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Original Article

Effectiveness of oxygen nebulization at preventing radiotherapy-induced mucositis in patients with nasopharyngeal cancer

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ABSTRACT

Purpose: To evaluate the effectiveness of oxygen nebulization at preventing radiotherapy-induced mucositis in patients with nasopharyngeal cancer.

Methods: Sixty patients with nasopharyngeal cancer treated with simultaneous integrated boost intensity-modulated radiotherapy were randomly assigned to oxygen nebulization or ultrasonic nebulization groups; treatment was once daily for 20 minutes. All patients received routine oral care. We compared saliva pH and volume, food intake, and change in oral mucosa during radiotherapy, and dry mouth and sore throat after radiotherapy between the two groups.

Results: There were significant differences in the incidence of grade III or IV mucositis, saliva volume and pH, and dry mouth and sore throat between the two groups when the total dose was 33 Gy ($p < 0.05$ or $p < 0.01$).

Conclusion: Oxygen nebulization reduces radiotherapy-induced mucositis and relieves symptoms such as dry mouth and sore throat in patients with nasopharyngeal cancer.

1. Introduction

Radiotherapy remains the preferred treatment for nasopharyngeal cancer; the most common adverse reaction is acute oral mucosa reaction to radiotherapy. The reaction is characterized by dry mouth, oropharyngeal pain, oral inflammation, pseudomembrane formation, easily broken mucous membranes, bleeding, ulcer formation, and eating disorder, All of which has a serious influence on radiotherapy, even leading to its suspension. Therefore, preventing and controlling oral mucosa reaction to radiotherapy effectively is

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a clinical problem that should be resolved. Oxygen nebulization is used for patients with chronic obstructive pulmonary disease [1] and infantile acute laryngitis [2], but its effect in the treatment of oral mucosa reaction to radiotherapy is unknown; therefore, we examined the effect of oxygen nebulization therapy in patients with nasopharyngeal cancer during radiotherapy in this study.

2. Design and methods

2.1. Participants

Between December 2011 and December 2012, we enrolled 60 patients with a pathological diagnosis of nasopharyngeal cancer at our department, and assigned them to experimental ($n = 30$) and control ($n = 30$) groups using the random number table method. Inclusion criteria: (1) pathological diagnosis of nasopharyngeal; (2) received radiotherapy for the first time; (3) Karnofsky functional status score $\geq$ 70 points; (4) no oral mucosal inflammation, cavities, dentures, or other oral diseases; (5) no synchronous chemotherapy or radiotherapy sensitization agent use during radiotherapy; (6) adherence to treatment as required. The grouping method was as follows: we obtained 60 random numbers with the random number table, removed the same numbers, and then assigned these random numbers to patients according to time of hospital admission. We ranked the numbers from small to large and placed the first 30 in the experimental group; the remaining numbers were placed in the control group. Table 1 lists the characteristics of the two groups in terms of age, sex, and dose. All patients completed the whole research process.

2.2. Methods

2.2.1. Radiotherapy

All subjects were treated with simultaneous integrated boost intensity-modulated radiotherapy (SIB-IMRT). SIB-IMRT uses 6-MV X-ray, 2.2-Gy gross tumor volume (GTV) dose (visible tumor imaging and neck lymph node metastasis), 2.0-Gy clinical target volume (CTV) 1 dose (high-risk areas), and 1.8-Gy CTV2 dose (low-risk areas) each time for a total 30 times, and GTV dose to test dose of 66 Gy five times per week.

2.2.2. Nursing intervention

Patients in the experimental group received oral care every day to maintain oral health, rinsed their mouths daily before and after radiotherapy and after eating, and received oxygen nebulization after radiotherapy each day. The drugs used were 10 mL saline, 240,000 U gentamicin, 4000 U chymotrypsin, and 5 mg dexamethasone, with an oxygen flow rate of 8 L/min for 20 min per session, until the end of radiotherapy. The control group received the same oral care during radiotherapy as the experimental group. During radiotherapy, control group patients received ultrasonic nebulization at the end of radiotherapy daily, using the same drugs as the experimental group for 20 min per session.

Table 1 – Demographic variables ($\bar{X}$ ± s).

Group	n	Age (y)	Sex		Dose (Gy)
			Male	Female	
Experimental	30	51.43 ± 10.43	21	9	67.61 ± 1.52
Control	30	52.30 ± 10.39	19	11	68.35 ± 2.00
t or χ^2		0.32	0.30		1.60
p		0.75	0.58		0.11

2.2.3. Outcome measures

Before radiotherapy, three primary nurses were trained to evaluate the effects. After radiotherapy was administered at 10 AM every Monday, the nurses in charge performed the following: (1) Oral pH measurement using precise test paper (Xingxia Xiangrui Technology Development, Beijing) and measuring the average of two points: the center of the tongue and on one side of the tongue. (2) Saliva collection using an Azov mong Trading (Shanghai) triangle funnel; patients gargled with water before saliva collection, then chewed two sticks of blueberry-flavored chewing gum for five minutes without swallowing while chewing. After the chewing gum had been spat out, the triangle funnel was affixed to the patient's jaw, and the patient lowered their head, allowing all of the saliva collected in their mouth to flow out; bubbles were filtered out. (3) Observed oral mucosa injury in patients. Based on the World Health Organization classification [3], radioactive oral mucosa injury was graded 0–IV. Grade 0: no mucosal response; grade I: mucosal hyperemia; grade II: mottled mucositis; grade III: 50% flaky mucositis in 50% of the area exposed to radiotherapy, or with obvious pain; grade IV, flaky mucositis accounting for >50% of the exposure area or severe reaction + need to stop treatment or stopping oral nutrition. (4) Evaluated dry mouth and degree of oropharyngeal pain using the visual analog scale ruler [4]. The ruler is numbered 0–10; patients rate their own discomfort: 0: no symptoms, 1–4: mild discomfort, 5–7: medium discomfort, 8–10: severe dry mouth or oropharyngeal pain.

2.2.4. Statistical analysis

We used SAS 9.0 for statistical analysis. We compared the oral mucosa reaction between the two groups with nonparametric tests; oral pH, saliva, and nebulization comfort of the two groups were compared by t-test.

3. Results

3.1. Comparison of oral mucosa reaction

Compared to the control group, significantly fewer patients in the experimental group had grade III–IV mucosal reaction after receiving up to 33 Gy radiotherapy, at the end of radiotherapy, and the following one week ($p < 0.05$, Table 2). As no patient in either group developed grade 0 or IV reaction, we merged grade 0 and I, and grade III and IV reactions to reduce statistical error during statistical analysis.

3.2. Comparison of oral pH and salivary flow rate

Salivary flow rate and pH of the experimental group remained higher than that of the control group ($p < 0.05$, Table 3).