

THE TOXIC EFFECTS OF FORMALDEHYDE AND FORMALIN

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Abstract

The results of this investigation may be summarized as follows: 1. The inhalation of formaldehyde gas in even small quantities is followed by bronchitis and pneumonia. Pneumonia is due to the inhalation of the gas and not to secondary infection. 2. Formalin belongs to that rare group of poisons which are capable of producing death suddenly when swallowed. 3. The introduction of formalin into the stomach is followed by the production of a gastritis which varies greatly in character. The duodenum and upper jejunum may also be involved in the inflammatory process. 4. Intraperitoneal injections of formalin cause peritonitis of a fibrino-haemorrhagic character. A definite reaction is obtained when very dilute formalin (1–1000) is employed. In the peritoneal cavity formalin exercises a destructive action upon all organs (pancreas, liver, peritoneal fat, Fallopian tubes, etc.) with which it comes in contact and causes inflammation in these organs. 5. The lethal dose of formalin when injected intraperitoneally into guinea pigs is approximately 2 cc. of 1–1000 formalin for each 100 gm. of body weight. 6. The injection of formalin into the lungs is followed by pneumonia and bronchitis. 7. The inflammation which follows subcutaneous injections of formalin is characterized by intense exudation. 8. The injection of formalin into the muscles produces myositis. 9. The injection of formalin into the anterior chamber of the eye causes the accumulation of an exudate containing leucocytes and fibrin. When formalin is dropped into the conjunctival sac iritis follows and may be severe enough to destroy the eye. 10. Formalin in whatever way introduced into the body is absorbed, and is then capable of producing lesions in the parenchymatous organs. 11. Changes in the liver after absorption of formalin consist of mild or severe grade of cloudy swelling accompanied by vacuolation of the protoplasm, changes in the nuclei and leucocytic infiltration. Focal necrosis may result. Similar changes follow the inhalation of formaldehyde. 12. The injection of formalin or the inhalation of the vapors of formaldehyde produces cloudy swelling of the parenchyma of the kidney. Focal necrosis may result. 13. Pneumonia and bronchitis are found in all animals after the injection of formalin. 14. The leucocytic infiltration which follows the introduction of formalin into an organ has these general characteristics: The eosinophiles are the first leucocytes to appear; these are followed by the other polynuclear leucocytes; last appear the large and small mononuclear leucocytes. Similar phenomena occur in the trachea, bronchi and lungs of animals subjected to formaldehyde inhalations. 15. Formalin is, directly or indirectly, chemiotactic for leucocytes. The tissues which are not infiltrated with leucocytes after the injection of formalin are those which have been so injured by the chemical that an inflammatory reaction is impossible. 16. Animals subjected to chronic poisoning with formalin administered by intraperitoneal injection develop fibrinous peritonitis, associated with marked eosinophilia. The changes in the kidneys and liver consist of cloudy swelling, fatty degeneration, focal necrosis and leucocytic infiltration.