er conditions where inhibition of gastric acid secretion may be beneficial.

Lansoprazole is usually given orally as capsules, dispersible tablets, or suspension containing enteric-coated granules. Once daily regimens are taken before food in the morning. An intravenous formulation is also available.

For the relief of acid-related **dyspepsia** (p.1695) intermittent courses of lansoprazole may be given in doses of 15 or 30 mg once daily, for 2 to 4 weeks.

In the treatment of **gastro-oesophageal reflux disease** (p.1696) the dose is 15 to 30 mg once daily for 4 to 8 weeks; thereafter maintenance therapy can be continued with 15 or 30 mg once daily according to response. In patients unable to take oral therapy, lansoprazole may be given by intravenous infusion for the treatment of erosive oesophagitis for up to 7 days; a dose of 30 mg over 30 minutes daily is recommended.

Lansoprazole is given for the treatment of **peptic ulcer disease** (p.1702) in the UK in doses of 30 mg once daily. Treatment is continued for 2 to 4 weeks for duodenal and 4 to 8 weeks for gastric ulcer. In the USA, a dose of 15 mg daily for 4 weeks is recommended for duodenal ulcer, and 30 mg once daily is given for up to 8 weeks for gastric ulceration. When appropriate, 15 mg daily may be used as maintenance therapy for the prevention of relapse of duodenal ulcer. Lansoprazole may be combined with antibacterials in one-week **triple therapy** regimens for the eradication of *Helicobacter pylori*. Effective regimens include lansoprazole 30 mg twice daily combined with clarithromycin 500 mg twice daily and amoxicillin 1 g twice daily, or combined with clarithromycin 250 mg twice daily and metronidazole 400 mg twice daily; lansoprazole with amoxicillin and metronidazole has also been used. In patients with **NSAID-associated ulceration** a dose of 30 mg daily for 4 to 8 weeks is recommended; 15 to 30 mg daily may be used as prophylaxis for patients who require continued NSAID treatment.

In the treatment of pathological hypersecretory states such as the **Zollinger-Ellison syndrome** (p.1704) the initial dose is 60 mg once daily, adjusted as required. Doses of up to 90 mg twice daily have been used. Daily doses greater than 120 mg should be given in divided doses.

In the USA, **children** aged from 1 to 11 years may be given lansoprazole for the short-term treatment of erosive oesophagitis and symptomatic gastro-oesophageal reflux disease. Children weighing 30 kg or less should be given 15 mg once daily, and those weighing more than 30 kg are given 30 mg once daily, for up to 12 weeks. Doses of up to 30 mg twice daily have been used. In children aged from 12 to 17 years, lansoprazole 30 mg once daily for up to 8 weeks may be used for erosive oesophagitis, and 15 mg once daily for up to 8 weeks may be used for symptomatic gastro-oesophageal reflux disease. Although not licensed for children in the UK, the *BNFC* recommends comparable oral daily doses of 0.5 to 1 mg/kg in children up to 30 kg in weight, and 15 or 30 mg once daily in those over 30 kg.

Doses of lansoprazole may need to be reduced in patients with hepatic impairment (see below).

◊ General references. For general reviews of proton pump inhibitors, see Omeprazole, p.1756.

1. Langtry HD, Wilde MI. Lansoprazole: an update of its pharmacological properties and clinical efficacy in the management of acid-related disorders. *Drugs* 1997; **54:** 473–500.
2. Matheson AJ, Jarvis B. Lansoprazole: an update of its place in the management of acid-related disorders. *Drugs* 2001; **61:** 1801–33.
3. Freston JW, *et al.* Lansoprazole for maintenance of remission of erosive oesophagitis. *Drugs* 2002; **62:** 1173–84.
4. Dando TM, Plosker GL. Intravenous lansoprazole: in erosive oesophagitis. *Drugs* 2004; **64:** 2085–9.
5. Croom KF, Scott LJ. Lansoprazole: in the treatment of gastro-oesophageal reflux disease in children and adolescents. *Drugs* 2005; **65:** 2129–35.

