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Research Article

Heart Rate Monitoring of Anaesthesiology Residents during the Airway Management of COVID 19 Suspect Patients: An Observational Study

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ABSTRACT

Background: Anaesthesiologists undergo shear stress during the perioperative period, which was further increased during the COVID 19 pandemic. Many observational studies were done to find out the stress levels of the residents.
Methods: This was a prospective observational cohort study of Anaesthesiology residents in a tertiary care academic institution. We have measured the minute to minute heart rate variability which can be an indirect measure of stress level with the help of wrist band MI 4 which works on the principle of PPG.
Results: The difference between baseline HR and resting HR was observed to be substantial (p value 0.115 and 0.000 respectively). The percentage rise in heart rate during intubation from resting heart rate was 42.79 ± 25.54 percentage points.
Conclusion: Users can use this type of ongoing information as a feedback option to increase their work efficacy. Understanding how to use these smart devices will assist us in balancing our stress-free day-to-day activities.

Technology has become an essential part of modern life, impacting how we all work and function. For the most part, technology is beneficial because it assists us in managing and monitoring our daily activities. Nonetheless, technological advances has a vital role to play in overcoming a variety of additional problems that medical services encounter.

Anesthesiology is a demanding profession in and of itself. And the residents' stress is apparent, leading to a slew of health problems, including cardiovascular disorders at a young age and a higher incidence of suicidal behaviors among Anesthesia residents [1-2]. Many factors contribute to this fact, like the complicated procedures performed by the residents, airway management of cases day in and day out, relationship with the surgeons, and ultimately the life and death process they see from the preoperative to the post-op ICU care of the patients. These stress levels have increased much more in this COVID 19 era, as the Anaesthesiologists are directly involved in the patients' airway manipulation.

Among medical caregivers, work-related stress is prevalent and affects all perioperative care providers. Although Anaesthesiologists are considered to experience anxiety, this issue is addressed by limited Indian data. The fact that Anaesthesiology is a group profession that needs perfect coordination with other professionals requires considerable responsibility for the patient's safety, the regular use of invasive "blind" procedures, and last but not least, the output stress that defines the operating theatre procedure.

With the rise of technology, mobile phone apps for healthcare, e.g., mobile heart disease detection, cardiac rhythm analyzation, distant home care monitoring, eye diagnosis of diseases, are becoming spotlighted. We conducted a study to examine the heart rate variation of Anesthesiology residents in the COVID 19 suspect zone to their sleeping HR and baseline HR value. We believe that a considerable increase in HR while airway

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management is an indication of the resident's stress, which most often goes undetected.

Methods

This was a prospective observational cohort study of Anaesthesiology residents in a tertiary care academic institution. All of the doctors in the research were between the ages of 20 and 45 years, had an ASA I-II classification, and had 6 months of airway management experience. The study did not include airway care for patients with difficult airways. All residents who took part in the study gave their informed consent. 30 residents were included in this pilot study because that was the first of its kind. Before bedtime, all respondents strapped on a smartwatch MI band 4, downloaded the MI fit app on their smartphones, and turned on the continuous sleep and heart rate sensor to detect sleep patterns and sleeping heart rate.

Subjects' sleeping duration, sleeping HR, and baseline HR were all recorded using the app's built-in software. Following morning, during in the induction of general anesthesia in an elective case (COVID SUSPECT area) at 8:40 am-9 am, HR monitoring of residents was acquired in 3 phases (Pre-induction, during induction, and post-induction).

Statistical testing was carried out using IBM SPSS statistics 23.0, a statistical tool for the social science system. Continuous variables were expressed by mean and standard deviation, whereas categorical variables were depicted by absolute numbers and percentages. The paired T test was employed to evaluate variables (Heart Rate) at different time points from baseline for within-group comparisons. Statistically significant difference was defined as a P value of less than 0.05.

