

Antidotes for phosgene-induced pulmonary oedema

It may be of interest to record the results of certain experiments on antidotes for phosgene-induced pulmonary oedema in laboratory animals, made in this department some years ago.

Death from phosgene poisoning in frogs could be prevented simply by placing the frogs in a bath of normal saline immediately after exposure to the gas (Boyd & Stewart, 1953). The saline solution apparently prevented diffusion of body fluids through the skin, the permeability of which had been apparently increased by phosgene.

Boyd & Perry (1960) found that pulmonary oedema in rabbits, after exposure to phosgene, was accompanied by the outpouring into respiratory tract fluid of a fluid similar in composition to blood plasma. Similar results were obtained in cats and dogs by Boyd & Perry (1963) who noted that postural pulmonary drainage did not clear this fluid from the lungs and did not prevent death. We have tried unsuccessfully to prevent or cure phosgene-induced pulmonary oedema by many means including the use of antihistamine agents, Janus green, goitrogenic agents and inhalation of ammonia gas. We did find, however, that death rates from phosgene were reduced in rabbits, cats and albino rats if the animals were allowed to inhale the phosgene through the nose rather than directly into the trachea. Since phosgene is fairly labile, this was due presumably to destruction of the gas in the naso-bucco-pharynx. We could not induce nasal breathing in dogs as they persisted in panting and drawing air directly into the trachea. Presumably as a result of this, we were unable to lower death rates to phosgene in dogs by this means.

The experiments on nasal breathing were made upon 18 adult rabbits, 14 cats, 80 albino rats and 21 dogs. The animals were anaesthetized with thiopentone sodium and a glass cannula was ligated into the trachea of half of the animals of each species. When the anaesthesia wore off, the animals were exposed to phosgene after the technique of Boyd & Perry (1960). After exposure, the tracheotomy tube was removed, the wound closed by sutures and the animals observed until recovery or death. The mortality rate in the tracheal-cannulated rabbits was 88% versus 25% in rabbits inhaling phosgene through the nose. Corresponding mortality rates in cats were 100% and 50% and in albino rats 90% and 40%. The combined mortality rate in these three species to inhaling phosgene directly into the trachea was 91% and to inhaling the gas through the nose 39%. The probability (P) that these percentage death rates were the same was less than 0.001. There were 3 deaths in 24 controls, which were tracheal-cannulated but not exposed to phosgene.

Boyd, MacLachlan & Perry (1944) reported similar results from inhalation of ammonia gas by rabbits and cats. Necrosis of the tracheo-bronchial mucosa was greater in animals which inhaled ammonia gas directly into the trachea than in animals which inhaled it through the nose. Boyd, MacLachlan & Perry (1944) referred to the phenomenon as the "naso-bucco-pharyngeal filter". It would appear that this filter may be of great significance in reducing the toxicity of inhalants.

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