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Osteogenic lesion regeneration in a dog using the integrative action of platelet-rich plasma and hydroxyapatite nanoparticles

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Introduction

An important line of application in regenerative medicine is given by the use of platelet concentrates that may differ according to the quality of the platelet concentration, the method of administration and in function of the desired clinical application. Platelet Rich Plasma (PRP) is the best known and the most used blood component that contains high levels of platelets. Its ability to stimulate tissue regeneration is due to the high concentration of various growth factors which induce tissue repair through neoangiogenesis, stimulating collagen deposition and recalling blood stem cells, thus contributing to the increase of cell proliferation and differentiation in the damaged area.

In veterinary clinical practice, this therapeutic strategy is used in many orthopaedic pathologies and for different species. However, for some pathologies with an higher level of damage is necessary to proceed with an integrated approach, mediated by the association between PRP and nanoparticles to provide also a structural support that assists tissue regeneration.

This study describes the clinical case of a Rottweiler of 13 months with a spiral fracture of the tibia (Figure 1).

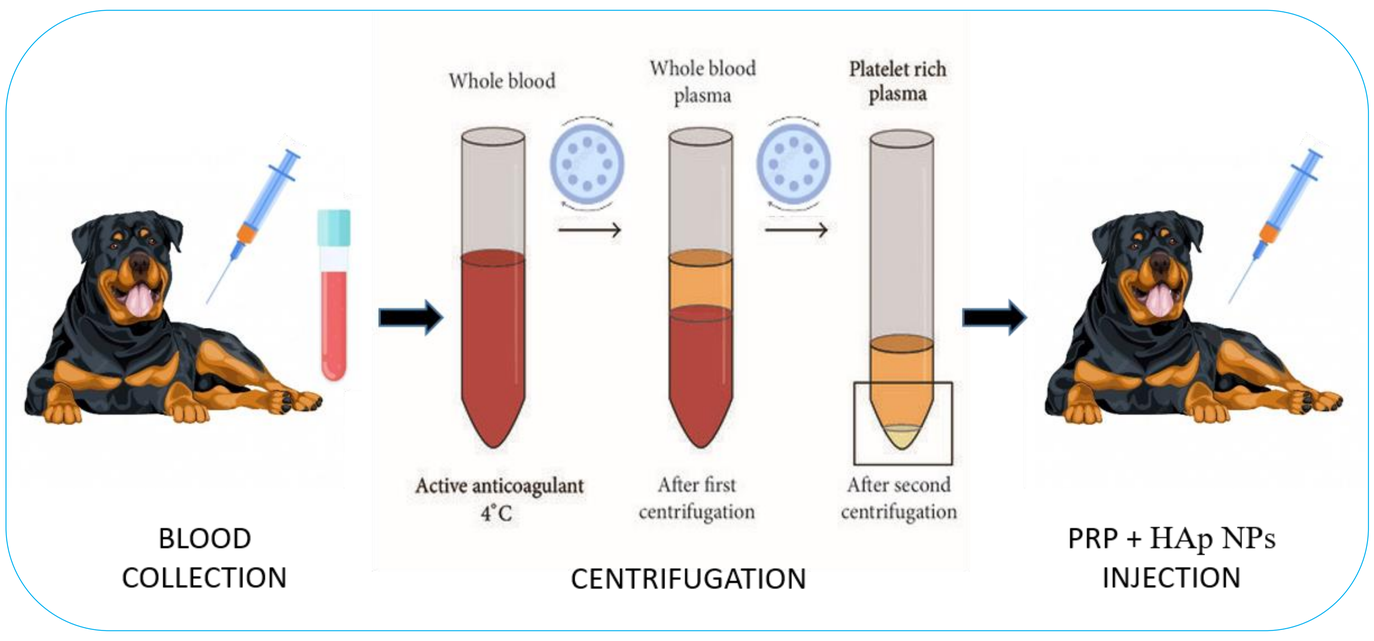

Figure 1. Blood collection, PRP + HAp NPs therapeutic preparation and inoculation

Conclusions

This clinical case well represents the potentiality of this combined treatment to better handle and recover a severe osteogenic lesion, thus demonstrating the integrative role of hydroxyapatite nanoparticles in the bone reconstruction.

In conclusion, the combined use of blood products together with the nanoparticles represents the best strategy to enhance and integrate the current applications of regenerative medicine, to further increase the therapeutic potential of this field of study and to cure an ever higher number of pathologies.

Results and Discussion

Many studies have recently increased in the field of innovative nanotechnologies, the interesting role of biomaterials, highlighing their versatility and potential exploitable physical properties, in association with the regenerative ability of blood hemocomponents, in areas such as regenerative therapy, tissue engineering, engineering and functionalization of new scaffolds.

