Plus; ***UK:*** Arheumacare; Digestive; HRI Golden Seal Digestive; Indian Brandee; Indigestion Relief; Neo Baby Gripe Mixture; Neo Gripe Mixture; Traveleeze; Wind & Dyspepsia Relief; Zinopin; ***Venez.:*** Ervossil; Jengimiel; Jengimiel Sabila.

Granisetron Hydrochloride

(BANM, USAN, rINNM)

BRL-43694A; Granisétron, chlorhydrate de; Granisetron-hydrochlorid; Granisetronhydroklorid; Granisetroni hydrochloridum; Granisetronihydrokloridi; Granisetrono hidrocloridas; Hidrocloruro de granisetrón. 1-Methyl-*N*-(9-methyl-9-azabicyclo[3.3.1]non-3-yl)-1*H*-indazole-3-carboxamide hydrochloride.

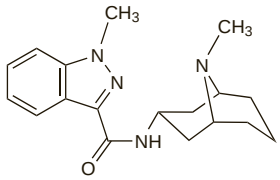
Гранисетрона Гидрохлорид

$C_{18}H_{24}N_4O$, HCl = 348.9.

CAS — 109889-09-0 (granisetron); 107007-99-8 (granisetron hydrochloride).

ATC — A04AA02.

ATC Vet — QA04AA02.



(granisetron)

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

Ph. Eur. 6.2 (Granisetron Hydrochloride). A white or almost white powder. Freely soluble in water; sparingly soluble in dichloromethane; slightly soluble in methyl alcohol. A 1% solution in water has a pH of 4.0 to 6.5.

Adverse Effects and Precautions

As for Ondansetron, p.1757, although no dosage reduction is considered necessary in renal or hepatic impairment.

Carcinogenicity. The manufacturer (*Roche*) has reported an increased incidence of hepatic neoplasms in *rodents* given very high doses of granisetron for prolonged periods, but the clinical relevance of these results is unknown. Although mutagenicity and genotoxicity have not been seen in some tests, others have reported an increased incidence of polyploidy or unscheduled DNA synthesis in exposed cells.

Effects on the cardiovascular system. For a discussion of the effects of 5-HT_3 antagonists on the cardiovascular system, see under Ondansetron, p.1757.

Interactions

The metabolism of granisetron is induced by phenobarbital.

Pharmacokinetics

Granisetron is rapidly absorbed after oral doses, with peak plasma concentrations occurring after about 2 hours. Oral bioavailability is about 60% as a result of first-pass hepatic metabolism. Granisetron has a large volume of distribution of around 3 litres/kg; plasma protein binding is about 65%. The pharmacokinetics exhibit considerable interindividual variation, and the elimination half-life after an intravenous dose is reported to be around 4 to 5 hours in healthy subjects but about 9 to 12 hours in cancer patients. It is metabolised in the liver, primarily by *N*-demethylation, with less than 20% of a dose recovered unchanged in urine, the remainder being excreted in faeces and urine as metabolites. Granisetron clearance is not affected by renal impairment, but is lower in the elderly and in patients with hepatic impairment.

Uses and Administration

Granisetron is a 5-HT_3 antagonist with an antiemetic action similar to that of ondansetron (p.1757). It is used in the management of nausea and vomiting induced by cytotoxic chemotherapy and radiotherapy and for the prevention and treatment of postoperative nausea and vomiting (p.1700). Granisetron is given as the hydrochloride, but doses are expressed in terms of the base. Granisetron hydrochloride 1.1 mg is equivalent to about 1 mg of granisetron base.

For acute **nausea and vomiting** associated with **chemotherapy** granisetron is used in *prevention* and *treatment* in similar doses.