Results

30 residents have been included in the study, with a mean and standard deviation of 26.4+ 1.4 years, minimum 22 and maximum 29 years, BMI (23.82+ 2.52, minimum 18.68 and maximum 26.56) kg/m2, and a sleeping schedule of (6.3+ 0.8h, minimum 5 and maximum 8) hours, with a preponderance of male residents (11:4). The differences in mean heart rate at various time intervals are presented in (Table 1), with major differences seen at different time points (T- B vs T-R and T-I vs T-B and T-R with p value 0.001, 0.000 and 0.000 respectively).

When the baseline HR was evaluated to the pre-intubation HR, no substantial variations were seen. When comparing baseline HR to post-intubation HR, no significant difference was found, however when comparing baseline HR to resting HR, a significant difference was found (p value 0.115 and 0.000 respectively). The percentage rise in heart rate during intubation from resting heart rate was 42.79 25.54 percentage points. (with a minimum increase of 2.79 percent and a maximum increase of 98 percent). The heart rate of individuals at various time points is depicted in (Figure 1).

Figure 1- Reflects heart rate of participants at various time points

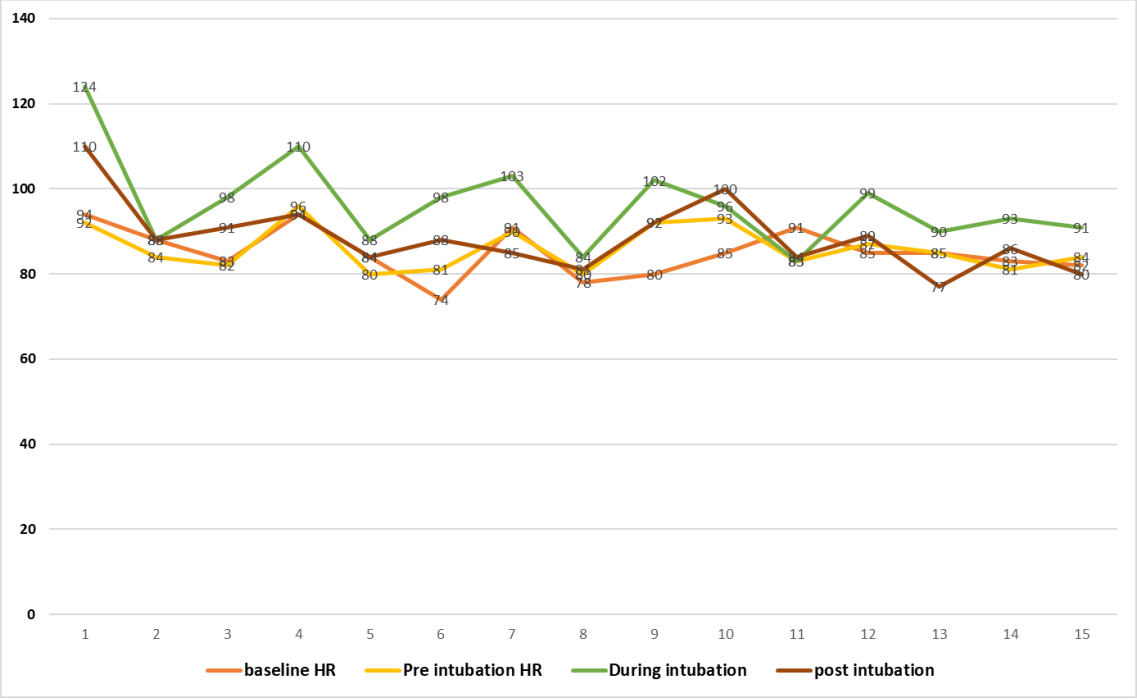

Table 1- Table showing the heart rate pattern

S. No	Time points	Heart rate pattern	Mean + SD	P value	P value
1	T-R	Sleeping heart rate	69.3 + 13		
2	T-B	Baseline HR	89.1 + 5.7	T-B vs T-R 0.001	T-B vs T-R 0.000
3	T-pre I	Pre Intubation HR	86.0 + 5.3	T-pre I vs T-B 0.523	T-pre I vs T-R 0.553
4	T -I	Intubation HR	96.4 + 10.4	T-I vs T-B 0.000	T-I vs T-R 0.000
5	T -post I	Post intubation HR	88.6 + 8.2	T-post I vs T-B 0.115	T-post I vs T-R 0.000

