EFFECT OF BENZANTHRONE ON LUNG PARENCHYMA
OF EXPERIMENTAL ANIMALS

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In a dye producing factory it has been observed that workers who come in contact with the dye benzanthrone (a derivative of anthraquinone) during its manufacture, pulverization and storage develop itching, burning sensation, erythema and pigmentation on exposed and even covered parts of the skin. Singh et. al. (1967) studied the effect of local application of benzanthrone on the skin of mice. In addition to skin affections, increased frequency of cough and respiratory trouble was mentioned by a number of workers (Trivedi and Niyogi, 1968 and Singh and Zaidi, 1969). Since there is evidence of benzanthrone inhalation in processing of benzanthrone dye, its toxic effect on the pulmonary tissue has been studied in guineapigs.

MATERIALS AND METHODS

Animals—Ninety male guineapigs, weighing 400-500 grams, of the I.T.R.C. colony were used.

Preparation of benzanthrone particles—Particle size must be very fine (0.5–5 µ) in order to penetrate deep into the air-sacks. Benzanthrone particle size less than 5 µ was separate from a commercial sample by sedimentation in distilled water (Cartwright, 1956).

Method of benzanthrone administration—Benzanthrone can be introduced into the lungs in two ways—(1) The animals may be exposed for various periods of time to a benzanthrone atmosphere and (2) a known amount of benzanthrone may be administered into the lungs by intratracheal injection. In the present experiments animals were lightly anesthetized with ether and 0.5 ml of 25 mg/ml sterilized normal saline suspension of benzanthrone (12.5 mg) was administered intratracheally to each guineapig (Kettle and Hilton, 1932 and Bell and King, 1945). Dusting cabinet was not available.

Plan of the experiment—Animals were divided into two group. Group I, consisting of 60 animals, was administered 0.5 ml benzanthrone suspension intratracheally and Group II (30 animals) 0.5 ml sterile normal saline. Ten animals of group I and five of group II were killed at 24, 48, 96, 144, 192 hours and 15 days respectively.

Histopathological technique—The lungs of the killed animals were slowly distended by injecting 10 ml of 10% formol saline through the trachea which was exposed at the neck. The trachea was then tied off, the thoracic cavity opened, and the lungs along with tied-off portion of the trachea were removed and put in 10% formol saline. After preliminary fixation, blocks were taken along the longestaxis of both the lungs. The blocks were embedded in paraffin and sections cut at 5 µ. A number of sections from each block were stained with haematoxylin and eosin.

RESULTS AND CONCLUSION

Macrosopic examination of the lungs—The lungs in the animals of group I showed marked surface congestion at 24 hours which gradually disappeared in 96 hours. Mild pulmonary surface congestion was seen only up to 24 hours in group II animals. No gross lesion in any other organ was seen.

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Fig. 1. Pulmonary alveoli filled with oedematous fluid with marked septal congestion (H & EX 100)

Fig. 2. Large area of lung parenchyma occupied by haemorrhagic fluid (H & EX 60)

Fig. 3. Phagocytic cells engulfing benzanthrone particles are seen in the alveoli (H & EX 400)

Fig. 4. Phagocytic cells lying in the centre of alveoli (H & EX 650)

Microscopic examination of the lungs—In animals of group I large areas of lung parenchyma were filled with oedematous and haemorrhagic fluid within 24 hours (Fig. 1, 2). Septal capillaries were markedly congested. At places, thin irregular sheet of acute inflammatory exudate was discernible. Variable number of phagocytic cells were seen along the septal wall in the alveolar spaces engulfing small, light brown benzanthrone particles. A few septal cells showed picnotic nuclei which might be due to toxic effect of benzanthrone. Phagocytic cells with 3–4 nuclei were also seen. Respiratory bronchioles and alveolar ducts were partly filled with haemorrhagic oedematous fluid. Lymphoid follicles along the bronchioles were not much affected.

At 48 hours diminution in the oedematous haemorrhagic congestion of the lung parenchyma was observed. The number of phagocytic cells was increased (Fig. 3). Tiny benzanthrone particles were seen inside the cytoplasm of these cells which had moved more towards the centre of the alveoli (Fig. 4). Small alveolar areas were still seen to be infiltrated with acute inflammatory exudate. At places, only a rim of exudate was seen around many alveoli. Capillaries were congested and a few respiratory bronchioles showed inflammatory exudate with large number of shredded bronchial epithelial cells. A number of prominent lymphoid follicles were seen.

Marked clearing of inflammatory oedematous exudate was noticed at 96 hours. Most of the alveoli were cleared of oedema fluid, but contained a few polymorphonuclear leucocytes and phagocytic cells (Fig. 5). Terminal and alveolar bronchi were almost clear of the exudate. Benzanthrone particles were not discernible.

Small focal areas of parenchymal involvement were seen at 144 hours (Fig. 6). Thin fibrinous exudate, a few polymorphonuclear leucocytes, phagocytic cells and lymphocytes were still seen. Some areas of lung parenchyma still showed reaction. However, the rest of the lung was clear at 192 hours. After 15 days the lung was found to be
Lung parenchyma in the animals of group II showed mild septal congestion within 24 hours. Acute inflammatory reaction or oedema fluid was not seen in the alveoli. Respiratory bronchioles and alveolar ducts were clear in all the animals of the group. Septal congestion may be due to ether anaesthesia.

SUMMARY

Toxic effect of the dye benzanthrone (an anthraquinone derivative) has been studied on the lung parenchyma of guineapigs. Benzanthrone suspension (0.5 ml. of 25mg/ml.) of particle size less than 5μ, was injected intratracheally to each animal. Animals were sacrificed at 24, 48, 96, 144, 192 hours and 15 days. Large areas of lung parenchyma were filled with oedematous and haemorrhagic fluid within 24 hours. Phagocytic cells engulfing small light brown benzanthrone particles were seen in the alveolar spaces. At 48 hours oedematous haemorrhagict cells increased. Most of the alveoli were clear of inflammatory exudate at 96 hours. Only a few small focal areas of parenchymal involvement were seen at 144 and 192 hours. Lungs were found to be clear at 15 days.

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Reference


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