- In the UK, a dose equivalent to 3 mg of granisetron is diluted to a volume of 20 to 50 mL with a suitable infusion solution and given intravenously over 5 minutes before the start of chemotherapy; alternatively this dose may be given in 15 mL of infusion solution as a bolus over not less than 30 seconds. The dose may be repeated up to twice in 24 hours; doses should be given at least 10 minutes apart and a total daily dose of 9 mg should not be exceeded. The efficacy of granisetron may be enhanced by the use of dexamethasone. The recommended oral dose is 1 to 2 mg within one hour before therapy begins, then 2 mg daily as a single dose or in 2 divided doses.
- For use in children, an intravenous infusion of 40 micrograms/kg, up to a maximum total dose of 3 mg, has been recommended, diluted in 10 to 30 mL of infusion fluid and given over 5 minutes. This dose may be repeated once within 24 hours, but at least 10 minutes after the original infusion. Alternatively, children may be given 20 micrograms/kg (up to 1 mg) orally twice daily for up to 5 days during therapy; the first dose should be given within 1 hour before the start of chemotherapy.
- In the USA, lower intravenous doses of the equivalent of granisetron 10 micrograms/kg are recommended in both adults and children over 2 years of age, beginning within 30 minutes before chemotherapy. Oral doses are the same as those described for the UK above.

For the *prevention* of nausea and vomiting associated with **radiotherapy** the recommended adult oral dosage is 2 mg daily taken within 1 hour of irradiation. The drug has also been given intravenously for the *treatment and prevention* of nausea and vomiting associated with radiotherapy, in similar doses to those recommended above for emetogenic chemotherapy. In the UK, the *BNFC* has recommended similar oral and intravenous doses to those given above (for chemotherapy-induced nausea and vomiting) in both the treatment and prevention of radiotherapy-induced nausea and vomiting in children.

For the *prevention* of **postoperative** nausea and vomiting in adults 1 mg is diluted to 5 mL and given by intravenous injection over 30 seconds. Injection should be completed before induction of anaesthesia. The same dose may be given up to twice daily for the *treatment* of established postoperative nausea and vomiting.

Transdermal and intranasal formulations of granisetron are under investigation.

◊ References.

1. Adams VR, Valley AW. Granisetron: the second serotonin-receptor antagonist. *Ann Pharmacother* 1995; **29:** 1240–51. Correction. *ibid.* 1996; **30:** 1043.
2. Wilson AJ, *et al.* Single-dose i.v. granisetron in the prevention of postoperative nausea and vomiting. *Br J Anaesth* 1996; **76:** 515–18.
3. Taylor AM, *et al.* A double-blind, parallel-group, placebo-controlled, dose-ranging, multicenter study of intravenous granisetron in the treatment of postoperative nausea and vomiting in patients undergoing surgery with general anesthesia. *J Clin Anesth* 1997; **9:** 658–63.
4. Blower PR. Granisetron: relating pharmacology to clinical efficacy. *Support Care Cancer* 2003; **11:** 93–100.
5. Minami M. Granisetron: is there a dose-response effect on nausea and vomiting? *Cancer Chemother Pharmacol* 2003; **52:** 89–98.
6. Prentice HG. Granisetron in the control of nausea and vomiting associated with bone marrow transplantation: a review of its efficacy and tolerability. *Support Care Cancer* 2003; **11:** 501–8.
7. Corman SL, *et al.* Low-dose granisetron for postoperative nausea and vomiting prophylaxis. *Ann Pharmacother* 2004; **38:** 710–13.
8. Goldsmith B. First choice for radiation-induced nausea and vomiting—the efficacy and safety of granisetron. *Acta Oncol* 2004; **43** (suppl 15): 19–22.
9. Aapro M. Granisetron: an update on its clinical use in the management of nausea and vomiting. *Oncologist* 2004; **9:** 673–86.

