

**TITLE:** CARDIAC OUTPUT IS THE MAIN FACTOR OF VARIATION OF MIXED VENOUS OXYGEN SATURATION DURING GENERAL ANESTHESIA.

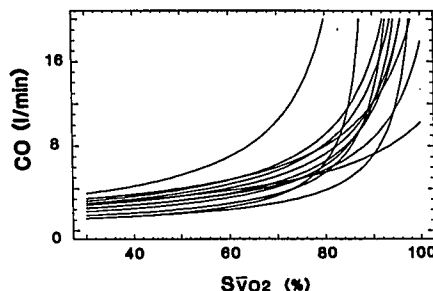
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Continuous monitoring of mixed venous oxygen saturation ( $S\bar{V}O_2$ ) has been proposed to optimize patient management during general anesthesia<sup>1</sup>. One general concern with  $S\bar{V}O_2$  is that its value depends on four physiological variables: cardiac output (CO), hemoglobin concentration, arterial blood oxygen saturation ( $SaO_2$ ) and oxygen consumption ( $\dot{V}O_2$ ). However, in clinical situations during which hemoglobin,  $\dot{V}O_2$  and  $SaO_2$  remain within a narrow range, it can be hypothesized that changes in  $S\bar{V}O_2$  are mainly due to changes in CO. The purpose of this study was to evaluate the relationship between  $S\bar{V}O_2$  and CO during general anesthesia.

After institutional approval and informed consent, 12 patients scheduled for abdominal aortic aneurysm repair were studied. Anesthesia was induced with etomidate, fentanyl and atracurium, and was maintained with  $N_2O$ , isoflurane and continuous infusions of fentanyl and atracurium.  $\dot{V}O_2$  was continuously measured by a mass-spectrometer system<sup>2</sup>.  $S\bar{V}O_2$  and CO were measured by a fiberoptic pulmonary arterial catheter (Abbott, Inc.). Measurements of CO were achieved at 15 min intervals during anesthesia, and were repeated whenever a therapeutic intervention was required to maintain arterial blood pressure within normal limits. Values of CO and  $S\bar{V}O_2$  measured during the period of clamping of the aorta were excluded from the study. Correlation between CO and  $S\bar{V}O_2$  was analyzed using the following formula of regression:  $1/y = a + bx$  where y was CO and x was  $S\bar{V}O_2$ .

**RESULTS:** The fitted lines of correlation between CO and  $S\bar{V}O_2$  obtained in each of our 12 patients are shown in the figure. The mean correlation coefficient was  $0.84 \pm 0.04$  (SE). During the period of anesthesia the mean coefficient of variation (SD/mean) of  $\dot{V}O_2$  and hemoglobin were  $7.1 \pm 0.4$  % (SE) and  $9.9 \pm 1.8$  % (SE), respectively.  $SaO_2$  remained between 96 and 100 %.



**CONCLUSION:** 1) During general anesthesia with  $N_2O$ , isoflurane, fentanyl and atracurium,  $\dot{V}O_2$  is fairly constant, as are  $SaO_2$  and hemoglobin, and changes in  $S\bar{V}O_2$  are related to changes in CO. 2) The accuracy of changes in  $S\bar{V}O_2$  as an indicator of changes in CO depends on the value of  $S\bar{V}O_2$ . Below a value of approximately 75 %, the accuracy is good, since small changes in CO are associated with large changes in  $S\bar{V}O_2$ . Above this value of approximately 75 %, the accuracy is less, since large changes in CO are required to induce significant changes in  $S\bar{V}O_2$ .

1-Ann Surg 203:329-333, 1986  
2- Acta Anaesthesiol Scand 32:691-697, 1988

**TITLE:** HEMODYNAMIC EFFECTS OF NICARDIPINE USED FOR THE TREATMENT OF STERNOTOMY INDUCED HYPERTENSION

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Despite the use of high doses of opioids, hypertension is still a frequent clinical problem following sternotomy in patients undergoing CABG. Nicardipine, a new calcium antagonist, appears to be an interesting alternative to other commonly used agents. This study was designed to evaluate the hemodynamic effects of nicardipine when used in the treatment of sternotomy induced hypertension.

Following institutional approval and informed consent, 15 patients scheduled for elective CABG were studied. Anesthesia was induced using fentanyl (80 mcg/kg), midazolam (0.1 mg/kg) and pancuronium (0.1 mg/kg). Hypertension was defined as a mean arterial pressure above 105 mm Hg for more than 2 min following sternal retraction. Then, nicardipine was administered as a single bolus of 0.02 mg/kg. Hemodynamic data (from Swan Ganz and radial artery catheters), i.e., cardiac output (CO), heart rate (HR), systemic vascular resistance (SVR) and pulmonary capillary wedge pressure (CWP) were recorded during steady state anesthesia, at the time of hypertension and at the time of maximal therapeutic response.

Nicardipine induced a therapeutic response in all cases by a decrease in SVR. CO increased

significantly while CWP decreased following nicardipine administration. HR increased but was not different from control value.

This study indicates that nicardipine is an effective treatment of sternotomy induced hypertension. In addition, nicardipine improves ejection of left ventricle since CO increases while CWP decreases. Volatile anesthetics or betablockers have been proposed to control blood pressure during CABG but they may induce a depression of LV function which can be deleterious. The combination of vasodilatation and improvement of left ventricular function with moderate effects on HR makes nicardipine useful for the management of hypertension in patients undergoing CABG.

m±SD	Anesthesia	Hypertension	Nicardipine
MAP (mm Hg)	81±11	110±5+	80±11*
HR (bts/min)	58±11	54±7+	61±11*
CO (l/min)	3.8±0.8	3.6±0.6	4.7±1.3*
SVR (units)	22±6	29±5+	17±7*
CWP (mm Hg)	8±3	10±2+	9±2*

$p < 0.05$ : + vs anesthesia ; \* vs hypertension (ANOVA)  
**Reference**

1. Anesthesiology 69:A39, 1988  
2. Anesth Analg 66:137-141, 1987