

EFFECT OF MUSIC INTERVENTION ON ANXIETY AND PATIENT SATISFACTION IN WOMEN UNDERGOING LOWER SEGMENT CAESAREAN SECTION UNDER SPINAL ANAESTHESIA: A RANDOMIZED CONTROLLED TRIAL

Thiyam Jamesbond Meetei¹, Laishram Dhanachandra Singh², Kangabam Sarda Devi³, Ayekpam Panthoisana Chanu¹, Abdul Matin Bin Muzib⁴, Md. Riyaz Khan¹, Ibemhal Heisnam⁴, Basanta Khumanthem¹

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Corresponding Author:

Dr. Thiyam Jamesbond Meetei,
Email: gemsvonhiyam@gmail.com

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¹PGT, Department of Anaesthesiology, JN Institute of Medical Sciences, Imphal, Manipur, India

²Assistant Professor, Department of Anaesthesiology, JN Institute of Medical Sciences, Imphal, Manipur, India

³Consultant, Department of Anaesthesiologist, ILDS, Imphal, Manipur, India

⁴Professor & HOD, Department of Anaesthesiology, JN Institute of Medical Sciences, Imphal, Manipur, India

ABSTRACT

Background: Lower Segment Caesarean Section (LSCS) is one of the most commonly performed operative procedures in obstetric practice across the world. Women undergoing LSCS frequently experience anxiety during the perioperative period. The causes of perioperative anxiety are complex and multifactorial. The common causes include fear of surgery and anesthesia, concern regarding the health and safety of the baby, unfamiliarity with the operating theatre environment, separation from family members, previous unpleasant childbirth experiences, inadequate preoperative counselling and fear of postoperative pain and recovery. The use of music in healthcare settings has gradually increased. However, its use in the operating theatre remains inconsistent and is not routinely focused on improving patients' comfort. In several developed countries, music has been used during spinal anesthesia to reduce intraoperative anxiety and decrease the requirement for sedative medications. The objectives were (i) To compare the anxiety scores of patients posted for elective caesarean section with the addition of music therapy to those of a control group (ii) To compare the BP, HR, RR and SpO₂ (iii) To compare the first rescue analgesia time and (iv) To assess maternal satisfaction towards the perioperative music listening. **Materials and Methods:** A randomized controlled trial was conducted in the Department of Anaesthesiology, Jawaharlal Nehru Institute of Medical Sciences, Porompat, Imphal, Manipur during the period of 2023-2025. Patients posted for elective lower segment caesarean section (LSCS) under spinal anaesthesia were included in the study. Patients who had given written informed consent, aged between 20–40 years with singleton term pregnancy of more than 37 weeks and who were categorized under ASA physical status II were included. A sample size of 74 was scientifically calculated. They were randomly divided into two groups equally viz. Study group (M) and Control group (N). Randomization was done using lottery method. A detailed pre-anaesthetic check-up was performed for all patients. This included a complete history, physical examination and required laboratory investigations. All patients were advised overnight fasting. On arrival in the preoperative room, in the music group, the type of music and volume were chosen by the patient. A short trial of music for about two minutes was given to ensure comfort and acceptability. Anxiety levels were assessed using this 10-point visual analog scale, supplemented with facial representations adapted from Dowrick's facial anxiety scale to enhance patient understanding. After shifting the patient to the operating room, standard ASA monitors were attached including non-invasive blood pressure, ECG, heart rate, respiratory rate and pulse oximetry. Baseline vital signs (BP, HR, RR and SpO₂) were recorded. An intravenous line was secured using an 18-gauge cannula. At this point, the first anxiety score was recorded using VASA. Headphones were then applied to

patients in both groups. In the music group, the selected music was played while no music was played in the control group. Heart rate, blood pressure, respiratory rate and SpO₂ were monitored and recorded at regular intervals. The duration of surgery, any additional intraoperative medications and any anaesthetic or surgical complications were noted. At the end of surgery, headphones were removed and anxiety was assessed again using VASA (VASA 2). The patient was then shifted to the post-anaesthesia care unit (PACU). Headphones were reapplied to both groups. Patients in the music group continued listening to music for 15 minutes while the control group did not receive music. After 15 minutes, anxiety was assessed again (VASA 3). Maternal satisfaction was assessed using a 4-point verbal rating scale viz. 1. Excellent 2. Good 3. Fair and 4. Poor. Patients who complained of pain were given rescue analgesia in the form of paracetamol 1gm intravenous or tramadol 100 mg intramuscular. The time at which rescue analgesia was administered was recorded. Anxiety scores were assessed at three time points: 1. After entering the operating room, before spinal anaesthesia 2. At the end of surgery and 3. Fifteen minutes after shifting to the PACU. **Result:** Systolic and diastolic blood pressure remained stable and similar in both the music and control groups throughout the intraoperative period. No statistically significant differences were observed at any time point. Mean arterial pressure, heart rate and respiratory rate were comparable between the two groups. Both the music and control groups maintained adequate and stable oxygen saturation throughout the intraoperative period and no statistically significant difference in SpO₂ was observed at any measured time point. The mean time to first rescue analgesia was longer in the music group with a mean (SD) duration of 117.49 (24.53) minutes compared to 107.84 (12.73) minutes in the control group (p=0.037). At the end of surgery, after removal of headphones (VASA2), the mean (SD) anxiety score in the music group decreased markedly to 0.41 (0.55). In contrast, the control group continued to have higher anxiety levels with a mean (SD) score of 1.70 (0.57). This difference was statistically significant (t = -9.949, p < 0.001), showing a clear reduction in anxiety among women who received music therapy. Similarly, at 15 minutes in the post-anaesthesia care unit (VASA3), anxiety levels were minimal in the music group with a mean (SD) score of 0.03 (0.16), whereas women in the control group continued to have higher anxiety levels with a mean (SD) score of 1.43 (0.65). This difference was also statistically significant (t = -12.802, p < 0.001). At the end of surgery, patient satisfaction levels differed markedly between the two groups (p=<0.0010). **Conclusion:** Women in the music group demonstrated a significant reduction in anxiety during and after surgery, a prolonged time to first rescue analgesic requirement and higher levels of patient satisfaction compared to the control group. Haemodynamic parameters remained stable in both groups, with no clinically significant adverse effects attributable to music therapy. Thus, music therapy can be considered an effective adjunct to routine anaesthetic care in women undergoing elective lower segment caesarean section under spinal anaesthesia.

