

Sodium iodide (¹³¹I) is given orally and by intravenous injection in studies of thyroid function, particularly in measurements of the uptake of iodine by the thyroid, and in thyroid scanning. It is also used in the treatment of hyperthyroidism and in the treatment of malignant neoplasms of the thyroid.

Injections containing iobenguane (¹³¹I) (*m*-iodobenzylguanidine (¹³¹I)) may be used for the localisation and treatment of pheochromocytoma (p.1179) and neuroblastoma (p.674).

Human albumin iodinated with iodine-131 is used in the determination of the blood or plasma volume.

Sodium iodohippurate (¹³¹I) is used intravenously for renal-function tests and for renal imaging.

Rose bengal sodium (¹³¹I) has been given intravenously in tests of liver function.

Iodinated (¹³¹I) norcholesterol (6β-iodomethyl-19-norcholesterol-5(10)-en-3β-ol (¹³¹I)) has been used for adrenal scintigraphy by slow intravenous injection.

Various monoclonal antibodies labelled with iodine-131 are used for the detection of malignant neoplasms and some are used for therapeutic purposes, such as iodine (¹³¹I) tositumomab for non-Hodgkin's lymphoma.

Preparations

Ph. Eur.: Iobenguane(I) Injection for Diagnostic Use; Iobenguane(I) Injection for Therapeutic Use; Iodinated(I) Norcholesterol Injection; Sodium Iodide(I) Capsules for Diagnostic Use; Sodium Iodide(I) Capsules for Therapeutic Use; Sodium Iodide(I) Solution; Sodium Iodide(I) Solution for Radiolabelling; Sodium Iodohippurate(I) Injection; **USP 31:** Iobenguane I 131 Injection; Iodinated I 131 Albumin Aggregated Injection; Iodinated I 131 Albumin Injection; Iodohippurate Sodium I 131 Injection; Rose Bengal Sodium I 131 Injection; Sodium Iodide I 131 Capsules; Sodium Iodide I 131 Solution.

Proprietary Preparations (details are given in Part 3)

Cz.: Capsion; Curicap; Hippuran; Lipiocis†; Theracap; **Neth.:** Capsion; Iobenguane; MIBG; Theracap; **Port.:** Capsion; Curicap; Theracap; **Spain:** Curicap; **UK:** Capsion; Theracap; **USA:** Bexxar; Hicon; Iodotope.

Iron-59

Hierro 59.

CAS — 14596-12-4.

ATC — V09XX04 (*ferric citrate* (⁵⁹Fe)).

ATC Vet — QV09XX04 (*ferric citrate* (⁵⁹Fe)).

HALF-LIFE. 44.6 days.

Profile

Iron-59, in the form of ferrous citrate (⁵⁹Fe) or ferric citrate (⁵⁹Fe), has been used by intravenous injection in the measurement of iron absorption and utilisation. Ferric chloride (⁵⁹Fe) has been given for the same purpose.

Krypton-81m

Criptón 81m.

CAS — 15678-91-8.

ATC — V09EX01 (*krypton gas* (^{81m}Kr)).

ATC Vet — QV09EX01 (*krypton gas* (^{81m}Kr)).

HALF-LIFE. 13.1 seconds.

Profile

Krypton-81m is a daughter of rubidium-81 (⁸¹Rb, half-life 4.58 hours), and is prepared immediately before use by elution from a generator containing rubidium-81 adsorbed on a suitable ion-exchange column using air or oxygen as the eluent. Krypton-81m is used as a gas in lung ventilation studies. Such ventilation studies can be combined with lung perfusion studies to diagnose pulmonary embolism.

Preparations

Ph. Eur.: Krypton(Kr) Inhalation Gas;

USP 31: Krypton Kr 81m.

Proprietary Preparations (details are given in Part 3)

Cz.: KryptoScan; **Neth.:** KryptoScan.

Nitrogen-13

Nitrógeno 13.

CAS — 13981-22-1.

HALF-LIFE. 9.96 minutes.

Profile

Nitrogen-13 is a positron-emitting radionuclide that is used in positron-emission tomography (see Emissions from Radioisotopes, p.2052). In the form of ammonia (¹³N) it is given intravenously for imaging blood flow in organs such as the heart, brain, and liver. Nitrogen gas (¹³N) may be used for pulmonary ventilation studies.

Preparations

Ph. Eur.: Ammonia(N) Injection;

USP 31: Ammonia N 13 Injection.

The symbol † denotes a preparation no longer actively marketed

Oxygen-15

Oxígeno 15.

CAS — 13982-43-9.

HALF-LIFE. 2 minutes.

