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Loss of Hypoxic Ventilatory Response Following
Bilateral Modified Radical Neck Dissection

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Introduction: Modified radical neck dissection is done for cancer involving head and neck structures. We observed lack of or reduced ventilatory response to doxapram in some of these patients following bilateral neck dissection. We speculated bilateral carotid body denervation in these patients and studied hypoxic ventilatory responses in 5 patients, preoperatively and two weeks following surgery.

Materials and Methods: After IRB approval and informed consent, five adult male patients with a mean age 64.6 years with head and neck cancer were included in the study. All the patients had preoperative study of isocapnic ventilatory responses to hypoxemia according to the method of Rebuck and Campbell. All the patients had excision of local tumor, bilateral modified radical neck dissection and tracheostomy under general anesthesia. Two weeks following surgery, isocapnic ventilatory responses were done. The responses were measured in duplicate. The VE slope for percent change in saturation (x-coefficient) and regression output for ventilation were calculated. Two patients of the 5 were identified to have absent ventilatory response to hypoxemia.

Results: The pre-operative hypoxic ventilatory responses were normal in all the patients. Two of the five patients had loss of hypoxic ventilatory responses (Table - patients 2,3) following surgery.

Table: Hypoxic drive in 5 patients under isocapnic conditions before and after surgery. The regression output of the ventilation on x-axis and saturation on x-axis was calculated. x-coefficients (slope of $\Delta VE / \Delta \text{saturation}$) and SE of coefficients were calculated.

Patient No.	Age Yrs	Pre operative	Post operative
		$\Delta VE / \Delta \text{SAT}$ L/min/percent sat	$\Delta VE / \Delta \text{SAT}$ L/min/percent sat
1	65	0.33 + 0.04	0.16 + 0.06
2	69	0.33 + 0.02	0.001 + 0.002*
3	65	0.21 + 0.07	0.14 + 0.12
4	62	0.22 + 0.04	0.01 + 0.01*
5	62	0.60 + 0.09	2.3 + 0.26

* Loss of hypoxic drive
Sat=saturation

Discussion: Bilateral neck dissection for cancer of head and neck, may be associated with complications like upper airway obstruction, optic neuropathy, papilledema, pleural effusion and injury to spinal accessory nerve. Our observation of loss of hypoxic drive in two of five patients, following the surgery indicates that some patients have probable denervation of the carotid bodies. Patients with carotid body denervation may not be able to have compensatory responses to hypoventilation and hypoxemia. At present we do not know whether denervation of the carotid bodies contributes to the post-operative morbidity in patients following bilateral modified neck dissection. We conclude that some patients after bilateral neck dissection have denervation of the carotid bodies and absent hypoxic ventilatory response.

References: Rebuck AS, Campbell EJM. A clinical method for assessing the ventilatory response to hypoxia. Am Rev Resp. Dis 109:345-350, 1974.

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Title: THE INDIVIDUALITY OF BREATHING PATTERNS DURING HYPOXIA AND EXERCISE

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Objectives: The aim of this study was to investigate the shape of respiratory cycles derived from flow signals which form characteristic, individual patterns during quiet breathing. These "breath prints" remain unchanged over time in adults, yet the effects of physiologic stresses have not been studied.

Methods: Twelve (12) healthy firemen (ages 23 to 52) selected to climb a Chilean Mt.(6885m) were studied before and after sojourn. Six (6) underwent prior acclimatization (5500m) in a multiplace chamber and 11 were studied upon return (4500m) both at rest and during exercise (50% VO₂max). Ventilatory flow was transduced by ultrasonic flowmeter and pO₂ and pCO₂ by mass spectroscopy. Flow signals were digitized and processed to quantify their shape² based on Fourier analysis of the first four harmonics covering 98% of the signal's energy. Average patterns were determined over 50-100 breaths per subject and compared at sea level vs alt. (4500m & 5500m) The Monte Carlo non-parametric probability test compared rank order of differences to 1000 random pairings of the differences. Ventilation (V_E), rate (f), and SaO₂'s were compared using paired T tests.

Results: All subjects' breathing patterns were unchanged by chamber hypoxia or by 30 day sojourn (p<0.005 and <0.003 for sameness). Exercise however made significant and characteristic differences as flow signals became more rectangular with a consistent hump during late inspiration (see figs). Hypoxia at 5500m (SaO₂ 64%) and exercise plus hypoxia at 4500m (SaO₂ 77%) increased V_E 23% and 46% (p<0.03 vs sea level and <0.0001 vs. exercise at sea level), while f increased 8% (p<0.25) at 5500m, and 20% (p<0.04) on exercise at 4500m vs. exercise at sea level.

Conclusion: The individuality of breathing patterns persisted before and after 30 day altitude sojourn, and was unchanged during acute chamber hypoxia exposures suggesting a lack of chemoreceptor influence. Exercise, requiring voluntary input, altered the flow signal consistently indicating that regular quiet breathing patterns originate outside the cortex. "Breath prints" could be helpful in assessing recovery of respiration after major surgery and/or prolonged intubation.

- Ref.
1 Benchetrit,G. et al Resp Physiol 75:199-210,1989
2 Bachy,J.P.et al Comp Methods Prog Biomed 23:297-307,1986.

Figs: Left shows flow signals of one subject; A-at sea level, B-at 5500m, and C-exercise at 4500m. Right side shows the corresponding vector representation of first four harmonics.

