In addition, the *BNFC* suggests that a dose of 30 mg/kg daily in 2 divided doses may be given for prophylaxis of urinary-tract infections.

Administration in renal impairment. In the UK, some products of nalidixic acid have been licensed for use at half the usual dose in patients with a creatinine clearance below 20 mL/minute (the *BNFC* suggests a similar reduction in children with creatinine clearance 20 mL/minute per 1.73 m^2 or less). However, other licensed product information does not include this information and suggests that nalidixic acid should not be used in patients with severe renal impairment.

Preparations

BP 2008: Nalidixic Acid Oral Suspension; Nalidixic Acid Tablets; ***USP 31:*** Nalidixic Acid Oral Suspension; Nalidixic Acid Tablets.

Proprietary Preparations (details are given in Part 3) ***Arg.:*** Nalidix†; Wintomylon†; ***Braz.:*** Naluril; Wintomylon; ***Canad.:*** NegGram†; ***Chile:*** Wintomylon†; ***Fr.:*** Negram†; ***Gr.:*** Nal-acid†; ***Hong Kong:*** Wintomylon; ***Hung.:*** Nevigramon; ***India:*** Diarlop; Gramoneg; Negadix; ***Indon.:*** Urineg; ***Irl.:*** Negram; ***Israel:*** NegGram†; ***Ital.:*** Betaxina†; Nalidixin†; Naligram†; NegGram†; Uri-Flor; ***Mex.:*** A-N-Dix; Acidix; Fardixon†; Kamilon; Nalix; Pronal Dix; Seltomylon†; Urlix†; Uronalin; Wintomylon; ***Pol.:*** Nevigramon; ***Port.:*** Wintomilon†; ***Rus.:*** Negram (Нерам); ***S.Afr.:*** Puromylon; Winlomylon; ***UK:*** Negram†; Uriben; ***USA:*** NegGram.

Multi-ingredient: ***Irl.:*** Mictral†; ***Mex.:*** Azo-Uronalin; Azo-Wintomylon; Azogen; Nalixone; Naxilan-Plus; Pirifur.

Neomycin *(BAN, rINN)*

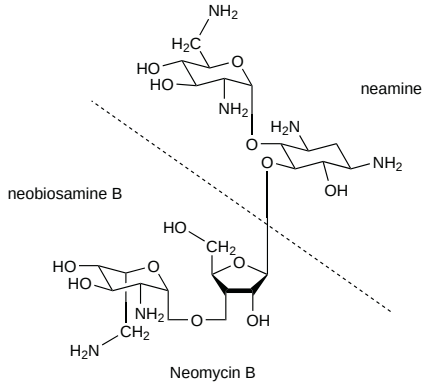
Neomicina; Néomycine; Neomycinum; Neomysiini.

Неомицин

CAS — 1404-04-2 (neomycin); 3947-65-7 (neomycin A); 119-04-0 (neomycin B); 66-86-4 (neomycin C).

ATC — A01AB08; A07AA01; B05CA09; D06AX04; J01GB05; R02AB01; S01AA03; S02AA07; S03AA01.

ATC Vet — QA01AB08; QA07AA01; QB05CA09; QD06AX04; QJ01GB05; QR02AB01; QS01AA03; QS02AA07; QS03AA01.



Neomycin B

Description. A mixture of 2 isomers, neomycin B ($C_{23}H_{46}N_6O_{13}$ = 614.6) and neomycin C ($C_{23}H_{46}N_6O_{13}$ = 614.6) with neomycin A (neamine, $C_{12}H_{26}N_4O_6$ = 322.4); neomycins B and C are glycoside esters of neamine and neobiosamines B and C. Framycetin (p.279) consists of neomycin B.

Neomycin Sulfate *(rINNM)*

Fradiomycin Sulfate; Neomicino sulfatas; Neomicin-szulfát; Neomisin Sülfat; Neomycin Sulphate *(BANM)*; Néomycine, sulfate de; Neomycini sulfas; Neomycinsulfat; Neomycin-sulfát; Neomycyny siarczan; Neomysiinisulfaatti; Sulfato de neomicina.

Неомицина Сульфат

CAS — 1405-10-3.

