The Rationale for Fractionation in Radiotherapy

Gary Mitchell, RN, MSc, BSc, BA

The use of radiotherapy as a cancer treatment is common, so an appreciation of the biologic effects of radiation at a cellular level is essential to help nurses prepare their patients for the challenging journey ahead using appropriate lay language. The four Rs of radiotherapy (repair, redistribution, reoxygenation, and repopulation) are well established with regard to the principles of radiotherapy; however, these concepts appear undeveloped in nursing literature. The current article aims to succinctly explain how radiation impacts cancer and provides rationale as to why radiation treatment is delivered during a number of sessions. Through receipt of this knowledge, oncology nurses will be better equipped to communicate more efficiently and effectively with their patients.

RADIATION’S EFFECT ON CELL REPLICATION

Radiation’s Effect on Cell Replication

The biologic basis of fractionation in radiation therapy takes advantage of what are known as the “four Rs” of radiobiology: repair, redistribution, reoxygenation, and repopulation.

Repair

Cells have complex mechanisms responsible for repairing radiation-induced damage. One of the clearest demonstrations of the cell’s ability to repair radiation damage is the phenomenon called sublethal damage repair (Heideker, Lis, & Römesberg, 2007). Following radiation exposure, cells can repair any sublethal or indirect damage. As explained earlier, direct DNA damage can be rare; the more exposures to small doses of radiation, the more likely direct DNA damage will accumulate. Sufficiently high doses of radiation will allow normal cells to repair, thereby reducing toxicity. According to Corner and Bailey (2008),