RESEARCH PAPER

Effect of Intraoperative Music Therapy on Anxiety and Patient Satisfaction in Patients Undergoing Surgery Under Regional Anaesthesia — A Prospective Randomized Controlled Study

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ABSTRACT

Background: Patients undergoing surgery under regional anaesthesia remain conscious and are exposed to intraoperative auditory stimuli, which frequently precipitate clinically significant anxiety. Pharmacological anxiolysis carries well-recognised risks; non-pharmacological adjuncts such as music are therefore of increasing interest. We evaluated the effect of intraoperative patient-selected instrumental music on anxiety, hemodynamic parameters and patient satisfaction during elective surgery under neuraxial block.

Methods: This prospective, parallel-group, randomized controlled trial enrolled 100 adult patients (ASA I–II, aged 18–65 years) scheduled for elective surgery under spinal or epidural anaesthesia at a tertiary-care teaching hospital between March and May 2026. Participants were randomized 1:1 by a computer-generated sequence to a Music Group (patient-selected instrumental music via headphones from skin incision to wound closure, n = 50) or a Control Group (silent headphones with standard intraoperative care, n = 50). The primary outcome was the change in Visual Analogue Scale for Anxiety (VAS-A, 0–10 cm) between baseline and end of surgery. Secondary outcomes were intraoperative heart rate (HR), systolic (SBP) and diastolic blood pressure (DBP) recorded every 15 minutes, and patient satisfaction rated on a five-point Likert scale at 24 hours postoperatively.

Results: Baseline demographic and surgical characteristics were comparable between groups. The mean end-of-surgery VAS-A score was significantly lower in the Music Group (2.4 ± 1.1) than in the Control Group (4.6 ± 1.3; mean difference −2.2, 95% CI −2.7 to −1.7; $p < 0.001$). Mean HR, SBP and DBP were lower in the Music Group from 30 minutes onwards (all $p < 0.05$). Overall satisfaction ("satisfied" or "very satisfied") was 92% in the Music Group versus 66% in the Control Group ($p = 0.001$). Rescue midazolam was required by 4% of the Music Group versus 18% of the Control Group ($p = 0.025$). No adverse events related to the intervention were recorded.

Conclusion: Intraoperative patient-selected instrumental music is a simple, inexpensive and safe adjunct that significantly reduces intraoperative anxiety, stabilises hemodynamic parameters, reduces rescue-sedative requirement and improves patient satisfaction in adults undergoing surgery under regional anaesthesia.

Keywords: Music therapy; Regional anaesthesia; Perioperative anxiety; Visual Analogue Scale; Patient satisfaction; Randomized controlled trial.

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Introduction

Perioperative anxiety is one of the most common and clinically significant psychological experiences reported by surgical patients, with a global pooled prevalence of approximately 48%.[1] Reported rates vary widely, from 17% to more than 80%, depending on the population, the anaesthetic technique and the instrument used for assessment.[2,3] Female gender,

higher trait anxiety, previous anaesthetic experience and fear of postoperative pain have been identified as independent predictors.[2,4] Patients undergoing surgery under regional anaesthesia are uniquely vulnerable because they remain conscious throughout the procedure and are directly exposed to operating-theatre noise, conversation between staff, and unfamiliar equipment sounds.[5] Such stimuli may precipitate anticipatory fear and sustained anxiety that activates the sympatho-adrenal axis, producing tachycardia, hypertension, elevated catecholamines and cortisol, and a measurable deterioration in perioperative hemodynamic stability.[6,7]

Uncontrolled perioperative anxiety has been repeatedly linked to adverse clinical outcomes, including increased anaesthetic and analgesic requirements, higher postoperative pain scores, slower wound healing, postoperative delirium and reduced satisfaction with care.[7–9] Pharmacological anxiolysis with benzodiazepines or opioids can attenuate anxiety but carries inherent risks including respiratory depression, paradoxical excitation in the elderly, delayed recovery and prolonged post-anaesthesia care unit stay.[10,11] These limitations have renewed interest in simple, low-risk, non-pharmacological adjuncts.

