible. An MRI scan at day 21 of life neither showed ischemic injuries of the brain nor space-occupying or mechanical lesions of the brachial plexus. Further laboratory testing did not detect inherited thrombophilias, hyperhomocysteinemia, or Factor-V-Leiden mutation, respectively. At day 6 of life, routine parameters of coagulation were normal.

Discussion

We report a case of an infant with thrombosis of the right common carotid and subclavian artery leading to brachial plexus paresis and acral necrosis of the 4th finger after birth. The reduced resistance indices in the middle cerebral artery seen before birth are indicative of prenatal onset of the thrombosis. The mother had presented with mild preeclampsia at 34 weeks of gestation. The risks for brachial plexus lesions are shoulder dystocia, instrumented delivery, breech delivery, and an exceptionally large baby. This injury generally occurs during spontaneous deliveries with an incidence of 1.5:1000 deliveries. In this case, the infant was delivered by a completely atraumatic cesarean section. Also, the more frequent mechanical lesion of the brachial plexus was excluded by MRI scan.

Only a small number of cases with intrauterine arterial thrombosis have been described in the past. We detected a very rare event of prenatal arterial thrombosis that occurs in 1:20,000–40,000 pregnancies, still mostly due to iatrogenic postnatal catheter lesions injuries. Prothrombotic fetal risk factors include congenital heart disease, polycythemia, growth restriction, autoimmune diseases, asphyxia, and maternal diabetes.

Without an evidence of genetic prothrombotic abnormalities in mother or fetus [5], we therefore suggest a potential association with the maternal state of preeclampsia. In preeclampsia, shedding of cellular debris, such as syncytiotrophoblast microparticles, cell-free DNA, and mRNA from the surface of the placenta into the maternal circulation is well recognized [6]. In the fetus, preeclampsia is associated with activation of neutrophils and monocytes involving enhanced chemokine activation, potentially contributing to thrombosis [7]. Moreover, evidence of endothelial dysfunction has been described in fetuses of preeclamptic mothers.

In conclusion, the unexplained finding of a reduced resistance to blood flow in the right middle cerebral artery of the fetus was postnatally explained by the diagnosis of the fetal thrombosis. The initially suspected traumatic plexus lesion was then clarified as atraumatic as a consequence of the thrombosis.

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The authors stated that there are no conflicts of interest regarding the publication of this article.