

CLINICAL RESEARCH / KLİNİK ÇALIŞMA

STRESS IN THE OPERATING ROOM: EMERGENCY AND ELECTIVE SURGERIES

OPERASYON ODASINDA STRES: ACİL VE ELEKTİF CERRAHİLER

¹Salih USLU, ²Şebnem ATICI

¹Yedikule Chest Diseases and Thoracic Surgery Training and Research Hospital, for Anesthesiology and Reanimation Clinics, Istanbul, Turkey

²Mersin University Faculty of Medicine, Department of Anesthesiology and Reanimation, İçel, Turkey

¹Yedikule Göğüs Hastalıkları ve Torasik Cerrahisi Eğitim Araştırma Hastanesi, Anesteziyoloji ve Reanimasyon Kliniği, İstanbul, Türkiye

²Mersin Üniversitesi Tıp Fakültesi, Anesteziyoloji ve Reanimasyon Anabilim Dalı, İçel, Türkiye

ABSTRACT

Objective: Stress increases anxiety, and reduces attention in operation rooms. The aim of this study was to evaluate the level of stress and the effect of stress on teamwork in operating rooms, by utilizing quantitative and qualitative assessment.

Method: The study was performed on anesthesia and surgery teams that participated in 64 surgeries (emergency; 32, elective: 32). Stress levels were assessed individually using heart rate, saliva cortisol levels, and the "State-Trait Anxiety Inventory-Short Form" (STAI-SF), while team work was assessed using the "Observational Teamwork Assessment for Surgery" (OTAS) tool.

Results: Mean heart rate of all team members in emergency surgeries was significantly higher than in elective surgeries during preoperative period ($p<0.05$). Members of both teams had significantly higher STAI-SF scores before emergency surgeries ($p<0.05$). Anesthesia teams had lower OTAS scores in preoperative and postoperative period whereas surgery teams had lower scores in preoperative and intraoperative period during emergency surgeries compared to elective surgeries ($p<0.01$).

Conclusion: Emergency surgeries had a more negative effect on teamwork than electives. The preoperative period of emergency surgeries was particularly more stressful for both teams.

KEYWORDS: STAI, OTAS, Teamwork, Stress, Emergency surgery, Elective surgery

ÖZ

Amaç: Stres anksiyeteyi artıran bir faktördür ve operasyon odasında ekibin dikkatini azaltır. Bu makalenin amacı acil ve elektif operasyonlarda stresin seviyesini değerlendirmek ve ekipler üzerine etkisini kalitatif ve kantitatif olarak değerlendirmektir.

Yöntem: Çalışmaya 64 ameliyata katılan ekipler alındı. Operasyonların 32'si acil, 32'si elektif idi. Ekiplerin kalp hızı, tükürük kortizol ölçümleri ve 'State Trait Anxiety Inventory-Short Form' (STAI-SF) skalası kullanılarak bireysel stres seviyeleri belirlendi. 'Observational Teamwork Assessment for Surgery' (OTAS) skalası ile takım çalışmaları değerlendirildi.

Bulgular: Bütün ekiplerin operasyon öncesi dönemde ortalama kalp hızları acil vakalarda elektiflere göre daha yüksek bulundu ($p<0.05$). Hem cerrahi hem de anestezi takımın acil cerrahi öncesi STAI-SF skorları elektiflere göre daha yüksekti ($p<0.05$). Acil ameliyatlar sırasındaki OTAS skorları elektif ameliyatlardaki ile karşılaştırıldığında, anestezi takımının operasyon öncesi ve sonrası cerrahi takımın ise operasyon öncesi ve sırasında daha düşük bulundu ($p<0.01$).

Sonuç: Acil ameliyatların elektiflere göre takım çalışmasını kötü etkilediği ve özellikle operasyon öncesi dönemin takımlar arasında oldukça ciddi stres oluşturduğu kanısına varıldı.

