



Short communication

Stimulation effect of chitosan on the immunity of radiotherapy patients suffered from lung cancer

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ARTICLE INFO

Article history:

Received 30 July 2014

Received in revised form 11 August 2014

Accepted 21 August 2014

Available online 28 August 2014

Keywords:

Water soluble chitosan

Radiotherapy patients

Immunity

ABSTRACT

Water soluble chitosan (WSC), with low molecular weight, has many special biological, chemical, and physical properties, such as antifungal activity, antibacterial activity, and antitumor activity. In this study, the WSC was prepared by hydrolysis of the original chitosan with commercial cellulase, and the effect of WSC on the immunity of radiotherapy patients suffered from lung cancer (RPSFLC) was investigated. Oral administration of WSC increased CD3, CD4, CD4/CD8 ration, NK cells, IL-6, and TNF- α levels compared with the control group. The results indicate that oral administration of WSC can enhance the immunity of RPSFLC, and therefore oral administration of WSC may be used as an adjuvant therapy for them.

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1. Introduction

Chitosan, (1 \rightarrow 4)-2-amino-2-deoxy- β -D-glucan, is a natural polymer generally obtained by full or partial deacetylation of chitin [1]. Water soluble chitosan (WSC), with low molecular weight, has many special biological, chemical, and physical properties, such as antifungal, antibacterial, antitumor, and immunity activities, which are different from ordinary chitosan [2–4].

WSC can be prepared by either chemical or enzymatic hydrolysis. The chemical approach has some defects, e.g. harsh hydrolytic conditions, low yields, and chemical modifications of glucose rings. However, enzymatic methods possess advantages such as mild reaction conditions, high specificity, no glucose ring modifications, and mass production of chitoooligosaccharides [5].

Chitosan was proven to be a kind of multi-functional sensitizer for radiotherapy by the experiments of antitumor activity, radiation sensitizing activity, and protective effect on the normal tissues [6]. Though WSC has antitumor and immunity activities [2,3], the application and role of it in tumor radiotherapy were not frequently reported.

Thus, in this study, WSC was prepared by hydrolysis of the original chitosan with commercial cellulase, and the effect of WSC on the immunity of radiotherapy patients suffered from lung cancer (RPSFLC) was investigated.

2. Materials and methods

2.1. Ethics statement

This study was approved by the ethics committee of The Second People's Hospital of Lianyungang, China. The participants provided their verbal informed consent to participate in this study and this consent was recorded in an electronic spreadsheet as approved by the ethics committee of The Second People's Hospital of Lianyungang, China.

2.2. Materials

Raw chitosan from shrimp shells was obtained from Nantong Biochemical Co. (Jiangsu, China). The molecular weight (M_w) and degree of deacetylation were 41×10^4 Da and 93.5%, respectively. The crude cellulase, derived from *Trichoderma viride*, was a product of the Shanghai Institute of Physiology, Academia Sinica (China).

2.3. Preparation of WSC

Chitosan was dissolved in 2% (v/v) aqueous acetic acid (HAc) to a concentration of 5% (w/w) and the pH was adjusted to 5.5 using 1 M NaOH. A 1 mg mass of cellulase was added into a reactor containing 100 mL of chitosan solution and then maintained in a thermostatic water bath at 50 °C for 4 h. The hydrolysates were incubated at 95 °C for 5 min to denature the enzyme, neutralized with 1 M NaOH, filtered, concentrated to 20% (w/v), and precipitated with 6 volumes of absolute ethanol. The precipitate was then filtered through a

