#123

First Place, Human Factors

Physiologic Stress Levels during Simulated and Actual Anesthesia Administration by Student Nurse Anesthetists

Richard Haas, Urs Nater, Duane Patterson, Jason Lowe, Howard Burtnett, Douglas Arbittier

WellSpan Health Nurse Anesthetist Program, York College of Pennsylvania, York, Pennsylvania; Klinische Psychologie und Psychotherapie, University of Zurich, Zurich, Switzerland; Medical Education, Wellspan Health York Hospital, York, Pennsylvania; Anesthesiology, Wellspan Health York Hospital, York, Pennsylvania

INTRODUCTION: Learners experience stress in early clinical training. High levels of stress may lead to performance degradation precisely when performance requirements are at their peak. This stress response is reduced with the accumulation of experience and increased competence. To what degree does a learner sense that a simulation encounter approximates the actual patient care experience (psychological fidelity)? One way of assessment is to measure stress during the simulation and compare that stress to the level experienced during actual patient care, thus using stress as a proxy measure for psychological fidelity. If high-fidelity simulation induces stress comparable to patient care, then learners can experience real stress in a safe environment, while gaining relevant experience and increasing in competence, eventually leading to a reduction of stress.

HYPOTHESIS: How does the degree of stress experienced by novice practitioners during simulation compare with stress experienced during the administration of general anesthesia?

METHODS: Pre-clinical student registered nurse anesthetists (SRNAs) induced and maintained general anesthesia for 25 minutes in a high-fidelity human patient simulator (n = 10). At the time of the study, the SRNAs were very familiar with the simulation environment, eliminating unfamiliarity bias. The participants had psychological and physiologic factors measured before, during, and after the simulation. The measures were retaken at corresponding times in a general anesthesia OR case during their first month of clinical practice. Data was collected after 12 noon in order to minimize diurnal effects on alpha-amylase and cortisol secretion.[1] Physiologic measurements were obtained at seven times (table 1). Additionally, the subjects completed a visual analog scale (VAS) of stress (0 to 100) to determine if a correlation existed between measured physiologic indicators of stress and a cognitive recognition/ admission of stress. (Table 1) Data Analysis: The paired data were compared using the statistical tests shown. (Table 2) A Type 1 error rate (alpha) of 0.05 was set to determine significance between samples, and the use of a repeated measures test provided a power of 0.8.

RESULTS: The data confirmed a significant increase in stress associated with the simulation of general anesthesia as indicated by elevated HR and SAA levels during

Table 1. Stress Marker Measurement Intervals

Time	Activity	Physiologic Test	Psychologic Test
Pre-study	Informed consent and initial testing	None	Stress Reactivity Scale
T1	Pre-simulation rest	Heart Rate (HR), Salivary Alpha Amylase (SAA), Salivary Cortisol (SC)	STAI State Test, STAI Trait Test, Visual Analog Scale (VAS)
T2	10 minutes after simulation induction and intubation	HR, SAA, SC	VAS
T3	15 minutes after T2	HR, SAA, SC	VAS
T4	Post-simulation rest period	HR, SAA, SC	VAS, Ways of Coping Questionnaire
T5	10 minutes after clinical induction and intubation	HR, SAA, SC	VAS
T6	15 minutes after T5	HR, SAA, SC	VAS
T7	Post-procedure rest and debrief	HR, SAA, SC	VAS

Table 2. Tests Measuring Differences Between Corresponding Simulation and Operating Room Intervals

Pairs	Paired Samples t-test Data Values	P Value	Pearson's r Correlation Coefficient	P Value
Salivary Alpha Amylase (units per mL)				
T2 and T5	T2 = 288.4 (172.8), T5 = 301.2 (255.1)	P = 0.817	r = 0.785	P = 0.012
T3 and T6	T3 = 295.2 (164.3), T6 = 229.1 (185.7)	P = 0.139	r = 0.736	P = 0.015
T4 and T7	T4 = 143.8 (78.7), T7 = 195.7 (149.7)	P = 0.216	r = 0.568	P = 0.087
Salivary Cortisol (mcg per dL)				
T2 and T5	T2 = 0.27 (0.16), T5 = 0.30 (0.21)	P = 0.730	r = 0.257	P = 0.505
T3 and T6	T3 = 0.31 (0.28), T6 = 0.29 (0.22)	P = 0.813	r = 0.436	P = 0.208
T4 and T7	T4 = 0.19 (0.19), T7 = 0.15 (0.05)	P = 0.489	r = 0.563	P = 0.090
Heart Rate (BPM)				
T2 and T5	T2 = 97 (18), T5 = 99 (24)	P = 0.815	r = 0.809	P = 0.005
T3 and T6	T3 = 97 (19), T6 = 97 (22)	P = 0.894	r = 0.696	P = 0.025
T4 and T7	T4 = 73 (10), T7 = 82 (14)	P = 0.006	r = 0.796	P = 0.006

Pairs	Paired Samples Wilcoxon Data Values	P Value	Spearman's Rho Correlation Coefficient	P Value
Visual Analog Scale (mm from 0)				
T2 and T5	T2 = 53.1 (20.7), T5 = 53.1 (23.3)	P = 0.838	r = 0.358	P = 0.310
T3 and T6	T3 = 55.4 (23.0), T6 = 39.3 (20.3)	P = 0.047	r = 0.602	P = 0.188
T4 and T7	T4 = 18.5 (22.0), T7 = 18.2 (11.9)	P = 0.953	r = 0.337	P = 0.340

Data values expressed as mean (sd) unless otherwise indicated.

induction (T2) and maintenance (T3). In comparing stress levels at corresponding times during simulated vs. actual anesthesia administration, no significant difference was found in HR and SAA values and significant correlation was found. The data also suggest that SC may be a late stress response. VAS showed no correlations at all. Some participants may not feel or admit stress, even in the presence of a physiologic stress response (table 2).

DISCUSSION: In this small exploratory study, stress levels among novice practitioners were similarly elevated in both simulated and actual practice, indicating that simulation has a high level of psychological fidelity.

REFERENCE:

1. Nater UM, LaMarca R, Florin L, et al. Stress-induced changes in human salivary alpha-amylase activity - associations with adrenergic activity. Psychoneuroendocrinology 2006; 31:49-58.

DISCLOSURES: None