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UNILATERAL REVERSAL OF CEREBROPLACENTAL RATIO IN FETAL AV MALFORMATION: A UNIQUE CLINICAL PRESENTATION

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Abstract

Background:

Key Doppler ultrasound metric used to evaluate fetal well-being, especially in high-risk pregnancies, is the cerebroplacental ratio (CPR). Abnormal CPR, particularly reversed flow, is often linked to fetalanemia, intrauterine growth restriction (IUGR), or placental insufficiency, usually requiring immediate delivery. Rare diseases such fetal arteriovenous malformations (AVMs), on the other hand, may change Doppler hemodynamics as well, which might cause misdiagnosis and unwarranted obstetric procedures.

Case Presentation

Routine prenatal care was done on a 23-year-old primigravida with Rh-negative blood type. Though no appropriate records were found, an outside centre had conducted an anomaly scan. A Doppler scan done at our hospital at 37 weeks revealed an unusually high CPR with a middle cerebral artery (MCA) Doppler index more than 3.4 MoM, which raised questions about fetalanemia. A specialist radiological scan showed a cerebral AVM on one side, changing patterns of cerebral blood flow. Expectant management was selected after counselling. At 39 weeks, the patient vaginally gave birth to a healthy girl baby. Postnatal MRI verified an AV fistula or vein of Galen abnormality; correction surgery was scheduled at six months of age.

Discussion:

This instance emphasizes the need of differentiating between fetalanemia and unusual vascular abnormalities including AVMs when aberrant CPR results are found. Misunderstanding AVMs could cause them to resemble placental insufficiency and result in unwarranted treatments. This instance further underlines that AVMs may not necessarily need cesarean section, since vaginal birth was successfully accomplished.

Conclusion:

Accurate diagnosis when aberrant Doppler results arise depends on expert imaging, so Optimal perinatal care is guaranteed by a multidisciplinary approach, hence avoiding misdiagnosis and needless treatments.

Keywords: Cerebroplacental ratio, fetal Doppler, arteriovenous malformation, fetalanemia, prenatal diagnosis, obstetric ultrasound

INTRODUCTION

A commonly used Doppler ultrasonography measure of fetal well-being, fetal cerebroplacental ratio (CPR), compares blood flow in the middle cerebral artery (MCA) to that in the umbilical artery. Particularly in high-risk pregnancies, it is a vital instrument for assessing placental health and fetal oxygenation.(1) Fetal hypoxia, placental insufficiency, and intrauterine growth restriction (IUGR) are typically linked with an aberrant CPR, particularly a reversal. Usually, such results call for early obstetric intervention and careful monitoring to maximize perinatal results. Though often connected with placental disease, CPR deficiencies' relationship with

uncommon prenatal vascular malformations such arteriovenous malformations (AVMs) remains underappreciated.(2)(3)

Comprising an unusual link between arteries and veins bypassing the capillary network, arteriovenous malformations (AVMs) are congenital vascular anomalies. Direct high-flow connection changes the normal hemodynamics of the fetal circulation by increasing blood velocity and turbulence.(4) Though cerebral AVMs are among the most worrisome since they may affect infant neurological outcomes, AVMs may form in many places including the brain, lungs, and liver. In extreme situations, these abnormalities might show with cerebral bleeding, hydrocephalus, or high-output cardiac failure. Some AVMs, nevertheless, are asymptomatic and only found during regular prenatal imaging.(4)

Cerebral AVMs are difficult to diagnose prenatally as they might resemble other diseases changing fetalhemodynamics, including fetalanemia or placental malfunction. Especially if done without high-resolution imaging or if follow-up documentation is lacking, standard anomaly scans may not always find these abnormalities.(5)(6) An AVM causes a shift of cerebral blood flow that raises MCA systolic velocity, which might cause a higher CPR or even a reversed flow pattern. Especially in Rh-negative pregnancies, when hemolytic illness is a major worry, this Doppler change could be misread as fetalanemia. These diseases must be distinguished as their therapeutic approaches vary greatly.(7)

Unneeded obstetric treatments are one of the main consequences of an undetected AVM. An urgent delivery—usually by cesarean section—is generally thought to avoid fetal compromise in situations where Doppler reversal is ascribed to fetalanemia.(8) Though some AVMs stay hemodynamically stable during pregnancy, if the underlying reason is an AVM, the necessity for urgent delivery may not always be warranted. This difference underlines the need of professional radiological assessment in situations of aberrant CPR results as misunderstanding might result in hasty or unneeded terminations.(9)

Though uncommon, AVMs should be included in the differential diagnosis of aberrant fetal Doppler results. Improvements in prenatal imaging, especially with fetal MRI and high-resolution ultrasound, have increased the discovery of these abnormalities, therefore allowing greater perinatal care. Optimal results depend on a multidisciplinary approach including obstetricians, radiologists, and neonatologists.(10)(11)

This case report is significant as it shows how an uncommon disorder like a fetal cerebral AVM may resemble more frequent obstetric problems, hence causing possible misdiagnosis and needless treatments. It underscores the need of specialist imaging in differentiating between the reasons of Doppler anomalies and underlines that AVMs do not automatically need cesarean delivery. Sharing this case would help doctors to be more aware of AVMs as an uncommon but important differential diagnosis, hence enhancing maternal and fetal treatment.

