

Resident's personal opinion on the stress events in anesthesia

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Abstract

Objective: To verify the crucial period of anesthesia that involves a high work stress in anesthesia residents. **Material and Method:** A study was performed on 37 volunteering residents. Participants logged on to a website at their leisure and answered contents of an anesthesia-related stress test designed through questionnaires. The test comprised sources of stress: pre-, intra- and post-operative sections. Two educational personnel performed the interpretation and assessment of the resident's personal opinion. All associated factors were analyzed by ANOVA as well as Tukey HSD and Dunette T3 following the Levine's test. p value less than 0.05 with a 95% confidence interval were noted as statistically significant. **Results:** Fourteen first-year (58.33%), seven second-year (29.17%) and sixteen third-year residents (66.67%) willingly participated in the study. All participants worried about

the stress events in the peri-operative period. There were statistically significant differences in mean scores in the post-operative events among the first, second and third-year residents as 7.14 ± 1.09 , 6.85 ± 1.64 and 5.62 ± 2.05 respectively. Particularly, the unstable vital signs, painful patients and anaphylactic/anaphylactoid reaction after surgery appeared to be significant differences between the first and third-year participants. **Conclusion:** All participants worried about the stress events in the peri-operative period. The post-operative events predominantly were the crucial period of anesthesia that involved a high work stress in anesthesia residents.

Keywords: occupation-related stress; peri-operative anesthesia, residency training program

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บทคัดย่อ

วัตถุประสงค์: เพื่อค้นหาช่วงเวลาสำคัญที่ทำให้แพทย์ประจำบ้านวิสัญญีเกิดภาวะเครียดจากการทำงาน **วิธีการศึกษา:** แพทย์ประจำบ้านวิสัญญีสมัครใจเข้าร่วมโครงการ จำนวน 37 คน เครื่องมือวิจัยประกอบด้วย แบบสอบถาม ความเครียดทางวิสัญญีผ่านระบบออนไลน์ ในช่วงก่อน ระหว่างและหลังการผ่าตัด นักการศึกษาจำนวน 2 คน เป็นผู้ประมวลผลปัจจัยต่างๆ ที่เกี่ยวข้องถูกนำมาวิเคราะห์เปรียบเทียบด้วย ANOVA, Tukey HSD และ Dunette T3 หลังการทดสอบ Levine โดยกำหนดนัยสำคัญเมื่อ p น้อยกว่า 0.05 ที่ระดับความเชื่อมั่นร้อยละ 95 **ผลการศึกษา:** แพทย์ประจำบ้านชั้นปีที่ 1 จำนวน 14 คน (58.33%), แพทย์ประจำบ้านชั้นปีที่ 2 จำนวน 7 คน (29.17%) และแพทย์ประจำบ้านชั้นปีที่ 3 จำนวน 16 คน (66.67%) เต็มใจเข้าร่วมในการศึกษาครั้งนี้ ทุกคนมีความวิตกกังวลในทุกช่วงเวลา ของการให้ยาระงับ

ความรู้สึกเพื่อการผ่าตัด ในช่วงหลังการผ่าตัด พบว่าแพทย์ชั้นปีที่ 1, 2 และ 3 มีคะแนนความวิตกกังวลเฉลี่ย แตกต่างกันอย่างมีนัยสำคัญตามลำดับดังนี้ 7.14 ± 1.09 , 6.85 ± 1.64 และ 5.62 ± 2.05 . โดยเฉพาะแพทย์ประจำบ้านชั้นปีที่ 1 และ 3 มีความแตกต่างอย่างมีนัยสำคัญในเรื่อง ความผิดปกติของสัญญาณชีพ ความปวดและอาการแพ้ที่เกิดขึ้นในช่วงหลังการผ่าตัด **สรุป:** แพทย์ประจำบ้านทุกคนมีความวิตกกังวลในทุกช่วงเวลาของการให้ยาระงับความรู้สึกเพื่อการผ่าตัด โดยเฉพาะหลังการผ่าตัดเป็นช่วงเวลาสำคัญที่ทำให้แพทย์ประจำบ้านวิสัญญีมีความเครียดจากการทำงานอย่างชัดเจน

คำสำคัญ: ภาวะเครียดจากการทำงาน, การให้ยาระงับความรู้สึกเพื่อการผ่าตัด, โครงการฝึกอบรมแพทย์ประจำบ้าน

Introduction

Anesthesiology appears easy when everything is going smoothly in the operating room (OR). However, it is very stressful when negative things happen with strong potential for disaster; it is always a life-and-death event. A patient's life is completely in the hands of anesthesiologists who make decisions in a very short time that is almost always critical.

The residency training program in anesthesiology involves activities starting from dawn to dusk. This includes anesthetic services (pre-operative, intra-operative and post-operative management), intra-curricular activities (interesting case conference, journal club, morbidity & mortality conference and morning report) and extra-curricular actions. Particularly, they are expected to be up-to-date on the latest literature and practice evidence-based medicine, to be vigilant at all times when a patient is under their care. As a result, residents are frustrated about updating their knowledge amid tight training schedules.

