5. Schiøtz HA. Antiseptic catheter gel and urinary tract infection after short-term postoperative catheterization in women. *Arch Gynecol Obstet* 1996; **258:** 97–100.
6. Webster J, *et al*. Water or antiseptic for periurethral cleaning before urinary catheterization: a randomized controlled trial. *Am J Infect Control* 2001; **29:** 389–94.
7. Koskeroglu N, *et al*. The role of meatal disinfection in preventing catheter-related bacteriuria in an intensive care unit: a pilot study in Turkey. *J Hosp Infect* 2004; **56:** 236–8.

## Preparations

***BP 2008:*** Chlorhexidine Irrigation Solution; Chlorhexidine Mouthwash; Lidocaine and Chlorhexidine Gel;
***USP 31:*** Chlorhexidine Gluconate Oral Rinse.

**Proprietary Preparations** (details are given in Part 3)
***Arg.:*** Antiminth; Biguanex; Bucogel; Elugel; Finaplac; Hexidin; Hexil; Hexil-P; Hibiscrub; Hiboquad†; Laclorhex; Periodil; Pervinox Clorhexidina; Pervinox Incoloro; Plac Out; Strictus†; ***Austral.:*** Anti-Plaque Chewing Gum†; Bactigras; Bush Formula†; Catheter Preparation; Clorhexitulle†; Hexol†; Microshield 2, 4, and 5; Periogard Clorohex†; Plaqacide†; Savacol Mouth and Throat Rinse; ***Austria:*** Chlorhexamed; Plak Out; ***Belg.:*** Astrexine; Baxil; Cedium Chlorhexidine; Corsodyl; Golaseptine; Hansamedic; Hibidil; Hibiguard; Hibiscrub; Hibitane; Medisepta; Mefren; Nolargin; Pixidin; Sterilon; Uro-Tainer†; ***Braz.:*** Asseptic; Glucohex†; Hibitane; Marclorhex; Merthiolate†; Noplak; ***Canad.:*** Bactigras; Baxedin; Hibidil; Hibitane; Peridex†; Spectro Gram; Stanhexidine; ***Chile:*** AB; Agermin†; Bucoseptil; Freshmel; Garonsept; Graneodin; Hibicrick†; Hibiscrub†; Oralgene; Ortoxine; Peridentt†; Perio-Aid; Periokin; Perioxidin†; ***Cz.:*** Corsodyl; Hibiscrub†; Septofort; ***Denm.:*** Hibitane; Periochip; ***Fin.:*** Corsodyl; Klorhexol; Travahex; ***Fr.:*** Biorgasept; Collunovar; Corsodyl; Dermachrome; Diaseptyl; Dosiseptine; Elgydium; Eluge; Euraxsepti; Exoseptoplix†; Hibidil; Hibiscrub; Hibisprint; Hibitane; Paroex; Plurexid; Prexidine; Septeal; Septiapaisyl; Septivon; ***Ger.:*** Bactigras†; Cathejell S; Chlorhexamed; CHX Dental Gel; Cidegol C; Dentosmin P; Frubilurgyl†; Gurgellosung Chauvin†; Hansamed Spray†; Lemocin CX; Nur 1 Tropfen Chlorhexidin; Periogard Chlorohex†; Trachisan N†; ***Gr.:*** Hibitane; Periochip; ***Hong