Pain. For reference to the use of granisetron in various painful syndromes see under Uses and Administration of Ondansetron, p.1758

Preparations

Proprietary Preparations (details are given in Part 3)
Arg.: Aludal; Eumetic†; Granitron; Kytril†; Rigmoz†; ***Austral.:*** Kytril; ***Austria:*** Kytril; ***Belg.:*** Kytril; ***Braz.:*** Kytril; ***Canad.:*** Kytril; ***Chile:*** Kytril; ***Cz.:*** Emegar; Kytril; ***Denm.:*** Kytril; ***Fin.:*** Kytril; ***Fr.:*** Kytril; ***Ger.:*** Kevatril; ***Gr.:*** Granitron; Kytril; ***Hong Kong:*** Kytril; ***Hung.:*** Granigen; Kytril; ***India:*** Granicip; ***Indon.:*** Kytril; ***Irl.:*** Kytril; ***Israel:*** Kytril; Setron; ***Ital.:*** Kytril; ***Jpn:*** Kytril; ***Malaysia:*** Kytril; ***Mex.:*** Kytril; ***Neth.:*** Kytril; ***Norw.:*** Kytril†; ***NZ:*** Kytril; ***Philipp.:*** Kytril; ***Port.:*** Kytril; ***Rus.:*** Kytril (Китрил); ***S.Afr.:*** Kytril; ***Singapore:*** Kytril; ***Spain:*** Kytril; ***Swed.:*** Kytril; ***Switz.:*** Kytril; ***Thai.:*** Kytril; ***Turk.:*** Kytril; Setron; ***UK:*** Kytril; ***USA:*** Kytril; ***Venez.:*** Granicip; Kytril; Rubrum.

Hydrotalcite *(BAN, rINN)*

Hidrotalcita; Hidrotalsit; Hydrotalcit; Hydrotalcitum; Hydrotalsiiti. Aluminium magnesium carbonate hydroxide hydrate.

Гидроталцит

$Mg_6Al_2(OH)_{16}CO_3{,}4H_2O$ = 604.0.

CAS — 12304-65-3.

ATC — A02AD04.

ATC Vet — QA02AD04.

NOTE. Compounded preparations of hydrotalcite may be represented by the following names:

- Co-simalcite *x/y* (*BAN*)—where *x* and *y* are the strengths in milligrams of simeticone and hydrotalcite respectively.

Pharmacopoeias. In *Br.*

BP 2008 (Hydrotalcite). A hydrated form of an aluminium magnesium basic carbonate corresponding to the formula $Al_2Mg_6(OH)_{16}CO_3{,}4H_2O$. It contains not less than 15.3% and not more than 18.7% of Al_2O_3 and not less than 36.0% and not more than 44.0% of MgO. The ratio of Al_2O_3 to MgO is not less than 0.40 and not more than 0.45. A white or almost white, free-flowing, granular powder. Practically insoluble in water; it dissolves in dilute mineral acids with slight effervescence. A 4% suspension in water has a pH of 8.0 to 10.0.

Profile

Hydrotalcite is an antacid (see p.1692) that is given in oral doses of up to about 1 g.

Preparations

BP 2008: Hydrotalcite Tablets.

Proprietary Preparations (details are given in Part 3)
Austria: Talcid; Talidat; ***Cz.:*** Rutacid; Talcid; Talidat; ***Ger.:*** Ancid; Megalac; Talcid; Talidat; ***Gr.:*** Talcid; ***Hung.:*** Talcid; Tisacid; ***Israel:*** Talcid†; ***Malaysia:*** Swecon; ***Mex.:*** Talcid; ***Neth.:*** Talcid; Talidat; Ultacit; ***Pol.:*** Malgacid; Rutacid; Talcid; Ulcetal; ***Port.:*** Talidat†; ***Rus.:*** Rutacid (Рутацид); Talcid (Тальцид); ***S.Afr.:*** Altacite; ***Spain:*** Talcid; ***Turk.:*** Talcid; ***Venez.:*** Baytalcid†.

