Doctors' opinion before and after an eLearning course about surgical stress modulation

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Abstract: *Surgical stress is a topic of interest in the literature, from multiple perspectives. The aim of this reserch was to evaluate doctors' opinion before and after an elearning course about surgical stress modulation Preparing medical staff to manage the modulation of this form of stress is very brief in our country. On the other hand, postgraduate eLearning training courses for physicians represent a form of training on various medical topics or topics with medical connections. Such a course was dedicated to the physicians training on a topic of modulation of surgical stress, in which we were also interested in assessing the participants' opinion before and after the course.*

Keywords: doctors, eLearning, surgical stress, stress modulation.

1. Introduction

Selye used the term "stress" to represent the effects of anything that seriously threatens the homeostasis of the body (Selye, 1956). The neuroendocrine, metabolic and inflammatory changes produced as a result of an injury are part of the "stress response", most frequently studied in relation to surgery: suppression of the secretion of anabolic hormones, activation of the sympathetic nervous system, immunological and haematological changes (Burton et al., 2004). Generally, the magnitude of the metabolic response is proportional to the severity of the surgical trauma, and physiological events are accompanied by psychological and behavioural changes (Burton et al., 2004; Lorenz, 2021).

2. Particularities of surgical stress

Surgical interventions are accompanied by peri-operative stress (Sobczak et al., 2023), which involves complex mechanisms and variable intensity. These mechanisms consist of a cascade of reactions that, schematically, unfold as follows (Finnerty et al., 2013): following surgical trauma, the nervous system activates the stress response, sending impulses from the site of the injury to hypothalamus; then,

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the hypothalamus either overrides the inhibition on the pituitary gland or releases hormones that stimulate the production and/or release of pituitary hormones; in turn, pituitary hormones (such as corticotropin - ACTH and growth hormone - STH) act on target organs, causing the release of other hormones (such as cortisol) and having, therefore, particularly important metabolic consequences; the increase in stress hormones (cortisol, glucagon, catecholamines), as well as inflammatory cytokines, further accentuates the stress response. The anticipation of surgery is often is correlated with high levels of anxiety (Davidson & McKenzie, 2011). Preoperative anxiety is associated with the development of postoperative maladaptive behaviours, including separation anxiety and sleep difficulties (Caumo et al., 2000; Kain et al., 1996; Kain et al., 1999). Also, increased preoperative anxiety has been associated with increased postoperative pain and analgesic dosage, (Kain et al., 1999) longer and more complicated postoperative recovery (Kain et al., 2006; McCann & Kain, 2001) and postoperative anxiety as an intensified state (Caumo et al., 2000). The common prevalence of anxiety in patients undergoing surgery has led to the attempt to routinely identify patients with higher anxiety (Ziętek et al., 2014). It was concluded that preoperative laboratory testing, which may harm patients, should be performed only after anamnesis and physical examination, identification of surgical severity components and comorbidities, so that the benefit of the tests is greater. than risk (Edwards & Forest, 2018). Due to these mechanisms, salivary cortisol (S Cortisol) and salivary alpha-amylase (SAA) are often used as a valid biomarker of stress (Grigoropoulou et al., 2023).

3. Methods of surgical stress modulation

3.1. Conventional methods of modulation

1. *Anaesthesia* can influence some aspects of the response to surgical stress, by:

a) *opioids*: opioids suppress the secretion of hypothalamic and pituitary hormones (Burton, Nicholson & Hall, 2004) and bi-directional effect on the immune system (Lisowska et al., 2020).

b) *anaesthetic drugs*: for example, etomidate suppresses the production of corticosteroids in the adrenal cortex and blocks the synthesis of aldosterone and cortisol for up to 8 hours; clonidine may decrease sympathoadrenal and cardiovascular responses to surgery (Burton, Nicholson & Hall, 2004); some anaesthetics (e.g., halogenated anesthetics), stimulate the production of reactive oxygen species, while others (eg. Propofol), have antioxidant properties (Tomsič & Nemec Svete, 2022).

c) *regional anaesthesia*: epidural/spinal anaesthesia can reduce changes in blood glucose, ACTH, cortisol, growth hormone and epinephrine values (Burton, Nicholson & Hall, 2004); regional anaesthesia may be part of multimodal analgesia regiments that reduced surgical stress response (Sertcakacilar et al., 2022).

