

**Protective Effects of New Femoral Reaming Techniques (Reamer Irrigator Aspirator, RIA I and II) on Pulmonary Function and Posttraumatic Contusion (CT Morphology): Results From a Standardized Large Animal Model**

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

**Purpose:** The effects of reaming for preparation of intramedullary fixation in long bone fractures have been widely studied. We compared pulmonary and systemic effects between conventional reaming with reamer irrigator aspirator (RIA) and unreamed nailing in an acute porcine trauma model with a standardized femur fracture.

**Methods:** In a standardized porcine model (moderate blunt chest trauma, abdominal injury and femoral shaft fracture), the femur was submitted to intramedullary nailing after resuscitation and normalization of pulmonary function. The treatment groups included 3 reamer types (group RFN: conventional reaming with Synream; group RIA1: reamer irrigator aspirator, version 2005; group RIA 2: reamer irrigator aspirator, version 2019) and were compared to unreamed femoral nailing (group UFN). Pulmonary function measurements included arterial partial carbon-dioxide pressure (paCO<sub>2</sub> [kPa]) (baseline, post reaming, 2, 4, 6 hours) and volumetric measures of contusion in chest CT (at 6 hours). Systemic inflammatory response was measured at baseline and every second hour until 6 hours after trauma.

**Results:** This study included 24 male animals, mean weight 50.76 ± 4.1 kg, n = 6 per group). Group RFN developed a significantly higher partial CO<sub>2</sub> (pCO<sub>2</sub>) at 1 hour after reaming when compared with all other groups (7.4 ± 0.4 kPa vs 5.4 ± 0.6 RIA 1, 5.6 ± 0.4 RIA 2, and 5.5 ± 0.5 UFN, P<0.001), along with a had lower pO<sub>2</sub> (12.3 ± 1.3 kPa vs 17.2 ± 1.9 RIA 1, 17.4 ± 1.6 RIA 2, and 16.4 ± 0.7 UFN, P<0.001) and the degree of pulmonary hyperdense changes in the CT analysis was higher in RFN (485.2 ± 98.5 cm<sup>3</sup> vs 344.4 ± 74.4 cm<sup>3</sup> RIA 1 and 335.2 ± 58.1 cm<sup>3</sup> RIA 2, P<0.01). The inflammatory reaction was lowest in both RIA groups when compared with group RFN or UFN (P<0.001).

**Conclusion:** Both RIA 1 and RIA 2 protect the lung from reaming induced dysfunction and have no systemic inflammatory effects, while the negative effects were more sustained after reamed or unreamed nailing. Both RIA 1 and RIA II appear to be of value in terms of a Safe Definitive Surgery (SDS) strategy.