Administration. Lansoprazole *capsules* should be swallowed whole and not crushed or chewed. Lansoprazole *dispersible tablets* should be placed on the tongue and allowed to disintegrate and the resultant granules swallowed; alternatively, the tablets may be swallowed whole with a glass of water. The tablets should not be crushed or chewed. The tablets may also be dispersed in a small amount of water and given via an oral syringe, or via a nasogastric tube. Lansoprazole *granules for oral suspension* should be reconstituted in a little water and swallowed immediately. Where the suspension formulation is not available, the contents of the capsules (enteric-coated granules) can be sprinkled on a small amount of soft food (such as yogurt or apple sauce) or mixed with a little fruit juice and swallowed. For administration via a nasogastric tube, the contents of a capsule may be mixed with 40 mL of apple juice; additional apple juice may be used to flush the tube.

Administration in hepatic impairment. Exposure to lansoprazole is increased in patients with hepatic impairment. Licensed product information recommends that patients with moderate to severe liver disease should be kept under supervision, and that the daily dose should be reduced by 50%.

Preparations

USP 31: Lansoprazole Delayed-Release Capsules.

Proprietary Preparations (details are given in Part 3)
Arg.: Ilsatec†; Lanzopral; Mesactol; Ogasto†; ***Austral.:*** Zoton; ***Austria:*** Agopton; Lansobene; ***Belg.:*** Dakar; ***Braz.:*** Anzoprol†; Lanogastro; Lanz; Lanzol; Lanzopept; Neozol; Ogastro; Prazol; ***Canad.:*** Prevacid; ***Chile:*** Fudermex; Gastride; Lanzopral; Ogasto†; Unival; ***Cz.:*** Lansone†; Lansoprol; Lanzul; ***Denm.:*** Lanzo; ***Fin.:*** Lanzo; Zolt; ***Fr.:*** Lanzor; Ogast; Ogastoro; ***Ger.:*** Agopton; Lanzor; ***Gr.:*** Elcodil; Lanciprol; Lanso; Laprazol; ***Hong Kong:*** Takepron; ***Hung.:*** Lansacid; Lansogen; Lansone; Lansoptol; Levant; Protonexa; Refluxon; ***India:*** Chexid; Lancus; Lanzol; ***Indon.:*** Compraz; Digest; Gastrolan; Inhipraz; Lancid; Lapraz; Laproton; Lasgan; Laz; Loprezol; Nufaprazol; Prazotec; Prolanz; Prosogan; Protica; Pysolan; Solans; Sopralan; Ulceran; ***Irl.:*** Lanziop; Lanzol; Razolager; Zomel; Zoton; Zotrole; ***Israel:*** Lanton; Zoton; ***Ital.:*** Lansox; Limpidex; Zoton; ***Jpn:*** Prevacid; Takepron; ***Malaysia:*** Prevacid; ***Mex.:*** Bonzol; Ilsatec; Imidex; Keval; Lafin; Lanodizol; Mavilan; Mediprim; Ogastro; Olan; Palatrin; Pranix; Safemar; Uldapril; Ulpax; ***Neth.:*** Prezal; ***Norw.:*** Lanzo; ***NZ:*** Solox; Zoton†; ***Philipp.:*** Lanzohex; Prevacid; Pylison; ***Pol.:*** LansoLek; Lanzostad; Lanzul; ***Port.:*** Alexin; Dispepci; Gastrex; Gastrolanzo; Gastroliber; Lansox; Lanzogastro; Lapol; Lizul†; Monolitum†; Ogasto; Pampe; Pepzol†; Ulcertec; ***Rus.:*** Acrilans (Акриланз); Epicur (Эпикур); Helicol (Геликол); Lanzap (Ланзап); ***S.Afr.:*** Adco-Roznal; Lancap; Lansoloc; Lanzor; ***Singapore:*** Prevacid; ***Spain:*** Bamalite; Estomil; Eudiges; Lanzol; Monolitum; Opiren; Pro Ulco; Protoner; ***Swed.:*** Lanzo; ***Switz.:*** Agopton; ***Thai.:*** Prevacid; ***Turk.:*** Aprazol; Degastrol; Helicol; Lansazol; Lansoprol; Lansor; Lanzedin; Ogastro; Opagis; Vogast; Zoprol; ***UAE:*** Lanfast; ***UK:*** Zoton; ***USA:*** Prevacid; ***Venez.:*** Biolanz; Gastrazol; Ilsatec†; Lansovax; Lanzap†; Lanzol; Lanzopral; Ogastro.

