Outcome of antenatally diagnosed intracranial hemorrhage: case series of 19 patients
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Objective
Factors predisposing to in utero ICH (intracranial hemorrhage) include a variety of conditions, mostly maternal trauma and fetal coagulation disorders. In many cases, the etiology is not revealed. The incidence is estimated at 1 in 10 000 pregnancies. The objective of this study was to determine the sonographic criteria for the diagnosis of fetal ICH, the role of MRI and the clinical implications and outcomes of this condition in our case series of 19 patients.

Methods
We retrospectively reviewed all of our cases of IVH diagnosed antenatally from 2008 to 2015. All patients were offered MRI. The cases were categorized as extracerebral (subdural) and intraventricular hemorrhage (IVH). IVH was subdivided in supratentorial and posterior fossa hemorrhage. Intraventricular hemorrhages were categorized following the classification commonly used in neonates.

Results
Of the 19 cases of fetal ICH, there were 3 subdural bleedings and 2 hemorrhages in the posterior fossa. Of the 14 intracerebral hemorrhages, 3 cases were of Grade I, 1 case of Grade II, 4 cases of Grade III and 6 cases of Grade IV. Diagnosis was made at a mean GA of 29 5/7 weeks (SD: 5, 1 days). In 12/19 cases ventriculomegaly was the first and most common ultrasound finding. Two Gr I bleedings were associated with TTTS in 2 MCDA twin pregnancies. A third case was associated with a second trimester CMV infection. All these children are doing well postnatally. In the fetus with Gr II intraventricular hemorrhage, it initially presented with a thrombus in the third ventricle, progressing into ventriculomegaly subsequently. A vascular malformation in the choroid plexus was also diagnosed. In the four cases of Gr III bleeding with severe bilateral ventriculomegaly (>15 mm) no etiology was found. All but one child shows neurodevelopmental impairment. Of the 6 Grade IV cases, all but one had a termination of pregnancy, the child died on day-9 postnatally. In our 3 cases of subdural bleeding, 2 underwent TOP and 1 child died day 5 postnatally. In 2 of these cases a coagulation disorder was found. (Coll/EPI 87 and the COLL/ADP 66s; Factor V gen mutations). The 2 hemorrhages in the posterior fossa were due to Parvo B19 virus infection. One child had bleeding and necrosis of the cerebellar hemisphere and a TOP was accepted. The other is doing well. A plausible cause for the hemorrhage was found in 16/19 cases. In 15/19 fetuses fetal MRI was performed. In addition to confirming the diagnosis it also added extra information e. g the extent of the bleeding and the parenchyma involvement.

Conclusion
Diagnosis of IVH is usually made late in second/third trimester. The most common ultrasound finding in our series was ventriculomegaly. MRI allows evaluation of the entire cerebral parenchyma although it adds little additional information compared to the prenatal ultrasound. No losses were reported in IVH grade I or II. All subdural hematomas in our series were due to coagulation disorders.