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Severe neonatal anemia due to acute massive fetomaternal hemorrhage - a case and literature review

S. Vlădăreanu[1], C. Berceanu[2], D. Navolan[3], A. Boiangiu[4], C. Mehedințu[5]

1. Department of Neonatology, "Carol Davila" Univeristy of Medicine and Pharmacy, Elias University Hospital, Bucharest, Romania
2. Departament of Obstetrics and Gynecology, Craiova University of Medicine and Pharmacy, Craiova County Emergency Hospital, Craiova, Romania
3. Department of Obstetrics-Gynecology and Neonatology, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania
4. Department of Obstetrics and Gynecology, Elias University Hospital, Bucharest, Romania
5. Departament of Obstetrics and Gynecology, "Carol Davila" Univeristy of Medicine and Pharmacy, "Nicolae Malaxa" Clinical Emergency Hospital, Bucharest, Romania

All authors have equal contribution

Correspondence:
Dr. Costin Berceanu
e-mail: dr_berceanu@yahoo.com

Abstract

Severe and unexpected anemia at birth has a serial of potential diagnosis including hemorrhage, hemolysis and impairment production of erythrocytes. Fetomaternal hemorrhage is defined as the entrance of fetal blood intro the maternal blood stream during pregnancy, being a poorly understood condition. At birth is the most frequent time for an important fetalmaternal heamorrage to ocure. Fetomaternal bleeding may be an acute or chronic event. Important fetomaternal hemorrhage include some fetal findings like absent or persistently decreased movement, heart rate abnormality (sinusoidal fetal heart rate pattern, recurrent late decelerations, and tachycardia), low biophysical profile score, hydrops fetalis, and death. At birth can result an affected newborn similar to a neonate with a degree of intrapartum hypoxia. Physician awareness of this uncommon diagnostic is an important step in the therapeutic management. An extremely pale newborn with respiratory distress and hypovolemic shock, or an unexpected stillbirth or precocious neonatal death should raise the physician's suspicion of this diagnostic. We report a case of an acute severe fetomaternal hemorrhage, conditions rapidly recognized and with proper neonatal reanimation resulting a favorable outcome.
Keywords: *fetal anemia, fetomaternal hemorrhage, Kleihauer-Betke test, cardiotocograph*

Introduction

A hemoglobin or hematocrit concentration of greater than 2 standard deviations below the mean for postnatal age defines neonatal anemia[(1)]. Unexpected anemia at birth raises some potential differential diagnosis like: hemorrhage, hemolysis, and impairment production of erythrocytes[(2)].

For a differentiating diagnosis between acute and chronic hemorrhage the reticulocyte count can be used. A higher reticulocyte number it is secondary to a compensatory mechanism in chronic events such as hemolisys, or chronic bleeding. An acute bleeding or a decreased production of erythrocytes will present with a normal or low reticulocyte numer[(3)].

Immune-mediated hemolysis, hemolysis due to blood group or Rhesus factor incompatibilities, or drug-induced sensitization will be confirmed using a positive Coombs test. For the microcytic hypochromic anemia the commonest diagnoses are fetomaternal hemorrhage (FMH) or twin-to-twin transfusions[(2)].

Anemia with a normal reticulocyte number and with normal bilirubinemia is due to acute bleeding during delivery. Anemia with a normal number of reticulocytes, a negative Coombs test and hyperbilirubinemia raise the suspicion of non-immune hemolysis and can be found in glucose-6-phosphate dehydrogenase and pyruvate-kinase deficiency, in some metabolic diseases, in hemoglobin defects, in congenital infections and in drug-induced hemolysis as with valproic acid[(2)].

Case report

A 28-year-old primiparous gravida, at 38 weeks of gestational age, presents to the obstetrics emergency department complaining of reduced fetal movements for the last 5h before admission, loss of amniotic fluid in the last 30 minutes and painful uterine contractions. Her pregnancy had been closely monitored by regularly antenatal consultations and all her laboratory results were within normal limits except for asymptomatic bacteriuria, with normal ultrasounds examinations. Her pregnancy was uneventful without a history of vaginal bleeding or abdominal trauma, without incompatibility problems. Her blood type was BIII positive. The obstetrical ultrasound examination at admission in the delivery department showed a fetus with normal biometrics markers but with alert cardiac beats. The cardiotocograph monitoring (CTG) was modified suggesting a sinusoidal fetal heart pattern with prolonged deceleration and reduced variability, showing fetal distress (Figure 1).

