

HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use Flebogamma 10% DIF safely and effectively. See full prescribing information for Flebogamma 10% DIF

Flebogamma 10% DIF [Immune Globulin Intravenous (Human)]
For intravenous administration, 10% Liquid Preparation
Initial U.S. Approval: 2010

WARNING: THROMBOSIS, RENAL DYSFUNCTION, and ACUTE RENAL FAILURE

See full prescribing information for complete boxed warning.

- **Thrombosis may occur with immune globulin products, including FLEBOGAMMA 10% DIF. Risk factors may include: advanced age, prolonged immobilization, hypercoagulable conditions, history of venous or arterial thrombosis, use of estrogens, indwelling vascular catheters, hyperviscosity, and cardiovascular risk factors.**
- **For patients at risk of thrombosis administer FLEBOGAMMA 10% DIF at the minimum dose and infusion rate practicable. Ensure adequate hydration in patients before administration. Monitor for signs and symptoms of thrombosis and assess blood viscosity in patients at risk of hyperviscosity.**
- **Renal dysfunction, acute renal failure, osmotic nephrosis and death may occur with the administration of human immune globulin intravenous (IGIV) products, particularly those products that contain sucrose. FLEBOGAMMA 10% DIF does not contain sucrose.**
- **For patients at risk of renal dysfunction or failure, administer FLEBOGAMMA 10% DIF at the minimum infusion rate practicable. [5.2]**

RECENT MAJOR CHANGES

- Boxed Warning; Warnings and Precautions, Thrombosis [5.4] 09/2013

INDICATIONS AND USAGE

Flebogamma 10% DIF is an Immune Globulin Intravenous (Human), indicated for treatment of Primary (inherited) Immunodeficiency (PI). [1]

DOSAGE AND ADMINISTRATION

For Intravenous Use Only

Indication	Dose	Initial Infusion Rate	Maintenance Infusion Rate (if tolerated)
PI	300-600 mg/kg every 3-4 weeks	0.01 mL/kg/minute (1 mg/kg/min)	0.08 mL/kg/minute (8 mg/kg/min)

- Ensure that patients with pre-existing renal insufficiency are not volume-depleted and discontinue Flebogamma 10% DIF if renal function deteriorates. [5.2]
- For patients at risk of renal dysfunction or thrombosis, administer Flebogamma 10% DIF at the minimum infusion rate practicable. [5.2, 5.4]

DOSAGE FORMS AND STRENGTHS

Liquid preparation containing 10% IgG (100 mg/mL).

CONTRAINDICATIONS

- History of anaphylactic or severe systemic reactions to human immunoglobulin. [4]
- IgA deficient patients with antibodies against IgA and a history of hypersensitivity. [4]

WARNINGS AND PRECAUTIONS

- IgA deficient patients with antibodies to IgA are at greater risk of developing severe hypersensitivity and anaphylactic reactions. [5.1]
- Monitor renal function, including blood urea nitrogen, serum creatinine and urine output in patients at risk of developing acute renal failure. [5.2]
- Hyperproteinemia, increased serum viscosity and hyponatremia may occur in patients receiving Flebogamma 10% DIF therapy. [5.3]
- Thrombosis may occur. Monitor patients with known risk factors for thrombosis and consider baseline assessment of blood viscosity for those at risk of hyperviscosity. [5.4]
- Aseptic Meningitis Syndrome (AMS) may occur in patients receiving Flebogamma 10% DIF therapy, especially with high doses or rapid infusion. [5.5]
- Hemolytic anemia can develop subsequent to Flebogamma 10% DIF treatment. Monitor patients for signs and symptoms of hemolysis and hemolytic anemia. [5.6]
- Monitor patients for pulmonary adverse reactions (transfusion-related acute lung injury, TRALI). [5.7]
- Patients receiving Flebogamma 10% DIF for the first time or being restarted on the product after a treatment hiatus of more than 8 weeks may be at a higher risk for development of fever, chills, nausea, and vomiting. [5.8]
- Flebogamma 10% DIF is made from human plasma and may contain infectious agents, e.g. viruses and, theoretically, the Creutzfeldt-Jakob disease (CJD) agent. [5.9]
- Passive transfer of antibodies may confound serologic testing. [5.11]

ADVERSE REACTIONS

The most common adverse reactions (reported in $\geq 5\%$ of clinical trial subjects) were headache, fever/pyrexia, shaking, tachycardia, hypotension, back pain, myalgia, hypertension, chest pain, pain, nausea, infusion site reactions and pain in extremities. [6]

To report SUSPECTED ADVERSE REACTIONS, contact Grifols Biologicals at 1-888-GRIFOLS (1-888 474 3657) or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.

DRUG INTERACTIONS

Passive transfer of antibodies may transiently interfere with the immune response to live virus vaccines, such as measles, mumps, and rubella. [7]

USE IN SPECIFIC POPULATIONS

- Pregnancy: No human or animal data. Use only if clearly needed. [8.1]
- Geriatric: In patients over age 65 or in any patient at risk of developing renal insufficiency, do not exceed the recommended dose, and infuse Flebogamma 10% DIF at the minimum infusion rate practicable and less than 0.04 mL/kg/min (4 mg/kg/min). [8.5]

See 17 for PATIENT COUNSELING INFORMATION.