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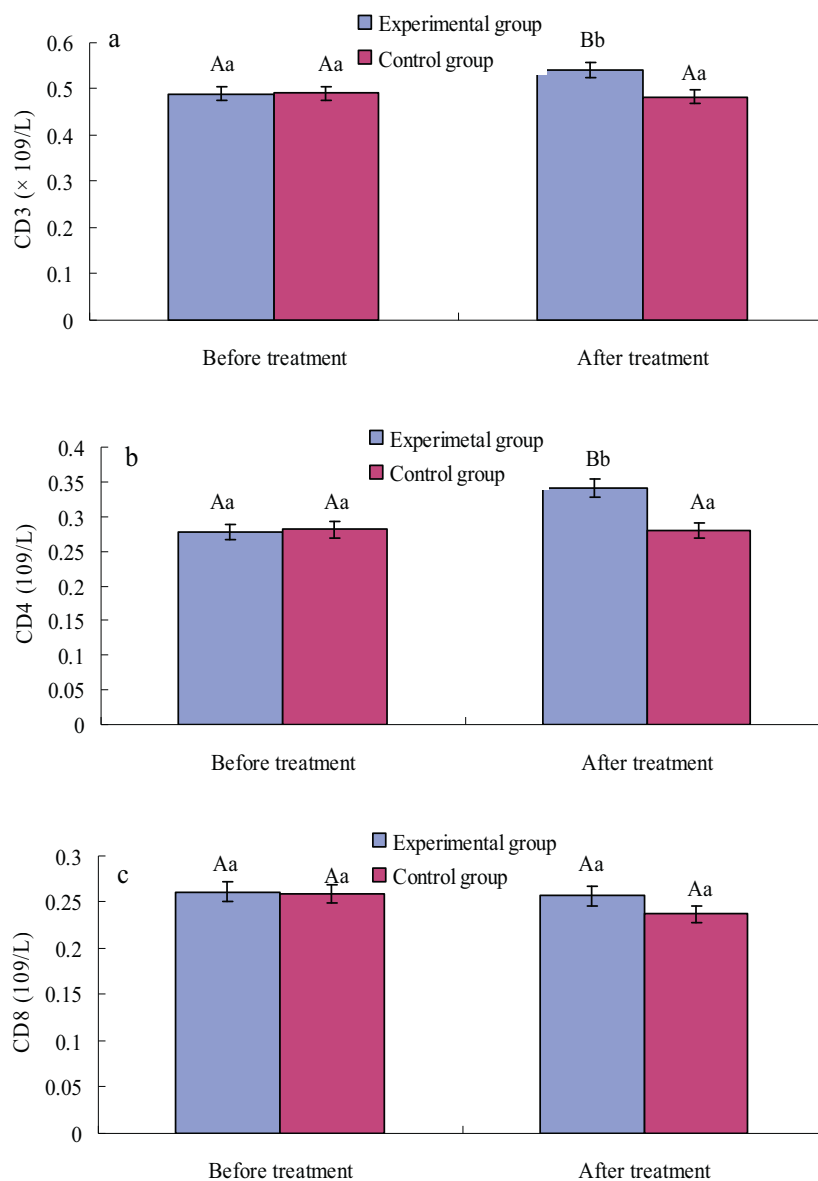


Fig. 1. Effect of water soluble chitosan treatment on CD3 (a), CD4 (b), and CD8 (c) levels in radiotherapy patients. Different superscript capital letters within the same treatment stage (before or after treatment) indicate significant differences ($p < 0.05$). The different superscript letters within the same treatment indicate the significant differences ($p < 0.05$).

preweighed Whatman GF/A filter, dried at 70 °C for 2 h, and finally crushed. The WSC was dissolved in distilled water to make a solution at a concentration of 1%.

2.4. The conditions of patients in group

All the cases, without contraindication to chemotherapy naive patients, aged ≤ 75 years, were pathologically diagnosed as lung cancer patients, have no serious drug allergy history, and have measurable primary lesions. The blood, liver function, renal function, and electrocardiogram routine examinations of all the cases were normal.

2.5. General data

120 cases of lung cancer patients, treated in our department from 2010 March to 2012 March, were chosen and randomly

divided into experimental group (60 cases) and control group (60 cases). Before and after the treatment, all the cases were subjected to pulmonary perspective and assay of CD3, CD4, CD8, NK cell, IL-6, and TNF- α levels.

2.6. Treatment methods

Radiotherapy used was the conventional radiotherapy. The radiation source for medical was Varian linear accelerator (6–15 MV-X). The dose used was 2 Gy/time and 5 times a week. The total dose used was 60–66 Gy/30–33 times/6–7 weeks. For experimental group, in addition to radiotherapy, the cases were treated with WSC oral liquid by 3 times/day and 10 mL/time and 3–4 weeks was 1 course of treatment. After the end of radiotherapy, the cases were no longer treated with WSC oral liquid.

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