INTRODUCTION

Lower Segment Caesarean Section (LSCS) is one of the most commonly performed operative procedures in obstetric practice across the world.^[1] Spinal anaesthesia is the preferred anaesthetic technique for elective LSCS as it provides rapid onset of anaesthesia, good muscle relaxation, effective pain control and minimal drug exposure to the fetus. It is widely regarded as a safe and reliable method for both the mother and the newborn.^[2]

In patients receiving neuraxial anaesthesia such as spinal or epidural anaesthesia, consciousness is maintained throughout the surgical procedure. As a result, patients are exposed to unfamiliar and potentially stressful stimuli within the operating

room, including bright surgical lights, cold ambient temperature, unfamiliar sounds from surgical instruments and monitoring equipment, and conversations among healthcare personnel, all of which contribute to increased fear and anxiety.^[3,4]

Women undergoing LSCS frequently experience anxiety during the perioperative period. The causes of perioperative anxiety are complex and multifactorial. The common causes include fear of surgery and anaesthesia, concern regarding the health and safety of the baby, unfamiliarity with the operating theatre environment, separation from family members, previous unpleasant childbirth experiences, inadequate preoperative counselling and fear of postoperative pain and recovery.^[5]

Perioperative anxiety triggers activation of the sympathetic nervous system, leading to the release of stress hormones such as cortisol and catecholamines. This physiological response results in increased heart rate, elevated blood pressure, and higher oxygen consumption. These changes may cause hemodynamic instability during surgery and can adversely affect both intraoperative management and postoperative recovery. Elevated stress levels have been associated with delayed wound healing, prolonged hospital stay, increased postoperative pain scores, higher analgesic requirements and an increased risk of postoperative infections. Furthermore, anxiety during childbirth has been linked to postpartum emotional disturbances, including postpartum depression, and may negatively influence maternal satisfaction with the childbirth experience.^[6-8] Although sedation is effective in reducing perioperative anxiety, it is often associated with adverse effects such as respiratory depression, hypotension, nausea, delayed recovery, and reduced patient cooperation. Furthermore, the use of pharmacological agents such as anxiolytics and analgesics are restricted, as many of these drugs can cross the placenta or be excreted into breast milk, potentially leading to neonatal respiratory depression or altered neonatal behavior. For these reasons, there is increasing interest in non-pharmacological approaches that can safely and effectively reduce anxiety without causing adverse maternal or neonatal effects.^[1,9]

The idea of using music as a therapeutic purpose during medical procedures has existed for a long time.^[4] In 1914, Dr. Evan O'Neill Kane reported the use of music in the operating room to calm and distract patients undergoing surgical procedures under local anaesthesia. Since then, the use of music in healthcare settings has gradually increased. However, its use in the operating theatre remains inconsistent and is not routinely focused on improving patients' comfort. In several developed countries, music has been used during spinal anaesthesia to reduce intraoperative anxiety and decrease the requirement for sedative medications.^[10-12]

Music influences neuroendocrine pathways by stimulating the release of neurotransmitters and hormones such as endorphins, serotonin, and oxytocin.^[6] Endorphins are natural substances produced by the body that act as pain relievers. They work in a way similar to opioids by reducing the transmission of pain signals to the brain. When endorphin levels increase, pain perception decreases, and the patient feels more comfortable. This effect is especially useful during and after surgery as it reduces the need for additional analgesic medications.^[13,14]

Music also helps to regulate breathing patterns. Slow and soothing music encourages deep, regular breathing which improves oxygenation and reduces muscle tension. Controlled breathing further enhances relaxation and reduces anxiety during

surgery.^[10,13] It creates a sense of familiarity and comfort, reduces fear and improves patient cooperation. This is particularly important in patients undergoing surgery under spinal anaesthesia, where the patient remains awake throughout the procedure.^[3,4,15] Through these combined mechanisms—including distraction, reduction of stress hormone release, neuroendocrine modulation, regulation of breathing and emotional comfort—music therapy helps to reduce anxiety, pain and stress. These effects contribute to a more positive perioperative experience and improved postoperative recovery.^[6,8,13]

In women undergoing caesarean section under spinal anaesthesia, music therapy helps to create a calm and reassuring environment within the operating theatre. Reduced anxiety and stress may lead to smoother recovery, lower pain intensity, reduced requirement for analgesics and improved emotional well-being. A calmer mental state may also support early maternal–infant bonding.^[13,16]

Despite these potential benefits, music therapy is not routinely practised during elective LSCS. There is limited evidence from well-designed studies evaluating its effectiveness in reducing perioperative anxiety and improving recovery outcomes in women undergoing caesarean delivery. Therefore, the present study was undertaken to evaluate the role of music therapy as an adjunct to standard anaesthetic care in women undergoing elective LSCS under spinal anaesthesia.

Aim and Objectives: The aim of the study was to determine the impact of perioperative music listening on anxiety, hemodynamic and maternal satisfaction in elective caesarean delivery. The objectives were (i) To compare the anxiety scores of patients posted for elective caesarean section with the addition of music therapy to those of a control group (ii) To compare the BP, HR, RR and SpO₂ (iii) To compare the first rescue analgesia time and (iv) To assess maternal satisfaction towards the perioperative music listening.

