

HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use HEPARIN SODIUM INJECTION safely and effectively. See full prescribing information for HEPARIN SODIUM INJECTION.

HEPARIN SODIUM INJECTION, for intravenous or subcutaneous use
Initial U.S. Approval: 1939

INDICATIONS AND USAGE

HEPARIN SODIUM INJECTION is an anticoagulant indicated for (1):

- Prophylaxis and treatment of venous thromboembolism
- Prophylaxis and treatment of the thromboembolic complications associated with atrial fibrillation
- Treatment of acute and chronic consumption coagulopathies
- Prevention of clotting in arterial and cardiac surgery
- Prophylaxis and treatment of peripheral arterial embolism
- Anticoagulant use in transfusion, extracorporeal circulation, and dialysis procedures

DOSAGE AND ADMINISTRATION

Recommended Adult Dosages:

- Therapeutic Anticoagulant Effect with Full-Dose Heparin[†] (2.3)

Deep Subcutaneous (Intrafat) Injection <i>Use a different site for each injection</i>	Initial Dose	333 units/kg subcutaneously
	Every 12 hours	250 units/kg subcutaneously
Intermittent IV Injection	Initial Dose	10,000 units
	Every 4 to 6 hours	5,000 to 10,000 units
Continuous IV Infusion	Initial Dose	5,000 units
	Continuous	20,000 to 40,000 units/24 hours

[†] Based on 150 lb. (68 kg) patient. Adjust dose based on laboratory monitoring.

- Cardiovascular Surgery (2.5)

Intravascular via Total Body Perfusion	Initial Dose	≥150 units/kg; adjust for longer procedures
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- Low-dose Prophylaxis of Postoperative Thromboembolism (2.6)

Deep Subcutaneous (Intrafat) Injection	Initial Dose	5,000 units 2 hours before surgery
	Every 8 to 12 hours	5,000 units

- Extracorporeal dialysis (2.10)

Intravascular via Extracorporeal Dialysis	25 to 30 units/kg followed by infusion rate of 1,500 to 2,000 units/hour if manufacturers' recommendations are not available
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DOSAGE FORMS AND STRENGTHS

Preservative-free	Preserved with Benzyl Alcohol
1,000 units per mL Vial: 2,000 units in 2 mL	1,000 units per mL Vial: 10,000 units in 10 mL
	5,000 units per mL Vial: 50,000 units in 10 mL Vial: 5,000 units in 1 mL
	10,000 units per mL Vial: 10,000 units in 1 mL

CONTRAINDICATIONS

- History of heparin-induced thrombocytopenia (HIT) or heparin-induced thrombocytopenia and thrombosis (HITTS) (4)
- Known hypersensitivity to heparin or pork products (4)
- In whom suitable blood coagulation tests cannot be performed at appropriate intervals (4)

WARNINGS AND PRECAUTIONS

- Fatal Medication Errors: Confirm choice of correct strength prior to administration. (5.1)
- Hemorrhage: Fatal cases have occurred. Use caution in conditions with increased risk of hemorrhage. (5.2)
- HIT and HITTS: Monitor for signs and symptoms and discontinue if indicative of HIT and HITTS. (5.3)
- Benzyl Alcohol Toxicity: Use preservative-free formulation in neonates and infants. (5.4)
- Monitoring: Blood coagulation tests guide therapy for full-dose heparin. Monitor platelet count and hematocrit in all patients receiving heparin. (5.5, 5.6)

ADVERSE REACTIONS

Most common adverse reactions are hemorrhage, thrombocytopenia, HIT and HITTS, injection site irritation, general hypersensitivity reactions, and elevations of aminotransferase levels. (6.1)

To report SUSPECTED ADVERSE REACTIONS, contact Pfizer at 1-800-438-1985 or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.

DRUG INTERACTIONS

- Drugs that interfere with platelet aggregation: May induce bleeding. (7.1)

USE IN SPECIFIC POPULATIONS

- Pregnancy: Preservative-free formulation recommended. Limited human data in pregnant women. (8.1)
- Nursing Mothers: Preservative-free formulation recommended. Caution should be exercised when administered to a nursing woman. (8.3)
- Pediatric Use: Use preservative-free formulation in neonates and infants. (8.4)