Profile

Oxygen-15 is a positron-emitting radionuclide used in positron-emission tomography (see Emissions from Radioisotopes, p.2052). It is used in the form of water (¹⁵O) and is given intravenously to study cerebral and myocardial perfusion.

Oxygen gas, carbon dioxide, and carbon monoxide have also been labelled with oxygen-15.

Preparations

Ph. Eur.: Carbon Monoxide(O); Oxygen(O); Water(O) Injection;

USP 31: Water O 15 Injection.

Phosphorus-32

Fósforo 32.

CAS — 14596-37-3.

ATC — V10AX01 (*phosphorus chromic phosphate colloid* (³²P)); V10XX01 (*sodium phosphate* (³²P)).

ATC Vet — QV10AX01 (*phosphorus chromic phosphate colloid* (³²P)); QV10XX01 (*sodium phosphate* (³²P)).

HALF-LIFE. 14.3 days.

Profile

Phosphorus-32, given as sodium phosphate (³²P), is used intravenously in the treatment of polycythaemia vera (p.654). Phosphorus-32 is taken up by the rapidly proliferating haematopoietic cells sufficiently to reduce their reproduction. Sodium phosphate (³²P) has also been used intravenously in the treatment of chronic myeloid (p.653) and chronic lymphocytic leukaemia (p.653) and in the palliative treatment of bone metastases.

Chromic phosphate (³²P) is given intraperitoneally or intrapleurally in the treatment of malignant effusions (p.659); it may also be given by interstitial injection for the treatment of ovarian (p.670) or prostatic carcinoma (p.671).

Preparations

Ph. Eur.: Sodium Phosphate(P) Injection;

USP 31: Chromic Phosphate P 32 Suspension; Sodium Phosphate P 32 Solution.

Proprietary Preparations (details are given in Part 3)

USA: Phosphocol.

Rhenium-186

Renio 186.

CAS — 14998-63-1.

ATC — V10AX05 (*rhenium sulfide colloid* (¹⁸⁶Re)); V10BX03 (*rhenium etidronate* (¹⁸⁶Re)).

ATC Vet — QV10AX05 (*rhenium sulfide colloid* (¹⁸⁶Re)); QV10BX03 (*rhenium etidronate* (¹⁸⁶Re)).

HALF-LIFE. 90.6 hours.

Profile

Rhenium-186 has been used in colloidal form for the treatment of arthritic joint conditions. Rhenium (¹⁸⁶Re) etidronate is used for the palliation of painful bone metastases of prostate cancer. Etidronate labelled with another isotope, rhenium-188, has also been used. Monoclonal antibodies labelled with rhenium-186 have been investigated for the treatment of various malignant neoplasms.

Preparations

Proprietary Preparations (details are given in Part 3)

Cz.: Nanocis; RE-186-MM-1; Re-Bone.

Rubidium-82

Rubidio 82.

CAS — 14391-63-0.

HALF-LIFE. 75 seconds.

Profile

Rubidium-82 is a positron-emitting radionuclide that is used in positron-emission tomography (see Emissions from Radioisotopes, p.2052). Rubidium chloride (⁸²Rb) is given intravenously for cardiac imaging.

Preparations

USP 31: Rubidium Chloride Rb 82 Injection.

Samarium-153

Samario 153.

CAS — 15766-00-4.

ATC — V10AX02 (*samarium hydroxyapatite colloid* (¹⁵³Sm)); V10BX02 (*samarium lexidronam* (¹⁵³Sm)).

ATC Vet — QV10AX02 (*samarium hydroxyapatite colloid* (¹⁵³Sm)); QV10BX02 (*samarium lexidronam* (¹⁵³Sm)).

HALF-LIFE. 47 hours.

Profile

Samarium-153, in the form of samarium (¹⁵³Sm) lexidronam (samarium (¹⁵³Sm) EDTMP) is used for the palliative treatment of painful bone metastases (p.660). It is given by intravenous injection.

◇ References.

- Sartor O, *et al.* Samarium-153-lexidronam complex for treatment of painful bone metastases in hormone-refractory prostate cancer. *Urology* 2004; **63**: 940–5.

Preparations

USP 31: Samarium Sm 153 Lexidronam Injection.

Proprietary Preparations (details are given in Part 3)

Austral.: Quadramet†; **Cz.:** Quadramet; **Fr.:** Quadramet†; **Ital.:** Quadramet; **Neth.:** Quadramet; **Port.:** Quadramet; **Spain:** Quadramet; **UK:** Quadramet; **USA:** Quadramet.

Selenium-75

Selenio 75.

CAS — 14265-71-5.

ATC — V09DX01 (*selenium tauroselcholic acid* (⁷⁵Se)); V09XX03 (*selenium norcholesterol* (⁷⁵Se)).

