

The Lion Heart of a Neurosurgeon: the Stress during a Life of Neurosurgery

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“A good surgeon must have an eagle’s eye, a lion’s heart and a lady’s hand”.
(old English proverb)

Abstract: Neurosurgery is a rewarding career choice in which there are many challenges and stress factors that can lower the level of satisfaction and also increase the levels of burnout. The identification and management of common work-related stressors is important for improving the performance of health-care specialists and also for providing high-quality patient care.

Introduction

It is well-known that surgeons work in a stressful environment due to the multiple surgical challenges, technical requirements and time pressure they have to face on a daily basis [16,53]. They also experience complex crisis situations while performing surgical procedures, which can inevitably lead to acute stress, with direct effects on patient outcomes [19,51]. Despite all these stressful factors, neurosurgery was and will always be a rewarding specialization [33].

Exhaustion and Burnout Syndrome

In 2015, the American neurosurgeon McAbee et al. published a recent nationwide study from USA where he reported a significant 57% of American neurosurgeons who met the burnout syndrome criteria [33].

This condition is defined as a clinical syndrome characterized by a high degree of emotional exhaustion and depersonalization and a low sense of personal accomplishment with negative consequences on the surgeon’s state of health and on the patient’s postoperative evolution [11,12,13,21,31,32, 33]. Also, the burnout syndrome has been

included in the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10), and its symptoms are: exhaustion, fatigue, cynicism, poor judgment, feelings of ineffectiveness and disconnection with patients and colleagues [10,11,41], but also lower quality of care for patients [52].

The prevalence of burnout is 40% in surgical specialties [5,6,7], being the greatest during the years of training [17], with residents being the most exposed of all doctors [39], as more than half of them are affected [52]. As concerns the field of neurosurgery, the prevalence of the burnout syndrome was estimated to range between 27 and 56.7%, with the highest rate among all surgical subspecialties [27,33]. This is accounted for by the fact that neurosurgery training is long-lasting, competitive, with the longest training programs of all specialties and the third most competitive specialty (76%) after vascular surgery (71%) and orthopedics (75%) [37]. Moreover, neurosurgery residents tend to work more than other residents in other specialties, as evidenced by the Accreditation Council for Graduate Medical Education in the USA with duty hours up to 88h/wk, which is 10% above the 80h limit for the other specialties [34].

The best demographic predictor of burnout syndrome is the number of hours worked per week, although many factors have been taken into account such as: hours slept per night and nights/weekends worked per month [17], number of nights on call per week (8), younger age [28], or even the specialty practice area [5,6,7].

Also, the burnout syndrome is associated with substance abuse, suicidal ideation, medical errors, impairment of interpersonal relationships or even desire by young surgeons to retire early [9,14,42,43,49,50], anxiety and depression [5]. Also, patients who have been treated by surgeons suffering from burnout are most often unhappy with the level of healthcare received [9].

As far as the level of satisfaction of doctors is concerned, the most unsatisfied surgeons are those who do not have time for their personal life or family [5,6,7,41] or work in private practice [6], and the most satisfied were reported to be those who have enough time for non-patient care activities [5,6,7,28], the eldest [28], those who spend more time in the operating theater [44], or those who teach at university [6]. In this regard, McBee demonstrated that neurosurgeons who are also academics have a lower rate of burnout than nonacademic neurosurgeons [33], which shows that neurosurgeons feel more satisfied if they are challenged at their work place.

In 2015, McBee et al. demonstrated that factors that increase the satisfaction in a neurosurgeon's career are: having children, being surgically productive, being intellectually stimulated, and a balance between their neurosurgeon careers and life outside of work [33].

Stress

In 1936, Hines and Brown were among the first to assume that mental stress can lead to hypertension, influencing cardiovascular activity by increasing their heart rate (HR) and blood pressure (BP) [20]. Another

research conducted in 2002 industrial workers proved a 2.2 times higher risk of cardiovascular events and mortality in high job stress employees compared to their low job stress colleagues [24].

When individuals are exposed to workplace risk factors, their reaction to stress may be emotional, behavioral, cognitive and physiological [45]. Thus, although low levels of stress may enhance alertness and efficiency of tasks [25], excessive and acute stress levels during surgery may affect attention [26], concentration and motor skills [2,3,15], may interfere with manual dexterity [2,3], cognitive functioning [36] and memory retrieval [29].



El cirujano (The surgeon), Jan Sanders van Hemessen.
Madrid, Museo del Prado (between 1550-1555)
(public domain)

This is of major importance, since for the purpose of performing a safe surgical procedure, it is necessary to integrate complex cognitive processes with manual dexterity [4]. Studies have shown that all these pathophysiological changes that occur in prolonged stress may lead to anxiety,

depression, alcoholism, substance abuse, broken relationships or even suicide, all of which are more common among surgeons and physicians than in other professions [9].

Also, with regard to surgical professions, studies have shown that the constant intraoperative fluctuation of BP and HR may increase the risk for coronary events [23], cerebrovascular disease [22], diabetes [35] and impairment of cognitive functioning and structural brain changes [18,38] or depression [47]. A recent study in orthopedic surgeons has shown that the BP of trainees was much higher when they performed surgery alone than when they performed it under supervision [18].

As concerns the high levels of stress during surgery, studies have shown that they are specific, higher in surgical residents and young specialists, and are attributed to the novelty of the procedures [18], and on the other hand, experienced surgeons are accustomed to the stress of surgery under pressure and intraoperative complications [12,13].

Cardiovascular Disease

Cardiovascular diseases are among the most common causes of death among doctors, including surgeons. When stress reaction persists for a long time, neurosurgeons may develop cardiovascular disease, chronic fatigue or musculoskeletal disorders due to the activation of the sympathoadrenal system and the hypothalamic-pituitary-adrenocortical axis leading to hyperlipidemia, atherosclerosis, hypertension and hence coronary heart

disease [45]. Interestingly enough, the cardiovascular response to intraoperative stress differs from that induced by exercise. In this respect, the increased BP incidence (SBP/DBP > 180/90mmHg) was higher during surgery, whereas the tachycardia rate was higher during exercise [45].

The surgeon's cardiovascular response to surgical procedures undoubtedly varies during the surgical procedures, being higher in more difficult surgical procedures or in the critical phases of the surgery [18,46]. Thus, Sharma et al. reported higher incidence of abnormal BP elevation episodes during vestibular schwannoma excision and aneurysm clipping surgeries, compared to the rest of neurosurgical procedures on the brain [45].

Bunevicius et al. found that during brain aneurysm surgery, if the procedure is divided into seven surgical phases (1 - before skin incision, 2 - after craniotomy, 3 - after dural opening, 4 - after aneurysm neck dissection, 5 - after aneurysm clipping, 6 - after dural closure, 7 - after skin closure), the highest HR and BP (systolic, diastolic and mean BP) occurred during and after the aneurysm neck dissection and clipping phases. These were followed by a gradual decline and return to normal levels. Interestingly enough, intraoperative cardiovascular and hemodynamic response was independent of the neurosurgeon's experience [12,13].

Conclusion

Mental stress and work-related stress management in the operating theater has important implications for both the

neurosurgeon's health and the safety of the patient. From this point of view, it is important to find factors that increase personal satisfaction and reduce mental stress. In this respect, an alternative found in recent years has been to listen to one's favorite music in the operating theater [40], which seems that even improves performance and reduces autonomic reactivity [1]. Since there have also been studies showing that music in the operating theater may lead to distraction [30,48], further research is required in this direction.

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