A jump start for the immune system

WHEN THE PATIENT’S own immune system isn’t up to the task, immune globulin (IVIG) is administered intravenously (I.V.) to help treat or prevent certain diseases. The active ingredient in IVIG is immunoglobulin G (IgG, also called gamma globulin), and it’s one of five classes of normal human immunoglobulins.

What are immunoglobulins? You may know them better by their other name—antibodies. Immunoglobulins are complex, Y-shaped molecules that play key roles in the immune system’s response to infection. Besides IgG, the other human immunoglobulins are IgM, IgA, IgE, and IgD. Each has its own structure, function, and serum concentration, and all five are contained in commercially prepared IVIG preparations in varying amounts.

Let’s look at how IVIG gets the job done.

Man the breaches
Because IVIG supplements the body’s immune system, let’s take a moment to review immune system function. This sophisticated system is made up of cells and molecules that work in concert to protect the body from infectious agents. They use two different sets of tools to accomplish this: innate immunity and adaptive immunity.

Innate immunity exists even before an antigen or infection launches an invasion; it’s conferred by the barriers that keep harmful materials from entering the body, making innate immunity the first line of defense in the immune response. Some of the barriers that are part of innate immunity include the skin, stomach acid, mucus, the cough reflex, and enzymes contained in tears and skin oils. If an antigen gets past these physical barriers, it’s attacked and destroyed by other parts of the immune system. Adaptive immunity is acquired protection. It develops in response to exposure to an antigen (bacteria, viruses, fungi, toxins, chemicals, certain drugs, and foreign material). B lymphocytes and T lymphocytes (also called B cells and T cells), subgroups of white blood cells, are the key players in acquired immune responses. When antibodies attach to a specific antigen, they pave the way for phagocytes (another type of white blood cell) to engulf and digest the antigen. T cells attack antigens directly, and they provide control of the immune response.

Some B cells and T cells develop that are specific to a particular antigen, and some of these multiply and provide the immune system with a “memory” that allows it to respond more efficiently the next time the antigen is encountered. This process is called immunity. In many cases, immunity can prevent illness. For example, before the widespread use of the varicella vaccine, one episode of chicken pox infection conferred lifetime immunity. The development of immunity through infection (or vaccination) is called active immunity.

In passive immunity, another type of adaptive immunity, antibodies produced in one organism are passed to another. A common example is the immunity conferred on infants by their mothers during gestation and breast-feeding.

The primary difference between active and passive adaptive immunity is that active immunity results in the formation of antigen-specific memory cells; not so with passive adaptive immunity.

Is that you?
You’re probably saying to yourself by now, “Very interesting, but what’s it got to do...”
with immunoglobulin?” The short answer is this: IVIG confers passive immunity through antibodies that are present in the pooled donor plasma that goes into IVIG products.

Normally, the immune system has a mechanism in place that allows it to differentiate between self and nonself. How? Human leukocyte antigens (HLAs), proteins on the outside of the body cells, are effectively unique for each individual. The immune system learns to recognize HLAs as self and doesn’t attack them. Sometimes this mechanism goes out of whack, and an autoimmune disorder like systemic lupus erythematosus can arise.

IVIG is derived from pooled immunoglobulin from plasma donors. Obviously, the risk of bloodborne pathogen transmission via infusion is possible. Every donor, however, is thoroughly screened, and the product itself undergoes a battery of viral inactivation processes: pasteurization, washing with solvent/detergent to remove most of the IgA (which is most often responsible for allergic reactions), and filtration to remove endotoxins and prions. The chance of pathogen transmission through IVIG is extremely remote.

While it’s not entirely clear exactly how administration of IVIG works to bolster immunity, experts propose several theories:

- IVIG may provide antibodies from healthy donors that are absent in immunocompromised patients.
- It may signal an immune system that’s in overdrive to slow down, decreasing autoimmune activity.
- In autoimmune disorders, IVIG may provide a decoy target for an overactive immune system to attack, thus sparing the patient.

**Read the instructions**

Several brands and formulations of IVIG products are commercially available. Because reconstitution, storage, and specific administration protocols typically vary by product, it’s important to read and follow the manufacturer’s instructions for the selected product. Regardless of brand, IVIG should be administered through a designated I.V. line. Never combine two different brands of IVIG. Also, don’t mix IVIG with other medications or piggyback it into other infusions.

Some powdered (lyophilized) products must be reconstituted before administration. Depending on the brand, IVIG may be stable in solution for only 2 to 3 hours. Because IVIG must be sterile, don’t reconstitute the solution until you’re ready to administer it; that means I.V. access should already be established.

Review the manufacturer’s instructions to ensure that you understand how to reconstitute that particular product. In general, when reconstituting a dry preparation, don’t shake the vials after adding the appropriate diluent to mix the solution; this could damage the IgG proteins. Instead, allow the diluent to dissolve the powder and gently roll the vials between your palms or gently swirl them to admix the solution. Again, depending on the product, it’ll take anywhere from 5 to 20 minutes for the powder to dissolve.

If I.V. tubing is included with the product packaging, use it to administer the IVIG infusion. Some formulations also require filtration; product instructions will specify any applicable product-specific filter pore size.

