Radiation-induced mesothelioma among solid cancer survivors: an analysis of the seer cohort

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Purpose or Objective: To investigate the association between external beam radiotherapy (EBRT) and pleural and peritoneal mesothelioma among long-term (>5 years) solid cancer survivors.

Material and Methods: We analysed data from the US Surveillance, Epidemiology, and End Results (SEER) program (1973-2012). We fitted survival models adjusted by age, gender, race, year, surgery, and relative risk of primary mesothelioma in the county of residence (proxy for individual asbestos exposure). We estimated hazard ratios [HR] with reference to non-irradiated patients. We distinguished between scattered and direct irradiation to study the dose-response.

Results: We observed 300 mesotheliomas (264 pleural; 32 peritoneal; 4 others) among 913,873 patients. EBRT increased the risk of mesothelioma (any site; HR 1.36, 95%CI 1.05–1.76). We observed an increased risk of pleural mesothelioma (HR for EBRT 1.35, 95%CI 1.02–1.78), but we did not find signs of a dose-response relationship (HR for scattered irradiation 1.35; HR for direct irradiation 1.36). On the opposite, only direct peritoneal irradiation was associated with peritoneal mesothelioma (HR 2.13, 95%CI 0.96–4.74), particularly for latencies ≥10 years (HR 3.19, 95%CI 1.11–9.18). A competing risks analysis revealed that the clinical impact of radiation-induced mesothelioma was limited by the high frequency of competing events. The cumulative incidence function of mesothelioma after 40 years of observation was very low (non-irradiated patients: 0.00031, irradiated patients: 0.00056).

Conclusion: EBRT is a determinant of mesothelioma. Longer latency periods are associated with higher risks, while the dose-response seems non-linear. The clinical impact of mesothelioma after EBRT for primary solid cancers is very limited.

Poster: Physics track: Basic dosimetry and phantom and detector development

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Direct dose measurements in contrast enhanced radiotherapy with iodine and gadolinium
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Purpose or Objective: Contrast enhanced radiotherapy (CERT) has already been shown to be a promising antitumor modality capable to overcome some limitation inherent to conventional beam radiotherapy. Depth dose distribution in CERT is characterized by local dose increase in a volume, which incorporates certain amount of a high atomic number element. Photobabsorption of external X-ray radiation by high atomic number elements (such as iodine, gadolinium, gold etc.) leads to absorbed dose enhancement exactly in the region of the element location. Dose increase is caused by emission of short range secondary radiation such as characteristic X-rays, photoelectrons and Auger electrons. Dose enhancement in CERT for particular high atomic number element is strongly dependent on energy spectrum of external radiation. Calculations of many researchers show that significant part of absorbed dose is caused by Auger-electrons especially in the close vicinity (about 1 um) of emitting atom. Because of their extremely short range in water Auger-electrons are not detectable by most dosimetric tools such as ionizing chambers, radiochromic films etc. However ferrosulfate based dosimeters (Fricke dosimeters) can be used to measure total absorbed dose caused by photobabsorption of external X-ray radiation by high atomic number elements.

Material and Methods: Direct dose enhancement was measured for iodine in the chemical form of iopromide (Ultravist 370, Bayer) and gadolinium in the from of gadolinium sulfate (Sigma-Aldrich). Fricke dosimeter solution was prepared by standard procedure described elsewhere.