Intravenous Catheter Sizes and Flow Rates: A Quick Guide for Nurses

Understanding Intravenous (IV) Catheter Sizes

IV catheter selection is determined by the patient's clinical status and the type/amount of intravenous therapy needed for immediate treatment.

Peripheral IV catheters come in different diameters, measured in gauge (G). The smaller the gauge number, the larger the catheter diameter, which allows for a higher flow rate.

Central venous catheters (CVCs) are sized in French. French size and diameter are directly related, therefore a higher French size will allow for a greater flow rate.

Common Peripheral IV Catheter Sizes and Flow Rates

Gauge (G)	Outer Diameter (mm)	Flow Rate (mL/min)	Common Uses
14G	2.1 mm	240 mL/min	Trauma, massive fluid resuscitation
16G	1.7 mm	180 mL/min	Surgery, rapid volume replacement
18G	1.3 mm	90 mL/min	Blood transfusions, fluid resuscitation
20G	1.1 mm	60 mL/min	Routine IV fluids, medications
22G	0.9 mm	35 mL/min	Elderly, pediatric patients, slower infusions
24G	0.7 mm	20 mL/min	Neonates, fragile veins, low flow rate needs

Flow Rates Through Central Venous Catheters (CVC) and PICC Lines

- **Central Venous Catheter (CVC)**: Flow rates vary by catheter length as well as lumen size and number.
    - Single-lumen CVC can deliver about 125 mL/min
    - Multi-lumen CVCs have lower flow per lumen due to divided capacity:
        - medial (blue) & proximal (white) lumen of triple lumen catheter: 18G, max flow rate = 26 ml/min
        - distal (brown) lumen of triple lumen catheter: 16G, max flow rate = 52 ml/min
    - Introducer 8 French (2.8 mm):

  - Sometimes called a Cordis, a brand name for a large bore catheter used in trauma patients
  - Flow rates up to 300 ml/min

- **Peripherally Inserted Central Catheter (PICC Line)**:
  - PICC lines are long and small in diameter, so their flow rate is slow, typically 20-65 mL/min depending on the French size and number of lumens.
  - PICC lines are used for long-term infusions (parenteral nutrition and antibiotics) and for patients with limited peripheral access.

Choosing the Right IV Catheter for the Situation

- **Emergency & Trauma**: **14G-16G** for rapid infusion of fluids and blood.
- **Surgery & Critical Care: 16G-18G** for high-volume fluids and blood transfusions. Vasopressors can be safely infused through a peripheral IV of this size for up to 24 hours, then central access should be placed by a provider.
- **Blood Transfusions**: **18G-20G** preferred to prevent hemolysis and ensure efficient flow.
- **General IV Fluids & Medications**: **20G-22G** for most hospitalized patients.
- **Computed Tomography and Magnetic Resonance Imaging studies with IV contrast**: Most radiology departments prefer a **20G** IV or larger.
- **Fragile Veins (Elderly, Pediatric, Neonates)**: **22G-24G** to reduce vein trauma.
- **CVC Indications**: Used for critically ill patients, cardiothoracic surgery, vasopressor administration, hemodynamic monitoring, and multiple infusion therapies.
- **PICC Line Indications**: Preferred for long-term IV therapy, TPN (total parenteral nutrition), antibiotic administration, and chemotherapy when peripheral access is inadequate.

Key Nursing Considerations

- Choose the smallest size that meets the patient's clinical needs to minimize complications.
- Larger gauge catheters allow faster fluid delivery but can cause more trauma to veins.
- Maximum flow rates are listed on the packaging of some brands of IV catheters (e.g., BD catheters)

- The choice of infusion tubing can be a rate-limiting issue in fluid resuscitation through a large bore catheter. A standard IV infusion set has a rate limit of 12,000 ml/hr. A rapid infusion set allows for 48,000 ml/hr and should be used with 14G catheters or introducers for massive transfusion protocols.
- For a patient in severe shock, consider the impact of catheter size on the time it takes to administer a liter of IV fluid using a pressure bag and rapid infuser tubing.

Catheter size	Catheter Type	1000 ml Infusion Time
8.5 French	Introducer/Cordis	0.46 seconds
14G	Standard IV Cannula	1:30 minutes
18G	Standard IV Cannula	4:23 minutes
20G	Standard IV Cannula	6:47 minutes

- Needleless connectors can substantially reduce flow rates.
- Ensure patency and assess for signs of infiltration, phlebitis, or occlusion regularly.
- Use a pressure bag or pump for faster administration if needed, but ensure catheter size can accommodate it.
- Packed red blood cells are 4 times as viscous as crystalloid and will infuse more slowly.

References

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