Discussion

Stress has a negative effect in healthcare organisations and, more importantly, is linked to poor patient safety and treatment quality, as it can manifest itself as exhaustion and impaired cognitive functioning, affecting employees' performance and contributing to a higher risk of human error. This is especially true for anaesthesiologists, whose poor performance has been linked to fatal patient injuries and negligence cases. Depression had also been identified among stressed youths, as it is linked to difficulty concentrating, dread of failing, and a pessimistic assessment of the future, among other things.

Stress exposure of an individual can be acute or chronic, and its effects on the human body can be immediate or delayed. Many studies have proven the fact that traumatic experiences can lead to psychopathological disorders of individuals [3]. Stress detection monitors/ devices are well known in the market for the general population. These devices work on the principle of continuous heart rate monitoring and feedback loops. New devices measure heart rate variability(HRV), an advanced version of measuring a steady heart rate. Low HRV indicates that an individual is stressed [4].

Anaesthesiology residents undergo much stress from intubating a patient until the end of the surgery with continuous monitoring. During surgery, Anaesthesiologists perform high duties and face challenging situations such as unanticipated complicated airway control, cardiac arrest, and other life-threatening emergencies. The work pattern can also be seen as more stressful, at least for medical facilities, given the sheer number of on-calls and long shifts and the increased possibility of working on weekdays and festive occasions, the lack of consistency between work and personal life. This stress is more acute during the handling of the airways of patients. This may be due to the narrow margin of safety associated with airways' handling and the generation and exposure of aerosols, which further exacerbates the stress related to COVID 19.

Heart rate variation depends on the alteration between sympathetic and parasympathetic nervous systems. During the acute stress of an individual sympathetic stimulation decreases the RR interval transiently increasing the HR [5]. When we compared the baseline HR to the induction HR in our study, we found significant differences in Sleeping HR ($p<0.05$). This could have been attributed to the resident's engagement and the body's stress response. We also discovered a substantial difference between baseline and intubating HR.

Electrocardiography (ECG) or photo-plethysmography is employed in many smartwatches, wristbands, and activity trackers these days (PPG). These devices are widely used to continuously measure physiological signs such as heart rate and peripheral oxygen saturation (SpO2) in daily life [6]. We used Mi band 4 to monitor the heart rate of all residents. We chose this band because it's cheap, comfortable to wear, rather discreet and lightweight. It is based on the principle of photo-plethysmography (PPG). Along with continuous monitoring of the heart rate, variables such as sleep duration, stress levels, and calorie output can be observed every day. Its battery backup of 3 weeks makes it much more user friendly.

Several studies were performed to check all the residents stress levels and particularly the Anaesthesiology residents, during the pandemic [7-8]. Most of them are subjective to the responses given by the residents to the questionnaires [9-10]. We have done this study to observe the continuous heart rate variability of the residents to check their minute-to-minute heart rate variability during the airway manipulation compared to the baseline heart rate and sleeping HR.

Conclusion

Knowledge of technology's capabilities aids in its application and optimization of the potential benefits that can be derived from its use, as well as a more realistic assessment of the demands and requirements involved. Residents can use this type of ongoing information as a feedback option to increase their work efficacy. Understanding how to use these smart devices will assist us in balancing our stress-free day-to-day activities. While we use technology in our daily lives, it is time for health care providers to employ it for their own safety and personal wellness in order to improve patient outcomes.

Limitations

We have used wristbands for continuous heart rate monitoring based on the principle of PPG, which can alter with light and movement. Variables like heart rate variability are more advanced than continuous heart rate monitoring, which we could not measure MI band 4.

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