Music is among the oldest and most accessible of such adjuncts. Contemporary neuroimaging and neurochemical investigations have demonstrated that listening to preferred music engages limbic and paralimbic circuits involved in emotion regulation, triggers dopamine release in reward-related structures, and produces measurable reductions in cortisol and sympathetic tone.[12,13] Experimental studies using standardised stressors have shown that music listening accelerates autonomic recovery and blunts endocrine stress responses.[14] Physiological studies further document favourable shifts in heart-rate variability and blood pressure consistent with increased parasympathetic tone.[15,16]

A growing body of randomized evidence supports music as an effective anxiolytic in the perioperative setting. The Cochrane systematic review by Bradt and colleagues pooled 26 trials (2,051 participants) and reported a mean reduction of 5.72 points on the State-Trait Anxiety Inventory with music listening versus standard care.[17] A subsequent meta-analysis of 92 trials in surgical patients confirmed moderate reductions in both anxiety (standardised mean difference −0.69) and pain (−0.50).[18] Hole and colleagues further demonstrated significant reductions in pain, analgesic consumption and anxiety with perioperative music across diverse surgical procedures.[19] More recent randomized controlled trials conducted in orthopaedic, obstetric and vascular surgery populations have extended these findings to neuraxial anaesthesia.[20–23]

Despite this evidence base, relatively few rigorous trials have examined the specific context of awake surgery under regional anaesthesia in Indian tertiary-care settings, and existing results are heterogeneous — a small minority of studies have even reported paradoxical increases in intraoperative anxiety.[24] The generalisability of findings from specialised surgical populations to mixed general-surgical cohorts therefore remains uncertain. Against this background, the present prospective randomized controlled trial was designed to evaluate the effect of intraoperative patient-selected instrumental music on anxiety levels, intraoperative hemodynamic parameters and postoperative satisfaction in adult patients undergoing elective surgery under regional anaesthesia at a tertiary-care teaching hospital. Demonstration of clinically relevant benefit in this pragmatic setting would support the integration of music therapy into routine perioperative care as a near-zero-cost, negligible-risk adjunct to standard anaesthetic practice.[25]

Materials and Methods

Study design and setting

This was a prospective, parallel-group, single-blind randomized controlled trial conducted in the Department of General Surgery of a tertiary-care teaching hospital from March 2026 to May 2026. The study protocol was approved by the Institutional Human Ethics Committee (Approval No. IHEC-I/128/02/2026). The study was conducted in accordance with the Declaration of Helsinki[26] and Good Clinical Practice guidelines, and has been reported in accordance with the CONSORT 2010 statement for randomized controlled trials.[27]

Participants

Adult patients aged 18–65 years with American Society of Anesthesiologists (ASA) physical status I or II, scheduled for elective general-surgical procedures under spinal or epidural anaesthesia, were considered eligible. Exclusion criteria were known

hearing impairment; diagnosed psychiatric illness or anxiety disorder; emergency surgery; conversion to general anaesthesia; and the requirement for intraoperative sedation prior to baseline anxiety assessment. Written informed consent was obtained from every participant after an explanation of the study in a language they understood.

Sample size

Based on the mean difference of approximately 5.7 points on the State-Trait Anxiety Inventory reported in the Cochrane meta-analysis by Bradt and colleagues,[17] and assuming a two-sided α of 0.05, power of 80%, and an anticipated standard deviation of 1.5 on the VAS-A, a minimum of 42 patients per group was required. To allow for potential dropouts, 50 patients per group (total n = 100) were enrolled.

Randomization and allocation concealment

Eligible participants were randomized 1:1 to the Music Group or the Control Group using a computer-generated block randomization sequence (alternating block sizes of four and six), prepared by an investigator not involved in recruitment or outcome assessment. Allocation was concealed in sequentially numbered, sealed opaque envelopes opened only on arrival in the operating room. Because of the nature of the intervention, full blinding of patients and attending anaesthesiologists was not feasible; however, the outcome assessor who recorded VAS-A, intraoperative hemodynamics and satisfaction scores was blinded to group allocation throughout the trial.[27]

Intervention

Following successful spinal or epidural block and immediately prior to skin incision, patients in the Music Group listened to patient-selected instrumental music through over-ear headphones. Music was selected preoperatively from a curated library of genres (Carnatic, Hindustani, devotional, Western classical and soft instrumental) to accommodate individual preference, which is known to enhance the anxiolytic effect of music interventions.[18,20] Volume was adjusted to a self-reported "comfortable" level (approximately 50–60 dB) and continued uninterrupted until wound closure. Patients in the Control Group wore silent over-ear headphones for comparable auditory isolation and received standard intraoperative care. No modification was made to the anaesthetic technique, intraoperative monitoring or surgical protocol on the basis of group allocation.