Kong:*** Bactigras†; Corsodyl; Hexol†; Hibiscrub†; Hibitane†; Hydrex; Qualikin; Scanlin; ***Hung.:*** Septofort; ***India:*** Orinse; ***Indon.:*** Mediscrub; ***Irl.:*** Corsodyl; Hibiscrub; Hibitane; ***Israel:*** Alcoxidine; Bactoscrub; Bactosept; Cleardent; Corsodyl; Medident; Periochip; Pharma-Dentix; Septadine Scrub; Septal; Septalone; Septol; Tarodent; Uniscrub†; Unisept†; ***Ital.:*** Benodent; Benodent CLX; Broxodin; Clarifex; Clomirex; Clorosan; Corsodyl; Dempol; Dentosan Clorexidina; Dentosan Parodontale; Eburos; Ekuba; Esoform Mani; Golasan; Iodosan Clorexidina; Lenil; Master-Aid; Neo Perginol†; Neo-Destomygen; Neomercurocromo; Neoxene; Neoxinal; Parodontax; Periogard Chlorohex; Plak Out; Sicura 3; Triseptil; ***Malaysia:*** Antibex†; Antisol†; Baby Shield Plus; Bactigras; Hibiscrub†; Hibisol†; Hibitane†; Oradex†; Sepsol†; ***Mex.:*** Hibiscrub†; Perioxidin; ***Neth.:*** Chlorhexamed; Corsodyl; Hibiscrub; Hibitane; Hydrex; Irrisol; Lifo-Scrub; Periochip; Sterilon; Urogliss-S; ***Norw.:*** Corsodyl; Hibiscrub; Hibitane; Periochip; ***NZ:*** DP Hand Rub; Hibitane; Riotane; ***Philipp.:*** Bactigras; Orahex; ***Pol.:*** Septofervex; ***Port.:*** Bexident; Cloraldin; Corsodyl; Dialens; Handscrub; Hibitane; Lifo-Scrub; Periochip; Plak Out†; ***Rus.:*** Elgydium (Эльгидиум); Elugel (Элюгель); Hexicon (Гексикон); Intim (Интим)†; ***S.Afr.:*** Bactigras; Corsodyl; D-Germ; Hexidin; Hibidil†; Hibiscrub; Hibitane; Orosept; ***Singapore:*** Acnederm Wash; Baby Shield Plus; Chlorohex; Elgydium; Elugel; Hexodane Mouthwash; Hexoscrub; Pfizer Obstetric Lotion†; ***Spain:*** Clorxil†; Cristalcrom; Cristalmina; Curafil; Cuvefilm; Deratin; Hibimax; Hibiscrub; Menalmina; Septisan; ***Swed.:*** Cervitec†; Corsodyl; Descutan; Hexident; Hibiscrub; Hibitane; Periochip; ***Switz.:*** Chlorhexamed; Chlorohex†; Corsodyl; Dentohexine; Hibidil; Hibiscrub; Hibitane; Lifo-Scrub; Periochip; Plak Out; ***Thai.:*** Bacard Antiseptic; Bactigras; C-20; Chlorhex; Desmanol G†; Hexene; Hexide; Hexol†; Hibiscrub†; Hibitane†; Hidine†; Hydrex; Q-Bac; ***Turk.:*** Cloder; Disinfecting; Klorheksol; Klorhex; Mediscrub; Oroheks; ***UAE:*** Zordyl; ***UK:*** Acriflex; Bactigras; Cepton; Chlorohex; Corsodyl; Curasept; CX Powder; Elgydium; Hibiscrub; Hibitane; Hydrex; Savlon Antiseptic Wound Wash; Serotulle; Spotoway; Steripod Chlorhexidine Gluconate; Unisept; Uriflex C; ***USA:*** Betasept; Dyna-Hex; Exidine; Hibiclens; Hibistat; Peridex; Periochip; Periogard; ***Venez.:*** Peridont.

