

## Effect of Operative Stabilization on Rib Fracture Healing in Porcine Experimental Model: A Pilot Study

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**Abstract :** Background: Clinical outcome benefits of the segment rib fracture surgical therapy are well known and follow from better stabilization of the chest wall. Despite this, some authors still incline to conservative therapy and point out to possible rib fracture healing failure in connection with the bone vascular supply disturbance caused by metal plate implantation. This suggestion met neither experimental nor clinical verification and remains the object of discussion. In our pilot study we investigated the titanium plate fixation effect on the rib fracture healing in porcine model and its histological, biomechanical and radiological aspects. Materials and Method: Two porcine models (experimental group) underwent the operative chest wall stabilization with a titanium plate implantation after osteotomy. Two other porcine models (control group) were treated conservatively after osteotomy. Three weeks after surgery, all animals were sacrificed, treated ribs were explanted and the histological analysis,  $\mu$ CT imaging and biomechanical testing of the calluses tissue were performed. Results: In  $\mu$ CT imaging, experimental group showed a higher cortical bone volume compared to the control group. Histological analysis using the non-decalcified bone tissue blocks demonstrated more matured callus with higher newly-formed osseous tissue ratio in experimental group in comparison to controls. In contrast, no significant differences in bone blood vessels supply in both groups were observed. This finding suggests that the bone blood supply in experimental group was not impaired. Biomechanical analysis using 3-point bending test demonstrated significantly higher bending stiffness and the maximum force in experimental group. Conclusion: Based on our observation, it could be concluded, that the titanium plate fixation of the rib fractures leads to faster bone callus maturation whereas does not cause the vascular supply impairment after 3 weeks and thus has a beneficial effect on the rib fracture healing.

**Keywords :** bone vascular supply, chest wall stabilization, fracture healing, histological analysis, titanium plate implantation

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