An emergency caesarean section was performed. A feminine baby weighting 3100 g was delivered. At delivery, the placenta was noted to be normal with no evidence of retro placental clots but the amniotic fluid was meconium stained. Upon delivery the baby was extremely pale, hypotonic and with respiratory depression. The Apgar scores were 7 /8 at 1, respectively at 5 minutes. Initial ASTRUP from the umbilical cord revealed metabolic acidosis with a pH of 7.2, 50.1 mm Hg pCO_2, 3 g/dL hemoglobin, 22.3 mmol/L bicarbonate, and 5.1 mmol/L

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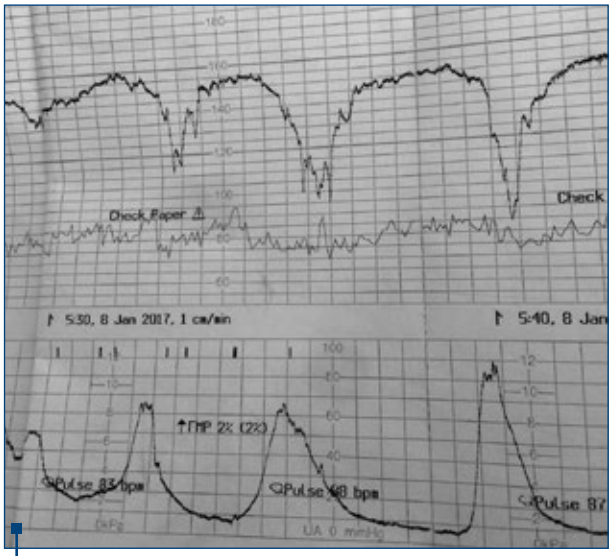

***Figure 1.** Sinusoidal pattern and prolonged decelerations*

lactate. Later laboratory exams revealed a hemoglobin of 2.0 g/dL, 43.500/ul red blood cells, with 23% neutrophils (10.000), 150.000/ul platelets count, 640 UI/L diffuse histiocytic lymphoma and 170 UI/L creatin-kinase. Bilirubin, creatine-kinase-MB, troponins and C reactive protein were in normal range. As a possible precocious neonatal sepsis was suspected empiric antibiotics were started. A complete neonatal sepsis evaluation was performed by testing the newborn for toxoplasmosis, syphilis, rubella, cytomegalovirus, herpes, Listeria, Parvovirus B19, and the titers obtained were normal. Therefore, a Coombs test was achieved and the results were negative, the reticulocites number was also normal suggesting an acute bleeding event. The baby was put on nasal CPAP because of respiratory distress. He also received two units of red blood cell transfusion and at 12 hours of life his hemoglobin was already 10 g/dL, white blood cells count of 9500/uL (60% neutrophils), platelets count of 190.000/uL. Mother's hemoglobin electrophoresis showed a presence of 5% fetal hemoglobin into maternal blood stream so a Kleihauer-Betke test was indicated. The Kleihauer-Betke test revealed 19 % of fetal erythrocytes into maternal blood stream, representing approximately 950 mL of fetal blood which means a massive acute FMH. The neonatal outcome was favorable due to adequate and prompt respiratory and hemodynamic reanimation and the baby was discharged in his 7th day of life.

Discussion

FMH is defined as the penetration of fetal blood into the maternal blood stream during pregnancy[3]. Antenatal FMH can have variable consequences, depending on the volume bleeds: as small volumes are common and clinically meaningless, important FMH is rare and can have severe outcomes[4]. Hemorrhage of the fetoplacental system into the maternal blood stream, resulting in severe or fatal fetal compromise has been reported since 1954, the magnitude of the problem is probably underestimated and the diagnosis overlooked[5].

The fetal blood is pumped by the fetal heart into the capillaries of the terminal villi in the placenta. The maternal blood is circulating through the intervillous space. This 2 circulation systems are separated by a thin vasculosyncitial and a basement membrane. Disruption of the fetal capillaries will result in a leak out of the fetal blood cells into the pool of maternal blood from the intervillous space[6]. This ability of fetal erythrocytes to pass the placental membrane was showed by Chown in 1954[7]. A healthy placenta's role is to allow transfer of nutrients, gasses and waste matters between mother and the fetus, while keeping the 2 circulations separate. FMH involves a disrupter between the 2 circulating systems of the placenta with penetration of fetal blood into the maternal circulating system[8]. A small volume of fetal blood transferred into the maternal stream is normal and common during pregnancy and delivery due to leaks of the placental filter. This clinically unimportant fetal blood volumes leakage can be detected after delivery in 50-75% of normal pregnancies without any consequences for the neonate[9,10].

