Heterogeneity in mechanosensitivity to external mechanical loads of osteosarcoma cells with different aggressiveness

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Osteosarcoma is the most common primary bone cancer and most frequent cause of cancer-related deaths in children and adolescents. Little is known about the pathogenesis of osteosarcoma and still less of the interactions occurring between microenvironment and tumor cells and governing tumor growth and progression. In this context, the role exerted by the "mechano-environment" in modulating cancer cell behavior has arousing growing interest in recent years. In this study, we evaluated the basal mechanosensitivity of two osteosarcoma cell lines with different aggressiveness by applying two different types of mechanical load, and assessing cancer cells features as proliferation and migration, as well as cellular and nuclear morphology. When subjected to 0.18 Pa Fluid Shear Stress (FSS), the low-aggressive SaOS-2 cells responded by increasing the cellular and the nuclear morphology, with no changes in the cell proliferation and migration. On the contrary, the high-aggressive 143B cells showed decreased proliferation and migration capability upon FSS treatment, as well as a reduction in both cellular and nuclear size. When subjected to vertical vibrations (VV), achieved by applying sinusoidal wave at 30 Hz/0.3 g, the low-aggressive SaOS-2 cells showed an increase in cell migration capability and a slight reduction in cellular and nuclear morphology. On the other side, high-aggressive 143B cells responded to VV by increasing proliferation and cellular morphology, decreased migration and no changes in the nuclear size. Taken together, these findings highlighted the different mechanosensitivity of osteosarcoma cells, pointing out the tight connection between the mechanobiology of cancer cells and their pathogenic behavior, thereby opening to new therapeutic targets. Moreover, deepening the response of different osteosarcoma cells to specific mechanical stimuli resembling the daily physical activities may provide patent-tailored pharmacological management in personalized-medicine approaches.