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Original Research

The Effect of Live Bedside Music on Pain in Elderly Surgical Patients. A Unique Collaboration

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Abstract

Postoperative pain has a negative influence on physical and mental recovery and may result in a variety of postoperative complications. Listening to recorded music has been revealed to reduce pain, but in addition to that, live bedside music further offers the possibility to interact with the patient, respond to their emotions, and help them in adapting their conditions. It, therefore, seems appropriate for older surgical patients. This study examines the effect of live bedside music on postoperative elderly patients. The study was designed as a prospective clinical pilot study with a control group. During six separate weeks, between September 2016 and May 2017, data were collected using convenience sampling among the postoperative patients aged ≥60 years (*n* = 35) accounting to 83 sessions. The intervention was live music, person-centred improvisation and existing repertoire, performed by professional musicians of a collaborating conservatoire for 10–15 min, one session a day on three surgical wards of a university hospital. The control group (*n* = 43; 80 sessions) did not receive the intervention. –The primary endpoint was pain, measured with a visual analog scale (VAS; score 0-10) before the intervention and after 30 minutes and 3 hours of the session. Secondary endpoints were hemodynamic parameters, oxygen saturation, and respiratory rate and anxiety. The Wilcoxon signed-rank test and Mann-Whitney U test were performed to determine differences within and between groups. Perceived pain was decreased in the live bedside music group at the time of the first post-test and continued to be so for up to three hours (p = .004; p = .000). This decrease in pain was not observed in the control group. There was no clinically relevant effect on secondary endpoints. Live bedside music, performed by professional musicians, has a positive effect on the perceived pain of elderly patients after surgery. Further research on the underlying mechanisms as well as possible clinical implications is required.

Keywords
Elderly; live bedside music; surgery; pain; hospital ward

1. Introduction

In modern medicine, despite the introduction of new standards and guidelines, up to 40% of patients experience moderate or severe pain after surgery [1]. Inadequate pain management adversely influences physical and psychological factors, which may lead to severe complications, such as delirium, pneumonia, anxiety, stress, and delayed wound healing [2, 3]. Elderly patients experiencing pain can be given less pain medications compared with younger patients. Moreover, the elderly are more likely to experience medication-related side effects [4-6]. This is relevant considering that the current prevalence of polypharmacy in the elderly is 40 to 60% [7]. It is pertinent to explore the effect of non-pharmaceutical interventions, which can be provided to a group of potentially vulnerable elderly surgical patients. Some recently conducted studies indicated that recorded music is effective in reducing postoperative pain in elderly patients [8-17]. Music has, to the best of our knowledge, no toxic side effects and therefore seems an attractive intervention for elderly patients who are more prone to develop complications due to their changed physiology and increased vulnerability [18]. Compared to recorded music, live bedside music has the advantage of the possibility to interact with the patient, respond to emotions and adapt to the patient’s situation. However, the effect of live bedside music on elderly patients is unknown; therefore, this prospective clinical pilot study with a control group was carried out to investigate the effect of live bedside music on pain in elderly patients after surgery.

2. Materials and Methods

The present pilot study was conducted as a part of the Meaningful Music in Health Care project (MiMiC) between September 2016 and May 2017 at the University Medical Center Groningen, the Netherlands, in collaboration with the Prince Claus Conservatoire of Groningen, Netherlands. As per the knowledge of the authors, University Medical Center Groningen is probably the first hospital to collaborate with a conservatoire and combine these two worlds for the benefit of patients. Alteration in the pain perception was the primary endpoint of the present study and measured using a visual analog scale (VAS) after the live bedside music session. Secondary outcomes that were taken into consideration were hemodynamic parameters, oxygen saturation (SpO2), respiratory rate, and anxiety.

2.1 Participants and Setting

Patients admitted to one of the three surgical wards University Medical Center Groningen, the Netherlands took part in the study. No sample size was formally calculated since convenience sampling was done, maintaining the design of the intervention and availability of the musicians. The inclusion criteria were patients were aged 60 years or older and had undergone surgery during this hospital admission. The exclusion criteria were patients with total deafness (perception deafness), the inability to communicate or the unwillingness or inability to provide written informed consent and those.