MATERIALS AND METHODS

A randomized controlled trial was conducted in the Department of Anaesthesiology, Jawaharlal Nehru Institute of Medical Sciences, Porompat, Imphal. Manipur during the period of 2023-2025. Patients posted for elective lower segment caesarean section (LSCS) under spinal anaesthesia were included in the study. Patients who had given written informed consent, aged between 20–40 years with singleton term pregnancy of more than 37 weeks and who were categorized under ASA physical status II were included. Patients undergoing emergency caesarean section, pregnant women with maternal hypertensive disorders (chronic hypertension or pre-eclampsia), insulin-dependent diabetes mellitus, intrauterine growth restriction, pregnancy beyond 41 weeks, premature rupture of membranes, multiple

pregnancies, intrauterine fetal death or known fetal anomalies, patients with hearing impairment, hepatic disease, renal disease, cardiac disease, anxiety disorders or other psychiatric illnesses patients with history of allergy to drugs or local anaesthetic and patients with any condition contraindicating to spinal anaesthesia were excluded.

A sample size of 37 in each arm of study was scientifically calculated based on a previous study conducted by Halder et al16, which reported the mean time for first rescue analgesia as 181 ± 30.09 minutes in the music group and 152 ± 46.56 minutes in the control group.

All eligible study participants were consecutively recruited until the required sample size was achieved. They were randomly divided into two groups viz. Study group (M) and Control group (N). Randomization was done using lottery method. [Figure 1]

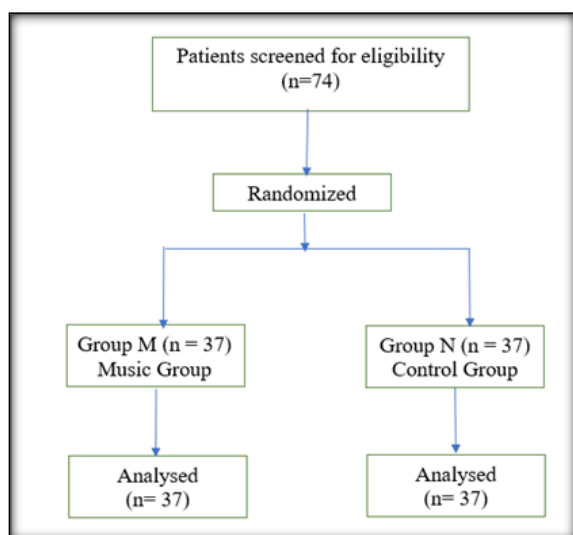


Figure 1: Flowchart for randomization

Headphone, Music player, Visual Analog Scale-Anxiety (VASA) self-assessment and Maternal satisfaction score were used in the study. A pre-tested, semi-structured proforma was used for data collection. It had sections on patient particulars, anaesthesia technique and drugs used, detailed pre-anaesthetic evaluation, anthropometry, hemodynamic parameters, VASA score, time and drug used for first rescue anaesthesia and maternal satisfaction score. The independent variables were age, sex and weight and the dependent variables were heart rate, blood pressure, respiratory rate and SpO_2 , Visual Analog Score for Anxiety (VASA), time to first rescue analgesia and maternal satisfaction score.

Procedure: A detailed pre-anaesthetic check-up was performed for all patients. This included a complete history, physical examination and required laboratory investigations. All patients were advised overnight fasting. On arrival in the preoperative room, in the music group, the type of music and volume were chosen by the patient. A short trial of music for about

two minutes was given to ensure comfort and acceptability.

Anxiety levels were assessed using this 10-point visual analog scale, supplemented with facial representations adapted from Dowrick's facial anxiety scale to enhance patient understanding.

After shifting the patient to the operating room, standard ASA monitors were attached including non-invasive blood pressure, ECG, heart rate, respiratory rate and pulse oximetry. Baseline vital signs (BP, HR, RR and SpO_2) were recorded. An intravenous line was secured using an 18-gauge cannula. At this point, the first anxiety score was recorded using VASA and labelled as VASA 1.

Preloading was done with Ringer lactate at 15 mL/kg, 20 minutes before spinal anaesthesia. Premedication with intravenous ondansetron 0.1 mg/kg was given before the block. Spinal anaesthesia was performed in the lateral position under strict aseptic precautions using a 25-gauge Quincke needle at the L3–L4 interspace. A total of 1.7 mL of hyperbaric bupivacaine (5 mg/mL) with fentanyl 15 µg was administered.

After the block, the patient was positioned supine and the level of sensory block was checked. Headphones were then applied to patients in both groups. In the music group, the selected music was played while no music was played in the control group.

Heart rate, blood pressure, respiratory rate and SpO_2 were monitored and recorded at regular intervals. The duration of surgery, any additional intraoperative medications and any anaesthetic or surgical complications were noted.

At the end of surgery, headphones were removed and anxiety was assessed again using VASA (VASA 2). The patient was then shifted to the post-anaesthesia care unit (PACU). Headphones were reapplied to both groups. Patients in the music group continued listening to music for 15 minutes while the control group did not receive music. After 15 minutes, anxiety was assessed again (VASA 3).

Maternal satisfaction was assessed using a 4-point verbal rating scale viz. Excellent, Good, Fair and Poor.

Patients who complained of pain were given rescue analgesia in the form of paracetamol 1gm intravenous or tramadol 100 mg intramuscular. The time at which rescue analgesia was administered was recorded.

Anxiety scores were assessed at three time points: 1. After entering the operating room, before spinal anaesthesia 2. At the end of surgery and 3. Fifteen minutes after shifting to the PACU.

