 Prague Medical Report / Vol. 112 (2011) No. 2, p. 144–150

Severe Tentorial Haemorrhage of the Term Newborn with a Favourable Outcome – Case Report

Termerová J.[1], Janota J.[1,2]
[1]Department of Neonatology, Thomayer University Hospital, Prague, Czech Republic;
[2]Institute of Pathological Physiology, First Faculty of Medicine, Charles University in Prague, Prague, Czech Republic

Received January 8, 2011; Accepted April 18, 2011.

Key words: Tentorial haemorrhage – Newborn – Neonatal – Outcome – Head injury

Abstract: The traumatic intracranial haemorrhage still remains a serious complication of instrumental deliveries with an uncertain prognosis. Regarding tentorial haemorrhage, surprisingly few clinical neurological data are available. Most of the references in literature are older case reports, associated frequently with an unfavourable outcome. We report a newborn after a serious tentorial haemorrhage with an excellent neurodevelopmental outcome. Computed tomography (CT) scan of our patient demonstrated an extensive bilateral tentorial haemorrhage extending to the foramen magnum. The newborn showed a good respiratory effort, but a neurological impairment including anisocoria, apathy, hypotonia, incomplete grasp and Moro reflex. Despite these signs, the development at 9 and 18 months of age was appropriate. The aim of this report is to accentuate that the prognosis of infants with tentorial haemorrhage should be always evaluated carefully with main respect to clinical signs. The outcome of the newborn even after a large tentorial haemorrhage can be surprisingly without a serious neurological deficit. Spontaneous breathing without support, normal blood pressure and absence of seizures are clinical indicators that may be associated with a good outcome despite an extensive tentorial haemorrhage.

Mailing Address: Jana Termerová, MD., Department of Neonatology, Thomayer University Hospital, Vídeňská 800, 140 59 Prague 4, Czech Republic; Mobile Phone: +420 777 028 642; Fax: +420 261 083 740; e-mail: jana.termerova@gmail.com

Introduction

Instrumental vaginal deliveries are used to decrease foetal mortality and morbidity. In The Czech Republic the frequency of instrumental deliveries is approximately 2% of total deliveries with predominance of forceps deliveries over vacuum extraction (Pařízek, 2010). The commonest indications for instrumental delivery are foetal distress and prolonged labour. The occurrence of significant foetal acidemia was not different among forceps-assisted, vacuum extraction and caesarean delivery regardless of the indication (Contag et al., 2010). Instrumental vaginal delivery could be associated with uncommon, but serious neonatal adverse effects. The main neonatal adverse outcomes described with both vacuum extraction, and forceps are extra and intracranial haemorrhages. There are only a few studies in the literature on long-term outcome of affected newborns. Large longitudinal study focused on long-term outcome is not available (Gardella et al., 2001; Looney et al., 2007; Baud, 2008; Volpe, 2008). The commonest described cause of tentorial haemorrhage is maldistribution of compressive forces on the head during delivery. If the head is distorted and elongated by traction, excessive stress is applied to the tentorium and falx, causing a tear to the free edge of tentorium with associated rupture of the veins or sinus (Levene, 2005).

Case report

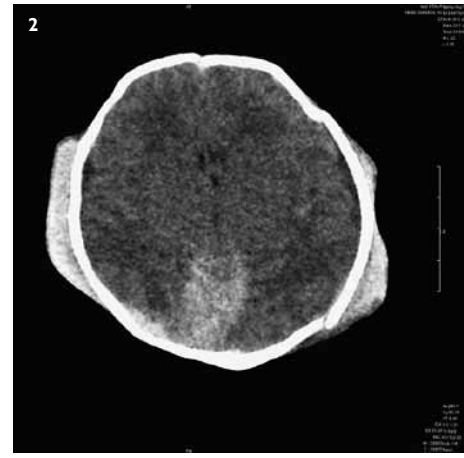
A term male neonate was born to a 30-year old primigravida, following an uncomplicated pregnancy. Membranes ruptured 2 hours before delivery. Because of pathologic cardiotocographic patterns and a prolonged second stage of labour, the delivery was facilitated by the use of low forceps. The weight was 3,070 g. The neonate was resuscitated with bag-and-mask after birth, the Apgar scores were 4 at 1 minute, 8 at 5 minutes and 9 at 10 minutes. The arterial umbilical cord pH was 7.02; BE –14 mmol/l.

