

7. Harati Y, Niakan E. Hydrazine toxicity, pyridoxine therapy, and peripheral neuropathy. *Ann Intern Med* 1986; **104**: 728–9.
8. Nagappan R, Riddell T. Pyridoxine therapy in a patient with severe hydrazine sulfate toxicity. *Crit Care Med* 2000; **28**: 2116–18.

Anorexia and cachexia. References^{1–3} to the use of hydrazine sulfate in patients with anorexia or cachexia associated with cancer.

1. Tayek JA, et al. Effect of hydrazine sulphate on whole-body protein breakdown measured by C-lysine metabolism in lung cancer patients. *Lancet* 1987; **ii**: 241–4.
2. Loprinzi CL, et al. Cancer-associated anorexia and cachexia: implications for drug therapy. *Drugs* 1992; **43**: 499–506.
3. Kaegi E. Unconventional therapies for cancer: hydrazine sulfate. *Can Med Assoc J* 1998; **158**: 1327–30.

Preparations

Proprietary Preparations (details are given in Part 3)

Rus.: Sehydryn (Сегидрин).

Hydrochloric Acid

Acide chlorhydrique; Acidum Hydrochloricum; Acidum hydrochloridum; Clorhídrico, ácido; E507; Kloorivetyhappo; Kwas solny; Kyselina chlorovodíková; Saltsyra; Salzsäure; Sósav; Suolahappo; Vandenilio chlorido rūgštis; Vetykloridihappo.

HCl = 36.46.

CAS — 7647-01-0.

ATC — A09AB03; B05XA13.

ATC Vet — QA09AB03; QB05XA13.

NOTE. The impure acid of commerce is known as Spirits of Salt and as Muriatic Acid.

Pharmacopoeias. *Chin., Eur.* (see p.vii), *Int., Jpn, Swiss, and Viet.* include various concentrations. Also in *USNF*.

Ph. Eur. 6.2 (Hydrochloric Acid, Concentrated; Acidum Hydrochloridum Concentratum; Hydrochloric Acid BP 2008). It contains 35.0 to 39.0% w/w of HCl. A clear, colourless, fuming liquid. Miscible with water. Store below 30° in stoppered containers of glass or other inert material.

Ph. Eur. 6.2 (Hydrochloric Acid, Dilute; Acidum Hydrochloridum Dilutum). It contains 9.5 to 10.5% w/w of HCl prepared by mixing hydrochloric acid 274 g with water 726 g.

USNF 26 (Hydrochloric Acid). It contains 36.5 to 38.0% w/w of HCl. A colourless, fuming liquid having a pungent odour. It ceases to fume when it is diluted with 2 volumes of water. Store in airtight containers.

USNF 26 (Diluted Hydrochloric Acid). It contains 9.5 to 10.5% w/w of HCl and may be prepared by mixing hydrochloric acid 226 mL with sufficient water to make 1000 mL. A colourless, odourless liquid. Store in airtight containers.

Adverse Effects

Hydrochloric acid is highly irritant and corrosive and ingestion has proved fatal. The corrosive effect causes chemical burns and severe pain. There may be violent vomiting, haematemesis, and circulatory collapse; acids can also produce intravascular coagulation and haemolysis. Ulceration may lead to perforation and patients can suffer strictures and pyloric stenosis. Asphyxiation may result from laryngeal oedema. Inhalation of acid fumes or aspiration of ingested acids may cause pneumonitis.

References

1. WHO. Chlorine and hydrogen chloride. *Environmental Health Criteria* 21. Geneva: WHO, 1982. Available at: <http://www.inchem.org/documents/ehc/ehc/ehc21.htm> (accessed 16/06/04)
2. Munoz Munoz E, et al. Massive necrosis of the gastrointestinal tract after ingestion of hydrochloric acid. *Eur J Surg* 2001; **167**: 195–8.

Treatment of Adverse Effects

Treatment of ingestion is mainly symptomatic. Gastric lavage and activated charcoal are not generally appropriate and emetics must not be used. Small amounts of water or milk may be given to dilute the acid but larger volumes may increase the risk of emesis and hence of further damage. Neutralising agents are not recommended because of the possibility of heat being produced during exothermic reactions, which may increase the injury further. Opioid analgesia may be required for pain. Endoscopy should be performed and surgical intervention may be necessary. There is little evidence to support the value of corticosteroids in preventing stricture formation.

Acid burns of the skin should be flooded immediately with water and the washing should be copious and prolonged. Any affected clothing should be removed while flooding is being carried out. For burns in the eye, the lids should be kept open and the eye flushed with a steady stream of water at room temperature or sodium chloride 0.9%. A few drops of a local anaesthetic solution will relieve lid spasm and facilitate irrigation.

