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ORIGINAL ARTICLE

Anti-inflammatory effects of hyperbaric oxygen on irradiated laryngeal tissues☆

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KEYWORDS
Hyperbaric oxygen;
Neck radiotherapy;
Inflammation

Abstract
Introduction: To manage the complications of irradiation of head and neck tissue is a challenging issue for the otolaryngologist. Definitive treatment of these complications is still controversial. Recently, hyperbaric oxygen therapy is promising option for these complications.
Objective: In this study, we used biochemical and histopathological methods to investigate the efficacy of hyperbaric oxygen against the inflammatory effects of radiotherapy in blood and laryngeal tissues when radiotherapy and hyperbaric oxygen are administered on the same day.
Methods: Thirty-two Wistar Albino rats were divided into four groups. The control group was given no treatment, the hyperbaric oxygen group was given only hyperbaric oxygen therapy, the radiotherapy group was given only radiotherapy, and the radiotherapy plus hyperbaric oxygen group was given both treatments on the same day.
Results: Histopathological and biochemical evaluations of specimens were performed. Serum tumor necrosis factor-α, interleukin-1β, and tissue inflammation levels were significantly higher in the radiotherapy group than in the radiotherapy plus hyperbaric oxygen group, whereas interleukin-10 was higher in the radiotherapy plus hyperbaric oxygen group.

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Conclusion: When radiotherapy and hyperbaric oxygen are administered on the same day, inflammatory cytokines and tissue inflammation can be reduced in an early period of radiation injury.

PALAVRAS-CHAVE
Oxigênio hiperbárico;
Radioterapia de pescoço;
Inflamação

Efeitos anti-inflamatórios do oxigênio hiperbárico sobre tecidos laríngeos irradiados

Resumo
Introdução: O manejo das complicações da irradiação do tecido da cabeça e pescoço é uma questão desafiadora para o otorrinolaringologista. O tratamento definitivo dessas complicações ainda é controverso. Recentemente, a oxigenoterapia hiperbárica tem sido uma opção promissora para estas complicações.
Objetivo: Nesse estudo foram utilizados métodos bioquímicos e histopatológicos para investigar a eficácia do oxigênio hiperbárico contra os efeitos inflamatórios da radioterapia no sangue e nos tecidos laríngeos, quando a radioterapia e oxigênio hiperbárico são administrados no mesmo dia.
Métodos: Trinta e dois ratos Wistar albinos foram divididos em quatro grupos. O grupo controle não recebeu tratamento, o grupo de oxigênio hiperbárico recebeu apenas oxigenoterapia hiperbárica, o grupo de radioterapia recebeu apenas radioterapia e o grupo de radioterapia com oxigênio hiperbárico recebeu ambos os tratamentos no mesmo dia.
Resultados: Foram realizadas avaliações histopatológicas e bioquímicas dos espécimes. Os níveis séricos de fator de necrose tumoral-α, interleucina-1β e inflamação tecidual foram significativamente maiores no grupo de radioterapia do que no grupo de radioterapia mais oxigênio hiperbárico, enquanto que a interleucina-10 foi maior no grupo de radioterapia mais oxigênio hiperbárico.
Conclusão: Quando a radioterapia e o oxigênio hiperbárico são administrados no mesmo dia, as citocinas inflamatórias e a inflamação tecidual podem ser reduzidas no período inicial da radiação.

Introduction

Head and neck cancers are the most frequently occurring cancers worldwide. In epidemiologic studies, they are ranked 10th globally, and their incidence has increased considerably in the past 10 years. The management of head and neck cancer is complex and requires a multidisciplinary approach.[1] Radiotherapy is used as a primary or adjuvant treatment option for the treatment of head and neck cancers. Irradiation of the neck region can be performed in the presence of neck lymph node metastasis from the larynx, or cancers of any other region, or in the various stages of laryngeal cancer.[2] Apart from the therapeutic nature of radiotherapy, it also has definite hazardous effects on the surrounding tissues and these effects can occur at either early or late stages. Dry mouth, mucositis, Soft Tissue Radionecrosis (STRN), Osteoradionecrosis (ORN), and Laryngeal Radionecrosis (LRN) are some of the examples of these side effects.[2,3]

Radiation causes the release of inflammatory mediators, marking the beginning of the inflammatory process, and these result in an increase in oxidizing activity in the damaged tissues.[4] Radiation not only causes damage to tissues through Reactive Oxygen Species (ROS) and ionization, but also through the caspase pathway and cytochrome activation, and as a result, necrosis develops in the damaged tissues from ischemia and apoptosis.[5,6] The cell tries to combat this damaging effect by activating its defense system (anti-inflammatory cytokines, antioxidant activity).[7]

Recently, a number of scientific studies on the management of side effects of radiotherapy have been conducted, and antioxidant herbal medicine, various chemical agents, vitamins, exogenous antioxidant molecules, and Hyperbaric Oxygen (HBO_2) have been used in these studies.[6,8–11] HBO_2 has been widely used for the treatment of various diseases for decades. Treatment of diabetic wounds, flap necrosis, and sudden hearing loss are some of the prominent examples.[12–14]

In this study, we used biochemical and histopathologic methods to investigate the efficacy of hyperbaric oxygen against the early inflammatory effects of radiotherapy on the laryngeal tissue when radiotherapy and HBO_2 are administered on the same day.