Case Presentation:

Presenting for regular prenatal treatment at our hospital was a 23-year-old primigravida with Rh-negative blood type. She had no notable prior medical history but was found to be somewhat anemic throughout pregnancy and treated with iron sucrose infusions. Until 37 weeks of gestation, her prenatal follow-up had been unremarkable; a regular Doppler examination was done then as part of normal treatment for Rh-negative pregnancies.

Though there was no appropriate record of the results, the patient had previously received an anomaly scan at an outside facility. Our hospital performed a Doppler examination and growth scan at 37 weeks. The Doppler scan showed an unusual cerebroplacental ratio (CPR) with the right middle cerebral artery (MCA) Doppler index reading more than 3.4 multiples of the median (MoM). This sparked worries about unusual fetalhemodynamics and the first impression pointed to fetalanemia, which may happen in Rh-negative pregnancies owing to hemolysis and calls for quick action.

An expert radiological consultation was requested for additional examination given the possible consequences of these results. A radiologist's thorough prenatal ultrasound found an arteriovenous malformation (AVM) confined to one side of the unborn brain. Unlike the first worry for fetalanemia, which would usually call for quick delivery, the AVM was not causing major fetal discomfort at that time. The results were reviewed with the woman and her family; after careful counseling, they chose expectant treatment with tight fetal monitoring.

Vaginal delivery of a healthy term girl baby occurred for the patient at 39 weeks of gestation as spontaneous labor. At delivery, the infant had typical Apgar scores and no early distress indications. A cranial ultrasound, which seemed normal, was part of postnatal assessment. MRI and MR venography, on the other hand, verified dilated veins in the right frontal lobe draining into the superior sagittal sinus, pointing to an AV fistula or a vein of Galen deformity. A normal abdominal ultrasound was also done. With intentions for corrective surgery after six months of age, the newborn was later sent for pediatric neurosurgery assessment.

DISCUSSION

Particularly in high-risk pregnancies, fetal Doppler investigations are very essential for evaluating placental function and fetal well-being. Doppler anomalies like middle cerebral artery (MCA) Doppler reversal are often read as indicators of fetalanemia in Rh-negative pregnancies, which call for quick action including early delivery. But, as this example shows, Doppler anomalies might sometimes indicate a completely distinct disease that calls for a more complex diagnostic and therapy strategy.

The patient in this instance had received an abnormality scan at an outside facility earlier in pregnancy, but appropriate records were lacking. Detecting structural anomalies requires anomaly scans; in many instances, an arteriovenous malformation (AVM) may be found during these regular checks. This possible finding, nevertheless, may have been ignored or unreported given the inaccessibility of data, hence causing its late discovery at 37 weeks during normal fetal Doppler assessment.

Standard treatment for Rh-negative pregnancies included a Doppler scan at our hospital for the patient at 37 weeks. Conducted by obstetricians, the scan revealed an unusually high cerebroplacental ratio (CPR) with a notably raised MCA Doppler index. Usually, such results cause worry for fetalanemia, a recognized consequence in Rh-negative pregnancies caused by hemolytic disease of the fetus and newborn (HDFN). Reversal of MCA Doppler flow is usually seen as a vital sign calling for quick pregnancy termination given that fetalanemia might cause perinatal death and hydrops fetalis.

An skilled radiologist conducted a more thorough investigation, however, before moving ahead with an emergency delivery. One side of the embryonic brain has a localised AVM as found by this further examination. AVMs are hereditary vascular anomalies defined by an unusual link between arteries and veins, hence bypassing the capillary system. High-flow vascular shunting results from this and may change brain hemodynamics and simulate the Doppler results seen in fetalanemia. Finding an AVM in this situation was vital as it affected the course of treatment and avoided an unneeded emergency cesarean delivery.

This example emphasizes an important clinical lesson—although Doppler reversal in a Rh-negative pregnancy is a major discovery, it is vital to seek other diagnoses before deciding on delivery. Though uncommon, AVMs should be considered as a possible source of aberrant Doppler waveforms. Moreover, having an AVM does not always need cesarean section. In this case, thorough reading of Doppler results is essential to prevent misdiagnosis and unneeded treatments.

