Prevention of ischemia-reperfusion injury in mice kidneys by low-dose whole body irradiation preconditioning

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TO THE EDITOR: The article recently published by Kim and coworkers (3) is very interesting and presents a new modality for the prevention of ischemia-reperfusion (I/R) injury in the mouse kidney. The authors have reported that whole body irradiation preconditioning (IP) of the animals with an acute single dose at 8 Gray (Gy) protects the kidney more efficiently compared with fractionate doses against subsequent I/R injury by maintaining the normal morphology and functions of the kidney. They have further attributed the protective effect of an acute dose of IP on I/R-induced kidney injury to the activation of manganese superoxide dismutase (MnSOD) and heat shock protein-27 expression pathways. Interestingly, in this study, the markedly increased activity of renal MnSOD (~50%) remained sustained for 6 days postirradiation. With whole body exposure of Balb/c mice to γ-rays at a dose range between 0.1 and 0.5 Gy, we have reported a 35–37% increase in renal SOD activity at 12 h postirradiation, which returned to normal levels at 24 h at all the doses studied (4). By extrapolation of our data, it implies that even the exposure of animals to low doses (10–15 cGy) can have almost the same degree of protective effect if I/R is induced between 8 and 15 h postirradiation. In brief, unnecessary exposure of animals to acute high doses can be avoided if similar results can be achieved at lower doses. Recently, multiple exposures to low-dose whole body irradiation (LD-WBI) of C57BL/6J mice have been reported to significantly suppress the diabetes-induced systemic and renal inflammatory response and renal oxidative damage, resulting in prevention of renal dysfunction and fibrosis (7). Had Kim and colleagues (3) simultaneously studied the impact of pre- and post-LD-WBI on the prevention of I/R-induced renal injury in these animals, it would have certainly added additional significant information at a molecular level to our existing knowledge. In this study, the authors have used high acute radiation doses (ranging from 4 to 8 Gy) for deriving the beneficial effects from I/R-induced renal injury. In this context, we would like to state that according to the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) report in 1986, acute radiation doses above 2.0 Gy, between 0.2 and 2.0 Gy, and below 0.2 Gy are regarded as high, intermediate, and low, respectively (6). Generally, damaging or lethal effects are observed following high radiation doses, while cellular stimulatory effects are observed following low-dose, short-term exposures in the range of 0.01–0.5 Gy (1). Since the LD 50/30 (radiation dose at which 50% of the animals die within 30 days of exposure) in the cases of different strains of mice has been reported to range between 6.5 and 9.5 Gy (2, 5), the application of high doses (between 6 and 8 Gy) for preventive/therapeutic purposes of I/R-induced organ injury appears to be illogical and unacceptable by the scientific community. With the application of higher radiation doses, acute toxic effects and potentially late long-term effects are expected. Since these authors terminated the studies after 6–8 days postirradiation, therefore, the mortality in these animals could not obviously be recorded. The preventive/therapeutic effect of any modality is acceptable only if the mortality/morbidity is minimal after its application. Therefore, there is a need to evaluate the application of a noninvasive technology like LD-WBI to be as realistic and parallel as is done for other therapeutic modalities. Based on the recent scientific reports, we believe that LD-WBI can play a critical role in prevention or treatment of certain pathological disorders.

DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the authors.

REFERENCES