Several experimental strategies of radiation-induced central nervous system toxicity prevention have recently resulted in encouraging data. The present review summarizes the background for this research and the treatment results. It extends to the perspectives of tissue regeneration strategies, based for example on stem and progenitor cells. Preliminary data suggest a scenario with individually tailored strategies where patients with certain types of comorbidity, resulting in impaired regeneration reserve capacity, might be considered for toxicity prevention, while others might be "salvaged" by delayed interventions that circumvent the problem of normal tissue specificity. Given the complexity of radiation-induced changes, single target interventions might not suffice. Future interventions might vary with patient age, elapsed time from radiotherapy and toxicity type. Potential components include several drugs that interact with neurodegeneration, cell transplantation (into the CNS itself, the blood stream, or both) and creation of reparative signals and a permissive microenvironment, e.g., for cell homing. Without manipulation of the stem cell niche either by cell transfection or addition of appropriate chemokines and growth factors and by providing normal perfusion of the affected region, durable success of such cell-based approaches is hard to imagine.