See 17 for PATIENT COUNSELING INFORMATION

Revised: 7/2011

FULL PRESCRIBING INFORMATION: CONTENTS*

- 1 INDICATIONS AND USAGE
- 2 DOSAGE AND ADMINISTRATION
 - 2.1 Preparation for Administration
 - 2.2 Laboratory Monitoring for Efficacy and Safety
 - 2.3 Therapeutic Anticoagulant Effect with Full-Dose Heparin
 - 2.4 Pediatric Use
 - 2.5 Cardiovascular Surgery
 - 2.6 Low-Dose Prophylaxis of Postoperative Thromboembolism
 - 2.7 Blood Transfusion
 - 2.8 Converting to Warfarin
 - 2.9 Converting to Dabigatran
 - 2.10 Extracorporeal Dialysis
- 3 DOSAGE FORMS AND STRENGTHS
- 4 CONTRAINDICATIONS
- 5 WARNINGS AND PRECAUTIONS
 - 5.1 Fatal Medication Errors
 - 5.2 Hemorrhage
 - 5.3 Heparin-Induced Thrombocytopenia and Heparin-Induced Thrombocytopenia and Thrombosis
 - 5.4 Benzyl Alcohol Toxicity
 - 5.5 Thrombocytopenia
 - 5.6 Coagulation Testing and Monitoring

- 5.7 Heparin Resistance
- 5.8 Hypersensitivity
- 6 ADVERSE REACTIONS
 - 6.1 Postmarketing Experience
- 7 DRUG INTERACTIONS
 - 7.1 Drugs Enhancing Heparin Effect
 - 7.2 Drugs Decreasing Heparin Effect
 - 7.3 Drug-Laboratory Test Interactions
- 8 USE IN SPECIFIC POPULATIONS
 - 8.1 Pregnancy
 - 8.3 Nursing Mothers
 - 8.4 Pediatric Use
 - 8.5 Geriatric Use
- 10 OVERDOSAGE
- 11 DESCRIPTION
- 12 CLINICAL PHARMACOLOGY
 - 12.1 Mechanism of Action
 - 12.2 Pharmacodynamics
 - 12.3 Pharmacokinetics
- 13 NONCLINICAL TOXICOLOGY
 - 13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility
- 16 HOW SUPPLIED/STORAGE AND HANDLING
- 17 PATIENT COUNSELING INFORMATION

* Sections or subsections omitted from the full prescribing information are not listed

FULL PRESCRIBING INFORMATION

1 INDICATIONS AND USAGE

HEPARIN SODIUM INJECTION is indicated for:

- Prophylaxis and treatment of venous thrombosis and pulmonary embolism;
- Prophylaxis and treatment of thromboembolic complications associated with atrial fibrillation;
- Treatment of acute and chronic consumption coagulopathies (disseminated intravascular coagulation);
- Prevention of clotting in arterial and cardiac surgery;
- Prophylaxis and treatment of peripheral arterial embolism;
- Anticoagulant use in blood transfusions, extracorporeal circulation, and dialysis procedures.

2 DOSAGE AND ADMINISTRATION

2.1 Preparation for Administration

Confirm the choice of the correct HEPARIN SODIUM INJECTION vial to ensure that the 1 mL vial is not confused with a “catheter lock flush” vial or other 1 mL vial of incorrect strength [see *Warnings and Precautions (5.1)*]. Confirm the selection of the correct formulation and strength prior to administration of the drug.

Inspect parenteral drug products visually for particulate matter and discoloration prior to administration, whenever solution and container permit. Use only if solution is clear and the seal is intact. Do not use if solution is discolored or contains a precipitate.

When HEPARIN SODIUM INJECTION is added to an infusion solution for continuous intravenous (IV) administration, invert the container at least six times to ensure adequate mixing and prevent pooling of the heparin in the solution. Storage of prepared infusion solution should not exceed 4 hours at room temperature or 24 hours at 2 to 8°C. HEPARIN SODIUM INJECTION is incompatible with certain substances in solution (e.g., alteplase, amikacin sulfate, atracurium besylate, ciprofloxacin, cytarabine, daunorubicin, droperidol, erythromycin lactobionate, gentamicin sulfate, idarubicin, kanamycin sulfate, mitoxantrone HCl, polymyxin B sulfate, promethazine HCl, streptomycin sulfate, tobramycin sulfate). Consult specialized references to verify with which substances incompatibilities have been noted, as compatibility may depend on concentration, temperature, time, and other variables.

Administer HEPARIN SODIUM INJECTION by intermittent IV injection, IV infusion, or deep subcutaneous (intrafat, i.e., above the iliac crest or abdominal fat layer) injection. HEPARIN SODIUM INJECTION is not intended for intramuscular (IM) use [see *Adverse Reactions (6.1)*].

