

The antidotes are vinegar, vegetable astringents, Lugol's solution, and stimulants.

Black and white hellebore, all the drastic cathartics, turpentine, etc., are irritant poisons in large doses. They present similar symptoms to those irritants previously mentioned, and require the same treatment.

CHAPTER XXII.

METALLIC POISONS.

ARSENIC.

EVERY preparation of arsenic acts as an irritant poison. Among the most common varieties are arsenious acid, arsenite of copper (Scheele's green); yellow sulphuret of arsenic (orpiment); and red arsenic, or realgar. Arsenious acid and Scheele's green are most frequently employed for purposes of murder or suicide.

Metallic arsenic is made by heating an oxide of arsenic with charcoal.

Arsenious acid (AsO_3) is obtained during the sublimation of the arseniuret of cobalt and iron. It usually exists in the shops as a fine white powder. If the sublimation has been slow, it will take the form of brilliant octahedral crystals (*Taylor*). It combines with many of the alkalies, as soda, ammonia, or potash, to form salts. The well-known Fowler's solution is a liquid preparation of the arsenite of potash.

Scheele's green is applied to a variety of purposes. It is the principal ingredient in the coloring matter of green wall-paper, artificial flowers, candy and paper boxes, etc. Nearly all the bright-green colors of household furniture, paper, and "knick-knacks," are made by this poison. This

indiscriminate and unguarded use has resulted in serious impairment of health and loss of life. Inhalations of the microscopical particles, which arise from the green surface of room-paper, may induce all the poisonous effects of arsenic. Cases are not rare where this has occurred.

Realgar and orpiment are much used also as coloring matters, but less extensively than arsenite of copper.

Arsenious acid (AsO_3) is a very powerful poison, but loss of life from its administration is exceedingly rare.

Arsenious acid kills in from three to forty-eight hours. The length of time varies with the dose, the condition of the stomach, and age of the patient. Christoson gives the smallest fatal doses of the preparation as thirty grains of the powder, and four grains in solution. Taylor relates a case where two or three grains in powder proved fatal.

Tests.—Ammonia nitrate of silver, added to a solution of arsenious acid, throws down a yellow precipitate, which is the arsenite of silver. Ammonia sulphate of copper gives a green precipitate of arsenite of copper.

Marsh's test is the most reliable. It consists in adding sulphuric acid and zinc to the arsenical solution, and forming arsenuretted hydrogen. The gas, as it passes out through the tube, is set on fire. The presence of arsenic is known by the garlicky odor, and by the blue color of the flame. In addition, if a porcelain slate is held near the flame, a black ring of metallic arsenic is deposited, and on the outside of this ring a whitish film of arsenious acid appears. To determine whether the deposit is arsenic or antimony, the plate is subjected to a high temperature, and, if arsenic is present, the substance is immediately volatilized; if antimony, it will remain.

Riensch's test consists in boiling slips of copper in an acidulated solution of the suspected liquid. The mixture is heated to the boiling-point, and a slip of copper dipped in it for five or ten minutes. If arsenic is present, it will be deposited on the copper, and will appear of a dark-gray color. If the material thus obtained is heated in a tube, the metallic arsenic is changed into arsenious acid, which is recognized by its peculiar bright octahedral crystals.

Scheele's green and other preparations of arsenic are distinguished by the same reagents. In all cases the arsenic may be reduced to arsenious acid by heat, while the latter can be recognized by its crystals.

Small and repeated doses of arsenic may produce slow poisoning. The constitutional effects of the drug administered in this manner are recognized by a pale, waxy look on the face, œdema of the eyelids and sometimes of the extremities, loss of appetite, pain in the stomach, nausea, or vomiting, eruptions on the cutaneous surface, feeble pulse, and great weakness. In some cases the urine is loaded with albumen. If the drug be continued, death soon ensues.

When large doses of arsenic are taken, there is pain in the epigastric region, which rapidly increases, and is aggravated by pressure. There are nausea and vomiting. At first, the vomited matter consists of the contents of the stomach, with particles of arsenic intermixed. Subsequently, they contain blood and thick mucus. Purging usually follows the vomiting, in about half an hour after the prominent symptoms are developed. There are sometimes soreness and constriction about the throat. The respiration becomes entirely thoracic, and the movements are short and

rapid. The pulse is quick, small, and intermittent. Death may be preceded by coma and convulsions.