Outcome measures

The primary outcome was change in anxiety measured using the Visual Analogue Scale for Anxiety (VAS-A), a 10-cm horizontal line anchored at 0 ("no anxiety at all") and 10 ("worst anxiety imaginable"). The VAS-A is a validated, rapid, single-item instrument with demonstrated reliability in perioperative settings.[28,29] VAS-A was recorded at three time-points: in the preoperative holding area before transfer to theatre (baseline, T0); immediately after successful block and positioning (post-block, T1); and at the end of surgery, before transfer to the post-anaesthesia care unit (T2). Secondary outcomes included intraoperative heart rate, systolic and diastolic blood pressure, and peripheral oxygen saturation, recorded at baseline and every 15 minutes throughout surgery. Patient satisfaction with the overall perioperative experience was assessed within 24 hours postoperatively using a five-point Likert scale (1 = very dissatisfied, 5 = very satisfied). The incidence of intraoperative rescue sedation and any adverse events related to the intervention were also recorded.

Statistical analysis

Data were analysed using SPSS version 27 (IBM Corp., Armonk, NY, USA) on an intention-to-treat basis. Continuous variables, expressed as mean ± standard deviation, were compared between groups using Student's unpaired t-test where normally distributed, or the Mann–Whitney U test otherwise. Categorical variables were compared using the chi-square test or Fisher's exact test as appropriate. Repeated intraoperative hemodynamic measurements were analysed using repeated-measures analysis of variance (ANOVA) with Bonferroni correction for multiple comparisons. A two-sided p-value of less than 0.05 was considered statistically significant.

Results

Patient flow and baseline characteristics

Between March and May 2026, 112 patients were assessed for eligibility. Twelve patients were excluded (hearing impairment, n = 4; psychiatric comorbidity, n = 3; declined consent, n = 3; conversion to general anaesthesia during block, n = 2), leaving 100 patients who were randomized and completed the study — 50 in the Music Group and 50 in the Control Group (Figure 1). Baseline demographic and surgical characteristics, including age, sex distribution, ASA

status, type of surgery and baseline VAS-A, were comparable between the two groups (Table 1).

Figure 1. CONSORT flow diagram of participants through the trial

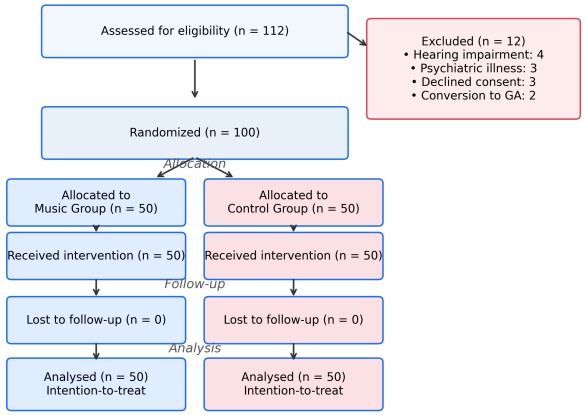

Figure 1. CONSORT flow diagram of participants through the trial.

Table 1. Baseline demographic and clinical characteristics of the study population.

Characteristic	Music Group (n = 50)	Control Group (n = 50)	p-value
Age (years), mean ± SD	42.6 ± 11.4	43.1 ± 12.0	0.83
Sex (Male / Female), n	28 / 22	26 / 24	0.69
BMI (kg/m²), mean ± SD	24.8 ± 3.2	25.1 ± 3.4	0.65
ASA I / II, n	32 / 18	30 / 20	0.68
Anaesthesia: Spinal / Epidural, n	44 / 6	45 / 5	0.75
Type of surgery, n			0.94
Inguinal hernia repair	18	17	
Varicose vein / perianal	14	15	
Lower-limb / soft-tissue	11	12	
Urological (TURP etc.)	7	6	
Duration of surgery (min), mean ± SD	72.4 ± 18.2	70.8 ± 17.6	0.66
Baseline VAS-A, mean ± SD	5.8 ± 1.4	5.7 ± 1.3	0.71

BMI = body mass index; ASA = American Society of Anesthesiologists; VAS-A = Visual Analogue Scale for Anxiety. TURP = transurethral resection of prostate.