In about 40-50% of late gestation pregnancies usually fetal red cells can be identified in the maternal circulation[11]. In 98% of the cases, the leakage of blood is minimal, usually under 0.1 ml[12]. Important FMH is rare condition with a frequency of about 0.2 per 1,000 pregnancies[13]. Massive FMH has been defined as bleeding in which more than 150 ml of fetal blood is found into the maternal circulation[14]. Neonatal anemia can be induced by FMH, fetal hemolysis or failure of red blood cell production. De Almeida and Bowman defined massive FMH as a fetal blood loss of 80-150 ml and reported an incidence of 0.2 per 1,000 pregnancies from a large cohort[13]. The risk factors of FMH include, stillbirth, cesarean delivery, abruptio placentae, placenta previa, manual removal of the placenta, intrapartum manipulation, antepartum genital bleeding, third trimester trauma and third-trimester amniocentesis[13]. Bowman and Pollock concluded that the risk of FMH of 20 ml or more in third-trimester amniocentesis was about 0.7%[15,16]. Manifestation of FMH depends on the magnitude of the fetal blood loss. FMH can be suspected due to some patterns like sinusoidal heart rate pattern on CTG and decrease in fetal movements[17]. In some cases hydrops foetalis[18] or fetal growth retardation[19] can be identified on prenatal ultrasound examinations. Fetal anemia can also be diagnosed by measuring the peak systolic velocity of the middle cerebral artery (MCA PSV) of the fetus[4]. To confirm the FMH diagnosis a count of fetal red blood cells into the maternal blood should be done and this test is called Kleihauer-Betke test.

Laube and Schauberger estimated that13.8% of the so called 'unexplained fetal death' in their series of 9223 deliveries might in fact be due to FMH[20]. Occult FMH should be considered in all unexpected cases of stillbirths or intrauterine death, and Kleihauser's test should be incorporated into the panel of investigations[5]. Reduced fetal movements and the sinusoidal fetal heart rate pattern on the CTG should alert the obstetrician on the possibility

of this serious condition[21]. This poorly studied disorder certainly warrants further research in future with regards to its pathogenesis and management.

Modanlou and co-workers considered the following criteria important in the definition of sinusoidal patterns:

l. Stable baseline heart rate of 120-160 bpm with regular oscillations from above or below the baseline

2. Amplitude of 5-15 bpm

3. Frequency of 2-5 cycles/minute

4. Fixed or flat short term variability

5. Absence of accelerations[21].

FMH can be an acute or chronic event. When it is a chronic event during pregnancy anemia develops slowly and the fetus have the opportunity to develop compensatory mechanisms[22]. Diagnosis often comes postpartum at a pale infant but with no other complications[23]. But when FMH occurs as an acute event perinatal complications such as hypoxia, severe anemia or stillbirth can be present[23]. FMH can manifest as neonatal anemia in 35% of the reported cases, but in severe cases hipovolemic shock and cardiac arrest may be present[24]. Alternative diagnoses to neonatal anemia such as: isoimmune hemolytic anemia, congenital infections such as Torch syndrome which may result in bone marrow suppression, neonatal sepsis, congenital red blood cell defects and hemoglobinopathies should be made[24]. Clinical tests for sepsis evaluation, Coombs test for hemolitic anemia and viral serology should be achieved to all newborns with unexpected anemia[24]. The poor prognosis of severe FMH can be improved if this condition is early recognized and corrected[22]. In near-term gestation pregnancies immediate cesarean section is indicated. *In utero* transfusion can be considered when the fetus is preterm and has been shown to be effectively and improving the neonatal prognosis[24]. Infants affected by massive FMH have poor long term outcome complicated with neurological sequels and death[24]. Is seems that initial hemoglobin value and post partum clinical manifests are more important to long term prognosis, compared with the volume of fetal blood transfused[25].

This condition should be confirmed by either a Kleihauer-Betke test or by flow-cytometry[26]. When FMH is suspected at a Rh negative women, in order to prevent sensitizations Rh immune globulin should be administered[25]. When delivery is anticipated before 34 weeks of gestations due to FMH, steroids may be administered. Ultrasonographic evaluation for the presence of hydrops fetalis, fetal growth retardation as well as MCA PSV values of greater than 1.5 MOM suggest possible fetal anemia[27].

Conclusions

Neonatal anemia should alert the psysicians to consider alternative diagnosis like isoimmune hemolytic anemia, congenital infections like Torch syndrome, neonatal sepsis, congenital red cell defects and hemoglobinopathies, but FMH should not be excluded. The earlier this rare and poorly understood condition is recognized the more improved the prognosis is. Pregnancy termination by emergency cesarean delivery is indicated in near term gestation. If the fetus is still preterm *in utero* transfusion can be considered. Massive FMH affects long term outcome of infants resulting in neurological dysfunction or death. The initial hemoglobin value and post partum clinical manifestations are patterns that influence the long time prognosis, more than the transfused volume of blood.

The case we reported emerged from a monitored normal pregnancy. The mother's perception of decreased fetal movements in the last hours corroborated the sinusoidal pattern on CTG and fetal distress led to an emergency caesarean section and prompt hemodynamic and respiratory support to the newborn with early red blood cells transfusion. This case support the idea that the earlier this condition is suspected, confirmed and reanimated, the proper the prognostic is. ■

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