High LET radiation can enhance TGFβ induced EMT and cross-talk with ATM pathways

Minli Wang¹, Megumi Hada¹, Janice Huff¹, Janice M. Pluth², Janiffer Anderson³, Peter O'Neill³ and Francis A. Cucinotta⁴

¹USRA Division of Life Sciences, Houston TX USA; ²Lawrence Berkeley National Laboratory, Berkeley CA USA, ³Oxford St. Johns, Oxford UK, ⁴NASA, Lyndon B. Johnson Space Center, Houston TX, USA

The TGF β pathway has been shown to regulate or directly interact with the ATM pathway in the response to radiation in mammary epithelial cells. We investigated possible interactions between the TGF^β and ATM pathways following simulated space radiation using hTERT immortalized human esophageal epithelial cells (EPC-hTERT), mink lung epithelial cells (Mv1lu), and several human fibroblast cell lines. TGF^β is a key modulator of the Epithelial–Mesenchymal Transition (EMT), important in cancer progression and metastasis. The implication of EMT by radiation also has several lines of developing evidence, however is poorly understood. The identification of TGF_β induced EMT can be shown in changes to morphology, related gene over expression or down regulation, which can be detected by RT-PCR, and immunostaining and western blotting. In this study, we have observed morphologic and molecular alternations consistent with EMT after Mv1lu cells were treated with TGFB. High LET radiation enhanced TGFB mediated EMT with a dose as low as 0.1Gy. In order to consider the TGF^β interaction with ATM we used a potent ATM inhibitor Ku55933 and investigated gene expression changes and Smad signaling kinetics. Ku559933 was observed to reverse TGF β induced EMT, while this was not observed in dual treated cells (radiation+TGFB). In EPC-hTERT cells, TGFB alone was not able to induce EMT after 3 days of application. A combined treatment with high LET, however, significantly caused the alteration of EMT markers. To study the function of p53 in the process of EMT, we knocked down P53 through RNA interference. Morphology changes associated with EMT were observed in epithelial cells with silenced p53. Our study indicates: high LET radiation can enhance TGF^β induced EMT; while ATM is triggering the process of TGF^β-induced EMT, p53 might be an essential repressor for EMT phenotypes.