In poisoning from corrosive sublimate, the symptoms are developed more rapidly than in arsenical poisoning. In the former there is greater pain in the throat, and in the course of the œsophagus, and the tongue, fauces, and throat, present a white appearance. These signs suffice to distinguish the two forms.

After death from arsenic, the mucous membrane of the stomach is congested, thickened, and softened. There is more or less redness over the whole organ, but marked in the most dependent portions. Collections of mucus, mixed with blood and arsenic, are found in isolated patches in different parts of the stomach. Arsenic does not act as a corrosive poison; it never produces ulceration of the mucous membrane.

Treatment.—The antidote for arsenious acid is the hydrated sesquioxide of iron. It is prepared by adding aqua ammonia, soda, or potash, to a solution of the persulphate of iron. When the alkali is added, a reddish-brown powder forms, which is administered *ad libitum* both to adults and children. The iron combines with the arsenic, and the insoluble subarsenate of the protoxide of iron is thrown down (*U. S. Disp.*). Preceding the administration of the antidote, the stomach should be thoroughly emptied with the stomach-pump, or by emetics of sulphate of zinc, mustard, or ipecac., assisted by copious draughts of warm water.

Preparations of magnesia are recommended as antidotes. Lime-water, mixed with oil, and mucilaginous drinks, may be given also.

The antidote for the salts of arsenic is the subacetate of the protoxide of iron (*Duflos*).

Fewtrell recommends the administration of a mixture of chalk and castor-oil, made into a thick paste.

When the stomach is cleansed and the antidotes given, the treatment should be directed to allay pain, and relieve the gastric inflammation, by hypodermic injections of morphia, internal administration of ice, and blisters to the epigastrium.

CORROSIVE SUBLIMATE (*Bichloride of Mercury*).

Mercury in the metallic state is inert. When taken internally it passes through the bowels with scarcely any change. An extremely small quantity may be oxidized, but not sufficient to affect the system. Many of the combinations of mercury act as corrosive and irritant poisons. The most deadly is corrosive sublimate. This substance, according to American authorities, consists of two atoms of chlorine united to one of mercury. The British Pharmacopœia, however, makes it a protochloride, consisting of equal parts of chlorine and mercury. The bichloride is made by subliming sulphuric acid and mercury together, and then adding chloride of sodium. It occurs in small white or transparent crystals, and is exceedingly soluble.

Tests.—Iodide of potassium gives a scarlet-colored precipitate of the biniodide of mercury. Ammonia throws down a white precipitate of ammoniated mercury. Lime-water gives a yellow precipitate of the hydrated deutoxide of mercury. A black precipitate is formed by sulphuretted hydrogen. If a piece of zinc and gold wire be dipped in the suspected solution, which has been slightly acidulat-

ed, a grayish deposit of mercury will take place on the metal.

In small doses, continued, it produces ptyalism and other characteristic effects of mercurial preparations. The patient's gums become red, tender, swollen and ulcerated; saliva is poured out in excessive quantities. There is a strong metallic taste in the mouth, and the breath has a fetid odor. A blue line, in some cases, may be noticed around the edge of the gums. The teeth loosen, and the throat becomes sore and inflamed. The blood loses its plasticity, and the red globules are diminished. If allowed to proceed without treatment, these symptoms are intensified; necrosis of bone and ulceration of the integument are added, and the patient dies from exhaustion.

Corrosive sublimate has been known to destroy life in doses of three grains (*Taylor*). Usually it takes from ten grains to a drachm. In a few cases much larger doses have been recovered from.

The symptoms produced by poisonous doses are those common to many corrosive poisons. A burning pain is felt along the œsophagus and in the stomach, a few moments after the drug is swallowed. This is followed by vomiting and purging of slimy mucus, marked with blood. Portions of mucous membrane have been thrown up with the evacuations. The mouth and throat have a white appearance, and a strong metallic taste is experienced. There are thirst, difficulty in swallowing, a feeling of oppression on the chest, and difficulty in breathing. The pain in the stomach increases in intensity, the pulse becomes small and thready, extremities cold; great prostration comes on, which is soon followed by death.

