furantoin monohydrate, is available in some countries and is given in a dose of 100 mg twice daily. A usual long-term prophylactic dose is 50 to 100 mg at bedtime.

For details of doses in children, see below.

◊ Reviews.

1. Guay DR. An update on the role of nitrofurans in the management of urinary tract infections. *Drugs* 2001; **61:** 353–64.

Administration in children. In the UK, nitrofurantoin may be given to children aged 3 months to 12 years for the *treatment* of urinary-tract infection in a usual oral dose of 3 mg/kg daily given in 4 divided doses; 1 mg/kg may be given at night for long-term *prophylactic* therapy. However, a systematic review[1] concluded, on the basis of the rather low-grade evidence available, that the adverse effects of nitrofurantoin may outweigh its benefits and render it unacceptable for long-term therapy.

Higher oral doses of 5 to 7 mg/kg daily in 4 divided doses are recommended for the *treatment* of urinary-tract infection in the USA in children aged 1 month and above; for long-term *prophylactic* therapy 1 mg/kg daily given in one or two divided doses is considered adequate.

Older children may be given usual adult doses (see above).

1. Williams GJ, *et al.* Long-term antibiotics for preventing recurrent urinary tract infection in children. Available in The Cochrane Database of Systematic Reviews; Issue 3. Chichester: John Wiley; 2006 (accessed 11/01/08).

Preparations

BP 2008: Nitrofurantoin Oral Suspension; Nitrofurantoin Tablets; ***USP 31:*** Nitrofurantoin Capsules; Nitrofurantoin Oral Suspension; Nitrofurantoin Tablets.

Proprietary Preparations (details are given in Part 3)
Arg.: Furadantina; ***Austral.:*** Furadantin; Macrodantin; Ralodantin†; ***Austria:*** Furadantin; ***Belg.:*** Furadantine; ***Braz.:*** Hantina; Macrodantina; Nitrofen; Urogem; ***Canad.:*** Macrobid; Macrodantin†; Novo-Furantoin; ***Chile:*** Macrodantina; Macrosan; Matidan; ***Cz.:*** Furantoin†; Nifurantin†; ***Fin.:*** Nitrofurc; ***Fr.:*** Furadantine; Furadoine; Microdoine; ***Ger.:*** Furadantin; Nifurantin; Nifuretten; Uro-Tablinen; ***Gr.:*** Furolin; ***India:*** Furadantin; ***Irl.:*** Furadantin; Macrobid; Macrodantin; ***Israel:*** Macrodantin†; Uvamin; ***Ital.:*** Furadantin; Furedan; Furil; Macrodantin; Neo-Furadantin; ***Mex.:*** Biofurin; Furadantina; Furitex; Futroken; Macrodantina; Macrofurin; Promac; Suronit; ***Neth.:*** Furabid; Furadantine MC; ***Norw.:*** Furadantin; ***NZ:*** Furadantin; Nifuran; ***Philipp.:*** Macrodantin; ***Pol.:*** Siraliden; ***Port.:*** Furadantina; ***S.Afr.:*** Furadantin; Macrodantin; ***Spain:*** Furantoina; Furobactina; ***Swed.:*** Furadantin; ***Switz.:*** Furadantine; Urodin; Uvamine retard; ***Turk.:*** Piyeloseptyl; ***UK:*** Furadantin; Macrobid; Macrodantin; ***USA:*** Furadantin; Macrobid; Macrodantin; ***Venez.:*** Furadina†; Macrodantina.

Multi-ingredient: ***Arg.:*** Bagociletas con Anestesia; Bagociletas sin Anestesia†; ***Braz.:*** Urofen†; Uropac; ***Ger.:*** Nifurantin B 6; Urospasmon sine†; Urospasmon†; ***India:*** Nephrogesic; ***Mex.:*** Furanton†; ***Turk.:*** Uriseptin.

Nitrofurazone *(BAN)*

Nitrofural *(plNN)*; Furacilinum; Nitrofuraali; Nitrofurál; Nitrofuralis; Nitrofuralum; Nitrofuratsoni; Nitrofurazon; Nitrofurazonum. 5-Nitro-2-furaldehyde semicarbazone.

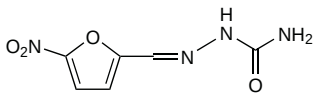
Нитрофурал

$C_6H_6N_4O_4$ = 198.1.

CAS — 59-87-0.

ATC — B05CA03; D08AF01; D09AA03; P01CC02; S01AX04; S02AA02.

ATC Vet — QB05CA03; QD08AF01; QD09AA03; QG01AX90; QP51AC02; QS01AX04; QS02AA02.



