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The roles of autophagy and apoptosis by spermidine in burn wound progression in rats

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Introduction: Spermidine is a naturally occurring polyamine involved in multiple biological processes, including DNA metabolism, autophagy and aging. Spermidine induces autophagy in cultured yeast and mammalian cells, as well as in nematodes and flies. Genetic inactivation of genes essential for autophagy abolishes the life span-prolonging effect of spermidine in yeast, nematodes and flies. These findings complement expanding evidence that autophagy mediates cytoprotection against a variety of noxious agents and can confer longevity when induced at the whole-organism level. In an acute burn injury the zone of stasis is initially vital but may progress to coagulation necrosis with time. In this experimental study, we hypothesized that apoptosis, autophagy induced by spermidine plays a role in burn wound progression.

Material and Methods: Healthy adult male Sprague Dawley rats (300–350 g, n = 40) were provided by the Institute for Biomedical Research, Medical University of Graz, Austria. A well-described and reliable “scald burn model with dressing protector” was employed to evaluate the roles of autophagy and apoptosis by spermidine in burn wound progression 5 days post-burn in a rat model. In two groups (each 8 rats) spermidine was injected intraperitoneally in two different concentrations thirty minutes and 48h after burn injury. Furthermore two groups (each 8 rats) were treated by a silicone foam dressing, where spermidine was injected in two different concentrations, over the burnt area. Animals in the control group (n= 8) were given the same amount of saline without spermidine. The animals were euthanized five days after burn injury and burn depth was assessed by hematoxylin and eosin staining.

Results: In both treated groups (intraperitoneally and topical) a significantly higher rate of inflammation with granulation tissue in the deep dermal and muscular layer than that of the control group was found. Furthermore lower burn wound progression, by less swelling collagen and edema in the dermal and muscular layer, was seen in the spermidine groups than in the control group.

Conclusion: Histological results of this study confirm that spermidine treatment has a statistically significant benefit in burn wound progression and survival of the stasis zone in an acute burn injury.

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