Multi-ingredient: ***Indon.:*** Promag; ***Jpn:*** Eki Cabe; ***Philipp.:*** Simeco; ***UK:*** Altacite Plus.

Hyoscine *(BAN)*

Escopolamina; Hioscina; Hioscyna; Hyoscin; Hyoscinum; Hyoskiini; Scopolamine; Scopolaminum; Skopolamiini; Skopolamin; Skopolamina; Tropato de epoxitropina. (−)-(1*S*,3*s*,5*R*,6*R*,7*S*,8*s*)-6,7-Epoxy-3[(*S*)-tropoyloxy] tropane.

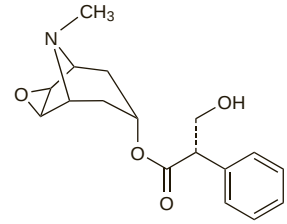
Гиосцин

$C_{17}H_{21}NO_4$ = 303.4.

CAS — 51-34-3.

ATC — A04AD01; N05CM05; S01FA02.

ATC Vet — QA04AD01; QN05CM05; QS01FA02.



NOTE. The following terms have been used as 'street names' (see p.vi) or slang names for various forms of hyoscine:
Burundanga.

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

Ph. Eur. 6.2 (Hyoscine). A white or almost white, crystalline powder or colourless crystals. M.p. 66° to 70°. Soluble in water; freely soluble in alcohol.

Hyoscine Butylbromide *(BANM)*

Butilbromuro de hioscina; Butylscopolamine Bromide; Butylscopolaminii Bromidum; *N*-Butylscopolammonium Bromide; Butylscopolamonii Bromidum; Butylskopolaminium-bromid; Escopolamina, butilbromuro de; Hioscino butilbromidas; Hioszcin-butilbromid; Hiyosin Bütilbromür; Hyoscinbutylbromid; Hyoscine-*N*-butyl Bromide; Hyoscini butylbromidum; Hyoskiinibutyylibromidi; Scopolamine *N*-Butyl Bromide; Scopolamine Butylbromide; Scopolamine, butylbromure de; Scopolamini butylbromidum; Scopolomini Butylbromidum; Skopolamino butilbromidas; Szkopolamin-butilbromid. (–)-(1*S*,3*s*,5*R*,6*R*,7*S*,8*r*)-6,7-Epoxy-8-butyl-3-[(*S*)-tropoyloxy]tropanium bromide.

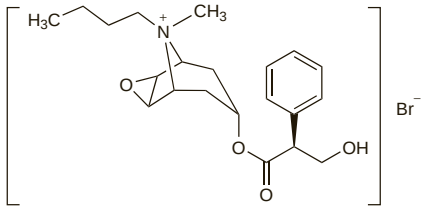
Гиосцина Бутилбромид

$C_{21}H_{30}BrNO_4$ = 440.4.

CAS — 149-64-4.

ATC — A03BB01.

ATC Vet — QA03BB01.



Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), and *Jpn*.
Ph. Eur. 6.2 (Hyoscine Butylbromide). A white or almost white, crystalline powder. Freely soluble in water and in dichloromethane; sparingly soluble in dehydrated alcohol. A 5% solution in water has a pH of 5.5 to 6.5.

Hyoscine Hydrobromide *(BANM)*

Bromhidrato de Escopolamina; Escopolamina, hidrobromuro de; Hidrobromuro de hioscina; Hioscino hidrobromidas; Hioscyny bromowodorek; Hioszcin-hidrobromid; Hiyosin Hidrobromür; Hyoscinhydrobromid; Hyoscini hydrobromidum; Hyoskiinihydrobromidi; Ioscina Bromidrato; Scopolamine Bromhydrate; Scopolamine, bromhydrate de; Scopolamine Hydrobromide; Scopolamini hydrobromidum; Scopolamini Hydrobromidum Trihydricum; Skopolamiinihydrobromidi; Skopolamin-bromid trihydrát; Skopolaminhydrobromid; Skopolamino hidrobromidas; Szkopolamin-butilbromid. (–)-(1*S*,3*s*,5*R*,6*R*,7*S*)-6,7-Epoxytropan-3-yl (*S*)-tropate hydrobromide trihydrate.