The collected data were entered into MS Excel and subsequently imported into SPSS Inc., Chicago, IL, USA, Windows version 23, for statistical analysis. Descriptive statistics were presented as mean (SD) and proportion. Physiological parameters such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and oxygen saturation were analysed using the Student's t-test and the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Approval for the study was obtained from Institutional Ethics Committee of JNIMS and informed consent from the patients concerned was obtained.

RESULTS

The mean (SD) age in the Group M and Group N was 29.59 (4.20) years and 28.24 (5.36) years, respectively. Overall, the two groups were comparable with respect to age ($p=0.231$), height ($p=0.699$), weight ($p=0.6$) and body mass index ($p=0.51$) at baseline. This suggests adequate randomization and rules out demographic and anthropometric factors as a source of bias.

On systolic blood pressure: At baseline (0 minute), the mean SBP was 123.97 mmHg (SD = 14.80) in Group M and 127.73 mmHg (SD = 15.40) in the Group N. The difference was not statistically significant ($p = 0.290$), indicating that both groups had comparable baseline systolic blood pressure. After spinal anaesthesia, SBP decreased in both groups at 3 and 6 minutes. At 3 minutes, the mean SBP was slightly lower in the music group (107.38 mmHg, SD = 17.86) compared to the control group (113.49 mmHg, SD = 15.58), but the difference was not statistically significant ($p = 0.121$). At 6 minutes, SBP remained similar between the music group (107.84 mmHg, SD = 16.57) and the control group (109.16 mmHg, SD = 15.32), with no significant difference ($p = 0.722$). From 9 minutes onward, systolic blood pressure in both groups gradually stabilized. At 9, 12, 15, 20 and 25 minutes, SBP values were comparable between the two groups and none of the differences were statistically significant. This pattern continued at 30, 35, 40 and 45 minutes, where SBP remained stable and similar in both groups.

After 50 minutes, the control group showed slightly higher SBP values than the music group but the differences were not statistically significant. From 55 minutes onward, the number of patients decreased due to completion of surgery which limited further comparison. However, systolic blood pressure remained comparable between the two groups.

Overall, systolic blood pressure remained stable and similar in both the music and control groups throughout the intraoperative period. No statistically significant differences were observed at any time point.

On diastolic blood pressure: At baseline (0 minute), the mean DBP in the music group was 76.27 mmHg (SD = 11.83) while in the control group it was 77.97 mmHg (SD = 13.10). The difference between the two groups was not statistically significant ($p = 0.559$) indicating comparable baseline diastolic blood pressure.

Following spinal anaesthesia, both groups demonstrated a marked reduction in DBP at 3 and 6 minutes. At 3 minutes, the mean DBP was 63.51 mmHg (SD = 12.61) in the music group and 65.97 mmHg (SD = 13.36) in the control group and the difference was not statistically significant ($p =$

0.418). At 6 minutes, DBP values remained comparable between the music group (63.73 mmHg, SD = 11.60) and the control group (62.76 mmHg, SD = 10.80) with a non-significant p -value ($p = 0.710$). From 9 to 25 minutes, diastolic blood pressure values in both groups remained largely comparable and no statistically significant differences were observed. At 15 minutes, the music group showed a slightly higher DBP of 63.7 mmHg (SD = 9.620) compared to the control group (59.59 mmHg, SD = 8.214); however, this difference narrowly missed statistical significance ($p = 0.052$).

A statistically significant difference in DBP was observed at 30 minutes where the mean DBP in the music group was 61.95 mmHg (SD = 6.00) compared to 58.16 mmHg (SD = 7.93) in the control group ($p = 0.024$). Similarly, at 40 minutes the music group demonstrated significantly higher DBP values (64.76 mmHg, SD = 7.12) compared to the control group (60.49 mmHg, SD = 8.90) with a p -value of 0.026. At subsequent time points from 45 minutes onward, diastolic blood pressure values were again comparable between the two groups. Beyond 55 minutes, analysis was limited due to a reduced number of patients following completion of surgery. Overall, diastolic blood pressure remained comparable between the music and control groups throughout most of the intraoperative period with statistically significant differences observed only at 30 and 40 minutes.

On mean arterial pressure: At baseline (0 minute), the mean MAP was 93.43 mmHg (SD = 12.47) in the music group and 95.73 mmHg (SD = 14.76) in the control group. The difference was not statistically significant ($p = 0.472$), indicating that both groups had comparable baseline MAP values. Following spinal anaesthesia, MAP decreased in both groups at 3 and 6 minutes. At 3 minutes, the mean MAP was slightly lower in the music group (78.00 mmHg, SD = 14.61) compared to the control group (82.59 mmHg, SD = 12.87), but the difference was not statistically significant ($p = 0.155$). At 6 minutes, MAP values were almost identical in both groups with no statistically significant difference ($p = 0.964$). From 9 to 25 minutes, MAP remained stable and comparable between the two groups. At 9 minutes, both groups had the same mean MAP (81.86 mmHg) and no significant difference was observed ($p = 1.000$). Similarly, at 12, 15, 20 and 25 minutes, MAP values remained similar and none of the differences were statistically significant. During the mid-intraoperative period from 30 to 55 minutes, MAP continued to remain comparable between the two groups. At 30, 35, 40, 45, 50 and 55 minutes, there were no statistically significant differences in MAP between the music and control groups.

Beyond 60 minutes, the control group showed slightly higher MAP values compared to the music group; however, these differences were not statistically significant. The number of patients decreased at these time intervals due to completion of surgery which limited further comparison.

Overall, mean arterial pressure remained stable and comparable between the music and control groups throughout the intraoperative period. No statistically significant differences were observed at any time point.

