Sodium thiosulfate has been used in humans to treat extravasation injuries secondary to carboplatin or cisplatin, for prophylaxis to prevent nephrotoxicity after cisplatin overdoses and ototoxicity with carboplatin overdoses.

Sodium thiosulfate's topical antifungal activity is probably due to its slow release of colloidal sulfur.

While sodium thiosulfate has been recommended for treating arsenic (and some other heavy metal) poisoning, the proposed mechanism of action is not known and its efficacy is in question. Presumably, the sulfate moiety may react with and chelate the metal allowing its removal.

Pharmacokinetics

Sodium thiosulfate is relatively poorly absorbed from the GI tract. When substantial doses are given PO, it acts a saline cathartic. When administered intravenously, it is distributed in the extracellular fluid and then rapidly excreted via the urine.

Contraindications/Precautions/Warnings

There are no absolute contraindications to the use of the drug.

Adverse Effects

The drug is relatively non-toxic. Large doses by mouth may cause profuse diarrhea. Injectable forms should be given slowly IV.

Reproductive/Nursing Safety

Safe use during pregnancy has not been established; use when benefits outweigh the potential risks. In humans, the FDA categorizes this drug as category ***C*** for use during pregnancy (*Animal studies have shown an adverse effect on the fetus, but there are no adequate studies in humans; or there are no animal reproduction studies and no adequate studies in humans.*)

No lactation information was found.

Drug Interactions/Laboratory Considerations

No specific drug or laboratory interactions or considerations were noted.

Doses

▪ DOGS, CATS:

a) For cyanide toxicity: Contact an animal poison control center for guidance.

b) For treating extravasation injuries secondary to doxorubicin, carboplatin, cisplatin infusions: **Note:** These are recommendations for human patients.

Doxorubicin: Subcutaneous sodium thiosulfate 2% added to therapy with subcutaneous hydrocortisone and topical betamethasone decreased the healing time by half for cytotoxic drug extravasation (including doxorubicin and epirubicin) when compared to therapy without sodium thiosulfate.

Carboplatin: Prepare a 0.17 moles/L solution by mixing 4 mL sodium thiosulfate 10% w/v with 6 mL sterile water for injection. Inject 5 mL into extravasation site.

Cisplatin: For extravasation of large amounts (greater than 20 mL) of highly concentrated (greater than 0.5 mg/mL) solutions: Prepare a 0.17 moles/L solution by mixing 4 mL sodium thiosulfate 10% w/v with 6 mL sterile water for injection. Inject into extravasation site. (DRUGDEX® Evaluations. Micromedex Healthcare Series; Thompson, 2007)

▪ HORSES:

a) For cyanide toxicity: First give sodium nitrite at a dose of 16 mg/kg IV followed with a 20% solution of sodium thiosulfate given at a dose of 30–40 mg/kg IV. If repeating treatment, use sodium thiosulfate only. (Bailey and Garland 1992)

b) For cyanide toxicity: First give sodium nitrite in a 20% solution at a dose of 10–20 mg/kg IV followed with a 20% solution of sodium thiosulfate given at a dose of 30–40 mg/kg IV (Osweiler 2003)

c) For arsenic toxicity: Sodium thiosulfate at 20–30 grams in 300 mL of water orally with dimercaprol (BAL) 3 mg/kg IM q4h (Jones 2004c)

▪ RUMINANTS:

Note: When used in food animals, FARAD states that this salt is rapidly excreted and is not considered a residue concern in animal tissues; therefore, a 24 hour preslaughter withdrawal interval (WDI) would be sufficient. (Haskell, Payne et al. 2005)

a) In combination with sodium molybdate for the treatment of copper poisoning: In conjunction with fluid replacement therapy, 500 mg sodium thiosulfate in combination with 200 mg ammonium or sodium molybdate PO daily for up to 3 weeks will help decrease total body burden of copper (Thompson and Buck 1993)

b) For treatment of cyanide toxicity secondary to cyanogenic plants: 660 mg/kg IV sodium thiosulfate in a 30% solution given rapidly using a 12 or 14 gauge needle (Nicholson 1993), (Post and Keller 2000)

c) For treatment of arsenic poisoning: 30–60 grams PO every 6 hours for 3–4 days and 30–60 grams as a 10–20% solution IV may be potentially useful in binding arsenic. Adjunctive fluid and electrolyte replacement is necessary. (Galey 1993)

Chemistry/Synonyms

Sodium thiosulfate occurs as large, colorless crystals or coarse, crystalline powder. It is very soluble in water, deliquescent in moist air and effloresces in dry air at temperatures >33°C.

Sodium thiosulfate may also be known as: natrii thiosulfas, natrium thiosulfuricum, sodium hyposulphite, sodium thiosulphate, *Consept Step 2®*, *Hiposul®*, *Hyposulfene®*, or *S-hydril®*.

Storage/Stability/Compatibility

Unless otherwise stated by the manufacturer, store at room temperature. Crystals should be stored in tight containers.

Sodium thiosulfate is **not compatible** mixed with cyanocobalamin.