Multi-ingredient: ***Arg.:*** Heliklar†; ***Braz.:*** Anzopac†; H-Bacter; Helicopac; Heliklar; Lansodom; Lansoprid; Pylorikit; Pyloripac; Pyloritrat; ***Canad.:*** Hp-Pac; ***Fin.:*** Helipak A; Helipak K; Helipak T; ***India:*** Okalan D; Pylokit; ***Mex.:*** Pylopac; ***Turk.:*** Helipak; ***UK:*** Helicleat†; HeliMet†; ***USA:*** Prevpac.

Used as an adjunct in: ***USA:*** Prevacid NapraPAC.

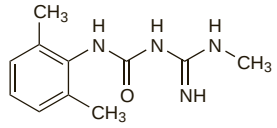
Lidamidine Hydrochloride *(USAN, rINNM)*

Hidrocloruro de lidamidina; Lidamidine, Chlorhydrate de; Lidamidini Hydrochloridum; WHR-1142A. *N*-(2,6-Dimethylphenyl)-*N'*-[imino(methylamino)methyl]urea hydrochloride.

Лидамидина Гидрохлорид

$C_{11}H_{16}N_4O,HCl$ = 256.7.

CAS — 66871-56-5 (lidamidine); 65009-35-0 (lidamidine hydrochloride).



(lidamidine)

Profile
Lidamidine is an alpha$_2$-adrenergic receptor stimulant used as the hydrochloride for the management of diarrhoea and other gastrointestinal disorders.

Preparations
Proprietary Preparations (details are given in Part 3)
Mex.: Idealid†; Supra.

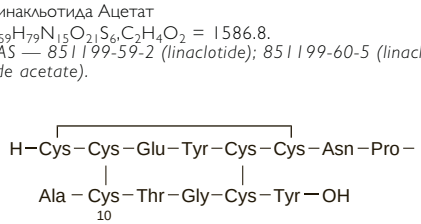
Linaclotide Acetate *(USAN, rINNM)*

Acetato de linaclotida; Linaclotide, Acétate de; Linaclotidi Acetas; MD-1100; MM-416775. [9-L-Tyrosine]heat-stable enterotoxin (Escherichia coli)-(6-19)-peptide monoacetate salt.

Линакльотида Ацетат

$C_{59}H_{79}N_{15}O_{21}S_6,C_2H_4O_2$ = 1586.8.

CAS — 851199-59-2 (linaclotide); 851199-60-5 (linaclotide acetate).



Profile
Linaclotide is a guanylate cyclase-C agonist being studied in the treatment of constipation-predominant irritable bowel syndrome and chronic constipation.

◊ References.

1. Harris LA, Crowell MD. Linaclotide, a new direction in the treatment of irritable bowel syndrome and chronic constipation. *Curr Opin Mol Ther* 2007; **9:** 403–10.
2. Andresen V, *et al.* Effect of 5 days linaclotide on transit and bowel function in females with constipation-predominant irritable bowel syndrome. *Gastroenterology* 2007; **133:** 761–8.

Liquorice

Alcaçuz; Édesgyökér; Gancao; Glycyrrhiza; Korzeń lukrecji; Lakritsijuuri; Lakritsrot; Lékořicový kořen; Licorice; Liquiritiae radix; Liquorice Root; Orozuz; Raiz de Regaliz; Regaliz; Réglisse, racine de; Saldymedžių šaknys; Süssholzwurzel.

Лакрица

Description. Liquorice is the dried rhizome and roots of *Glycyrrhiza glabra*. Those of *G. glabra* var. *typica* are known in commerce as Spanish Liquorice, those of *G. glabra* var. *glandulifera* as Russian Liquorice, and those of *G. glabra* var. *β-violacea* as Persian Liquorice.

