Protein to stop acute cerebral hemorrhage

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A research team led by Won Bae Jeon at DGIST's Companion Diagnostics and Medical Technology Research Group conducted a joint study with the research team of Professor Jong Eun Lee at Yonsei University's College of Medicine and found a thermally responsive elastin-like polypeptide, a protein that controls acute intracerebral hemorrhage and accelerates nerve regeneration. Thermal-responsive elastin-like polypeptides (ELPs) are cell-attaching proteins that are soluble in water at room temperature, but are transformed to insoluble gel at body temperature.

Brain hemorrhages, including intraventricular hemorrhages, intracerebral hemorrhages and subarachnoid hemorrhages, cause permanent disability, including paralysis and language disorders, or even death. Cerebral hemorrhage accounts for 10 to 15 percent of all strokes, and the mortality rate is 30 to 50 percent within 30 days of onset. However, there are no effective hemostatic methods or therapies to stop bleeding within the first 6 hours of acute intracerebral hemorrhage.

The two research teams artificially induced intracerebral hemorrhage in rats. Then, they injected a thermally responsive elastin-like polypeptide solution and observed that the volume of hematoma was significantly reduced in those rats.

Through biochemical and immunological analysis, the teams determined that thermally responsive elastin-like polypeptides play a role in blocking physically damaged cerebral blood vessels by building a protein nanostructure in the form of a self-assembled gel and simultaneously

accelerate vascular restoration by binding to the vascular endothelium. In addition, the team anticipates no toxicity or side effects, as the peptide gel produced in the cerebral hemorrhage region confers a hemostatic effect, and also stimulates brain tissue regeneration, after which the gel is decomposed into amino acids and released into the urine.

Thermo-responsive elastin-like polypeptides can be used for the treatment of intracerebral hemorrhages, including hypertensive cerebral hemorrhages, Willis' arterial ring obstruction (Moyamoya disease) and other cerebral hemorrhages. Moreover, it is expected to be used as a hemostatic agent in the operation of removing cerebral hematomas.

The principal researcher Won Bae Jeon says, "While there is no proper treatment to stop bleeding in the early stage of acute intracerebral hemorrhage, this study suggests the possibility of developing hemostatic therapies using thermo-responsive elastin-like polypeptide proteins. We will conduct further research to develop biopharmaceuticals for hemostatic therapy for intracerebral hemorrhage and brain tissue regeneration by optimizing the molecular weight and cell binding capacity of polypeptides."

More information: Joohyun Park et al, Thermo-sensitive assembly of the biomaterial REP reduces hematoma volume following collagenase-induced intracerebral hemorrhage in rats, *Nanomedicine: Nanotechnology, Biology and Medicine* (2017). DOI: 10.1016/j.nano.2017.04.001

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