**Reaming Irrigation and Aspiration (RIA) Is Associated with Enhanced Fracture Hematoma Cell Viability and Decreased Neutrophil Maturation in Porcine Intramedullary Nailing**

***Michel Teuben**; Sascha Halvachizadeh, MD; Yannik Kalbas; Zhi Qiao; Nikola Cesarovic, DVM, PhD; Frank Hildebrand, MD; Paolo Cinelli, PhD; Hans-Christoph Pape, MD; Roman Pfeifer, MD*
*University Hospital Zurich, Zurich, Switzerland*

**Purpose:** The quality of early fracture hematoma dictates the healing process in long bone fractures. The impact of different reaming protocols for intramedullary nailing (IMN) on cellular characteristics of early fracture hematoma is unclear. We hypothesized that the application of reaming irrigation and aspiration (RIA) techniques optimizes cellular content of fracture hematoma.

**Methods:** Twenty-four pigs underwent standardized femur fracturing. Thereafter they were exposed to different protocols of IMN. Group A was underwent IMN without reaming, group B was treated with conventional reaming + IMN, and group 3 was composed of animals treated with RIA and subsequent nailing. Animals were observed for 6 hours and thereafter fracture hematoma was collected. Immune cells were isolated and studied by flow cytometry. Cell viability was tested by Annexin-V. Neutrophil activation was determined by Mac-1/CD11b- cell surface expression levels, whereas FcyRIII/CD16-receptor expression was utilized to investigate neutrophil maturation.

**Results:** All animals survived the observation period and proportions of leukocyte subtypes did not differ between groups. However, the percentage of viable fracture hematoma immune cells (Annexin-V-negative cells) was significantly higher in animals treated with RIA compared with conventional reaming (respectively mean 86.7% vs 96.5%, $P = 0.04$). Furthermore, neutrophil CD16-expression was significantly lower (–35%, $P = 0.04$) in those animals treated with RIA compared with the conventional reaming condition. Additionally, we observed a trend toward decreased neutrophil CD11b-expression in the RIA group compared with group A (+54%) and group B (+61%).

**Conclusion:** The current study reveals that utilization of RIA techniques for treatment of long bone fractures is associated with increased immune cell viability and less neutrophil senescence in early fracture hematoma. These findings suggest an important role of reaming techniques on local cellular immune homeostasis during the early phase of fracture healing. In order to improve cellular content of early fracture hematoma, future investigations should focus on optimization of RIA protocols.