

Mid-trimester fetal subdural hemorrhage: prenatal diagnosis

S. E. MEAGHER*, S. P. WALKER† and S. CHOONG*

*Monash Ultrasound for Women, Richmond, †Maternal-Fetal Medicine, The Mercy Hospital for Women, Melbourne, Victoria, Australia

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ABSTRACT

A routine antenatal ultrasound examination at 20 weeks' gestation revealed a space-occupying lesion in the fetal right cerebral hemisphere. The borders of the mass were indistinct and there was no midline shift. A small collection of echogenic bowel was identified at the right iliac fossa. In an attempt to explain both findings a provisional diagnosis of a fetal blood dyscrasia was made. Fetal cranial magnetic resonance imaging 24 h later confirmed the diagnosis of a subdural hemorrhage. Subsequent fetal blood sampling confirmed severe fetal thrombocytopenia. To our knowledge this is the first report of the antenatal diagnosis of spontaneous mid-trimester fetal subdural hemorrhage.

INTRODUCTION

Spontaneous antenatal subdural hemorrhage is a rare complication of pregnancy. Possible causes of hemorrhage include arteriovenous malformation, benign or malignant intracranial tumors, fetal infection, drug toxicity and clotting disorders such as isoimmune or alloimmune thrombocytopenia. Subdural hemorrhage has also been reported in relation to trauma but this mostly occurs in the third trimester where the fetal cranium is more exposed to direct trauma which may lead to varied intracranial injuries with or without skull fracture¹.

Imaging modalities that may be of value in assessing suspected fetal intracranial hemorrhage include color Doppler and power energy Doppler ultrasound, and more recently magnetic resonance imaging (MRI)^{2,3}. In the past fetal paralysis has been necessary to obtain meaningful MRI images of fetal anatomy. More recently rapid sequence MRI has obviated the need for paralysis. A rapid sequence technique in this case provided clear images and the exact location of the fetal intracranial lesion. Also in contrast to ultrasound it was possible to distinguish fresh vs. old hemorrhage.

CASE REPORT

A 26-year-old, gravida 3, para 3 presented in her third pregnancy for a routine mid-trimester morphology scan. Her first pregnancy was uncomplicated, and resulted in the term delivery

of a live female. Her second pregnancy was a monochorionic twin pregnancy, complicated by twin–twin transfusion syndrome. Despite treatment with serial amnioreduction, delivery at 25 weeks by Cesarean section was necessary because of a critical cardiotocograph in the donor twin. This twin died on the third postnatal day, but the surviving twin is alive and well.

The patient was referred in this pregnancy at 20 + 5 weeks for fetal evaluation in view of a suspected choroid plexus cyst at the 18-week ultrasound scan. On examination, a space-occupying lesion was identified overlying the right temporo-parieto-occipital region (Figure 1). The anterior horns of the ventricles appeared prominent, although the atria measured only 8 mm in transverse section. The small bowel had an abnormally echogenic appearance, but the remainder of the anatomy appeared unremarkable. A follow-up fetal MRI was performed 24 h later. Axial sagittal and coronal T2 and axial T1 weighted sequences were performed through the fetal brain which confirmed the presence of a 35 × 10 × 21-mm right temporo-parieto-occipital extra-axial hemorrhage, with both acute and subacute features (Figures 2 and 3). There was a marked mass effect with compression of the body,



Figure 1 Ultrasound image of the transverse section through the fetal head at 20 weeks' gestation. The electronic calipers define a 29 × 21-mm mass in the near field.

Correspondence: Dr S. E. Meagher, Level 4, Epworth Hospital, 89 Bridge Road, Richmond, Victoria 3121, Australia (e-mail: spm@unimelb.edu.au)

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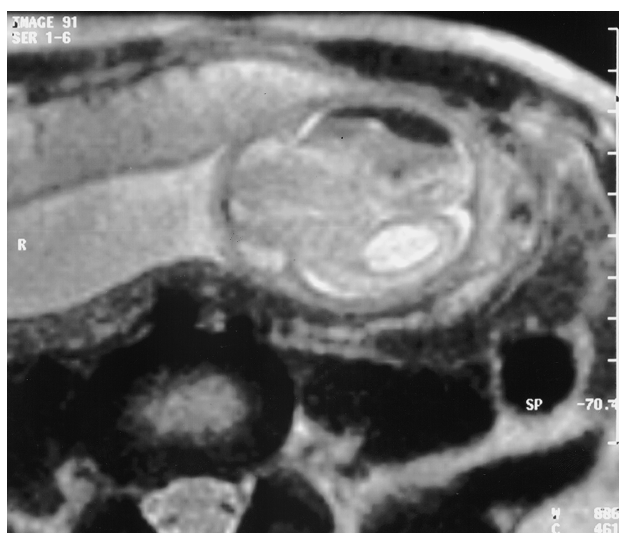


Figure 2 Magnetic resonance image of an axial section through the fetal head revealing a subdural hemorrhage compressing the proximal cerebral hemisphere. The proximal lateral ventricle is obliterated and the contralateral lateral ventricle is slightly dilated.



Figure 3 Magnetic resonance image of a coronal section through the fetal head which reveals the subdural hemorrhage with more obvious compression of the near lateral ventricle.

temporal horn and atrium of the right lateral ventricle. Mild midline shift was noted.