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FULL PRESCRIBING INFORMATION

Flebogamma 10% DIF Immune Globulin Intravenous (Human) 10% Liquid Preparation

WARNING: THROMBOSIS, RENAL DYSFUNCTION, and ACUTE RENAL FAILURE

- **Thrombosis may occur with immune globulin products, including FLEBOGAMMA 10% DIF. Risk factors may include: advanced age, prolonged immobilization, hypercoagulable conditions, history of venous or arterial thrombosis, use of estrogens, indwelling central vascular catheters, hyperviscosity, and cardiovascular risk factors. Thrombosis may occur in the absence of known risk factors. (See *Warnings and Precautions* [5.4] and *Patient Counseling Information* [17]).**
- **For patients at risk of thrombosis, administer FLEBOGAMMA 10% DIF at the minimum dose and infusion rate practicable. Ensure adequate hydration in patients before administration. Monitor for signs and symptoms of thrombosis and assess blood viscosity in patient at risk for hyperviscosity. (See *Dosage and Administration* [2.3] and *Warnings and Precautions* [5.4])**
- **Renal dysfunction, acute renal failure, osmotic nephrosis, and death (7) have been related to intravenous immune globulin (IGIV) products. Patients predisposed to acute renal failure include patients with any degree of pre-existing renal insufficiency, diabetes mellitus, age greater than 65, volume depletion, sepsis, paraproteinemia, or patients receiving known nephrotoxic drugs.**
- **Administer FLEBOGAMMA 10% DIF at the minimum rate of infusion practicable in patients at risk for renal dysfunction or failure.**
- **Reports of renal dysfunction and acute renal failure occur more commonly in patients receiving IGIV products containing sucrose as a stabilizer. They account for a disproportionate share of the total number of reported cases of renal dysfunction and acute renal failure. FLEBOGAMMA 10% DIF does not contain sucrose. (See *Dosage and Administration* [2.3] and *Warnings and Precautions* [5.2])**

1 INDICATIONS AND USAGE

Flebogamma 10% DIF is an Immune Globulin Intravenous (Human) 10% preparation that is indicated for the treatment of Primary Immunodeficiency (PI) including the humoral immune defect in common variable immunodeficiency, x-linked agammaglobulinemia, severe combined immunodeficiency, and Wiskott-Aldrich syndrome.

2 DOSAGE AND ADMINISTRATION

For Intravenous Use Only

2.1 Dosage

Treatment of Primary Immunodeficiency (PI)

Dose	Initial Infusion Rate	Maintenance Dose Rate (if tolerated)
300 to 600 mg/kg body weight (3.0 to 6.0 mL/kg) administered every 3 to 4 weeks	0.01 mL/kg/minute (1 mg/kg/min)	0.08 mL/kg/minute (8 mg/kg/min)

As there are significant differences in the half-life of IgG among patients with PI, the frequency and amount of immunoglobulin therapy may vary from patient to patient. Dosing should be adjusted according to the clinical response.

The dosage may be adjusted over time to achieve the desired trough IgG levels and clinical responses. No randomized controlled trial data are available to determine an optimum target trough serum IgG level.

2.2 Preparation and Handling

- Inspect Flebogamma 10% DIF visually for particulate matter and color prior to administration. Do not use the vial if particles are detected. Do not use if turbid.
- Several vials of Flebogamma 10% DIF may be pooled into an empty sterile solution container by using aseptic technique, if large doses are to be administered.
- Dilution with intravenous fluids is not recommended. Injection of other medications into intravenous tubing being used for Flebogamma 10% DIF is not recommended.
- Infuse Flebogamma 10% DIF through a separate intravenous line. Do not add any medications or intravenous fluids to the Flebogamma 10% DIF infusion container. Do not mix IGIV products of different formulations or from different manufacturers.
- Discard unused contents and administration devices after use.
- Any vial that has been entered should be used promptly.
- Discard partially used vials. Do not save for future use because the solution contains no preservative.
- Do not use solution that has been frozen.

2.3 Administration

The recommended initial infusion rate of Flebogamma 10% DIF is 0.01 mL/kg/min (1 mg/kg/min) for the first thirty minutes. If tolerated, the rate may be gradually increased to 0.04 mL/kg/min (4 mg/kg/min) and if tolerated, gradually to a maximum of 0.08 mL/kg/min (8 mg/kg/min).

Monitor patient vital signs throughout the infusion. Slow or stop infusion if adverse reactions occur. If symptoms subside promptly, the infusion may be resumed at a lower rate that is comfortable for the patient.

For the first 2-3 infusions, Flebogamma 10% DIF may be administered at infusion rates slower than recommended rates. If after administration of the first few infusions no adverse drug reactions are observed, the infusion rate for subsequent infusions may be slowly increased to the maximum rate. For patients experiencing adverse drug reactions reduce the infusion rate in subsequent infusions or administer IGIV at 5% concentration.

3. DOSAGE FORMS AND STRENGTHS

Flebogamma 10% DIF is a liquid preparation containing 10% IgG (100 mg/mL).

4 CONTRAINDICATIONS

- Flebogamma 10% DIF is contraindicated in patients who have had a history of anaphylactic or severe systemic hypersensitivity reactions to the administration of human immune globulin.
- Flebogamma 10% DIF is contraindicated in IgA deficient patients with antibodies to IgA and a history of hypersensitivity (see *Warnings and Precautions* [5.1]).

