Date : May 1, 1980

Title : REGIONAL HEMODYNAMIC CHANGES OF SODIUM NITROPRUSSIDE VS. NITROGLYCERIN

Authors : Simon Bergman, D.D.S., William E. Hoffman, Ph.D., Anita Jozefiak, B.S., David J. Miletich, Ph.D., B.J. Gans, D.D.S., M.S., and Ronald F. Albrecht, M.D.

Affiliation : Department of ANesthesiology, Michael Reese Hospital & Medical Center, Chicago, Illinois 60616

Introduction. In recent years hypotensive anesthesia with nitroprusside has been used with increased frequency. The principal benefits of deliberately induced hypotension include a significant reduction in the need for transfusion due to decreased blood loss and a greater ease of operating because of a drier surgical field. While these benefits are desirable, underperfusion of the vital organs is not. Although nitroprusside (NTP) has enjoyed popularity as a hypotensive agent, its undesirable effects may include tachyphylaxis, cyanide toxicity, and death. This has renewed interest in search for an effective and safer hypotensive drug. In light of recent interest in nitroglycerin (NTG) it would be important to study and compare the regional hemodynamic effects of NTP with NTG.

Methods. S.D. female rats (275-325gms) were tracheotomized and anesthetized with enflurane. PE50 catheters were placed in the femoral artery, vein and in the left ventricle. Arterial blood gases were adjusted to a pCO_2 of 38 torr. Body temperature was maintained at 37°C. 15 um radioactive microsphere injections were given at baseline blood pressure with 2% enflurane. In other rats the pressures were decreased to means of 70 with NTG or NTP before injection of microspheres. After sacrificing the rats, brain, heart, kidney, small intestine, spleen, skeletal muscle and skin samples were dissected out and counted with a gamma counter. Cardiac index and blood tissue flows were calculated as in Malik et al (1). Groups were compared with unpaired t-tests.

Results. The three groups compared in this experiment are as follows: 1) control 2% enflurane, 2) 2% enflurane + nitroprusside to mean pressure of 70, 3) 2% enflurane + nitroglycerin to mean BP of 70. NTP and NTG both showed no significant change in cardiac index but both BP and TPR were significantly decreased compared to controls. Both NTP and NTG produced decreases in tissue vascular resistance in brain, heart, kidney, muscle, intestine, spleen but not skin tissues. The greatest percentage decrease in vascular resistance was observed in muscle tissues with both NTP and NTG (see table 1). Decreases were seen in skin tissue blood flow during both NTP and NTG while increases were observed in spleen flow. NTP and NTG produced significantly different hemodynamic effects in brain and muscle tissues.

Discussion. The results of these studies indicate that infusions of NTP and NTG which decrease blood pressure to similar hypotensive levels also have similar cardiovascular effects. Decreasing the blood pressure to 70 mmHg with both NTP and NTG decreased peripheral resistance but did not significantly affect cardiac index. It was observed that NTG and NTP have a range of effects on vascular resistance, depending on the specific region. Muscle resistance vessels were most reactive to NTG and NTP while skin vasculature was least reactive. The differential effects of NTP and NTG on brain and muscle hemodynamics suggest differences in the mechanism of action of the two vasodilator drugs. These differences may be exploited during hypotensive therapy to provide better control of regional hemodynamics.

References.

1. Malik, A.B., Kaplan, J.E. and Saba, T.M.: Reference Sample Method for Cardiac Output and Regional Blood Flow Determinations in the Rat. J. Appl. Physiol. 40:472-475, 1976.

	Control	NTP	NTG
BP	128± 9	70± 2**	72± 2**
CI	206± 15	176± 22	181± 8
TPR	0.70±.07	0.44±.03**	0.41±.02**
Tissue Resistances (torr/ml/100g/m)			
Brain	1.01±.08	0.76±.06*	0.54±.07**
Heart	0.28±.02	0.19±.02*	0.20±.02**
Kidney	0.36±.03	0.22±.02**	0.26±.03**
Intest.	1.32±.09	0.69±.07**	0.71±.05**
Spleen	1.74±.23	0.56±.09**	0.72±.13**
Muscle	43.39±5.0	6.74±.88**	13.02±.95**
Skin	16.21±1.7	15.19±.80	13.50±.46
n =	18	13	11

* = $p<.05$, ** = $p<.01$ compared to control