2.2 Laboratory Monitoring for Efficacy and Safety

Adjust the dosage of HEPARIN SODIUM INJECTION according to the patient’s coagulation test results. Dosage is considered adequate when the activated partial thromboplastin time (aPTT) is 1.5 to 2 times normal or when the whole blood clotting time is elevated approximately 2.5 to 3 times the control value. When initiating treatment with HEPARIN SODIUM INJECTION by continuous intravenous infusion, determine the coagulation status (aPTT, INR, platelet count) at baseline and continue to follow aPTT approximately every 4 hours and then at appropriate intervals thereafter. When the drug is administered intermittently by intravenous injection, perform coagulation tests before each injection during initiation of treatment and at appropriate intervals thereafter. After deep subcutaneous (SC) injections, tests for adequacy of dosage are best performed on samples drawn 4 to 6 hours after the injections.

Periodic platelet counts and hematocrits are recommended during the entire course of HEPARIN SODIUM INJECTION therapy, regardless of the route of administration.

2.3 Therapeutic Anticoagulant Effect with Full-Dose Heparin

The dosing recommendations in Table 1 are based on clinical experience. Although dosages must be adjusted for the individual patient according to the results of suitable laboratory tests, the following dosage schedules may be used as guidelines:

Table 1: Recommended Adult Full-Dose Heparin Regimens for Therapeutic Anticoagulant Effect

METHOD OF ADMINISTRATION	FREQUENCY	RECOMMENDED DOSE*
Deep Subcutaneous (Intrafat) Injection Use a different site for each injection to prevent the development of hematoma	Initial Dose	333 units/kg subcutaneously
	Every 12 hours	250 units/kg subcutaneously

Intermittent Intravenous Injection	Initial Dose	10,000 units, either undiluted or in 50 to 100 mL of 0.9% Sodium Chloride Injection, USP
	Every 4 to 6 hours	5,000 to 10,000 units, either undiluted or in 50 to 100 mL of 0.9% Sodium Chloride Injection, USP
Continuous Intravenous Infusion	Initial Dose	5,000 units by IV injection
	Continuous	20,000 to 40,000 units per 24 hours in 1,000 mL of 0.9% Sodium Chloride Injection, USP (or in any compatible solution) for infusion

* Based on 150 lb (68 kg) patient

2.4 Pediatric Use

Use preservative-free HEPARIN SODIUM INJECTION in neonates and infants.

There are no adequate and well controlled studies on heparin use in pediatric patients. Pediatric dosing recommendations are based on clinical experience. In general, the following dosage schedule may be used as a guideline in pediatric patients:

<u>Initial Dose</u>	75 to 100 units/kg (IV bolus over 10 minutes)
<u>Maintenance Dose</u>	<p>Infants: 25 to 30 units/kg/hour; Infants < 2 months have the highest requirements (average 28 units/kg/hour)</p> <p>Children > 1 year of age: 18 to 20 units/kg/hour; Older children may require less heparin, similar to weight-adjusted adult dosage</p>
<u>Monitoring</u>	Adjust heparin to maintain aPTT of 60 to 85 seconds, assuming this reflects an anti-Factor Xa level of 0.35 to 0.70.

2.5 Cardiovascular Surgery

Patients undergoing total body perfusion for open-heart surgery should receive an initial dose of not less than 150 units of heparin sodium per kilogram of body weight. Frequently, a dose of 300 units per kilogram is used for procedures estimated to last less than 60 minutes or 400 units per kilogram for those estimated to last longer than 60 minutes.

2.6 Low-Dose Prophylaxis of Postoperative Thromboembolism

The most widely used dosage has been 5,000 units 2 hours before surgery and 5,000 units every 8 to 12 hours thereafter for 7 days or until the patient is fully ambulatory, whichever is longer. Administer the heparin by deep subcutaneous (intrafat, i.e., above the iliac crest or abdominal fat layer, arm, or thigh) injection with a fine (25 to 26-gauge) needle to minimize tissue trauma.

2.7 Blood Transfusion

Addition of 400 to 600 USP units per 100 mL of whole blood is usually employed to prevent coagulation. Usually, 7,500 USP units of heparin sodium are added to 100 mL of 0.9% Sodium Chloride Injection, USP (or 75,000 USP units per 1,000 mL of 0.9% Sodium Chloride Injection, USP) and mixed; from this sterile solution, 6 to 8 mL are added per 100 mL of whole blood.

