



## Role of MRI in Detecting Cerebral Anomalies and Cerebral Hypoperfusion in Surviving Twin after the Co Twin Demise of Monochorionic Twin Pregnancy

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### Authors' contributions

Author KS designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors R. Rangasami and R. Ramesh managed the analyses of the study. Authors R. Ramesh and CA managed the literature searches. All authors read and approved the final manuscript.

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Case Study

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### ABSTRACT

**Aim:** To demonstrate the role of MRI in detecting cerebral anomalies and cerebral hypo perfusion in surviving twin after the co twin demise of monochorionic twin pregnancy.

**Case Presentation:** 28 year old second gravida came for routine antenatal sonography at 29 weeks. Her routine anomaly scan at 20 weeks for her twin gestation was unremarkable. Present antenatal sonography revealed monochorionic diamniotic twin pregnancy with demise of one of the twins at 23 weeks. Ultrasound and doppler evaluation did not exhibit abnormality in surviving twin whereas MR evaluation revealed changes in fetal brain due to ischaemia.

**Discussion:** Mono chorionic twin pregnancies are associated with numerous complications due to vascular anastomotic channels in the shared placenta. Complications include Twin to Twin

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Transfusion Syndrome, Anaemia - polycythemia sequence, selective intra uterine growth retardation, cotwin demise, neurological damage in surviving twin. Though prenatal Doppler sonography is often used for neurological assessment of the surviving twin, in utero Magnetic Resonance Imaging of foetal brain aids in definitive diagnosis of cerebral pathologies.

**Conclusion:** MRI plays an important role in assessing cerebral hypo perfusion injuries and cerebral anomalies.

*Keywords:* Twin - twin transfusion syndrome; fetal MRI; co twin demise; cerebral ischaemia.

## 1. INTRODUCTION

Mono chorionic twin pregnancies are associated with numerous complications due to vascular anastomotic channels in the shared placenta. Complications include Twin to Twin Transfusion Syndrome, Anaemia - polycythemia sequence, selective intra uterine growth retardation, cotwin demise, neurological damage in surviving twin. Though prenatal Doppler sonography is often used for neurological assessment of the surviving twin, in utero Magnetic Resonance Imaging of foetal brain aids in demonstrating additional cerebral pathologies. We report a rare case wherein foetal doppler was normal, but MR imaging of the surviving foetus revealed encephalomalacia of occipital lobes indicating ischemia.

## 2. CASE PRESENTATION

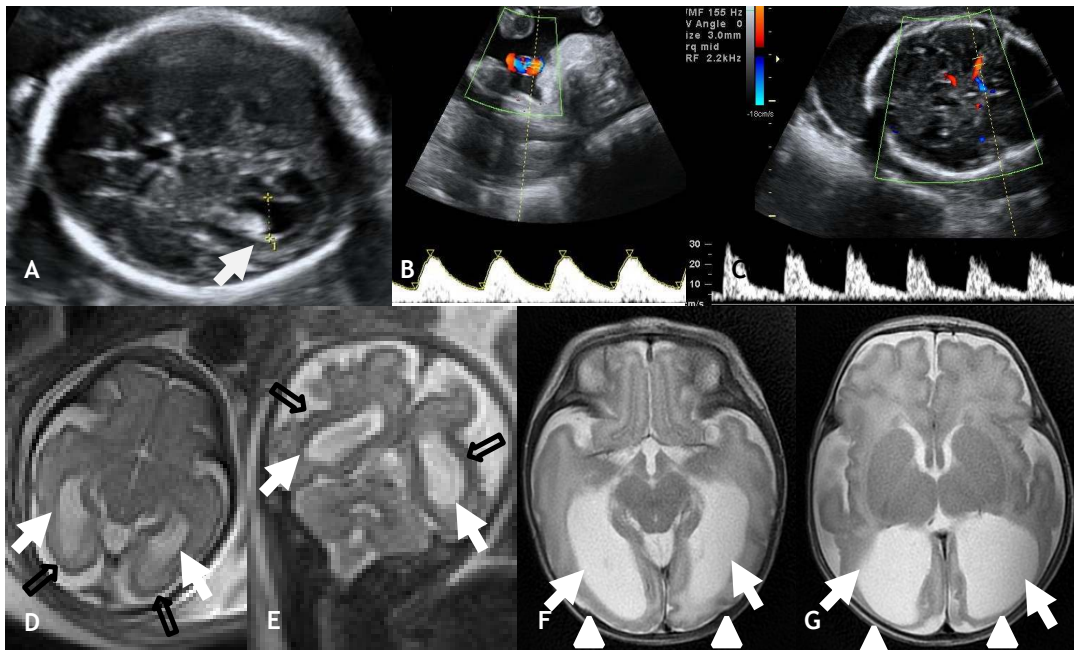
A 28 year old second gravida came for routine antenatal sonography at 29 weeks. Her routine anomaly scan at 20 weeks for her twin gestation was unremarkable. Present antenatal sonography revealed monochorionic diamniotic twin pregnancy with demise of one of the twins at 23 weeks. The surviving twin showed mild ventriculomegaly with occipital horns measuring 11 mm (Fig. 1A). The umbilical artery pulsatility index and Systolic / Diastolic (S/D) ratio were 1.05 and 2.9 respectively (Fig. 1B). The fetal middle cerebral artery pulsatility index and S/D ratio were 1.35 and 3.2 respectively, all within normal limits (Fig. 1C). In the further work up of mild ventriculomegaly, MR imaging of the foetus was performed which revealed papyraceous twin A in lower uterine segment. The surviving, twin B showed periventricular leukomalacic changes in bilateral parieto occipital lobes with ex vacuo dilatation of occipital horns of bilateral lateral ventricle (Figs. 1D,E), features suggesting hypoxic sequelae due to co twin demise. There was also associated pachygyria in the overlying bilateral parieto occipital cortex. The patient was counseled and delivered by caesarean at 31 weeks of gestation as there was oligohydramnios

