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**Intracranial hemorrhage due to rupture of an arteriovenous malformation in a full-term neonate**

**Abstract** A case of neonatal intracerebral hemorrhage (ICH) secondary to rupture of an arteriovenous malformation (AVM) is reported. The baby began to vomit frequently 9 h after birth. Computed tomographic scan revealed the presence of an ICH. Intravenous digital subtraction angiography (IVDSA) demonstrated an AVM, which was successfully excised on the 2nd day after birth. It is stressed that IVDSA is safe and noninvasive in comparison with conventional angiography and is useful for diagnosis of cerebral vascular disease in neonates.

**Keywords** Neonate • Intracerebral hemorrhage • Arteriovenous malformation • Intravenous digital subtraction angiography

**Introduction**

Arteriovenous malformation (AVM) is a rare cause of neonatal intracranial hemorrhage. We report a full-term neonate with intracerebral hemorrhage (ICH) due to rupture of an AVM on the day of birth. He underwent successful transcranial excision of the lesion on the 2nd day after birth, and is developing without any severe neurological deficits 18 months after the operation.

The diagnosis of AVM was established using intravenous digital subtraction angiography (IVDSA). To our knowledge only 12 cases of intracranial hemorrhage secondary to rupture of an AVM in full-term neonates have been reported [1, 4–6, 8–15]. In 9 of these cases, the AVM was diagnosed using conventional cerebral angiography [1, 4, 6, 8–10, 12, 13, 15], and in only 1 case was it diagnosed using digital subtraction arteriography [5]. The safety and usefulness of IVDSA in the diagnosis of cerebral vascular disease in neonates is discussed.

**Case report**

The patient was a male infant born in the 41st week of gestation via a spontaneous vaginal delivery after an uneventful pregnancy at a local hospital on January 30, 1991. There was no family history of hereditary vascular disease. His head circumference was 34.0 cm and his body weight was 3412 g. Apgar score was 9 at 5 min.

He was well until 9 h after birth, when he began to vomit frequently. Computed tomographic (CT) scanning performed 22 h after birth revealed an ICH. Intravenous digital subtraction angiography (IVDSA) demonstrated an AVM, which was successfully excised on the 2nd day after birth. It is stressed that IVDSA is safe and noninvasive in comparison with conventional angiography and is useful for diagnosis of cerebral vascular disease in neonates.
Fig. 1 Computed tomographic scan obtained 22 h after birth showing intracerebral hemorrhage in the right occipital lobe with displacement of the midline structure to the left associated with subarachnoid and subdural hematoma located predominantly along the cerebellar tentorium.

Fig. 2 Intravenous digital subtraction angiogram, anteroposterior view, showing a small nidus (arrow) fed by the branches of the right posterior cerebral artery and early filling of the cortical veins (arrowheads).

Fig. 3 Intraoperative photograph. Note that the arteriovenous malformation (arrowheads) is located along the cerebellar tentorium (arrows).

Fig. 4 Photograph of the removed vascular nodule. Note the numerous arteries and veins of various sizes. (Elastica van Gieson, x 100)

ly. The small nidus was observed anteromedial to the hematoma near the cerebellar tentorium (Fig. 3). Histological examination of the specimen revealed numerous arteries and veins of various sizes, suggesting an AVM (Fig. 4).

In the following months, the infant presented transient mild left hemiparesis, which disappeared by 18 months after the operation. He is developing with a normal cognitive status and can walk unassisted.

Discussion

Twelve cases of intracranial hemorrhage due to rupture of an AVM in full-term neonates have been reported [1, 4–6, 8–15]. The initial symptoms, which developed within 23 days after birth, included apnea [11, 14], loss of consciousness [1], vomiting [5, 10, 13], seizure [5, 6, 8, 9, 12], and irritability [4]. Eight of the 12 patients suffered intraventricular hemorrhage (IVH) and/or ICH [1, 4–6, 9–11, 15], and 4 including our patient had subdural hematoma [1, 8, 10]. Nine of 10 patients who underwent operation survived for follow-up periods, and 5 of them were reported to be developing normally [5, 8, 10, 13, 14]. These observations show that the outcome of surgical removal of an AVM in a neonate is good. Celli et al. [2], in a large-scale study of AVMs in infants, found that the probability of recovery from pre- and postoperative neurological deficits was high. As in the present case, Uno