2.8 Converting to Warfarin

To ensure continuous anticoagulation when converting from HEPARIN SODIUM INJECTION to warfarin, continue full heparin therapy for several days until the INR (prothrombin time) has reached a stable therapeutic range. Heparin therapy may then be discontinued without tapering [see *Drug Interactions* (7.3)].

2.9 Converting to Dabigatran

For patients currently receiving intravenous heparin, stop intravenous infusion of heparin sodium immediately after administering the first dose of oral dabigatran (PRADAXA[®]); or for intermittent intravenous administration of heparin sodium, start oral dabigatran 0 to 2 hours before the time that the next dose of heparin was to have been administered.

2.10 Extracorporeal Dialysis

Follow equipment manufacturers' operating directions carefully. A dose of 25 to 30 units/kg followed by an infusion rate of 1,500 to 2,000 units/hour is suggested based on pharmacodynamic data if specific manufacturers' recommendations are not available.

3 DOSAGE FORMS AND STRENGTHS

HEPARIN SODIUM INJECTION is available as:

- 1,000 units per mL **preservative-free**
Vial: 2,000 units in 2 mL
- 1,000 units per mL preserved with **benzyl alcohol**
Vial: 10,000 units in 10 mL
- 5,000 units per mL preserved with **benzyl alcohol**
Vial: 50,000 units in 10 mL
Vial: 5,000 units in 1 mL
- 10,000 units per mL preserved with **benzyl alcohol**
Vial: 10,000 units in 1 mL

4 CONTRAINDICATIONS

The use of HEPARIN SODIUM INJECTION is contraindicated in patients:

- History of heparin-induced thrombocytopenia and heparin-induced thrombocytopenia and thrombosis
- Known hypersensitivity to heparin or pork products (e.g., anaphylactoid reactions) [*see Adverse Reactions (6.1)*]
- In whom suitable blood coagulation tests (e.g., whole-blood clotting time, partial thromboplastin time) cannot be performed at appropriate intervals. This contraindication refers to full-dose heparin regimens only; there is usually no need to monitor coagulation parameters in patients receiving low-dose heparin.

5 WARNINGS AND PRECAUTIONS

5.1 Fatal Medication Errors

Do not use HEPARIN SODIUM INJECTION as a “catheter lock flush” product. HEPARIN SODIUM INJECTION is supplied in vials containing various strengths of heparin, including vials that contain a highly concentrated solution of 10,000 units in 1 mL. Fatal hemorrhages have occurred in pediatric patients due to medication errors in which 1 mL HEPARIN SODIUM INJECTION vials were confused with 1 mL “catheter lock flush” vials. Carefully examine all HEPARIN SODIUM INJECTION vials to confirm the correct vial choice prior to administration of the drug.

5.2 Hemorrhage

Avoid using heparin in the presence of major bleeding, except when the benefits of heparin therapy outweigh the potential risks.

Hemorrhage can occur at virtually any site in patients receiving heparin. Fatal hemorrhages have occurred. Adrenal hemorrhage (with resultant acute adrenal insufficiency), ovarian hemorrhage, and retroperitoneal hemorrhage have occurred during anticoagulant therapy with heparin [*see Adverse Reactions (6.1)*]. A higher incidence of bleeding has been reported in patients, particularly women, over 60 years of age [*see Clinical Pharmacology (12.3)*]. An unexplained fall in hematocrit or fall in blood pressure should lead to serious consideration of a hemorrhagic event.

Use heparin sodium with caution in disease states in which there is increased risk of hemorrhage, including:

- Cardiovascular – Subacute bacterial endocarditis, severe hypertension
- Surgical – During and immediately following: (a) spinal puncture or spinal anesthesia or (b) major surgery, especially involving the brain, spinal cord, or eye
- Hematologic – Conditions associated with increased bleeding tendencies, such as hemophilia, thrombocytopenia, and some vascular purpuras
- Patients with hereditary antithrombin III deficiency receiving concurrent antithrombin III therapy – The anticoagulant effect of heparin is enhanced by concurrent treatment with antithrombin III (human) in patients with hereditary antithrombin III deficiency. To reduce the risk of bleeding, reduce the heparin dose during concomitant treatment with antithrombin III (human).
- Gastrointestinal – Ulcerative lesions, continuous tube drainage of the stomach or small intestine, and clinical settings in which stress-induced gastrointestinal hemorrhage is possible.

- Other – Menstruation, liver disease with impaired hemostasis, severe renal disease, or in patients with indwelling catheters.