The mucous membrane lining the œsophagus and stomach present after death a slate-gray appearance. The membrane is softened, and may be ulcerated. Extravasations of blood are found beneath it, and occasionally on the surface. If a piece of the membrane is taken up with a forceps, it is easily separated. There are also redness and tumefaction, particularly marked in the great *cul-de-sac* of the stomach.

Treatment.—When profuse salivation arises from medicinal doses of corrosive sublimate, or other preparations of mercury, iodide of potassium is given as an antidote in conjunction with chlorate of potash. A solution of the latter makes an efficient wash for the ulcerated mouth. Carbonic acid, in the proportion of one drachm to four ounces of water, is an excellent application for the same part.

When poisonous doses of the bichloride have been taken, the stomach should be emptied rapidly and completely with emetics or the stomach-pump. The common antidote, *albumen*, may then be administered, in the form of white of egg, or the *gluten* of bread. The egg should be beaten up with a large quantity of water before it is given. Milk may also be administered in large quantities. The casein it contains, as well as the albumen of the egg, forms an insoluble compound with the mercury. Small rolls of zinc and gold foil have been recommended as antidotes.

The subsequent inflammation should be treated in the same manner as that arising from arsenical poisoning (*see Arsenic*).

Calomel is the true protochloride of mercury. It acts sometimes as an irritant poison, but there are few cases of destruction of life from its use. It is recognized by its

extreme insolubility. The bile is the only fluid in the body which exerts a solvent action upon it, and that only in very small proportions. Potash and ammonia give a black precipitate; lime-water gives also a black precipitate.

COPPER.

The preparations of copper in common use are the sulphate (*blue vitriol*) and subacetate (*verdigris*). The sulphate of copper is employed medicinally, internally, as an emetic, and externally as an escharotic. Verdigris possesses similar properties, but is little used.

Chronic poisoning from copper may be induced by working in alloys of that metal, inhaling copper-dust, or eating from utensils lined with that metal.

All the soluble preparations of copper are corrosive poisons, and the effects on the system similarly manifested. The quantity of sulphate of copper which will destroy life is subject to great variation. Being a powerful emetic, the poison is rapidly thrown from the stomach, and the danger lessened. Nearly an ounce of the poison has been taken and recovered from, while in another instance one drachm has been known to destroy life.

Tests.—Ammonia, potash, and soda, give a bluish-white precipitate. Ferrocyanide of potassium gives a claret red precipitate (*Taylor*).

When the system becomes slowly impregnated with copper, there are a rapid loss of flesh and strength, nausea, tendency to diarrhoea, griping abdominal pains, tympanitis, muscular tremors, retraction of the gums, with a purple line around the edge (*Corrigan*), a dry cough, paralysis, dysenteric discharges from the bowels, and great prostration.

In acute poisoning there are intense griping pains in the abdomen, profuse greenish-colored discharges from the stomach and bowels, metallic taste in the mouth, anxious facies, vertigo, headache, dimness of vision, muscular tremors, a rapid, small pulse, paralysis, and sometimes convulsions.

After death, the mucous membrane of the œsophagus, stomach, and intestines, is reddened and softened. Ulceration and erosion in patches are found in different parts of the canal.

Treatment.—Ferrocyanide of potassium is recommended as an antidote by Schræder. Milk and honey, or white of egg, and milk in copious draughts, are often serviceable. Albumen in any form, or sugar, is considered, by many, an efficient antidote.

The resulting gastro-enteritis is treated as in the preceding cases.

LEAD.

Every soluble salt of lead possesses poisonous properties. The carbonate and oxide are more frequently the active agents in chronic poisoning than any other preparations. The acetate (sugar of lead), and the solution of the subacetate (Goulard's extract), occasionally exert a deleterious effect on the system, when given in ordinary medicinal doses. The carbonate of lead (white lead) is more severe in its action than the other salts. Usually a very large quantity of lead is necessary to destroy life.

Chronic poisoning is of frequent occurrence, from using hair-dyes, drinking beer or water which flows through lead pipes, constant handling of the thin foil covering chewing-tobacco, manufacturing or mixing white lead. It is some-

times produced by wearing Brussels lace, the material of which owes its white color to carbonate of lead.