2. *Surgical technique*: refinement of surgical techniques may have some advantages in reducing inflammatory responses; thus, cytokine release is reduced in less invasive surgery such as laparoscopic techniques leading to faster recovery and discharge (Burton, Nicholson & Hall, 2004); the inflammatory-immune, as a part of a pathophysiological response to surgical injury, may be harmful, leading to dysregulated state (Bain et al., 2023).

3. *Maintenance of normothermia*: is also beneficial in reducing the intensity of the metabolic response to a surgical intervention (Burton, Nicholson & Hall, 2004), knowing the fact that anaesthesia leads to impairments in central and peripheral thermoregulatory responses (Koh et al., 2021).

4. *Nutrition*: can play an important role in preventing the adverse effects of the stress response (Burton, Nicholson & Hall, 2004); nutritional status is a strong predictor of postoperative outcomes and important in surgical recovery programs (Hirsch et al., 2021).

3.2. Psychological methods of modulation

In children, preoperative psychological preparation (PPP), which consists primarily of providing information and training in parent-child coping skills before induction of anaesthesia, is the main non-pharmacological approach used by various paediatric healthcare institutions to reduce paediatric preoperative anxiety (Capurso & Ragni 2016). Interventions to reduce anxiety included the presence of parents in the operating room during the induction of anaesthesia, sedative drugs administered preoperatively, verbal distraction techniques performed by hospital staff (Wright et al., 2007). In addition, there are hospitals that use preoperative videos (Vernon & Bailey, 1974). More, distraction applied to children in the preoperative period significantly reduced anxiety and separation anxiety (Aytekin et al., 2016). Use of behaviour modification techniques in dentistry, to overcome the child's anxiety before the start of a dental extraction can be useful in reducing the stress level (Chaturvedi et al., 2018).

Currently, it appears that the evidence is insufficient to be sure that preoperative psychological interventions are beneficial or to know which interventions are the most effective, as their impact over time has been heterogeneous; there is an urgent need for high-quality prospective studies with baseline psychological assessment, well-described interventions, and agreement on the most appropriate psychological, physiological, and quality-of-life measures (Levett & Grimmett, 2019). Recently it was found that psychological counselling coupled with visual aids before the endoscopic procedures can alleviate anxiety, acute stress and fear related to this procedure (Khan et al., 2023). Surgical coaching is a new approach based on live or video observation of procedures, with potential benefits such as collaborative analysis, technical skills improvements (Willemot et al., 2023).

3.3. Integrative methods of modulation

Also known as integrative therapies. Natural sources of therapy can be very helpful in modulating stress.

1. Phytotherapy. The results of a relatively review (Tsuchiya, 2017) show that plant preparations and their phytochemicals contain the potential to become local anaesthetics, general anaesthetics, antinociceptive, analgesic or sedative; although clinical trials are still limited, there is a possibility that certain phytochemicals may be used in anaesthesia; thus, terpenoids, alkaloids, and flavonoids are expected to become new aesthetic agents of plant origin because they meet the mechanical requirements to interact with receptors, channels, and membranes and have characteristic molecular structures different from conventional drugs. Phytochemicals, naturally occurring molecules, have an imperative role in modulating favourable the immune responses (Behl et al., 2021).

2. Adaptogens. The beneficial stress-protective activity of adaptogens has been shown to be associated with the hypothalamic-pituitary-adrenal axis (HPA) and the regulation of key mediators of the stress response (Jurcău & Jurcău, 2018; Jurcău et al., 2017; Jurcău et al., 2013; Jurcău et al., 2018; Panossian & Wikman, 2010). E.g., rutin has adoptogenic potential via normalization of HPA, oxidative / nitrergic, and neuroinflammatory inhibitions (Emudainohwo et al., 2023). e.g., Korean Red Ginseng (KRG) plays a key role in heme oxygenase (HO)-1 induction under physical and moderate oxidative stress conditions.

3. Acupuncture. Perioperative acupuncture not only reduces the consumption of anaesthetics and analgesics, but also anaesthesia-related complications and protects organs in the perioperative period; thus, acupuncture represents a promising approach in perioperative management, especially for improving surgical recovery and for particular categories of patients such as the elderly (Lu et al., 2015). Electroacupuncture (EA) can effectively reduce surgical stress-induced HPA axis dysfunction and promote postoperative recovery by activating the oxytocin and oxytocin receptor signalling pathway (Wu et al., 2023).