Regularly, residents are under the supervision of an anesthesiologist staff who may be in charge of two or more operating theatres at a time. Successful residents must be reliable and skilled at communicating with the staff, nurse anesthetists, surgeons, nurses, and ancillary personnel. Likewise, they have to meet unpredictable staff needs, often resulting in the preparation of drugs and syringes that may not be used, and to be able to manage patients during periods of rapid deterioration. One area of potential stress is the occurrence of an expected death or other catastrophic events, particularly when the patient

was previously healthy. Although, their training includes the medical aspects of these situations (resuscitation, invasive procedures, etc.), they may not prepare themselves for the emotional stress that ensues.

The resident's opinion on events related to stress in anesthesia have been neglected by authorized personnel. To date, researches on the peri-operatively perceived stress of anesthesia residents and the factors that mitigate this stress is limited. We would like to study stress among residents in anesthesia by Siriraj Anesthesia-related Stress Test (SAST) (Appendix A, *contact correspondence*). The SAST is an open-ended opinion poll, which will help verify the resident's opinion, and yield the solutions to alleviate those worries as well as improving both physical and mental health to handle difficulties.

Objectives

To verify the crucial period of anesthesia that involves a high work stress in anesthesia residents.

Materials and Methods

This study has been approved by Siriraj Institutional Review Board (Si-IRB), number COA: Si095/2012 (02/13/2013) and a written informed consent was obtained from all subjects.

There were 24 residents in each year of the three-year residency training program. We performed a prospective survey study by communicating with first, second and third-year residents in anesthesia who expressed their intention to join this research project. We asked them through the participant

information sheet and required that qualified persons registered and responded all items in questionnaires of the SAST. No sample size calculation was needed since all participants were currently under the residency training program.

Participants logged on to a website and answered contents of the SAST designed through questionnaires. Participation was voluntary, and their only benefit was self-awareness of stress. They also knew that they could freely and at their leisure answer the questionnaires. No efforts were made to evaluate whether residents completed their assignments. Whether they participated did not affect their academic scores in any way. In addition, they were free not to answer any questions that put them in an awkward position. Those feeling overwhelmed by the conditions were allowed to withdraw from the project anytime. The data derived from such withdrawal would be excluded from statistical analysis. The study was held in between the daily rounds of anesthesia practice, near the end of their academic year; and data about individual participants were kept confidential.

Validation and reliability of the test

The SAST, an opinion poll on the peri-operative stress test, consists of six sections: (1) background data: age, gender, experience in anesthesia; (2) working data: working time, overnight shift, number of calls; (3) personal data: off-duty the day after serving, sleeping time; (4) patient safety issues: frequencies of various situations involving unsafe actions, occurrence of operating room events; (5) attitude when under pressure: revision to improve,

disinterest, worry and obsession, regression and discouragement, isolation and indignation/outrage; and (6) ratings of sources of production pressure (Appendix A, *contact correspondence*). The open-ended questionnaires had undergone quality analysis and verification for conciseness, accuracy, and clarity, as well as content and structural validity by three doctorate educational experts with at least a decade of teaching experience. The index of item-objective congruence (IOC) was 0.79. The reliability analysis through Cronbach's alpha among the 25 residents and 35 nurse students in anesthesiology was 0.82 for the questionnaires, and 0.96, 0.97 and 0.96 for pre-, intra- and post-operative anesthetic events respectively. The ratings of sources of production pressure were scored through a numerical rating scale: most stressful (10), moderately stressful (5), and not stressful (0).

Statistics

Two educational personnel not directly involved in participants recruitment or contact and located at a different site, performed the interpretation and assessment of resident's opinions on the events related to stress in anesthesia.

The information from an open-ended questionnaire yielded values along with content analysis for our subsequent discussion.

Data analysis

Continuous data were presented as mean $\pm$ standard deviation and evaluated for statistical significance using the Statistical Package for Social

Sciences for Windows, release 17. All associated factors were analyzed by ANOVA as well as Tukey HSD and Dunette T3 following the Levine's test. The statistically significant differences were noted when p value < 0.05 with a 95% confidence interval.

Results

Fourteen first-year (R-1, 58.33%), seven second-year (R-2, 29.17%) and sixteen third-year residents (R-3, 66.67%) volunteered to join the study and completed the questionnaires. R-1 and R-2 tended to get nervous from the pre-operative to post-operative period. On the other hand, R-3 showed less stress from the pre-operative to post-operative period.

R-1, R-2 and R-3 had mean scores of their opinions on the stress events in the pre-operative, intra-operative and post-operative period of

6.70 ± 1.06, 6.90 ± 1.05 and 7.14 ± 1.09; 6.56 ± 0.92, 6.55 ± 1.46 and 6.85 ± 1.64 as well as 6.21 ± 1.28, 5.77 ± 2.13 and 5.62 ± 2.05 respectively (table 1). There were statistically significant differences in mean scores in the post-operative events among R-1, R-2 and R-3 as 7.14 ± 1.09, 6.85 ± 1.64 and 5.62 ± 2.05 respectively.

All participants worried about the stress events in the peri-operative period. For unstable vital signs, painful patients and anaphylactic/anaphylactoid reaction in the post-operative period; R-1, R-2 and R-3 had mean scores as 8.07 ± 1.49, 6.72 ± 1.49 and 8.00 ± 1.18; 7.86 ± 1.68, 6.14 ± 2.34 and 7.57 ± 2.57 as well as 6.13 ± 2.39, 4.38 ± 2.50 and 5.94 ± 2.74 respectively. There was a statistically significant difference in the mean scores on these episodes between R-1 and R-3.