Like our research, Similar to our research, the study by Bonnevier et al. (2021) looked at the predictive value of CPR in high-risk pregnancies and found that while CPR was better than its individual components—middle cerebral artery pulsatility index (MCA PI) and umbilical artery pulsatility index (UA PI)—in predicting small-for-gestational-age (SGA) infants, it performed poorly in predicting perinatal asphyxia and mortality. This fits our situation, where an aberrant CPR caused worries about fetal compromise yet the baby had a good perinatal result. This supports the idea that while CPR irregularities call for further research, they should not be the only factor guiding choices for emergency delivery.(12)

Likewise, VollgraffHeidweiller-Schreurs et al. (2021) undertook a major meta-analysis and found that in evaluating negative perinatal outcomes, CPR did not much increase the predictive value of UA PI by itself. Had we relied only on the CPR result, the patient could have had an unneeded emergency cesarean section. Expert imaging, on the other hand, showed an AVM as the genuine cause, hence avoiding unnecessary obstetric intervention. In situations with aberrant Doppler results, specialist fetal imaging is essential to distinguish between placental insufficiency and other vascular abnormalities.(13)

Emphasizing the use of composite indices such the cerebro-placental-uterine ratio (CPUR), Khanjani et al. (2023) investigated further the link between Doppler parameters and fetal growth restriction (FGR). Their research underlined that while CPR is still a significant marker, its prognostic accuracy is enhanced by combining it with other Doppler measures. In our situation, the dependence on CPR alone first suggested fetalanemia, but professional evaluation revealed a different diagnosis, hence supporting the drawbacks of relying on one Doppler measure for clinical decision-making.(14)

Morales-Roselló et al. (2023) conducted another important research that predicted worse perinatal outcomes by comparing CPR with the ductus venosus pulsatility index (DV PI). They discovered that while DV PI become aberrant later in gestation, it did not increase the prediction accuracy of CPR. Our case corresponds to this result as the AVM was discovered late in pregnancy during a regular Doppler examination, hence stressing the importance of thorough fetal evaluations outside of conventional Doppler indices.(15)

Examining the effects of lower CPR in the third trimester, Andrade et al. (2023) found that while low CPR is connected to worse newborn outcomes, it does not justify clinical management modifications by itself. This fits our situation, in which an irregular CPR first triggered a false alarm for fetalanemia but further imaging verified an AVM, hence guiding a more cautious and suitable therapy approach.(16)

This case report emphasizes that while fetal monitoring benefits from CPR, its anomalies have to be read in a larger clinical and imaging setting. As seen in our example, depending just on CPR results could result in misdiagnosis and unwarranted treatments. A uncommon cause of CPR change, an AVM emphasizes even more

the need of skilled imaging and interdisciplinary assessment in situations of Doppler anomalies. Our instance further underlines that AVMs do not always need cesarean delivery; vaginal birth was accomplished without issues. This underlines the need of tailored obstetric decision-making based on thorough fetal evaluation rather than just on Doppler results.

CONCLUSION

This case report underscores the need of recognizing arteriovenous malformations (AVMs) as an uncommon but notable etiology of atypical fetal Doppler results. The reversal of the cerebroplacental ratio (CPR) is often linked to fetalanemia; nevertheless, meticulous assessment is essential to prevent unwarranted treatments. Expert radiological evaluation was important in properly detecting the AVM, so averting an unnecessary emergency cesarean surgery. This example further demonstrates that arteriovenous malformations do not always need surgical delivery, since a vaginal birth was successfully accomplished. A multidisciplinary approach is crucial for successful prenatal therapy, guaranteeing the greatest results for both the mother and the neonate.

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Conflict of Interest:
The authors mention no conflicts of interest.

IMAGES :

Figure 1 Doppler USG showing possible vascular malformation

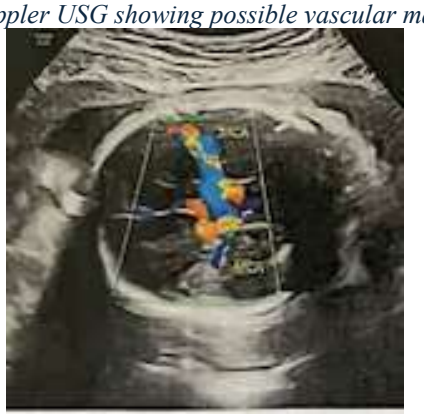


Figure 2 Right Middle Cerebral Artery - increased systolic flow

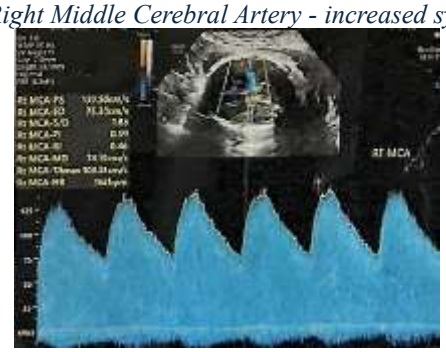
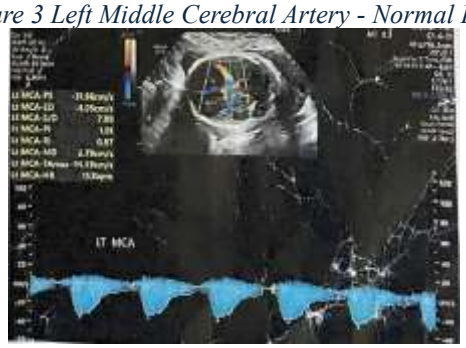


Figure 3 Left Middle Cerebral Artery - Normal Flow



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