**Multi-ingredient:** ***Arg.:*** Antiseptic Plus; Buclorhex; Consil; Dexatopic†; Drill; Elgydium; Elgydium Dientes Sensibles; Elgyfluor†; Eludril; Fluorexidina†; Hexil Antiseptico; Instillagel; Merthiolate NF; Odontobiotic†; Parodium; Periobacter; Periobacter Prof Avio; Periodent; Periodil; ***Austral.:*** Acnederm Foaming Wash; Curacleanse†; Difflam-C; Hamilton Body Lotion†; Hamilton Cleansing Lotion†; Hemocane; Medi Creme; Medi Pulv; Microshield Antiseptic; Microshield Handrub; Microshield Tincture; Mycil Healthy Feet; Nasalate; Oralife Peppermint; Paraderm Plus; Pro-PS†; Savlon Antiseptic; Seda-Gel†; Silvazine; Soov Cream; Xylocaine Jelly with Chlorhexidine; ***Austria:*** Bepanthen Plus; Cathejell; Cathejell mit Lidocain; Dermaspray; Endosgel; Instillagel; Skinsept mucosa; Uromont; Vitawund; ***Belg.:*** Angiocine; Cathejell; Cetavlex; Dermaspray†; Eludril; HAC; Hacdil-S; Hibitane; Instillagel; Medica; Neo-Cutigenol; Neo-Golaseptine; Nestosyl; Sabenyl; Vita-Mefren†; ***Braz.:*** Effaclar; ***Canad.:*** Avagard CHG; Baxedin 2% - 70%; Flamazine C†; Savlodil; Spectro Tar†; ***Chile:*** AB Antitusivo; Cariax; Endogel Esteril; Freshmel Tos; Graneodin N†; Graneodin-Tos; Halita; Medisept†; Oralgene; Orthokin; Perio-Aid c Cloruro de Cetilpiridinio; ***Cz.:*** Bepanthen Plus; Cyteal; Drill; Hexoral; Hexoraletten N; Hibicet Hospital Concentrate†; Instillagel; N-Septonex†; Skinsept mucosa†; ***Denm.:*** Hexokain; Instillagel; ***Fin.:*** Duocort; Sibicort; Toncils; ***Fr.:*** Alco-Aloe; Aphtoral; Biseptine; Cantalene; Chlorisprayt; Collu-Blache†; Collustan†; Cyteal; Dacryne; Dermaspraid Antiseptique; Dermobacter; Drill; Elgydium Dents Sensibiles; Elgyfluor†; Eludril; Instillagel; Mercryl; Mercrylsoins; Nostril; Parodium; Parogencyl sensibilite gencives; Paroplak; Posine†; Spitaderm†; Thiovalone; ***Ger.:*** Bepanthen Antiseptische; Cathejell mit Lidocain; Desmanol†; Endosgel; Hermalind†; Hexoraletten N; Instillagel; Nystalocal; Skinsept F; Skinsept mucosa; Trachisan†; Uro-Stilloson†; ***Gr.:*** Hibicet; Instillagel; Octrene; Trachisan; ***Hong Kong:*** Acnederm Wash; Dermobacter; Difflam-C; Hibicet Hospital Concentrate†; Hibisol†; Instillagel; Medicreme; Medipulv†; Mycil; Oragesic; Pilelife; Soov Cream; Trachisan†; ***Hung.:*** Alkcema; Alksebor; Bepanthen Plus; Drill; Instillagel; Vita-Merfen†; ***India:*** Argisept†; Burnheal†; Iteol-3; Silverex; ***Indon.:*** Dexatopic; Neo Resiguard; Pravlon; Spitaderm; ***Irl.:*** Alltracel S†; Hibicet; Hibisol; Instillagel; Mycil; Naseptin; Nystaform-HC†; Nystaform†; Savlon; ***Israel:*** Alcosept; Bepanthen Plus; Cathejell; Cetrin; Instillagel†; Merfen; Neocutan Silver; Savior; Septacare†; Septadine; Sterets H; Tisept; Travasept; V-Tabur; Vita-Merfen NF; ***Ital.:*** Bactigras; Baxidin; Benodent; Benodent Gel Gengivale†; Biopatch; Cetrexidin; Cetrisan; Citroclorex; Citromed; Citromed 