

with methodological limitations. However, a controlled trial of liothyronine with paroxetine could not confirm any advantage of additive therapy.³

1. Aronson R, *et al.* Triiodothyronine augmentation in the treatment of refractory depression: a meta-analysis. *Arch Gen Psychiatry* 1996; **53**: 842–8.
2. Altshuler LL, *et al.* Does thyroid supplementation accelerate tricyclic antidepressant response? A review and meta-analysis of the literature. *Am J Psychiatry* 2001; **158**: 1617–22.
3. Appelhof BC, *et al.* Triiodothyronine addition to paroxetine in the treatment of major depressive disorder. *J Clin Endocrinol Metab* 2004; **89**: 6271–6.

Obesity. Thyroid drugs have been tried in the treatment of obesity (p.2149) in euthyroid patients, but they produce only temporary weight loss, mainly of lean body-mass, and can produce serious adverse effects, especially cardiac complications.¹ Hypothyroidism has also been reported² when these drugs were withdrawn from previously euthyroid patients being treated for simple obesity. Levothyroxine appears to have been abused by some athletes to promote weight loss.³

1. Rivlin RS. Therapy of obesity with hormones. *N Engl J Med* 1975; **292**: 26–9.
2. Dornhorst A, *et al.* Possible iatrogenic hypothyroidism. *Lancet* 1981; **i**: 52.
3. MacAuley D. Drugs in sport. *BMJ* 1996; **313**: 211–15.

Urticaria. There is some suggestion that chronic urticaria (p.1584) may be associated with thyroid autoimmunity and that treatment with thyroid hormones may result in clinical remission.¹ In one study, a nine-year-old boy was successfully treated for chronic urticaria with levothyroxine therapy at doses of 50 to 100 micrograms daily.² The authors advised screening for thyroid function and anti-thyroid microsomal antibodies in cases of chronic urticaria as these patients may benefit from thyroid hormone therapy. A small investigative study concluded that treatment with levothyroxine sodium (in hypothyroid patients) or antithyroid drugs (in patients with Graves' disease) is of benefit in patients with severe chronic urticaria associated with thyroid autoimmunity.³

1. Rumblyr JS, *et al.* Resolution of chronic urticaria in patients with thyroid autoimmunity. *J Allergy Clin Immunol* 1995; **96**: 901–5.
2. Dreyfus DH, *et al.* Steroid-resistant chronic urticaria associated with anti-thyroid microsomal antibodies in a nine-year-old boy. *J Pediatr* 1996; **128**: 576–8.
3. Gaig P, *et al.* Successful treatment of chronic idiopathic urticaria associated with thyroid autoimmunity. *J Invest Allergol Clin Immunol* 2000; **10**: 342–5.

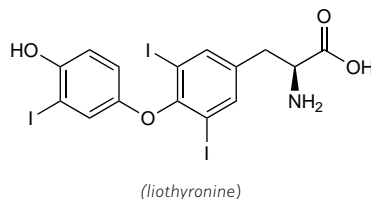
Preparations

BP 2008: Levothyroxine Tablets;
USP 31: Levothyroxine Sodium Tablets; Liotrix Tablets.

Proprietary Preparations (details are given in Part 3)

Arg.: Euthyrox; Juno; T4; **Austral.:** Eutroxig; Oroxine; **Austria:** Euthyrox; Neothyrion; Thyrex; **Belg.:** Elthyron; Euthyrox; Thyrox; **Braz.:** Euthyrox; Puran T4; Synthroid; Tetroid; Tiroidin; **Canad.:** Eltroxin; Euthyrox; Synthroid; **Chile:** Esaldox; Eutirox; **Cz.:** Eltroxin; Euthyrox; Letrox; Thyra; **Denm.:** Eltroxin; **Fr.:** Levothyrox; **Ger.:** Berthyrox; Eferox; Euthyrox; L-Thyrox; Lixin; Thevier; **Gr.:** Levothyroid; T-4; Thyro-4; Thyrothormone; **Hong Kong:** Eltroxin; **Hung.:** Euthyrox; Letrox; **India:** Eltroxin; **Indon.:** Euthyrox; Thyrox; **Irl.:** Eltroxin; **Israel:** Eltroxin; **Ital.:** Eutirox; Euthyrox; Thyra; **Jpn.:** Thyradin-S; **Malaysia:** Oroxine; **Mex.:** Abutiro; Cynocuatro; Daltroid; Eutirox; Sintroid; Tiroidine; **Neth.:** Eltroxin; Euthyrox; Thyrox; **Norw.:** Levaxin; **NZ:** Eltroxin; **Philipp.:** Eltroxin; Euthyrox; Thyra; Thyrohex; **Pol.:** Eferox; Eltroxin; Euthyrox; Letrox; **Port.:** Eutirox; Letequatro; Letter; Thyra; **Rus.:** Bagothyrox (Баготирокс); Euthyrox (Эутирокс); **S.Afr.:** Eltroxin; **Singapore:** Eltroxin; Levaxin; **Spain:** Dexnon; Eutirox; Levothyroid; **Swed.:** Euthyrox; Levaxin; **Switz.:** Eltroxin; Euthyrox; **Thai.:** Elthyro; Eltroxin; Euthyrox; Pondtroxin; Thyrosit; **Turk.:** Levotiron; Tefor; **UK:** Eltroxin; Evotrox; **USA:** Levothyroid; Levoxyl; Novothyrox; Synthroid; Unithroid; **Venez.:** Euthyrox; Thyra.