5 WARNINGS AND PRECAUTIONS

5.1 Hypersensitivity

Severe hypersensitivity reactions and anaphylactic reactions with a fall in blood pressure may occur, even in patients who had tolerated previous treatment with IGIV (see *Contraindications* [4]). If hypersensitivity reaction develops, discontinue Flebogamma 10% DIF infusion immediately and institute appropriate treatment.

Flebogamma 10% DIF contains trace amounts of IgA (less than 100 µg/mL) (see *Description* [11]). Patients with antibodies to IgA have a greater risk of developing potentially severe hypersensitivity and anaphylactic reactions. Flebogamma 10% DIF is contraindicated in patients with antibodies against IgA and a history of hypersensitivity reaction (see *Contraindications* [4]).

5.2 Renal Dysfunction/Failure

Acute renal dysfunction/failure, acute tubular necrosis, proximal tubular nephropathy, osmotic nephrosis and death have been reported in patients receiving IGIV, particularly those products containing sucrose (2). Flebogamma 10% DIF does not contain sucrose.

Ensure that patients are not volume-depleted before administering Flebogamma 10% DIF. For patients judged to be at risk for developing renal dysfunction, including patients with any degree of pre-existing renal insufficiency, diabetes mellitus, age greater than 65, volume depletion, sepsis, paraproteinemia, or patients receiving known nephrotoxic drugs, administer Flebogamma 10% DIF at the minimum rate of infusion practicable (3) (See Boxed Warning) (see *Dosing and Administration* [2.3]).

Periodic monitoring of renal function and urine output is particularly important in patients judged to be at increased risk of developing acute renal failure (1). Assess renal function, including measurement of blood urea nitrogen (BUN) and serum creatinine, before the initial infusion of Flebogamma 10% DIF and at appropriate intervals thereafter. If renal function deteriorates, consider discontinuation of the product.

5.3 Hyperproteinemia, Increased Serum Viscosity, and Hyponatremia

Hyperproteinemia, increased serum viscosity and hyponatremia may occur in patients receiving Flebogamma 10% DIF therapy. It is clinically critical to distinguish true hyponatremia from a pseudohyponatremia that is temporally or causally related to hyperproteinemia with concomitant decreased calculated serum osmolality or elevated osmolar gap, because treatment aimed at decreasing serum free water in patients with pseudohyponatremia may lead to volume depletion, a further increase in serum viscosity and a higher risk of thrombosis.

5.4 Thrombosis

Thrombosis may occur following treatment with immune globulin products, including FLEBOGAMMA 10% DIF. Risk factors may include: advanced age, prolonged immobilization, hypercoagulable conditions, history of venous or arterial thrombosis, use of estrogens, indwelling central vascular catheters, hyperviscosity, and cardiovascular risk factors. Thrombosis may occur in the absence of known risk factors.

Consider baseline assessment of blood viscosity in patients at risk for hyperviscosity, including those with cryoglobulins, fasting chylomicronemia/markedly high triacylglycerols (triglycerides), or monoclonal gammopathies. (see *Warnings and Precautions* [5.10]) For patients at risk of thrombosis, administer FLEBOGAMMA 10% DIF at the minimum dose and infusion rate practicable. Ensure adequate hydration in patients before administration. Monitor for signs and symptoms of thrombosis and assess blood viscosity in patients at risk for hyperviscosity (see *Boxed Warning, Dosage and Administration* [2.3] and *Patient Counseling Information* [17]).

5.5 Aseptic Meningitis Syndrome (AMS)

AMS has been reported to occur following IGIV treatment. Discontinuation of IGIV treatment has resulted in remission of AMS within several days without sequelae (7-8). The symptoms of AMS usually begin within several hours to 2 days following IGIV treatment.

AMS is characterized by the following signs and symptoms: severe headache, nuchal rigidity, drowsiness, fever, photophobia, painful eye movements, nausea, and vomiting (see *Patient Counseling Information* [17]). Cerebrospinal fluid (CSF) studies frequently reveal pleocytosis up to several thousand cells per cubic millimeter, predominantly from the granulocytic series and elevated protein levels up to several hundred mg/dL, but negative culture results. Conduct a thorough neurological examination to patients exhibiting such signs and symptoms, including CSF studies, to rule out other causes of meningitis.

AMS may occur more frequently following high doses (2 g/kg) and/or rapid infusion of IGIV.

5.6 Hemolysis

Hemolytic anemia can develop subsequent to IGIV therapy including Flebogamma 10% DIF. Flebogamma 10% DIF contains blood group antibodies which may act as hemolysins and induce *in vivo* coating of red blood cells (RBCs) with immunoglobulin, causing a positive direct antiglobulin reaction and hemolysis (9-10). Acute intravascular hemolysis has been reported, and delayed hemolytic anemia can develop subsequent to IGIV therapy due to enhanced RBC sequestration (11).

Monitor patients for clinical signs and symptoms of hemolysis. If signs and/or symptoms of hemolysis are present after Flebogamma 10% DIF infusion, perform appropriate confirmatory laboratory testing (see *Patient Counseling Information* [17]).