ANAHTAR KELİMELELER: STAI, OTAS, Takım çalışması, Stres, Acil operasyon, Elektif cerrahi

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Yazışma Adresi (Correspondence):

Dr. Şebnem ATICI, Mersin Üniversitesi Tıp Fakültesi, Anesteziyoloji ve Reanimasyon Anabilim Dalı, Çiftlikköy, İçel, Türkiye

E-posta (E-mail): sebnematici@hotmail.com

INTRODUCTION

Operating rooms are environments in which complex tasks are performed and solved through intense concentration. However, increasing stress leads to higher anxiety, and reduces attention and concentration. Higher stress levels may not only adversely affect interpersonal relations, but may also reduce efficiency and lead to mistake. In addition, higher stress levels may lengthen the duration of surgery or lead to improper practices and interventions, which may have a significant negative impact on the health of the patients (1). According to a study conducted in the United States, nearly 100,000 individuals lose their lives in hospitals every year due to preventable medical errors (1).

In a study investigating preventable anesthesia errors in operating rooms, it was determined that 82% of errors stemmed from human mistakes, while 14% stemmed from the inadequacy of equipment (2). The study emphasizes that, inadequacy of non-technical skills (and especially of communication skill) also plays an important role, as well as low knowledge and skill level of health personnel, in the occurrence of medical errors. Thus, studies that investigate non-technical skills used in operating rooms are gradually becoming more important.

The aim of this study was to assess and compare the level of stress exhibited by anesthesia and surgery teams in operating rooms, as well as the effect of stress on team work, by utilizing quantitative and qualitative data from emergency and elective surgeries.

MATERIAL AND METHOD

The study was approved by the Clinical Research Ethics Committee and performed on anesthesia and surgery teams that participated in a total of 64 surgeries in the operating room of the University Hospital. The study was conducted by one observer on 32 elective and 32 emergency surgeries which could be perform on daily listed elective operations or emergency surgeries randomly. Operations having severe life-threatening conditions, such as excessive bleeding, were excluded from the study because of the possible distraction of team members. The teams included in the study were divided

into two groups as the "anesthesia team" and the "surgery team." The "anesthesia team" consisted of anesthesiologists, anesthesiology assistants, and anesthesiology technicians, while the "surgery team" consisted of surgeons, assistant surgeons, scrub nurses, and circulating nurses. Written informed consent forms were obtained from all team members assessed within the scope of this study. Any team member with systemic diseases or diagnosed psychiatric disorders was excluded from the study.

The heart rates of the team members were measured, and saliva samples were obtained for cortisol level assessments before, during and after surgery. Heart rates were monitored using a "Polar RS100" heart rate monitor watch, which works via radiofrequency method, and a "Polar T31 Coded Transmitter" (Figure 1). Cortisol levels were measured with the chemiluminescence method, by using cortisol kits (Siemens Advia Centaur 4610138) and the "Siemens Centaur Xp Immunoassay System" (Germany) device.

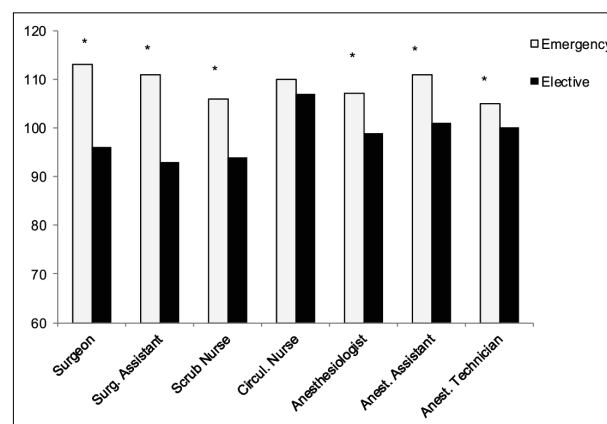


Figure 1. Comparison of the heart rates of team members in the period before emergency and elective surgeries

*p < 0.01: A significant difference was identified between emergency and elective surgeries with respect to the mean heart rate of the team members.

