Insight Medical Publishing

JOURNAL OF SURGERY AND EMERGENCY MEDICINE

Mechanical stimulation of PIEZO1 induces Runx-2 gene expression through the Akt/GSK-3β/β-catenin pathway in MC3T3-E1 cells

Jidong Song and **Xiaoqian Dang**

Xi'an Jiaotong University, China

Abstract

Mechanically-induced biological responses in bone cells involve a complex biophysical process. Although various mechanosensors have been identified, the precise mechanotransduction pathway remains poorly understood. PIEZO1 functions as a new mechanically activated ion channel in bone cells. This study aimed to explore the involvement of PIEZO1 in mechanical loading (fluid shear stress)-induced signaling cascades that control osteogenesis. We applied a physiological range of fluid shear stress to the osteoblasts using a horizontal shaking apparatus. The results showed that fluid shear stress increased PIEZO1 expression in MC3T3-E1 cells. The fluid shear stress promoted osteoblastic proliferation and elicited the key osteoblastic gene Runx-2 overexpression; however, PIEZO1 silencing using small interference RNA blocked these effects. The AKT/GSK-3β/β-catenin pathway was activated in this process. PIEZO1 silencing impaired mechanically-induced activation of the AKT/GSK-3β/β-catenin pathway. Therefore, the results demonstrated that MC3T3-E1 osteoblasts required PIEZO1 to adapt to the external mechanical fluid shear stress, thereby inducing osteoblastic Runx-2 gene overexpression, partly through the AKT/GSK-3β/β-catenin pathway.

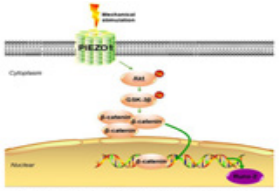

Fig.1 Schematic representation of the proposed crosstalk between PIEZO1 and Akt/GSK-3β/β-catenin pathway in MC3T3-E1 cells under mechanical stimulation The PIEZO1 acts as a mechanosensor that responds to mechanical stimulus applied onto the cell. As a result, PIEZO1 activates the Akt/GSK-3β/β-catenin pathway following the phosphorylation of Akt and phosphorylation of GSK-3β. Then the β-catenin translocates to the nuclear to modulate Runx-2 gene expression, an essential osteoblastic gene that influences osteoblast differentiation.

Biography

Jidong Song, MD, the department of orthopaedics in the second affiliated hospital of Xi'an Jiaotong University. The department made an in- depth study in the pathogenesis of femoral head necrosis and creatively carried out the reconstruction of the joint function of Kashin-Beck disease. In China, we first performed the anastomotic vascular fibular grafting for the treatment of femoral head necrosis and femoral neck fracture. We are interested in the pathogenesis of femoral head necrosis and metabolic bone disease.

13th International Conference on Osteoporosis, Arthritis and Musculoskeletal Disorders | Dubai, UAE | April 23-24, 2021

Citation: Jidong Song, *Mechanical stimulation of PIEZO1 induces Runx-2 gene expression through the Akt/GSK-3β/β-catenin pathway in MC3T3-E1 cells*, Osteoporosis 2021, 13th International Conference on Osteoporosis, Arthritis and Musculoskeletal Disorders, Dubai, UAE, 23-04-2021