Skeletal maturity contributes to the impairment of fracture healing via down regulation of immune response.

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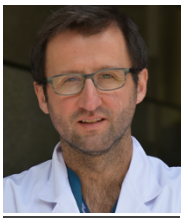

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Abstract :

Introduction: The treatment of bone fractures in the elderly is challenging for surgical teams, leading to numerous intraoperative and postoperative complications. Despite the improvement of osteosynthesis systems, understanding how a fracture heals in the

elderly is not fully understood. We aim to better understand this topic by characterizing the immune response and bone response in a preclinical model of aging.

Methods: We created a stable tibial fracture model in a group of young, skeletally immature Balb/C mice (n=10, five weeks old) and a group of skeletally mature adults of the same strain (n=10, 24 weeks old). Then, we compare inflammatory infiltrate at day two post-intervention (PID2) and the newly formed bone at day seven post-intervention (PID7). Tibiae were harvested, fixed, decalcified, and embedded in paraffin for histological, immunohistochemical, and histomorphometry analyses.

Results: At PID2, young mice showed a massive immune response compared with mature mice ($p<0.0001$). This immune infiltrate surrounds the bone hematoma at the medullar space near the bone defect, composed of macrophages and T cells. At PSD7, young and mature mice heal their bone defect; however, young mice exhibited a significant increase in new bone surface compared with mature mice ($p<0.0001$). This response comes from the local endosteal surfaces and bridges the bone marrow space.

Conclusion: We conclude that skeletal maturity decreases the immune infiltrate and the new bone formation in the fracture site. These findings highlight the role of immune response in the elderly as an essential driver of impairment of fracture healing observed in the elderly.