What is the current evidence related to basing vasoactive drips on body weight for bariatric patients?

Linda Harrington, RN, PhD, CNS, CPHQ, replies:

This is an important question because two thirds of the population is considered overweight and 30% of the adults in the United States are considered obese. Coinciding with the growing incidence of obesity is the increasing number of bariatric surgeries along with the associated risks including emergency cardiovascular situations. Therefore, the answer to this question has a broad clinical application beyond bariatric patients to include the larger obese population.

For the purpose of this article, I use the Iowa Model of Evidence-Based Practice to Promote Quality Care to define the term evidence. This model is easy to understand and simple to use. According to the Iowa model, evidence consists of research, case reports, expert opinions, scientific principles, and theory. Some people may equate evidence solely to research; however, the reality is that there is not enough research to support the majority of our healthcare processes. Often, it is necessary to look for other sources of evidence to make the best clinical decisions. In this article, I use the Iowa model to navigate the issues and sources associated with evidence-based practice.

**Research Evidence**

Following the publication of the American Heart Association (AHA) guidelines for cardiopulmonary resuscitation and emergency cardiovascular care in December 2005, our bariatric multidisciplinary team questioned the application of these guidelines for our bariatric surgery patients. We wanted to know what the evidence, in particular the research evidence, was for our bariatric surgery patients, in addition to other obese patients. We did an extensive review of the literature and included all weight-based medications identified in the AHA advanced cardiac life support guidelines, which include vasoactive drips such as dopamine, dobutamine, and nitroprusside. We did not limit our review to bariatric surgery patients but included obese patients as well, largely because we did not find any research specific to bariatric surgery patients and dosing of weight-based emergency medications.

Limited research exists on weight-based emergency medications including vasoactive drips; we found only 8 research articles relating to obesity. Furthermore, these 8 articles covered only 6 of the 17 weight-based advanced cardiac life support medications (35%).

Generally, if no specific recommendations exist, weight-based medications should be administered on the basis of total body weight; however, this assumption is not consistent with the limited research. One study on digoxin recommended that loading and maintenance doses be based on ideal body weight in obese patients, which reflects lean body mass as recommended by the AHA. Two other studies on lidocaine and verapamil recommended loading and maintenance dosing on the basis of total body weight, also consistent with AHA guidelines.

However, although Christoff et al found that distribution and clearance of procainamide was similar in obese and normal-weight patients, they recommended that loading and maintenance doses be based on ideal body weight to...
ensure a margin of safety and to prevent complications associated with procainamide. The 2 remaining studies on propranolol and sotalol made no recommendations on dosing in obese patients.

Although we found no research on vasoactive drips specific to bariatric surgery or obesity, we found 2 studies on normal-weight subjects, which are pertinent to this discussion. In a prospective study of 16 hemodynamically unstable adults (aged 18 to 84 years) requiring dobutamine for inotropic support, researchers examined the variability in the pharmacokinetics of dobutamine. Both interpatient and intrapatient variability in infusion rate and resultant serum concentrations were wide: mean (SD) infusion rate of dobutamine was 8.2 (5.7) μg/kg/min (range 1.7-22.3 μg/kg/min) and mean serum concentration was 214 (183) ng/mL (range 15-759 ng/mL). These findings suggest that the infusion rate must be guided by clinical end points rather than by predetermined values because of the wide variability. The researchers concluded that recommended weight-based dosing also has limitations in nonobese patients.

In a more recent study, normal-weight subjects were given dopamine at 3 μg/kg/min for 90 minutes. Similar to the dobutamine study, this dosing produced a wide range of serum concentrations from 1880 to 18300 ng/L. The variation increased with larger doses of dopamine at 10 μg/kg/min for 10 minutes to 12300 to 20500 ng/mL. Researchers concluded that the 10- to 75-fold inter-subject variability suggested that dosing dopamine on the basis of body weight does not yield predictable blood concentrations.

In short, research evidence on vasoactive drugs in bariatric or obese patients could not be found. Studies on the administration of emergency medications in obese patients are scarce and have not produced conclusive results in terms of effective weight-based dosing strategies. Research on vasoactive infusions in normal weight subjects also is limited and shows wide variability precluding weight as a reliable predictor of dosing. Examination of other evidence is therefore warranted.

**Theoretical Evidence**

One theory of medication dosing in obese patients deals with drug solubility: drug distribution may be modified as a result of changes...
in body composition whereby obese patients have a greater amount of adipose tissue. Drugs that are lipophilic in nature are thought to have an affinity for adipose tissue and therefore should have an increased volume of distribution and prolonged half-life in obese patients. Conversely, drugs that are hydrophilic have a tendency to be solvated by water and are more attracted to lean body mass, which has a higher percentage of water.

Several researchers have questioned the reliability of drug solubility as a predictor of dosing in obese patients because there are several exceptions. For example, in emergency medications in obese patients, drugs such as digoxin and procainamide are highly lipophilic but there is no systematic relationship between their degree of lipophilicity and their distribution in obese individuals.\(^6\) Available research suggests that weight-based dosing based on knowledge of specific drugs is more reliable than dosing based on general drug properties such as lipophilicity or hydrophilicity.\(^{14-18}\)

**Expert Evidence**

The complex pharmacokinetics in obese patients and the increased risk of complications in this patient population warrant research on vasoactive drips. Although a review of the literature provided some insight into 6 emergency medications in obese patients, the limited number of studies significantly minimizes the support for clinical decisions. Additionally, these studies involved single dosing, nontherapeutic dosing, and dosing in nonemergency situations. Other variables such as blood flow, protein binding, and tissue binding were not routinely measured and may also influence medication distribution and clearance in obese patients.\(^3\)

**Conclusions**

There are 3 things nurses should take away from this discussion: (1) there is a paucity of research on weight-based vasoactive drips in obese patients; (2) the research on weight-based vasoactive drips in nonobese patients is insufficient; and (3) there are reasonable actions to consider when administering weight-based vasoactive drips despite the lack of research evidence.

In the practice setting, nurses should:

- titrate drugs for desired effects,
• monitor for signs and symptoms of drug toxicity, and
• obtain serum drug levels when appropriate.

In nonemergent situations, consider a conservative approach such as ideal body weight for the dosing of drugs with a narrow therapeutic index. Findings from the limited research suggest that loading and maintenance dosing based on ideal body weight is more likely to avoid problems13; however, this may not always be appropriate in critical situations.

References