

Effects of Formaldehyde on Respiratory Mucosa in Rats

Efectos del Formaldehído sobre la Mucosa Respiratoria en Ratas

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SUMMARY: Formaldehyde inhalation, are known to be nasal mucosa irritating feature. This study we are examined the effects histopathologic of formaldehyde inhalation on rats by using light microscopy. 16 adult wistar albino rats were used in this study. 8 rats were in control group and 8 rats were in experiment group. Experiment group was exposed to 10 ppm formaldehyde 8hours/day,5days/week for 8 week. Nasal mucosa was removed and placed in 10% formaline. Sections were stained with Hematoxyline-Eosine and observed under light microscopy. The lining epithelium of respiratory mucosa showed a loss of ciliated cells with metaplasia of goblet cells and hyperplasia of squamous cells.

KEY WORDS: Formaldehyde; Rat; Respiratory mucosa.

INTRODUCTION

The nasal mucosa is a structurally and functionally complex organ in the upper respiratory tract. It is the primary site of entry for inhaled air in the respiratory system of mammals and therefore has many important and diverse functions. Detection of cadavers in anatomy and organs, intact formaldehyde carried out long-term storage pools. The anatomist and medical school dissection students affected by formaldehyde. Histology and Pathology fixation of tissues under laboratory used. Exposure to the formaldehyde vapours can cause irritation of mucous membranes and allergic sensitization of skin, but the critical target is upper respiratory tract (Mathur & Rastogi, 2007; Paustenbach *et al.*, 1997).

Inhalation studies on rats have also shown that long-term repeated exposure to formaldehyde at concentrations of 6 ppm and above, induced rhinitis, degeneration, necrosis, hyperplasia, and squamous metaplasia of the ciliated and non-ciliated nasal respiratory epithelium (Cassee & Feron, 1994). In this study, inhalation of formaldehyde may occur depending on histopathological changes in respiratory mucosa were examined.

MATERIAL AND METHOD

Wistar rats (9 weeks old, 180–200 g body weight) used in these trials were divided into two groups of 16 animals each (Control group and Experimental group). The rats were obtained from the Department of Medical Science Application and Research centre of Dicle University. All the animals were individually housed in stainless steel cages at room temperature. The animals had free access to standard laboratory rat pellet and water. 100x65x100 in the sizes of the experimental group were taken into a glass vase.

During the time period of 8 weeks, 5 days a week with 8 hours the inhalation of 10ppm formaldehyde was made. Formaldehyde vapor in the environment, with a special air pump ventilation constant volume, pressure and temperature achieved (Pabst, 1987). The nasal mucosa were dissected under ketamine hydrochloride anesthesia and placed in % 10 formaldehyde solution. They were placed in paraffin inclusion melted at 58°C after treatment with xylol, the 4–6µm sections were taken by rotary microtome and the sections were stained with Hematoxyline-Eosin (H-E) and Trichrom-masson dyes and then observed under olympus BH2 light microscopy to determine histological changes.

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RESULTS

In control group, no histopathologic changes were seen (Fig. 1). As a result of the 8-week inhalation of formaldehyde; The lining epithelium of respiratory mucosa showed a loss of ciliated cells with metaplasia of goblet cells and hyperplasia of squamous cells. At places, there was vacuolation and hydropic degeneration of epithelium within filtration of monolymphonuclear cells (Fig. 2).

The cells of nasal glands were hyperchromatic with more mucoid secretions in their lumen due to the irritation of formaldehyde. The subepithelial connective tissue stroma showed a marked congestion of blood vessels and infiltration of lympho-mononuclear cells. In another experimental group section; Although there was no exposure-related epithelial cell necrosis in surface or glandular epithelium there was marked thickening of this surface epithelium due to epithelial cell proliferation (Fig. 3).

DISCUSSION

Formaldehyde, eye, nose and respiratory tract irritant is a substant. The surface epithelium lining the nasal passages is often the first tissue in the nose to be directly injured by inhaled toxicants. The surface epithelium lining the nasal airways is a potential target for inhaled contaminants such as formaldehyde. The epithelial response to injury may depend on the toxicant, the severity of

