Title: EVIDENCE FOR TONIC NEURAL VASODILATATION OF THE PULMONARY CIRCULATION IN CONSCIOUS DOGS

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Introduction. Detailed anatomical studies provide convincing evidence of autonomic nervous system innervation of the pulmonary circulation. However, the extent to which the autonomic nervous system modulates basal vasomotor tone in the pulmonary circulation has not been clearly documented. We have developed a new technique which permits the construction of multipoint pulmonary vascular pressure-cardiac output (P:Q) plots in conscious dogs. The generation of P:Q plots allows us to distinguish between passive (i.e. hydraulic) and active (i.e. vasoactive) changes in the pulmonary circulation induced by total or selective autonomic nervous system block. Moreover, the use of chronically-instrumented conscious dogs avoids the potentially confounding direct and indirect effects of anesthesia and surgical trauma on the pulmonary circulation. Our overall objective was to investigate the extent to which the pulmonary circulation is under tonic neural control. Specifically, we examined the effects of total autonomic ganglionic block, as well as the effects of selective inhibition of cholinergic and adrenergic nerve activity on pulmonary vascular P:Q relationships.

Methods. Experiments were performed on 10 conscious dogs chronically instrumented with catheters in the thoracic aorta, main pulmonary artery and left atrium to measure pressures and sample arterial and mixed venous blood gases. Cardiac output (thermal dilution) and pulmonary capillary wedge pressure were measured with a Swan-Ganz catheter acutely positioned in the pulmonary artery via percutaneous jugular puncture on the day of the experiment. Multipoint P:Q plots were constructed by stepwise inflation of a hydraulic occluder chronically implanted around the thoracic inferior vena cava to reduce venous return. P:Q plots were constructed with the autonomic nervous system intact, following total autonomic nervous system block (hexamethonium chloride, 30 mg/kg iv), and following selective cholinergic block (atropine sulfate, 0.1 mg/kg iv) and adrenergic block (propranolol HCl, 1 mg/kg and phentolamine HCl, 2 mg/kg iv). Linear regression analysis was used to compute slopes and intercepts of pulmonary vascular pressures as a function of cardiac output. Calculated pulmonary vascular pressures from individual experiments were averaged at 0.5 lit/min intervals of cardiac output and are presented as Mean $\pm$ 1 SEM. Treatment effects were assessed by two-way analysis of variance with repeated measures and Duncan's Multiple Range Test.

Results. Neural block had no significant effect on arterial or mixed venous blood gases. The effects of neural block on the pulmonary circulation are summarized in Figure 1. Cholinergic block had no significant effect on the pulmonary vascular pressure gradient (PAP-PCWP) over this normal range of cardiac outputs. In contrast, as indicated by the asterisks, both total autonomic ganglionic block and adrenergic block significantly increased ($p<0.01$) the pulmonary vascular pressure gradient compared with nerves intact. Moreover, the increase in the pulmonary vascular pressure gradient induced by total autonomic ganglionic block was significantly greater ($p<0.01$) than adrenergic block alone. Whereas total autonamic ganglionic block increased the pressure gradient approximately 60 percent above intact levels, adrenergic block alone increased the pressure gradient only about 20 percent above intact levels.

Conclusion. In conscious dogs, sympathetic nerves exert a modest tonic vasodilator influence on the pulmonary circulation. The more marked pulmonary vasoconstrictor response observed with total autonomic ganglionic block implies a separate tonic non-adrenergic, non-cholinergic vasodilator influence on the pulmonary circulation.

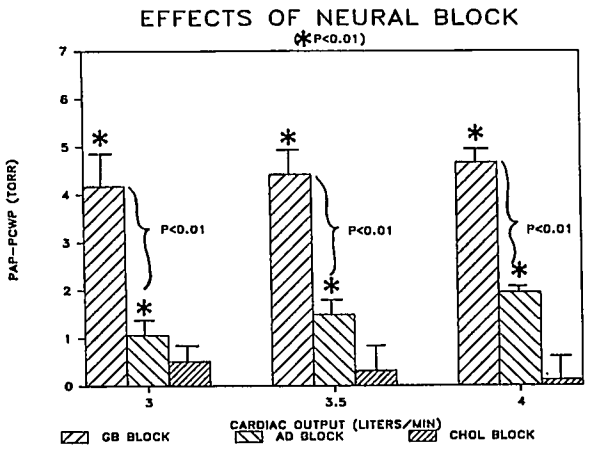

Figure 1