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"Innovation and translation of biological and biomaterial treatment for challenging musculoskeletal disorders"

Animal models are essential in preclinical research that shall be validated to simulate clinical scenarios as close as possible. With the same or similar pathophysiology, animal models can provide an excellent platform for testing diagnostic tools both non-invasively and more powerful using invasive assessment methodologies to study the underlying mechanisms at molecular, cellular and tissue levels. In this issue, Luo JC et al. provided a review on Animal model for tendinopathy where they summarized that the existing tendinopathy models could be classified into six types according to the pathogenesis they simulate: extracellular matrix synthesis-decomposition imbalance, inflammation, oxidative stress, metabolic disorder, overload, and traumatic injury [1]. Stem cells are used for treating many musculoskeletal disorders and in this issue, Shen WL et al. systemically introduced tested stem cell-based therapeutic strategies for rotator cuff tendinopathy and also proposed novel prospective approaches that can overcome cell population heterogeneity and standardize patient types for stem cell applications [2].

Osteoporosis is a challenging skeletal disorder and ovariectomy (OVX) animal models are well established to study pharmacological agents in prevention of OVX-induced bone loss. A new protein S-palmitoylation was reported to be able to inhibit osteoclastogenesis and ameliorate OVX-induced bone loss in mice, reported by ZT Wang et al. [3]. Fracture occurred, often with bone defects and Wu HR et al. discovered multipotent progenitor cells from human induced membrane that showed equivalent osteogenic potential compared to periosteum-derived stem cells in bone regeneration [4]. Heterotopic ossification is often seen in trauma patients and sustained notch signaling inhibition with a gamma-secretase inhibitor was found effective to prevent such heterotopic ossification [5]. Orthopaedic implants are developed to fix the bone fracture and new materials are desirable for achieving better clinical outcome. Zhang QD et al. developed mechanical assessment methods to for testing a novel magnesium–titanium hybrid cannulated screws for treatment of challenging vertical femoral neck fractures [6], while Meng M et al. introduced 3D printing metal implants in orthopedic surgery, from Methods, applications to future prospects that served good reference for orthopaedic surgeons for clinical applications [7]. Unilateral tibial cortex transverse transport technique was tested for treating bilateral diabetic foot ulcers where both efficacy and safety were evaluated using a propensity score matching approach reported by Qin WC et al. [8]. Chronic pain after spine surgery is common yet its pathogenesis remained for further research. Wu QC et al. reviewed relevant work in the literature and updated pathogenesis, new treatment, and preventive therapy for this relevant clinical problem [9].

How to prevent intervertebral disc degeneration is a clinically relevant direction. X Tian et al. developed a Kartogenin-enhanced dynamic hydrogel that showed to be able to ameliorate intervertebral disc degeneration via restoration of local redox homeostasis [10]. Cartilage damage is another musculoskeletal problem where chondrogenesis is the focus of cartilage repair. Sun YC et al. reported that dedifferentiated fat cells (DFATs) derived from infrapatellar fat pad hold advantage on chondrogenesis and adipogenesis to evade age mediated influence [11]. Finally, age-associated osteoporosis is accompanied by sarcopenia and how to quantify muscle mass clinical is of great interests. Engelke K is an international leading researcher in developing magnetic resonance imaging (MRI) techniques for quantitative analysis of skeletal muscle and he and his co-workers reported state of the art in using MRI for clinical applications [12].

Scientific research is a foundation in translation medicine. For bring preclinical research findings into clinical applications, especially for developing medical devices or implants and pharmaceutical agents, we have to pay attention to regulatory requirements for testing at the time designing experimental research with evaluation methods that are already available in relevant regulatory body of countries, such as FDA, CE, and NMPA (previously known as China FCA) for safety and efficacy assessments.

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