Delivery Systems for Intravenous Nitroglycerin

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The indications for administration of intravenous nitroglycerin (IV NTG) have broadened considerably. Anaesthesiologists and intensivists may wish to utilize the venous, arterial, or coronary vasodilator properties of IV NTG for the treatment of myocardial infarction, myocardial ischaemia, congestive heart failure, hypertension, or for the induction of deliberate hypotension.¹ In addition to pharmacokinetic and pharmacodynamic variables influencing the dose-response relationship for IV NTG, the delivery system used to administer NTG may substantially influence the actual dose of NTG administered at a given concentration and infusion rate.² Unless an appropriate delivery system is used to administer IV NTG, the clinical response will be unpredictable and will vary substantially with time. Significant quantities of NTG are adsorbed to the surface, and dissolved in the matrix, of polyvinyl chloride (PVC) plastic, the major constituent of most transparent and flexible intravenous fluid containers and tubing.³ The presence of PVC in any portion of an NTG delivery system will result in administration of reduced concentrations of NTG.⁴

The magnitude and time course of fluctuations in administered NTG concentration will depend upon several variables, including NTG concentration, the surface-to-volume ratio of the PVC container or tubing, and the infusion flow rate.⁵ If NTG is administered from a glass container through a PVC infusion set, the administered concentration typically decreases by 50–80 per cent during the first 20–30 minutes of infusion at 0.5–1.0 ml/min, and then rises slowly as the PVC tubing becomes saturated with NTG.⁶

Intravenous NTG is often infused centrally. Commonly used central venous, and pulmonary arterial catheters contain varying lengths of PVC plastic. We have found *in vitro* that these catheters cause further significant NTG loss (unpublished data). Until recently, most published clinical investigations of IV NTG have not included detailed

descriptions of the NTG delivery systems used, and PVC containers and administration sets were probably employed in many instances. The use of various PVC delivery systems, under a variety of circumstances, probably accounts for the marked variability of IV NTG dosage required to achieve significant haemodynamic effects in these studies.

Recently, reliable commercial non-adsorptive delivery systems for IV NTG (eg. Nitrostat IV, Parke-Davis; Tridilset, American Critical Care) have become available.⁶ However, a simple non-adsorptive delivery system can be prepared from materials available in most operating rooms. An infusion pump is used to deliver NTG solution from a glass or polypropylene syringe,* through high-density polyethylene tubing,† connected to a Teflon catheter‡ in a peripheral vein. We have assessed such delivery systems *in vitro* and found 99 per cent delivery of NTG. Clinical investigations of peri-operative IV NTG administration using non-adsorptive delivery systems are now being published.⁷ These studies provide accurate dose response data for nitroglycerin, and suggest that IV NTG is significantly more potent than previously thought.⁸ Thus, inadvertent NTG overdosage may occur if previously published infusion rates for IV NTG are used with non-adsorptive systems. However, with experience, the use of non-adsorptive NTG delivery systems should make IV NTG administration safer, and its effects more predictable. Published investigations of IV NTG

*Plastipak® – Becton Dickinson.

†Cobe Laboratories (40/106/001).

‡Cathlon IV® – Critikon Canada.

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should henceforth document that all components of the delivery systems employed were non-adsorptive for NTG.

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