Title: CEREBRAL RESPONSES TO NITROGLYCERIN WITH HYPOXIA

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Introduction. In the experimental animal nitroglycerin (NTG) is capable of increasing cerebral spinal fluid pressure (PCSF)[1] and decreasing cerebral blood flow (CBF). [2] In the human, these drugs are used in clinical settings in which other factors may also influence PCSF or CBF. For example, many patients who receive NTG may be hypoxic and it is not clear how the hypoxia influences the cerebral hemodynamic effects of NTG. The present study was designed to evaluate the effect of NTG on PCSF and CBF during normoxic and hypoxic conditions.

Methods. Mongrel dogs of either sex were anesthetized with sodium pentobarbital (30mg/kg), paralyzed with succinylcholine and ventilated with a Harvard respirator to maintain $PaCO_2$ between 32-36 torr. $PaO_2$ in control animals was 90 torr. PCSF was measured in the lateral ventricle; CBF was measured with the cerebral venous outflow technique; and cerebral perfusion pressure (CPP) was calculated as the difference between mean arterial pressure and PCSF. PCSF could be elevated by infusion of mock CSF in the lateral ventricle. NTG (5, 25, 50µg/kg) was injected into a femoral vein.

Following normoxic studies, animals were ventilated with a low $O_2$ mixture ($PaO_2$ = 39 torr) and repeat measurements of CBF, PCSF and CPP were made after administration of NTG. The animals were then returned to control $PaO_2$ and the studies repeated to demonstrate a return to control response to NTG.

Results. In normoxic animals with normal PCSF (10-15 mm Hg) NTG (5, 25, 50µg/kg) increased PCSF by 90, 139 and 164% and decreased CPP by 18, 32 and 36% respectively. CBF remained unchanged from control values. Following elevation of PCSF to 30-40 mm Hg, NTG increased PCSF by 49, 57 and 56% and decreased CPP by 30, 39 and 47%. CBF decreased by 9, 14 and 24% with each dose of NTG. During hypoxemia CBF increased from 20 ± 2 to 42 ± 3 ml/min and PCSF increased from 12 ± 3 to 35 ± 3 torr. NTG (5, 25, 50µg/kg) further increased PCSF by 40, 46 and 58% while decreasing CPP by 35, 53 and 60%. CBF decreased by 20, 33 and 38% with each dose of NTG.

Discussion. We conclude that the previously demonstrated deleterious effects that NTG may have on CBF by reducing CPP below the autoregulatory range may be enhanced by hypoxemia. The interaction of hypoxemia and elevated resting PCSF make the administration of NTG likely to reduce CPP below the autoregulatory range and thus reduce CBF. These findings may be important in hypoxic patients with cardiovascular abnormalities requiring treatment with NTG.

References.

1. Rogers, M.C., Hamburger, C., Owen, K., and Epstein, M.H.: Effects on Nitroglycerin on Intracranial Pressure in the Cat. Anesthesiology 51: 227-231, 1979.
2. Rogers, M.C., Traystman, R.J.: Cerebral Hemodynamic Effects of Nitroglycerin and Nitroprusside, Acta Neurolog Scand (Supp) 72: 600-601, 1979.

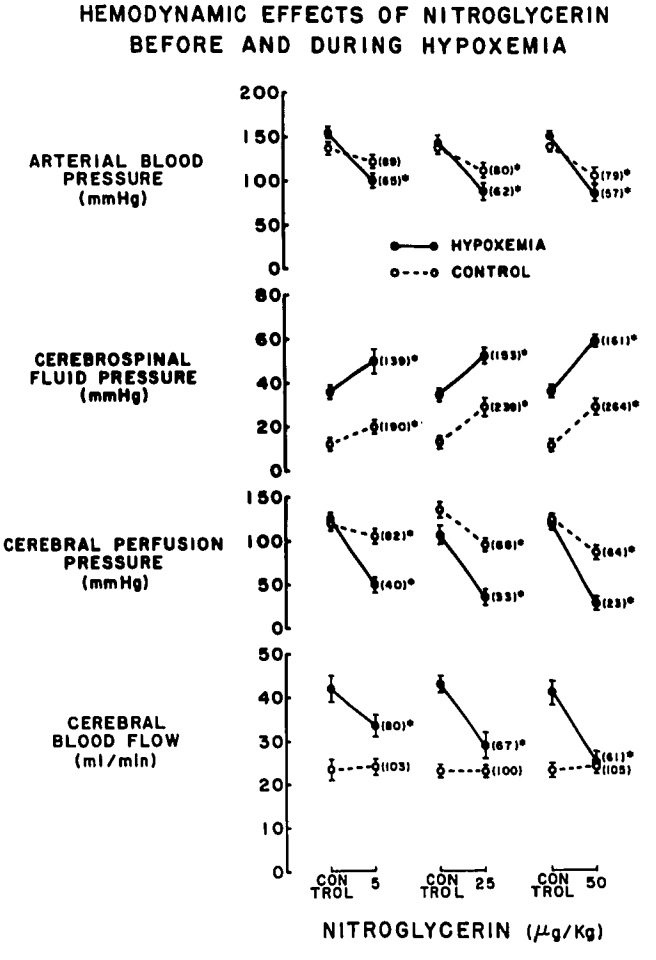


Fig. 1. * = P less than 0.05 using student's t-test for paired samples.