Primary outcome: anxiety (VAS-A)

Baseline VAS-A in the preoperative holding area was comparable between groups (Music 5.8 ± 1.4 vs Control 5.7 ± 1.3; p = 0.71). Following the intervention, the Music Group demonstrated significantly lower anxiety scores at every subsequent time-point. The mean end-of-surgery VAS-A was 2.4 ± 1.1 in the Music Group compared with 4.6 ± 1.3 in the Control Group, a mean difference of −2.2 (95% CI −2.7 to −1.7; p < 0.001). The mean reduction from baseline to end of surgery was 3.4 ± 1.2 in the Music Group versus 1.1 ± 1.0 in the Control Group (p < 0.001) (Table 2, Figure 2).

Figure 2. Visual Analogue Scale for Anxiety (VAS-A) at each time-point. Bars represent mean ± SD.

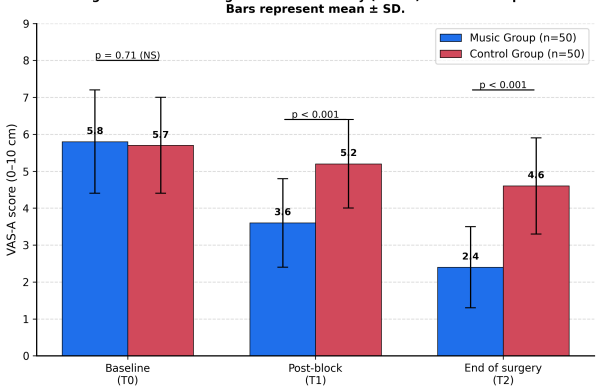

Figure 2. VAS-A scores at each time-point (mean ± SD).

Table 2. Visual Analogue Scale for Anxiety (VAS-A) scores across time-points.

Time-point	Music Group	Control Group	p-value
Baseline (T0)	5.8 ± 1.4	5.7 ± 1.3	0.71
Post-block (T1)	3.6 ± 1.2	5.2 ± 1.2	**< 0.001**
End of surgery (T2)	2.4 ± 1.1	4.6 ± 1.3	**< 0.001**
Change (T0 → T2)	−3.4 ± 1.2	−1.1 ± 1.0	**< 0.001**

Values are mean ± SD. VAS-A: 0 = no anxiety, 10 = worst possible anxiety.

Secondary outcomes: hemodynamic parameters

Mean heart rate, systolic and diastolic blood pressure were comparable at baseline (all $p > 0.05$). From 30 minutes into surgery onwards, the Music Group maintained consistently lower values compared with the Control Group. At 60 minutes, the mean heart rate was 74.2 ± 6.8 bpm in the Music Group versus 82.4 ± 8.1 bpm in the Control Group ($p < 0.001$); mean systolic blood pressure was 124.6 ± 8.9 mmHg versus 134.8 ± 10.2 mmHg ($p < 0.001$); and mean diastolic blood pressure was 76.8 ± 6.2 mmHg versus 84.2 ± 7.4 mmHg ($p < 0.001$). Peripheral oxygen saturation remained at 98% or higher in both groups throughout surgery ($p = 0.82$) (Table 3, Figure 3).

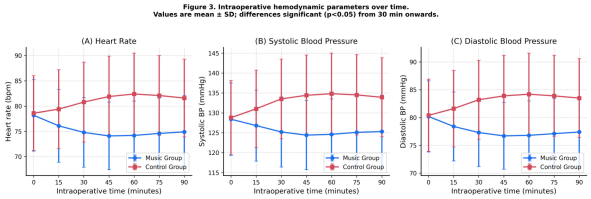

Figure 3. Intraoperative hemodynamic parameters over time (mean ± SD).

Table 3. Intraoperative hemodynamic parameters at 60 minutes.