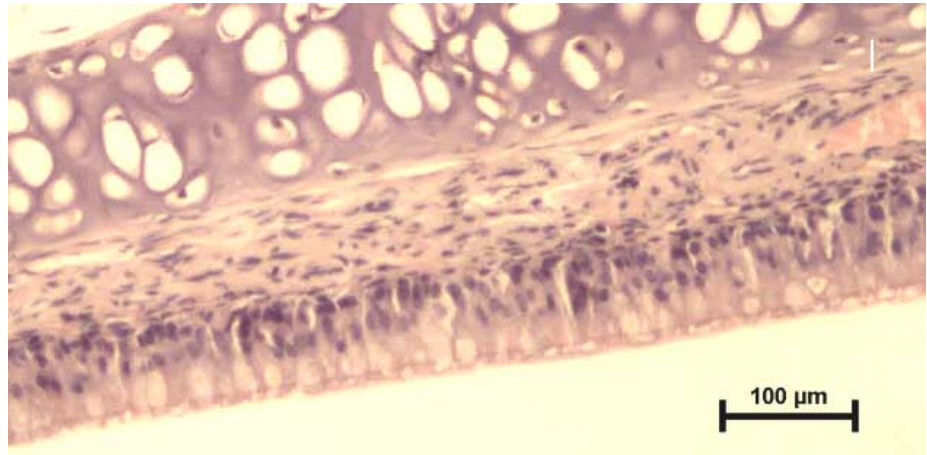


Fig. 1. The appearance of respiratory mucosa (Hematoxylin-Eosin).



Fig. 2. A loss of cilia (arrow), metaplasia of goblet cells (thin arrow), and hyperplasia of squamous cells (thick arrow) (Trichrom-Masson).

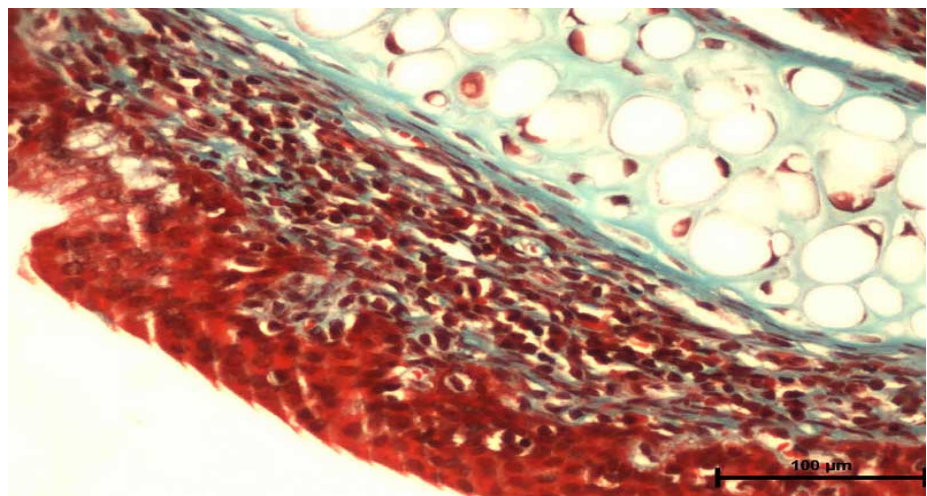


Fig. 3. A thickening and cell proliferation in epithelium (Trichrom-Masson).

the injury, and the presence of inflammatory cells and their secreted products. Researchers investigating the effects of formaldehyde on nasal mucosa different results have emerged. Cell proliferation is increased by 5 days of inhalation at 6 ppm formaldehyde and microarray analysis shows the expression of 15 genes were altered by 5 days of inhalation at 2 ppm formaldehyde (Andersen *et al.*, 2008). Squamous metaplasia and epithelial hyperplasia are apparent after 5 days of exposure at 6 ppm (Andersen *et al.*).

Bansal *et al.* (2011) in their study on rabbits, it may be concluded from the present study that even the short-term exposure (6 weeks) of concentrated vapors of formaldehyde (40% solution) cause an irritant effect on the respiratory tract and alters its functional activity and cellular morphology. Application of 10 ppm formaldehyde for a period of 8 week completely disrupt the structure of the mucosa histopathologically would like to state, Squamous cell metaplasia was found significantly more often among the formaldehyde-exposed rats

The results of our study showed that exposure to formaldehyde inhalation, cause histopathologic changes. such as: subepithelial mononuclear cell infiltration, epithelial disorganization and cilia loss of rat respiratory mucosa epithelium as well. The principal morphologic lesion in rats exposed to 10 ppm formaldehyde was a marked, chronically active rhinitis.

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RESUMEN: Es conocido que la inhalación de formaldehído tiene características irritantes para la mucosa nasal. En este estudio se examinaron los efectos histopatológicos de la inhalación de formaldehído en ratas mediante microscopía de luz. Se utilizaron en este estudio 16 ratas Wistar albinas adultas, ocho ratas como grupo control y ocho como grupo experimental. El grupo experimental fue expuesto a 10 ppm formaldehído 8 horas/día, 5 días/semana por 8 semanas. La mucosa nasal fue retirada y colocada en formalina al 10%. Las secciones obtenidas fueron teñidas con Hematoxilina-Eosina y observadas al microscopio óptico. El epitelio de revestimiento de la mucosa respiratoria mostró una pérdida de células ciliadas con metaplasia de las células caliciformes e hiperplasia de células escamosas.

PALABRAS CLAVE: Formaldehído; Rata; Mucosa respiratoria.

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