Drip rate and Intravenous (IV) Medication Dosage Calculations

Medication (med) calculations are a cornerstone of nursing. In the intensive care unit (ICU), nurses sometimes monitor multiple intravenous (IV) medications all of which infuse at different rates. In the pediatric population, weight-based dosage calculations are imperative for safe medication administration. The following examples demonstrate complex multistep problems. Teachers can adjust these types of calculations to the capabilities of their students.

Sodium nitroprusside (sold under the brand Nitropress™) is a medication that directly dilates peripheral blood vessels to reduce blood pressure quickly in a hypertensive crisis (i.e., a sudden and dangerous increase in blood pressure). Often these hypertensive events are the result of long-standing cardiac (heart) or pulmonary (lung) dysfunction, but common street drugs, such as methamphetamine and cocaine, will also lead to dangerously high blood pressure readings. The order for Nitropress below provides a typical example of what a nurse would receive in the emergency department or the ICU.

Suppose a patient has an order for a nitroprusside drip at 0.5 mcg/kg of weight/min. The concentration is 50 mg of nitroprusside per 250 mL fluid. The patient weighs 85 kg. At what rate per hour should the nurse set the IV pump? Note that the unit mcg, or microgram, is one thousandth of a milligram. Writing mcg/kg/min is a convention used in medical literature; it is perhaps more accurate mathematically to denote this as:

$$\frac{\frac{mcg}{kg}}{min.} = \frac{mcg}{kg} \div min. = \frac{mcg}{kg} * \frac{1}{min.}$$

Multiple ways exist to determine an answer to the nurse's question. In the method presented, the dosage is first converted from micrograms to milligrams of nitroprusside delivered per kilogram of body mass per minute. The new dosage is then multiplied by the patient's body mass of 85 kg to determine the milligrams of nitroprusside needed for every minute of IV delivery. This rate is then multiplied by the inverse of the concentration of this IV solution. There are 50 mg of nitroprusside for every 250 mL of IV solution, and the reciprocal of this conversion factor is used to allow cancellation of units (see Figure 1).

Figure 1. Conversion and rate per hour solution.

$$\frac{0.5 \text{ mcg nitroprusside}}{\text{kg body weight *min.}} * \frac{1 \text{ mg}}{1000 \text{ mg}}$$

$$= 0.0005 \ \frac{\text{mg nitroprusside}}{kg \text{ body weight*min.}}$$

For a person weighing 85 kg,

$$\frac{0.0005 \text{ mg nitroprusside}}{\text{kg body weight*min.}} * 85 \text{ kg body weight}$$

$$= 0.0425 \ \frac{\text{mg nitroprusside}}{\text{min.}}$$

$$\frac{0.0425 \text{ mg nitroprusside}}{\text{min.}} * \frac{250 \text{ mL medication}}{50 \text{ mg nitroprusside}}$$

$$= 0.2125 \ \frac{\text{mL medication}}{\text{min.}}$$

Converting to the rate per hour,

$$\frac{0.2125 \text{ mL medication}}{\text{min.}} * \frac{60 \text{ min.}}{\text{hr.}}$$

$$= 12.75 \ \frac{\text{mL medication}}{\text{hr.}}$$

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