5.3 Heparin-Induced Thrombocytopenia and Heparin-Induced Thrombocytopenia and Thrombosis

Heparin-induced thrombocytopenia (HIT) is a serious antibody-mediated reaction resulting from irreversible aggregation of platelets. HIT may progress to the development of venous and arterial thromboses, a condition known as heparin-induced thrombocytopenia and thrombosis (HITT). Thrombotic events may also be the initial presentation for HITT. These serious thromboembolic events include deep vein thrombosis, pulmonary embolism, cerebral vein thrombosis, limb ischemia, stroke, myocardial infarction, mesenteric thrombosis, renal arterial thrombosis, skin necrosis, gangrene of the extremities that may lead to amputation, and possibly death. Monitor thrombocytopenia of any degree closely. If the platelet count falls below 100,000/mm³ or if recurrent thrombosis develops, promptly discontinue heparin, evaluate for HIT and HITT, and, if necessary, administer an alternative anticoagulant.

HIT and HITT can occur up to several weeks after the discontinuation of heparin therapy. Patients presenting with thrombocytopenia or thrombosis after discontinuation of heparin should be evaluated for HIT and HITT.

5.4 Benzyl Alcohol Toxicity

Use preservative-free HEPARIN SODIUM INJECTION in neonates and infants. The preservative benzyl alcohol has been associated with serious adverse events and death in pediatric patients. The minimum amount of benzyl alcohol at which toxicity may occur is not known. Premature and low-birth weight infants may be more likely to develop toxicity [*see Use in Specific Populations (8.4)*].

5.5 Thrombocytopenia

Thrombocytopenia in patients receiving heparin has been reported at frequencies up to 30%. It can occur 2 to 20 days (average 5 to 9) following the onset of heparin therapy. Obtain platelet counts before and periodically during heparin therapy. Monitor thrombocytopenia of any degree closely. If the count falls below 100,000/mm³ or if recurrent thrombosis develops, promptly discontinue heparin, evaluate for HIT and HITT, and, if necessary, administer an alternative anticoagulant [*see Warnings and Precautions (5.3)*].

5.6 Coagulation Testing and Monitoring

When using a full dose heparin regimen, adjust the heparin dose based on frequent blood coagulation tests. If the coagulation test is unduly prolonged or if hemorrhage occurs, discontinue heparin promptly [*see Overdosage (10)*]. Periodic platelet counts and hematocrits are recommended during the entire course of heparin therapy, regardless of the route of administration [*see Dosage and Administration (2.2)*].

5.7 Heparin Resistance

Resistance to heparin is frequently encountered in fever, thrombosis, thrombophlebitis, infections with thrombosing tendencies, myocardial infarction, cancer, in postsurgical patients, and patients with antithrombin III deficiency. Close monitoring of coagulation tests is recommended in these cases. Adjustment of heparin doses based on anti-Factor Xa levels may be warranted.

5.8 Hypersensitivity

Patients with documented hypersensitivity to heparin should be given the drug only in clearly life-threatening situations.

Because HEPARIN SODIUM INJECTION is derived from animal tissue, it should be used with caution in patients with a history of allergy.

6 ADVERSE REACTIONS

6.1 Postmarketing Experience

The following adverse reactions have been identified during post approval use of HEPARIN SODIUM INJECTION. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency.

- Hemorrhage – Hemorrhage is the chief complication that may result from heparin therapy [*see Warnings and Precautions (5.2)*]. Gastrointestinal or urinary tract bleeding during anticoagulant therapy may indicate the presence of an underlying occult lesion. Bleeding can occur at any site but certain specific hemorrhagic complications may be difficult to detect including:
 - Adrenal hemorrhage, with resultant acute adrenal insufficiency, has occurred with heparin therapy, including fatal cases.
 - Ovarian (corpus luteum) hemorrhage developed in a number of women of reproductive age receiving short- or long-term heparin therapy.
 - Retroperitoneal hemorrhage.
- HIT and HITT, including delayed onset cases [*see Warnings and Precautions (5.3)*].

- Local irritation – Local irritation, erythema, mild pain, hematoma, or ulceration have occurred following deep subcutaneous (intrafat) injection of heparin sodium. Because such reactions occur more frequently after intramuscular administration, the IM route is not recommended.
- Histamine-like reactions – Such reactions have been observed at the site of injection. Necrosis of the skin has been reported at the site of subcutaneous injection of heparin, occasionally requiring skin grafting [*see Warnings and Precautions (5.3)*].
- Hypersensitivity – Generalized hypersensitivity reactions have been reported with chills, fever, and urticaria as the most usual manifestations; asthma, rhinitis, lacrimation, headache, nausea and vomiting, and anaphylactoid reactions, including shock, occur less frequently. Itching and burning, especially on the plantar site of the feet, may occur.
- Elevations of serum aminotransferases – Significant elevations of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) levels have occurred in patients who have received heparin.
- Others – Osteoporosis following long-term administration of high doses of heparin, cutaneous necrosis after systemic administration, suppression of aldosterone synthesis, delayed transient alopecia, priapism, and rebound hyperlipemia on discontinuation of heparin sodium have been reported.