Fetal thrombocytopenia was suspected in view of the antenatal diagnosis of cerebral hemorrhage. The maternal platelet count was $259 \times 10^9/L$ (normal range $150\text{--}400 \times 10^9/L$) and antiplatelet antibody assays were negative. There was no past history of neonatal thrombocytopenia except in the donor twin, whose hemoglobin at birth was 7.2 g/dL (normal range, 13.5–19.5 g/dL), and platelet count was $82 \times 10^9/L$ (normal range $150\text{--}400 \times 10^9/L$). The platelet count of the recipient twin, however, was normal. Despite this, platelet genotyping was performed on the parents to assess the likelihood of neonatal alloimmune thrombocytopenia (NAIT). This

confirmed incompatibility at the HPA-1 and HPA-3 loci. Although HLA antibodies were detected, no platelet specific antibodies were identified. At cordocentesis, the fetal platelet count was $27 \times 10^9/L$, and maternal washed platelets were administered into the intrahepatic portion of the umbilical vein. Further investigation for fetal thrombocytopenia including TORCH serology, parvovirus serology and systemic lupus erythematosus work-up was negative. A karyotype analysis was not performed at the patient's request. A repeat MRI at 23 weeks revealed evidence of porencephaly within the right cerebral hemisphere and slight ventricular enlargement. Serial ultrasound examinations did not find the hydrocephalus to be progressive. Despite the guarded prognosis, including possible hemiparesis, mental retardation and epilepsy, the pregnancy continued. With a presumptive diagnosis of NAIT, the patient received weekly intravenous immunoglobulin at a dose of 1 g/kg. A repeat cordocentesis 6 weeks after initiating therapy (27 weeks' gestation) revealed a fetal platelet count of $115 \times 10^9/L$. Weekly Intragam was continued until elective delivery at 35 weeks' gestation. A cordocentesis with administration of maternal washed platelets was performed immediately prior to Cesarean section to cover possible thrombocytopenia in the immediate peridelivery period. A female infant was delivered with a birth weight of 1884 g, and Apgar scores of 7 and 10, but with obvious microcephaly. Seizure activity was noted on day 3, and postnatal computed tomography scan confirmed loss of brain substance and gliosis in the left temporo-parietal region with enlargement of the left lateral ventricle and widening of the subdural space. The baby was discharged home breast feeding on day 12 and neurological follow-up was planned.

DISCUSSION

The diagnosis of fetal subdural hemorrhage at the routine mid-trimester examination (18–20 weeks) has not been previously described. Vergani *et al.*⁴, in a comprehensive review of the English literature, reported on 41 cases of fetal intracranial hemorrhage of which eight were subdural in location. Four additional cases of spontaneous subdural hemorrhage have been since reported and all were documented in the late third trimester of pregnancy^{5–8}. The paucity in the literature of this diagnosis in early pregnancy may be explained by failure of recognition of the lesion at the routine mid-trimester examination or by the natural history of the lesion which only becomes manifest in the later stages of pregnancy. The latter would seem more plausible and could possibly be explained by greater capillary stability in earlier pregnancy and less exposure to spontaneous head movements at this time.

The anatomical location of fetal intracranial hemorrhage may determine the prognosis and long-term sequelae of the surviving child. The best available evidence suggests a poor prognosis when the hemorrhage is subdural in location⁴. Secondary complications that also determine prognosis may include secondary ventricular obstruction with hydrocephalus, cerebral infarction and diffuse cerebral atrophy with microcephaly as occurred in this case. A mid-trimester diagnosis of this rare and serious lesion provides an opportunity for counseling parents in regard to termination of pregnancy.

Both parents were counseled in detail and despite the knowledge of a poor prognosis chose to continue the pregnancy. They opted for prenatal therapy with intravenous immunoglobulin (Intragam) and platelet transfusions which were performed at 20, 27 and 35 weeks' gestation. While the relative size of the initial hemorrhage was constant, severe secondary microcephaly ensued.

With the advent of ultrafast MRI techniques such as echo-planar and single-shot fast spin-echo sequence, it is now possible to obtain clear images of the moving fetus^{9,10}. There are an increasing number of reviews and reports on the benefits of prenatal MRI with most attention focussing on the development of the normal fetal brain and varied fetal intracranial pathologies. There are also some reports of the benefits of MRI on non-central nervous system lesions^{11,12}. Magnetic resonance imaging has been reported as providing superior images of the fetal anatomy by providing more distinct boundaries between tissues of different texture and echodensity. It is by no means however, a first line investigation and in most reported cases its benefits have been described as an adjuvant to ultrasound. In our case, a space-occupying lesion was suspected on ultrasound principally through the loss of the normal cerebral architecture. There was no impression initially that the mass was a hemorrhagic collection. The ultrasound findings were nonspecific with an echogenic collection identified below the reverberation from the temporal bone (Figure 1). Other diagnostic possibilities of a fetal intracranial mass include an arteriovenous malformation, which may be easily distinguished using Doppler, or an intracranial tumor. Of these, teratomas account for more than 50% of cerebral neoplasms in neonates under the age of 2 months¹³ but other reported intracranial tumors include glioblastoma, meningeal sarcoma, craniopharyngioma and oligodendroglioma¹⁴. In our case follow up MRI provided pinpoint location of the hemorrhage, the volume of the bleed and its secondary effects. With ultrasound, visualization of the fetal anatomy is dependent on an acoustic window that in many cases is provided by the surrounding amniotic fluid. The efficacy of MRI is independent of the amniotic fluid volume and thus provides an additional advantage.

Doppler ultrasound assessment of the middle cerebral artery may show signs of flow disturbance, which precede morphological changes, and thus provide an earlier sign of a cerebral hemorrhagic insult¹⁵.

Ultrasound is likely to remain the principal screening method but fast MRI is increasingly being used as a correlative imaging modality in pregnancy because it uses no ionizing radiation, provides excellent soft-tissue contrast, and has multiple planes for reconstruction and a large field of view¹⁰.

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