Pharmacopoeias. In *Chin.*, *Eur.* (see p.vii), *Jpn*, and *US*. *Eur.* (see p.vii) also includes Liquorice Dry Extract for Flavouring Purposes. *US* also includes Powdered Liquorice and Powdered Licorice Extract. *Br.* also includes Liquorice Root for use in Traditional Herbal Medicine and Processed Liquorice Root for use in Traditional Herbal Medicinal Product.

Ph. Eur. 6.2 (Liquorice Root; Liquorice BP 2008). The dried unpeeled or peeled, whole or cut root and stolons of *Glycyrrhiza glabra* and/or *G. inflata* and/or *G. uralensis*. It contains not less than 4% of glycyrrhizic acid. Protect from light.

USP 31 (Licorice). The roots, rhizomes, and stolons of *Glycyrrhiza glabra* or *G. uralensis*. It contains not less than 2.5% of glycyrrhizic acid, calculated on the dried basis. Store in a cool, dry place.

BP 2008 (Liquorice Root for use in THM). It is the dried unpeeled root and rhizome of *Glycyrrhiza uralensis*, *G. inflata*, or *G. glabra*. For use in traditional Chinese medicines. It contains not less than 2.0% of glycyrrhizic acid calculated with reference to the dried material. Protect from moisture.

BP 2008 (Processed Liquorice Root for use in THMP). Liquorice Root for use in THM which has been cleaned, softened, sliced transversely or longitudinally to form uniform pieces, and dried. It contains not less than 2.0% of glycyrrhizic acid calculated with reference to the dried material. Protect from moisture.

Adverse Effects and Precautions
Liquorice has mineralocorticoid-like actions manifesting as sodium and water retention and hypokalaemia (see below).

Deglycyrrhizinised liquorice is not usually associated with such adverse effects.

Mineralocorticoid effects. Mineralocorticoid effects have been reported after excessive or prolonged ingestion of liquorice. The liquorice may be ingested in confectionery (including liquorice-flavoured chewing gum), tea, soft drinks, herbal medicines, cough mixtures, or by chewing tobacco. The enzyme 11-β-hydroxysteroid dehydrogenase (cortisol oxidase) converts cortisol to cortisone, preventing cortisol gaining access to non-specific mineralocorticoid receptors. This enzyme is inhibited by glycyrrhetinic acid (produced by the hydrolysis of glycyrrhizic acid, a natural constituent of liquorice), resulting in increased concentrations of cortisol in the body, enhancing its physiological effects.[1-3]

Clinical manifestations include consequences of sodium retention such as hypertension,[4-10] and hypokalaemia, which can result in neuromuscular disturbances ranging from muscle weakness,[11] myoclonus,[12] and myopathy[10] to paralysis[13-15] and rhabdomyolysis.[15-17] Arrhythmias[16,18] and fatal cardiac arrest[19] have also been reported.

Increased amounts of cortisol in vascular smooth muscle may cause vasoconstriction. Vasospasm of vessels supplying the optic nerve may have caused transient visual disturbances reported after liquorice ingestion.[2]

Other reported effects of liquorice include growth retardation in a boy with Addison's disease;[20] liquorice was thought to have potentiated the effect of hydrocortisone.

Endocrine effects of liquorice have been reviewed.[21] Conflicting effects on testosterone and prolactin have been reported. Components of liquorice root (which has been tried for menopausal symptoms) have both oestrogenic and anti-oestrogenic activity, and it has reportedly caused gynaecomastia.

Individuals vary markedly in their susceptibility to liquorice-induced adverse effects.[1] Those consuming 400 mg glycyrrhetinic acid daily generally experience adverse effects, but a regular daily intake of no more than 100 mg of glycyrrhetinic acid (about 50 g of liquorice sweets) has produced adverse effects in some who appear more sensitive to its effects. Some consider a daily intake of 10 mg glycyrrhetinic acid to be a safe daily dose for adults; the amount of salt consumed needs to be considered as