2.2 Music Intervention Procedure

The pilot study was carried out in six separate weeks, where live bedside music was performed by one to three professional musicians consisting of a clarinettist, flutist, violinist, contrabassist, and cellist (for changing composition). These performing musicians with comprehensive experience were all associated with the conservatoire.

The intervention was planned according to a fixed structure where it was performed once daily in the morning between 11.00 a.m. to 12.15 p.m. The intervention was carried out for six or seven consecutive days, one ward at a time following the fixed structure. Each ward was allowed to participate for two separate weeks, and each day started with a joint session comprising of the musicians, a mediator, the coordinating nurse of the ward, and the researchers. During this session, patients who were present and able to participate were discussed, and the response of the previous day was evaluated. The mediator was responsible for the time schedule and served as an intermediary between the musicians, patients, and healthcare professionals. After the joint session, one of the musicians walked the hallway and played an improvisation to notify the patients that the musicians were present. The patients were visited at their bedside after the walk-around. The music consisted of genre-based improvisation, idiomatic improvisation, the repertoire of the musicians and person-centred improvisation. For person-centred improvisation, the musician asked for input from the patient in the form of a landscape, feeling or colour. Using improvisation, musicians created meaningful communication with the patient and involved the patient in the process of composing music. The music sessions took place in single, double, and quadruple rooms. The doors of individual rooms were closed and the sound for other patients outside the room was blocked. Each session lasted approximately 10 to 15 minutes. One or two pieces were played, depending on the patient’s wishes or condition. The musicians performed for approximately 75 min each day, and afterward, there was a brief evaluation in which the experiences were discussed. The participation of patients was allowed until the availability of the musicians in the ward.

2.3 Data Collection

Patients were informed on the day of admission, prior to surgery or as soon as possible, by two trained research assistants. Data on the patient characteristics (age, gender, nationality) and clinical condition were obtained from the patients, which included the date and surgical category, comorbidity using the Charlson Comorbidity Index (CCI), and the patients were further classified according to the American Society of Anesthesiologists (ASA). The degree of pain was measured 30 to 60 min before each intervention (pre-test), and 30 min after the live bedside music session (post-test) and again after three hours (follow-up test).

To correct for natural changes in pain sensation over time, a control group was formed. The same research assistants collected data in the control group in which no live music was played. The data in the control group were collected during six separate weeks for five consecutive days when the musicians were absent. The same inclusion and exclusion criteria and sampling method were used in the control group.

2.4 Instruments

Pain was defined as ‘an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage’ [19] and measured using the VAS [20]. The VAS is also employed to measure various subjective clinical phenomena. The patient verbally rates his/her pain on a 10-cm horizontal line. The starting point (0 cm) represents no pain, while the other end (10 cm) represents the unendurable pain. VAS scores are directly proportional to the degree of pain. Hemodynamic parameters and oxygen saturation were kept as secondary outcomes and were measured using a non-invasive bedside monitor (Philips SureSigns VS2). The respiratory rate was computed for one minute. The VAS was also used to measure the degree of anxiety, and it is also directly proportional to the scores [14].

2.5 Statistical Analysis

Statistical analyses are presented using the median (range) and number (%). Data were checked for normal distribution using Q-Q plots and the Shapiro-Wilk test. The independent samples t-test was used to examine the differences in numerical data between the control and live bedside music groups. The chi-squared test was used for the categorical data. Further, if data were normally distributed, the paired samples t-test was used for the within-group analyses; if not, the Wilcoxon signed-rank test was used. To analyze the difference between the groups, the Mann-Whitney U test was used.

All statistical analyses were performed using IBM SPSS Statistics version 23 (IBM Corporation, Armonk, NY). The data were considered statistically significant when P-values < 0.05 (two-sided).

2.6 Ethical Considerations

The medical ethics board concluded that this study did not fall within the scope of the Dutch law of Medical Research Involving Human Subjects Act and provided dispensation for further assessment. The study was registered on the national Netherlands Trial Register (trial ID: NTR6046). Commonly used ethical principles in clinical trials were followed. All participating patients in the study signed the written informed consent according to local regulations, and the data collection was done following the Declaration of Helsinki. Participation in the test was solely entitled to make individual decisions about the number of days they wanted to participate, and also, they were allowed to withdraw from the study at any time without consequences for their care.

