

OS-2. Alleviation of bone marrow damage due to radiotherapy by inhaling hydrogen gas under hyperbaric pressure in cancer patients

[Background & Objectives]

Radiation therapy is effective, but damages normal surrounding tissues, as well as targeted cancer tissues, resulting in radiation injuries. To alleviate radiation injuries, intensity-modulated radiation therapy (IMRT) has recently been employed with TomoTherapy. However, side effects, such as bone marrow damage, are insufficiently alleviated for multiple or large cancer lesions. In addition, terminally ill cancer patients are temporarily treated in a health care chamber (HCC, i.e., hyperbaric oxygen capsule) to alleviate cancer symptoms. However, such treatment alone is not sufficiently effective. In the present study, we report the alleviating effects of the combination therapy with HCC and hydrogen gas inhalation on bone marrow damage in terminally ill cancer patients after IMRT.

[Materials & Methods]

Twenty-three terminally ill cancer patients who visited Yukokai Clinic C4 to receive IMRT were randomly divided to inhale (16 patients, hydrogen group) or not to inhale (7 patients, control group) hydrogen gas under hyperbaric pressure. The irradiation time in each IMRT was 5-20 minutes, and the number of irradiations per week was 5 times. This schedule was repeated. In addition, after each irradiation, the patients in the control group were treated for 30 minutes in an HCC (1.35 atmosphere and 28% oxygen concentration), while those in the hydrogen group were similarly treated by 5% hydrogen gas inhalation (4 L/min) in a hydrogen gas inhaler (MiZ Co., Ltd.). Bone marrow damage was evaluated by hematological tests with peripheral blood samples collected before and immediately after irradiation to determine the ratio of

post-irradiation to pre-irradiation.

[Results]

The average number of irradiations was not significantly different between the control and hydrogen groups. In addition, the sum obtained by multiplying the dose by the volume of irradiated region for each tumor was regarded as the total volume of irradiation of the patient. Similarly, the average total volume of irradiation was not significantly different between the control and hydrogen groups. Irradiation had no effect on red blood cell counts and hemoglobin and hematocrit values, but markedly decreased white blood cell and platelet counts in the control group. However, the decreases were significantly improved in the hydrogen group ($p < 0.01$ and < 0.05 , respectively). The total volume of irradiation was negatively correlated with the white blood cell counts in the control group ($r = -0.863$). However, there was no correlation in the hydrogen group.

[Discussion]

The combination therapy with HCC and hydrogen gas inhalation effectively alleviated bone marrow damage in the terminally ill cancer patients after IMRT, suggesting that hydrogen gas inhalation under hyperbaric pressure may provide an effective strategy. The mechanism of action of hydrogen inhalation under hyperbaric pressure is under investigation. Some of the results will be introduced in the future.