4. Music therapy. Music therapy is a non-pharmacological, inexpensive and non-invasive technique that can significantly increase patients' satisfaction and reduce their unpleasant experiences related to pain and perioperative stress (Kahloula et al., 2016). Thus, music therapy can be used as a complementary no-drug intervention alongside standard surgical care before, during and after medical procedures (Giordano et al., 2023).

4. Objective

The objective of this study was to test the knowledge of doctors regarding modulation of surgical stress (MSC), before the eLearning course, and the effectiveness of the course, at the end of its implementation.

5. Methods

Participant. The subjects were 49 doctors from different specialties: 19 men and 30 women. The average age of the participants was: 40, 3±1 years, for men and 49, 3±10 years, for women.

Instruments. All participants answered the same questionnaire (see Appendix), which contained 13 items.

Design. All participants attended a post-graduate eLearning course on MSC in the summer of 2023. The course was part of a postgraduate training program and took place during one day of this program, for 6 hours. In this MSC course, relevant information was presented regarding: a) Stress: definition, framing, factors, physio pathological mechanisms, functional implications; b) Surgical stress: psychological; aesthetic; pre-intra-post-operative; the categories involved - patients, doctors, medical staff; c) Modulation of stress: mechanisms, modalities, implications. The eLearning course was taught by the course coordinators, two specialist doctors with training in Physiopathology, teaching staff at UMF Cluj-Napoca, in collaboration with a doctor specializing in Surgery, also teaching staff at UMF Cluj-Napoca and a psychologist. The study and measurements were conducted in July 2018. All subjects' participation in the research was voluntary. Participants answered the first 12 items of the questionnaire 15 minutes before the class and the last item, 13, 15 minutes after the class ended. For the data analysis, the absolute frequency and the ratio of the participants to the total of those who answered the item (R), who gave the respective answer, were determined for each answer variant of each item.

6. Result

Results are presented in the order of the items in the questionnaire.

1) What does the MSC mean?

Most of the participants (R=0.6) mentioned that they do not know what MSC entails, and the fewest (R=0.04) mentioned other methods (for example, informing patients). Psychological methods were selected by more participants (R=0.24) than medical ones (R=0.12).

2) How many MSC courses have you attended?

All participants (R=1) mentioned that they had not attended another course on MSC.

3) How many MSC ways do you know?

Most participants (R=0.49) answered that they do not know any method, and the fewest mentioned herbal therapy (R=0.12). An important percentage of participants (R=0.21) mentioned psychological procedures, for example, counselling, psychotherapy.

4) What MSC modalities have you seen in practice?

Most participants (R=0.71) answered that they did not see any method applied practically, and the fewest mentioned patient counselling, done by the surgeon, anaesthesiologist or the average staff (R=0.19). The other participants did not give any answer (R=0.10).

5) What are the basic mechanisms of MSC?

Most of the participants (R=0.43) answered that MSC reduces surgical stress, and the fewest mentioned the hypothalamus-pituitary-adrenal (HHA) axis as being involved (R=0.17). The other participants (R=0.40) gave varied answers, for example, reduction of anxiety, decrease of sympathetic action, reduction of cortisol.

6) What are the main functional effects of MSCs?

Most participants (R=0.69) mentioned cardiovascular effects, as a whole, and the fewest noted that improvement in sympathetic activity occurs (R=0.12). The other participants (R=0.19) gave varied answers, for example, blood pressure reduction, heart rate reduction, respiratory rate reduction.

7) What are the main biological effects of MSCs?

The most participants (R=0.49) mentioned the reduction of cortisol, and the fewest noted the reduction of adrenaline (R=0.12). The other participants (R=0.39) gave varied answers, for example, reduction of blood sugar, biochemical changes in stress parameters.

8) What are the main psychological effects of MSC?

The most participants (R=0.43) mentioned the reduction of anxiety, and the fewest noted the reduction of fear (R=0.17). The other participants (R=0.40) gave varied answers, for example, inducing a sense of peace, trust, and optimism.

9) What are the main evaluation markers of MSC?

Most participants (R=0.42) answered that they don't know, and the fewest noted adrenaline (R=0.19). The other participants (R=0.39) gave varied answers, for example, anxiety, heart rate, blood sugar, cortisol.

10) On a scale of 1-10, how much can MSC improve the quality of surgery?

Most participants (R=0.42) answered with 6, and the fewest (R=0.10) answered with 2 and 3, respectively. The highest mentioned was 6.