For this reason, the combination between the physical properties of biomaterials and the regenerative ability of blood hemocomponents, become very important in regenerative therapy.

In our case of study, we show that after four weeks from the traditional surgical approach for the implantation of a medial plate, the lesion got worse, due to the loss of bone substance (Figure 2B). Conversely, after one treatment of the injury using the combination of PRP and hydroxyapatite nanoparticles (HAp NPs), it was possible already from 10 days post treatment to observe the formation of the bone callus and a good functional response of the animal (Figure 2C).

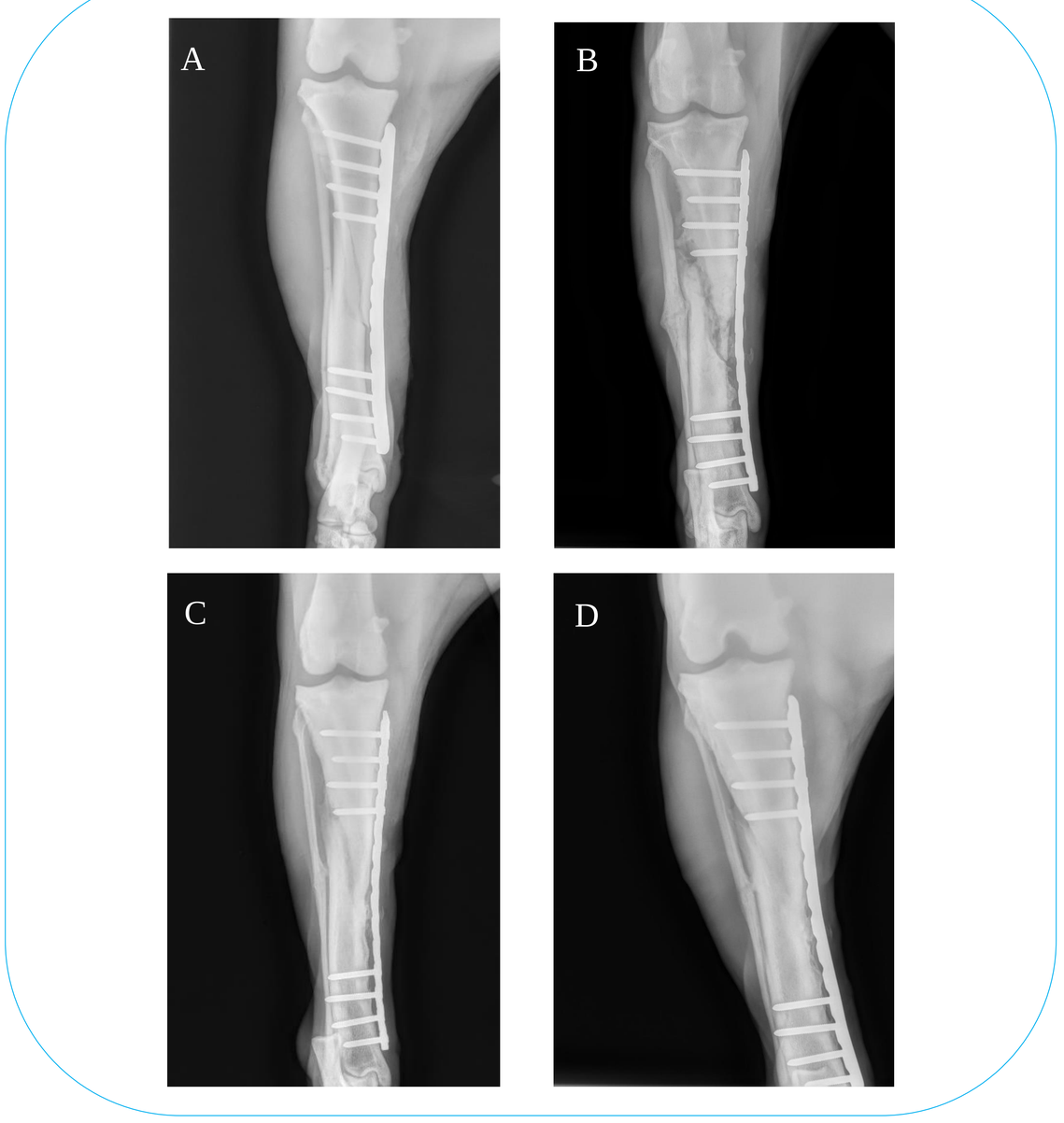

Figure 2. X-rays of tibia A) post-surgery B) 4 weeks after surgery C) 10 days after treatment with PRP and HAp NPs D) recovery