TITLE: PERSISTENT OCCURENCE OF POSTOPERATIVE ARTERIAL OXYGEN DESATURATIONS DESPITE OXYGEN THERAPY

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Patient arterial oxyhemoglobin desaturations are well documented to occur during both postoperative transport and recovery room care with room air breathing. However, the incidence of hypoxemic episodes during routine postoperative oxygen administration has not been determined during continuous monitoring of saturation. After approval by the institutional Clinical Investigation Committee, we evaluated 100 postoperative patients for the incidence of hypoxemic episodes and factors significantly associated with desaturations from time of admission to discharge from the recovery room. Oxygen saturations were recorded by a Nellcor-N 200 pulse oximeter and desaturations of $\leq$92% for $\geq$30 seconds were considered significant. Patients were transported to recovery room breathing room air and on admission received oxygen by face tent at 12 lpm with a 0.4-0.6 FiO_2. Recovery room personnel were not blinded to the saturation and routine care or therapeutic interventions were not controlled. Blood pressure, heart rate and respiratory rate were recorded by nursing personnel. Data collected for each patient included sex, age, weight, type of anesthesia (regional or general), narcotic dosage intraoperatively and in recovery room), smoking and pulmonary history, total intravenous fluid (volume), duration of anesthesia and whether surgery was thoracic, abdominal or peripheral. Statistical analysis of data was performed using multiple regression analysis and Student t tests. A p value $\leq$0.05 was considered significant.

On recovery room admission 15% of patients had low saturations. Low admission saturations correlated positively with general anesthesia (p=0.03), patient age (p=0.03), body weight (p=0.001), and intravenous fluid volumes, particularly volumes >1500 ml. Later desaturations during oxygen administration were to 86.7$\pm$4.7% and occurred at 32$\pm$54 min lasting for 5.2$\pm$12.6 min. (All values are mean $\pm$ standard deviation.) These desaturations, ranging from 72 to 91%, occurred in 25% of patients. Factors correlating positively with these desaturations included peripheral surgical procedures (p=0.02), low oxygen saturation on admission (p=0.04), duration of anesthesia, and intravenous fluid volume (p=0.0001). Desaturation duration correlated positively with female sex (p=0.05), body weight (p=0.02) and intravenous fluid volume (p=0.02). Significant desaturations occurred despite prophylactic oxygen therapy during acute postoperative recovery room care of surgical patients. This suggests more individualized oxygen therapy is necessary and methods of postoperative oxygen delivery must be assessed.

A541

TITLE: AN ALTERNATIVE PARALLEL-COMPUTING APPROACH TO INTELLIGENT HEMODYNAMIC MONITORING

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Many authors have explored the potential application of artificial intelligence (AI) techniques in hemodynamic monitoring. Most have advocated the use of "if-then" rules, which don't take temporal sequencing directly into account, in development of intelligent monitors and "smart alarms."[1,2,3] We have developed an alternative paradigm for hemodynamic monitoring in which a hemodynamic process is modelled as a temporal sequence of hemodynamic patterns called "scenes,"[4] each named somewhat arbitrarily to reflect the predominant physiologic process involved. For example, hypovolemia might be represented in the scene sequence 1) intravascular depletion, 2) vasoconstriction, 3) hypotension. some of the distinct advantages in characterizing hemodynamic diagnoses using scenes rather than if-then rules include system coherence, system modularity, and ability to relate hemodynamic derangement severity in a clinically natural fashion.[4]

The sequential clinical scene approach has been implemented in a prototype parallel computer system, DYNASCENE, for the diagnoses: 1) fluid overload, 2) hypovolemia, 3) sepsis, and 4) cardiac tamponade,[4] in the parallel programming language Linda.

DYNASCENE was preliminarily evaluated using 1116 minutes of data recorded as part of ordinary patient care from 6 patients undergoing cardiopulmonary bypass surgery. Two senior anesthesiologists were presented graphs of 1) pulmonary artery diastolic pressure, 2) heart rate, and 3) systolic blood pressure for these patients and were asked to diagnose periods of "early," "middle," and "late" hypovolemia. DYNASCENE's recommendations concerning hypovolemia were compared with those rendered by the anesthesiologists from the perspectives of 1) pulmonary artery diastolic pressure at the time of diagnosis, and 2) time of "late" hypovolemia diagnosis (seconds from the start of data collection). The data from this evaluation is summarized in the table below:

Event #	Case #	DYNASCENE PAD (TIME)	DR. 1 PAD (TIME)	DR. 2 PAD (TIME)
1	1	10 (6607)	9 (5640)	—
2	3	7 (6216)	7 (5760)	7 (5760)
3	4	7 (6288)	13 (6360)	—
4	5	11 (6085)	11 (5760)	12 (6120)
5	6	3 (1328)	4 (1680)	3 (1080)
6	6	—	10 (5260)	—

The average temporal interval between earliest and latest recommendations was 473 seconds. The cardiac filling pressures derived by DYNASCENE and the clinicians corresponded within 1 mm HG. The clinicians may have rendered their diagnoses somewhat earlier than DYNASCENE because they had the benefit of future data in rendering a decision. DYNASCENE was monitoring data as it was made available and did not have access to this hindsight. Further evaluation of this approach will include a real-time clinical evaluation of DYNASCENE in the intensive care unit, but these initial results are encouraging. We believe the use of "scenes" is a conceptually potent, clinically logical approach to the application of artificial intelligence in hemodynamic monitoring.

1. Anesthesiology 1986; 65(3A):A533
2. Anesthesiology 1987; 67(3A):A203
3. Anesthesiology 1988; 69(3A): A241
4. Methods Inform Med (in press)