ATC Vet — QV09DX01 (*selenium tauroselcholic acid* (⁷⁵Se)); QV09XX03 (*selenium norcholesterol* (⁷⁵Se)).

HALF-LIFE. 118.5 days.

Profile

Selenium-75 in the form of tauroselcholic acid (⁷⁵Se) (⁷⁵SeHCAT) is used orally in the measurement of bile acid absorption for the assessment of ileal function.

Selenium-75 in the form of 6β-[methyl(⁷⁵Se)seleno]methyl]-19-norcholesterol-5(10)-en-3β-ol (selenonorcholenol (⁷⁵Se)) has been used intravenously in adrenal scintigraphy.

Preparations

Proprietary Preparations (details are given in Part 3)

Neth.: SeHCAT; **UK:** Scintadren.

Strontium-89

Estroncio 89.

CAS — 14158-27-1.

ATC — V10BX01 (*strontium chloride* (⁸⁹Sr)).

ATC Vet — QV10BX01 (*strontium chloride* (⁸⁹Sr)).

HALF-LIFE. 50.5 days.

Profile

Strontium-89, in the form of strontium chloride (⁸⁹Sr), is used for the palliation of pain in patients with bone metastases (p.660); it is given intravenously.

◇ References.

- Robinson RG, *et al.* Strontium 89 therapy for the palliation of pain due to osseous metastases. *JAMA* 1995; **274**: 420–4.

Preparations

Ph. Eur.: Strontium(Sr) Chloride Injection;

USP 31: Strontium Chloride Sr 89 Injection.

Proprietary Preparations (details are given in Part 3)

Austral.: Metastron; **Austria:** Metastron; **Cz.:** Metastron; **Fr.:** Metastron; **Ital.:** Metastron; **Neth.:** Metastron; **Port.:** Metastron; **Spain:** Metastron; **UK:** Metastron; **USA:** Metastron.

Techneium-99m

Tecnecio 99m.

CAS — 14133-76-7 (*technetium-99*).

ATC — V09AA01 (*technetium exametazime* (^{99m}Tc)); V09AA02 (*technetium bicisate* (^{99m}Tc)); V09BA01 (*technetium oxidronate* (^{99m}Tc)); V09BA02 (*technetium medronate* (^{99m}Tc)); V09BA03 (*technetium pyrophosphate* (^{99m}Tc)); V09BA04 (*technetium butedronate* (^{99m}Tc)); V09CA01 (*technetium pentetate* (^{99m}Tc)); V09CA02 (*technetium succimer* (^{99m}Tc)); V09CA03 (*technetium meritide* (^{99m}Tc)); V09CA04 (*technetium gluceptate* (^{99m}Tc)); V09CA05 (*technetium gluconate* (^{99m}Tc)); V09DA01 (*technetium disofenin* (^{99m}Tc)); V09DA02 (*technetium etifenin* (^{99m}Tc)); V09DA03 (*technetium lidofenin* (^{99m}Tc)); V09DA04 (*technetium mebrofenin* (^{99m}Tc)); V09DA05 (*technetium galitfenin* (^{99m}Tc)); V09DB01 (*technetium nanocolloid* (^{99m}Tc)); V09DB02 (*technetium microcolloid* (^{99m}Tc)); V09DB03 (*technetium millimicrospheres* (^{99m}Tc)); V09DB04 (*technetium tin colloid* (^{99m}Tc)); V09DB05 (*technetium sulfur colloid* (^{99m}Tc)); V09DB06 (*technetium rhenium sulfide colloid* (^{99m}Tc)); V09DB07 (*technetium phytate* (^{99m}Tc)); V09EA01 (*technetium pentetate* (^{99m}Tc)); V09EA02 (*technetium technegas* (^{99m}Tc)); V09EA03 (*technetium nanocolloid* (^{99m}Tc)); V09EB01 (*technetium macrosalb* (^{99m}Tc)); V09EB02 (*technetium microspheres* (^{99m}Tc)); V09FX01 (*technetium pertechnetate* (^{99m}Tc)); V09GA01 (*technetium sestamibi* (^{99m}Tc)); V09GA02 (*technetium tetrofosmin* (^{99m}Tc)); V09GA03 (*technetium teboroxime* (^{99m}Tc)); V09GA04 (*technetium human albumin* (^{99m}Tc)); V09GA05 (*technetium furifosmin* (^{99m}Tc)); V09GA06 (*technetium stannous agent labelled cells* (^{99m}Tc)); V09GA07 (*technetium apcitide* (^{99m}Tc)); V09HA01 (*technetium human immunoglobulin* (^{99m}Tc)); V09HA02 (*technetium exametazime labelled cells*).