At five hours of age, the neonate became apathetic, hypotonic and peripherally shut down. The neonate sucked poorly, grasp and Moro reflex were incomplete. Phenobarbital was administered. The head was extensively swollen, with marks of traumatic bleeding into soft tissues and with subperiostal cephalohaematomas. The newborn had no respiratory distress and normal blood pressure. No clinical seizures were detected. At seven hours of life mydriasis and no pupillary light reflex were noticed on the left side. Computed tomography (CT) scan of the brain was performed and demonstrated an extensive peritentorial haemorrhage on both sides of cerebellum extending to foramen magnum, and a small intraventricular haemorrhage, two epidural haematomas above both frontal lobes, small contusive changes in the temporoparietal cortex and small multiple skull fractures (Figures 1 and 2). An electroencephalogram demonstrated sharp waves and spikes and low background voltage. A lumbar puncture showed aseptic bloody fluid. Clotting studies (aPTT, PT, fibrinogen, platelet count, D-dimer) were within normal limits. Retinal haemorrhages were not seen. Cranial sonography was performed daily, blood flow

velocities in the anterior cerebral artery were measured and Pourcelot's resistivity index was determined. All measured variables were within the normal range. The family was fully informed about the serious nature of the injuries to their son and the uncertain prognosis.

Despite clinical and CT findings, the patient improved his neurological condition over two weeks. He showed a good spontaneous activity and started to suck with a good effort. CT scan on day 14 showed a regression of tentorial haemorrhage and intraventricular haemorrhage, no abnormal dilatation of lateral ventricles and no midline deviation (Figure 3). The electroencephalogram demonstrated improvement, but still with a low background voltage and sporadic sharp waves. Baby was discharged home on day 21. The neurological examination at three, six, nine and eighteen month of age was normal.

At the age of six month patient was completely examined during a short-term hospitalization. The electroencephalography, visual evoked potentials,



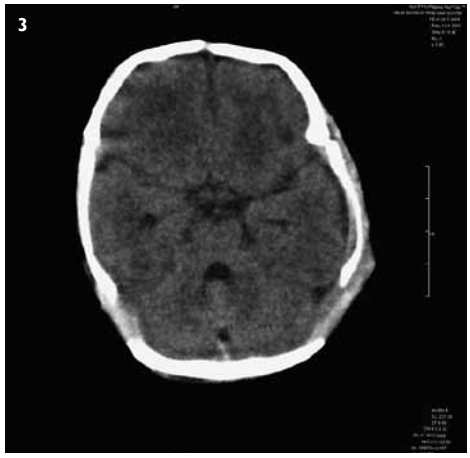


Figure 1 – Axial computed tomography scan demonstrates tentorial haemorrhage around the cerebellum (arrows).

Figure 2 – Axial computed tomography scan demonstrates haemorrhage extending to foramen magnum.

Figure 3 – CT scan on day 14 shows a regression of tentorial haemorrhage and intraventricular haemorrhage, no abnormal dilatation of lateral ventricles and no midline deviation observed.

electroretinography, and brainstem auditory evoked potentials were normal. The magnetic resonance imaging scan of the brain was normal. Clinically there was noticed a transient mild left hemisyndrome that was treated with physiotherapy and resolved. The verticalization of the baby was appropriate. Follow-up at 12 and 18 months of age revealed normal findings on physical and neurological examination and normal growth and development (Figure 4).

Discussion

Traditionally it has been postulated that birth trauma can produce tentorial or falx tears, which give rise to subdural (SDH) or tentorial haemorrhage. Birth trauma is also assumed to be responsible for subdural haemorrhage through damage to the bridging veins, which run from the brain to the dura mater, caused by deformation of the skull during labour (Hanigan et al., 1990; Levene, 2005). It has been considered that the subdural space is located between the arachnoid and the dura and that subdural haemorrhage is the result of blood accumulating in this virtual space. But this is only a virtual space. Under normal conditions, there is no evidence of a naturally occurring subdural space. This space, however, may develop as a consequence of a pathological process that damages the weak plane of the dural border cell layer between the arachnoid and the dura (Cohen and Scheimberg, 2009).