Гиосцина Гидробромид

$C_{17}H_{21}NO_4$,HBr,$3H_2O$ = 438.3.

CAS — 114-49-8 (anhydrous hyoscine hydrobromide); 6533-68-2 (hyoscine hydrobromide trihydrate).

ATC — A04AD01; N05CM05; S01FA02.

ATC Vet — QA04AD01; QN05CM05; QS01FA02.

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

Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), *Jpn*, and *US*.
Ph. Eur. 6.2 (Hyoscine Hydrobromide). A white or almost white, efflorescent, crystalline powder or colourless crystals. Freely soluble in water; soluble in alcohol. A 5% solution in water has a pH of 4.0 to 5.5. Store in well-filled airtight containers of small capacity. Protect from light.
USP 31 (Scopolamine Hydrobromide). Colourless or white crystals, or white granular powder. Is odourless and slightly efflorescent in dry air. Soluble 1 in 1.5 of water and 1 in 20 of alcohol; slightly soluble in chloroform; insoluble in ether. pH of a 5% solution in water is between 4.0 and 5.5. Store in airtight containers. Protect from light.

Hyoscine Methobromide *(BAN)*

Epoxymethamine Bromide; Escopolamina, metilbromuro de; Hyoscine Methylbromide; Methscopolamine Bromide; Metilbromuro de hioscina; Metobromuro de escopolamina; Metobromuro de hioscina; Scopolamine Methobromide; Scopolamine Methylbromide. (–)-(1*S*,3*s*,5*R*,6*R*,7*S*)-6,7-Epoxy-8-methyl-3-[(*S*)-tropoyloxy]tropanium bromide.

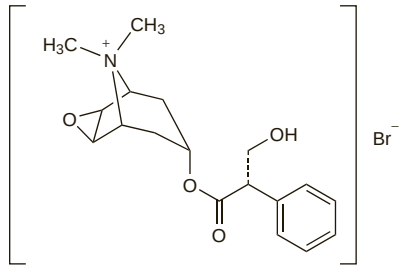
Гиосцина Метобромид

$C_{18}H_{24}BrNO_4$ = 398.3.

CAS — 155-41-9.

ATC — A03BB03; S01FA03.

ATC Vet — QA03BB03; QS01FA03.



Pharmacopoeias. In *US*.
USP 31 (Methscopolamine Bromide). Store in airtight containers. Protect from light.

Hyoscine Methonitrate *(BANM)*

Escopolamina, metilnitrato de; Hyoscine Methylnitrate; Methscopolamine Nitrate; Methylhyoscini Nitras; Methylscopolamine Nitrate; Methylscopolamini Nitras; Metilnitrato de hioscina; Metonitrato de escopolamina; Metonitrato de hioscina; Metylskopolaminnitrat; Metyyliskopolamiininitraatti; Scopolamine Methonitrate; Scopolamine Methylnitrate. (–)-(1*S*,3*s*,5*R*,6*R*,7*S*)-6,7-Epoxy-8-methyl-3-[(*S*)-tropoyloxy]tropanium nitrate.

Гиосцина Метонитрат

$C_{18}H_{24}N_2O_7$ = 380.4.

CAS — 6106-46-3.

ATC — A03BB03; S01FA03.

ATC Vet — QA03BB03; QS01FA03.

Adverse Effects, Treatment, and Precautions

As for Atropine Sulfate, p.1219. In contrast to atropine, hyoscine produces central depression at therapeutic doses and symptoms include drowsiness and fatigue. Toxic doses of hyoscine produce stimulation of the CNS in a similar manner to atropine. However, hyoscine does not stimulate the medullary centres and therefore does not produce the increases in respiration rate or blood pressure seen with atropine. Hyoscine may produce CNS stimulation rather than depression at therapeutic doses if used in the presence of pain without opioid analgesics; symptoms include excitement, restlessness, hallucinations, or delirium.