Table 1. The first-year residents had mean scores of their opinion on the stress events higher than that of the second- and third-year residents. The second-year residents expressed their response higher than that of the third-year residents.

Stress events	Resident 1 (n = 14)	Resident 2 (n = 7)	Resident 3 (n = 16)
Pre-operative	6.70 ± 1.06 (4.04 – 8.14)	6.56 ± 0.92 (5.43 – 8.18)	6.21 ± 1.28 (3.89 – 8.18)
Intra-operative	6.90 ± 1.05 (4.93 – 8.40)	6.55 ± 1.46 (3.60 – 7.80)	5.77 ± 2.13 (0.00 – 8.80)
Post-operative	7.14 ± 1.09 (5.23 – 8.85)	6.85 ± 1.64 (4.77 – 9.00)	5.62 ± 2.05 (0.00 – 8.46)

Table 2. Residents expressed their opinion on the pre-operative stress events (mean ± SD)

Resident 1 (n = 14)	Resident 2 (n = 7)	Resident 3 (n = 16)
Malignant hyperthermia 9.29 ± 1.07	Unable to ventilate 9.29 ± 1.50	Unable to ventilate 9.31 ± 1.25
Unable to ventilate 8.93 ± 1.21	Malignant hyperthermia 9.29 ± 0.95	Unable to maintain airway 8.63 ± 1.71
Unable to intubate 8.71 ± 1.20	Unable to maintain airway 9.00 ± 1.53	Unable to intubate 8.56 ± 1.26
Myocardial ischemia 8.64 ± 1.78	Cardiac arrhythmias 8.43 ± 1.13	Malignant hyperthermia 8.50 ± 2.03
Unable to maintain airway 8.64 ± 1.34	Unable to intubate 8.29 ± 1.89	Myocardial ischemia 8.19 ± 1.56
Unexpected adverse events 8.36 ± 1.55	Airway problems 8.00 ± 0.82	Cardiac arrhythmias 7.88 ± 1.63
Aspiration 8.36 ± 1.01	Myocardial ischemia 7.86 ± 1.46	Aspiration 7.69 ± 2.02
Bronchospasm 8.00 ± 1.47	Unexpected adverse events 7.71 ± 1.25	Unexpected adverse events 7.63 ± 2.16
Cardiac arrhythmias 7.93 ± 1.49	Aspiration 7.43 ± 1.51	Bronchospasm 7.25 ± 2.21
Repeated intubation 7.64 ± 1.87	Repeated intubation 7.14 ± 1.95	Repeated intubation 7.06 ± 2.02
Airway problems 7.29 ± 1.44	Uncontrolled BP 7.00 ± 1.16	Airway problems 6.69 ± 1.58
Pediatrics patients 7.07 ± 1.77	Unable cannulate IV line 6.86 ± 2.55	Uncontrolled BP 6.50 ± 1.90
Uncontrolled BP 7.00 ± 1.61	Bronchospasm 6.86 ± 1.95	Pediatrics patients 6.19 ± 1.72
Miss preop visit 6.79 ± 2.46	Pediatrics patients 6.57 ± 1.40	Emergency case 6.13 ± 1.82
Irritable airway 6.79 ± 1.25	Poor lab results 6.43 ± 2.07	Miss preop visit 6.06 ± 2.32
Emergency case 6.71 ± 2.16	Emergency case 6.14 ± 1.46	Unable cannulate IV line 5.94 ± 2.72
Unable cannulate IV line 6.43 ± 2.14	ASA > III 6.14 ± 1.07	Missing incisor 5.81 ± 2.46
Failed regional block 6.21 ± 1.48	Miss preop visit 6.00 ± 1.73	Unexpected change 5.50 ± 2.16
ASA > III 6.00 ± 1.57	Irritable airway 5.86 ± 1.46	ASA > III 5.50 ± 1.10

Table 2. (cont.)

Resident 1 (n = 14)	Resident 2 (n = 7)	Resident 3 (n = 16)
Unexpected change 5.86 ± 2.91	Unexpected change 5.71 ± 1.89	Poor lab results 5.8 ± 1.86
Poor lab results 5.64 ± 1.65	Failed regional block 5.71 ± 1.11	Irritable airway 5.25 ± 2.15
Missing incisor 5.57 ± 1.79	Invasive monitoring 5.57 ± 1.27	
Old age patients 5.57 ± 1.70	Postop. care problems 5.29 ± 1.98	
Postop. care problems 5.43 ± 1.34	Missing incisor 5.29 ± 1.50	

R-1 showed grave concerns about malignant hyperthermia (9.29 ± 1.07), unable to ventilate (8.93 ± 1.21), unable to intubate (8.71 ± 1.20), myocardial ischemia (8.64 ± 1.78), unable to maintain airway (8.64 ± 1.34), unexpected adverse events (8.36 ± 1.55), aspiration (8.36 ± 1.01), bronchospasm (8.00 ± 1.47), cardiac arrhythmias (7.93 ± 1.49), repeated intubation (7.64 ± 1.87), airway problems (7.29 ± 1.44), pediatric patients (7.07 ± 1.77), uncontrolled blood pressure (7.00 ± 1.62), missed preoperative visit (6.79 ± 2.46), irritable airway (6.79 ± 1.25), emergency case (6.71 ± 2.16), unable to cannulate IV line (6.43 ± 2.19), failed regional block (6.21 ± 1.48), ASA>III (6.00 ± 1.57), unexpected case change (5.86 ± 2.91), poor lab results (5.64 ± 1.65), missing incisors (5.57 ± 1.79), old-age patient (5.57 ± 1.70) and postoperative care problems (5.43 ± 1.34).