7 DRUG INTERACTIONS

7.1 Drugs Enhancing Heparin Effect

- Drugs that interfere with platelet aggregation – These drugs (e.g., systemic salicylates, NSAIDs including celecoxib and ibuprofen, glycoprotein IIb/IIIa antagonists, thienopyridines, dipyridamole, hydroxychloroquine, dextran) may induce bleeding. Use heparin sodium with caution in patients receiving such agents.
- Antithrombin III (human) – The anticoagulant effect of heparin is enhanced by concurrent treatment with antithrombin III (human) in patients with hereditary antithrombin III deficiency. To reduce the risk of bleeding, a reduced dosage of heparin is recommended during treatment with antithrombin III (human).

7.2 Drugs Decreasing Heparin Effect

Digitalis, tetracyclines, nicotine, nitrates, and antihistamines may partially counteract the anticoagulant action of heparin sodium. Monitor patients' coagulation tests appropriately.

7.3 Drug-Laboratory Test Interactions

- Elevated aminotransferase levels – Significant elevations of AST and ALT levels without elevation in bilirubin or alkaline phosphatase have occurred in patients (and healthy subjects) who have received heparin. Because aminotransferase determinations are important in the differential diagnoses of certain conditions including myocardial infarction, liver disease, and pulmonary emboli, elevations in aminotransferase levels that may be related to heparin use should be interpreted with caution.
- Prothrombin time – Heparin sodium may prolong the one-stage prothrombin time. Therefore, when heparin sodium is given with warfarin, allow a period of at least 5 hours after the last intravenous dose or 24 hours after the last subcutaneous dose of heparin to elapse before blood is drawn to obtain a valid prothrombin time.

8 USE IN SPECIFIC POPULATIONS

8.1 Pregnancy

Pregnancy Category C

There are no adequate and well-controlled studies on heparin use in pregnant women. In published reports, heparin exposure during pregnancy did not show evidence of an increased risk of adverse maternal or fetal outcomes in humans. Heparin sodium does not cross the placenta, based on human and animal studies. Administration of heparin to pregnant animals at doses higher than the maximum human daily dose based on body weight resulted in increased resorptions. Use heparin sodium during pregnancy only if the potential benefit justifies the potential risk to the fetus.

If available, preservative-free HEPARIN SODIUM INJECTION is recommended when heparin therapy is needed during pregnancy. There are no known adverse outcomes associated with fetal exposure to the preservative benzyl alcohol through maternal drug administration; however, the preservative benzyl alcohol can cause serious adverse events and death when administered intravenously to neonates and infants [*see Use in Specific Populations (8.4)*].

In a published study conducted in rats and rabbits, pregnant animals received heparin intravenously during organogenesis at a dose of 10,000 units/kg/day, approximately 10 times the maximum human daily dose based on body weight. The number of early resorptions increased in both species. There was no evidence of teratogenic effects.

8.3 Nursing Mothers

If available, preservative-free HEPARIN SODIUM INJECTION is recommended when heparin therapy is needed during lactation. Due to its large molecular weight, heparin is not likely to be excreted in human milk, and any heparin in milk would not be orally absorbed by a nursing infant. Benzyl alcohol present in maternal serum is likely to cross into human milk and may be orally absorbed by a nursing infant. Exercise caution when administering HEPARIN SODIUM INJECTION to a nursing mother [see *Use in Specific Populations (8.4)*].

8.4 Pediatric Use

There are no adequate and well controlled studies on heparin use in pediatric patients. Pediatric dosing recommendations are based on clinical experience [see *Dosage and Administration (2.4)*].

Carefully examine all HEPARIN SODIUM INJECTION vials to confirm choice of the correct strength prior to administration of the drug. Pediatric patients, including neonates, have died as a result of medication errors in which HEPARIN SODIUM INJECTION vials have been confused with “catheter lock flush” vials [see *Warnings and Precautions (5.1)*].