Parameter	Music Group	Control Group	p-value
Heart rate (bpm)	74.2 ± 6.8	82.4 ± 8.1	**< 0.001**
Systolic BP (mmHg)	124.6 ± 8.9	134.8 ± 10.2	**< 0.001**
Diastolic BP (mmHg)	76.8 ± 6.2	84.2 ± 7.4	**< 0.001**
SpO_2 (%)	99.1 ± 0.7	99.0 ± 0.8	0.82

BP = blood pressure. Values are mean ± SD at the 60-minute intraoperative time-point.

Patient satisfaction and rescue sedation

Overall satisfaction at 24 hours postoperatively was significantly higher in the Music Group. Thirty-four patients (68%) in the Music Group rated their experience as "very satisfied" compared with 14 (28%) in the Control Group; a further 12 (24%) and 19 (38%) respectively rated themselves as "satisfied". The combined proportion reporting "satisfied" or "very satisfied" was 92% in the Music Group versus 66% in the Control Group ($p = 0.001$). No patient in the Music Group reported dissatisfaction, whereas five patients (10%) in the Control Group reported being "dissatisfied" and one (2%) "very dissatisfied". Eight patients (16%) in the Control Group specifically volunteered that operating-room noise had been distressing, compared with none in the Music Group (Figure 4).

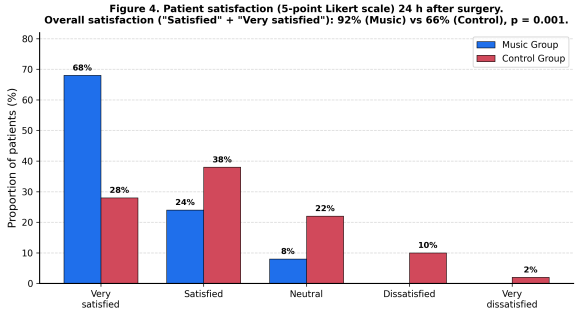

Figure 4. Distribution of patient satisfaction (5-point Likert scale) 24 hours postoperatively.

Rescue intravenous midazolam (1 mg) was required by 2 patients (4%) in the Music Group versus 9 (18%) in the Control Group ($p = 0.025$). No adverse events related to the intervention occurred; no patient requested premature removal of headphones, and no conversion to general anaesthesia occurred after randomization.

Discussion

This prospective randomized controlled trial in 100 adult patients undergoing elective surgery under

regional anaesthesia demonstrates that patient-selected intraoperative instrumental music produces a clinically meaningful reduction in anxiety, stabilises intraoperative hemodynamic parameters, reduces the need for rescue sedation, and improves patient-reported satisfaction. These findings support the integration of music therapy as a simple, virtually cost-free, non-pharmacological adjunct in routine surgical practice.

The observed mean between-group reduction in VAS-A of 2.2 points is consistent with, and slightly larger than, the effect size reported in the 2013 Cochrane systematic review by Bradt and colleagues, which pooled 26 trials and reported a mean reduction of 5.72 STAI-S units (corresponding to approximately 1.8–2.3 points on a 10-point analogue scale).[17] Our findings are also concordant with those of Shukla and colleagues (2024), whose randomized trial of 107 adults undergoing lower-limb orthopaedic surgery under spinal anaesthesia reported significantly lower postoperative STAI scores and reduced sedative requirement in the music arm.[20] Kaur and colleagues (2024) reported reductions in both anxiety scores and hemodynamic indices in women undergoing lower segment caesarean section under spinal anaesthesia,[21] and Kaur and colleagues (2022) demonstrated a comparable effect in orthopaedic patients.[22] The consistency of these effects across different surgical specialties, patient populations and measurement tools strengthens the external validity of our findings.

Mechanistically, the observed hemodynamic stabilisation is in keeping with the proposed neurobiological effect of music on the autonomic nervous system. Listening to preferred music engages limbic structures — the amygdala, nucleus accumbens, insula and ventromedial prefrontal cortex — triggering release of dopamine and modulation of cortisol and catecholamines.[12,13] Experimental studies have documented increased heart-rate variability, reduced salivary cortisol and faster autonomic recovery following a stressor in participants exposed to music.[14,16,30] In perioperative settings, these physiological effects translate into the clinically observable reductions in heart rate and blood pressure seen in our trial and in previous work.[31–33]