80 and 85; Citromed Chirurgico; Citromedics Pronto; Citrosteril Pronto; Clorexan; Clorexan Ferri; Clotramid†; Cuprosodio Plus; Decon Lavanda; Dentaton; Dentosan Azione Intensiva; Dentosan Mese; Dentosan Placca & Carie; Disinfene; Eso Ferri Plus; Eso S 80; Esosan Pronto; Farvicett; Handexin; Hibizene; Neo-Stomygen; Neogyn; Ninfagin; Panseptil; Parogencyl Gengive Delicate; Rexichlor; Sicura3 Medical; Simp; Simpottantacinque; Spitaderm; Steridol†; Videorelax†; ***Malaysia:*** Acnederm Foaming Wash; Cathejell with Lidocaine; Difflam-C; Elan-Forte; Hibicet†; Horf; Oral-Aid; Trachisan†; ***Mex.:*** Instillagel†; Perioxidin; ***Neth.:*** Dexatopic†; Endosgel; Hibicet concentraat; Hibicet verdunning; Hibisol; Instillagel; Spitaderm; Urogliss; ***Norw.:*** Bacimycin; ***NZ:*** Acnederm Foaming Wash; Acnederm Wash†; Conditioning Solution†; Difflam-C; Egomycol†; Medicreme; Medipulv; Oralife Peppermint; Paraderm Plus; Savlon; Silvazine; Soov Cream; Xylocaine with Chlorhexidine†; ***Philipp.:*** Cathejell; ***Pol.:*** Bepanthen Plus; Sebidin; ***Port.:*** Alkagin; Alphacedre; Bepanthene; Bepanthene Plus; Biofluor Plus†; Biofluor Prevencao†; Cathejell; Cyteal; Drill; Eludril; Hibitane Menta†; Hibitane†; Instillagel; Lactigriet; Lubrificante Anestesico; ***Rus.:*** Bepanthen Plus (Бепантен Плюс); Cathejell with Lidocaine (Катеджель С Лидокаином)†; Cyteal (Цитеал); Drill (Дрилл); Elgyfluor (Эльгифлуор); Eludril (Элюдрил); Lysoplac (Лизоплак); Metrogyl Denta (Метрогил Дента); Parodium (Пародиум); Sebidin (Себидин); ***S.Afr.:*** Andolex-C; Cathejell with Lidocaine; Germolene; Hibicet†; Naseptin; Orochlor; ***Singapore:*** Cyteal; Difflam-C; Elgyfluor; Eludril; Hexodane Handrub; Oral-Aid; Savlon†; Silvazine; Silvin; Soov Cream; Trachisan; ***Spain:*** Angileptol; Bucodrin; Bucometasana; Bucospray; Drill; Eludril; Faringesic; Gargaril; Garydol; Hibitane; Mastiol; Menalcol; Mercryl Plus; ***Swed.:*** Instillagel; ***Switz.:*** Antebor N; Bepanthene Plus; Collu-Blache; Collunosol-N; Eludril; Eubucal†; Galamila; Gleitmittel†; Hibital; Hibitane Teinture; Lidohex†; Merfen; Nystacortone†; Nystalocal; Trachisan†; Vita-Hexin; Vita-Merfen; ***Thai.:*** Bacard; Cathejell with Lidocaine; Chlorhex-C; Dekka; Frebac; Hibicet†; Inhibac; Sepdine†; Septone†; ***Turk.:*** Bepanthene Plus; Dervanol; Gleitgelen; Hemoralgine; Kloroben; Pantenol Plus; Savlex; Savonol; Savrolin; Setilin; ***UK:*** Cathejell with Lidocaine; ChloraPrep; Clearasil Pore Cleansing Lotion; Covonia Throat Spray; Cyteal; Dermol; Eludril; Germolene; Germoloids†; Hibicet†; Hibisol; Instillagel; Medi-Swab H; Medi-Wipe; Mycil; Naseptin; Nystaform; Nystaform-HC; Quinoderm Antibacterial Face Wash; Savlon Antiseptic Cream; Savlon Antiseptic Liquid; Sterets H; Steripod Chlorhexidine Gluconate with Cetrimide†; Tisept; Torbetol; Travasept; ***USA:*** BactoShield; Fresh-N-Free.