There are a few specific distinctions for neonatal age. The subdural haemorrhage in the infant can have a different pattern from that seen in the older child and adult. It is usually a widespread, bilateral, thin film, unlike the thick space occupying and often unilateral clot seen in older children and adults after trauma (Squier and Mack, 2009). Whether both arise by the same mechanism is unknown, but it seems unlikely. Squier and Mack described in their work possible alternative mechanisms of subdural haemorrhage in infants. They mentioned, that in the neonate the dura has an extensive venous plexus that forms sinuses in the tentorium, posterior falx and the dura of the floor of the posterior cranial fossa, subsequently dwindling to be represented only by the familiar major sinuses of the adult dura (Tubbs et al., 2007; Squier and Mack, 2009). The second distinctive feature for neonatal age is immaturity the arachnoidal villi, which are poorly developed in the first 7 month

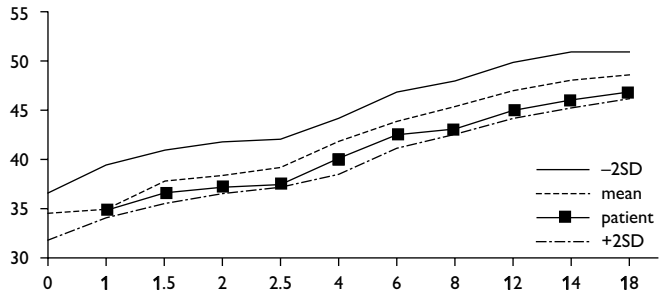


Figure 4 – Head circumference measurement during the first 18 months of life. For head circumference The Sixth Czech Anthropometric Nation-wide Investigation 2001 percentile chart was used (Vignerová et al., 2007).

of life. The presence of valveless channels entering the sinuses and the extensive vascularity of the dural folds may well predispose to congestion and bleeding if intracerebral and intravascular pressure relationships are disturbed in the first month of postnatal life. A series of studies in the last few years have shown an incidence of subdural haemorrhage in between 9 and 46% of asymptomatic neonates after normal, instrumental and caesarean delivery. The majority of subdural haemorrhage is found in the posterior fossa or over the posterior part of the brain (Looney et al., 2007; Squier and Mack, 2009).

In the first few days after bleeding, the haemorrhage sediments under the influence of gravity and undergo secondary redistribution to dependent part of the intracranial compartment. Blood spreads widely between all subdural compartments and tracks down around the spinal cord. The accumulation of blood in the posterior fossa subdural space causes neurological symptoms and signs, which are manifest within the first day of life (Levene, 2005).

Seizures are the major neurological clinical signs of intracranial pathology. Seizure may occur soon after birth or after an extended period without any pathological neurologic signs. Apnoea, as a manifestation of seizure activity, is usually associated with tachycardia, increased blood pressure, or hypoxia. On the other hand, apnoea with bradycardia may be a manifestation of elevated intracranial pressure (Levene, 2005; Gupta et al., 2009). The other described clinical findings associated with intracranial haemorrhages in term newborns are respiratory distress, depression of primitive reflexes, hypotonia and cranial nerve involvement.

Our patient developed symptoms of brainstem irritation including loss of the pupillary light reflex on the left side mydriasis from compression of oculomotor nerve. The haemorrhage which leads to compression of the oculomotor nerve, usually affects the superficial parasympathetic fibers and manifests as a loss of the pupillary reflex (Bennett and Pelak, 2001). Other noticed symptoms were hypotonia and hyporeflexia. He had no respiratory or thermoregulation problems, therefore conservative management was chosen.

The phenobarbital in the dose of 20 mg/kg IV given within six hours of life to term neonates with hypoxic-ischemic encephalopathy (HIE) is reported to decrease significantly the incidence of neonatal seizures. Also it is associated with a decrease in lipid peroxides and anti-oxidant enzymes (Singh et al., 2004, 2005).

