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Effects of music on patients undergoing orthopaedic surgery under spinal anaesthesia

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Abstract:
Introduction: *Attenuation of intraoperative anxiety and stress always remains a challenge in the practice of anaesthesia. This study was designed to observe the effects of listening music during intraoperative period on patients undergoing orthopedic surgery under spinal anaesthesia.*
Methods:*This randomized controlled clinical trial was conducted for a period of two years.100 patients with American Society of Anesthesiologists (ASA) status I–II scheduled to undergo orthopedic surgery under spinal anaesthesia were taken up for the study and were randomly divided into two equal groups. The objective of the study was to evaluate the effect of music on self-reported anxiety and hemodynamic parameters in the intraoperative phase in patients who underwent orthopaedic surgeryunder spinal anaesthesia. The Visual Analogue Scale for Anxiety (VASA) was explained in details to the patients and was used to measure the preoperative (VASA-1) and postoperative anxiety (VASA-2), Patient satisfaction score (PSS), and haemodynamic parameters was recorded.*
Results: *There was no statistically significant change was observed in the haemodynamic parameters and VASA-1 but statistically significant difference was recorded in the VASA-2 (0.0001) and PSS (P=.0001) in the postoperative period in the music group.*
Conclusion: *Music therapy is an example of a simple non-pharmacological aid to tone down surgical stress, anxiety in patients undergoing orthopaedic surgery under spinal anaesthesia with an additional benefit of enhancing overall satisfaction of the patient.*
Key words: *Orthopedic surgery**,** Headphone, Music, Spinal Anaesthesia.*

I. Introduction

Most lower limb orthopaedic surgeries are performed under epidural or Spinal Anaesthesia / Subarachnoid Block (SAB) and such patients often experience anxiety in anticipation of the event to which one may be unfamiliar, uncomfortable or in apprehension of undesirable results. This anxiety can increase the risk of psychological and physiological complications and delays in postoperative recovery [1]. Other detrimental manifestations are increased blood pressure and heart rate, leading to delayed stress wound healing, diminished immune response, and increased risk of infection [2]. For attenuation of stress and anxiety use of pharmacologic methods like opioids and benzodiazepines may impair the recovery of patients do to their sedative and emetic effects. Research suggests that anxiety affects postoperative recovery, decreasing pain tolerance and impending wound healing. Music is primarily used during the peroperative period to reduce anxiety and increase relaxation, which is usually accomplished through passive music listening [1]. In the present era music is emerging as a useful non-pharmacological means of treatment of stress and anxiety.

Since ancient time it has been observed that music plays a role in different situations of our day to day life. Music is found to enhance well being and reduce stress by exerting direct physiologic effects through the autonomic nervous system. Some studies have suggested that exposure to calming music can alleviate perioperative pain and anxiety [3,4], and may improve the hemodynamic status of patients [5,6]. This randomized controlled clinical trial was conducted to evaluate the effects of music on self-reported anxiety and hemodynamic parameters in the intraoperative phase in patients who underwent orthopaedic surgery under spinal anaesthesia (SAB).

II. Methods

This randomized, controlled study was conducted in College of Medicine & JNM Hospital, Kalyani (West Bengal) from April 2013 to March 2015. 100 patients with ASA physical status I-II scheduled to undergo lower limb orthopaedic surgery under spinal anaesthesia were taken up for the study:

- **Aims & Objective**:
  - **i)** Observe the level of intraoperative anxiety of the patient.
  - **ii)** Observe the level patient satisfaction.
  - **iii)** Observe any change in intraoperative vitals of the patient.
  - **iv)** Observe any adverse effects.
- **Inclusion Criteria:**
  - **i)** Patients who gave written consent.
  - **ii)** ASA-I&II
  - **iii)** 18 years-55 years
  - **iv)** Any lower limb operations that can be done under subarachnoid block
- **Exclusion Criteria:**
  - **i)** Any contraindication to spinal anaesthesia.
  - **ii)** Patient requiring intraoperative added any general anaesthetic aid.
  - **iii)** Deaf patient
  - **iv)** Mentally retarded patient/Dementia.
  - **v)** Patient with psychiatric disorder.

