Radiotherapy outcome could be influenced by antioxidant capacity in breast cancer cell lines
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Introduction. The cancer cell radioresistance remains a fundamental barrier to attaining the maximal efficacy of radiotherapy for the treatment of breast cancer. Ionizing radiation (IR) enhances free radicals generation altering the redox status. The antioxidant effect carried out by glutathione peroxidase (GPX) enzyme and glutathione (GSH) plays an important role reducing the harmful action of the IR-induced reactive oxygen species (ROS).

Hypothesis. The downregulation of GPX and GSH through chemical inhibition using buthionine sulfoximine (BSO) could modify the radiation response in different cell lines

Materials and methods. We used two cell lines of breast cancer (MDA-MB-231 and MCF-7) with different radiosensibility and GSH/GSSG ratio (total GSH). MDA-MB-231 cell line was more radioresistant and showed higher levels of total GSH than MCF-7 after IR. Pretreated cells with 100 mM of BSO were irradiated at 2 Gy. They were stopped at different times: short times (0–210 min) and long times (24–72 h). We determined: (1) native antioxidant levels (reduced glutathione “GSH” and oxidized “GSSG”) and (2) enzyme antioxidant activity (glutathione peroxidase “GPX”). The experiments were performed in triplicate for each cell line.

Results. Measurements of GSH and GSSG showed an oscillatory pattern in both cell lines for short times (15–210 min). Taking into account long times (24–72 h), GSH maximum values were obtained at 48 h in MCF-7 and at 72 h for MDA-MB-231 (P = 0.0031 and P = 0.0020, respectively). Concerning GSSG levels no differences were found in these cell lines. MDA-MB-231 showed an upward trend for long times (24–72 h) in GSH/GSH + GSSG ratio, reaching the maximum value after 72 h (P < 0.0001). Although GSH/GSH + GSSG ratio did not reflect any differences in MCF-7, it was higher than in MDA-MB-231 cell line. Interestingly, this pattern was inverted when the cell lines were treated without BSO. Our results showed two maximum values (15 min and 72 h, P < 0.0001) for GPX activity levels in MDA-MB-231. We also found maximum values (90 and 150 min and 72 h; P < 0.0001) for GPX activity levels in MCF-7.

Conclusions. The antioxidant capacity could influences the radiation treatment in the breast cancer cell lines used in this work.

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RapidArcTM for complex cases of breast irradiation including nodal region
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Objective. IMRT use for breast cancer remains controversial. In complex situations, 3DCRT does not allow coverage of PTV with sparing of healthy tissues. We present the dosimetric results of first patients treated at our institution using volumetric modulated arctherapy (VMAT).

Materials and methods. Nine patients with complex anatomy, were selected for treatment with RapidArc. Two partial arcs (240◦) delivered 6 MV photons. The prescribed dose to breast and lymph nodes was 52.2 Gy with an integrated boost to the tumor bed at 63.2 Gy in 29 fractions. PTV was created by extension of 7 mm from CTV with the exclusion of the first 5 mm under the skin. Dosimetric results concerning the PTV coverage and normal tissues sparing were collected.

Results. 95% of the breast PTV received 91.7% of the prescribed dose [80.6–98.2]. 95% of the supraclavicular PTV received 88.5% of the prescribed dose [72–98]. 95% of the MIC PTV received 90% of the prescribed dose [75–100]. The ipsilateral lung V5, V20 and V30 were 90% [75–100], 23.6% [13.7–35] and 9.7% [4.7–14], respectively. The average dose was 15 Gy [11–19]. The contralateral lung V5 and V10 were 38.9% [16.6–68.5] and 5.4% [0–15], respectively. The average dose was 5 Gy [3.4–7.2]. The heart V5 and V35 were 78.1% [49–100] and 0.8% [0–5]. The average dose was 14 Gy [9–19]. The contralateral breast V5 and V10 were 23.6% [0.8–64.9] and 4.4% [0–20]. The average dose was 4.1 Gy [2.1–7.3]. The average delivered monitor unit was 568 UM [448–772].

Conclusion. RapidArc treatment yielded satisfactory PTV coverage while sparing healthy tissues where conventional radiotherapy would not have been acceptable.

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