The short form of "State-Trait Anxiety Inventory Form" (STAI-SF) was used to assess the individual stress levels of the team members (Table I). The STAI-SF scale was completed individually by the team members, before, during, and after surgery. During surgery, the

Table I. The short-form of State Trait Anxiety Inventory (STAI-SF)

	Not At All	Somewhat	Moderately So	Very Much So
I am calm	1	2	3	4
I am tense	1	2	3	4
I am sad	1	2	3	4
I am relaxed	1	2	3	4
I am content	1	2	3	4
I am concerned	1	2	3	4

scale was completed by directly asking the questions to the nurses and surgeons, and recording their answers.

The behaviors of teams in the operating room were assessed with the "Observational Teamwork Assessment for Surgery" (OTAS) tool before, during and after surgery. The OTAS tool evaluated five types of behaviors exhibited by team members, which were communication, cooperation, coordination, leadership, and observational/behavioral awareness. Each type of behavior was scored between 0-6, based on a range of seven points. Statistical evaluations regarding the OTAS scores of the teams were performed based on total scores.

The data were analyzed using the "SPSS Version 16.0 for Windows" package program. Results were expressed as mean \pm SD and percentage (%). The Wilcoxon test was used for intragroup comparisons, while the Mann-Whitney U-test was used for intergroup comparisons. P-values <0.05 were considered as statistically significant.

RESULTS

With the exception of circulating nurses and anesthesiology technicians, the heart rate of all team members was higher during emergency operations than electives in all periods ($p<0.01$). Among circulating nurses, no significant difference in heart rate was observed between elective and emergency surgeries at any period of the surgeries; on the other hand, among anesthesiology technicians, only significant difference in heart rate was observed between elective and emergency surgeries in the period before surgery ($p>0.05$) (Figure 1,2,3).

Only anesthesiology technicians showed higher saliva cortisol values during emergency operations intraoperatively, compared to postoperatively (15.8 ± 13.1 and 10.9 ± 12.1 , respectively; $p<0.05$).

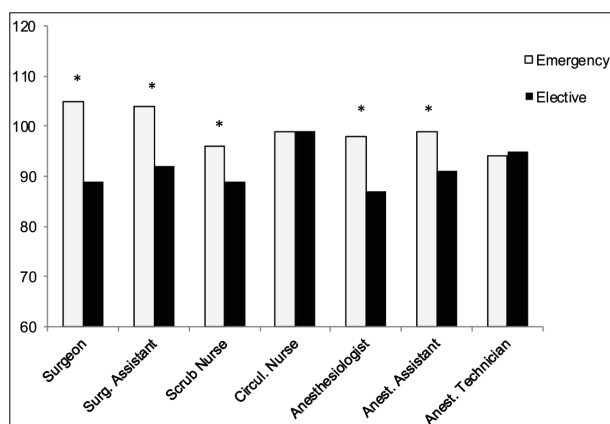


Figure 2. Comparison of the heart rates of team members during emergency and elective surgeries.

* $p<0.01$

With the exception of anesthesiology assistants, the preoperative STAI-SF scores of the team members was significantly higher in emergency surgeries compared to elective surgeries ($p<0.05$) (Table II). Intraoperative and postoperative STAI-SF scores of the responsible anesthesiologists was significantly higher in emergency surgeries compared to elective surgeries ($p<0.05$ and $p<0.05$, respectively). In addition, all team members had significantly higher preoperative STAI-SF scores than postoperative in both emergency and elective operations ($p<0.05$). Intraoperative STAI scores of anesthesiologists, surgeons, circulating nurses, and surgery assistants were also significantly higher than their postoperative scores ($p<0.05$).

The anesthesia team showed the lowest OTAS scores in intraoperative period during emergency surgeries, while the surgery team exhibited the lowest OTAS scores in preoperative period during emergency surgeries (24.8 ± 3.5 and 18.8 ± 2.8 , respectively) (Table III). The pre- and post-operative OTAS scores of the anesthesia team was statistically significantly lower in emergency surgeries compared to elective surgeries ($p<0.01$). The pre- and intraoperative OTAS scores of the surgery team was statistically significantly lower in emergency surgeries compared to elective surgeries ($p<0.01$). In anesthesia and surgery teams, no significant differences in OTAS scores were observed throughout elective surgeries ($p>0.05$).