Tests.—Sulphuric acid throws down a white precipitate. Iodide of potassium gives a yellow, and sulphuretted hydrogen a black precipitate.

The symptoms of poisoning by lead appear gradually. There are, at first, colicky pains in the abdomen, and constipation. The attack of colic (*colica pictonum*) may be very severe, or so slight as scarcely to demand attention. It is paroxysmal in character. The bowels are constipated. A blue line appears around the edge of the gums. There are "thumb-drop" and wrist-drop," from paralysis of the extensor muscles. The right rectus abdominalis is said to be the first muscle affected by the paralysis. The retraction of the abdomen witnessed in these cases is due to paralysis of those muscles. Paraplegia and hemiplegia exist in rare cases. Loss of flesh and strength, and muscular tremors, are also present.

When very large doses of lead are taken, there are thirst, dryness of the fauces, burning sensation in the throat, constipation, and intense colicky pains in the abdomen. If the bowels are moved, the fæces will be found to possess a dark color due to the change of the lead into the sulphuret in the intestinal canal (the same color is also observed after the administration of iron; the iron is changed into the sulphuret). Vomiting is sometimes present; there are difficult respiration and oppression over the præcordia. Paralysis and coma precede death.

On *post-mortem* examination there is usually found abrasion of the mucous membrane of the stomach and intestines, with redness and congestion in isolated patches:

also, a grayish-white color in certain portions, from the mixing of the mucus with the lead.

Treatment.—In chronic poisoning, iodide of potassium is considered the best eliminative. It joins with the lead in the system to form a soluble iodide of lead, which is carried out through the different emunctories. Sulphuric acid is sometimes administered for the same purpose. The patient should entirely change his habits, take active exercise in the open air, eat nourishing food, and keep regular hours. Quinine is a useful tonic in these cases. The paralyzed limbs may be treated by frequent bathing in cold water and by friction.

In acute poisoning from lead, the stomach should first be emptied by emetics, or with the stomach-pump. Strong solutions of Epsom salts (sulphate of magnesia), or Glauber's salts (sulphate of soda), may then be given in large quantities, as antidotes. If the bowels do not move, castor-oil should be given until free evacuations are produced. Animal charcoal is given by some. Albumen and milk may be used after or before the administration of the salts of magnesia or soda. These are not unfrequently employed alone. Taylor advises a mixture of vinegar and sulphate of magnesia as an antidote for poisoning by the carbonate of lead.

TARTARIZED ANTIMONY.

This substance is prepared by adding an ounce of the oxide of antimony, and one ounce of bitartrate of potash to eighteen ounces of water, and then boiling for one hour. Tartarized antimony is used in medicine as an emetic, sedative, alterative, diaphoretic, and expectorant. In large

doses is an irritant poison. The ordinary dose for an adult, as an emetic, is from one to two grains; with young persons very small doses will often produce dangerous effects. Three-quarters of a grain has been known to destroy life in a child (*Wilton*). Ten grains is the smallest recorded fatal dose in an adult. Although antimony is capable of producing rapid, violent constitutional disturbances, yet remedial efforts are generally followed by recovery. It is not apt to prove fatal, with proper care.

Tests.—Nitric acid throws down a white precipitate, which is soluble in tartaric acid. Sulphuretted hydrogen gives a characteristic red color to a solution of antimony, and, if muriatic acid is added to the precipitate, it is dissolved. If the solution is then added to water, a white precipitate appears.

Chronic poisoning by tartarized antimony is distinguished by gradual exhaustion, nausea, and vomiting, pain in the epigastrium, a small, feeble pulse, pallid surface, and cold, clammy extremities, sunken eyes, anxious expression of countenance, and metallic taste in the mouth.

In large quantities the drug produces in a few moments profuse bilious vomiting, and the matter vomited is soon mixed with blood. Portions of mucous membrane, of a grayish-white or dark-brown color, may come away in small pieces (*Taylor*). Diarrhoea is present if much of the poison has been swallowed. Signs of collapse are apparent: the skin becomes cold and bathed in a clammy perspiration, the pulse is feeble and rapid, and respiration sighing. A pustular eruption has been observed on the skin in some cases. Before death, the patient sinks into a deep coma.