3. Results

Characteristics of the patients and the clinical data of both the control group and intervention groups are detailed in Table 1. The live bedside music group consisted of 43 patients, whereas the control group comprised 35 patients. The median age group of the study population was 70 years, and approximately 60% of the participants were male. Over 50% of the patients underwent intracavitary surgery. The median time of the first participation in the intervention group was two days postoperatively (range 1–36) compared to three days in the control group (range 1–15). Most of the patients participated for once or twice in the control group (79.1%) or the intervention group (65.7%). No significant differences were found in patients and their clinical characteristic data between both the groups. Approximately 40% of the patients declined to participate in research or were not able to participate due to their medical conditions.

Table 1 Patient characteristics and clinical data.

Variables	**Control group (n = 43)**	**Live bedside music group (n = 35)**	***p*- value**
Age	70 (60–86)	70 (60–88)	.786[x]
Gender			.820[y]
Male	26 (60.5%)	20 (57.%)	
Female	17 (39.5%)	15 (42.9%)	
CCI	3 (0–10)	4 (0–9)	.104[z]
Location of surgery			.301[y]
Intracavitair	23 (53.5%)	19 (54.3%)	
Extremity	17 (39.5%)	10 (28.6%)	
Head-neck area	3 (7%)	6 (17.1%)	
ASA - classification	2 (1–4)	2 (1–3)	.245[y]
Days POD of first measurement	3 (1–15)	2 (1–36)	.530[z]
Number of participated/measured session	2 (1–5)	2 (1–7)	.502[z]
	20 (46.5%)	17 (48.6%)	
1	14 (32.6%)	6 (17.1%)	
2	5 (11.6%)	4 (11.4%0	
3	3 (7%)	2 (5.7%)	
4	1 (2.3%)	5 (11.4%)	
5	n.a.	-	
6	n.a.	2 (5.7%)	
7			

Presented as median (range) or number (%). A p-value of < 0.05 was considered significant.

x Independent samples T-Test

y Chi-square Test

z Mann Whitney U test

3.1 Pain

The low pain scores measured on the VAS resulted in positively skewed distributed data and median scores of zero for the live bedside music group (see Table 2). For the sake of illustration, we presented the means of the pain scores of both groups instead of medians in Figure 1a. The *p*-values are based on non-parametric testing. Statistical analysis revealed that a significant diminution was noted between the pre-test and post-test score (Z = –2.916; p = .004) in the live bedside music group that continued up to the follow-up test (Z = –4.200; p = .000). The control group revealed a minimal, non-significant (Z = –0.492; p = .623) change in pain scores in the post-test, and the follow-up test scores did not differ significantly (Z = –0.712; p = .476) when compared to the pre-test. No differences were observed in the baseline pain scores between the groups (p = .525). However, it was evident from the analysis that differences were revealed in the post-test (U = 2518.0; p = .014) and follow-up test (U = 2119.5; p = .005), indicating live bedside group perceived less pain at the post-test and follow-up test compared to the control group. Additional analysis of patients, who underwent major surgery (intracavitair) showed a significant decrease of pain scores on post-test (Z = -2.663; p = .008) and follow-up (Z = -3.531; p = .000) in the intervention group. Patients with minor surgery (head-neck area & extremity) also showed a decline in pain scores, which was only significant at the follow-up test (Z = -2.272; p = .023). A comparison between major and minor surgery showed no significant difference.

Table 2 Comparison of results in- and between the groups per outcome.