Uses and Administration

Hydrochloric acid has been used as an escharotic. It has been used in the diluted form for the treatment of achlorhydria and other gastrointestinal disorders. It has also been given intravenously in the management of metabolic alkalosis (p.1667). An acid perfusion test using hydrochloric acid has been used in the diagnosis of oesophageal disorders. When taken orally, it should be sipped through a straw to protect the teeth.

Homoeopathy. Hydrochloric acid has been used in homoeopathic medicines under the following names: Acidum hydrochloricum; Muriaticum acidum; Hydrochloridum acidum; Chlorhydricum acidum; Acidum muriaticum; Ac. mur.

Diagnosis and testing. References and comments on the use of an acid perfusion test in the diagnosis of oesophageal disorders,^{1–5} such as gastro-oesophageal reflux disease (p.1696) and oesophageal motility disorders (p.1702). The test involves intra-oesophageal perfusion of 0.1M hydrochloric acid; subsequent development of pain indicates an acid-sensitive oesophagus. This test has also been used in the differential diagnosis of angina.²

1. Sladen GE, et al. Oesophagoscopy, biopsy, and acid perfusion test in diagnosis of "reflux oesophagitis". *BMJ* 1975; **1**: 71–6.
2. Anonymous. Angina and oesophageal disease. *Lancet* 1986; **i**: 191–2.
3. Hewson EG, et al. Acid perfusion test: does it have a role in the assessment of non cardiac chest pain? *Gut* 1989; **30**: 305–10.
4. de Caestecker JS, Heading RC. Acid perfusion in the assessment of non-cardiac chest pain. *Gut* 1989; **30**: 1795–7.
5. Howard PJ, et al. Acid perfusion is a good screening test for symptomatic oesophageal reflux. *Gut* 1989; **30**: A1445.

Pregnancy. Heartburn during pregnancy may be due to reflux of alkaline duodenal contents. A dilute solution of hydrochloric acid (pH 2) taken after meals and at bedtime produced improvements in heartburn in pregnant women.¹

1. Anonymous. Heartburn in pregnancy. *Drug Ther Bull* 1990; **28**: 11–12.

Preparations

Proprietary Preparations (details are given in Part 3)

Pol.: Mixture Pepsini.

Multi-ingredient: *Ital.:* Gastro-Pepsin; *S.Afr.:* Sentinel Ulcer Mixture.

Hydrofluoric Acid

Fluohydric Acid; Fluorhídrico, ácido; Fluoric Acid; Kwas fluorowodorowy.

HF = 20.01.

CAS — 7664-39-3.

Description. Hydrofluoric acid is a solution of hydrogen fluoride in water. Various strengths are used. It attacks glass strongly.

Adverse Effects

As for Hydrochloric Acid, above. Although the corrosive effects of hydrofluoric acid tend to predominate, absorption may produce systemic fluoride poisoning as described under Sodium Fluoride, p.1962.

The pain from contact with weak solutions may be delayed, so that the patient is not aware of being burnt until some hours later, when the area begins to smart; intense pain then sets in and this may persist for several days. Destruction of tissue proceeds under the toughened coagulated skin, so that the ulcers extend deeply, heal slowly, and leave a scar.

The fumes of hydrofluoric acid are highly irritant.

Treatment of Adverse Effects

The initial treatment of poisoning after oral exposure to hydrofluoric acid is similar to that described for hydrochloric acid, see above. Calcium gluconate should also be given intravenously to correct known or suspected hypocalcaemia. Burns in the eye are also managed as for hydrochloric acid, although irrigation of the eye may be continued with calcium gluconate solution 2% after initial flood with water or sodium chloride 0.9%.

In the event of skin burns with hydrofluoric acid, contaminated clothing or articles should be removed and the skin washed with copious cold water. A calcium gluconate gel is sometimes used and it may be necessary to infiltrate the affected areas with calcium gluconate intradermally or subcutaneously. Regional intravenous infusion of calcium gluconate may be necessary in severe burns of the forearm, hand, or fingers; if ineffective, intra-arterial infusion for burns of the fingers may be considered. Hydrofluoric acid passes through finger- and toe-nails without causing any apparent damage; nails will therefore have to be removed or perforated to be able to treat the underlying tissues. Other first-aid measures reported to be effective include prolonged soaks in iced solutions of benzalkonium chloride; iced water has sometimes been used as has iced magnesium sulfate solution. Local anaesthesia may be needed. Burn eschars should be excised and necrotic tissue debrided. Absorption may lead to systemic fluoride toxicity and the need for intravenous calcium gluconate to manage hypocalcaemic symptoms.

