Candidate biomarkers for deep tissue damage from molecular biological and biochemical aspects

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Abstract	Suspected deep tissue injury (DTI) is a new category of pressure ulcer (PU), and defined as an ulcer that developed from a deep tissue (subcutaneous tissue) region and deteriorates towards the superficial skin. DTI is a serious clinical problem because it cannot be detected at an early stage and rapidly deteriorates to a deep PU. Consequently, there is a requirement for the identification of novel biomarkers to detect damage to the deep tissue including deep muscle tissue. For this purpose, it is essential to understand the molecular and cellular mechanisms of DTI formation and deterioration. This article reviews the recent progress in studies on the hypoxia-related mechanisms of DTI, and introduces our attempts to establish novel biomarkers for detecting deep muscle damage. Hypoxia-inducible factor 1 alpha subunit (HIF1-alpha) is a widely used marker for hypoxic conditions. We detected increased expression and localization of HIF1-alpha in the deep muscle tissue of PU model rats, indicating that HIF1 alpha is a key molecule in DTI and a valuable biomarker for hypoxia in DTI in the research field. From the biochemical aspect, we focused on creatine phosphokinase (CPK). CPK is an intracellular enzyme related to energy metabolism, and its level in serum has been extensively used as a diagnostic marker for muscle injury. We attempted to estimate muscle injury from the CPK levels in exudates, which can be collected non-invasively and reflect the microenvironmental conditions. Our results using PU model rats suggested that exudate CPK could be a more sensitive biomarker than serum CPK for deep muscle tissue injury, and could be applicable for clinical diagnosis of DTI. (C) 2009 Published by Elsevier Ltd on behalf of Tissue Viability Society.
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