Efficacy of Squalenoyl-Adenosine (SQAd) Nanoparticles in Spinal Cord Injury Animal Model

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Trauma is one of the major problems in surgery that needs special strategies for treatment. In neurosurgery, especially after head and spinal cord injuries, immediate care must be taken into account, since a cascade of events start after primary insult. In many trauma incidents, an initial mechanical insult is followed by a sequence of biochemical pathways leading to secondary injury. Free radicals-principally oxygen-react with the membrane phospholipids to cause destruction of both cellular and mitochondrial membranes as well as the blood brain barrier. In addition, inflammation and edema formation appear to be the fundamental mechanisms of secondary damage. In this study, we report a very simple and easy way to use the currently unusable adenosine as a neuroprotective drug following intravenous injection. We show that the bioconjugation of adenosine with squalene (a natural and biocompatible lipid) to form an amphiphilic prodrug led to the spontaneous formation of nanoparticles with a size of ~120 nm, allowing (1) efficient protection from rapid metabolization, (2) induction of a dramatic neuroprotective effect in both an ischaemia–reperfusion model in mice and a spinal cord injury (SCI) model in rats, (3) a prolonged drug interaction with the neurovascular unit, (4) no triggering of side effects or systemic toxicity. In this part of the study, especially, surgical procedure regarding the evaluation of spinal cord injury and histological investigations will be focused on.