

Title: TECHNIQUE OF ADMINISTRATION ALTERS INTRACRANIAL PRESSURE RESPONSE TO NITROGLYCERIN BUT NOT TO NITROPRUSSIDE

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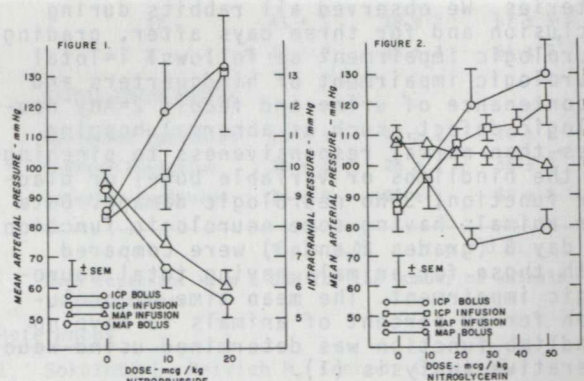
Introduction. Nitroglycerin (NTG) and Nitroprusside (SNP) have both been used to induce controlled hypotension during anesthesia. Both drugs also alter cerebral blood flow and elevate intracranial pressure (ICP) in experimental models. The intracranial pressure response to SNP has also been found to be modified by the rate of administration in cats with intracranial hypertension.¹ This study evaluates the effect of administration rate of NTG versus SNP on ICP during two different levels of general anesthesia.

Methods. Nine unpremedicated mongrel dogs (18-25 kg) were anesthetized with halothane in oxygen, intubated after 2 mg/kg of succinylcholine I.M., and ventilated with a Harvard respirator. PaCO₂ was maintained between 38 and 42 mmHg. The dogs were secured in the prone position after intra-arterial and intravenous lines were established. ICP was measured via a Richmond subarachnoid bolt. Animals were divided into two groups. Group I (n=5) received SNP by bolus injection and constant infusion (10 and 20 mcg/kg). Group II (n=4) received NTG by bolus injection (25 and 50 mcg/kg) and constant infusion (10,20,30,40,50 mcg/kg/min). Animals in both groups were studied during 0.5% and 1% end tidal concentrations of halothane. Technique of drug administration and level of anesthesia were randomized within each group.

Results. Group I dogs had significant decreases in MAP and significant increases in ICP at all dose levels of SNP at both 0.5% and 1.0% halothane ($P < 0.001$). Correlation analysis of MAP to ICP was also significant ($P < .01$, $r = -.31$). Incremental decreases in MAP produced related incremental increases in ICP. When the analysis was repeated with the effects of MAP removed via covariance no effects of SNP on ICP were significant in either group. Changes in ICP due to nitroprusside administration were accounted for by changes in MAP. Changes in ICP due to SNP were not significantly different at 0.5% versus 1.0% halothane. Group II dogs also had significant increases in ICP at all dose levels of NTG at both 0.5% and 1.0% halothane ($P < .01$). MAP decreased significantly with bolus administration of NTG but not with infusion. Correlation analysis of MAP to ICP was also significant in both NTG groups ($P < .01$, $r = -.51$). NTG administration resulted in incremental increases in ICP. However, when the effects

of MAP on ICP were removed by covariant analysis NTG administration still significantly increased ICP in both the 0.5% and 1% halothane groups.

Discussion. These studies confirm that SNP and NTG can both increase ICP even when baseline ICP is within normal limits. It is known that the hemodynamic effects of NTG and SNP are different. SNP has a dose dependent, direct relaxant effect on vascular smooth muscle resulting in predictable decrease in systemic vascular resistance. NTG, also a vasodilator, has unpredictable effects on systemic vascular resistance. These studies indicate that the mechanism by which these drugs alter cerebral autoregulation, and hence ICP are also not analogous. SNP is a direct vasodilator producing a dose-related effect on both the peripheral and cerebrovascular circulation with a dose-related effect on both MAP and ICP. The effects of NTG on ICP are not related to changes in MAP. Significant increases in ICP were found without significant changes in MAP. SNP would seem to be a superior drug for inducing controlled hypotension in situations where changes in ICP are important. The changes in ICP produced by SNP are dose dependent and directly related to the decrease in MAP. NTG, however, is capable of producing significant increases in ICP with no change in MAP.



Figures 1 & 2: Effects of SNP and NTG respectively on MAP and ICP during 1% halothane anesthesia.

References

1. Marsh ML, Aidinis SJ, Naughton KVH, et al; The technique of nitroprusside administration modifies the intracranial pressure response. Anesthesiology 51:538-541, 1979.