Relationship Between Peripheral Perfusion Index and Anxiety

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ABSTRACT

Peripheralperfusionindex(PI) provides information about vascular tone and fluid status by interpreting the data obtained from pulse oximetry. However, the vascular tone may be affected by anxiety in patients. Impaired perfusion index in patients with high anxiety may cast a shadow on the predictive power of the PI. In the present study, we aimed to evaluate the relationship between anxiety and perfusion index values.

Preoperatively, anxiety scores of the patients were measured by APAIS and STAI tests. Perfusion index values were also recorded in the preoperative room. The correlation between these values was evaluated.

95 patients aged 18-65 years were included in the present study. Mean anxiety scores of all patients were 48.35±4.42. Perfusion index values were significantly lower in the patients with higher anxiety. In addition, we have found a negative and significant correlation between anxiety and perfusion index.

The perfusion index is a non-invasive, easy to apply and cost-effective method. It has been used in the important studies such as predicting the development of hypotension induced by anesthesia. However, according to the results of our study, this technique is affected by the anxiety levels of the patients. It may be misleading in patients whose anxiety is not obvious.

Anxiety levels should be questioned in awake patients and it should be kept in mind that perfusion index may decrease in high anxiety levels.

Key Words: Preoperative Anxiety; Peripheral Perfusion İndex; Preoperative Monitorization.

Introduction

Peripheral perfusion index (PI) is a non-invasive measurement with the ratio of pulsatile and non-pulsatile photoplethysmographic signals obtained from pulse oximetry (1). This non-invasive and easily applicable technique can be used before or after anesthesia to obtain information about the fluid status and vascular tone of the patients. Pulsatile flow time prolongation is observed as an increase in perfusion index when the vascular tone is low.

With this measurement, the ability of patients to respond to fluid treatment can be predicted or with an increase in perfusion index, conclusions can be drawn about the success of sympathetic blockade (2, 3).

Perioperative anxiety may have many effects on anesthetic or postoperative analgesia requirements by affecting the neuroendocrine response of the patients (4, 5). The use of the perfusion index is expanding with an increasing number of studies in patients (6-8). Increased anxiety is also known to affect vascular tone (9). However, the effect of anxiety on patients' perfusion index measurements is not known.

In this study, the effect of preoperative anxiety on perfusion index was investigated.

Material and Method

After the approval of the ethics committee, 100 patients who agreed to participate in the study by signing the informed consent form were included in the study. The number of patients was determined as a result of power analysis based on previous studies on this subject. According to this analysis, when the alpha value was calculated as 0.05 and the power value was calculated as 80%, it was seen that there should be at least 50 patients for the study.

Adult patients with American Society of Anesthesiologists (ASA) scores I - III who were planned to undergo elective surgery and who had sufficient language skills for interview were included in the study. The interviewer was a nurse who was completely blind to our study. The patients were interviewed in the preoperative waiting room before

surgery under the supervision of a specialist anesthesiologist. The questioning applied before the premedication visit in the waiting room.

Amsterdam Preoperative Anxiety and Information Scale (APAIS) and State-Trait Anxiety Score (STAI) tests were performed to measure anxiety levels and causes. Baseline perfusion index values were measured after 5 minutes of rest in the same waiting room. In addition, demographic data such as education, age and gender were recorded to a printed form.

APAIS is an anxiety measurement tool developed in 1996 for the first time. In this test, there are 6 questions that measure anesthesia anxiety, surgical anxiety and anxiety with lack of knowledge. Each question is scored from 1 to 5 points and high scores are considered as increased anxiety.

STAI test measures anxiety related to an event and the patient's character in a single test (10). In this test, which consists of 20 questions, each question is scored between 1 and 4 according to the patients' own reports (11). A high total score is an indicator of high anxiety. It is one of the most commonly used tests for the evaluation of preoperative anxiety with APAIS.

In our study, vascular diseases, autonomic neuropathy and diabetes mellitus that could affect perfusion index were determined as the exclusion criteria. In addition, 5 patients who did not want to continue after partially answering the questionnaire were excluded from the study.

With the data obtained, patients were divided into two groups with higher and lower anxiety. Demographic data, anxiety scores, and perfusion index values were compared between the two groups.

SPSS vs 22.0 program (IBM, Chicago IL.) was used for statistical analysis. Their reliability of the test was determined by Cronbach's alpha value. Independent T-test was used for comparison between the groups. The relation between STAI and PI values was examined by Pearson Correlation Analysis. p <0.05 considered as significant.

Results

One hundred patients were included in our study, but five patients were excluded because they met the exclusion criteria. Of the total 95 patients, 60% (n = 57) were female and 40% (n = 38) were male.

The classification of the operations was found as 10.5% major, 58.9% moderate and 30.5% minor. Anxiety scores of the patients who would have major operation were 48.12± 3.81 and higher than the

patients scores who would have minor operations (46.18± 2.66). However, no significant difference was found between the type of operation and anxiety levels. p = 0.085, (p> 0.05).

