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THE ROLE OF APOPTOSIS IN THE EARLY BRAIN INJURY AFTER SUBARACHNOID HEMORRHAGE

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Subarachnoid haemorrhage (SAH) is one of the types of intracerebral haemorrhage and denotes the presence of blood within the subarachnoid space between the pial and arachnoid membranes. It occurs in different situations like head trauma, rupture of the cerebral aneurysm or arteriovenous malformation. Subarachnoid hemorrhage has a high mortality rate because 14% of patients die before reaching the hospital. These deaths occur mostly due to initial hemorrhage, and no effective treatment is available for brain injury after this. For survivors, early brain injury caused by the initial hemorrhage and delayed ischemic neurologic deficits due to cerebral vasospasm are major causes of the subsequent morbidity and mortality.

Treatment with a view to reverse the vasospasm with a wide range of drugs didn't improve the outcome. Early brain injury is considered a prime target for future research and may be also an important factor in preventing symptomatic vasospasm. In this respect, early brain injury may predispose the brain to ischemic injury due to vasospasm. Recent studies showed that exactly apoptosis is involved in the pathogenesis of early brain injury after experimental SAH or in a clinical setting.

Apoptosis is essential for the correct development of the human organism and the clearance of adverse cells like autoreactive or tumor cells. Programmed cell death is initiated by the activation of specific receptors and in most cases it is associated with the activation of the cysteine proteases, which lead to apoptotic cell death. Cells shrink, chromatin undergoes condensation into compact patches against the nuclear envelope (pyknosis); it becomes discontinuous and the DNA inside is fragmented (karyorrhexis). The nucleus breaks into several discrete chromatin bodies due to the degradation of DNA. The cell breaks apart into several apoptotic bodies, which are then phagocytosed by neighbor phagocytic cells (efferocytosis). In this way molecular apoptotic pathways in neurons may induce brain edema, neurological deficit, and higher mortality rate. In general, apoptosis may play an important role in early brain injury after SAH and therefore it is thought that an antiapoptotic treatment can be a therapeutic candidate for early brain injury after SAH and further studies regarding it may lead to the improvement of outcome for these patients.

The most important information about apoptosis in SAH for the last 9 years was gathered and analyzed.