5.7 Transfusion-Related Acute Lung Injury (TRALI)

Non-cardiogenic pulmonary edema has been reported in patients following IGIV treatment (12). TRALI is characterized by severe respiratory distress, pulmonary edema, hypoxemia, normal left ventricular function and fever. Symptoms typically appear within 1 to 6 hours following treatment.

Monitor patients for pulmonary adverse reactions (see *Patient Counseling Information* [17]). If TRALI is suspected, perform appropriate tests for the presence of anti-neutrophil antibodies and anti-HLA antibodies in both the product and patient serum. TRALI may be managed using oxygen therapy with adequate ventilatory support.

5.8 Infusion Reactions

Individuals receiving Flebogamma 10% DIF for the first time or being restarted on the product after a treatment hiatus of more than 8 weeks may be at a higher risk for the development of fever, chills, nausea, and vomiting. Careful monitoring of recipients and adherence to recommendations regarding dosage and administration may reduce the risk of these types of events (see *Dosage and Administration* [2.3]).

5.9 Transmissible Infectious Agents

Because Flebogamma 10% DIF is made from human plasma, it may carry a risk of transmitting infectious agents, e.g., viruses, and theoretically, the Creutzfeldt-Jakob (CJD) agent. This also applies to unknown or emerging viruses and other pathogens. No cases of transmission of viral diseases or CJD have been associated with the use of Flebogamma 10% DIF. All infections suspected by a physician possibly to have been transmitted by this product should be reported by the physician or other healthcare provider to Grifols Biologicals at 1-888-474-3657. Before prescribing or administering Flebogamma 10% DIF, the physician should discuss the risks and benefits of its use with the patient (see *Patient Counseling Information* [17]).

5.10 Monitoring: Laboratory Tests

- Periodic monitoring of renal function and urine output is particularly important in patients judged to be at increased risk of developing acute renal failure. Assess renal function, including measurement of BUN and serum creatinine, before the initial infusion of Flebogamma 10% DIF and at appropriate intervals thereafter.
- Consider baseline assessment of blood viscosity in patients at risk for hyperviscosity, including those with cryoglobulins, fasting chylomicronemia/markedly high triacylglycerols (triglycerides), or monoclonal gammopathies, because of the potentially increased risk of thrombosis.
- If signs and/or symptoms of hemolysis are present after an infusion of Flebogamma 10% DIF, perform appropriate laboratory testing for confirmation.
- If TRALI is suspected, perform appropriate tests for the presence of anti-neutrophil antibodies and anti-HLA antibodies in both the product and patient's serum.

5.11 Interference with Laboratory Tests

After infusion of IgG, the transitory rise of the various passively transferred antibodies in the patient's blood may yield positive serological testing results, with the potential for misleading interpretation. Passive transmission of antibodies to erythrocyte antigens (e.g., A, B, and D) may cause a positive direct or indirect antiglobulin (Coombs') test.

6 ADVERSE REACTIONS

The most common adverse reactions (reported in $\geq 5\%$ of clinical trial subjects) were headache, fever/pyrexia, shaking, tachycardia, hypotension, back pain, myalgia, hypertension, chest pain, pain, nausea, infusion site reactions and pain in extremities.

To report SUSPECTED ADVERSE REACTIONS, contact Grifols Biologicals at 1-888-GRIFOLS (1-888-474-3657) or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.

6.1 Clinical Trials Experience

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in clinical practice.

In a multicenter, open-label, non-randomized, historically controlled clinical study, 46 individuals with PI received infusion doses of Flebogamma 10% DIF at 300 to 600 mg/kg body weight every 3 weeks (mean dose 469 mg/kg) or 4 weeks (mean dose 457 mg/kg) for up to 12 months (see *Clinical Studies* [14.1]). Routine pre-medication was not allowed. Of the 601 infusions administered, 130 infusions (22%) in 21 (47%) subjects were given pre-medications (antipyretic, antihistamine, or antiemetic agent) because of experience with consecutive infusion-related adverse reactions.

One subject experienced four serious adverse events (AEs, bacterial pneumonia, subcutaneous abscess and two episodes of cellulitis) and withdrew from the study. Two other subjects who participated in the study discontinued prematurely due to AEs (back pain/chest pain/headache; and chills/tachycardia). Three subjects experienced four serious non-related AEs (drug abuse/depression; hernia; and sinusitis).

Thirty-eight subjects (83%) had at least an adverse reaction at some time during the study that was considered product-related. Of the 21 subjects receiving pre-medications, 12 (57%) subjects reported adverse reactions during or within 72 hours after the infusion in 48 of the 130 pre-medicated infusions (37%).

Adverse reactions that occurred with an incidence of $\geq 5\%$ on a per subject basis are summarized in Table 1.

Table 1. Adverse Reactions occurring in $\geq 5\%$ of Subjects

Adverse Reaction	Subjects (%) N=46	Number of Events
Headache	24 (52.2)	71
Pyrexia ^a	19 (41.3)	11
Rigors	17 (37.0)	38
Tachycardia/heart rate increased	11 (23.9)	20
Hypotension	9 (19.6)	11
Back Pain	8 (17.4)	27
Myalgia	8 (17.4)	21
Hypertension ^b	7 (15.2)	12
Chest pain ^c	6 (13)	25
Pain	4 (8.7)	8
Nausea	4 (8.7)	6
Infusion site reaction	3 (6.5)	6
Pain in extremities	3 (6.5)	3

a = includes combined reported terms of pyrexia and body temperature increase.

b = includes combined reported terms of hypertension, diastolic hypertension, blood pressure increased, systolic blood pressure increased and systolic hypertension.

c = includes combined reported terms of chest pain and chest discomfort.

