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Intravenous Infusions: Making Life Easy

To the Editor:—The use of vasoactive drugs delivered by infusion pumps during anesthesia is becoming more and more frequent. Guidelines for infusion concentrations and rates have been given by Hug and Kaplan and have been adopted widely.[1] However, use of these concentrations makes it difficult to calculate how much drug is being delivered at a given moment.

Most infusion pumps are calibrated in ml/h. If the pump is set to deliver x ml/h of a drug concentration y μg/ml, then: amount of drug delivery per minute $= \frac{xy}{60}$ μg/min.

From this equation it easily can be seen that the usual "round number" concentration of drug gives no simple relationship between the pump setting and the amount of drug being delivered. It is clear, though, that if the drug concentration is a multiple of 60, there will be a fixed relationship between the pump setting and drug infusion rate.

As an example, the suggested concentration for sodium nitroprusside is 50–100 μg/ml, which results in a drug delivery rate of 0.83 or 1.67 × pump setting, respectively. This makes for unnecessary mental arithmetic, should it be necessary to know the infusion rate. If, instead, the drug concentration is 60 or 120 μg/ml, the amount of drug delivered per minute equals the pump setting or is twice the pump setting, respectively.

The best way of dealing with mathematics in clinical medicine is to get it out of the way at the start. In the case of anesthesia drug infusions, this can be accomplished by rational selection of drug concentrations. While the drugs are titrated to effect, it is always adventageous to know how much drug is being delivered. Table 1 lists suggested dilutions, the resulting concentrations, and drug infusion rates. These assume an infusion pump calibrated in ml/h.

It may seem odd at first to prepare drugs in these concentrations. However, much time and headache is saved when it is desired to know the amount of drug delivered.

TABLE 1. Suggested Dilutions, the Resulting Concentrations and Drug Infusion Rates

Drug	Suggested Dilution	Infusion Rate, μg/min
Dopamine (Intropin®)	60 mg in 100 ml = 600 μg/ml	10 × pump setting
Dobutamine (Dobutrex®)	60 mg in 100 ml = 600 μg/ml	10 × pump setting
Sodium nitroprusside (Nipride®)	12 mg/100 ml = 120 μg/ml	2 × pump setting
Nitroglycerin (Tridil™, and others)	12 mg/100 ml = 120 μg/ml	2 × pump setting
Phentolamine (Regitine®)	12 mg/100 ml = 120 μg/ml	2 × pump setting
Phenylephrine (Neo-Synephrine®)	12 mg/100 ml = 120 μg/ml	2 × pump setting
Metaraminol (Aramine®)	12 mg/100 ml = 120 μg/ml	2 × pump setting
Norepinephrine (Levarterenol)	1.2 mg/100 ml = 12 μg/ml	0.2 × pump setting
Epinephrine (Adrenaline®)	0.6 mg/100 ml = 6 μg/ml	0.1 × pump setting
Isoproterenol (Isuprel®)	0.6 mg/100 ml = 6 μg/ml	0.1 × pump setting

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A Simple Device for Monitoring the Esophageal Electrocardiogram

To the Editor:—The diagnosis of complex dysrhythmias is often problematic, especially when the dysrhythmia occurs in the setting of tachycardia.[1] The use of an esophageal electrocardiogram often can be a useful technique in this clinical setting to help augment the "P" wave on the electrocardiogram.[2,3] Kates and colleagues recently

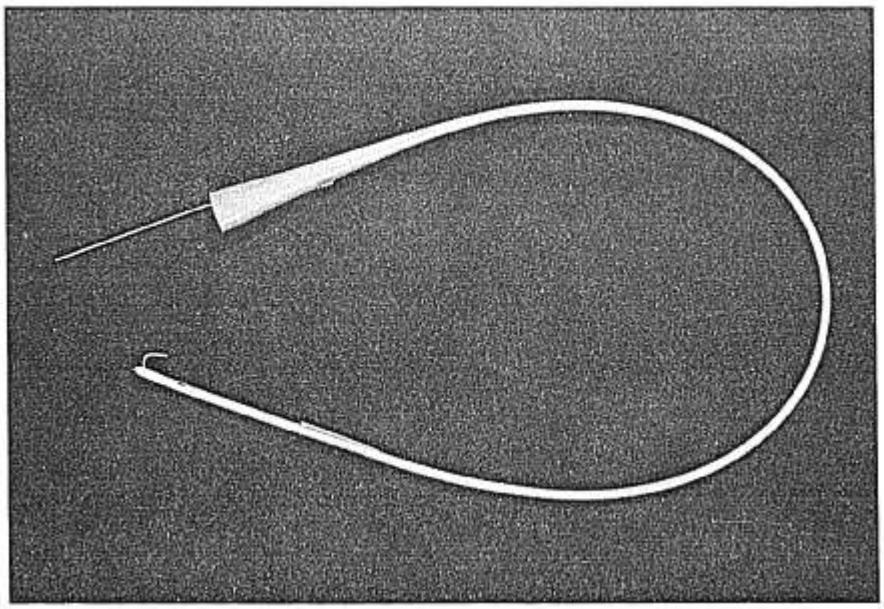

FIG. 1. Esophageal lead construction.

reported the successful use of a bipolar esophageal lead fashioned from an esophageal stethoscope with two external chloridized silver wires as electrodes.[4] We have developed a unipolar esophageal lead and have used this esophageal electrode on patients ranging in weight from 10 to 130 kg.

Our esophageal lead can be constructed from common operating room materials in a short period of time. The esophageal lead is constructed from an intravascular "J"-wire ("Duoflex" Spring Wire Guide,® 0.035-in diameter × 17 and ¾-in length with 3-mm "J" tip, Arrow International, Inc., Hill and George Ave., Reading, Pennsylvania 19610), and an 8 French multipurpose ("Red Robinson") catheter (Robinson-Nealton Catheter-Argyle®, 8 French × 16-in length, Sherwood Medical Industries, St. Louis, Missouri 63103). The "J"-wire is placed in the catheter so only the flexible 3-mm "J" portion of the wire protrudes through the distal opening in the catheter. (fig. 1) The catheter then is placed into the lumen of the esophagus and is ready for positioning electrocardiographically to provide the most distinct "P"-wave appearance.

This apparatus should be able to be fashioned in almost any hospital in this country and abroad from disposable, inexpensive materials (total cost approximately $4.00). The 8 French catheter was chosen to electrically isolate the "J" portion of the guide wire, since the smaller-sized distal openings seem to prevent esophageal secretions from gaining access to the interior of the catheter. We initially attempted to use larger catheters to facilitate placement into the esophageal lumen, but the "P"-wave appearance was not as satisfactory as that with the smaller-sized catheter, presumably because of the problem of secretions gaining access to interior of catheter. The use of the smaller catheter often necessitates that one place the lead into the esophageal lumen with gloved hands, since the catheter is quite pliable. The proximal straight portion of the "J"-wire is connected to the chosen EKG lead with an alligator clip, and monitoring is undertaken. Appropriate electrical safety precautions should be followed any time this electrocardiographic lead is utilized.[5]

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