

Physiopathology of cerebral ischemia and clinical need for Imaging

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Following an ischemic insult, brain tissue loses functional activity in a few seconds and undergoes irreversible damage and eventually cell death in a few minutes. In case of incomplete ischemia, associated with critical reduction of the cerebral blood flow, the brain damage consists of a process rather than a sudden event, and cellular recovery or death is attained after an intricate cascade of results. Quite consistently, in stroke patients, dishomogeneous areas of damaged, potentially viable, tissue surround an immediately necrotic area. Identifying the viable tissue in the hours following the ischemic onset is a major challenge in the stroke field.

The increasing knowledge into the relevance of the neurovascular unit as a whole functional system, and into the mechanisms of the different kinds of programmed cell deaths, which are thought to mediate the ischemia-induced tissue damage, has produced a new conceptual framework, which includes several systemic or local variables relevant to the fate of the damaged tissue. Residual perfusing blood flow, however, remains the most relevant predicting factor of functional recovery. A number of methods have been devised to attain cerebral blood flow-related neuroimages. Very few approaches allow measurements of cerebral blood flow in terms of volume of blood which perfuses the brain per unit of time, per unit of mass.