The most common other adverse drug reactions reported in fewer than 5% of the subjects included flatulence, fatigue, feeling cold, malaise, neck pain, dizziness, wheezing, muscle spasms/tightness and abdominal distension/pain.

In 117 infusions the patients reported mild adverse reactions; 74 infusions were recorded with moderate adverse reactions and in 8 infusions the patients reported a severe adverse reaction. The percentages of infusions with a mild, moderate or severe adverse reaction were 19.5% (upper bound 95% CI=22.9%), 12.3 % (upper bound 95% CI=15.2%) and 1.3% (upper bound 95% CI=2.6%), respectively.

The total number of adverse reactions reported whose onset were within 72 hours after the end of an infusion of Flebogamma 10% DIF was 291. There were a total of 601 infusions, resulting in a rate of 0.48 temporally associated adverse reactions per infusion (the upper bound of the 1-sided 95% confidence interval = 0.52). There were 166 infusions (30.3%, 1-sided 95% upper bound CI = 37.6%) associated with 1 or more adverse reaction that began within 72 hours after the completion of an infusion.

AE reporting was based upon a clinical protocol precluding pre-medication against AEs. Pre medication could be utilized only after the first 2 infusions only in those patients that exhibited adverse events.

Forty-three of the 46 subjects enrolled in this study had a negative Coombs test at baseline. Of these 43 subjects, 10 (23.3%) developed a positive Coombs test at some time during the study. However, no subjects showed evidence of hemolytic anemia.

6.2 Post-marketing Experience

Because adverse reactions are reported voluntarily post-approval from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to product exposure. The following adverse reactions have been identified during post-approval use of IGV products (13-14), including Flebogamma 5% and 10% DIF.

Infusion reactions	Hypersensitivity (e.g., anaphylaxis), headache, diarrhea, tachycardia, fever, fatigue, dizziness, malaise, chills, flushing, urticaria or other skin reactions, wheezing or other chest discomfort, nausea, vomiting, rigors, back pain, myalgia, arthralgia, and changes in blood pressure
Renal	Acute renal dysfunction/failure, osmotic nephropathy
Respiratory	Apnea, Acute Respiratory Distress Syndrome (ARDS), Transfusion-Related Acute Lung Injury (TRALI), cyanosis, hypoxemia, pulmonary edema, dyspnea, bronchospasm
Cardiovascular	Cardiac arrest, thromboembolism, vascular collapse, hypotension
Neurological	Coma, loss of consciousness, seizures, tremor, aseptic meningitis syndrome
Integumentary	Stevens-Johnson Syndrome, epidermolysis, erythema multiforme, dermatitis (e.g., bullous dermatitis)
Hematologic	Pancytopenia, leukopenia, hemolysis, positive direct antiglobulin (Coombs) test
Musculoskeletal	Back pain
Gastrointestinal	Hepatic dysfunction, abdominal pain
General/Body as a Whole	Pyrexia, rigors

7 DRUG INTERACTIONS

Passive transfer of antibodies may transiently impair the immune response to live attenuated virus vaccines such as measles, mumps and rubella. Inform the immunizing physician of recent therapy with Flebogamma 10% DIF so that appropriate measures can be taken (see *Patient Counseling Information* (17)).

8 USE IN SPECIFIC POPULATIONS

8.1 Pregnancy

Pregnancy Category C. Animal reproduction studies have not been performed with Flebogamma 10% DIF. It is also not known whether Flebogamma 10% DIF can cause fetal harm when administered to a pregnant woman or can affect reproduction capacity. Immunoglobulins cross the placenta from maternal circulation increasingly after 30 weeks of gestation. Flebogamma 10% DIF should be given to a pregnant woman only if clearly needed.

8.3 Nursing Mothers

Use of Flebogamma 10% DIF has not been evaluated in nursing mothers.

8.4 Pediatric Use

Three (3) pediatric patients with PI (two between the ages of 6 and 10, and one 16 years old) were included in the clinical evaluation of Flebogamma 10% DIF. This number of subjects is too small to establish safety and efficacy in the pediatric population (see *Clinical Studies* (14)).

8.5 Geriatric Use

Limited information is available for the geriatric use of Flebogamma 10% DIF. Clinical studies of Flebogamma 10% DIF did not include sufficient numbers of subjects over the age of 65 to determine whether they respond differently from younger subjects. Use caution when administering Flebogamma 10% DIF to patients age 65 and over who are judged to be at increased risk for developing thrombosis or renal insufficiency. Do not exceed the recommended dose, and infuse Flebogamma 10% DIF at the minimum infusion rate practicable and less than 0.04 mL/kg/min (4 mg/kg/min) (see *Boxed Warning, Warning and Precautions* [5.2, 5.4]; *Dosage and Administration* (2.3)).

10 OVERDOSAGE

Overdose may lead to fluid overload and hyperviscosity. Patients at particular risk of complications of fluid overload and hyperviscosity include elderly patients and patients with cardiac or renal impairment.