DISCUSSION

This article represents the first study to evaluate the level of individual stress and team work among anesthesia and surgery teams in operating rooms during emergency and elective operations. Based on the assessments performed during the study, it was determined that the

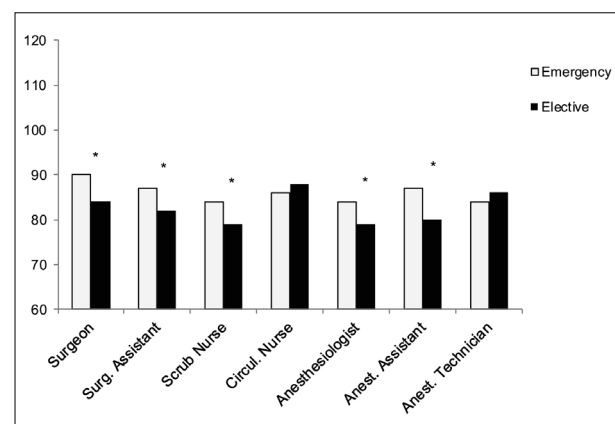


Figure 3. Comparison of the heart rates of team members in the period after emergency and elective surgeries

* $p<0.01$

Table II. The STAI-SF score results (mean±SD)

	Before Surgery		During Surgery		After Surgery	
	Emergency	Elective	Emergency	Elective	Emergency	Elective
Surgeon	14.8±2.6 ^{a#}	12.2±2.3 ^{a#}	11.9±4.0 ^β	10.5±3.0 ^β	9.1±1.2	9.0±1.2
S Assistant	15.9±3.1 ^{a#}	11.0±3.9	12.7±3.9 ^β	11.2±3.2 ^β	9.1±1.2	9.0±1.3
Sc Nurse	13.0±2.7 ^{a#}	11.3±3.8 ^{a#}	10.3±3.7	9.7±2.5	8.8±1.3	8.9±1.2
C Nurse	15.9±2.5 ^{a#}	13.9±3.8 ^{a#}	12.0±3.2 ^β	11.6±3.4 ^β	8.7±1.1	8.8±1.1
Anesthesiologist	13.2±2.7 ^{a#}	11.6±2.7 ^{a#}	10.2±2.9 ^β	8.5±2.4 ^β	9.3±1.5*	8.5±1.7
A Assistant	12.6±1.9 ^{a#}	11.7±2.4 ^{a#}	9.1±3.0	7.9±2.0	9.1±1.2	9.0±1.3
A Technicians	11.9±2.7 ^{a#}	10.3±2.6 ^{a#}	8.5±2.3	8.9±2.7	8.9±1.4	8.6±1.4

A: Anesthesiology, S: Surgery, Assistant: Assistant Sc: Scrub C: Circulating.

*p <0.05; in the pre-surgery period, higher scores were identified in emergency surgeries compared to elective surgeries.

Intragroup comparisons of the emergency and elective surgeries:

^ap <0.05; comparison of the pre-surgery and during surgery periods,

[#]p <0.05; comparison of the pre-surgery and post-surgery periods,

^βp <0.05; comparison of the during surgery and post-surgery periods.

Table III. Comparison of the OTAS scores of the teams in emergency and elective surgeries (mean±SD)

	ANESTHESIA		SURGERY	
	Emergency	Elective	Emergency	Elective
Before Surgery	24.9±4.0 ^{a#}	27.9±2.1 ^a	23.5±2.0 [#]	25.5±2.0
During Surgery	24.8 ±3.5 ^a	26.2±1.7 ^β	22.9±3.1 [#]	25.5±3.1
After Surgery	25.9± 3.3 ^{#a}	28.0±1.8 ^a	18.8±2.8 ^β	19.6±2.0 ^β

[#]p<0.01: differences between emergency and electives cases/surgeries for both teams.