Before administering the infusion, review the product instructions, infusion procedure, indications for therapy, symptoms of adverse reaction, and what steps to take in the event of complications arising. Be sure to emphasize to the patient that he needs to alert you if he feels anything unusual during the infusion.

Administer any premedications (like diphenhydramine, acetaminophen, and/or methylprednisolone sodium succinate [Solu-Medrol]). Premedications are sometimes ordered as a precaution even though anaphylactic events are rare (affecting less than 5% of patients), and usually attributable to reactions to IgA immunoglobulins.

Because IVIG is a fairly concentrated solution, try to use a large vein and a small catheter to achieve adequate hemodilution or use a central line to avoid reactions at the administration site. Remember, peripheral infusion of concentrated solutions increases the risk of phlebitis. Patients requiring lifetime infusion may benefit from early place-
ment of a permanent port for central venous access. Refer to the standards of practice from the Infusion Nurses Society for details on pH and osmolarity parameters for peripheral infusion. (The pH range for IVIG is 4.0 to 7.2; osmolarity is approximately 300 mmOsm/L.)

Assess the patient’s heart and lung sounds, and get a baseline set of vital signs before beginning the infusion. Some facilities require nurses to have an emergency drug kit and airway at the bedside when administering IVIG.

Now we’re ready for the main event: administering the IVIG.

**Easing into it**

A patient receiving his initial IVIG therapy is usually started at the lowest concentration while his tolerance for the therapy is assessed. More concentrated varieties of the product are available for patients who can’t tolerate the high volume of fluid associated with larger doses of IVIG.

IVIG is typically infused over a 2- to 4-hour period. Always follow the manufacturer’s recommendations for maximum rates of administration. Rates vary based on the dose to be administered and the patient’s diagnosis, body size, and medical history. Vital signs are usually obtained throughout the infusion. Many protocols mimic those for transfusion therapy.

After the infusion, follow your institution or agency’s protocol for disposal of vials. (Protocols vary from state to state. They’re sometimes grouped in with state-required policies for disposal of blood products.) Also, be sure to document the following:

- baseline assessment and vital signs
- I.V. access site
- trade name of the IVIG infused, lot number of all vials, expiration date(s), and the volume and dose administered
- patient education regarding therapy, patient response, and understanding regarding education
- how the patient tolerated the infusion
- nursing interventions
- any adverse reaction and emergency care provided.

Continue to monitor (or encourage the patient or caregiver to monitor) the patient’s hydration status for a few days after he receives IVIG. Advise the patient to report any signs and symptoms that might be associated with an adverse reaction to the infusion. Because the benefits of the IVIG infusion last for a limited period of time, patients usually require repeated infusions; frequency of therapy depends on the indication for which it’s ordered.

IVIG is a generally safe and effective treatment, but its use isn’t without risks. Let’s examine some of the pitfalls.

**Be prepared**

If a patient has any signs or reports any symptoms suggestive of an infusion reaction (fever, chills, rigor, malaise, flushing, sweating, hives, and shortness of breath) try slowing down the infusion. Infusion reactions are often related to a too-rapid infusion rate. Some institutions require the use of an infusion pump to better control the infusion rate. If a serious infusion reaction occurs (compromised airway, drop in blood pressure, change in level of consciousness), stop the infusion at once, maintain I.V. access, call for assistance, and administer emergency medications as needed and according to your institution’s protocol.

Other adverse events identified with IVIG include the following:

- **kidney failure.** Patients should be monitored for decreased urine output and hydration status. Obtain blood urea nitrogen and creatinine levels before and after IVIG administration. Don’t exceed 3 mg/kg/min of sucrose administration in sucrose-containing IVIG solutions. Because of their osmolarity, sucrose-containing IVIG solutions are contraindicated for patients over age 60 and those with signs and symptoms of heart failure or a serum creatinine level over 2.0. These patients should be given an iso-osmotic form of IVIG, such as Gamimune N.
- **aseptic meningitis.** This infrequent reaction is most likely to occur in IVIG-naïve patients receiving high-dose and/or rapid infusions.
- **hyperviscosity of the blood.** Thrombotic...
complications like pulmonary embolus, deep vein thrombosis, stroke, and myocardial infarction can occur from hyperviscosity of the blood. The concentration of IVIG can lead to increased blood viscosity and platelet aggregation.

Look past the label
Before administering IVIG, consult the manufacturer’s labeling for the approved indications and use of the product being administered, as these vary by brand. The Food and Drug Administration has approved IVIG for six conditions: primary immunodeficiencies, immune-mediated thrombocytopenia, Kawasaki disease, hematopoietic stem cell transplantation in patients older than 20 years (Gamimune N only), B-cell chronic lymphocytic leukemia, and pediatric HIV type 1 infection.

However, the National Guideline Clearinghouse cites off-label use of IVIG for many more conditions, including hematologic, infectious, neurologic, obstetric, pulmonary, rheumatologic, and other disease categories. Not surprisingly, up to 70% of patients who receive IVIG infusions do so for an off-label indication. Generally speaking, IVIG therapy is considered if a patient needs prophylaxis or treatment for an infection that can’t be effectively suppressed by the body’s own antibodies.

Learn more about it
