Benefits of examination by post mortem performed magnetic resonance imaging of foetus: haemorrhage in germinal matrix

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Abstract
Post mortem magnetic resonance imaging is demonstrated as a supplementary method to classic pathological-anatomical autopsy in determining anomalies of the foetus. Frequently it plays a key role; primarily where the possibilities of performing autopsy are somehow limited (autolysis, ventricular dilatation). Specification of the final diagnosis subsequently enables us to improve prenatal diagnostics, both by means of magnetic resonance imaging and primarily by correlation with the prenatal ultrasound scan; this feedback improves the later method.

This case report demonstrated that post mortem magnetic resonance imaging, in contrast with prenatal ultrasound examination, showed extensive haemorrhage in the germinal matrix, and also illustrated indirect symptoms testifying to agenesis of the corpus callosum. Prenatal ultrasound examination showed only hydrocephalus and absence of septum pellucidum. Pathological-anatomical autopsy of the brain was insufficient with regard to advanced autolysis and brain haemorrhage.

CASE
28 years old quadrigavida, with one previous miscarriage in 1st trimester and one pregnancy termination in the 1st trimester. Course of current pregnancy without complications. Ultrasound examination in 21st week of gestation determined severe oligohydramnios and oedematous placenta, with height of up to 60 mm. In addition a missing septum pellucidum and hydrocephalus were described (Figure 1A,B). The vital signs of the foetus were still present two days before induction of abortion due to foetus mortuus.

The MRI, which was conducted immediately following the abortion, displayed extensive haemorrhage in the germinal matrix, with bursting into...
the ventricles, which were distended (level III according to the Burstein classification). In addition there were evident lined (striped) deposits with a low signal intensity, which in their shape and localisation corresponded to venous infarctions (according to classification the level IV). There was lateral ventricular dilatation as well as dilatation of the third ventricle (triventricular hydrocephalus). Corpus callosum was not displayed; indirect symptoms indicating agenesis thereof (parallel lateral ventricles, inside concave shape of frontal horns of lateral ventricles) (Figure 2A,B,C). Immediately following MRI a pathological-anatomical autopsy was performed. This concerned intrauterine death of the foetus with advanced autolysis. Even despite brain fixation performed in situ it was not possible to distinguish the individual ventricles of the brain, brain tissue with haemorrhage was found in the cranial cavity (Figure 3).

Focally oedematous tracts of tissue of a gelatinous consistency were found on the placenta by macroscopic analysis, some chorionic villi were of a diameter of 4 mm. The histological examination showed micromolar degeneration of the placenta and incipient chorionitis.

**DISCUSSION**

According to the comparison the largest part of the information relating to the pathological finding in CNS was provided by the MRI, which demonstrated both haemorrhage in the germinal matrix and agenesis of the corpus callosum. With regard to autolysis the autopsy finding was considerably limited, describing only brain tissue with haemorrhage, without a more detailed evaluation (it was not possible to state a finding with regard to the presence of congenital development defects – here agenesis of the corpus callosum). The ultrasound finding displayed only ventricular dilatation and an absence of medial structures. The ultrasound examination illustrated the pathology in the area of the placenta optimally, changes were confirmed in the pathological-anatomical autopsy.

Haemorrhage in the germinal matrix occurs in prematurely born babies (<32 weeks gestation and 1500 grams) most frequently in the first week after birth, less frequently haemorrhage may be observed prenatally, which was the case of our casuistic report, or later after birth. Periventricular leukomalacia occurs less
frequently in comparison with haemorrhagic mani-
estations, affecting only 5–15% of prematurely born babies (Osborn et al. 2004). In the pathogenesis of haemorrhage and ischemia in prematurely born babies, ischemia plays an important role, which contributes to an erosion of the wall of fragile blood vessels of the germinal matrix (Garel 2004; Fusch et al. 1997). In this case study, as in the work of Fusch et al, pathology of the placenta led to intrauterine hypoxia of the foetus, which culminated in haemorrhage in the germinal matrix (Fusch et al. 1997). This was the last degree in which haemorrhage with bursting into the ventricles first of all led to dilatation thereof, causing serious venous drainage, in turn leading to intraparenchymal haemorrhagic necrosis (Osborn et al. 2004; Garel 2004).

MRI helped to clarify in further detail the final diagnosis, primarily relating to the finding on CNS. Prenatal ultrasound examination described only hydrocephalus, lack of medial structures and pathology of the placenta, and an amount of amniotic fluid. With regard to the advanced autolysis in the brain area the pathological-anatomical autopsy was insufficient.

Griffiths et al. (2003) correlated findings on post mortem MRI with autopsy analysis, in 8 cases out of 40 the autopsy was inconclusive (for advanced autolysis), in 28 out of 32 cases there was concurrence and in 4 cases the diagnosis differed. These 4 cases were reviewed, in 3 cases MR imaging provided more information, in one case diagnosis from MRI was lacking (Griffiths et al. 2003).

A limitation of examination of the foetus, for both autopsy and MRI, is autolysis of the foetus. The degree of autolysis is influenced by two factors: 1. the length of time during which the dead foetus was in the womb and 2. the length of time from abortion to the performance of MRI. It is not possible to influence the duration of the actual induction of the abortion and whether necrosis of the foetus takes place in the womb. After abortion it is possible to ensure that MRI is conducted very quickly, and in this manner it is possible to prevent autolysis of the aborted foetus (Sabire 2006).

Post mortem MRI is performed on foetus for a number of fundamental reasons. One is the above-men-
tioned correlation of the MRI finding with the pathological-anatomical autopsy, the aim of which is the most precise possible diagnosis of the pathological state. A further reason is to compare how far prenatal ultrasound examination is capable of determining precisely what kind of defect (or pathological state) is concerned, and whether it is applicable to supplement prenatal MRI (Fusch et al. 1997; Griffiths et al. 2003; 2005; Sabire 2006, Whitby et al. 2006; Grandjean et al. 1999).

We believe that post mortem MR examination may be of significant help in increasing the precision of prenatal diagnosis, primarily where the possibilities of pathological-anatomical autopsy are limited (above all in cases of advanced autolysis or extensive dilatation of the ventricle system).

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REFERENCES