Cardiovascular responses of the anaesthetized cat to lower body negative pressure

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By enclosing the lower limbs and pelvis of human subjects in an airtight box these parts may be exposed to pressures below atmospheric. This manoeuvre—lower body negative pressure (L.B.N.P.)—causes blood to pool in the parts exposed to the suction and evokes compensatory reflex responses. This is a non-invasive procedure which has been used to investigate the effect of drugs on autonomic mechanisms in man (Ardill, Bhatnagar & Fentem, 1967; Bannister, Ardill & Fentem, 1969). The method has recently been extended to the investigation of cardiovascular control in the rabbit (Yates & Fentem, 1975) and some of the findings were sufficiently different from those reported in man to prompt a similar investigation in the cat.

Measurements of systemic arterial blood pressure, heart rate, and, in some animals, cardiac output by thermodilution were made on cats anaesthetized with chloralose 70 mg kg^{-1}. When L.B.N.P. was applied for 1 min at −70 to −85 mmHg, the arterial blood pressure showed a transient fall of 22 ± 4.4 mmHg ($n = 5$) but returned to resting levels within 30 s even though suction was still being applied. Cardiac output at 30 sec had fallen by 26%; the change in heart rate was variable (+28 to −32 beats min^{-1}). There was an increase in total peripheral resistance. Thus the stimulus induced compensatory changes in these control cats which, in the absence of drugs, were unchanged over a 7 h period of observation (n = 4) and were proportional to the degree of L.B.N.P. During 2 h following a single dose of bethanidine (0.3 mg kg^{-1} i.v., $n = 5$) there was a fall in resting arterial pressure of 18 ± 4 mmHg and with L.B.N.P. (−70 to −85 mmHg) a further fall in arterial blood pressure occurred (29 ± 3.6 mmHg) which persisted for the whole period of suction. No increase in total peripheral resistance occurred, and there was a persistent bradycardia (-23 ± 4.9 beats min^{-1}).

After a single dose of thymoxamine of 0.5 mg kg^{-1} i.v. ($n = 4$) maintained by an infusion of 0.5 mg $kg^{-1}h^{-1}$ the resting arterial blood pressure fell by 28 ± 8 mmHg and again with L.B.N.P. there was a further fall of 17 ± 5.1 which persisted for the duration of the suction; two cats had an increase in heart rate of 10 beats min^{-1}, two showed no change.

Thus L.B.N.P. in the cat induced reflex cardiovascular changes which were modified by a noradrenergic neurone blocking agent and by an α-receptor blocking agent. This technique would appear to be potentially useful in the analysis of drug mechanisms in cardiovascular control in anaesthetized animals.

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References

ARDILL, B.L., BHATNAGAR, V.M. & FENTEM, P.H. (1967). Intravenous administration of drugs for obtaining regional adrenergic block. *Cardiovascular Res.*, **1**, 233-240.

BANNISTER, R., ARDILL, B.L. & FENTEM, P.H. (1969). An assessment of various methods of treatment of idiopathic orthostatic hypotension. *Quart. J. Med.*, **152**, 377-395.

YATES, JANET M. & FENTEM, P.H. (1975). The effect of lower body negative pressure on the cardiovascular system of the anaesthetised rabbit. *Cardiovasc. Res.*, **9**, 190-200.