11 DESCRIPTION

Flebogamma 10% DIF is a ready to use, sterile, clear or slightly opalescent and colorless to pale yellow, liquid preparation of purified immunoglobulin (IgG) obtained from human plasma pools. The purification process includes cold ethanol fractionation, polyethylene glycol precipitation, ion exchange chromatography, low pH treatment, pasteurization, solvent detergent treatment and Planova nanofiltration using 20 nanometer (nm) filters.

Flebogamma 10% DIF is a purified (≥ 97% IgG), unmodified, human IgG. The distribution of the four IgG subclasses is approximately 66.6% IgG₁, 27.9% IgG₂, 3.0% IgG₃, and 2.5% IgG₄. Flebogamma 10% DIF contains trace amounts of IgA (typically < 100 µg/mL) and trace amounts of sodium and IgM.

Flebogamma 10% DIF contains 10 g human normal immunoglobulin and 5 g D-sorbitol (as stabilizer) in 100 mL of water for injection, and ≤ 6 mg/mL polyethylene glycol. There is no preservative in the formulation. The pH of the solution ranges from 5 to 6 and the osmolality from 240 to 370 mOsm/kg, which is within the normal physiological range.

Screening against potentially infectious agents begins with the donor selection process and continues throughout plasma collections and plasma preparation. Each individual plasma donation used in the manufacture of Flebogamma 10% DIF is collected only at FDA approved blood establishments and is tested by FDA licensed serological test for Hepatitis B Surface Antigen (HBsAg), for antibodies to Human Immunodeficiency Virus (HIV-1/HIV-2) and Hepatitis C Virus (HCV) in accordance with U.S. regulatory requirements. As an additional safety measure, mini-pools of plasma are tested for the presence of HBV, HIV-1 and HCV by FDA licensed Nucleic Acid Testing (NAT) and found to be negative. In addition, plasma is tested by in-process NAT testing for Hepatitis A virus (HAV) and parvovirus B19 (B19) on mini-pools and the viral load limit for B19 in the manufacturing pool is set not to exceed 10⁴ IU/mL. NAT testing for the presence of HCV and HIV in the manufacturing plasma pool is also performed and found to be negative.

To further improve the margin of safety, three dedicated, independent and effective virus inactivation/removal steps have been integrated into the manufacturing and formulation processes, namely pasteurization at 60 °C, 10 hours, solvent-detergent treatment for 6 hours and nanofiltration down to 20 nm Planova filters.

In vitro virus spiking studies have been used to validate the capability of the manufacturing process to inactivate and remove viruses.

To establish the minimum applicable virus clearance capacity of the manufacturing process, these virus clearance studies were performed on 7 steps of the production process (pasteurization, solvent-detergent treatment, nanofiltration, Fraction I precipitation, Fraction II+III precipitation, 4% PEG precipitation and pH treatment for 4 hours at 37 °C).

The viral reduction data (in log₁₀) from these experiments are summarized in Table 2.

Table 2. Flebogamma 10% DIF: viral reduction capacity of combined steps (log₁₀)

Target virus	HIV-1, HIV-2 (env. RNA)	HBV Herpesvirus (env. DNA)		HCV (env. RNA)		WNV (env. RNA)	HAV (non-env. RNA)	B19 Virus (non-env. DNA)
		PRV	IBR	BVDV	SINDBIS			
Model virus	HIV-1	PRV	IBR	BVDV	SINDBIS	WNV	EMC	PPV
Fraction I precipitation	< 1.00*	nd	nd	nd	nd	2.78	nd	< 1.00*
Ethanol incubation (Fraction II+III)	1.48	nd	nd	nd	nd	< 1.00*	nd	nd
PEG precipitation	≥ 6.10	≥ 5.92	nd	≥ 5.78	nd	nd	≥ 6.41	6.35
Acid pH treatment	2.47	≥ 5.32	nd	< 1.00*	nd	nd	1.36	na
Pasteurization	≥ 5.64	≥ 4.96	≥ 6.33	≥ 4.69	≥ 6.49	≥ 5.42	≥ 5.56	4.08
Solvent Detergent	≥ 4.61	≥ 6.95	nd	≥ 6.14	nd	≥ 5.59	na	na
Nanofiltration 20 nanometer	≥ 4.81	≥ 4.63	nd	≥ 4.67	nd	≥ 3.63	≥ 5.92	4.61
Overall Reduction Capacity	≥ 25.11	≥ 27.78	≥ 6.33	≥ 21.28	≥ 6.49	≥ 17.42	≥ 19.25	15.04

*When the RF is < 1 log₁₀, it is not taken into account for the calculation of the overall reduction capacity.

≥: No residual infectivity detected / nd: not done / na: non-applicable, since the virus is theoretically resistant to this treatment.

Abbreviations: HIV, Human Immunodeficiency Virus, PRV, Pseudorabies Virus, IBR, Infectious Bovine Rhinotracheitis Virus, BVDV, Bovine Viral Diarrhoea Virus, SINDBIS, Sindbis Virus, WNV, West Nile Virus, EMC, Encephalomyocarditis Virus, PPV, Porcine Parvovirus.

Additionally, the manufacturing process was investigated for its capacity to decrease infectivity of an experimental agent of transmissible spongiform encephalopathy (TSE), considered as a model for the vCJD and CJD agents.