R-2 were concerned about patients being unable to ventilate (9.29 ± 1.50), malignant hyperthermia (9.29 ± 0.95), unable to maintain airway (9.00 ± 1.53),

cardiac arrhythmias (8.43 ± 1.13), unable to intubate (8.29 ± 1.89), airway problems (8.00 ± 0.82), myocardial ischemia (7.86 ± 1.46), unexpected adverse events (7.71 ± 1.25), aspiration (7.43 ± 1.51), repeated intubation (7.14 ± 1.95), uncontrolled blood pressure (7.00 ± 1.16), unable to cannulate IV line (6.86 ± 2.55), bronchospasm (6.86 ± 1.95), pediatric patients (6.57 ± 1.40), poor lab results (6.43 ± 2.07), emergency case (6.14 ± 1.46), ASA>III (6.14 ± 1.07), missed preoperative visit (6.00 ± 1.73), irritable airway (5.86 ± 1.46), unexpected case change (5.71 ± 1.89), failed regional block (5.71 ± 1.11), invasive monitoring (5.57 ± 1.27), postoperative care problems (5.29 ± 1.98) and missing incisors (5.29 ± 1.50).

R-3 were anxious about patients being unable to ventilate (9.31 ± 1.25), unable to maintain airway (8.63 ± 1.71), unable to intubate (8.56 ± 1.26), malignant hyperthermia (8.50 ± 2.03), myocardial ischemia (8.19 ± 1.56), cardiac arrhythmias (7.88 ± 1.63), aspiration (7.69 ± 2.02), unexpected adverse events

(7.63 ± 2.16), bronchospasm (7.25 ± 2.21), repeated intubation (7.06 ± 2.02), airway problems (6.69 ± 1.58), uncontrolled blood pressure (6.50 ± 1.90), pediatrics patients (6.19 ± 1.72), emergency case (6.13 ± 1.82), missed preoperative visit (6.06 ± 2.32), unable to cannulate IV line (5.94 ± 2.72), missing incisors (5.81 ± 2.46), unexpected case change (5.50 ± 2.16), ASA>III (5.50 ± 1.10), poor lab results (5.38 ± 1.86) and irritable airway (5.25 ± 2.15).

Table 3. Residents expressed their opinion on the intra-operative stress events (mean ± SD)

Resident 1 (n = 14)	Resident 2 (n = 7)	Resident 3 (n = 16)
Embolism 9.36 ± 0.75	Embolism 9.14 ± 1.07	Embolism 7.75 ± 2.98
Oxygen desaturation 8.36 ± 1.22	Cardiac arrhythmias 8.29 ± 1.38	Oxygen desaturation 7.56 ± 2.34
Unstable vital signs 8.21 ± 1.05	Oxygen desaturation 8.00 ± 1.63	Unstable vital signs 6.69 ± 2.21
Cardiac arrhythmias 7.71 ± 1.68	Unstable vital signs 7.57 ± 1.90	Cardiac arrhythmias 6.88 ± 2.60
Displaced ETT 7.36 ± 1.91	Massive bleeding 6.86 ± 2.19	Massive bleeding 6.88 ± 2.50
Massive bleeding 6.93 ± 1.27	Displaced ETT 6.57 ± 1.40	Displaced ETT 6.13 ± 3.07
Inadequate regional block 6.79 ± 1.42	High airway pressure 6.43 ± 1.51	ETT cuff leakage 5.81 ± 3.21
High airway pressure 6.71 ± 0.99	Inadequate regional block 6.29 ± 1.89	High airway pressure 5.75 ± 2.11
ETT cuff leakage 6.50 ± 1.74	ETT cuff leakage 6.14 ± 2.48	Inadequate regional block 5.38 ± 2.63
No/low urine output 6.50 ± 1.70	High ETCO2 6.00 ± 1.42	High ETCO2 5.19 ± 2.34
Awareness/awakening 6.36 ± 1.87	No/low urine output 5.86 ± 1.68	No/low urine output 5.06 ± 2.65
High ETCO2 6.29 ± 2.02	Epidural cath obstruction 5.86 ± 1.46	
Hypothermia 5.64 ± 1.39	Hypothermia 5.29 ± 2.22	
Epidural cath obstruction 5.57 ± 1.99	Awareness/awakening 5.29 ± 2.14	
Prolonged surgery 5.21 ± 1.76		

R-1 showed grave concerns about embolism (9.36 ± 0.75), oxygen desaturation (8.36 ± 1.22), unstable vital signs (8.21 ± 1.05), cardiac arrhythmias (7.71 ± 1.68), displaced ETT (7.36 ± 1.91), massive

bleeding (6.93 ± 1.27), inadequate regional block (6.79 ± 1.42), high airway pressure (6.71 ± 0.99), ETT cuff leakage (6.50 ± 1.74), no/low urine output (6.50 ± 1.70), awareness/awakening (6.36 ± 1.87), high ETCO₂ (6.29 ± 2.02), hypothermia (5.64 ± 1.39), epidural catheter obstruction (5.57 ± 1.99) and prolonged surgery (5.21 ± 1.76).