Large longitudinal study focused on long-term outcome is not available (Gardella et al., 2001; Looney et al., 2007; Baud, 2008; Gupta et al., 2009). Older studies described poor neurodevelopmental outcome of these babies, the trauma was large, associated with a serious contusion of cerebral parenchyma (Serfontein et al., 1980; Hanigan et al., 1990).

Serfontein et al. reported three cases of newborns with tentorial haemorrhage treated surgically. The infants developed seizures and respiratory distress and one patient third nerve involvement. Follow-up in 6–9 months showed a transient right hemisyndrome in a first case and significant motor consequence in two other cases

(Serfontein et al., 1980). Hanigan et al. described in their work three neonates after vacuum extraction. All neonates were full term and developed generalized seizures within 36 hours. Computed tomography and magnetic resonance imaging outlined distinctive tentorial haemorrhages with extension over the superior surface of the cerebellum or inferior surface of the occipital lobe. One patient had surgical evacuation of bilateral subdural haematomas. Follow-up from 1 to 5 years showed significant developmental delay in two patients (Hanigan et al., 1990). The other group of authors studied intracranial haemorrhage in term newborns (Nanba et al., 1984). They observed high incidence of intraventricular haemorrhage and haemorrhage around the falx. Subdural haemorrhage was frequently accompanied by cerebral infarction and followed by porencephaly. They concluded, that subdural haematomas with low density on cranial CT scan may predict a poor prognosis.

Perrin et al. reported 15 neonates with symptoms of intracranial haemorrhage in the first 24 hours. CT scan established diagnosis of subdural haemorrhage of posterior fossa in all cases. Surgical evacuation was performed in eight neonates. Seven patients had normal neurological outcome, three were mildly delayed, two moderately, and three profoundly delayed (Perrin et al., 1997). In Looney's group 97 asymptomatic neonates underwent magnetic resonance imaging between age of 1 and 5 weeks. Intracranial haemorrhage was identified in 17 newborns (26%). 16 subdural, 2 subarachnoid and 6 parenchymal haemorrhages were found. All subdural haematomas were infratentorial. All newborns were asymptomatic (Looney et al., 2007). Brouwer et al. studied 53 newborns with intracranial haemorrhage and parenchymal involvement. Clinical or subclinical seizures were seen in 91% of infants, mortality rate was 25%. At 15 month of age 17% had severe developmental deficit (Brouwer et al., 2010).

Conclusion

The aim of this report is to accentuate that the prognosis of infants with tentorial haemorrhage should be always evaluated carefully with main respect to clinical signs. There is a lack of longitudinal studies focused on a long-term outcome of affected newborns. The outcome of the newborn even after a large tentorial haemorrhage can be surprisingly without a serious neurological deficit. Spontaneous breathing without support, normal blood pressure and absence of seizures are clinical indicators that may be associated with a good outcome despite an extensive tentorial haemorrhage.

References

Baud, O. (2008) Neonatal outcomes after instrumental vaginal delivery. *J. Gynecol. Obstet. Biol. Reprod. (Paris)* **37(8)**, 260–268.

Bennett, J. L., Pelak, V. S. (2001) Palsies of the third, fourth, and sixth cranial nerves. *Ophthalmol. Clin. North Am.* **14(1)**, 169–185.

Brouwer, A. J., Groenendaal, F., Koopman, C., Nievelstein, R. J., Han, S. K., de Vries, L. S. (2010) Intracranial hemorrhage in full-term newborns: a hospital-based cohort study. *Neuroradiology* **52(6)**, 567–576.

Cohen, C. M., Scheimberg, I. (2009) Evidence of occurrence of intradural and subdural hemorrhage in the perinatal and neonatal period in the context of hypoxic ischemic encephalopathy: an observational study from two referral institutions in the United Kingdom. *Pediatr. Dev. Pathol.* **12**, 169–176.