Pharmacopoeias. In *Eur.* (see p.vii) and *US.*

Ph. Eur. 6.2 (Nitrofural; Nitrofurazone BP 2008). A yellow or brownish-yellow, crystalline powder. Very slightly soluble in water; slightly soluble in alcohol. The filtrate from a 1% suspension in water has a pH of 5.0 to 7.0. Protect from light.

USP 31 (Nitrofurazone). A lemon-yellow, odourless crystalline powder. It darkens slowly on exposure to light. Soluble 1 in 4200 of water, 1 in 590 of alcohol, and 1 in 350 of propylene glycol; practically insoluble in chloroform and in ether; soluble in dimethylformamide; slightly soluble in polyethylene glycol mixtures. The filtrate from a 1% suspension in water has a pH of 5.0 to 7.5. Store in airtight containers at a temperature not exceeding 40°. Protect from light.

Sterilisation. Autoclaving gauze dressings impregnated with nitrofurazone, as recommended by the US manufacturer, resulted in a greater than 10% loss of the drug.[1] Since the spectroscopic assay used may not distinguish between nitrofurazone and some of its degradation products, the degree of degradation may have been greater than this.

1. Phillips C, Fisher E. Effect of autoclaving on stability of nitrofurazone soluble dressing. *Am J Health-Syst Pharm* 1996; **53:** 1169–71.

Adverse Effects

Sensitisation and generalised allergic skin reactions may be produced by topical nitrofurazone.

Nitrofurazone is a toxic drug when given orally and serious adverse effects include severe peripheral neuropathy; haemolysis may occur in patients with G6PD deficiency. Nitrofurazone in high oral doses is carcinogenic in *rats*.

Precautions

Nitrofurazone is contra-indicated in patients with known hypersensitivity. Preparations containing macrogols should be used with caution in patients with renal impairment since macrogols can be absorbed and their accumulation in such patients may result in symptoms of further impairment.

Oral nitrofurazone should be used with caution in patients with G6PD deficiency because of the risk of haemolysis.

Antimicrobial Action

Nitrofurazone is a nitrofuran derivative with a broad spectrum of antibacterial activity, but with little activity against *Pseudomonas* spp. It also has antitrypanosomal activity.

Uses and Administration

Nitrofurazone is a nitrofuran derivative that is used topically for wounds, burns, ulcers, and skin infections, and for the preparation of surfaces before skin grafting. It is usually applied in a concentration of 0.2% in a water-soluble or water-miscible basis. A solution of nitrofurazone is used for bladder irrigation.

Urinary catheters impregnated with nitrofurazone, to reduce bacterial colonisation and infection, are available in some countries.

Preparations

USP 31: Nitrofurazone Ointment; Nitrofurazone Topical Solution.

Proprietary Preparations (details are given in Part 3)
Arg.: Furacin; Ivoran Pilot†; Nitromed; ***Belg.:*** Furacine; ***Braz.:*** Alivioderm†; Caziderm; Cleanbac†; Furacin; Sensiderme; ***Chile:*** Demodek†; Furacin; ***Ger.:*** Furacin-Sol; ***India:*** Furacin; ***Mex.:*** Furacin; Kufro; Nifurol; Probizal; Vulnizol; ***Neth.:*** Furacine; ***Philipp.:*** Furacin; ***Port.:*** Rayonfur; ***S.Afr.:*** Furacin; Furex; Germex; ***Spain:*** Furacin; ***Thai.:*** Bactacin; Mytrocin; Polycin; ***Turk.:*** Dermikolin; Furacin; Furaderm; Furazol; ***USA:*** Furacin†; ***Venez.:*** Furacin; Furfuril; Fuxal; Polifur†.

Multi-ingredient: ***Arg.:*** Fadanasal; Neo Pelvicillin; O-Biol; Vagicural; Vagisan; Vagisan Compuesto; Vislus; ***Braz.:*** Nitrileno; Nitrolerg†; Otodol†; ***India:*** Furacin-S; ***Ital.:*** Furotricina; ***Mex.:*** Madecassol C; Madecassol N; ***Spain:*** Dertrase; ***Thai.:*** Denson.

Nitroxoline *(BAN, plNN)*

Nitroxolina; Nitroxolinum. 5-Nitroquinolin-8-ol.

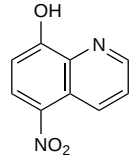
Нитроксолин

$C_9H_6N_2O_3$ = 190.2.

CAS — 4008-48-4.

ATC — J01XX07.

ATC Vet — QJ01XX07.



Profile

Nitroxoline has antibacterial and antifungal properties and is used in the treatment of urinary-tract infections in oral doses ranging from 80 to 250 mg three times daily before food. It has also been given with sulfamethizole.