ATC — A01AB08; A07AA01; B05CA09; D06AX04; J01GB05; R02AB01; S01AA03; S02AA07; S03AA01.

ATC Vet — QA01AB08; QA07AA01; QB05CA09; QD06AX04; QJ01GB05; QR02AB01; QS01AA03; QS02AA07; QS03AA01.

NOTE. NEO is a code approved by the BP 2008 for use on single unit doses of eye drops containing neomycin sulfate where the individual container may be too small to bear all the appropriate labelling information.

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

Ph. Eur. 6.2 (Neomycin Sulphate). A mixture of the sulfates of substances produced by the growth of certain selected strains of *Streptomyces fradiae*, the main component being the sulfate of neomycin B. The potency is not less than 680 units/mg, calculated with reference to the dried substance. A white or yellowish-white, hygroscopic powder. Very soluble in water; very slightly soluble in alcohol; practically insoluble in acetone. A 1% solution in water has a pH of 5.0 to 7.5. Store in airtight containers. Protect from light.

USP 31 (Neomycin Sulfate). The sulfate salt of a kind of neomycin, an antibacterial substance produced by the growth of *Streptomyces fradiae* (Streptomycetaceae), or a mixture of two or more such salts. It has a potency equivalent to not less than 600 micrograms of neomycin per mg, calculated on the dried basis. A white to slightly yellow powder, or cryodesiccated solid. It is odourless or practically so, and is hygroscopic. Soluble 1 in 1 of water; very slightly soluble in alcohol; insoluble in acetone, in chloroform, and in ether. pH of a solution in water containing the equivalent of neomycin 3.3% is between 5.0 and 7.5. Store in airtight containers. Protect from light.

Neomycin Undecenoate *(BANM)*

Neomycin Undecylenate *(USAN, rINNM)*; Néomycine, Undécylénate de; Neomycini Undecylenas; Undecilenato de neomicina. The 10-undecenoate salt of neomycin.

Неомицина Ундецилената

CAS — 1406-04-8.

ATC — A01AB08; A07AA01; B05CA09; D06AX04; J01GB05; R02AB01; S01AA03; S02AA07; S03AA01.

ATC Vet — QA01AB08; QA07AA01; QB05CA09; QD06AX04; QJ01GB05; QR02AB01; QS01AA03; QS02AA07; QS03AA01.

Adverse Effects and Treatment

As for Gentamicin Sulfate, p.282.

Neomycin has particularly potent nephrotoxic and ototoxic properties and so is generally no longer given parenterally. However, sufficient may be absorbed after use by other routes (e.g. orally, instillation into cavities or open wounds, or topical application to damaged skin), to produce irreversible partial or total deafness. The effect is dose-related and is enhanced by renal impairment. Nephrotoxic effects may also occur.

When given orally in large doses, neomycin causes nausea, vomiting, and diarrhoea. Prolonged oral use may cause a malabsorption syndrome with steatorrhoea and diarrhoea which can be very severe. Superinfection may occur, especially with prolonged treatment.

Neomycin has a neuromuscular-blocking action similar to, but stronger than, that of other aminoglycosides, and respiratory depression and arrest has followed the intraperitoneal instillation of neomycin. Fatalities have occurred.

Hypersensitivity reactions, such as rashes, pruritus, and sometimes drug fever or even anaphylaxis, during local treatment with neomycin and may be masked by the combined use of a corticosteroid. Cross-sensitivity with other aminoglycosides may occur.

Precautions

As for Gentamicin Sulfate, p.283. Parenteral use of neomycin, or its use for irrigation of wounds or serous cavities such as the peritoneum, is no longer recommended.

Neomycin is contra-indicated for intestinal disinfection when an obstruction is present, in patients with a known history of allergy to aminoglycosides, and in infants under 1 year. It should be used with great care in patients with renal or hepatic impairment, or with neuromuscular disorders, and in those with impaired hearing. The topical use of neomycin in patients with extensive skin damage or perforated tympanic membranes may result in deafness.

Prolonged local use should be avoided as it may lead to skin sensitisation and possible cross-sensitivity to other aminoglycosides.