A *post-mortem* examination shows signs of inflammation

in the throat, stomach, and intestines. Patches of mucous membrane, softened and easily detached and broken down, are found in the throat and stomach, and occasionally in the small intestines. Peritonitis is found in a small proportion of cases. The lungs are congested.

Treatment.—Large quantities of warm water should be given, to promote the complete evacuation of the stomach. Strong infusions of green tea may be taken at the same time or subsequently; various vegetable astringents, as tannic acid, etc., are also used as antidotes. Attempts should be made to counteract the collapse by hot bottles and blankets applied to the surface, and by friction of the extremities.

ZINC.

Sulphate of zinc, or *white vitriol*, and chloride of zinc, are energetic poisons; the former is an irritant, the latter a corrosive poison. The sulphate is employed in medicine as an astringent, nervine, and emetic. Its dose, as an emetic, is from ten to twenty grains. The chloride of zinc in solution is a valuable disinfectant.

The tests for zinc are ammonia, ferrocyanide of potassium, and sulphuretted hydrogen, all of which give a white precipitate.

In poisoning from white vitriol, there are nausea and vomiting, pain in the abdomen, followed by all the signs of collapse. When the chloride is the poisoning agent, the pain and collapse are greater; there are lividity of the surface, vertigo, and dimness of vision. In the evacuations from the stomach, shreds of mucous membrane are found.

The stomach, after death, is dark-colored; the mucous membrane thickened, congested, and perhaps ulcerated.

Treatment.—White of egg, beaten up with milk and water, followed by infusions of astringent medicines, is the chief remedy for poisoning from the sulphate.

In poisoning from the chloride, emetics should first be given; the albumen in milk can be administered when the stomach has been emptied.

NITRATE OF SILVER.

This substance is a corrosive poison. It has powerful escharotic properties, due to its affinity for the albumen of the tissues.

In poisonous doses, it produces intense pain, vomiting, and purging. Mucus, blood, and shreds of mucous membrane, are found in the excavations. If these are allowed to stand, they become dark from exposure to air.

Common salt (chloride of sodium) throws down a white precipitate with solutions of nitrate of silver, and it is also given as an antidote. Mucilaginous drinks should be administered *ad libitum*.

PHOSPHORUS.

Phosphorus is largely employed in the manufacture of lucifer matches. It is seldom used for medicinal purposes. Children are frequently poisoned by sucking the ends of matches, or drinking water in which they have been soaked. In match-factories, chronic poisoning from inhalation of phosphorus-vapor is of common occurrence. The symptoms of acute poisoning from phosphorus are peculiar in not developing for some hours after the poison has been taken. A small amount, one-tenth of a grain, has caused death.

Phosphorus is recognized by its peculiar odor, and its luminous appearance in the dark.

Chronic poisoning usually manifests itself first by ordinary dyspeptic symptoms; such as loss of appetite, feeling of weight and heat in the epigastrium, and by prostration. There are also nausea, diarrhoea, restlessness, inability to sleep, pains in the bones, and febrile excitement, which is worse toward night. If the exposure to the poisonous vapor have been of long duration, necrosis of the lower jaw, low grades of inflammation in various parts, and congestion of the lungs, will be found, in addition to the other symptoms.

In acute poisoning there are vomiting and purging of a greenish-colored substance, which soon becomes mixed with blood and mucus. The ejections and breath have a garlicky odor. If brought to a dark place, they exhibit a peculiar luminous appearance. There are intense pain in the abdomen, and tympanites. The face is anxious, skin cold, and the pulse is rapid and small. A fatal termination does not, usually, take place until a day or two has elapsed from the commencement of the symptoms, and in some cases life has been prolonged for a week.

After death the stomach presents signs of gangrenous inflammation. The mucous membrane is intensely red, and easily detached and broken down. There may be perforations in the wall of the intestines, passing into the peritoneal cavity. Congestion of the brain and serous effusion into the ventricles are also present. The viscera have a garlicky odor, and, when exposed in a dark place, become luminous.

Treatment.—Phosphorus has no direct antidote. Taylor recommends hydrated magnesia, and the free use of demulcent drinks, and albumen.