**Lipidomic Analysis Shows Significant Changes in Circulating Di- and Triglycerides After Intramedullary Nailing in a Porcine Polytrauma Model With a Femur Fracture**

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**Purpose:** Fat embolism is a recurring complication in patients with acute trauma and long bone fractures. Caused by the intravasation of bone marrow fat, it often occurs during intramedullary reaming and nailing. New methods of analyzing the circulating lipid profile are gaining attention in the field of trauma. Several lipid subgroups show high concentration in bone marrow fat. In this study, we investigated the posttraumatic and postinterventional Intravasation of 233 specific lipids in a well-established porcine polytrauma model with a femur fracture.

**Methods:** 54 male pigs (Swiss landrace) weighing 50 ± 5 kg underwent general anesthesia for 6 hours. Pigs were split in 3 groups: polytrauma (PT), monotrauma (MT), and sham (S). MT received an isolated femoral shaft fracture, while PT received an additional blunt chest trauma with lung contusion, a grade II (American Association for the Surgery of Trauma [AAST]) liver laceration and controlled hemorrhagic shock (mean arterial pressure [MAP] 30 ± 5 mm Hg for 60 minutes). After resuscitation, we used different means of intramedullary reaming and nailing (SynReam [SR], Reamer-Irrigator-Aspirator System [RIA], and introduction without reaming [NO]). Venous blood was taken regularly from baseline to 6 hours post trauma. Lipid concentrations and lipid composition were investigated using mass spectrometry. 233 specific lipids were analyzed.

**Results:** We organized lipids into 17 subgroups based on molecular characteristics. Total lipid concentration showed a significant ($P<0.01$) decrease after polytrauma and remained low over the course of observation. Di- and triglycerides (DAGs and TAGs) initially follow this trend but then show a significant increase right after intervention: 95.8 ± 52.4 to 235.2 ± 202.6 nM/mL ($P = 0.01$) and 241.5 ± 171.6 to 583.8 ± 620.9 nM/mL ($P = 0.036$). In MT, DAGs and TAGs show significant increases after fracture and remain elevated for 4 hours: 148.9 ± 63.6 (B) to 211.7 ± 77.7 nM/mL (2 hours) ($P<0.01$) and 366.4 ± 207.8 (B) to 552.8 ± 343.3 nM/mL (2 hours) ($P = 0.01$). SR and NO showed significant ($P<0.05$) increase of circulating DAGs and TAGs after intervention in every group (MT/PT/MT+PT), while RIA never did.

**Conclusion:** Our data clearly suggest significant changes to circulating lipid composition after trauma and treatment. Furthermore, we showed a significant decrease of intravasation of DAGs and TAGs by using RIA. Lipidomic analysis in our standardized porcine polytrauma model helps understand the role of lipids in acute trauma, treatment, and complications. Collation with data from the clinical setting is needed.