Multi-ingredient: **Arg.:** Eutroid; Levotrin; **Austria:** Combithyrex; Jodthyrox; Novothyral; Prothyrid; **Belg.:** Novothyral; **Braz.:** Tyroplus; **Chile:** Novothyral; **Cz.:** Jodthyrox; Novothyral; Thyreotom; **Fr.:** Euthyral; **Ger.:** Eferox Jod; Jodthyrox; L-Thyrox Jod; Novothyral; Prothyrid; Thyreocomb N; Thyreotom; Thyronajod; **Gr.:** Dithyron; **Ital.:** Dermocinetic; Somatoline; Tiroide Amsa; **Mex.:** Cynoplus; Novotiral; Proloid S; **Pol.:** Jodthyrox; Novothyral; **Rus.:** Jodthyrox (Йодтирокс); Novothyral (Новотирал); Thyreocomb (Тиреокс); Thyreotom (Тиреотом); **S.Afr.:** Diotroxin; **Switz.:** Novothyral; **Turk.:** Bitiron; **USA:** Thyrolar.



NOTE. The abbreviation T₃ is often used for endogenous tri-iodothyronine in medical and biochemical reports. Liotrix is *USAN* for a mixture of liothyronine sodium with levothyroxine sodium.

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

Ph. Eur. 6.2 (Liothyronine Sodium). A white or almost white or slightly coloured powder. Practically insoluble in water; slightly soluble in alcohol. It dissolves in dilute solutions of alkali hydroxides. Store at 2° to 8° in airtight containers. Protect from light.

USP 31 (Liothyronine Sodium). A light tan, odourless, crystalline powder. Very slightly soluble in water; slightly soluble in alcohol; practically insoluble in most other organic solvents. Store in airtight containers.

Adverse Effects, Treatment, and Precautions

As for Levothyroxine Sodium, p.2171.

Interactions

As for Levothyroxine Sodium, p.2172.

Pharmacokinetics

Liothyronine is readily and almost completely absorbed from the gastrointestinal tract. Once in the circulation, liothyronine binds principally to thyroxine-binding globulin (TBG), although less strongly than levothyroxine; some is also bound to thyroxine-binding pre-albumin (TBPA) or to albumin. Liothyronine has a plasma half-life in euthyroidism of about 1 to 2 days; the half-life is prolonged in hypothyroidism and reduced in hyperthyroidism.

Liothyronine is metabolised by deiodination to inactive di-iodothyronine and mono-iodothyronine. Iodine released by deiodination is largely reused within the thyroid cells. Further metabolites result from deamination and decarboxylation to tiratricol (triac).

Uses and Administration

Liothyronine is a thyroid hormone (see p.2165). It is used in the treatment of hypothyroidism (p.2167), and is believed to be more active than levothyroxine (p.2173). The onset of action of liothyronine is rapid, developing within a few hours, and therefore it tends to be used in circumstances where this, and its short duration of action, are useful, particularly in hypothyroid (myxoedema) coma.

With regular dosing the peak therapeutic effect is usually achieved after 3 days; on withdrawal its effects may persist for 1 to 3 days.

The dose of liothyronine should be individualised on the basis of clinical response and biochemical tests and should be monitored regularly. Although liothyronine is given as the sodium salt, doses can be expressed in terms of liothyronine sodium or liothyronine; the doses below are in terms of liothyronine sodium. Liothyronine sodium 10.3 micrograms is equivalent to about 10 micrograms of liothyronine. Liothyronine sodium 20 to 25 micrograms is generally considered to be equivalent in activity to about 100 micrograms of levothyroxine sodium.

In hypothyroidism a usual initial adult oral dose is 5 to 25 micrograms daily, increased gradually to a maintenance dose of 60 to 75 micrograms daily in 2 to 3 divided doses, although up to 100 micrograms daily may be required in some patients. In elderly patients, in those with cardiovascular disorders, or in those with severe long-standing hypothyroidism, treatment should be introduced with doses at the low end of the range, with smaller increments, and longer intervals between increases, as necessary.

