

## Pulmonary oedema due to inhalation of detergent aerosol

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### Abstract

Healthy adult male albino rats were subjected to inhalation of increasing doses of detergent (dioctyl sodium sulfo-succinate) aerosol ranging from 100mg to 500mg. Administration of 500 mg of detergent aerosol resulted in peribronchial and focal alveolar oedema in 3 out of 5 animals. The lungs of control animals which were subjected to inhalation of vehicle aerosol (ethanol and saline) did not show any abnormality. It is possible that pulmonary oedema observed in detergent aerosol inhalation may be due to the action of detergents on the surfactant system of the lung.

*Key words:* Detergent, aerosol, vehicle, surfactant, pulmonary, oedema

### INTRODUCTION

Alteration in pressure-volume relationship of lungs rinsed with detergents is well documented.<sup>1,2</sup> It was suggested that such alteration was due to the effect of detergent on the surfactant system of the lung. The surfactant system of the lung has been shown to be a factor in the prevention of pulmonary oedema.<sup>3,4</sup> In view of the use of detergent sprays by people engaged in lubricating machinery and beauty parlours, it was proposed to observe whether inhalation of detergent aerosol can lead to pulmonary oedema.

### MATERIALS AND METHODS

Healthy male albino rats of Wistar strain weighing between 200 and 220 gms were used for the study. The animals were maintained in cages with free access to air, food and water.

Twenty-five animals were studied in groups of 5 each. A powerful anionic detergent, dioctyl sodium sulfo-succinate<sup>5</sup> (Sigma) was chosen as the detergent for this study. Detergent solution was freshly prepared for each animal. Equal volumes of 95% ethanol and isotonic saline were employed as a vehicle for dissolving the detergent. The solution was prepared to contain 50mg of detergent per ml.

Doses of detergent administered as aerosol to animals in each of these experimental groups were as below:-

- Group I – 2 ml (100 mg of detergent)
- Group II – 4 ml (200 mg of detergent)
- Group III – 6 ml (300 mg of detergent)

Group IV – 8 ml (400 mg of detergent)

Group V – 10 ml (500 mg of detergent)

The aerosol was administered in the following way: A nebulizer of 2ml capacity was filled with detergent solution and connected to an air compressor via a Y cannula. The flow of air was regulated by a tap. The other end of a Y cannula was connected to a pressure gauge. Aerosol formation was found at 80mm of Hg. The nebulizer was locally made and the particle size in aerosol could not be measured. The aerosol was delivered by a tube into an airtight perspex chamber in which the animal was freely moving. About 10 to 12 minutes was needed for a 2ml solution to be completely converted to aerosol. Nebulizers of similar capacity filled with an additional 2ml of detergent were kept ready to ensure continuous inhalation of aerosol by animals, until the total dose for each animal in the group was administered. Thus, the time for administration of aerosol to each animal in group I was about 10 minutes, while that for each animal in group V was approximately one hour.

To observe whether inhalation of vehicle aerosol itself has any effect on rat lung, another group of 5 animals was used as control and 10ml of vehicle aerosol (ethanol and saline) was administered to each animal in the group.

After administration of the total dose of the aerosol, each animal was taken out of the chamber. A period of 30 minutes was allowed for each animal for the detergent to act on the pulmonary system. Later, the animals were given pentobarbitonesodium intraperitoneally at a dose

of 40 mg/kg. Thoracotomy was done and the lungs were removed and subjected to Histopathological examination.

## RESULTS

The animals in all the groups (experimental and control) showed no signs of distress except closure of eyes after a few minutes of exposure to aerosol, due possibly to irritation to eyes. They opened their eyes within a few minutes after completion of exposure and were moving freely.

Except in experimental group V, the lungs were normal in all other animals. In lungs of animals in experimental group V which received a total of 500mg of detergent aerosol over a period of about one hour, peribronchial and focal alveolar oedema was seen in 3 out of 5 animals.

## DISCUSSION

Peribronchial oedema is the first stage of pulmonary oedema.<sup>6</sup> It is possible that 500 mg of detergent aerosol is the minimum dose needed in these animals to interfere with surfactant activity leading to pulmonary oedema. The oedema could not be due to anaphylaxis to detergent or vehicle since none of the animals showed signs of any distress, and control animals did not have any pulmonary oedema. Hypoxia could not be a factor since the animals were breathing normally and a vent in the perspex chamber was opened now and then for circulation of air. The present experiment is aimed at determining the effect of acute exposure of detergent aerosol on the lung parenchyma particularly in the development of pulmonary oedema. The role of surfactant in pulmonary oedema has been established. The effect of detergents on pulmonary surfactant activity is being pursued currently. Human beings at certain occupations are constantly exposed to detergent aerosol spray, albeit for short periods each time but repeatedly over a long period. Whether repeated effects of acute exposure could lead to chronic lung diseases cannot be ascertained from this study.

The half life of surfactant has been estimated to be about 3 hours in rat lungs.<sup>7</sup> Maximum exposure in this study was only for about 1 hour in group V. Prolonged exposure might result in pulmonary oedema in the remaining animals of this group as well as of the other groups. Further studies are needed to elucidate the role of detergents in the development of chronic occupational lung disease.

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