Benzyl Alcohol Toxicity

Use preservative-free HEPARIN SODIUM INJECTION in neonates and infants. The preservative benzyl alcohol has been associated with serious adverse events and death in pediatric patients. The “gaspings syndrome” (characterized by central nervous system depression, metabolic acidosis, gasping respirations, and high levels of benzyl alcohol and its metabolites found in the blood and urine) has been associated with benzyl alcohol dosages >99 mg/kg/day in neonates and low-birth weight infants. Additional symptoms may include gradual neurological deterioration, seizures, intracranial hemorrhage, hematologic abnormalities, skin breakdown, hepatic and renal failure, hypotension, bradycardia, and cardiovascular collapse.

Although normal therapeutic doses of this product deliver amounts of benzyl alcohol that are substantially lower than those reported in association with the “gaspings syndrome”, the minimum amount of benzyl alcohol at which toxicity may occur is not known. Premature and low-birth weight infants may be more likely to develop toxicity. Practitioners administering this and other medications containing benzyl alcohol should consider the combined daily metabolic load of benzyl alcohol from all sources.

8.5 Geriatric Use

There are limited adequate and well-controlled studies in patients 65 years and older, however a higher incidence of bleeding has been reported in patients over 60 years of age, especially women [see *Warnings and Precautions (5.2)*]. Lower doses of heparin may be indicated in these patients [see *Clinical Pharmacology (12.3)*].

10 OVERDOSAGE

Bleeding is the chief sign of heparin overdosage.

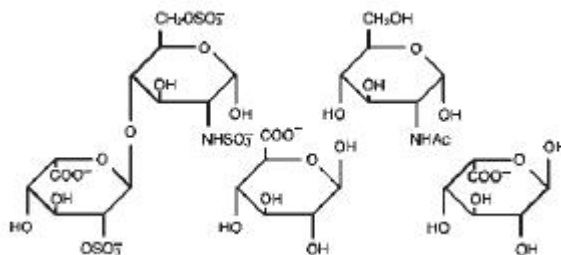
Neutralization of Heparin Effect

When clinical circumstances (bleeding) require reversal of the heparin effect, protamine sulfate (1% solution) by slow infusion will neutralize heparin sodium. **No more than 50 mg** should be administered, **very slowly**, in any 10 minute period. Each mg of protamine sulfate neutralizes approximately 100 USP heparin units. The amount of protamine required decreases over time as heparin is metabolized. Although the metabolism of heparin is complex, it may, for the purpose of choosing a protamine dose, be assumed to have a half-life of about 30 minutes after intravenous injection. Because fatal reactions often resembling anaphylaxis have been reported with protamine, it should be given only when resuscitation techniques and treatment of anaphylactoid shock are readily available. For additional information, consult the prescribing information for protamine sulfate injection.

11 DESCRIPTION

Heparin is a heterogenous group of straight-chain anionic mucopolysaccharides, called glycosaminoglycans, possessing anticoagulant properties. It is composed of polymers of alternating derivations of α -D-glucosamido (*N*-sulfated *O*-sulfated or *N*-acetylated) and *O*-sulfated uronic acid (α -L-iduronic acid or β -D-glucuronic acid).

Structure of heparin sodium (representative subunits):



HEPARIN SODIUM INJECTION is a sterile preparation of heparin sodium derived from porcine intestinal tissue, standardized for anticoagulant activity, in water for injection. It is intended for intravenous or deep subcutaneous administration. The potency is determined by a biological assay using a USP reference standard based on units of heparin activity per milligram.

For formulations preserved with benzyl alcohol, each mL of the 1,000 and 5,000 USP units per mL preparations contains: heparin sodium 1,000 or 5,000 USP units; 9 mg sodium chloride; 9.45 mg benzyl alcohol added as preservative. Each mL of the 10,000 USP units per mL preparations contains: heparin sodium 10,000 USP units; 9.45 mg benzyl alcohol added as preservative.

The preservative-free product contains (per mL): 1,000 USP units of heparin sodium and 9 mg sodium chloride.

When necessary, the pH of HEPARIN SODIUM INJECTION is adjusted with hydrochloric acid and/or sodium hydroxide. The pH range is 5.0 to 7.5.

