Title: Right ventricular end-systolic pressure-volume relation during propofol infusion.

Authors: C. Martin, P. Sauy, J. Albanese, B. Ron, F. Gouin

Affiliation: Département d'Anesthésie-Réanimation Marseille-Sud, Professeur F. GOUIN, Hôpital Sainte-Narguerite, 270, Bd de Sainte-Marguerite - 13277 - MARSEILLE CEDEX 9 - FRANCE.
Département d'Anesthésie-Réanimation, Professeur C. GRANTHIL, Hôpital Nord, Bd Pierre DRANARD - 13015 - MARSEILLE - FRANCE.

Introduction. Propofol (P.) is a short acting hypnotic drug whose short plasma half-life makes it suitable for prolonged sedation. A significant degree of cardio-vascular dysfunction has been reported with this drug (2) but its effects on ventricular contractility have not been studied so far. In animals and humans, the end-systolic pressure-volume relation (ESPVR) has been introduced as an index of ventricular contractility (3). This study was carried out to determine whether P. could alter the ESPVR.

Methods. After institutional approval and informed consent had been obtained from the family, 11 patients were studied. They had no sign of cardiovascular failure and no history of cardiac disease. They required prolonged sedation and mechanical ventilation for acute pulmonary insufficiency (7 cases) or neurologic disease (4 cases). Ventilation parameters were adjusted to maintain normoxia and normocapnia. Systemic, and their pulmonary artery catheterized with a modified Swan-Ganz catheter equipped with a fast response-thermistor (95 mmseu) and atrial and ventricular electrodes (93 A, 431 H 7.5 F Edwards Laboratories, Santa Ana CA). Cardiac output and right ventricular (RV) ejection fraction (EF) were measured by thermodilution. The thermodilution washout curve was analyzed by an original algorithm (1) (REF 1 computer Edwards Laboratories). RV end diastolic volumes (RVEDV) were calculated: RVEDV = Stroke volume/ RVESV, as well as RV and systolic volumes: RVESV = RVEF X RVEDV - Stroke Volume. The proximal injectate lumen of the catheter was positioned in the right ventricle and RV end systolic pressures (RVESVP) were recorded. Before P. infusion, measurements were performed before and after infusion of 7 ml.kg⁻¹ IV of dextrose given over 25 min. Then the patients were given an induction dose of 1 or 2 mg.kg⁻¹ P. over 1 min, followed by a continuous infusion of 3 mg.kg⁻¹. Simultaneous measurements of the parameters were obtained at 1 min, 10 min, 20 min, 40 min, 60 min, 120 min. The ESPVR was obtained as follows: the E slope was derived by best fit linear regression using the relation: EUMP = E X RVEDV + constant. The slope of this relation (E) is the elastance and is proportional to RV contractility. The computation of the regression line was obtained before P., during P. infusion and during P. + Dobutamine (μg.kg⁻¹.min⁻¹). In five patients with cardiac depression and oliguria, statistical analysis (regression line, variance analysis) was performed on a Macintosh SE with a "Stat View" program.

Results. Baseline elastance slope derived in the 11 patients was 0.21 mmHg.ml⁻¹. The regression line was RVESV = 0.21 RVEF + 2.4, r = 0.83, p < 0.0001, indicating very good linearity between RVEF and RVESV. During P. infusion, the elastance slope decreased to 0.12 mmHg.ml⁻¹ (p < 0.0001 as compared with baseline). The regression line was RVESV = 0.12 RVEF + 6.9, r = 0.68, p < 0.0005. Dobutamine infusion produced a steeper ESPVR with an elastance slope of 0.22 mmHg.ml⁻¹ and a regression line RVESV = 0.22 RVEF + 6.3, r = 0.78 p < 0.001. This steeper ESPVR was significantly different from P. infusion and not different from baseline. The ESPVR are shown on the figure.

Discussion. This study demonstrates that P. infusion was accompanied by a decrease in the slope of the ESPVR. Changes in the slope reflect changes in the contractile state of the ventricle and P. exerts a negative inotropic effect on the RV. The ESPVR calculated in this study showed very good linearity when subjected to regression analysis. Thus the slopes calculated in these patients appear to faithfully represent changes in RV contractility during P. infusion. Dobutamine corrected hemodynamic abnormalities and restored ESPVR to baseline values. This study does not provide results regarding the left ventricle and further studies should be carried out to investigate the effects of P. on this ventricle.

References.