Patients who experience drowsiness should not drive or operate machinery. Caution has been advised in elderly patients and in patients with impaired liver, or kidney function, as adverse CNS effects have been stated to be more likely in these patients. There have been rare reports of an increase in frequency of seizures in epileptic patients.

The quaternary derivatives, such as the butylbromide, methobromide, or methonitrate, do not readily cross the blood-brain barrier, so central effects are rare.

Abuse. Hyoscine has been used by criminals to incapacitate and produce anterograde amnesia in their victims in crimes such as drug-facilitated rape ('date rape'), robbery, and kidnapping. In some countries in South America there has been a particular problem with the use of powders or extracts of plants containing hyoscine for such crimes. A powder, known locally as burundanga, prepared from the borrachero or borracchio tree (also referred to as cacao sabanero) has been blown into the victim's face or given in drinks, chocolate, or chewing gum.

Breast feeding. The American Academy of Pediatrics[1] states that there have been no reports of any clinical effect on the infant associated with the use of hyoscine by breast-feeding mothers, and that therefore it may be considered to be usually compatible with breast feeding.

1. American Academy of Pediatrics. The transfer of drugs and other chemicals into human milk. *Pediatrics* 2001; **108:** 776–89. Correction. *ibid.*; 1029. Also available at: http://aappolicy.aappublications.org/cgi/content/full/pediatrics%3b108/3/776 (accessed 19/01/06)

Effects on the eyes. ***ANISOCORIA.*** Although bilateral mydriasis has occurred with the use of transdermal hyoscine, development of a unilateral fixed dilated pupil (anisocoria) may be due to contamination of a finger with hyoscine in handling the device, and then rubbing the eye.[1-6] Similarly, anisocoria has been attributed[7] to ocular contamination after handling broken hyoscine methobromide tablets.

1. Chiaramonte JS. Cycloplegia from transdermal scopolamine. *N Engl J Med* 1982; **306:** 174.
2. Lepore FE. More on cycloplegia from transdermal scopolamine. *N Engl J Med* 1982; **307:** 824.
3. McCrary JA, Webb NR. Anisocoria from scopolamine patches. *JAMA* 1982; **248:** 353–4.
4. Bienia RA, *et al.* Scopolamine skin-disks and anisocoria. *Ann Intern Med* 1983; **99:** 572–3.
5. Riddick FA, Jordan JD. Cruise ship anisocoria. *Ann Intern Med* 1992; **117:** 95.
6. Lin Y-C. Anisocoria from transdermal scopolamine. *Paediatr Anaesth* 2001; **11:** 626–7.
7. Nussdorf JD, Berman EL. Anisocoria associated with the medical treatment of irritable bowel syndrome. *J Neuroophthalmol* 2000; **20:** 100–101.

GLAUCOMA. A few cases of angle-closure glaucoma, both unilateral[1] and bilateral,[2] have been associated with transdermal hyoscine devices.

1. Hamill MB. *et al.* Transdermal scopolamine delivery system (TRANSDERM-V) and acute angle-closure glaucoma. *Ann Ophthalmol* 1983; **15:** 1011–12.
2. Fraunfelder FT. Transdermal scopolamine precipitating narrow-angle glaucoma. *N Engl J Med* 1982; **307:** 1079.

STRABISMUS. Strabismus developed in a 4-year-old boy during treatment with transdermal hyoscine patches for drooling.[1] The strabismus resolved shortly after stopping hyoscine.

1. Good WV, Crain LS. Esotropia in a child treated with a scopolamine patch for drooling. *Pediatrics* 1996; **97:** 126–7.