Several individual production steps in the Flebogamma 10% DIF manufacturing process have been shown to decrease TSE infectivity of an experimental model agent. TSE reduction steps include: 4% Polyethylene glycol precipitation [≥ 6.19 log₁₀] and Planova nanofiltration using a 20 nanometer filter [≥ 5.45 log₁₀]. These studies provide reasonable assurance that low levels of CJD/vCJD agent infectivity, if present in the starting material, would be removed.

12 CLINICAL PHARMACOLOGY

12.1 Mechanism of Action

Immune Globulin Intravenous (Human), Flebogamma 10% DIF is a replacement therapy for PI. It supplies a broad spectrum of opsonizing and neutralizing IgG antibodies against a wide variety of bacterial and viral agents. Flebogamma 10% DIF also contains a spectrum of antibodies capable of reacting with cells such as erythrocytes. The role of these antibodies and the mechanisms of action of IgG in Flebogamma 10% DIF have not been fully elucidated.

12.3 Pharmacokinetics

In the clinical study assessing safety and efficacy in PI, the pharmacokinetics of Flebogamma 10% DIF was assessed for 21 or 28 days after administration in 19 subjects. PK analysis was performed for 10 subjects receiving Flebogamma 10% DIF on a 21-day schedule and for 9 subjects receiving treatment on a 28-day schedule.

The mean dose (range) for those on the 21-day schedule was 476 mg/kg (range: 339-597), and it was 496 mg/kg (range: 434-588) for those on the 28 day schedule. Blood samples for PK analysis were obtained after Infusion 7 for subjects on a 28-day schedule and after Infusion 9 for subjects on a 21-day schedule. Table 3 summarizes the pharmacokinetic parameters of Flebogamma 10% DIF, measured as serum concentrations of total IgG.

Table 3. Pharmacokinetic Variables of Total IgG in Patients with PI

Variable	3-Week Dosing Interval (n=10)		4-Week Dosing Interval (n=9)	
	Mean ± SD	Range	Mean ± SD	Range
C_{max} (mg/mL)	195 ± 28.3	151 – 244	209.2 ± 36.6	168 – 292
AUC_{0-12h} (day·mg/mL)	3,395 ± 452.7	2,411.2 – 3,802.1	3,423.7 ± 397.2	2,768.3 – 4,082.5
Clearance (mL/day)	115 ± 31	81 – 186	144 ± 47	77 – 237
Half-life (days)*	34 ± 10	21 – 58	37 ± 13	24 – 59
Trough IgG level (mg/mL)^b	97.6 ± 16.5	64.5 – 114	87.7 ± 12.6	75.9 – 117

a. This half-life is an apparent value derived from a period of measurement of 28 days

b. For subjects on the 3-week schedule, the average of the trough levels from Infusion 9 to the end of the study was calculated; for those on a 4-week schedule, the average of the trough levels from Infusion 7 to the end of the study was calculated. The means of the subject means are presented in this table.

The half-life of IgG can vary considerably among patients.

13 NONCLINICAL TOXICOLOGY

13.1 Carcinogenicity, Mutagenesis, Impairment of Fertility

No animal studies were conducted to evaluate the carcinogenic or mutagenic effect of Flebogamma 10% DIF or its effects on fertility.

13.2 Animal Toxicology and/or Pharmacology

Acute toxicity studies were performed in mice and rats at doses up to 2.5 g/kg body weight with infusion rates 6 to 37 times higher than the maximum rates recommended for humans. The most common clinical observations in mice studies were piloerection, ptosis, ataxia and increase in respiration all lasting 90 minutes or less. No relevant adverse effects could be confirmed affecting respiratory, circulatory, renal, autonomic and central nervous systems, somatomotor activity, and behavior of the treated mice and rats.

Five out of the 25 rats treated with the highest dose at approximately 8 times the maximum infusion rate recommended for humans, showed a transient "reddish urine" sign which was not confirmed as a relevant toxicity causing phenomenon after renal macro and microscopic analysis. This phenomenon was ascribed to hemolysis when serum was analyzed, suggesting a possible relation to cross-reactivity of rodent red cells with human antibodies. No "reddish urine" was detected in any mouse, a much smaller animal where the rate of infusion was comparatively much higher than in rats. The macroscopic inspection of all treated mice did not show any renal alteration.

14 CLINICAL STUDIES

A phase 3, multicenter, open-label, historically controlled study to assess the efficacy, safety and pharmacokinetics of Flebogamma 10% DIF in subjects with PI was conducted in the United States. Forty-six subjects were treated with Flebogamma 10% DIF for 12 months at a 3-week or 4-week dosing interval. Subjects ranged in age from 6 to 65 years; 65% were male and 35% were female; 96% were Caucasian and 4% were Hispanic.

Since the subjects in the clinical study were assigned to 2 different treatment intervals (3-week vs. 4-week infusion schedules), the dosage had to be adjusted to ensure that the subjects received approximately the same dosage on an annualized basis. Therefore, subjects in the 3-week schedule received 75% of the monthly (4-week) dosage per infusion. This resulted in a mean annualized dosage of 468.5 mg/kg/month for subjects in the 3-week schedule (n=16, range 320-597 mg/kg/month) and 457.4 mg/kg/month for subjects in the 4-week schedule (n=30, range 307-588 mg/kg/month). Subjects received a total of 601 infusions of Flebogamma 10% DIF. The maximum infusion rate allowed during the study was 0.08 mL/kg/min.

