



Application of Hydrogen Producing Microorganisms in Radiotherapy: An Idea

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Dear Editor-in-Chief

Radiotherapy (RT) is the most widely used cancer treatment modality that plays a pivotal role in the management of wide variety of cancers and malignancies. About 50% of all cancer patients receive radiation treatment during the course of their disease (1). Although by advances in medical technologies the final goal of RT, deliver the highest radiation dose to the tumor volume and sparing surrounding normal tissues, is partially met, but is not enough and normal tissues or organs at risk (OARs) are damaged. Irradiation of OARs particularly in children may causes a wide spectrum of diseases that the secondary cancers are on the front line (2). New radiation related cancer treatment modalities such as intensity modulated radiation therapy (IMRT) potentially elevate secondary exposures to healthy tissues distant from the target volume and therefore more contribute to secondary cancer induction (3).

Radiation induced normal tissue complication is a complex process that highly dependent on radiation quality and dose, fractionation scheme, dose rate, total dose, irradiated volume and radiosensitivity, so normal tissue protection can be achieved by different approaches. Of the physical, chemical and biological radiation protection methods, chemical methods that use radioprotectors are more well-known (4). The mechanisms that implicated by radioprotectors are free-radical scavenging that

protects against -based free-radical generation by ionizing radiations and hydrogen-atom donation to facilitate direct chemical repair at sites of DNA damage. Several radioprotectors have been evaluated in clinical trials, human and animal models but the results advice against the use of these substances because of their toxicity.

Hydrogen as radioprotector

During recent years, clinical studies have reported that hydrogen is an important physiological regulatory factor with antioxidant, anti-inflammatory and anti-apoptotic protective effects on cells and organs. The antioxidant property of hydrogen in free radicals scavenging and increasing antioxidant enzyme activities such as catalase, heme ase-1, superoxide dismutase has caused to researchers remember hydrogen as a radioprotective agent with efficacy and non-toxicity (5).

Finding best therapies to reduce normal tissue damages and also enhancing tumour cells killing in RT remain the main goal of cancer treatment. The most important parts of these therapies are cost effectiveness and having minimal side effects. In this paper we suggested and hypothesized that some hydrogen producing microorganisms can be used as radioprotectors and in radiotherapy.

The production of hydrogen by many natural microorganisms and also via microbial biotechnol-

ogy is an open field of research. Due to its excessive applications for fuel cells as a non-polluting and renewable energy source, hydrogen continues to be very attractive. The hydrogen produced by microorganisms, biohydrogen, can be produced by photosynthetic or fermentative processes that the latter because of higher hydrogen-production rates is more efficient (6). In recent years many attempts have been made for producing high yields of biohydrogen. New genetic manipulations of microorganisms such as expression of hydrogen producing genes, knockout of competitive pathways, creation of a new productive pathway, and creation of dual systems to enhance the production of biohydrogen has been an active area of research among many scientists. There are many different microorganisms that can produce hydrogen including bacteria, algae and also from waste (7).

According to well documented roles of hydrogen as radioprotector we suggest to use hydrogen producing microorganisms in radiotherapy. In regard to this idea, biohydrogen can be used as a cost effective and efficient radioprotector that can be produced from many cheap microorganisms.

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