Subjects were randomly assigned to either Silence Group (A) or Music Group (B). Group-A received standard care while Group B received standard care along with music. The study was approved by the ethics committee of the hospital. Patients of Group-B were subjected to listen preoperatively self chosen music with the help of headphone with the volume label as acceptable by the patient. Music listening started on completion of successful spinal anaesthetic procedure and lasted till the end of the surgery. Music of different types (As per preference of patients choice): Religious prayers/Instrumentals/Popular Singers/Movie songs/Regional were used. Visual Analogue Scale for Anxiety (VASA) was explained in detail to the patients, which consists of a 10 cm horizontal line with the descriptors '0-no anxiety' at the left extent and '10-worst possible anxiety' at the right extent [7]. Preoperative anxiety (VASA-1) was recorded; Intraoperative haemodynamic parameters were monitored and recorded which included Pulse, Haemoglobin Oxygen saturation (SpO_2), Respiration rate (per minute), Systolic and Diastolic blood pressure (mmHg). Intraoperative anxiety (VASA-2) was recorded and Patient Satisfaction Score (PSS) regarding perioperative experience was recorded using Visual Analogue Scale (VAS) which consists of a 10 cm horizontal line with descriptors '0-worst experience' at the left extent and '10-Highly satisfied' was recorded in the immediate postoperative period.

Standard routine monitoring was done. SAB was performed as per routine care and safety. Once SAB procedure was complete, patient was positioned for surgery and patient of the study group was subjected to listen music of their choice and as per desired volume via ear phone. Same ear phone and Mp3 player was used to maintain uniform quality of the sound.

Intraoperative and immediate post operative monitoring of patient vitals were recorded as per routine process. Once the patient got shifted to post operative care unit, patients intraoperative anxiety level was assessed by VASA and patient was also asked to grade his or her level of satisfaction for the intraoperative care and service using VAS. Any adverse effect / complain of the patient was noted along with the management.

Randomization was done by allocating the patients in the groups on alternate basis. Blinding was done as: (i) One recorded the VASA-1, VASA-2 and PSS; (ii) One applied headphone to all patient but played the music only to the Music group; (iii) One recorded the haemodynamic parameters and (iv) One did the analysis of the data using MS Excel and SPSS 22.0 software. The differences of means of different variables were tested with independent t test. All tests applied were two-tailed. P value less than .05 was considered to be significant.

III. Results

Table 1: Comparison of baseline characteristics and duration of surgery in two groups.

Variable	Music group(n=50)	Silence group (n=50)	p value
Age (years) Mean (Standard Deviation)	44.94 (10.28)	45.12 (9.94)	0.9293
Weight (Kg) Mean (Standard Deviation)	61.06 (5.98)	61.74 (4.29)	0.5149
Height (cm) Mean (Standard Deviation)	161.14 (7.26)	159.46 (3.41)	0.1419
Duration of Surgery(minutes) Mean (Standard Deviation)	60.08 (10.30)	61.74 (11.23)	0.4434

n=number of patients

Patients in both the groups were comparable in terms of age, weight, height and duration of surgery.

Table 2: Comparison of SpO_2, respiration rate, pulse rate, systolic and diastolic blood pressure in two groups.