	Variables		**Control group (median-range)**	**n**	**Live bedside Music group (median-range)**	**n**	***p*-value**
Primary outcome	**Pain (VAS: 0–10)**	Pre- test	0,40 (0–8,40)	80	0,00 (0,00–10,00)	83	.525
		Post- test	0,15 (0–8,00)	78	*0,00 (0,00–10,00)* [1]	81	.014*
		Follow-up test	0,00 (0–8,00)	73	*0,00 (0,00–04,00)* [1]	75	.005*
Secondary outcomes	**Heart rate (bpm)**	Pre- test	79,50 (46–133)	80	80,00 (47–126)	80	0,085
		Post- test	76,50 (45–131)	78	*79,00 (45–113)* [1]	78	0,126
		Follow-up test	80,00 (50–131)	73	*78,00 (50–111)* [2]	73	0,8
	Respiratory rate (n per minute)	Pre- test	16,00 (12–24)	80	18,00 (12–28)	80	0,03*
		Post- test	16,00 (12–24)	77	18,00 (11–30)	77	0,027*
		Follow-up test	16,00 (12–24)	73	18,00 (10–28)	73	0,022*
	Saturation (%)	Pre- test	96,00 (78–100)	78	97,00 (92–100)	78	0.010*
		Post- test	97,00 (81–100)	77	98,00 (87–100)	77	0,051
		Follow-up test	97,00 (87–100)	72	98,00 (89–100)	72	0,001*

Systolic blood pressure (mmHG)	Pre- test	132,00 (83–200)	80	124,00 (95–167)	80	0,038*
	Post- test	134,00 (84–192)	78	125,00 (76–182)	78	0,01*
	Follow-up test	136,00 (64–172)	73	122,00 (90–180)	73	0,017*
Diastolic blood pressure (mmHg)	Pre- test	69,00 (42–108)	80	62,50 (28–104)	80	,002*
	Post- test	68,00 (39–101)	78	63,00 (36–116)	78	,004*
	Follow-up test	*67,00 (42–95)* [2]	73	61,00 (29–97)	73	0,013*
Mean arterial blood pressure (mmHg)	Pre- test	84,00 (51–148)	78	76,00 (48–112)	78	0,001*
	Post- test	86,00 (55–136)	78	78,00 (54–119)	78	0,003*
	Follow-up test	*84,00 (55–136* [2]	73	*74,00 (45–120)* [2]	73	0,003*
Anxiety (VAS: 0–10)	Pre- test	0,00 (0,00–10,00)	78	0,00 (0,00–10,00)	78	0,659
	Post- test	*0,00 (0,00–7,00)* [1]	78	*0,00 (0,00–2,70)* [1]	78	0,734
	Follow-up test	*0,00 (0,00–8,00)* [2]	73	*0,00 (0,00–2,20)* [2]	73	0,895

* sign. >*p,005*

1. significance difference within the group between pre-test and post-test measurement

2. significance difference within the group between pre-test and follow-up test measurement

