TITLE: OXYGENATION OF PERIPHERAL TISSUES IN YOUNG AND ELDERLY PATIENTS DURING SPINAL ANESTHESIA

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INTRODUCTION: Supplemental oxygen via nasal prongs is routinely provided to patients undergoing regional anesthesia. Although FiO_2 and arterial oxygenation are elevated by this practice[1], improved delivery of O_2 to peripheral tissues, the ultimate goal of such therapy, has never been demonstrated. Peripheral tissue O_2 tension is a valid monitor of O_2 transport *in vivo*[2,3]. This study determined whether continuously-measured transcutaneous O_2 tension ($TCPO_2$) changed significantly during spinal anesthesia with supplementary O_2 therapy.

METHODS: 20 young (range 18-38 yrs) and 23 elderly (range 61-86 yrs) patients (ASA I-III) undergoing spinal anesthesia for elective surgery were studied using a Healthdyne-Airshields TC-075-1 transcutaneous O_2 system with a protocol approved by the local Human Studies Committee for use without written informed consent. Patients received morphine (5-10 mg im) and atropine (0.2-0.4 mg im) or diazepam (5-10 mg p.o.) for premedication. No additional sedation or analgesia, and no pressor therapy was given after lumbar puncture (LP) in patients studied. $TCPO_2$ probes were taped to the anterior chest or upper arm and allowed to equilibrate for 15 min prior to LP and injection of tetracaine, lidocaine, or dibucaine adequate for maximum sensory level (MSL) between T_{11} and T_2. After LP, patients remained supine or prone for 25 min and then supplemental O_2 was given for 20 min by nasal prongs connected to an anesthesia breathing circuit with 10-15 cm H_2O positive O_2 pressure (3-6 L/min). Statistical analysis consisted of t-test, analysis of variance, and chi square analysis, with $p < 0.05$ the criterion of significance.

RESULTS: Mean $TCPO_2$ for young vs. elderly patients at time of LP ("baseline", figure) did not differ significantly. Similarly, there were no significant changes in $TCPO_2$ for either group at MSL 25 min later ("spinal"). Subsequent O_2 therapy ("oxygen") produced large, significant increases in $TCPO_2$ in both groups: 97% and 73% for young and elderly, respectively. After return to air ("return"), mean $TCPO_2$ was indistinguishable from the "baseline" or "spinal" values of either groups. Decrease in blood pressure occurred in elderly patients following LP, but no further changes in vital signs occurred with O_2 therapy (table 1). Demographic comparison revealed significant differences only in age and hemoglobin (table 2).

DISCUSSION: During spinal anesthesia, supplemental O_2 therapy by nasal prongs improved peripheral tissue oxygenation as reflected by $TCPO_2$. Perhaps because of reductions in blood pressure and, presumably, cardiac output seen during spinal anesthesia, elderly patients had a reduced response to O_2. The difference in hemoglobin between the two groups, although statistically significant, was not sufficient to explain the reduced response. We conclude that although circulatory depression in the elderly may limit the improvement in peripheral oxygenation during O_2 therapy, the response in all patients is large enough to justify routine application of supplemental O_2 during spinal anesthesia.

REFERENCES: 1) Kory RC, Bergmann JC, Sweet RD, et al.: Comparative evaluation of oxygen therapy techniques. JAMA 179:767-772, 1962. 2) Littooy F, Fuchs R, Hunt TK, et al.: Tissue oxygen as a real-time measure of oxygen transport. J Surg Res 20:321-325, 1976. 3) Haldén E: Monitoring of optimal oxygen transport by the transcutaneous oxygen tension method in the pig. Acta Anaesth Scandinav 26:209-212, 1982.

Table 1.
(Mean ± S.E.)

		baseline	spinal	oxygen
YOUNG	BP_S	121.9±3.6*	118.5±2.7	116.6±2.3
	BP_D	72.7±2.6	68.0±1.9	66.3±2.1
	HR	80.0±4.2	70.0±3.6	66.2±3.2
ELDERLY	BP_S	135.9±3.1*	122.0±3.1†	124.6±3.6
	BP_D	75.2±1.5	68.5±1.8†	70.4±2.2
	HR	71.5±1.8	66.6±2.4	63.6±1.8

* † young vs. elderly, $p < 0.01$
† different from preceding value, $p < 0.01$

Table 2.
(Mean ± S.E.)

	young	p	elderly
n=	20		23
Age (yrs)	29.8±1.4	<.01	72.1±1.6
Hgb (gm%)	14.3±0.4	<.05	13.1±0.4
Wt. (kg)	78.6±3.3	NS	73.2±2.3
MSL (T=)	6.7±0.7	NS	6.6±0.6
Male/Female	16/4	NS	18/5

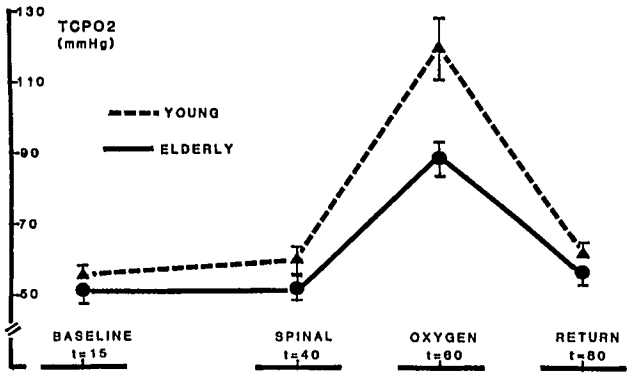

Figure.