

## 国際セミナー

## 3. Pathogenesis of Dysbaric Osteonecrosis

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The typical dive profiles of diving fisherman with unsafe diving practices were studied, since both groups experience severely inadequate decompressions with rapid (no-stop) ascents which are frequently fatal. One group uses surface-supplied compressed-air as a hookah rig for scallops, and the other group makes repetitive deep dives on SCUBA for lobsters. However, it is known that dysbaric osteonecrosis (DON) can occur in humans and sheep after a single hyperbaric air exposure with inadequate decompression. Previous unproven theories suggest that DON is caused by a primary intravascular (embolic) and/or extravascular (compressive) effect of nitrogen bubbles directly on the osseous vasculature. However, experimental studies in animals and pathologic examinations of divers who expired shortly after their inadequate decompressions suggest that DON is caused by a secondary injury to marrow adipose tissue by rapidly expanding nitrogen gas that releases liquid fat and other procoagulants (tissue thromboplastin) and trigger-activates local, and possibly systemic, intravascular coagulation with intraosseous platelet aggregation and fibrin-platelet thrombosis of the marrow vasculature. For example, a 28-year-old scallop diver remained at 92 feet of sea water for 4.5 hours on surface-supplied compressed air. Decompression sickness (DCS) occurred after a no-stop ascent to the surface, and he died 70 minutes later. Autopsy revealed multiple gas bubbles, not

only within the great vessels, but in the fatty marrow of the femoral and humeral heads. Lipid and platelet aggregates were found on the surface of marrow bubbles. Fibrin-platelet thrombi were present within venous sinusoids adjacent to the bubbles, and were also detected in veins, arteries, and capillaries, suggesting intravascular coagulation. Marrow adipocytes were separated by dilated and thrombosed sinusoids. Pulmonary and renal fat embolism was also found. Fat embolism and fibrin thrombosis of subchondral capillaries was discovered for the first time in dysbarism.