On heart rate: At baseline (0 minute), the mean heart rate was 98.08 beats per minute (SD = 13.18) in the music group and 99.81 beats per minute (SD = 19.64) in the control group. The difference between the two groups was not statistically significant ($p = 0.658$), indicating that both groups had comparable baseline heart rate values. After administration of spinal anaesthesia, heart rate showed a mild reduction in both groups. At 3 minutes, the mean heart rate was 96.49 beats per minute (SD = 17.32) in the music group and 97.62 beats per minute (SD = 20.25) in the control group and the difference was not statistically significant ($p = 0.796$). At 6 minutes, heart rate values remained comparable between the two groups and the difference was not statistically significant ($p = 0.473$). From 9 minutes to 55 minutes, heart rate remained stable in both groups and within normal physiological limits. Although the music group showed slightly lower mean heart rate values at several time points, the differences between the groups were not statistically significant ($p > 0.05$).

At 60 minutes, the mean heart rate was lower in the music group (81.07 beats per minute, SD = 12.57) compared to the control group (94.00 beats per minute, SD = 19.40), but this difference was not statistically significant ($p = 0.098$). However, at 65 minutes the mean heart rate was significantly lower in the music group at 79.43 beats per minute (SD = 13.59) compared to 102.33 beats per minute (SD = 10.21) in the control group ($p = 0.032$). Similarly, at 75 minutes the music group had a lower mean heart rate of 78.00 beats per minute (SD = 0.00) compared to 89.00 beats per minute (SD = 1.41) in the control group and this difference was statistically significant ($p = 0.008$). Beyond 75 minutes, the number of patients in both groups decreased due to completion of surgery making comparison difficult. However, heart rate remained stable in both groups.

Overall, heart rate remained comparable between the music and control groups during most of the intraoperative period. A significantly lower heart rate was observed in the music group at 65 and 75 minutes.

On respiratory rate: At baseline (0 minute), the mean respiratory rate was 19.05 breaths per minute (SD = 3.05) in the music group and 19.95 breaths per minute (SD = 4.13) in the control group. The difference between the two groups was not statistically significant ($p = 0.483$), indicating that both groups had comparable respiratory rates at the beginning of the procedure. During the early intraoperative period at 3 and 6 minutes, respiratory rates remained stable and similar in both groups. At 3 minutes, the mean respiratory rate was 20.03 breaths per minute (SD = 4.82) in the music group and 19.46 breaths per minute (SD = 4.39) in the control group, with no statistically significant

difference ($p = 0.598$). At 6 minutes, respiratory rates remained comparable between the music group (19.43 breaths per minute, SD = 3.16) and the control group (18.43 breaths per minute, SD = 3.40), and the difference was not statistically significant ($p = 0.194$). From 9 minutes to 55 minutes, respiratory rates in both groups remained within normal physiological limits. Although slight variations were observed at different time points, the differences between the groups were not statistically significant ($p > 0.05$).

At 60 minutes, the mean respiratory rate was slightly lower in the music group (19.00 breaths per minute, SD = 5.41) compared to the control group (20.00 breaths per minute, SD = 4.85), but the difference was not statistically significant ($p = 0.719$). Beyond 60 minutes, the number of patients gradually decreased due to completion of surgery, which limited further comparison. However, respiratory rates remained stable in both groups.

Overall, both the music and control groups maintained stable respiratory rates throughout the intraoperative period and no statistically significant difference was observed between the two groups at any time point.

On SpO₂: At baseline (0 minute), the mean SpO₂ in the music group was 97.41% (SD = 1.09) while in the control group it was 97.78% (SD = 1.00). The difference between the two groups was not statistically significant ($p = 0.125$), indicating that both groups had comparable oxygen saturation levels at the start of the procedure. During the early intraoperative period at 3 and 6 minutes, SpO₂ remained stable and similar in both groups. At 3 minutes, the mean SpO₂ was 97.49% (SD = 1.17) in the music group and 97.81% (SD = 0.94) in the control group, with no statistically significant difference ($p = 0.192$). At 6 minutes, oxygen saturation remained comparable between the music group (97.68%, SD = 1.20) and the control group (97.86%, SD = 0.89) and the difference was not statistically significant ($p = 0.444$). Between 9 and 55 minutes, oxygen saturation remained stable and within normal limits in both groups. Although there were minor variations in mean SpO₂ values at different time points, the differences were small and not statistically significant ($p > 0.05$). Both groups maintained adequate oxygenation throughout this period.

At 60 minutes, the mean SpO₂ was identical in both groups (97.80%) and the difference was not statistically significant ($p = 1.000$). After 60 minutes, the number of patients gradually decreased as surgeries were completed. Despite this, SpO₂ values remained within normal limits in both groups and no significant differences were observed. Overall, both the music and control groups maintained adequate and stable oxygen saturation throughout the intraoperative period and no statistically significant difference in SpO₂ was observed at any measured time point.

Table 1: Comparison of time (in minutes) to first rescue analgesia between the music and control groups

Group	Mean time for first rescue (SD) in min.	t-value	P-value
Music group (n=37)	117.49 (4.531)	2.124	0.037*
Control group(n=37)	107.84 (12.73)		

*p-value < 0.05, Significant at 95%CI

The mean time to first rescue analgesia was longer in the music group with a mean (SD) duration of 117.49 (24.53) minutes compared to 107.84 (12.73) minutes in the control group. Statistical analysis using the t-test showed a t-value of 2.124 with a p-value of 0.037, indicating a statistically significant difference between the two groups at the 95% confidence

interval [Table 1]. These findings suggest that music therapy was associated with a delay in the requirement of first rescue analgesia indicating better postoperative pain relief and improved comfort among women in the music group compared to the control group.

