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Early pH Changes in Musculoskeletal Tissues upon Injury – Aerobic Catabolic Pathway Activity Linked to Inter-Individual Differences in Local pH

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Abstract:

Local pH is stated to acidify after bone fracture. However, the time course and degree of acidification remain unknown. Whether the acidification pattern within a fracture hematoma is applicable to adjacent muscle hematoma or is exclusive to this regenerative tissue has not been studied to date. Thus, in this study, we aimed to unravel the extent and pattern of acidification *in vivo* during the early phase post musculoskeletal injury. Local pH changes after fracture and muscle trauma were measured simultaneously in two pre-clinical animal models (sheep/rats) immediately after and up to 48 h post injury. The rat fracture hematoma was further analyzed histologically and metabolically. *In vivo* pH measurements in bone and muscle hematoma revealed a local acidification in both animal models, yielding mean pH values in rats of 6.69 and 6.89, with pronounced intra- and inter-individual differences. The metabolomic analysis of the hematomas indicated a link between reduction in tricarboxylic acid cycle activity and pH, thus, metabolic activity within the injured tissues could be causative for the different pH values. The significant acidification within the early musculoskeletal hematoma could enable the employment of the pH for novel, sought-after treatments that allow for spatially and temporally controlled drug release.

Keywords: pH changes, musculoskeletal system, bone healing, muscle injury, initial healing phase, pH-triggered drug release