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Plasma-type gelsolin in subarachnoid hemorrhage: novel biomarker today, therapeutic target tomorrow?

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(Article begins on next page)

COMMENTARY

Plasma-type gelsolin in subarachnoid hemorrhage: novel biomarker today, therapeutic target tomorrow?

Sherry Hsiang-Yi Chou^{1,2}, Eng H Lo² and MingMing Ning^{2*}

See related research by Pan et al., <http://ccforum.com/content/17/4/R149>

Abstract

There is growing interest in the potential neuroprotective properties of gelsolin. In particular, plasma-type gelsolin (pGSN) can ameliorate deleterious inflammatory response by scavenging pro-inflammatory signals such as actin and lipopolysaccharide. In a recent issue of *Critical Care*, Pan and colleagues report an important association between pGSN and subarachnoid hemorrhage (SAH) disease severity, and found pGSN to be a novel and promising biomarker for SAH clinical outcome. Previous research shows pGSN may be actively degraded by neurovascular proteases such as matrix metalloproteinases in the cerebral spinal fluid of SAH patients. Taken together, these results suggest that pGSN is not only a novel marker of SAH clinical outcome, but may also play an active mechanistic role in SAH, and potentially serve as a future therapeutic target.

In a recent issue of *Critical Care*, Pan and colleagues [1] report the largest study to date on blood plasma-type gelsolin (pGSN) as a promising biomarker in subarachnoid hemorrhage (SAH). In a cohort of 262 well characterized SAH patients and 150 control subjects, Pan and colleagues found that low blood pGSN (compared to healthy controls) is independently predictive of poor outcome or death [1]. A pGSN level <63.3 mg/L has 80.8% sensitivity and 75.1% specificity in predicting poor neurologic outcome at 6 months. They also found an important association between the level of gelsolin and severity of SAH, as measured by World Federation of Neurosurgical Societies and Fisher grading scales [1].

* Correspondence: ning@hms.harvard.edu

²Department of Neurology, Massachusetts General Hospital, Harvard Medical School, 15 Parkman Street, Boston, MA 02114, USA

Full list of author information is available at the end of the article

There is growing interest in the potential neuroprotective properties of gelsolin, which has two distinct isoforms. Cytoplasmic gelsolin (cGSN) is intracellular and ubiquitously expressed by all tissues, while pGSN has a 23 amino acid moiety targeted for extracellular secretion [2,3]. Though cGSN has been implicated in numerous biological processes, including cell motility, apoptosis, and phagocytosis [4], the function of pGSN remains largely unknown. Since pGSN can scavenge circulating actin and lipopolysaccharide, it is thought that pGSN may dampen the deleterious pro-inflammatory effects of these circulating inflammatory mediators [4].

Animal data have suggested a neuroprotective role for gelsolin since gelsolin-null neurons enhance cell death and gelsolin-null mice have larger infarct sizes following ischemia [5]. Gelsolin-null cells and animals are deficient in both cGSN and pGSN. Subsequent experiments showed that local infusion of pGSN decreases infarct size after ischemia [6], suggesting pGSN has a pivotal role in stroke.

Human data have consistently shown that pGSN is decreased in severe illnesses, including sepsis [7], and that lower blood pGSN is associated with higher mortality [8]. In neurovascular disorders, pGSN is decreased in both blood and cerebral spinal fluid (CSF) in SAH [9], and decreased blood pGSN is independently associated with mortality after intracerebral hemorrhage and ischemic stroke [10,11]. However, the fact that pGSN is associated with a wide spectrum of illnesses raises the concern that blood pGSN depletion is a non-specific marker of disease severity.

Is there any evidence that pGSN may be mechanistically involved in SAH? Indeed, SAH is the only condition where pGSN has been identified in the CSF compartment itself [9]. In SAH, novel degraded pGSN fragments were also identified in the CSF - likely resulting from

active digestion by matrix metalloproteinases (MMPs) [9], the elevation of which is associated with worse SAH outcome [12].

In their study, Pan and colleagues very nicely demonstrated a dose-dependent effect of pGSN on SAH disease severity - the lower the level of pGSN, the more severe the SAH grade and the worse the clinical outcome [1]. Previous research has shown pGSN to be present in the CSF compartment in SAH and that MMPs may mediate the depletion of pGSN [9,12]. Taken together, these studies suggest that, in the case of SAH, pGSN may be more than just a non-specific marker. It may play an active mechanistic role in SAH, and could potentially serve as a therapeutic target.

Many questions still remain in the gelsolin story in SAH. Exactly how does blood pGSN affect SAH outcome? Where is the source of pGSN in the CSF - does it come from blood? How does the pGSN-MMP pathway facilitate inflammation and injury in the central nervous system and blood? Further targeted mechanistic studies and collaborative multicenter translational and clinical studies are needed to answer these important questions. Indeed, pGSN may not only be a novel and important clinical biomarker for SAH clinical outcome, but may also be a future potential target for treatment.

Abbreviations

cGSN: Cytoplasmic gelsolin; CSF: Cerebral spinal fluid; MMP: Matrix metalloproteinase; pGSN: Plasma-type gelsolin; SAH: Subarachnoid hemorrhage.

Competing interests

The authors declare that they have no competing interests.

Author details

¹Brigham and Women's Hospital, Department of Neurology, 45 Francis St, Suite BB-204, Boston, MA 02115, USA. ²Department of Neurology, Massachusetts General Hospital, Harvard Medical School, 15 Parkman Street, Boston, MA 02114, USA.

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