Medical Xpress

Adapting space-industry technology to treat breast cancer

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Researchers at Rush University Medical Center and Argonne National Laboratory are collaborating on a study to determine if an imaging technique used by NASA to inspect the space shuttle can be used to predict tissue damage often experienced by breast cancer patients undergoing radiation therapy. The study is examining the utility of three-dimensional thermal tomography in radiation oncology.

Preliminary results from the study are being displayed during the American Society for Radiation Oncology (ASTRO) Annual Meeting in Chicago, being held from November 1 - 5, 2009.

Approximately 80 percent of breast cancer patients undergoing radiation treatment develop acute skin reactions that range in severity. The more severe reactions cause discomfort and distress to the patient, and sometimes result in treatment interruptions. The severity is quite variable among patients and difficult to predict.

"Because reactions usually occur from 10 to 14 days after the beginning of therapy, if we could predict skin reactions sooner we may be able to offer preventative treatment to maximize effectiveness and minimize interruption of radiation treatment," said Dr. Katherine Griem, professor of radiation oncology at Rush.

Researchers at Rush and Argonne are studying if three-dimensional thermal tomography (3DTT) can detect the earliest changes that may trigger a skin reaction. 3DTT is a relatively new thermal imaging process that is currently being used as a noninvasive away to detect defects in composite materials. The basic idea of thermal imaging is to apply heat or cold to a material and observing the resulting temperature change with an infrared camera to learn about its composition.

Unlike most thermal imaging studies which have quantitative limitations, 3DTT measures the thermal effusivity of skin tissue. Thermal effusivity is a measure of a material's ability to exchange heat with its surroundings.

In this study, a flash of light is used to heat up the skin. An infrared camera captures a series of images over time that display the temperature of the skin, represented by colors. An algorithm developed by Argonne is used to calculate the temperature change and determine the thermal effusivity of different areas of the skin.

"How quickly the skin cools is related to the structure underneath. Damaged skin cells have different effusivity values compared to that of healthy skin, said James Chu, PhD, chairperson of the section of medical physics at Rush. "By identifying the earliest changes in damaged tissue, we may be able to predict acute skin toxicities."

Preliminary data from the study show that marked decreases in thermal effusivity of irradiated skin occur well in advance of the development of high grade skin reactions.

"Our initial data with radiation induced skin changes are quite encouraging," said Dr. Alan Coon, chief resident of radiation oncology at Rush and primary author on the study. "In addition to finding decreases in effusivity of the treated areas many days before the development of skin reactions, we have also seen that the magnitude of these decreases varies with the grade of the reactions. This exciting result bodes well for the clinical utility of this technique in predicting the severity of a skin reaction before it occurs."

In addition, researchers note that 3DTT techniques can be used to measure these tissue property changes noninvasively with no interruption of therapy and the technique allowed for rapid feedback.

"3DTT may also be used to detect other skin diseases such as skin cancer and measure skin damage caused by electricity or lightening. Such applications require the determinations of tissue conditions below the skin that is normally not visible but can be measured by 3DTT," said J.G. Sun, a mechanical engineer at Argonne.

Researchers plan to perform additional studies to confirm the preliminary results and hope to soon begin studying 3DTT in breast cancer patients.

Source: Rush University Medical Center (news : web)

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