Effects on mental function. There have been reports of psychotic reactions associated with the transdermal use of hyoscine.[1-6] Psychotic reactions have also occurred after instillation of hyoscine eye drops.[7]

1. Osterholm RK, Camoriano JK. Transdermal scopolamine psychosis. *JAMA* 1982; **247:** 3081.
2. Rodysill KJ, Warren JB. Transdermal scopolamine and toxic psychosis. *Ann Intern Med* 1983; **98:** 561.
3. MacEwan GW, *et al.* Psychosis due to transdermally administered scopolamine. *Can Med Assoc J* 1985; **133:** 431–2.
4. Ziskind AA. Transdermal scopolamine-induced psychosis. *Postgrad Med* 1988; **84:** 73–6.
5. Rubner O, *et al.* Ungewöhnlicher Fall einer Psychose infolge einer Langzeiteinwirkung mit einem Skopolaminmembranpflaster: Paranoid-halluzinatorische und delirante Symptomatik. *Nervenarzt* 1997; **68:** 77–9.
6. Minagar A, *et al.* Transderm-induced psychosis in Parkinson's disease. *Neurology* 1999; **53:** 433–4.
7. Barker DB, Solomon DA. The potential for mental status changes associated with systemic absorption of anticholinergic ophthalmic medications: concerns for the elderly. *DICP Ann Pharmacother* 1990; **24:** 847–50.

Effects on the oesophagus. A patient developed pain on swallowing after 4 days of treatment with hyoscine. Endoscopy showed oesophageal ulceration, which healed completely after 8 weeks of esomeprazole treatment.[1]

1. Philcox S, Keegan A. A case of hyoscine-related oesophagitis. *Med J Aust* 2007; **186:** 650–1.

Effects on the skin. Contact dermatitis occurred in 16 men being treated for seasickness with transdermal hyoscine for 6 weeks to 15 months.[1]

1. Gordon CR, *et al.* Allergic contact dermatitis caused by transdermal hyoscine. *BMJ* 1989; **298:** 1220–1.

Porphyria. Hyoscine butylbromide has been associated with acute attacks of porphyria and is considered unsafe in porphyric patients.

Pregnancy. A report[1] of hyoscine toxicity in a neonate born to a mother who had received a total of 1.8 mg of hyoscine in divided doses with pethidine and levorphanol before delivery. The neonate was lethargic, barrel chested, and had a heart rate of 200 beats/minute. Symptoms subsided when physostigmine 100 micrograms was given intramuscularly.

1. Evens RP, Leopold JC. Scopolamine toxicity in a newborn. *Pediatrics* 1980; **66:** 329–30.

Withdrawal. A withdrawal syndrome of dizziness and nausea[1,2] can occur in patients who have used transdermal hyoscine patches for several days; hypersalivation and diarrhoea has also been described.[3] In reported cases, transdermal hyoscine had been used continuously for 7 or 10 days to prevent motion sickness. Symptoms usually begin 2 or 3 days after the last patch has been removed, and may last for a few days.

1. Meyboom RHB. More on Transderm Scop patches. *N Engl J Med* 1984; **311:** 1377.
2. Saxena K, Saxena S. Scopolamine withdrawal syndrome. *Postgrad Med* 1990; **87:** 63–6.
3. Feder RE. Transdermal scopolamine withdrawal syndrome. *Clin Neuropharmacol* 1999; **22:** 120.

Interactions

As for antimuscarinics in general (see Atropine Sulfate, p.1220).

The sedative effect of hyoscine may be enhanced by alcohol or other CNS depressants.

Pharmacokinetics

Hyoscine is readily absorbed from the gastrointestinal tract after oral doses of the hydrobromide. It is almost entirely metabolised, probably in the liver; only a small proportion of an oral dose is excreted unchanged in the urine. It crosses the blood-brain barrier and has been stated to cross the placenta. Hyoscine is also well absorbed after application to the skin.