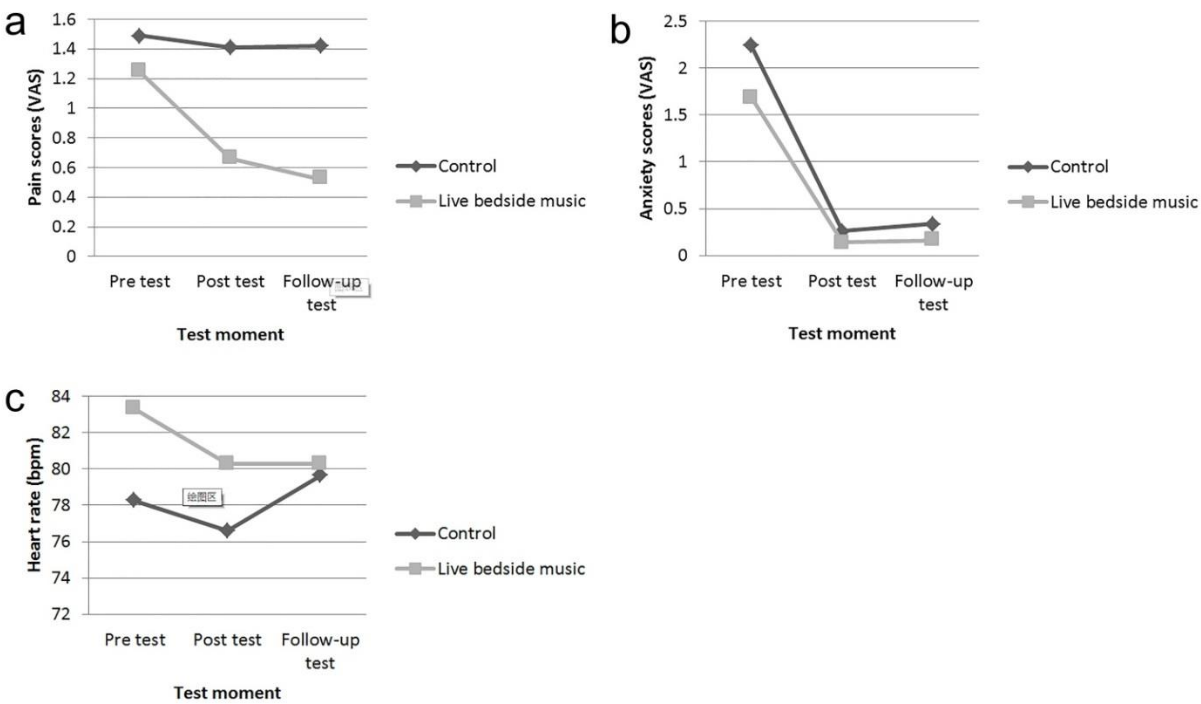

Figure 1 The dark gray line represents the control group and the light gray line the live bedside music group. a: Mean pain mean scores, measured on a visual analog scale; b: Mean anxiety scores, measured on a visual analog scale; c: Heart rate (bpm, mean values).

3.2 Hemodynamic Parameters

3.2.1 Heart Rate

The results exhibited that the heart rate was significantly reduced in the post-test (Z = –2.759; p = .006) and remained lower at the follow-up test in the live bedside music group (t = 2.757; df = 74; p = .007). Although non-significant, a change was noted in the control group during the post-test measurement. It was observed that the heart rate increased after three hours, exceeding the pre-test (Figure 1b). No significant statistical difference was observed when analyzed by the Mann-Whitney U test between the groups at the three test points.

3.2.2 Blood Pressure

Overall, patients in the control group had higher blood pressure, resulting in a significant difference at pre-test. In both groups, values exhibited a small increase at post-test and a decrease 3 hours later at the follow-up test. In the live bedside music group, these changes were not significant. In the control group, these changes were for the diastolic blood pressure (t = 3.132; df = 72; p = .003) and for the MAP (Z = -2.830; p = .005).

3.3 Oxygen Saturation (SpO2) and Respiratory Rate

There was a significantly higher level of SpO2 at pre-test in the live bedside music group (Z = –2.560; p = .010). In this group, SpO2 rose from a mean level of 97.05 (*SD* 2.33) to 97.35 (*SD* 2.47) at post-test and 97.53 (*SD* 2.35) at follow-up, but not significantly. In the control group, SpO2 rose at post-test from a mean level of 95.47 (*SD* 5.47) to 96.44 (*SD* 3.18), but decreased slightly at follow-up (*m* 96.32; *SD* 2.58).

The respiratory rate was higher (18 breaths per minute) among patients in the live bedside music group compared to the control group (16 times per minute). We found no differences within the groups.

3.4 Anxiety

In both groups, the median VAS score was zero at all test points, and no significant differences were found between the groups. A decrease in anxiety was noted between the pre-test and post-test or the follow-up test in both groups, as illustrated in Figure 1c. Furthermore, the level of anxiety range in the live bedside group as computed by VAS decreased considerably from 0–10 at the pre-test to 0–2.7 at the post-test, 0–2.2 at the follow-up.

4. Discussion

Findings from the present investigation gathered evidence to demonstrate that live music creates a positive environment and has a positive effect on the postoperative pain in the geriatric patients that lasts for at least three hours. The same effects were not found in the control group. To our best knowledge, no previous study has examined the effect of live music on pain, specifically in the elderly surgical population. This study also distinguishes itself by the fact that a prolonged decrease in pain perception, up to three hours after intervention, was found, despite the low pain scores at baseline in both groups. The pain scores were reduced by 0.59 at post-test and 0.73 at follow-up; this is marginally greater than the results described in two meta-analyses evaluating recorded music interventions postoperatively with a standardized mean difference of 0.53/0.71 [21, 22].