^ap<0.05: differences between emergency and electives cases/surgeries for the anesthesia and surgery teams.

^βp<0.01: differences between the surgery periods (i.e. before, during, and after surgery periods).

period before emergency surgeries was particularly more stressful for members of both the surgery and anesthesia teams. It was observed that this stress negatively affected team work both before and during surgery.

In the period after surgery, a decrease was observed in stress levels in both emergency and elective surgeries; however, during this period, the work of the surgery team was negatively affected to a greater extent than the work of the anesthesia team. Previous studies have investigated the factors that cause stress in operating rooms, along with their effects on surgery performance (5). Based on these studies, the most important factors were identified as the concomitant diseases of the patient, the type of surgery to be performed, pressures associated with time, equipment problems, and bleeding problems. In emergency surgeries, it is expected that stress factors would be different and also have a greater effect on the team members. The most important stress factor in emergency cases is the uncertainty regarding the problems that may arise, and the concern of being unable to solve them. In a study investigating the effect of stress on team work within the scope of 20 elective

surgeries, it was described that STAI levels were relatively lower among team members due to the prepared and planned nature of these operations (4). In another study, 54 elective surgeries were grouped as stressful and stress-free surgeries, and the stress levels of surgeons were evaluated accordingly (6). The study reported that STAI scores in the post-surgery period were higher in stressful surgeries. As emergency surgeries in the current study were associated with higher pre-surgery heart rates and STAI scores compared to elective surgeries, it was determined that emergency surgeries led to more significant stress on individuals.

Previous studies have reported that team members (surgeons; anesthesiologists; surgery and anesthesiology assistants and nurses,) assume different tasks during different period of the surgery. Consequently, different team members also tend to have different stress levels (7). In the current study, we also observed that some of the team members had different heart rates, cortisol levels, and STAI scores compared to other team members in both emergency and elective surgeries. For example, in contrast to the other team members, anesthesiologists

had constantly higher STAI scores throughout (i.e. before, during, and after surgery) emergency surgeries compared to elective surgeries. The judgment and decision-making role of anesthesiologists becomes more important in emergency cases. For this reason, the significantly higher stress levels they exhibited in our study compared to the other team members, up until the moment the patient left the operating room, can be associated with the responsibilities that these anesthesiologists assume. The saliva cortisol levels of anesthesiology technicians were determined to be significant during emergency surgeries. This difference, which was only observed among anesthesiology technicians, suggests that these technicians experienced greater levels of stress compared to the other team members during the preparation stage of emergency surgeries. In conclusion, knowledge that the stress levels exhibited by different team members tend to vary during the different periods of surgery is important with respect to ensuring the efficiency of teamwork.

Teamwork is essential for the procedures performed on patients in operating rooms. Although improving competencies relating to occupational knowledge and skills is important, team communication is also very a valuable instrument for preventing errors in working environments and increasing the efficiency of the team (8). Systematic studies on team work in operating rooms began with the revision and adaptation of a type of checklist used in aviation by Helmreich et al. (2,9). In this study, the problems, decision-making, communication, and work load management of a team were evaluated, and the technical and other performances of the team were scored accordingly. Lingard et al. (7) previously described that the lack of communication was a significant factor in increasing tension among team members, procedural errors, and increased duration of surgery. In a previous survey study, it was determined that anesthesiologists considered communication, coordination and team work as important as technical skills and competency (10).

CONCLUSION

Based on the study results, we determined that team members in operating rooms exhibited different stress levels at different times, and that they experienced the most stress during emergency operations. These variable and high stress levels negatively affected teamwork and team spirit. For this reason, it is essential to organize simulation trainings which assess the non-technical skills required by emergency surgeries. We believe that feedback provided during trainings would serve to

increase team efficiency, while also reducing errors which might affect patient safety. We thus consider that it is necessary to include simulation activities and programs into the standard training curricula of young anesthesiologists and surgeons.

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