Variable	Music group(n=50)	Silence group (n=50)	p value
SpO_2			
(I) Pre- operative Mean (Standard Deviation)	99.62 (0.64)	99.58 (0.81)	0.7842
(II) On completion of SA Mean (Standard Deviation)	99.58 (0.54)	99.52 (0.95)	0.699
(III) 15 minutes Mean (Standard Deviation)	99.58 (0.58)	99.56 (0.79)	0.1388
(1V) 30 minutes Mean (Standard Deviation)	99.84 (0.37)	99.86 (0.35)	0.8849
(V) On completion of surgery Mean (Standard Deviation)	99.36 (1.98)	99.38 (0.85)	0.9478
Respiratory rate			
(I) Pre- operative Mean (Standard Deviation)	16.22 (0.89)	16.24 (1.00)	0.9161
(II) On completion of SA Mean (Standard Deviation)	16.16 (0.51)	16.28 (1.67)	0.6274
(III) 15 minutes Mean (Standard Deviation)	16.14 (0.45)	16.16 (0.997)	0.8975
(1V) 30 minutes Mean (Standard Deviation)	16.14 (0.45)	16.12 (0.85)	0.8834
(V) On completion of surgery Mean (Standard Deviation)	16.22 (0.68)	16.24 (0.98)	0.2583
Pulse rate			
(I) Pre- operative Mean (Standard Deviation)	83.2 (14.70)	81.9 (14.07)	0.6517
(II) On completion of SA Mean (Standard Deviation)	85.28 (13.22)	85.88 (13.23)	0.821
(III) 15 minutes Mean (Standard Deviation)	82.38 (11.41)	84.56 (10.51)	0.3229
(1V) 30 minutes Mean (Standard Deviation)	79.06 (12.63)	82.02 (12.87)	0.2484
(V) On completion of surgery Mean (Standard Deviation)	76.9 (11.17)	78.86 (9.47)	0.3463
Systolic blood pressure			
(I) Pre- operative Mean (Standard Deviation)	126.38 (15.26)	125.34 (13.80)	0.7215
(II) On completion of SA Mean (Standard Deviation)	125.06 (13.92)	123.78 (13.03)	0.6361
(III) 15 minutes Mean (Standard Deviation)	110.96 (13.91)	112.2 (13.35)	0.6502
(1V) 30 minutes Mean (Standard Deviation)	107.26 (12.07)	108.88 (11.87)	0.5
(V) On completion of surgery Mean (Standard Deviation)	106.48 (7.67)	107.54 (8.14)	0.5043
Diastolic blood pressure			
(I) Pre- operative Mean (Standard Deviation)	84.2 (13.33)	83.48 (13.11)	0.7859
(II) On completion of SA Mean (Standard Deviation)	83.66 (9.94)	83.14 (8.41)	0.7752
(III) 15 minutes Mean (Standard Deviation)	71.04 (8.50)	72.16 (8.72)	0.517
(1V) 30 minutes Mean (Standard Deviation)	67.6 (6.88)	69 (8.34)	0.362
(V) On completion of surgery Mean (Standard Deviation)	70.92 (8.03)	71.64 (6.88)	0.631

n=number of patients

No significant change was observed at any interval of time in the clinical outcomes of SpO_2, respiration rate, pulse rate, systolic and diastolic blood pressure were presented as means and standard deviations (SD) for both groups (Table 2).

Table 3: Comparison of VASA, PSS in two groups.

Data	Music group(n=50)	Silence group (n=50)	p value
VASA:1 Mean (Standard Deviation)	5.86 (2.37)	6.2 (1.99)	0.4395
VASA:2 Mean (Standard Deviation)	0.88 (0.80)	4.7 (1.33)	0.0001
PSS Mean (Standard Deviation)	9.58 (0.67)	4.52 (0.50)	0.0001

n=number of patients

Preoperative anxiety (VASA-1), Intraoperative anxiety (VASA-2) and Patient Satisfaction Score (PSS) in the postoperative period were presented as mean and standard deviation (SD) for both groups. No significant change was observed in VASA-1 (0.4395) whereas a significant change was observed VASA-2 (0.0001) and PSS (0.0001). (Table 3)

IV. Discussion

With the availability of different music, we see that it makes its presence in different emotional and psychological situations. It is evident that one can enjoy different music depending upon his/her own mental situation at different intervals of time.