Dosage Forms/Regulatory Status

VETERINARY-LABELED PRODUCTS: None

HUMAN-LABELED PRODUCTS:

Sodium Thiosulfate for Injection: 10% (100 mg/mL, as pentahydrate) & 25% (250 mg/mL) preservative-free in 10 mL & 50 mL single-use vials; generic, (American Regent); (Rx)

SOMATOTROPIN (GROWTH HORMONE)

(soe-ma-toe-***troe***-pin)

HORMONE

Prescriber Highlights

- Used for canine hypopituitary dwarfism or growth hormone-responsive dermatosis (in adult dogs).
- May cause diabetes mellitus
- Availability & expense issues

Uses/Indications
Somatotropin may be useful in treating hypopituitary dwarfism or growth hormone-responsive dermatosis (in adult dogs).

Pharmacology/Actions
Growth hormone (somatotropin) is responsible for, or contributes to, linear and skeletal growth, organ growth, and cell growth. It also is a factor in protein, carbohydrate, lipid, connective tissue, and mineral metabolism.

Pharmacokinetics
No canine information was located. Both the liver and kidney are major elimination organs for somatotropin.

Contraindications/Precautions/Warnings
Growth hormone derived from other species is contraindicated in patients hypersensitive to it.

Adverse Effects
Growth hormone may cause diabetes mellitus in dogs. This may be transient or permanent even after discontinuing treatment. Blood and urine glucose should be routinely monitored. If blood glucose exceeds 150 mg/dl, therapy should be stopped. Hypersensitivity reactions are possible, but less so if using porcine origin product. Long-term treatment at high doses may cause acromegaly. Acromegaly in dogs can cause increased size of paws and head, increased skin folds around head and neck area, prognathism, and inspiratory stridor.

Reproductive/Nursing Safety
In humans, the FDA categorizes this drug as category ***C*** for use during pregnancy (*Animal studies have shown an adverse effect on the fetus, but there are no adequate studies in humans; or there are no animal reproduction studies and no adequate studies in humans.*)

Overdosage/Acute Toxicity
Acute overdosage could cause hypoglycemia initially and then hyperglycemia. Blood glucose should be monitored and supportive treatment (glucose/insulin) performed.

Drug Interactions
The following drug interactions have either been reported or are theoretical in humans or animals receiving somatotropin and may be of significance in veterinary patients:

- **GLUCOCORTICOIDS**: May inhibit the growth promoting effect of somatotropin. When concurrent adrenal insufficiency is diagnosed, adjust glucocorticoid dose carefully to avoid negative effects on growth.

Doses
- **DOGS:**
  a) For treatment of hypopituitary dwarfism: 0.1 IU (0.05 mg)/kg SC three times per week for 4–6 weeks. **Note:** May also require life-long thyroid hormone supplementation and if secondary adrenal insufficiency present, glucocorticoid treatment. If after successful treatment, dermatologic signs recur, may dose as above (0.1 IU/kg three times weekly for one week). Repeat these weekly regimens at intervals determined by the time lapse between treatments and relapse. (Feldman and Nelson 1996)
  b) For treatment of growth hormone-responsive dermatosis in adult dogs: Dose as above (a), but thyroid and steroid supplementation not required (Feldman and Nelson 1996)
  c) For Alopecia X: 0.15 IU/kg of porcine growth hormone SC 2 times weekly for 6 weeks. (Hillier 2006a)

Monitoring
- Clinical efficacy
- Blood glucose (weekly)
- Urine glucose (daily)
- Thyroid function, adrenal function initially and then periodically (pituitary dwarfism pts.)

Client Information
- Clients should be instructed on the methods for SC injection and testing urine glucose
- May be expensive to treat and diabetes (permanent) can occur

Synonyms
Somatotropin may also be known as: CB-311, HGH, human growth hormone, LY-137998, somatropinum; many trade names are available.

Dosage Forms/Regulatory Status
There are several manufacturers of human recombinant DNA origin somatotropin products, but these are expensive, can cause immunogenicity reactions in dogs, and not sold for veterinary use.

The bovine recombinant growth hormone product (*Posilac*®—Monsanto) is not suitable for canine use as it is a sustained release formulation and not easily diluted down to the smaller doses required for dogs.

Porcine growth hormone appears to have little immunogenicity in dogs and reportedly can be obtained via: Dr A. F. Partlow at: 310-222-3537 E-Mail: Partlow@HUMC.edu WEBSITE: www.humc.edu/hormones

The ARCI (Racing Commissioners International) has designated this drug as a class 2 substance. See the appendix for more information.

SOTALOL HCL

(***soh***-ta-lole) Betapace®

BETA-ADRENERGIC BLOCKER

Prescriber Highlights
- **Non-selective beta blocker/Class III antiarrhythmic for ventricular tachycardia**
- **Adverse Effects: Most serious: negative inotropism & pro-arrhythmic but dyspnea/bronchospasm, fatigue/dizziness, & nausea/vomiting possible**
- **Treatment is relatively expensive**

Uses/Indications
Sotalol may be useful in the treatment of ventricular tachycardias and, possibly, supraventricular tachycardias in dogs.

Pharmacology/Actions
Sotalol is a non-selective beta-blocker and Class III antiarrhythmic agent. The beta blocking activity of sotalol is about 30% that of propranolol. Its primary usage in veterinary medicine is associated with its antiarrhythmic activity. Like other Class III drugs, it prolongs repolarization and refractoriness without affecting conduction. The pharmacologic action is believed caused by selectively inhibiting potassium channels.