11) At what point in the surgical operation can MSC be applied?

Most participants (R=0.49) mentioned the pre-operative time, and the fewest (R=0.04) noted the postoperative period and that any pre- or postoperative time can be used (R=0.04). An average percentage of participants (R=0.43) answered that they do not know.

12) Given the information you have so far, would you choose an MSC in practice?

Most participants (R=0.49) answered Yes, the least No (R=0.10), and an average percentage of participants (R=0.41) answered I don't know.

13) On a scale of 1-10 how much did this eLearning *course help you learn more about MSC.*

The most participants (R=0.49) answered 10 for how much the eLearning course helped them in understanding MSC, and the fewest (R=0.04) answered 6. There was no answer between 1 and 5.

Gender and age differences were irrelevant for all items analysed. However, overall, the most answers in favour of using MSC and the most knowledge about MSC were given by female participants and those aged 40-49.

7. Discussions

Specifications

Operative stress is a reality faced by many medical specialties that involve surgical interventions. That is why the modulation of surgical stress is a medical goal, which requires at least basic knowledge on the subject of operative stress, in order to be achievable. Stress is a complex field of interference, due to the multitude of factors, mechanisms and connections involved. Surgical interventions assume a diversity of aspects: the nature of the condition, the operating team, the complexity of the surgical act, the individual characteristics of the patient, etc. As a result, the modulation of peri-operative stress requires, in turn, complex approaches, such as addressability and intervention. This article is a continuation of the author's previous research on stress and stress modulation (Jurcău & Jurcău, 2018; Jurcău et al., 2013; Jurcău et al., 2017; Jurcău et al., 2018).

Analysis of questionnaire responses

This study was attended by a large number of doctors (49) a fact that proves that the subject of the course was an interesting one. For a postgraduate course, this is an important number of participants, the minimum allowed being 5.

The participating doctors had different specialties, more than half of which were surgical specialties, such as surgery, otolaryngology, urology, ophthalmology.

The course participants were of both genders, but female doctors predominated. Comparable answers given by men and women, regardless of their age, do not allow us to make a particular comment regarding differences in answers in relation to participants gender or age.

Following the application of the questionnaire, we could find that the participants have little information about the MSC. This aspect could be understood by the fact that there is currently no specific education for doctors in the field of stress modulation. The approach to this subject in practice is limited by the crowded professional schedule of doctors and by the rather empirical

understanding of intervention methods. However, a moderate percentage of participants knew MSC, through the lens of mechanisms, effects or evaluations.

All participants declared that it was the first eLearning course on MSC that they attended. This online course has proven to be a very practical option, which can save a lot of time spent in the classical way and which allows a much larger number of doctors to participate in this training. The e-learning format represents an additional explanation of the important number of participants who chose this course.

What is more encouraging, regarding the position of the participants in the course, towards MSC, is the answer to the last item, which represented the question at the end of the eLearning course. This answer shows that the information provided in the eLearning course helped most to understand MSC.

8. Conclusion

This postgraduate eLearning course seems to be the first related to MSC. Initially, most participants had little knowledge of MSC. Taking into account the final evaluation of this eLearning course, we could consider that the information presented was positively appreciated by the learners. Further elearning training on MSC is needed, as the use of this type of modulation could improve the quality of the medical act.

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Appendix

The questionnaire used in the research

Items	**Answers**
1) What does the MSC mean?	I don't know / Medical techniques / Psychological techniques / Other
2) How many MSC courses have you attended?	To none / 1 / 2 / 3
3) How many MSC ways do you know?	None / I know - list: .....
4) What MSC modalities have you seen in practice?	None / I know - list: .....
5) What are the basic mechanisms of MSC?	I don't know / I know – list: .....
6) What are the main functional effects of MSCs?	I don't know / I know – list: .....
7) What are the main biological effects of MSCs?	I don't know / I know – list: .....
8) What are the main psychological effects of MSC?	I don't know / I know – list: .....
9) What are the main evaluation markers of MSC?	I don't know / I know – list: .....
10) On a scale of 1-10, how much can MSC improve the quality of surgery?	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10
11) At what point in the surgical operation can MSC be applied?	I don't know / I know – list: .....
12) Given the information you have so far, would you choose an MSC in practice?	Not / I don't know / Yes
13) On a scale of 1-10 how much did this eLearning course help you learn more about MSC	1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10
The legend, MSC = modulation of surgical stress	