In the present study, we used a VAS to measure pain, which is a commonly used instrument for this purpose in studies with similarly aged populations with recorded music [8, 10, 12, 14, 15, 17], However, it remains unclear whether these findings reflect a reduction in pain medication. Some of the earlier studies with recorded music yielded conflicting results in the reduction of pain medication [8, 12, 13, 23]. It is difficult to generalize the data due to the heterogeneity of our study population. Hence, the evidence-based effect of live music on drug use among the geriatric surgical population is still obscure. Further research is needed to establish the influence of live bedside music on pain, which is more pronounced in patients undergoing major surgery. The underlying mechanistic pathway also deserves further insight. Furthermore, it is necessary to understand and compare the effect of live music with recorded music to determine clinical implications and draw definite conclusions. The results from the present investigation indicate that live bedside music can be potentially used in pain management.

Although, due to the distribution of the data, the median score for anxiety was zero, there was a notable decrease in the range of the live bedside group, which was not present in the control group. This concords with previously conducted studies on elderly surgical patients with recorded music that found a positive effect on anxiety [8, 12, 14, 17]. This is relevant because psychological aspects such as anxiety can affect the postoperative pain of an older surgical patient and adversely affect a patient's recovery [24, 25].

Based on our data, music has some effect on psychological parameters, although its clinical relevance is debatable. Non-parametric analyses of the heart rate revealed a significant decrease between pre- and post-test values and pre- and follow-up test values, which was not found in studies with recorded music [10, 12-15, 26, 27]. It can be presumed that live music affects the autonomic nervous system. It is a well-acknowledged fact that the heart rate is regulated by the autonomic nervous system, where the parasympathetic nervous system pacifies the body after the action of the sympathetic nervous system. Heart rate increases when the sympathetic nervous system is activated as a response toward harmful stimuli like pain or surgery, and responses are monitored by calculating heart rate variability (HRV), which is the time difference between consecutive heartbeats [28]. Earlier studies [29, 30] revealed that live music not only enhances parasympathetic activity but also causes a reduction in sympathetic activity as measured by HRV. The influence of live music on HRV in elderly patients after surgery, to our best knowledge, has not been measured and should be further explored to gain insight into the mechanism behind the effect of live music.

This study was performed with live music and conducted among a broad range of elderly patients undergoing various types of major and complex surgery. The data were collected in both groups by the same professionals, any Hawthorne effect cannot be completely ruled out due to the nature of the intervention and focus on experienced pain of patients. The limited availability of the musicians restricted the inclusion of patients who were admitted at the same time. However, baseline characteristics between the live bedside music group and the control group did not differ.

In the Netherlands, music therapy is not common care in hospital wards, and certainly not in surgical wards. In a previously conducted review on the effect of live music in older patients, no specific studies using live music therapy in surgical patients were found [18]. The intervention in our study was performed by professional musicians and must not be confused with music therapy, in which selected music-based interventions are applied using both music and the therapist-patient relationship as agents of change, or with 'music medicine', an intervention in which music is delivered by healthcare professionals [31]. In the analysis of pain perception, the effects of musical characteristics like volume, beats per minute, patient's choice of music, and various types of improvisations, were not taken in to account. Some studies among young adults have shown that personal preference and type of music played can be associated with the effect of music on pain perception [32, 33]. However, a meta-analysis by Hole and colleagues (2015) found a positive but non-significant effect of the music choice on reduction in pain [21]. Further research should be done keeping these variables into account.

The study demonstrates the applicability of live bedside music is an attractive and likely achievable option, which may create a new dimension in the working environment for professional musicians. The advantage of this intervention is that live music is multi-faceted and can be designed in various ways, which could be further explored. A larger-scale implementation and formal feasibility study can potentially bring out obstructing economic factors as attitudes of patients and healthcare professionals toward this innovative practice. Nevertheless, the results of this study indicate that live music influences pain perception in geriatric surgical patients in a positive way with no side effects.

5. Conclusion

Live bedside music, performed by professional musicians, has a positive effect on the perceived pain of elderly patients after surgery compared with patients who did not receive the intervention. Further research on the clinical implications, such as reduced pain medication usage, and the mechanism behind decreased pain must be conducted.

Author Contributions

All authors contributed substantial, approved the final version and are accountable for all aspects.

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Competing Interests

The authors have declared that no competing interests exist.

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