

TITLE : PERIPHERAL VASCULAR EFFECTS OF PROPOFOL

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INTRODUCTION

Propofol is a short-acting anesthetic agent which provides rapid recovery, the patient being oriented, alert and clear-headed early on in the post-operative period. However, it induces cardiovascular depression which is responsible for arterial hypotension¹. In this study, the peripheral vascular effects of propofol were studied in patients with a Jarvik-7 artificial heart, independent of the effect of the drug on cardiac output.

METHODS

Patients : seven patients (mean age 42 ± 8 years) who had a Jarvik-7 artificial heart implantation whilst waiting for cardiac transplantation were included in the study, according to the following criteria : 1) presence of respiratory failure requiring mechanical ventilation 2) presence of agitation or discoordination from the ventilator, requiring intravenous sedation 3) absence of the administration of any sedative or vasoactive drug in the 12 preceding hours. In each case, informed consent was obtained from the nearest relative and authorization was given by the Ethical Committee of our Institution.

Hemodynamic measurements : for cardiovascular monitoring, each patient already had an arterial line and a right atrial catheter percutaneously inserted, and left atrial and pulmonary artery catheters surgically implanted. Four patients had a Jarvik-7 artificial heart model 70 ml and 3 had a Jarvik-7 artificial heart model 100 ml. Right and left cardiac output and right and left stroke volume were continuously monitored using the cardiac diagnostic unit of the Utah heart-drive console (COMDU TM). Arterial and mixed venous blood samples were simultaneously withdrawn for blood gas analysis and SaO_2 and SVO_2 were measured using a Co-oximeter OSM3. Arteriovenous oxygen difference, oxygen consumption and venous admixture were calculated, using standard formula. Arterial pressure, cardiac filling pressures and right and left cardiac output were simultaneously recorded on a Gould ES 1000 multi-channel recorder.

Procedure : Initially, the Jarvik-7 artificial heart was set to provide adequate circulatory conditions without the ventricular chambers being filled at the end of diastole. For the study period, the Jarvik-7 settings were modified in order to maintain cardiac output constant in presence of a moderate decrease in venous return : the diastolic time was lengthened by decreasing frequency and/or increasing percentage of systole, so that each ventricular chamber was completely filled well before the end of the time allotted to diastole. With such settings, despite a decrease in venous return, each cardiac chamber remains filled at the end of diastole and cardiac output remains constant despite the decrease in right atrial pressure. Consequently, the Jarvik-7 artificial heart ensures a

constant preload independent cardiac output and represents a unique model for studying the peripheral vascular effects of any drug, independent of its action on cardiac output.

Five minutes after changing Jarvik-7 settings, hemodynamic parameters were recorded and blood samples withdrawn (control values). Propofol 2.5 mg/kg was then intravenously injected over a 10 second period and hemodynamic parameters were continuously recorded during the following 30 minutes. Blood samples were withdrawn 5, 15, 30 and 60 minutes after propofol injection. All data are expressed as mean \pm SD and were analysed by a one-way analysis of variance followed by a modified student t-test. $p < 0.05$ was considered significant.

RESULTS

1) The Jarvik-7 settings used were : frequency 80 ± 17 bpm, percentage of systole 44 ± 3 %, drive pressure of the left ventricle 188 ± 17 mmHg, drive pressure of the right ventricle 57 ± 8 mmHg.

2) PaO_2 (179 ± 65 mmHg at control using a FIO_2 of 60 ± 5 %), PaCO_2 (35 ± 4 mmHg at control), temperature ($36.3 \pm 0.7^\circ\text{C}$ at control) remained unchanged during the study.

3) As shown in the table, mean arterial pressure and cardiac filling pressures significantly decreased following propofol injection whereas venous admixture remained constant.

Table (mean \pm SD) * $p < 0.05$ vs control	Control	5 min	10 min	30 min	60 min
Mean arterial pressure (mmHg)	71 ± 7	$43 \pm 4^*$	$52 \pm 8^*$	$56 \pm 10^*$	69 ± 8
Mean Pulmonary arterial pressure (mmHg)	22 ± 5	$15 \pm 4^*$	$18 \pm 4^*$	$18 \pm 5^*$	23 ± 5
Left atrial pressure (mmHg)	14 ± 6	$8 \pm 4^*$	$7 \pm 3^*$	$9 \pm 6^*$	13 ± 6
Right atrial pressure (mmHg)	12 ± 4	$0 \pm 4^*$	$9 \pm 3^*$	$10 \pm 4^*$	12 ± 4
Venous admixture (%)	25 ± 7	27 ± 9	23 ± 8	24 ± 9	24 ± 7
Left cardiac output (l/min/m ²)	2.9 ± 0.5	2.8 ± 0.2	2.9 ± 0.3	3.0 ± 0.3	2.9 ± 0.4

DISCUSSION

Since cardiac output was maintained constant throughout the study, propofol induced decreases in right atrial, pulmonary, left atrial and mean arterial pressures suggest a reduction of vascular tone at the venous level, at the pulmonary level (arteries and veins) and at the arterial level. Since venous admixture did not change throughout the study, propofol appears to have no effect on hypoxic pulmonary vasoconstriction. Finally propofol induces a potent cardiovascular depression via a peripheral vasodilatation which concerns venous, pulmonary and arterial vessels.

REFERENCE

1 - Coates et al. Anesth. Analg. 66 : 64, 1987