12 CLINICAL PHARMACOLOGY

12.1 Mechanism of Action

Heparin inhibits reactions that lead to the clotting of blood and the formation of fibrin clots both *in vitro* and *in vivo*. Heparin acts at multiple sites in the normal coagulation system. Small amounts of heparin in combination with antithrombin III (heparin cofactor) can inhibit thrombosis by inactivating activated Factor X and inhibiting the conversion of prothrombin to thrombin. Once active thrombosis has developed, larger amounts of heparin can inhibit further coagulation by inactivating thrombin and preventing the conversion of fibrinogen to fibrin. Heparin also prevents the formation of a stable fibrin clot by inhibiting the activation of Factor XIII, the fibrin stabilizing factor. Heparin does not have fibrinolytic activity.

12.2 Pharmacodynamics

Bleeding time is usually unaffected by heparin. Clotting time is prolonged by full therapeutic doses of heparin; in most cases, it is not measurably affected by low doses of heparin.

12.3 Pharmacokinetics

Peak plasma levels of heparin are achieved 2–4 hours following subcutaneous administration, although there are considerable individual variations. Log-linear plots of heparin plasma concentrations with time for a wide range of dose levels are linear which suggests the absence of zero order processes. Liver and the reticulo-endothelial system are the sites of biotransformation. The biphasic elimination curve, a rapidly declining alpha phase ($t_{1/2} = 10$ minutes) and, after the age of 40 a slower beta phase, indicate uptake in organs. The absence of a relationship between anticoagulant half-life and concentration half-life may reflect factors such as protein binding of heparin.

Patients over 60 years of age, following similar doses of heparin, may have higher plasma levels of heparin and longer activated partial thromboplastin times (aPTTs) compared with patients under 60 years of age [see *Use in Specific Populations (8.5)*].

13 NONCLINICAL TOXICOLOGY

13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

No long-term studies in animals have been performed to evaluate carcinogenic potential of heparin. No studies in animals have been performed addressing mutagenesis or impairment of fertility.

16 HOW SUPPLIED/STORAGE AND HANDLING

HEPARIN SODIUM INJECTION **preservative-free** is available in the following strengths and package sizes:

DESCRIPTION	NDC
1,000 units per mL	
Preservative-free, 1 vial: 2,000 units in 2 mL, single-dose*	0069-0043-02
Preservative-free, 25 vials: 2,000 units in 2 mL, single-dose*	0069-0043-01

* Discard unused portion

HEPARIN SODIUM INJECTION preserved with **benzyl alcohol** is available in the following strengths and package sizes:

DESCRIPTION	NDC
1,000 units per mL	
1 vial: 10,000 units in 10 mL, multiple-dose	0069-0058-02
25 vials: 10,000 units in 10 mL, multiple-dose	0069-0058-01
5,000 units per mL	
1 vial: 50,000 units in 10 mL, multiple-dose	0069-0059-02
25 vials: 50,000 units in 10 mL, multiple-dose	0069-0059-01
1 vial: 5,000 units in 1 mL, multiple-dose	0069-0059-04
25 vials: 5,000 units in 1 mL, multiple-dose	0069-0059-03
10,000 units per mL	
1 vial: 10,000 units in 1 mL, multiple-dose	0069-0062-02
25 vials: 10,000 units in 1 mL, multiple-dose	0069-0062-01

Store at 20° to 25°C (68° to 77°F) [see USP Controlled Room Temperature]. Use only if solution is clear and the seal is intact. Do not use if solution is discolored or contains a precipitate.

17 PATIENT COUNSELING INFORMATION

Hemorrhage

Inform patients that it may take them longer than usual to stop bleeding, that they may bruise and/or bleed more easily when they are treated with heparin, and that they should report any unusual bleeding or bruising to their physician. Hemorrhage can occur at virtually any site in patients receiving heparin. Fatal hemorrhages have occurred [see *Warnings and Precautions (5.2)*].

Prior to Surgery

Advise patients to inform physicians and dentists that they are receiving heparin before any surgery is scheduled [see *Warnings and Precautions (5.2)*].

Heparin-Induced Thrombocytopenia

Inform patients of the risk of heparin-induced thrombocytopenia (HIT). HIT may progress to the development of venous and arterial thromboses, a condition known as heparin-induced thrombocytopenia and thrombosis (HITT). HIT and HITT can occur up to several weeks after the discontinuation of heparin therapy [see *Warnings and Precautions (5.3)*].

Hypersensitivity

Inform patients that generalized hypersensitivity reactions have been reported. Necrosis of the skin has been reported at the site of subcutaneous injection of heparin [see *Warnings and Precautions (5.8), Adverse Reactions (6.1)*].

Other Medications

Because of the risk of hemorrhage, advise patients to inform their physicians and dentists of all medications they are taking, including non-prescription medications, and before starting any new medication [see *Drug Interactions (7.1)*].



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