References to the treatment of hydrofluoric acid burns.

1. Browne TD. The treatment of hydrofluoric acid burns. *J Soc Occup Med* 1974; **24**: 80–9.
2. MacKinnon MA. Hydrofluoric acid burns. *Dermatol Clin* 1988; **6**: 67–74.
3. McIvor ME. Acute fluoride toxicity: pathophysiology and management. *Drug Safety* 1990; **5**: 79–85.
4. Kirkpatrick JJR, et al. Hydrofluoric acid burns: a review. *Burns* 1995; **21**: 483–93.
5. Sanz-Gallen P, et al. Hypocalcaemia and hypomagnesaemia due to hydrofluoric acid. *Occup Med (Lond)* 2001; **51**: 294–5.
6. Martin HCO, Muller MJ. Hydrofluoric acid burns from a household rust remover. *Med J Aust* 2002; **176**: 296.
7. Foster KN, et al. Hydrofluoric acid burn resulting from ignition of gas from a compressed air duster. *J Burn Care Rehabil* 2003; **24**: 234–8.

Uses

Hydrofluoric acid is used in industry. Its main use has been for the production of fluorocarbons for use as refrigerants and propellants. It has also been used as an ingredient of preparations for glass etching and rust removal.

Homoeopathy. Hydrofluoric acid has been used in homoeopathic medicines under the following names: Fluoricum acidum; Acidum hydrofluoricum; Ac. fluor.

Hydroquinine Hydrobromide

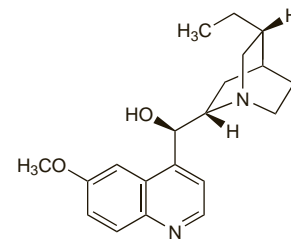
Dihydrochinin Hydrobromide; Dihydroquinine Hydrobromide; Hydroquinina, hidrobromuro de; Hydrochinin Hydrobromide; Methylhydrocupreine Hydrobromide. 8 α ,9R-10,11-Dihydro-6'-methoxycinchonan-9-ol hydrobromide.

C₂₀H₂₆N₂O₂.HBr = 407.3.

CAS — 522-66-7 (hydroquinine).

ATC — M09AA01.

ATC Vet — QM09AA01.



(hydroquinine)

NOTE. Do not confuse with Hydroquinone (p.1598).

Profile

Hydroquinine is a derivative of quinine (p.612) used similarly in the treatment of nocturnal muscle cramps. It is given as the hydrobromide in an oral dose of 200 mg with the evening meal and a further 100 mg at bedtime for 14 days.

Muscle spasm. Quinine and its derivatives such as hydroquinine have traditionally been used for the prevention of nocturnal cramps (p.1887) but there has been concern over their efficacy and potential for adverse effects, especially in the elderly.

References.

1. Jansen PHP, et al. Randomised controlled trial of hydroquinine in muscle cramps. *Lancet* 1997; **349**: 528–32.
2. van Kan HJM, et al. Hydroquinine pharmacokinetics after oral administration in adult patients with muscle cramps. *Eur J Clin Pharmacol* 2000; **56**: 263–7.

Preparations

Proprietary Preparations (details are given in Part 3)

Neth.: Inhibin.

Hydroxymphetamine Hydrobromide

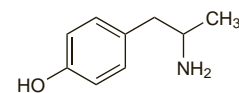
(BANM, rHNMM) ⓧ

Bromhidrato de Hidroxianfetamina; Hidrobromuro de hidroxianfetamina; Hydroxamfetamine, Bromhydrate d'; Hydroxamfetamini Hydrobromidum; Hydroxamphetamine Hydrobromide; p-Hydroxamphetamine Hydrobromide; Oxamphetamine Hydrobromide. (±)-4-(2-Aminopropyl)phenol hydrobromide.

Гидроксимфетамин Гидробромид

C₉H₁₃NO.HBr = 232.1.

CAS — 103-86-6 (hydroxymphetamine); 1518-86-1 ((±)-hydroxymphetamine); 306-21-8 (hydroxymphetamine hydrobromide); 140-36-3 ((±)-hydroxymphetamine hydrobromide).



(hydroxymphetamine)

Pharmacopoeias. In *US*.

USP 31 (Hydroxymphetamine Hydrobromide). A white, crystalline powder. Freely soluble in water and in alcohol; slightly soluble in chloroform; practically insoluble in ether. Its solutions in water are slightly acid to litmus, having a pH of about 5. Protect from light.

Profile

Hydroxymphetamine hydrobromide is a sympathomimetic with an action similar to that of ephedrine (p.1559), but it has little or no stimulant effect on the CNS. It was formerly used as a vasopressor and in the management of some cardiac disorders.