Preparations

Proprietary Preparations (details are given in Part 3)
Fr.: Nibiol†; ***Ger.:*** Cysto-Saar; ***Rus.:*** 5-Nitrox (5-Нитрокс); 5-Nok (5-Нок); ***S.Afr.:*** Nicene N.

Multi-ingredient: ***Braz.:*** Minazol.

Norfloxacin *(BAN, USAN, rINN)*

AM-715; *N*-Desmethylpefloxacin; MK-366; Norfloksacinas; Norfloksacyna; Norfloksasiini; Norfloksasin; Norfloxacine; Norfloxacino; Norfloxacinum. 1-Ethyl-6-fluoro-1,4-dihydro-4-oxo-7-(piperazin-1-yl)quinoline-3-carboxylic acid.

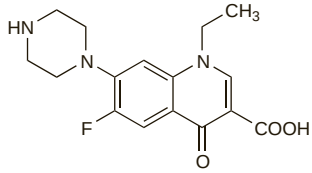
Норфлоксацин

$C_{16}H_{18}FN_3O_3$ = 319.3.

CAS — 70458-96-7.

ATC — J01MA06; S01AX12.

ATC Vet — QJ01MA06; QS01AX12.



Pharmacopoeias. In *Chin., Eur.* (see p.vii), *Jpn*, and *US.*

Ph. Eur. 6.2 (Norfloxacin). A white or pale yellow, hygroscopic, photosensitive, crystalline powder. Very slightly soluble in water; slightly soluble in alcohol and in acetone. Store in airtight containers. Protect from light.

USP 31 (Norfloxacin). A white to pale yellow crystalline powder. Slightly soluble in water, in alcohol, and in acetone; freely soluble in acetic acid; sparingly soluble in chloroform; practically insoluble in ether; very slightly soluble in ethyl acetate and in methyl alcohol. Store in airtight containers. Protect from light.

Norfloxacin Pivoxil *(BANM, rINNM)*

Norfloxacine, Pivoxil de; Norfloxacini Pivoxil; Norfloxacino pivoxilo. Pivaloyloxymethyl 1-ethyl-6-fluoro-1,4-dihydro-4-oxo-7-(piperazin-1-yl)quinoline-3-carboxylic acid.

Норфлоксацина Пивоксил

$C_{22}H_{28}FN_3O_5$ = 433.5.

Adverse Effects and Precautions

As for Ciprofloxacin, p.244.

Interactions

As for Ciprofloxacin, p.246.

Antimicrobial Action

As for Ciprofloxacin, p.246, although norfloxacin is less potent *in vitro*. Norfloxacin is not active against Chlamydiaceae, mycoplasmas, or mycobacteria.

Pharmacokinetics

About 30 to 40% of an oral dose of norfloxacin is absorbed. Peak plasma concentrations of about 1.5 micrograms/mL occur about 1 to 2 hours after a 400-mg oral dose; the presence of food can delay absorption. Norfloxacin is about 14% bound to plasma proteins. It is probably widely distributed, but information is limited. Norfloxacin penetrates well into tissues of the genito-urinary tract. It crosses the placenta. Relatively high concentrations are achieved in bile.

The plasma half-life is 3 to 4 hours and may be prolonged in renal impairment; a value of 6.5 hours or more has been reported when creatinine clearance is below 30 mL/minute per 1.73 m^2. About 30% of a dose is excreted unchanged in the urine within 24 hours, producing high urinary concentrations; norfloxacin is least soluble at a urinary pH of 7.5. Urinary excretion is by tubular secretion and glomerular filtration and is reduced by probenecid, although plasma concentrations of norfloxacin are not generally affected. Some metabolism occurs, possibly in the liver, and several metabolites have been identified in urine, some with antibacterial activity. About 30% of an oral dose is recovered from the faeces.

Uses and Administration

Norfloxacin is a fluoroquinolone antibacterial with properties similar to those of ciprofloxacin (p.243), but it is generally less potent *in vitro*.

Norfloxacin is used mainly in the treatment of urinary-tract infections (p.199) and for the treatment of gonorrhoea (p.191).

Norfloxacin is given orally at least 1 hour before, or 2 hours after, food or milk.

In urinary-tract infections the usual dose is 400 mg twice daily for 3 to 10 days. Treatment may need to be continued for up to 12 weeks in chronic relapsing urinary-tract infections; it may be possible to reduce the dose to 400 mg once daily if there is an adequate response within the first 4 weeks. A 28-day course of treatment with a dose of 400 mg twice daily should be given for acute or chronic bacterial prostatitis.

For details of reduced doses to be used in renal impairment, see below.

A single oral dose of 800 mg is given in the treatment of uncomplicated gonorrhoea.

Eye drops containing 0.3% of norfloxacin are used to treat eye infections.

The pivaloyloxymethyl salt of norfloxacin, norfloxacin pivoxil, is also used in some countries.