Table 2: Comparison of Visual Analog Scale scores for anxiety between the music group and the control group

VASA score Recorded in	Mean anxiety score (SD)		t-value	p-value
	Music group	Control group		
VASA 1 (After Monitor attached)	2.62 (0.893)	2.38 (0.861)	1.193	0.237
VASA2 (At end of surgery after headphone removed)	0.41 (0.551)	1.70 (0.571)	-9.949	<0.001**
VASA3 (At PACU after 15 mins.)	0.03 (0.164)	1.43 (0.647)	-12.802	<0.001**

**p-value < 0.001, Significant at 99.9% CI

[Table 2] compares the Visual Analog Scale for Anxiety (VASA) scores between the music group and the control group at different time points. At baseline, after monitor attachment (VASA1), the mean (SD) anxiety score in the music group was 2.62 (0.89), while in the control group it was 2.38 (0.86). Although the anxiety score was slightly higher in the music group, the difference was not statistically significant ($t = 1.193$, $p = 0.237$). This indicates that both groups had comparable anxiety levels before the intervention. At the end of surgery, after removal of headphones (VASA2), the mean (SD) anxiety score in the music group decreased markedly to 0.41 (0.55). In contrast, the control group continued to have higher anxiety levels with a mean (SD) score of 1.70 (0.57). This difference was statistically significant ($t = -9.949$, $p < 0.001$), showing a clear reduction in anxiety among women who received music therapy.

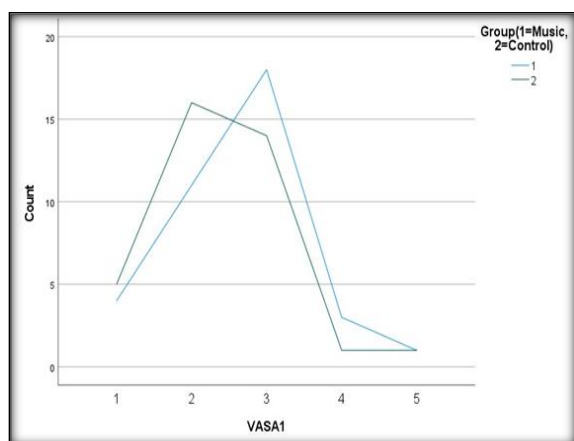


Figure 2: The line chart showing number of women in the music and control groups based on their Visual Analog Scale scores after monitor attachment

Similarly, at 15 minutes in the post-anaesthesia care unit (VASA3), anxiety levels were minimal in the music group with a mean (SD) score of 0.03 (0.16),

whereas women in the control group continued to have higher anxiety levels with a mean (SD) score of 1.43 (0.65). This difference was also statistically significant ($t = -12.802$, $p < 0.001$). Overall, while anxiety levels were similar in both groups at baseline, the music group showed a marked reduction in anxiety by the end of surgery and in the early postoperative period. In contrast, anxiety levels remained higher in the control group. [Figure 2-4]

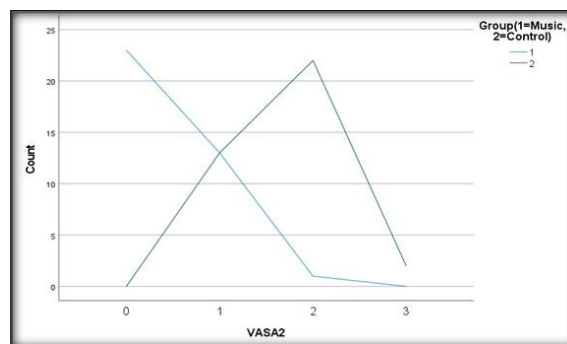


Figure 3: The line chart showing distribution of women based on their Visual Analog Scale scores in the music and control groups at the end of surgery after the headphones were removed

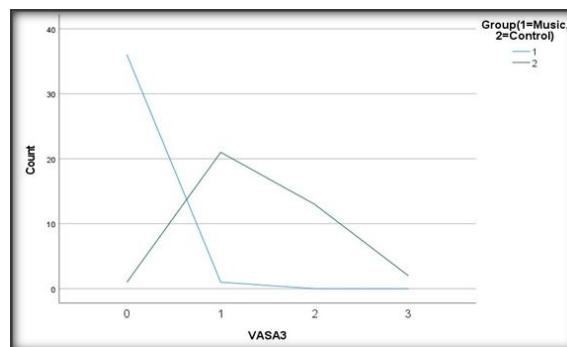


Figure 4: Line chart showing distribution of women based on their Visual Analog Scale scores in the music and control groups at 15 minutes in the PACU

Table 3: Association of severity range of anxiety score level among the music group and control group

VASA score Recorded in		No. of women n (%)		Total	χ^2 -value	p-value
		Music group	Control group			
VASA1	Not Anxious	0 (0.0)	0 (0.0)	0 (0.0)	0.725	0.674
	Mild Anxiety level	33 (89.2)	35 (94.6)	68 (91.9)		
	Moderate Anxiety level	4 (10.8)	2 (5.4)	6 (8.1)		
VASA2	Not Anxious	23 (62.2)	0	23 (31.1)	33.373	< 0.001**
	Mild Anxiety level	14 (37.8)	37 (100)	51 (68.9)		
VASA3	Not Anxious	36 (97.3)	1 (2.7)	37 (50.0)	66.321	< 0.001**
	Mild Anxiety level	1 (2.7)	36 (97.3)	37 (50.0)		

**p-value < 0.001, Significant at 99.9%CI

[Table 3] illustrates the association between anxiety severity levels and group allocation (music group and control group) at different time points among women undergoing lower segment caesarean section under spinal anaesthesia.

At baseline, after monitor attachment (VASA1), the distribution of anxiety severity was comparable between the two groups. In the music group, 33 women (89.2%) experienced mild anxiety and 4 women (10.8%) experienced moderate anxiety whereas in the control group, 35 women (94.6%) were classified as mildly anxious and 2 women (5.4%) had moderate anxiety. None of the women in either group were categorized as not anxious or severely anxious. The chi-square test for VASA1 yielded a χ^2 value of 0.725 and a p-value of 0.674, indicating no statistically significant association between anxiety severity and group allocation at baseline.