R-2 were concerned about embolism (9.14 ± 1.07), cardiac arrhythmias (8.29 ± 1.38), oxygen desaturation (8.00 ± 1.63), unstable vital signs (7.57 ± 1.90), massive bleeding (6.86 ± 2.19), displaced ETT (6.57 ± 1.40), high airway pressure (6.43 ± 1.51), inadequate regional block (6.29 ± 1.89),

ETT cuff leakage (6.14 ± 2.48), high ETCO₂ (6.00 ± 1.41), no/low urine output (5.86 ± 1.68), epidural catheter obstruction (5.86 ± 1.46), hypothermia (5.29 ± 2.22) and awareness/awakening (5.29 ± 2.14).

R-3 were anxious about embolism (7.75 ± 2.98), oxygen desaturation (7.56 ± 2.34), unstable vital signs (6.69 ± 2.21), cardiac arrhythmias (6.88 ± 2.60), massive bleeding (6.88 ± 2.50), displaced ETT (6.13 ± 3.07), ETT cuff leakage (5.81 ± 3.21), high airway pressure (5.75 ± 2.11), inadequate regional block (5.38 ± 2.63), high ETCO₂ (5.19 ± 2.34) and no/low urine output (5.06 ± 2.65).

Table 4. Residents expressed their opinion on the post-operative stress events (mean $\pm$ SD)

Resident 1 (n = 14)	Resident 2 (n = 7)	Resident 3 (n = 16)
Cardiac arrest 9.93 $\pm$ 0.27	Cardiac arrest 10.00 $\pm$ 0.00	Cardiac arrest 8.81 $\pm$ 2.71
Neurological deficit 8.71 $\pm$ 1.14	Neurological deficit 8.43 $\pm$ 1.81	Neurological deficit 7.13 $\pm$ 2.36
Unstable vital signs 8.07 $\pm$ 1.49	Patients not awake 8.00 $\pm$ 1.83	Oxygen desaturation 6.75 $\pm$ 2.49
Anaphylactoid/anaphylactic 8.00 $\pm$ 1.18	Oxygen desaturation 8.00 $\pm$ 1.83	Patients not awake 6.56 $\pm$ 2.71
Patients not awake 7.93 $\pm$ 1.44	Unstable vital signs 7.86 $\pm$ 1.68	Recurarization 6.31 $\pm$ 2.65
Oxygen desaturation 7.86 $\pm$ 1.56	Anaphylactoid/anaphylactic 7.57 $\pm$ 2.57	Unstable vital signs 6.13 $\pm$ 2.39
Recurarization 7.71 $\pm$ 1.64	Impaired cognitive function 6.86 $\pm$ 2.12	Anaphylactoid/anaphylactic 5.94 $\pm$ 2.74
Impaired cognitive function 7.14 $\pm$ 1.66	Recurarization 6.86 $\pm$ 1.86	Impaired cognitive function 5.50 $\pm$ 2.31
Painful patients 6.71 $\pm$ 1.49	Painful patients 6.14 $\pm$ 2.34	
Patients on ventilator 5.50 $\pm$ 3.06	Hypothermia 6.00 $\pm$ 2.31	
Hypothermia 5.43 $\pm$ 1.83	Patients on ventilator 5.14 $\pm$ 2.80	
Patients on T-piece 5.14 $\pm$ 1.75		

R-1 showed grave concerns about cardiac arrest (9.93 ± 0.27), neurological deficit (8.71 ± 1.14), unstable vital signs (8.07 ± 1.49), anaphylactoid/anaphylactic (8.00 ± 1.18), patients not awake (7.93 ± 1.44), oxygen desaturation (7.86 ± 1.56), recurarization (7.71 ± 1.64), impaired cognitive function (7.14 ± 1.66), painful patients (6.71 ± 1.49), patients on ventilator (5.50 ± 3.06), hypothermia (5.43 ± 1.83) and patients on T-piece (5.14 ± 1.75).

R-2 were concerned about cardiac arrest (10.00 ± 0.00), neurological deficit (8.43 ± 1.81), patients not awake (8.00 ± 1.83), oxygen desaturation (8.00 ± 1.83), unstable vital signs (7.86 ± 1.68), anaphylactoid/anaphylactic (7.57 ± 2.57), impaired cognitive function (6.86 ± 2.12), recurarization (6.86 ± 1.86), painful patients (6.14 ± 2.34), hypothermia (6.00 ± 2.31) and patients on ventilator.

R-3 were anxious about cardiac arrest (8.81 ± 2.71), neurological deficit (7.13 ± 2.36), oxygen desaturation (6.75 ± 2.49), patients not awake (6.56 ± 2.71), recurarization (6.31 ± 2.65), unstable vital signs (6.13 ± 2.39), anaphylactoid/anaphylactic (5.94 ± 2.74) and impaired cognitive function (5.50 ± 2.31).

Content analysis of questionnaires

Based on the acknowledgment of relevant persons through an analysis of questionnaires confirmed by records of website log-ins, the 37 residents consisted of 4 males (10.81%) and 33 females (89.19%), aged 20-25 (8.11%), 26-30 (89.19%) and 31-35 (2.70%), experienced in anesthesia less than 1 year (37.84%) and 1-5 years (62.16%).

