DermNet NZ

Authoritative facts about the skin from the New Zealand Dermatological Society Incorporated.

Chemical burns

What are chemical burns?

Chemical burns are burns to internal or external organs of the body caused mainly by chemical substances that are strong acids or bases (also known as alkalies). Chemical burns can occur in the home, at work or at school and are usually the result of an accident. They much more commonly occur at work, particularly in manufacturing plants that use large quantities of chemicals.

Very mild chemical burns result in irritant contact dermatitis.

What causes chemical burns?

The main cause of chemical burns is from contact with strong acids or bases. The strength of acids and bases is defined by the pH scale, which ranges from 1-14. A very strong acid has a pH of 1 and may cause a severe burn. A very strong base has a pH of 14 and may also cause a severe burn. A substance with a pH of 7 is considered neutral and does not burn. Chemical burns from acids or bases are also referred to as caustic burns.

The following table lists some common products containing chemical substances that may potentially cause chemical burns.

Common acids	Products
Sulphuric acid – concentration ranging from 8% to almost pure acid	• Toilet bowl cleaners • Drain cleaners • Metal cleaners • Car battery fluid • Fertiliser manufacturing
Nitric acid	• Used in engraving, metal refining, electroplating and fertiliser manufacturing
Hydrofluoric acid – a weak acid and in a dilute form does not burn or cause pain on contact	• Rust removers • Tyre cleaners • Tile cleaners • Glass etching • Dental work • Refrigerant
Hydrochloric acid – concentrations range from 5-44%	• Toilet bowl cleaners • Metal cleaners • Swimming pool cleaners • Dye manufacturing • Metal refining

Phosphoric acid	• Metal cleaners • Rustproofing • Disinfectants, detergents • Fertiliser manufacturing
Common bases	**Products**
Sodium hydroxide and potassium hydroxide – depending on the concentration may be very corrosive	• Drain cleaners • Oven cleaners • Denture cleaners
Sodium and calcium hypochlorite	• Household bleach • Pool chlorinating solution
Ammonia	• Cleaners and detergents used in the dilute form is not highly corrosive • Gaseous anhydrous ammonia used in fertilising manufacturing can cause severe burns
Phosphates	• Many household detergents and cleaners

What are the signs and symptoms of chemical burns?

The signs and symptoms of a chemical burn depend on several factors, including:

- pH of the agent
- concentration of the agent
- length of contact time
- amount of agent involved
- physical form of the agent (ie: solid, liquid, gas)
- site of contact (e.g. eye, skin, mucous membrane)
- whether swallowed or inhaled
- whether or not skin is intact

The swallowing of solid pellets of alkaline substances highlights the importance of these factors. The solid pellets will sit in the stomach for a longer period, thus more severe burns sustained. Another important factor is concentrated forms of some acids and bases generate a large amount of heat when diluted, this results not only in chemical burns but thermal burns too.

Some signs and symptoms of chemical burns include:

- Redness, irritation, or burning at the site of contact
- Pain or numbness at the site of contact
- Formation of black dead skin (eschar) – this occurs particularly with acid chemical burns as they produce a coagulation necrosis by denaturing proteins
- Deep tissue injury to the skin is caused by alkali chemical burns as they produce a liquefaction necrosis that involves denaturing of proteins as well as saponification of fats
- Vision changes or complete loss of vision if chemicals get into the eyes

Unknown cause

24 hours after fluoride burn

10 days after fluoride burn

In severe chemical burns where the agent has been swallowed, inhaled or absorbed into the bloodstream, the following systemic symptoms may occur.

- Cough or shortness of breath
- Low blood pressure
- Faintness, weakness, dizziness
- Headache
- Muscle twitching or seizures
- Cardiac arrest or irregular heartbeat

What is the management of chemical burns?

Basic first aid should be administered as soon as a chemical burn has occurred. This should include removal of contaminated clothing and prompt irrigation of the affected area with copious amounts of water. Wash for at least 20 minutes, taking care not to allow runoff to contact unaffected areas. It has been shown that irrigation received within 10 minutes of the burn reduces the severity of the wound and time of stay in hospital.

Chemical burns involving elemental metals (lithium, potassium, sodium and magnesium) should not be irrigated with water as this can result in a chemical reaction that causes burns to worsen. These types of chemical burns should be soaked with mineral oil while waiting for medical attention.

People with minor chemical burns do not require hospitalisation. For more severe burns patients should receive treatment as for a typical thermal burn patient. In some situations an antidote may be given to counteract the offending chemical agent.

The main treatment aims of burn wound management are:

- Carefully monitor wound
- Keep wounds clean
- Prevent the wound drying out
- Manage secondary infection

Commonly used topical antibacterials include 1% silver sulfadiazine cream, 0.5% silver nitrate solution and mafenide acetate 10% cream.

Related information

References:

- Book: Textbook of Dermatology. Ed Rook A, Wilkinson DS, Ebling FJB, Champion RH, Burton JL. Fourth edition. Blackwell Scientific Publications.
- Chemical Burns – emedicine, the online textbook

On DermNet NZ:

- Thermal burns

- Irritant contact dermatitis
- Wound dressings
- Sunburn

Other websites:

- Chemical burns – emedicine consumer health

Books about skin diseases:

See the DermNet NZ bookstore

Author: Vanessa Ngan, staff writer

DermNet does not provide an on-line consultation service.
If you have any concerns with your skin or its treatment, see a dermatologist for advice.