Gardner and Licklider [8] and Licklider [9] and Mittleman [10] have indicated that the sound spectrum produced by white noise saturates the auditory nerve with impulses, which in turn excite the medial geniculate body of the thalamus. When impulses that originate from a painful stimulation register in the ventral nucleus of the thalamus (which nucleus is situated just above the medial geniculate body of the thalamus), this surrounding area "being confused by white noise" interprets the pain impulses at a level of consciousness differentially from the normal impulse pain. The specificity of this neurophysiological theory has been modified by the psychological factors of suggestion, distraction and a pre-occupation of the individual's attention with stereophonic music. Because of these factors, the psychological states of motivation and expectancy have been highly emphasized.

In our study we found that music is effective in reducing anxiety with increased patient satisfaction in regard to the surgical process. Studies evaluating the effects of music interventions in surgical patients have examined music provided at different times (preoperatively, intraoperatively, and/or postoperatively), with different patient populations, and using different types of musical selections. Pamela G et al concluded in their study that music is a noninvasive and low-cost intervention that can be easily implemented in the perioperative setting, and can reduce MAP, anxiety, and pain among women undergoing mastectomy for breast cancer [11].There are several positive reports regarding the effects of music on perioperative anxiety levels [12,13]. Chang et al in their study on music used SpO2, respiration rate, pulse rate, systolic and diastolic blood pressure, and VASA score as primary outcomes and birth satisfaction as a secondary outcome with no statistically significant differences between the intervention and control groups for most outcomes [5]. Anxiety was not influenced by music in the study by Ebneshahidi A and Mohseni M possibly because the levels of estimated anxiety were low and the preoperative levels of anxiety was not measured [14].

A few studies showed the efficacy of music postoperatively on reducing blood pressure and heart rate [15,16]. But these studies did not adjust hemodynamic parameters for the intensity of pain and anxiety; thus, a desirable direct effect on blood pressure and heart rate could not be determined by their results.

In studies that reported significant effects of music on blood pressure, patients were allowed to choose the type of music [1,11,17], and in few of these studies with significant effects on blood pressure, the music intervention was initiated preoperatively [11,18,19]. These findings suggest that music interventions may be most effective in reducing blood pressure if patients are allowed to choose the type of music and if the music intervention is initiated preoperatively. In this study, we allowed participants to listen music of their own choice. We expected that self chosen music might help our patients feel at home in the strange environment of Operation Theater and facilitate distraction from undesired experiences such as noise of orthopaedic instrumentation, pain and anxiety. In agreement with our results, some previous studies demonstrated the efficacy of patient-selected music in the perioperative period [20,21,22], even with comparable effects with standard sedative music [23].

However, it has been suggested by Siedliecki SL et al that no particular style of music is more effective than another at increasing relaxation; rather, the most important factor is how much the patient likes the music [24]. Broscious SK et al found that music therapy might be more effective when patients are capable of focusing on music intervention [25]. It is important to note that age, culture, socioeconomic status, and religion affect the way people respond to pain and music [26,27].

Music can act as a distracting agent to refocus the attention from negative stimuli causing the stress, to something that is pleasant; it occupies one's mind with something familiar, soothing and preferred, allowing

people to escape to "their own world". The patient can focus on his or her awareness of the music, as an aid to relaxation [1]. Additional research is needed to more specifically examine the mechanisms by which music produces beneficial effects on anxiety. Our study demonstrated that listening music during surgery under spinal anaesthesia would be beneficial for patients.

V. Conclusion

The Audio-Analgesic condition which was based on the postulation of diminished awareness to the original sensation and an increasing awareness to another auditory stimulation appears to be effective. However, its ability to suppress pain appeared to potentially depend on adaptation. By analysis of the essential components of Audio-Analgesia, it was inferred that attention adaptation occurs to the white noise. As the subject adapts to the white noise, he concentrates more fully upon the music, thus his awareness to the original sensation (pain) gets gradually diminished. Music therapy is an example of a non-pharmacological aid that can be used on patients undergoing surgery under spinal anaesthesia to alienate intraoperative stress and and its detrimental effects on different systems of body. This intervention is a simple, inexpensive and non-invasive method and is beneficial both during intra and postoperative care.

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