At the end of surgery, after removal of headphones (VASA2), anxiety levels were lower in the music group compared to the control group. In the music group, 23 women (62.2%) were classified as not anxious while the remaining 14 women (37.8%) experienced mild anxiety. In contrast, all women in the control group (37 women, 100%) were classified as having mild anxiety with none categorized as

anxiety-free. No women in either group experienced moderate or severe anxiety. The chi-square test for VASA2 yielded a χ^2 value of 33.373 and a p-value of < 0.001, indicating a statistically significant association between anxiety severity and group allocation.

At 15 minutes in the post-anaesthesia care unit (VASA3), the difference in anxiety severity distribution between the two groups was even more pronounced. In the music group, 36 women (97.3%) were classified as not anxious while only 1 woman (2.7%) experienced mild anxiety. In contrast, in the control group, only 1 woman (2.7%) was classified as not anxious whereas 36 women (97.3%) continued to experience mild anxiety. No women in either group were categorized as having moderate or severe anxiety. The chi-square test for VASA3 yielded a χ^2 value of 66.321 with a p-value of < 0.001, demonstrating a statistically significant association between anxiety severity and group allocation at this time point.

Overall, both groups had similar anxiety levels at the beginning. However, women in the music group showed a clear reduction in anxiety by the end of surgery and in the early postoperative period with most becoming anxiety-free. In contrast, women in the control group continued to have mild anxiety.

Table 4: Comparison of patient's satisfaction in the music group and control group

Patient's satisfaction	No of women n (%)		Total	χ^2 -value	p-value
	Music group	Control group			
Excellent	33 (89.2)	0 (0.0)	33 (44.6)	67.108	< 0.001**
Good	3 (8.1)	1 (2.7)	4 (5.4)		
Fair	1 (2.7)	36 (97.3)	37 (50.0)		
Poor	-	-	-		

**p-value < 0.001, Significant at 99.9%CI

At the end of surgery, patient satisfaction levels differed markedly between the two groups. In the music group, the majority of women reported excellent satisfaction with 33 women (89.2%) rating their experience as excellent while 3 women (8.1%) reported good satisfaction and only 1 woman (2.7%) reported fair satisfaction. In contrast, in the control group, most women reported fair satisfaction with 36 women (97.3%) rating their experience as fair while only 1 woman (2.7%) reported good satisfaction. No women in either group reported poor satisfaction. Statistical analysis using the chi-square test demonstrated a χ^2 value of 67.108 with a p-value of < 0.001, indicating a statistically significant association between music intervention and patient

satisfaction at the 99.9% confidence interval [Table 4].

DISCUSSION

In the present study, the effect of music therapy on perioperative anxiety, haemodynamic parameters, postoperative analgesic requirement and patient satisfaction was evaluated in women undergoing elective LSCS under spinal anaesthesia. The finding of this study demonstrate that music therapy significantly reduced perioperative anxiety, delayed the requirement for first rescue analgesia and improved patient satisfaction without causing adverse haemodynamic or respiratory effects.

Effect of Music Therapy on Anxiety: Baseline anxiety levels measured after monitor attachment (VASA1) were similar in both the music and control groups, indicating adequate group comparability prior to intervention. After initiation of music therapy, a significant and progressive reduction in anxiety was observed in the music group. At the end of surgery (VASA2), anxiety scores were significantly lower in the music group compared to the control group and this reduction persisted into the early postoperative period (VASA3). Furthermore, analysis of anxiety severity demonstrated a clear shift toward an anxiety-free state in the music group, while anxiety levels remained higher in the control group. The findings of the present study are similar to those reported in earlier studies, which have shown that exposure to music during caesarean section can significantly reduce anxiety among women.^[3,9,12,14,17] Further evidence from meta-analyses by Weingarten et al and Khaity et al supports the effectiveness of music therapy as an anxiolytic intervention during caesarean delivery under regional anaesthesia.^[18,19] Previous studies have also reported similar beneficial effects of music therapy on perioperative anxiety, demonstrating significantly lower anxiety levels among women who received music intervention during caesarean delivery.^[20-23] Bonde et al also reported significantly lower perioperative anxiety scores in women undergoing elective caesarean section who received music therapy compared with controls, further supporting the anxiolytic role of perioperative music.^[24]

The anxiolytic effect of music can be explained by several mechanisms. Music acts as a cognitive distraction, diverting attention away from stressful stimuli and modulating the limbic system, thereby reducing sympathetic nervous system activity and decreasing the release of stress hormones.^[4,7] In addition, music promotes the release of endogenous neurotransmitters such as endorphins, serotonin, and oxytocin, which contribute to emotional relaxation and psychological comfort.^[6] These mechanisms may explain the sustained anxiolytic effect observed even after cessation of music exposure in the post-anaesthesia care unit (PACU).

Effect of Music Therapy on Hemodynamic and Respiratory Parameters In the present study, systolic, diastolic, and mean arterial blood pressures, heart rate, respiratory rate, and oxygen saturation remained largely comparable between the music and control groups throughout the intraoperative period. Although isolated statistically significant differences were observed at a few intraoperative time points, these changes were small and transient and did not indicate clinically significant haemodynamic instability. Importantly, music therapy did not result in hypotension, bradycardia, respiratory depression or oxygen desaturation. Oxygen saturation remained within normal physiological limits in both groups at all measured intervals.