## Chlorinated Lime

Bleaching Powder; Cal clorada; Calcaria Chlorata; Calcii Hypochloris; Calcium Hypochlorite; Calcium Hypochlorosum; Calx Chlorata; Calx Chlorinata; Chloride of Lime; Chlorkalk; Chlorure de Chaux; Cloruro de Cal; Desmanche.
*CAS — 7778-54-3.*

**Pharmacopoeias.** In *Br.* and *Jpn*.
**BP 2008** (Chlorinated Lime). A dull white powder with a characteristic odour, containing not less than 30.0% w/w of 'available chlorine'. It becomes moist and gradually decomposes on exposure to air, carbon dioxide being absorbed and chlorine evolved. Partly soluble in water and in alcohol.

### Adverse Effects, Treatment, and Precautions
As for Sodium Hypochlorite, p.1661.

### Uses and Administration
Chlorinated lime is a disinfectant and antiseptic with the general properties of chlorine (p.1638).

Its action is rapid but brief, the 'available chlorine' soon being exhausted by combination with organic material. It is used to disinfect faeces, urine, and other organic material, and as a cleansing agent for lavatories, drains, and effluents.

Chlorinated lime is used in the preparation of Surgical Chlorinated Soda Solution (BPC 1973) (Dakin's Solution) which has been employed as a wound disinfectant, and Chlorinated Lime and Boric Acid Solution (BP 1993), (Eusol), which has been used as a disinfectant lotion and wet dressing, sometimes with equal parts of liquid paraffin. However, such solutions are irritant when applied undiluted, and are no longer recommended for use in this way. In addition, there is some evidence that such chlorine-releasing solutions may delay wound healing (see Disinfection, Wounds under Uses and Administration of Sodium Hypochlorite, p.1662).

### Preparations
***BPC 1973:*** Surgical Chlorinated Soda Solution.

# Chlorine

925; Chlor; Chlore; Chlorium; Cloro; Klor.
Хлор
$Cl_2$ = 70.906.
*CAS — 7782-50-5.*

**Description.** Chlorine is a greenish-yellow gas with a suffocating odour; commonly available as a pressurised liquid.

## Adverse Effects and Treatment
Chlorine gas is irritant and corrosive producing inflammation, burns, and necrosis. Inhalation may result in coughing, choking, headache, dyspnoea, dizziness, expectoration of frothy white sputum (which may be blood stained), a burning chest pain, and nausea. Bronchospasm, laryngeal oedema, acute pulmonary oedema with cyanosis, and hypoxia may occur. There may be vomiting and development of acidosis. Death may result from hypoxia.

Some of the toxicity of chlorine may be due to its dissolution in tissue water to produce hydrochloric acid and hypochlorite. After exposure to chlorine, conjunctivitis may require a topical anaesthetic and frequent irrigations of water or saline. Respiratory distress should be treated with inhalations of humidified oxygen and bronchodilators; mechanical ventilation may be required. Corticosteroids have been given in an attempt to minimise pulmonary damage but their benefit is unproven. Acidosis may require the intravenous use of sodium bicarbonate or other suitable alkalising agent.