Work data: day shift (hr/day) 5-6 (10.81%), 7-8 (70.27%) and over 8 (18.92%), day shift

(day/week) 5 (81.08%) and 6 (18.92%), night shift (day/week) 1 (24.32%), 2 (16.22%) and 3 (59.46%), numbers of night call (call/night) 3 (29.73%), 4 (27.03%), 5 (13.51%) and 6 (29.73%), night shift (hr/call) 1-2 (24.32%), 3-4 (43.24%), 5-6 (13.51%), 7-8 (5.41%) and over 8 (3.7%).

Personal data: leave after night shift 100%, sleeping time (hr/day) 3-4 (2.7%) 5-6 (70.27%) and 7-8 (27.03%).

Patient safety issues: occurrence of morbidity cases in 6 months (collect any information) 0 (24.32%), 1 (18.92%), 2 (24.32%), 3 (10.81%), 4 (10.81%) and 5 (10.81%). Occurrence of morbidity cases in lifetime (collect any information) 1 (24.32%), 2 (13.51%), 3 (16.22%), 4 (5.41%), 5 (10.81%) and 6 (29.73%). Occurrence of mortality cases in 6 months (collect any information) 0 (16.22%), 1 (27.03%), 2 (18.92%), 3 (21.62%), 4 (13.51%) and 5 (2.70%). Occurrence of mortality cases in lifetime (collect any information) 1 (24.32%), 2 (13.51%), 3 (21.62%), 4 (13.51%), 5 (0%) and 6 (27.03%). Unsafe period: pre-operative (0%), intra-operative 26 (70.27%), post-operative 6 (16.22%) and post-operative 48 hr 5 (13.51%). Unsafe time: 20.00-24.00 (2.70%), 24.00-02.00 (10.81%), 02.00-04.00 (62.16%), 04.00-06.00 (16.22%) and 06.00-08.00 (8.11%).

Attitudes toward stress: revision (59.46%), carelessness (2.70%), depression (21.62%), regression (13.51%), remain silent (2.70%) and anger (0%).

Residents' opinions: some medical staff embarrassed them in front of others in the operating room by asking questions they could not answer or reprimand them severely for not following instructive procedures.

Table 5. Through an analysis of questionnaires which confirmed by records of website log-in: background data, working data, personal data, patient safety issues and attitudes toward production pressure

Categories			Resident1 (n = 14)	Resident2 (n = 7)	Resident3 (n = 16)
Background data					
Gender	male		1 (7.14%)	0	3 (18.75%)
	female		13(92.86%)	7 (100%)	13 81.25%)
Age (yr)	20-25		3 (21.43%)	0	0
	26-30		11(78.57%)	7 (100%)	15 93.75%)
	31-35		0	0	1 (6.25%)
Experience in anesthesia (yr)	<1		13(92.86%)	0	0
	1-5		1 (7.14%)	7 (100%)	16 (100%)
Working data					
Day shift (day/week)	5		10 71.43%)	7 (100%)	13 81.25%)
	6		4 (28.57%)	0	3 (18.75%)
Day shift (hr/day)	5-6		1 (7.14%)	0	1 (6.25%)
	7-8		9 (64.29%)	7 (100%)	12(75%)
	>8		4 (28.57%)	0	3 (18.75%)
Night shift (day/week)	1		3 (21.43%)	1 (14.29%)	5 (31.25%)
	2		8 (57.14%)	5 (71.43%)	9 (56.25%)
	3		3 (21.43%)	1 (14.29%)	2 (12.5%)
Number of night call (call/night)	3		6 (42.86%)	3 (42.86%)	2 (12.5%)
	4		8 (57.14%)	1 (14.29%)	1 (6.25%)
	5		0	0	5 (31.25%)
	6		0	3 (42.86%)	8 (50%)
Night shift (hr/call)	1-2		2 (14.29%)	0	0
	3-4		6 (42.86%)	4 (47.14%)	6 (37.5%)
	5-6		3 (21.43%)	2 (28.57%)	0
	7-8		0	0	2 (12.5%)
	>8		3 (21.43%)	1 (14.29%)	8 (50%)
Personal data					
Leave after night shift	Yes		14 (100%)	7 (100%)	16 (100%)
Sleeping time (hr)	3-4		0	0	1 (6.25%)
	5-6		10(71.43%)	5 (71.43%)	11(68.75%)
	7-8		4 (28.57%)	2 (28.57%)	4 (25%)
Patient safety issues					
Morbidity case in 6 month	0		5 (35.71%)	1 (14.29%)	3 (18.75%)
	1		2 (14.29%)	3 (42.86%)	2 (12.5%)
	2		3 (21.43%)	3 (42.86%)	3 (18.75%)
	3		0	0	4 (25%)
	4		1 (7.14%)	0	3 (18.75%)
	5		3 (21.43%)	0	1 (6.25%)

Table 5. (cont.)