During the study period, the annual rate of acute serious bacterial infection, defined as bacterial pneumonia, bacteremia or sepsis, osteomyelitis/septic arthritis, visceral abscesses and bacterial meningitis per subject per year, was 0.025 (with an upper 1-sided 98% confidence interval of 0.001 to 0.133). One subject had one episode of bacterial pneumonia. There were no other episodes of serious bacterial infections (Table 4).

Table 4. Summary of Bacterial Infections (Intention-to-Treat Population, N = 46)

Infections	Patients (N=46) N (%)	Episodes	Estimates [1]	98% CI [2]
Bacterial pneumonia	1 (2.2)	1		
Bacteremia or sepsis	0 (0.0)	0		
Osteomyelitis/septic arthritis	0 (0.0)	0		
Visceral abscess	0 (0.0)	0		
Bacterial meningitis	0 (0.0)	0		
Patients with at least 1 serious bacterial infection	1 (2.2)	1	0.025	(0.001, 0.133)

[1] Estimate = Total episodes/Total patient years.

[2] The confidence interval is obtained by using a generalized linear model procedure for Poisson distribution

The number of days of work/school missed, hospitalizations and days of each hospitalization, the number of visits to physicians or emergency rooms, other infections documented by positive radiographic findings and fever, and days on therapeutic and prophylactic oral/parenteral antibiotic use were also evaluated. These variables were annualized by using the subject-years exposure data of those subjects experiencing the events, but not the entire study cohort. With regard to the number of other validated infections, the mean rate was less than 2 days/subject/year (the calculation used all subjects, including those who had no infections, see Table 5).

Table 5. Summary of Annualized Efficacy Variables

Variable	Subjects		Mean number of events, days or visits/subject/year [1]
	N	%	
Work/school days missed	20	43.5	3.0
Days in hospital	5	11.0	0.6
Visits to physician/ER	24	52.2	2.1
Number of other documented infectious episodes	7	15.2	0.2
Days of therapeutic oral antibiotic use	36	78.3	56.4
Days of therapeutic parenteral antibiotic use	2	4.3	1.3
Days of other therapeutic antibiotic use	14	30.4	60.5
Days of prophylactic oral antibiotic use	19	41.3	45.8
Days of prophylactic parenteral antibiotic use	1	2.2	0.02
Days of other prophylactic antibiotic use	1	2.2	3.3

[1] Days of work/school missed per patient year are derived as total days of work/school missed divided by total days in study multiplied by 365. If data are missing for a period (e.g., between Infusion 2 and Infusion 3), then number of days in this period is not counted in the denominator. All other endpoints are derived similarly.

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16 HOW SUPPLIED/STORAGE AND HANDLING

Flebogamma 10% DIF is supplied in single-use, individually laser etched vials containing the labeled amount of functionally active IgG.

The following presentations of Flebogamma 10% DIF are available:

NDC Number	Fill Size	Grams Protein
61953-0005-1	50 mL	5 g
61953-0005-2	100 mL	10 g
61953-0005-3	200 mL	20 g

Each vial has an integral suspension band and a label with two peel-off strips showing the product name and lot number.

Flebogamma 10% DIF may be stored at room temperature at 2 to 25 °C (36 to 77 °F) for up to 24 months, as indicated by the expiration date printed on the outer carton and container label. Discard after expiration date. **Do not freeze.**

Keep Flebogamma 10% DIF in its original carton to protect it from light.

17 PATIENT COUNSELING INFORMATION

Instruct patients to immediately report the following signs and symptoms to their physician:

- Decreased urine output, sudden weight gain, fluid retention/edema, and/or shortness of breath (*see Renal Failure* [5.2])
- Symptoms of thrombosis which may include: pain and/or swelling of an arm or leg with warmth over the affected area, discoloration of an arm or leg, unexplained shortness of breath, chest pain or discomfort that worsens on deep breathing, unexplained rapid pulse, numbness or weakness on one side of the body (*see Thrombosis* [5.4])
- Severe headache, neck stiffness, drowsiness, fever, sensitivity to light, painful eye movements, nausea and vomiting (*see Aseptic Meningitis Syndrome* [5.5])
- Increased heart rate, fatigue, yellowing of skin or eyes and dark-colored urine (*see Hemolysis* [5.6])
- Trouble breathing, chest pain, blue lips or extremities, fever (*see TRALI* [5.7])

Inform patients that Flebogamma 10% DIF is made from human plasma and may contain infectious agents that can cause disease (e.g., viruses, and, theoretically, the CJD agent). The risk of Flebogamma 10% DIF transmitting an infection has been reduced by screening plasma donors for prior exposure, testing donated plasma, and inactivating and/or removing certain viruses during manufacturing (*see Warnings and Precautions* [5.8]). Instruct patients to report any symptoms that concern them might be caused by infections.

Inform patients that Flebogamma 10% DIF may interfere with their immune response to live viral vaccines such as measles, mumps and rubella. Inform patients to notify their health care professional of this potential interaction when they are receiving vaccinations (*see Drug Interactions* [7]).

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