Intramedullary fixation is a treatment option for long bone fractures. The effect with intramedullary reaming and nailing regarding to marrow fat intravasation and potential consequence of fat embolism syndrome remain controversial. Although pulmonary fat embolization occurred frequently after intramedullary reaming, not every patient develops pulmonary dysfunction. Exact mechanism to remove pulmonary fat embol was not fully understood. The objective of present study was to investigate the clearance mechanism of pulmonary fat emboli after intramedullary reaming.

**Methods:** Twenty goats were used in the present study. The protocol of experiment was approved by the Research Animal Ethnic Committee of the Chinese University of Hong Kong. For each goat, the first pulmonary biopsy was performed at the beginning of experiment. Thereafter, twelve goats underwent intramedullary reaming and were then kept for one day \((n = 6)\) or for three days \((n = 6)\). The other eight goats served as control and were only subjected to soft tissue dissection and then kept for one day \((n = 4)\) or for three days \((n = 4)\). At the end of experiment, the second pulmonary sample was taken. The pulmonary tissue was homogenized, centrifuged, and the resulting supernatant which contained the membrane-bound lipase was collected. Pulmonary lipase activities were measured using fluorometric method and normalized by the protein content in each sample. The total protein content in each sample was quantitated by Bradford. The levels of pulmonary lipase activities from the first and the second lung samples were compared using paired-t test. Pulmonary ultrastructures were also examined using electron microscopy.

**Results:** Pulmonary lipase activity slightly increased from \(21.34 \pm 3.07 \text{ pmol x ml}^{-1} x \text{min}^{-1} x \text{mg}^{-1}\) to \(23.26 \pm 1.93 \text{ pmol x ml}^{-1} x \text{min}^{-1} x \text{mg}^{-1}\) \((p = 0.132, \text{paired t-test})\) one day after intramedullary reaming. The activity was further significantly increased from \(22.96 \pm 2.27 \text{ pmol x ml}^{-1} x \text{min}^{-1} x \text{mg}^{-1}\) to \(25.82 \pm 3.66 \text{ pmol x ml}^{-1} x \text{min}^{-1} x \text{mg}^{-1}\) \((p = 0.027, \text{paired t-test})\) three days after intramedullary reaming (Figure 1). However, in the control group, the lipase activity was not significantly changed. In ultrastructural study, some pulmonary capillaries were entirely obstructed by fat droplets after intramedullary reaming. Endothelium was elongated to accommodate the embolic fat (Figure 2). Fat droplet contained intravascular macrophages were observed in the pulmonary capillary after intramedullary reaming (Figure 3).

**Discussions:** The threshold of intramedullary pressure for marrow fat intravasation has been reported to be 50 mm Hg \((1)\). Reaming increased intramedullary pressures which substantially exceeds this threshold value \((2)\). Marrow fat intravasation, therefore, is unavoidable after intramedullary reaming. However, pulmonary fat embolization induces the activity of pulmonary lipase which hydrolyzes the embolic fat in the pulmonary capillary. On the other hand, pulmonary intravascular macrophage play an important role in the clearance of pulmonary fat emboli. It indicates that pulmonary tissue can spontaneously remove embolic fat after marrow fat embolization. Our findings can explain the low incidence of pulmonary fat embolism syndrome after intramedullary fixation.

**References:**