Categories		Resident1 (n = 14)	Resident2 (n = 7)	Resident3 (n = 16)
Patient safety issues (con.)				
Morbidity case in life time	1	5 (35.71%)	2 (28.57%)	2 (12.5%)
	2	1 (7.14%)	1 (14.29%)	3 (18.75%)
	3	1 (7.14%)	2 (28.57%)	3 (18.75%)
	4	1 (7.14%)	1 (14.29%)	0
	5	3 (21.43%)	1 (14.29%)	0
	6	3 (21.43%)	0	8 (50%)
Mortality case in 6 month	0	3 (21.43%)	1 (14.29%)	2 (12.5%)
	1	4 (28.57%)	3 (42.86%)	3 (18.75%)
	2	1 (7.14%)	2 (28.57%)	4 (25%)
	3	3 (21.43%)	0	5 (31.25%)
	4	3 (21.43%)	1 (14.29%)	1 (6.25%)
	5	0	0	1 (6.25%)
Mortality case in life time	1	6 (42.86%)	1 (14.29%)	2 (12.5%)
	2	1 (7.14%)	2 (28.57%)	2 (12.5%)
	3	3 (21.43%)	2 (28.57%)	3 (18.75%)
	4	3 (21.43%)	1 (14.29%)	1 (6.25%)
	5	0	0	0
	6	1 (7.14%)	1 (14.29%)	8 (50%)
Unsafe period	Pre-operative	0	0	0
	Intra-operative	13(92.86%)	3 (42.86%)	10 (62.5%)
	Post-operative	1 (7.14%)	2 (28.57%)	3 (18.75%)
	Postop. 48 hr	0	2 (28.57%)	3 (18.75%)
Unsafe time	20.00-24.00	1 (7.14%)	0	0
	24.00-02.00	2 (14.29%)	1 (14.29%)	1 (6.25%)
	02.00-04.00	7 (50%)	3 (42.86%)	13 81.25%)
	04.00-06.00	2 (14.29%)	2 (28.57%)	2 (12.5%)
	06.00-08.00	2 (14.29%)	1 (14.29%)	0
Attitudes toward stress	Revision	8 (57.14%)	4 (47.14%)	10 (62.5%)
	Carelessness	0	1 (14.29%)	0
	Depression	2 (14.29%)	1 (14.29%)	5 (31.25%)
	Regression	4 (28.57%)	0	1 (6.25%)
	Remain silent	0	1 (14.29%)	0

Discussion

R-1’s stress scores tended to increase insignificantly from the pre-operative to post-operative period; while

that of R-2, from the pre-operative and intra-operative to post-operative period. This might imply that the post-operative event was the crucial period of

anesthesia that involved a high work stress to R-1 and R-2. On the contrary, pre-operative events likely affected R-3 since their stress scores showed a mild drop from the pre-operative to post-operative period.

In the pre-operative period, we can classify stress events into four categories –1) airway management e.g. unable to ventilate, unable to intubate, unable to maintain airway, aspiration, bronchospasm, repeated intubation, airway problems, irritable airway, missing incisors 2) patient preparation e.g. missed preoperative visit, postoperative care problems, poor lab results, uncontrolled blood pressure, unable to cannulate IV line, emergency case, ASA>III, unexpected case change, failed regional block 3) general conditions e.g. myocardial ischaemia, cardiac arrhythmias, pediatric patients, old-age patients 4) unusual conditions e.g. malignant hyperthermia and unexpected adverse events

Malignant hyperthermia is such a matter of life-and-death that everyone takes the precaution of ensuring safety anesthesia; however, it is a rare occasion. Residents were anxious about the way to secure the airway which is vital during the induction and intubation of anesthesia. Though ventilating and maintaining the airway are supposed to be a chicken-and-egg situation, the ability to maintain the airway and ventilate patients is crucial in lifesaving, like intubation. Regarding airway management, guidelines are also taught to them to avoid bronchospasm and aspiration particularly in patients with irritable airways. Still, pediatrics is a delicate matter that let young trainees concentrate on children's anatomy and patho-physiology.

Case cancellation yields a feeling of frustration, wastes time on preparation of specific drugs or monitoring or even personnel, and wastes opportunities for high turnovers of daily cases. Patient identification becomes the performance of anesthetist official duties for legal documentation, witnesses and communication in order to avoid the mismatch of blood transfusion, administration of allergic drugs or operation on an incorrect site. Choice of anesthesia is a topic suggested for discussion to perform surgical procedure at ease, proper maintenance of anesthesia and post-operative pain control. However, all participants kept a low profile on these matters probably because they all happen before the commencement of the anesthesia working process. In addition, some are mostly under the responsibility of peri-operative nurses and the decision of attending anesthesiologist staff. Gaba et al. claimed that California anesthesiologists' pressures were due to elective surgery in patients without adequate evaluation or with significant contraindications to surgery as well as avoided delaying cases, and hastened anesthetic procedures¹.