Hypersensitivity and vaccination. Neomycin was thought to be responsible for a hypersensitivity reaction[1] in a child given measles, mumps, and rubella vaccine containing neomycin 25 micrograms. However, there is also a report of successful vaccination with measles, mumps, and rubella vaccine in a neomycin-sensitive child.[2] Although the vaccine may contain small amounts of neomycin or kanamycin, and sensitivity to either is considered a contra-indication to its use, it is only rarely necessary to withhold it once appropriate expert advice has been taken. There is little logic to intradermal testing since test solutions contain 4 to 40 times as much neomycin as the vaccine.[2]

1. Kwittken PL, *et al.* MMR vaccine and neomycin allergy. *Am J Dis Child* 1993; **147:** 128–9.
2. Elliman D, Dhanraj B. Safe MMR vaccination despite neomycin allergy. *Lancet* 1991; **337:** 365.

Interactions

As for Gentamicin Sulfate, p.283. Absorption after oral or local use may be sufficient to produce interactions with other drugs given systemically.

Neomycin orally has been reported to impair the absorption of other drugs including phenoxymethylpenicillin, digoxin, and methotrexate; the efficacy of oral contraceptives might be reduced. The effects of acarbose may be enhanced by oral neomycin.

Antimicrobial Action

Neomycin has a mode of action and spectrum of activity similar to that of gentamicin (p.283) but it lacks activity against *Pseudomonas aeruginosa.* It is reported to be active against *Mycobacterium tuberculosis.*

Because of its extensive topical use, resistance has been reported to be relatively widespread, notably among staphylococci, and some *Salmonella*, *Shigella*, and *Escherichia coli* strains. Cross-resistance with kanamycin, framycetin, and paromomycin occurs.

Pharmacokinetics

Neomycin is poorly absorbed from the gastrointestinal tract, about 97% of an oral dose being excreted unchanged in the faeces. Doses of 3 g orally produce peak plasma concentrations of up to 4 micrograms/mL and absorption is similar after an enema. Absorption may be increased in conditions which damage or inflame the mucosa. Absorption has also been reported to occur from the peritoneum, respiratory tract, bladder, wounds, and inflamed skin.

Once neomycin is absorbed it is rapidly excreted by the kidneys in active form. It has been reported to have a half-life of 2 to 3 hours.

Uses and Administration

Neomycin is an aminoglycoside antibiotic used topically in the treatment of infections of the skin, ear, and eye due to susceptible staphylococci and other organisms. Most preparations contain the sulfate, but neomycin undecenoate is also used. Neomycin is often used with another antibacterial such as bacitracin, colistin, gramicidin, or polymyxin B. Such combinations have been used topically in the eye before ophthalmic surgery for infection prophylaxis and, with propamidine isetionate, in the treatment of acanthamoeba keratitis (p.822). A cream containing neomycin sulfate and chlorhexidine hydrochloride has been used for application to the nostrils in the treatment of staphylococcal nasal carriers (p.195) but, as with other topical antibacterial preparations, development of resistance may be a problem. Neomycin is often used with topical corticosteroids, but such preparations should be used with caution because of the risk that signs of resistant infection may be suppressed. Care must also be taken where there is skin trauma because of the risk of increased absorption and toxicity (see Adverse Effects, above). For details of bacterial skin infections and their treatment, see p.194.

Because neomycin sulfate is poorly absorbed from the gastrointestinal tract, it has been given orally for bowel preparation before abdominal surgery, often with erythromycin (p.195). Neomycin sulfate is also used with other antibacterials and antifungals in the selective decontamination of the digestive tract in patients in intensive care (p.175).

Neomycin is rarely used in the treatment of existing gastrointestinal infections. Although it has been used in the treatment of diarrhoea due to infection with enteropathogenic *Escherichia coli* (EPEC) (p.173), the use of neomycin in children with acute diarrhoea is generally not recommended.

Neomycin sulfate may be given orally to patients with incipient hepatic encephalopathy (p.1697) to reduce the flora of the gastrointestinal tract.

Neomycin has lipid regulating properties and has occasionally been given orally in the treatment of hyperlipidaemias (see below). It has also been used for the irri-