

TITLE: COMPARISON OF METHODS OF PREOXYGENATION AND DENITROGENATION

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Denitrogenation of the lungs with 100% O₂ increases the safe apnea time before irreversible hypoxic injury occurs. Clinical circumstances sometimes preclude mask application, e.g. facial or nasal trauma, or mask phobia. We determined whether breathing through a plastic respiratory therapy mouthpiece, with nasal occlusion, was comparable to use of an anesthesia airway mask for preoxygenation and denitrogenation. The time required for maximum denitrogenation was measured using a mass spectrometer for end-tidal nitrogen (eTN₂) determination.

Ten healthy volunteers were studied (with informed consent and approval by the Institutional Review Board, Allegheny General Hosp., Pgh., PA). Each subject underwent four trials: 1) 4 vital capacity breaths with 100% O₂ at 10 L flow; 2) 4 vital capacity breaths with 100% O₂ through a mouthpiece (Marquest Med. Products, Englewood, CO.) held between pursed lips with nose occluded; 3) 5 min of normal breathing with 100% O₂ through a mask; 4) 5 min of normal breathing with 100% O₂ through the mouthpiece. Arterial O₂ saturation was monitored by pulse oximeter, and inspired/expired gases were analyzed by mass spectrometer (SARA, PPG Biomedical Systems, Lenexa, KS). Data collected included: change in O₂ sat. in each trial group after breathing O₂; time to

lowest eTN₂ in the normal breathing groups (trials 3 and 4); lowest achieved eTN₂ in each trial group. Statistical analysis included ANOVA with Bonferroni correction, and student's paired t-test. Statistical significance was accepted at p<0.05.

TRIAL	eTN ₂ (lowest)	Time (min) to eTN ₂ (lowest)	
1	40.4 (9.3)	-	All data presented as MEAN (S.D)
2	36.0 (14.1)	-	
3	4.9 (2.5)	3.3 (0.7)	
4	6.6 (4.8)	3.3 (1.0)	

The eTN₂ values for the four trial groups are significantly different. Trials 1 and 2 show no difference, as do trials 3 and 4, but 1 or 2 are different from 3 or 4. There is no difference in the time to lowest eTN₂ in trials 3 and 4. All subjects had initial O₂ sat. between 96% and 100%, and all final sats. upon completion of each trial were 100%.

Measurement of O₂ sat. is inadequate as an indication of optimal preoxygenation. Gambee et. al. showed that normal breathing of 100% O₂ at high flow for 3 min provided better protection against hypoxia than the 4 deep breath method. Using a mass spectrometer for gas analysis, we found that maximum denitrogenation required a mean of 3.3 min. We have shown that 3 min may not always be adequately long for full denitrogenation with normal breathing. We also found that a mouthpiece (with nasal occlusion) is equivalent to an airway mask for preoxygenation. This applies to both the four breath technique and the 3-5 min normal breathing technique.

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TITLE: IS WHOLE BODY OXYGEN UPTAKE A GOOD INDICATOR OF LIVER ALLOGRAFT FUNCTION ?

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Variations of whole body oxygen uptake (VO₂) during orthotopic liver transplantation (OLT) are well described. The return of calculated VO₂ to preremoval levels is a possible indicator of immediate function in a grafted liver (1) and the lack of increasing VO₂ after reperfusion would be in favor of either irreversible non function or poor graft function (2,3). However, in these studies, variations of VO₂ were related to patient clinical evolution or survival and not to parameters of liver function. The present study was designed to assess the evolution of respiratory measured VO₂ and indicators of hepatic function.

Eighteen patients aged 43 ± 11 yr (mean ± SD) weighing 71.2 ± 18.5 kg and undergoing OLT were studied after approval by our Ethics committee. All were anesthetized with thiopental (5mg.kg⁻¹) followed by midazolam (50 µg.kg⁻¹.h⁻¹), fentanyl (10-12 µg.kg⁻¹.h⁻¹). Pancuronium was given for muscle relaxation. They were mechanically ventilated with a 40% oxygen/air mixture. During the anhepatic stage thirteen patients were connected to a veno-venous bypass. We used a metabolic monitor (DELTA TRAC, Datex Corp. Finland) to measure VO₂. Twelve values of VO₂ were recorded: at incision (1); before (2) and during (3) the trial of clamping; before (4) and after (5) connecting the veno-venous bypass; at the beginning (6) and end (7) of the anhepatic stage; unclamping the vena cava (8); unclamping the portal vein (9); 10 min (10) and 1 h (11) after unclamping; at closure (12). Indicators of hepatic

function were recorded at 1, 3, 7, 14 and 21 days postoperatively; i.e. clotting factors (FII, FV) and transaminases. The weight of the grafted liver and the duration of ischemia were noted. ΔVO₂ was determined by the equation: ΔVO₂ = VO₂ postanhepatic minus VO₂ anhepatic. Results are expressed as mean ± SD. Statistical analysis was performed using repeated measures ANOVA followed by appropriate post-hoc tests (p < 0.05 was considered significant).

As described previously, VO₂ decreased during either trial of clamping or anhepatic stage (figure) and increased after reperfusion. However no correlation was found between ΔVO₂ and FII, FV, transaminases, weight of grafted liver or duration of ischemia (r ranged from 0.018 to 0.497). In addition, one patient had an early graft dysfunction with a major increase of VO₂ after reperfusion.

In conclusion, continuous measurements of VO₂ cannot predict successfully the immediate liver allograft function following OLT.

References: 1-Transplant.Proc., 19, 56-58, 1987
2-Transplant.Proc., 21, 2279-2281, 1989
3-Anesthesiology 69, A174, 1988

