TITLE: PREDICTING HYPOXEMIA DURING ONE-LUNG VENTILATION

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Hypoxemia is a recognized complication of one-lung ventilation (OLV) for thoracic surgery. The aim of this study was to see if independent covariates for arterial oxygenation (PaO_2) during OLV could be identified and then used to construct a predictive equation for PaO_2 during OLV.

With Ethics Committee approval and informed consent eighty patients having thoracotomies were studied. All patients were intubated with a left-sided double lumen tube. OLV was abandoned if the patient became hypoxemic (pulse oximeter saturation <85% or arterial blood gas PaO_2 <70mmHg).

The data from the first fifty patients (Group A) were studied for correlations with PaO_2 during OLV. Multiple linear regression was used to identify the most explanatory variables and to construct a predictive equation for PaO_2 during OLV. The subsequent thirty patients (Group B) were studied prospectively using both the observed and predicted PaO_2.

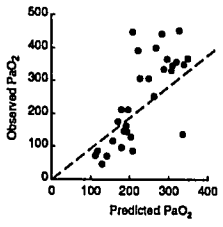
The most explanatory independent covariates for PaO_2 during OLV were: FEV_1%, initial intra-operative PaO_2 during two-lung ventilation (2L-PaO_2) and side of operation. The resultant predictive equation for PaO_2 after 10 min of OLV was:

PaO_2 = 100-72(side)* -1.86(FEV_1%) +0.75(2L-PaO_2)
(*for side insert: 1 for right-sided thoracotomy
0 for left-sided thoracotomy)

There was a significant correlation by linear regression between observed and predicted PaO_2 values for Group B (see figure). 4/30 patients had a predicted PaO_2 <150mmHg; of these 4/4 had an observed PaO_2 <80 and in 2/4 OLV was abandoned. 19/30 patients had a predicted PaO_2 150-300; of these 0/19 had an observed PaO_2 < 80 and 3/19 had an observed PaO_2 80-100. 7/30 patients had a predicted PaO_2 >300; of these 0/7 had an observed PaO_2 <100.

Using data which are routinely available, it is possible to predict intra-operative hypoxemia during OLV. These findings concur with previous studies that have found correlations between PaO_2 during OLV and 2L-PaO_2[1] or pulmonary function tests[2]. In patients at high risk of hypoxemia during OLV prophyllactic measures, such as non-dependent lung CPAP, can be employed.

References
1. South Med J 69:619-626, 1976
2. Anesthesiology 56:164-171, 1982



Observed versus predicted PaO_2 values for Group B (30 patients) after 10 min. of one-lung ventilation ($r = .73$, $p < .01$) (--line of identity)

TITLE: EFFECT OF ISOFLURANE & CARDIAC OUTPUT ON HYPOXIC PULMONARY VASOCONSTRICTION

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Isoflurane's effect on HPV is controversial[1-2] because of its effects on variables such as Q_T and $P_{\bar{v}O2}$. Computer simulation[3-4] allows blood flow distribution to be predicted. The model requires input of PAP, Q_T, LAP, $P_{\bar{v}O2}$, $\%Q_L$, P_{AO2-R}, P_{AO2-L}, P_{alv-R} and P_{alv-L} ($5cmH_2O$) and estimates P_{pl}(0 cmH_2O). The iteratively derived constriction ratio(CR) 0.6 corresponds to maximal hypoxic constriction and 1.0 to no constriction. During left lung hypoxia and right lung hyperoxia, the P/Q curves with no-isoflurane to the left lung are obtained at 3 levels of Q_T(low[Δ],normal[nl,○],high[hi, □])(Fig 1). With no isoflurane during hypoxic ventilation, the left lung vasoconstricts most when relative blood flow (RQ) was nl>hi>low (CR 0.61<0.69<0.70). Isoflurane's effect on HPV is more clearly demonstrated at comparable Q_T. At low RQ with 0 MAC-low and 2.5 MAC-nl, the hypoxic left lung essentially vasodilates the same amount (CR 0.70 vs 0.69). Vasodilatation at medium RQ is greater at 2.5 MAC-hi than at 1 MAC-nl (CR 0.78 vs 0.68) and at high RQ is greater at 1.0 MAC-hi than at 0 MAC-hi (CR 0.77 vs 0.69). All plots assume that isoflurane minimally affects baseline pulmonary vascular tone in the hyperoxic right lung. Computer simulation demonstrates that when the effects of Q_T are controlled for, the mechanism of inhibition of HPV by isoflurane is due to vasodilation in the hypoxic lung. 1) Domino KB, Anesthesiol 64:423, 1986. 2) Benumof JL, Anesthesiol 67:910, 1987. 3) Zhuang F, JAP 55:1341, 1983. 4) Marshall BE, JAP 64:68, 1984.