Demographic data of the patients with and without anxiety are shown in Table 1. The mean APAIS scores of the patients included in the study were 14.69±5.51 and the STAI scores were 48.35±4.42. The Cronbach's alpha value was 0.915 for the test. STAI scores above the average were evaluated as anxiety. A total of 35 (36.8%) patients had high anxiety scores. Anxiety scores of the patients who had operation previously were found low (p>0.05).

Anesthesia anxiety (APAIS = 7.3±1.6) was found to be the highest cause of anxiety in the patients. Surgical anxiety and lack of knowledge anxiety scores were 6.8±3.2 and 6.2±2.11, respectively. However, no statistical difference was found between these values (p> 0.05).

The mean PI value of the patients with high anxiety was 4.31±.52 and the PI value of the patients with low anxiety was 6.62±3.27. In patients with anxiety, the PI value was found to be significantly lower (p = 0.037). There was a negative and statistically significant correlation between anxiety and PI (p = 0.004). As the anxiety level increased, the PI values of the patients were decreased. The correlation between PI and anxiety is shown in Table 2.

Discussion

The perfusion index is a non-invasive method that measures the rate of pulsatile and non-pulsatile blood flow by analyzing data from pulse oximetry. It provides information about vascular dynamics through peripheral vascular tone changes. Variations in vascular filling caused by inhalation lead to higher perfusion index values in patients with fluid deficit and low vascular tone (12). The ability to easily obtain data on a special pulse oximeter makes this test very practical. In this way, the perfusion index has become increasingly used as a non-invasive monitoring technique (1).

In the patients who underwent sympathetic blockade, peripheral vascular tone decreased and an increase in perfusion index was observed. This increase can be used as an indicator of the success of the block.

Toyama S et al. demonstrated that preoperative high basal perfusion index values may be an indicator for the development of hypotension during spinal anesthesia in cesarean section. In this study, they found that the incidence of hypotension was higher in the patients with PI value higher than 3,5 (13).

Table 1. Demographical data of the patients according to anxiety level

	STAI <48.35±4.42 (n=60)	STAI >48.35±4.42 (n=35)	p
Age(years)	42.51±15.67	46.68±14.31	0.178
Sex (F/M)	36/24	21/14	0.741
Education (High school and above)	28/60	22/35	0.113
Previously operated	24/60	10/35	0.167
PI	6.62±3.27	4.31±.52	0.037

PI: peripheral perfusion index, STAI: State-trait anxiety score

Table 2. STAI and PI correlation

		PI	STAI
PI	Pearson Correlation	1	-,290**
	Sig. (2-tailed)		,004
	N	95	95
STAI	Pearson Correlation	-,290**	1
	Sig. (2-tailed)	,004	
	N	95	95

**. Correlation is significant at the 0.01 level (2-tailed)

Surgical anxiety has many undesirable effects on patients from postoperative pain to delayed wound healing. Preoperative anxiety seems to be unaffected by the gender factor in our study. However, some studies have been reported to be more common in women. In addition, many factors such as having previous operation, age, type of operation, and level of knowledge of the patient may affect preoperative anxiety.14 It is known that informing patients sufficiently, getting support from parents for pediatric patients and comforting in the preoperative waiting room reduce stress level. 15

In a study conducted in 2018, it was found that intraoperative music listening decreased postoperative pain in the pediatric patients by probably reducing the level of anxiety [16]. Increased pain may be the cause or the result of anxiety. Caumo et al. showed the level of pain as the most common cause of anxiety in their study17. In addition, Kain and Maranets found that surgical anxiety increased the anesthetic consumption and in patients with high anxiety, more postoperative pain is observed4. In addition to anesthetic and analgesic consumption, preoperative anxiety may also lead to the development of undesirable cardiac events, increase mortality and morbidity18.

In our clinical practice, anxiety levels of patients are not measured objectively. Ayada C. et al and David zhang et al. stated that increased anxiety level also increased the peripheral vascular tone 19,20. In the studies using PI as a predictive tool, anxiety levels were not considered. However, according to the results of our study, preoperative anxiety reduced the perfusion index. Thus, the effect of anxiety on the perfusion index would make suspicious the results of studies using perfusion index as a predictive tool for vascular tone or hypotension in awake patients. In patients with high anxiety, vascular tone may change and this weak point of the tests based on vascular tone measurement is often ignored. In the study of Toyama et al.,which is one of the most striking studies on the use of perfusion index, they did not take into account the anxiety levels of the patients. This point is often overlooked as they do. 13. In this respect, our study also questions the efficacy of studies using perfusion index in awake patients.

STAI test is the most widely used test among the anxiety measurement tests. Aykent et al. stated that STAI is a more convincing test to measure preoperative anxiety in the Turkish population. 21.However, the Cronbach's alpha score of 0.915 in our study could be interpreted as some of the questions were not discriminative. The same tests can be asked with fewer questions or more specific tests can be used to measure anxiety.

Neuroendocrine and psychological adverse effects of surgical anxiety on patients are known. In addition to these effects, increased anxiety also indirectly leads to misinterpretation of hemodynamic data by affecting the vascular responses. Increased preoperative anxiety reduces perfusion index. Regardless of this fact, using the perfusion index as a predictive tool may yield misleading results. Anxiety level should be questioned in patients before using the perfusion index.

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