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Editorial

Immunomodulation Enhancing Bone Healing

George M Weisz[1]*, Marina-Portia Anthony[2] and Michael Houang[3]

[1]MD, FRACS(osteo), MA, FAMLC, Uni NSW (Sydney)and Uni, New England (Armidale), Australia

[2]MB BS, BSc, MPH, FRANZCR, Edgecliff Radiology, Sydney, Australia

[3]MBBS, FACR, FANZCR, Edgecliff Radiology, Sydney, Australia

***Corresponding Author:** George M Weisz, MD, FRACS(osteo), MA, FAMLC, Uni NSW (Sydney)and Uni, New England (Armidale), Australia.

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A significant change in the concept of osteosynthesis was recorded by the end of the last century and the early years of the new one. From a simple metabolic/hormonal concept of bone regeneration, first to an inflammatory concept, eventually moved to a more complicated immunological description. Bone repair process was found to be interfered with age, by diabetes, nutrition, hormone connection, autoimmune diseases, rheumatic arthritis, and nicotine. A new branch of medicine emerged, the Osteoimmunology, yet partially only successful in explaining bone repair.

It was in 2020 that the team from Bethesda VA hospital gave a comprehensive description of the normal, delayed, or non-union fracture biology [1]. It described the cascades of bone healing, reviewing a previous thesis of 3 classic stages. It was extended further by Philips [2] and then as the "Diamond concept" by Giannoudis [3]. It was presented as follows:

- Inflammation stage (Macrophage, T-cell, cytokine secretion)
- Reparation stage (Soft callus to hard callus)
- Regeneration stage (Osteosynthesis).

In the process of fracture repair, an active immune system starts a cascade of stages: the first being the "inflammatory stage", a hematoma resulting from blood vessel disruption attracts platelets, neutrophiles, macrophages and cytokine secreting T cells. This process leads to the second stage in the "reparation" process, namely the soft (cartilaginous) and then the hard (osteogenic) callus and angiogenesis.

The dead tissues are removed by macrophages, themselves undergoing apoptosis. The last stage is the renewal or the remodeling stage, when bone tissue is regenerated and flooded with minerals, promoting osteogenesis.

Publications abound with information on attempts with various pharmaceutical, experimental, and clinical trials did not lead to a significant shortening of healing time. The standard average healing time for a weight bearing, long bone closed fracture (uncompromised by diabetes, muscular dystrophy, malnutrition, nicotine dependence, renal disease, geriatrics, immune deficiency, polytrauma or open fracture was accepted as 17 weeks, and up to 35 weeks in a compromised patient [1].

Reviewing but part of the vast literature on this topic during the 21st century, the authors found a majority confirming the effect of immunomodulation on the bone healing. The authors have published a case of rapid healing of closed fracture of tibia, vertically splitting the condyle and complicated by a transverse fracture reaching the cortex [4].

The authors observed the case with full weight bearing, with no immobilization, allowing an active and unrestricted life, requiring 32 days to a full fracture healing. It was theoretically explained by the effect of a parallel immunomodulation provided for prevention of recurrence of a previously excised melanoma. The case was a traumatic fracture, with no evidence of malignancy, but an existent lymphoedema resulting from a groin dissection on the same lower limb [5].

This topic was presented at the Australian Orthopedic Conference in Brisbane, Queensland, September 2023.

Bibliography

1. Maruyama M., *et al*. "Modulation of the inflammatory response and bone healing". *Frontiers in Endocrinology* 11 (2020): 386.
2. Phillips AM. "Overview of the fracture healing cascade". *Injury* 36.3 (2005): S5-S7.
3. Giannoudis PV., *et al*. "Fracture healing: The Diamond concept". *Injury* 38.4 (2007): S3-S6.
4. Weisz GM and Anthony MA. "Can immunotherapy improve fracture healing?" *IMAJ* 25.8 (2023): 580.
5. Weisz GM and Anthony MA. "Enhanced bone healing and immunomodulation". *IMAJ* 25.11 (2023): 769-770.

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