◊ Experience gained from 186 cases of acute chlorine exposure indicated that medical support was required for only a short time even when exposure was repeated;[1] late sequelae were not seen, even in patients with abnormal respiratory function tests or blood gases on admission. Thirteen children who were accidentally exposed to chlorine products and gas at a community swimming pool complained of eye and throat irritation, chest pain and tightness, shortness of breath, wheezing, and anxiety and 5 children with hypoxia required hospital admission. These children received humidified oxygen, salbutamol, and, in 4 patients, methylprednisolone, and all were discharged 1 to 2 days later.[2] Another report on 76 children with chlorine poisoning revealed that the longest period of hospitalisation was 12 hours after treatment with oxygen and corticosteroids.[3] A 14-year-old boy with a history of asthma exposed to chlorine gas developed acute respiratory distress syndrome and required intubation, ventilatory support, salbutamol, and corticosteroids. He was extubated after 19 days and recovered well.[4] There have been reports of deliberate inhalation of chlorine,[5,6] in one instance for pleasure,[5] leading to severe adverse effects. Some individuals may be unduly insensitive to chlorine-induced irritation and workers should be warned that concentrations of chlorine which can be tolerated for short periods without undue discomfort can still cause serious injury which may not be immediately apparent.[6]

Guidelines[7,8] have been issued for the management of chlorine exposure.

1. Barret L, Faure J. Chlorine poisoning. *Lancet* 1984; **i:** 561–2.
2. Sexton JD, Pronchik DJ. Chlorine inhalation: the big picture. *Clin Toxicol* 1998; **36:** 87–93.
3. Fleta J, *et al*. Intoxication of 76 children by chlorine gas. *Hum Toxicol* 1986; **5:** 99–100.
4. Traub SJ, *et al*. Case report and literature review of chlorine gas toxicity. *Vet Hum Toxicol* 2002; **44:** 235–9.
5. Rafferty P. Voluntary chlorine inhalation: a new form of self-abuse? *BMJ* 1980; **281:** 1178–9.
6. Dewhurst F. Voluntary chlorine inhalation. *BMJ* 1981; **282:** 565–6.
7. Department of Health. Chlorine: guidelines for action in the event of a deliberate release (issued February 2004). Available at: http://www.hpa.org.uk/web/HPAwebFile/HPAweb_C/1194947362398 (accessed 27/08/08)
8. Agency for Toxic Substances and Disease Registry. Medical management guidelines (MMGs) for chlorine (Cl ). Available at: http://www.atsdr.cdc.gov/MHMI/mmg172.html (accessed 15/03/06)

**Effects on the eyes.** Eye examinations of 50 subjects immediately before and after swimming in a chlorinated pool (chlorine range 1.0 to 1.5 ppm) showed that 68% had symptoms of corneal oedema and 94% had corneal epithelial erosions. No subject had a measurable decrease in visual acuity.[1]

1. Haag JR, Gieser RG. Effects of swimming pool water on the cornea. *JAMA* 1983; **249:** 2507–8.

## Precautions
The antimicrobial activity of chlorine disinfectants is reduced by the presence of organic material and by increasing pH. Hypochlorite solutions may delay wound healing (see Disinfection: Wounds under Uses and Administration of Sodium Hypochlorite, p.1662).

## Uses and Administration
Chlorine is a disinfectant with a rapid potent brief bactericidal action. It is capable of killing most bacteria, and some fungi, yeasts, algae, viruses, and protozoa. It is slowly active against spores.

It is used for the treatment of water (p.1623), but for most other purposes it is used in the form of hypochlorites, organic and inorganic chloramines, chlorinated hydantoins, chlorinated isocyanurates, and similar oxidising compounds capable of releasing chlorine. In the presence of water these compounds produce hypochlorous acid (HOCl) and hypochlorite ion ($OCl^-$) and it is generally considered that the lethal action on micro-organisms is due to chlorination of cell protein or enzyme systems by nonionised hypochlorous acid, although the hypochlorite ion may also contribute.

The activity of most of the compounds decreases with increase of pH, the activity of solutions of pH 4 to 7 being greater than those of higher pH values. However, stability is usually greater at an alkaline pH.

The potency of chlorine disinfectants is expressed in terms of **available chlorine**. This is based on the concept of chlorine gas ($Cl_2$) as the reference substance. Two atoms of chlorine (2 × Cl) yield in water only one