A notable finding was the 14-percentage-point reduction in rescue midazolam use (4% vs 18%). This sedative-sparing effect has been reported in multiple previous randomized trials. Koch and colleagues, in their landmark 1998 study, demonstrated a 43% reduction in intraoperative propofol and alfentanil requirements in patients receiving music during outpatient urologic surgery under spinal anaesthesia.[34] Bringman and colleagues (2009), in a comparative trial of relaxing music versus oral midazolam premedication, found music to be non-inferior — and in some measures superior — for anxiolysis without the adverse effects of pharmacological sedation.[35] Reducing benzodiazepine use is particularly relevant in elderly or frail patients, in whom these agents are linked to respiratory depression, paradoxical excitation and postoperative delirium.[8,11]

The substantial improvement in patient satisfaction (92% versus 66% rating themselves "satisfied" or "very satisfied") merits particular attention. Perioperative satisfaction is increasingly recognised as a patient-centred outcome of primary importance, influencing willingness to undergo future surgery, adherence to postoperative regimens and institutional reputation. A unique observation in the present study is the attention that Control Group patients paid to operating-room noise — 16% specifically reported it as a source of distress, highlighting the dual anxiolytic effect of music as both a positive sensory stimulus and a masker of aversive environmental sound.[5,36]

Our findings contrast with those of Kavakli and colleagues (2019), who reported paradoxically higher intraoperative anxiety in patients listening to music during carotid endarterectomy under regional anaesthesia.[24] Several factors may account for this discrepancy. The carotid endarterectomy cohort involved an older population with substantial cardiovascular comorbidity, intraoperative carotid cross-clamping (which produces neurological stimuli unrelated to the intervention), and music that was not patient-selected. Our use of individually preferred instrumental tracks may have contributed to a more robust anxiolytic effect, in keeping with evidence that self-chosen music produces stronger dopaminergic and autonomic responses than investigator-selected music.[18,37]

Strengths of the present trial include its prospective randomized design, adequate a-priori sample size, blinded outcome assessment, objective hemodynamic endpoints, and the use of a validated, widely applicable anxiety instrument. Several limitations

should be acknowledged. First, as with all music-intervention trials, blinding of participants and clinicians to the intervention is inherently impossible; we mitigated this by blinding the outcome assessor and by providing silent headphones to the Control Group. Second, the study was conducted at a single tertiary-care centre, which may limit external generalisability. Third, we did not measure biomarkers of stress such as salivary cortisol, alpha-amylase or plasma catecholamines, which would have strengthened the mechanistic interpretation.[38] Fourth, the relatively short three-month enrolment window captured a predominantly elective surgical cohort; effects in emergency surgery, prolonged procedures or alternative anaesthetic techniques were not assessed. Finally, longer-term outcomes such as postoperative pain trajectory, wound healing, persistent postoperative pain and chronic analgesic use — all of which have been linked to perioperative anxiety — were not evaluated, and represent important avenues for future research.[19],[39]

Taken together, our results contribute to a growing evidence base that supports routine use of intraoperative music as a zero-cost, virtually zero-risk adjunct for awake surgical patients. Given the high global prevalence of perioperative anxiety,[1] the well-documented adverse consequences of untreated anxiety,[7–9] and the demonstrated cost-effectiveness of perioperative music interventions,[40] implementation in Indian tertiary-care surgical practice appears both feasible and clinically justified.

Conclusion

Intraoperative patient-selected instrumental music significantly reduced anxiety, stabilised hemodynamic parameters, reduced rescue-sedative requirements and improved overall patient satisfaction in adults undergoing elective surgery under regional anaesthesia. This simple, inexpensive and safe non-pharmacological adjunct can be readily integrated into routine perioperative practice with minimal additional resource requirement. Larger multicentre trials that incorporate objective stress biomarkers, varied anaesthetic techniques and longer-term outcomes are warranted to further consolidate these findings and to define optimal music selection, dosing and delivery parameters for diverse surgical populations.

Declarations

Ethics approval and consent to participate: The study was approved by the Institutional Human Ethics Committee, Chettinad Academy of Research and Education (Approval No. IHEC-I/128/02/2026). Written informed consent was obtained from every participant prior to enrolment.

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Conflicts of interest: The authors declare that they have no conflicts of interest relevant to the content of this article.

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