In myxoedema coma liothyronine sodium may be given intravenously in a dose of 5 to 20 micrograms by slow intravenous injection, repeated as necessary, usually at intervals of 12 hours; the minimum interval between doses is 4 hours. An alternative regimen advocates an initial dose of 50 micrograms intravenously followed by further injections of 25 micrograms every 8 hours until improvement occurs; the dosage may then be reduced to 25 micrograms intravenously twice daily.

Liothyronine has also been given in the diagnosis of hyperthyroidism in adults. Failure to suppress the uptake of radio-iodine after several days of receiving liothyronine sodium suggests a diagnosis of hyperthyroidism.

Liothyronine hydrochloride has also been used.

Preparations

BP 2008: Liothyronine Tablets;
USP 31: Liothyronine Sodium Tablets; Liotrix Tablets.

Proprietary Preparations (details are given in Part 3)

Austral.: Tertroxin; **Braz.:** Cynomel; **Canad.:** Cytomel; **Cz.:** Tertroxin; **Fr.:** Cynomel; **Ger.:** Thybon; Thyrotardin N; **Gr.:** Cynomel; T-3; **Ital.:** Disporin; Ti-Tre; **Mex.:** Cynomel; Liotrex; Triyotex; **Neth.:** Cytomel; **NZ:** Tertroxin; **Port.:** Neo-Tiroidade; **S.Afr.:** Tertroxin; **Thai.:** Tertroxin; **Turk.:** Tiroidel; **UK:** Tertroxin; Triiodothyronine Injection; **USA:** Cytomel; Triostat; **Venez.:** Tertroxin;

Multi-ingredient: **Arg.:** Eutroid; Levotrin; Tresite F; **Austria:** Combithyrex; Novothyral; Prothyrid; **Belg.:** Novothyral; **Braz.:** Tyroplus; **Chile:** Novothyral; **Cz.:** Novothyral; Thyreotom; **Fr.:** Euthyral; **Ger.:** NeyNormin N (Revitorgan-Dilutionen N Nr 65); NeyTumirin N (Revitorgan-Dilutionen N Nr 66); Novothyral; Prothyrid; Thyreotom; **Gr.:** Dithyron; **Ital.:** Tiroide Amsa; **Mex.:** Cynoplus; Novotiral; Proloid S; Redotex; **Pol.:** Novothyral; **Rus.:** Novothyral (Новотирал); Thyreocomb (Тиреокс); Thyreotom (Тиреотом); **S.Afr.:** Diotroxin; **Switz.:** Novothyral; **Turk.:** Bitiron; **USA:** Thyrolar.

Potassium Perchlorate

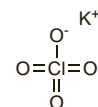
Chloristan draselny; Kalii perchloras; Kalio perchloratas; Kaliumperkloraatti; Kaliumperklorat; Kálium-perklorát; Perclorato potásico; Potassium, perchlorate de.

KClO₄ = 138.5.

CAS — 7778-74-7.

ATC — H03BC01.

ATC Vet — QH03BC01.



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

Ph. Eur. 6.2 (Potassium Perchlorate). A white or almost white crystalline powder or colourless crystals. Sparingly soluble in water; practically insoluble in alcohol.

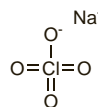
USP 31 (Potassium Perchlorate). pH of a 0.1M solution in water is between 5.0 and 6.5.

Sodium Perchlorate

Perclorato sódico; Soda naddchloran.

NaClO₄ = 122.4.

CAS — 7601-89-0 (anhydrous sodium perchlorate); 7791-07-3 (sodium perchlorate monohydrate).



(anhydrous sodium perchlorate)

Handling. Potassium and sodium perchlorate have been used for the illicit preparation of explosives or fireworks; care is required with their supply. Great caution should be taken in handling perchlorates in solution or in the dry state as explosions may occur if brought into contact with organic or other readily oxidisable substances.

Adverse Effects

Fever and rashes have occurred after use of perchlorate. Some patients may experience nausea and vomiting. Potassium perchlorate seldom produces adverse effects when given as a single dose for diagnostic purposes. Prolonged use as an antithyroid drug has been

Liothyronine Sodium (BANM, rINNM)

Liothyronin sodná sůl; Liothyronine sodique; Liothyroninum natrium; Liotironin Sodyum; Liotironina sódica; Liotironin-nátrium; Liotironina natrio druska; Liotironiinatrium; Liothyronina sodowa; Liotironinnatrium; Natrii Liothyroninum; Sodium Liothyronine; L-Tri-iodothyronine Sodium; 3,5,3'-Tri-iodo-L-thyronine Sodium; Tri-iodotironin Sodyum; Sodium 4-O-(4-hydroxy-3-iodophenyl)-3,5-di-iodo-L-tyrosine.

Натрий Лиотиронин

C₁₅H₁₁I₃NNaO₄ = 673.0.

CAS — 6893-02-3 (liothyronine); 55-06-1 (liothyronine sodium); 8065-29-0 (liotrix).

ATC — H03AA02.

ATC Vet — QH03AA02.