In the intra-operative period, we can classify stress events into three categories: 1) anesthetic management e.g. oxygen desaturation, unstable vital signs, displaced ETT, inadequate regional block, high airway pressure, ETT cuff leakage, no/low urine output, awareness/awakening, high ETCO₂, hypothermia, epidural catheter obstruction 2) surgical management e.g. massive bleeding, prolonged surgery 3) unusual conditions e.g. embolism, cardiac arrhythmias.¹

Residents were apprehensive about intra-operative air/fat/amniotic embolism. This was not surprising since embolism in any case is a serious condition that needs urgent medical attention. Though cardiac arrhythmias are a significant contributing factor to patient morbidity; the underlying variables of the intra-operative arrhythmias are not completely understood². Nowadays, pulse oximetry plays an important role in daily anesthesia monitoring. As a result, oxygen desaturation is a warning of severe crisis facing anesthesia standard practices. Trainees are on a strictly need-to-know basis as a precaution to prevent the spread of a compromising situation. Prolonged surgery might annoy R-1 with the ability to stabilize patients during the procedure. Then, hypothermia aggravates the situation of prolonged anesthetics resulting in delayed awakening and regaining consciousness. Epidural catheter obstruction can lead to improper analgesia control and does not yield smooth anesthesia.

In the post-operative period, we can classify stress events into two categories: 1) anesthetic management e.g. oxygen desaturation, unstable vital signs, patients not awake, recurarization, impaired cognitive function, painful patients, patients on ventilator, hypothermia and patients on T-piece 2) unusual conditions e.g. cardiac arrest, neurological deficit, anaphylactoid/anaphylactic.

All residents agreed that cardiac arrest is a medical crisis that needs emergency treatment. In addition, they got embarrassed when patients had problems of post-operative neurological deficit. This seems to be under the direct responsibility of

anesthesiologists and the underlying causes might follow mal-positioning during the intra-operative period or a remnant of local anesthetic or direct nerve-root damage after the regional nerve block².

Though there was no statistically significant difference in the mean scores in the pre-operative period among the groups, R-1 were worried over some matters. It was quite acceptable due to their lack of experience in response to the events. In the intra-operative period, R-1 was trying to raise alertness about unstable vital signs in general and not cardiac arrhythmias in particular. Their choice was based on an apparent lack of information regarding cardiac anesthesia which they would attend in the second year of the residency training program. In the post-operative period, they expressed concerns about unstable vital signs, painful patients and anaphylactic/anaphylactoid. This stress might be due to improper fluid assessment, a delayed response to massive hemorrhage and inadvertent exposure to allergic medications, inadequate anesthesia or analgesia, remnant of muscle relaxant as well as compromised cardiovascular, respiratory or renal function. Both R-1 and R-2 were concerned about delayed recovery and hypothermia in the post-operative period particularly when the patient needs an artificial airway or a ventilator. Patient awakening was R-2's concern, which reflects their concerns over maintaining anesthesia while others pay too little attention to awareness due to the low incidence and few suing cases in this country.

R-3 had much more experience than the others. This made their scores different from others, and

their concerns also are different. The responsibility, experience, work hours are very important in anesthetic practices. Deliberate anesthetic management is crucial. The experiences they get in anesthesia are in direct proportion to the effort they put in for the past few years. Some critical events for both R-1 and R-2 seem easy to cope with and not life-and-death situation for R-3. As a result, they have grown enough to act as junior staff and look after those younger than they.

Content analysis of questionnaires implies that residents had additional stressors – such as long work hours, both day and night shifts. They worked on average 7-8 hours/day and 6 days/week. More than 40% worked on average 3-4 hours/night call with 3 calls/night; 70% slept between 5-6 hours/night. In addition, overnight work can build up much stress to a resident on call. Simms M. et al. reported that Canadian anesthesia residents worked on average 65 hours/week and 5 calls/month. Less than 35% sleep between 7-8 hours/night, and 23.4% have thought about leaving their program. Anesthesia residents in general are experiencing stress, burnout, & work-life conflict. Senior residents tend to report less healthy behaviors than junior residents³.

More than 60% believed that an intra-operative event between 02.00-04.00 hr was an unsafe period. Some claimed that the pre-anesthesia induction timeout is the crucial period of any anesthetic, which involves a high workload and is often the most hurried; this combination may cause practitioners to make errors⁴.

In addition, some medical staff played a role as the burden on residents and became a knowledge barrier to tire them out. Collection of information regarding morbidity and mortality from here and there may lead to anxiety or depression. Fortunately, nearly 60% had good attitudes toward stress by facing and revising the problems in order to correct it; however, 20% suffered from depression and 13% got feelings of regression.

Conclusion

All participants worried about the stress events in the peri-operative period, owing to their intense training; sleep deprivation, compounded by a lack of experience and knowledge. The post-operative events predominantly were the crucial period of anesthesia that involved a high work stress in anesthesia residents.

Department and institutes should display ethical responsibilities both to achieve residents' competency and skills in the specialty and to maintain their physical and mental health to cope with the demand of patients where medical errors can become an important societal and professional issue.

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What is already known on this topic?

Residents in anesthesiology, who are under the supervision of an anesthesiologist staff, are expected to be up-to-date on the latest literature and practice evidence-based medicine, to be vigilant at all times when a patient is under their care. Likewise, they have to meet unpredictable events, often resulting in not able to manage patients during periods of rapid deterioration, an expected death or other catastrophic events, particularly when the patient was previously healthy. As a result, they are frustrated about updating their knowledge amid tight training schedules.

What this study adds?

This evidence-based study implies that residents in anesthesiology may be particularly prone to stress and strain because of their intense training, sleep deprivation, compounded by a lack of experience and knowledge. They could not handle a heavy load, which may lead to unsafe practice. The post-operative event was the crucial period of anesthesia that involved a high work stress to first and second year residents, whereas pre-operative events likely affected third year residents.

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