These findings indicate that music therapy mainly functions as a psychological modulator rather than a

direct physiological intervention. Previous studies have also reported that music can effectively reduce anxiety without producing significant changes in haemodynamic or respiratory parameters during regional anaesthesia.^[9,11,12,14,18] Bonde et al also reported that perioperative music therapy helped maintain heart rate within normal limits in women undergoing elective caesarean section, without causing hypotension or respiratory depression, further supporting the haemodynamic safety of music therapy.^[24]

In contrast, some studies have reported statistically significant reductions in specific haemodynamic parameters with music therapy. Syal et al observed a significant reduction in heart rate and mean arterial pressure following music intervention, particularly during the early intraoperative period; however, these changes were not associated with haemodynamic compromise and did not require intervention.^[25] Similarly, Hojjati et al demonstrated a significant reduction in heart rate in patients exposed to music therapy,^[26] while Allameh et al reported a significant decrease in mean arterial pressure, suggesting attenuation of the sympathetic stress response rather than adverse haemodynamic effects.^[23] The absence of clinically significant haemodynamic or respiratory disturbances in the present study further supports the safety of music therapy as a non-pharmacological adjunct during elective caesarean section under spinal anaesthesia.

Effect of Music Therapy on Postoperative Analgesia:

In the present study, the time to first rescue analgesia was significantly prolonged in the music group compared to the control group, indicating improved postoperative analgesia in patients who received perioperative music therapy. The findings of the present study are consistent with previous studies reporting lower postoperative pain scores, reduced analgesic requirements, and improved comfort in patients receiving perioperative music therapy.^[27,28] Bonde et al also demonstrated significantly lower postoperative pain scores in women undergoing elective caesarean section who received perioperative music therapy, supporting its analgesic benefit.^[24] Kurdi et al reported improved postoperative analgesia with intraoperative meditation music during caesarean delivery.^[29]

In contrast, other studies have also reported variable analgesic effects. Nilsson et al noted improved recovery and comfort without a consistent reduction in pain scores.^[14] Furthermore, the meta-analysis by Masoud et al,^[30] and the Cochrane review by Laopaiboon et al,^[2] reported variability in analgesic outcomes, suggesting that the effectiveness of music therapy may depend on factors such as timing and duration of exposure, type of music used, patient preference, methods of pain assessment, and perioperative analgesic protocols.

Overall, the present findings are consistent with the majority of the available literature, demonstrating reduced postoperative pain and delayed analgesic requirements with perioperative music therapy.

Importantly, these benefits are achieved without pharmacological side effects, making music therapy a safe, simple, non-invasive, and cost-effective adjunct to routine postoperative analgesic management.

Effect of Music Therapy on Patient Satisfaction:

In the present study, patient satisfaction was significantly higher in the music group, with most women reporting excellent satisfaction, whereas women in the control group predominantly reported fair satisfaction. Improved satisfaction in the music group is likely related to reduced perioperative anxiety, better postoperative analgesia, and a more relaxed intraoperative environment. The calming and soothing effect of music appears to enhance emotional comfort and contribute to a more positive overall surgical experience.

Earlier studies have reported higher satisfaction scores among women who received perioperative music during caesarean delivery, although the extent of pain reduction varied.^[20,21] Similar findings have also been reported in other studies,^[9,24] while a systematic review and meta-analysis by Weingarten et al confirmed the beneficial effect of music therapy on patient satisfaction during caesarean section under regional anesthesia.^[18] The meta-analysis by Masoud et al also demonstrated improved overall patient satisfaction with music therapy, although some variability was noted due to differences in study design, timing, and duration of music exposure.^[30]

In contrast, a few studies have reported less consistent findings. Drzymalski et al observed that although music therapy reduced anxiety and improved patient experience, the improvement in overall satisfaction scores was not always statistically significant.^[31] Similarly, Nilsson et al reported improvements in comfort and recovery but without consistent statistical significance in satisfaction scores at all postoperative time points.^[14] Overall, the findings of the present study are consistent with the majority of the available literature, which demonstrates that music therapy significantly improves patient satisfaction. As a safe, simple, non-invasive, and cost-effective intervention, music therapy can be considered a valuable adjunct for enhancing patient care in women undergoing caesarean section under spinal anaesthesia.

Limitations of the study: Despite the encouraging findings, certain limitations of the present study should be acknowledged. First, this study was conducted in a single hospital with a relatively small sample size. Because of this, the findings may not be fully applicable to other hospitals or different patient populations. Second, the personal music preferences of the patients such as the type of music, tempo and cultural background were not studied in detail. Since individual preference can affect emotional response, this may have influenced the degree of anxiety reduction observed in the study. Third, anxiety was measured using subjective assessment scales. Although validated scales were used, such measurements depend on the patient's personal

feelings and responses and may not completely reflect the actual physiological stress response.

Another limitation is that the study included only female patients undergoing elective LSCS. Therefore, the results cannot be generalised to male patients. Emotional responses and coping patterns may differ between males and females; therefore, the effect of music therapy in male surgical patients remains unclear. In addition, this study was limited to elective LSCS cases only. Music therapy was not evaluated in other major surgical procedures, such as general surgical or orthopaedic procedures. Since different surgeries can produce varying levels of stress and pain, the findings of this study may not apply to other types of surgical patients. Finally, long-term outcomes such as prolonged postoperative pain, breastfeeding behaviour, and maternal–neonatal bonding were not assessed. Evaluating these factors could have provided a better understanding of the overall benefits of music therapy.

CONCLUSION

The study found no significant differences between the music group and the control group with respect to baseline demographic variables such as age, weight and baseline anxiety scores. However, significant differences were observed between the two groups in terms of perioperative anxiety levels, time to first rescue analgesic requirement and patient satisfaction. Women in the music group demonstrated a significant reduction in anxiety during and after surgery, a prolonged time to first rescue analgesic requirement and higher levels of patient satisfaction compared to the control group. Haemodynamic parameters remained stable in both groups, with no clinically significant adverse effects attributable to music therapy. Thus, music therapy can be considered an effective adjunct to routine anaesthetic care in women undergoing elective lower segment caesarean section under spinal anaesthesia.

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