in the follow up sonography. The immediate postnatal period of the neonate was unremarkable and was discharged with advice for follow up. The follow up postnatal MR imaging of the brain at 2 months confirmed the antenatal MRI findings (Figs. 1F,G).

## 3. DISCUSSION

Multiple cerebral abnormalities have been described in complicated mono chorionic twin pregnancies. Most of the abnormalities involve localised or diffuse parenchymal destruction such as encephalomalacia, porencephaly, periventricular leukomalacia [5,7,8]. These are the result of hypoxic ischaemia due to hypo perfusion [5]. In co twin demise postulates state that intra uterine death of one twin leads to acute hemodynamic changes in the surviving twin, thus resulting in cerebral hypoxic ischemic changes [1,2,5,6]. Two theories explain the neurological sequelae in co twin demise. The "Thromboplastin theory" states that passage of thrombotic materials from the dead twin through the placental arterio-arterial or arterio-venous channels results in thrombosis and ischemia in surviving twin. The "ischaemic theory" states that immediately before death, the dying twin becomes hypovolemic and extracts blood from the other twin through placental anastomosis channels. This leads to hypo perfusion in the other twin, hence neurological injury in the surviving twin [3].

Doppler evaluation reveals the hypoxic injuries. Abnormal umbilical artery values indicates uteroplacental insufficiency, hence cerebral hypoxia. Low pulsatility in the middle cerebral artery is associated with fetal compromise. Duration, type of injury and brain maturity at time of insult influence on the anatomical distribution and imaging of foetal cerebral lesion. Septated cysts with irregular walls are more common in injury during late second or early third trimester of pregnancy whereas porencephalic cysts without gliosis are common in immature brain. Ischaemia due to hypo perfusion before



**Fig. 1(A) - Sonography axial section shows mild ventriculomegaly with lateral ventricular diameter of 11mm (arrow) . (B) - Umbilical arterial Pulse wave Doppler shows normal low resistance waveform with Systolic / Diastolic ratio of 2.9 (C) Fetal middle cerebral arterial Doppler shows a waveform with Systolic / Diastolic ratio of 3.2. (D, E) - Axial and coronal T2 weighted MR images of the fetus show bilateral ventriculomegaly (arrow) with associated pachygyria in the overlying parieto occipital cortex (open arrow). (F,G)- Post natal MRI obtained at 2 months of age show bilateral ventriculomegaly (arrows), reduction in volume of bilateral parieto occipital lobes and overlying pachygyria (arrowhead)**

28 weeks of gestation alter the neuronal population and interrupt neuronal migration thereby leading to periventricular leukomalacia, multi cystic leukoencephaly, germinal matrix haemorrhage [3,5]. Germinal matrix haemorrhage can lead to parenchymal venous hemorrhagic infarction. Subcortical leukomalacia, ulegyria, lenticulo striate vasculopathy may be associated after 36 weeks [2].

Early findings of cerebral hypoxia such as intraventricular or germinal matrix haemorrhage, cortical necrosis leading to cystic changes can be seen only after two weeks post co twin demise by sonography. Another study states that ischemia can be detected as early as 1-2 days after co twin demise by Diffusion Weighted MR imaging [7]. In our case mild ventriculomegaly with normal Doppler values were seen but MR Imaging of foetal brain revealed additional periventricular leukomalacic changes and pachygyria. We hypothesize that since Doppler was done few weeks after the first twin demise and not just after the demise, the surviving fetus would have got acclimatized and developed

haemodynamic adjustments. Thus MRI not only showed classical features of ischaemia like periventricular leukomalacia it also showed cerebral anomalies due to disordered neuronal migration like pachygyria. Ischemia is considered as a rare cause of neuronal migrational disorder [3,5]. MR is more sensitive in detecting cortical lesions close to skull, cystic necrosis and vasogenic edema [4].

#### 4. CONCLUSION

MRI is very sensitive in detecting the various cerebral complications arising due to cotwin demise. Hence we recommend liberal use of fetal MRI in cotwin demise, thereby expediting the management.

#### CONSENT

All authors declare that written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

## ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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