Pathophysiology of Intracranial Haemorrhage in the Newborn

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Intracranial haemorrhage remains an important cause of neonatal mortality although the relative importance of different forms of haemorrhage have changed in recent years.

Subdural haemorrhage usually results from birth trauma. Modern obstetric management, by avoiding difficult vaginal delivery, has reduced the incidence of this type of bleeding as a primary cause of death to less than 1 in 2000 births in most series.

Subarachnoid haemorrhage may occur either in localized or generalized forms. The localized haemorrhages are associated often with abnormalities of haemostasis such as disseminated intravascular coagulation, whereas the generalized bleeds are usually ascribed to hypoxia.

The form of intracranial haemorrhage which has become of most concern to the neonatologist is intraventricular haemorrhage (IVH) associated with subependymal periventricular haemorrhage. Recent studies using computerized tomography have shown that nearly half of all infants below 1500 g birthweight admitted to neonatal intensive care units develop this condition. Understanding of the pathophysiology of this form of haemorrhage demands knowledge of the anatomy and physiology of the developing cerebral circulation.

Injection studies have shown that the vessels supplying the basal ganglia and subependymal region are very well developed in the preterm brain and it is inferred that there is preferential blood flow to this area. Periventricular haemorrhage has been shown to originate from the microcirculation.

Consideration of circulatory physiology and studies of cerebral blood flow in newborn infants have suggested two possible sequences leading to IVH. The hypoxia and hypercapnia of the respiratory distress syndrome may cause a primary hyperperfusion with breakdown of the microcirculation, whereas birth asphyxia may cause hypoperfusion with ischaemic damage to the microcirculation and haemorrhage following restoration of normal flow.

The soft cranium of the preterm infant may have a major influence in determining the susceptibility of the immature brain to vascular damage. Tight bands or netting used to secure a face mask for mask ventilation of small preterm infants may decrease cerebral perfusion by raising intracranial pressure in addition to causing impairment in venous drainage from the posterior fossa. This results in a characteristic type of haemorrhagic infarct of the cerebellum.

It is concluded that monitoring of blood pressure and intracranial pressure, and strict control of blood gas tensions, are important measures which may help to prevent intracranial haemorrhage in the newborn.

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