

Shear Wave Elasticity Imaging to Investigate the Role of Interferon Gamma on the Treatment of Murine Pancreatic Ductal Adenocarcinoma

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Background, Motivation and Objective

Pancreatic cancer is a lethal disease that can be targeted with radiotherapy. Studies on the effectiveness of radiotherapy on cancer treatment suggest dependency on the immune system. Interferon-gamma (IFN-G) is a key cytokine responsible for regulating immigration of T-cells to tumor tissue. We hypothesize that depletion of IFN-G will not modify biomechanics. To test this hypothesis, we used shear wave elasticity imaging (SWEI) to investigate how depletion of IFN-G combined with radiotherapy impacts tumor stiffness.

Methods

Orthotropic KCKO pancreatic tumors were implanted in 27 IFN-G knockout mice, which were divided into two groups: 15 mice in the control group and 12 mice treated with (5Gy) stereotactic body radiation over 5 days. Another two groups of orthotropic KCKO pancreatic tumors were implanted in 36 wild-type mice: 19 mice in the control group and 17 treated with the same treatment regime. The tumors were removed and implanted in a gelatin matrix consisting of 10% gelatin, 1% cornstarch, and 89 % water. SWEI was performed using a Vantage 256 scanner (Verasonics, Inc., Kirkland, WA, USA) with a 5 MHz L7-4 transducer in order to obtain shear modulus. We also performed quantitative histological analysis to assess how collagen density varied between the two groups during treatment.

Results and Discussion

Figure 1 shows the mean Young's modulus of the control and the treated groups for the IFN-G knockout and wild-type mice. Figure 2 shows the elastogram of a control tumor. The average Young's moduli measured were $62.30 \pm 17.68\text{kPa}$ and $48.28 \pm 12.77\text{kPa}$ for the control and treated IFN-G knockout groups respectively. The stiffness results show there is a statistical difference between the control and treated IFN-G knockout groups. The Young's moduli of the treated IFN-G knockout and wild-type groups have no statistical difference. The stiffness results show that IFN-G does not impact the stiffness of pancreatic cancer.

Figure 1: Boxplot for Young's modulus

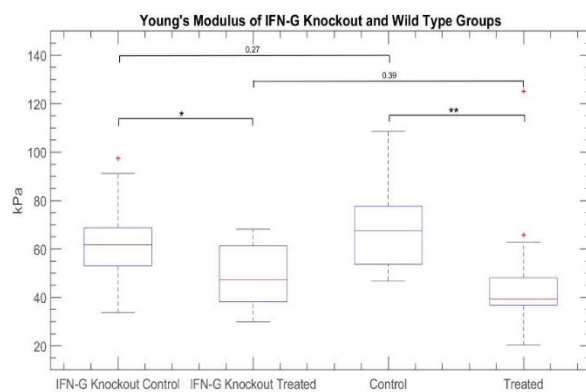


Figure 2: Elastogram of Control Tumor