Contag, S. A., Clifton, R. G., Bloom, S. L., Spong, C. Y., Varner, M. W., Rouse, D. J., Ramin, S. M., Caritis, S. N., Peaceman, A. M., Sorokin, Y., Sciscione, A., Carpenter, M. W., Mercer, B. M., Thorp, J. M. Jr., Malone, F. D., Iams, J. D. (2010) Neonatal outcomes and operative vaginal delivery versus cesarean delivery. *Am. J. Perinatol.* **27(6)**, 493–499.

Gardella, C., Taylor, M., Benedetti, T., Hitti, J., Critchlow, C. (2001) The effect of sequential use of vacuum and forceps for assisted vaginal delivery on neonatal and maternal outcomes. *Am. J. Obstet. Gynecol.* **185(4)**, 896–902.

Gupta, N. G., Kechli, A. M., Kamalla, U. S. (2009) Intracranial hemorrhage in term newborns: management and outcomes. *Pediatr. Neurol.* **40(1)**, 1–12.

Hanigan, W. C., Morgan, A. M., Stahlberg, L. K., Hiller, J. L. (1990) Tentorial hemorrhage associated with vacuum extraction. *Pediatrics* **85(4)**, 534–539.

Levene, M. (2005) Intracranial hemorrhage at term. In: *Roberton's Textbook of Neonatology*, 4th edition. Rennie, J. M., pp. 1120–1128, Elsevier, London.

Looney, C. B., Smith, J. K., Merck, L. H., Wolfe, H. M., Chescheir, N. C., Hamer, R. M., Gilmore, J. H. (2007) Intracranial hemorrhage in asymptomatic neonates: prevalence on MR images and relationship to obstetric and neonatal risk factors. *Radiology* **242**, 535–541.

Nanba, E., Eda, I., Takashima, S., Ohta, S., Ohtani, K., Takeshita, K. (1984) Intracranial hemorrhage in the full-term neonate and young infant: correlation of the location and outcome. *Brain Dev.* **6(5)**, 435–443.

Pařízek, A. (2010) Porodnické kleště – Překonaná porodnická technika? *Čes. Gynek.* **75(5)**, 408–416. (in Czech)

Perrin, R. G., Rutka, J. T., Drake, J. M., Meltzer, H., Hellman, J., Jay, V., Hoffman, H. J., Humphreys, R. P. (1997) Management and outcome of posterior fossa subdural hematomas in neonates. *Neurosurgery* **40(6)**, 1190–1200.

Serfontein, G. L., Rom, S., Stein, S. (1980) Posterior fossa subdural hemorrhage in the newborn. *Pediatrics* **65(1)**, 40–43.

Singh, D., Kumar, P., Majumdar, S., Narang, A. (2004) Effect of phenobarbital on free radicals in neonates with hypoxic ischemic encephalopathy – a randomized controlled trial. *J. Perinat. Med.* **32**, 278–281.

Singh, D., Kumar, P., Narang, A. (2005) A randomized controlled trial of phenobarbital in neonates with hypoxic ischemic encephalopathy. *J. Matern. Fetal Neonatal Med.* **18**, 391–395.

Squier, W., Mack, J. (2009) The neuropatology of infant subdural haemorrhage. *Forensic Sci. Int.* **187(1–3)**, 6–13.

Tubbs, R. S., Loukas, M., Louis, R. G. Jr., Shoja, M. M., Acakpo-Satchivi, L., Blount, J. P., Salter, E. G., Oakes, W. J., Wellons, J. C. III. (2007) Anatomy of the falcine venous plexus. *J. Neurosurg.* **107(1)**, 155–157.

Vignerová, J., Humeníková, L., Brabec, M., Riedlová, J., Bláha, P. (2007) Long-term changes in body weight, BMI, and adiposity rebound among children and adolescents in the Czech Republic. *Econ. Hum. Biol.* **5(3)**, 409–425.

Volpe, J. J. (2008) Intracranial hemorrhage: Subdural, primary subarachnoid, cerebellar, intraventricular (term infant), and miscellaneous. In: *Neurology of the Newborn*, 5th edition. Volpe, J. J., pp. 483–516, Saunders, Philadelphia.