Acta Anaesthesiol Scand 2003; 47: 278–283
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ACTA ANAESTHESIOLOGICA SCANDINAVICA
ISSN 0001-5172

Analgesia following music and therapeutic suggestions in the PACU in ambulatory surgery; a randomized controlled trial

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Background: This study was designed to determine whether music (M), or music in combination with therapeutic suggestions (M/TS) could improve the postoperative recovery in the immediate postoperative in daycare surgery.
Methods: One-hundred and eighty-two unpremedicated patients who underwent varicose vein or open inguinal hernia repair surgery under general anaesthesia were randomly assigned to (a) listening to music (b) music in combination with therapeutic suggestions or (c) blank tape in the immediate postoperative period. The surgical technique, anaesthesia and postoperative analgesia were standardized. Analgesia, the total requirement of morphine, nausea, fatigue, well-being, anxiety, headache, urinary problems, heart rate and oxygen saturation were studied as outcome variables.
Results: Pain intensity (VAS) was significantly lower ($P = 0.002$) in the M (2.1), and the M/TS (1.9) group compared with the control group (2.9) and a higher oxygen saturation in M (99.2%) and M/TS (99.2%) group compared with the control (98.0%), $P < 0.001$, were found. No differences were noted in the other outcome variables.
Conclusion: This controlled study has demonstrated that music with or without therapeutic suggestions in the early postoperative period has a beneficial effect on patients' experience of analgesia. Although statistically significant, the improvement in analgesia is modest in this group of patients with low overall pain levels.

Accepted for publication 1 November 2002

Key words: ambulatory surgery; music; oxygen saturation; pain; post-operative; therapeutic suggestions.

Music has characteristic psychological and physiological effects on humans, and can also be used as a source of distraction in conscious patients (1). To increase the benefit of medication, patients can use soothing music or music in combination with relaxation in the postoperative period as a-non-pharmacological method to manage postoperative pain (1, 2). Listening to music can also modulate the human's response to stress (3, 4), increase satisfaction of the peri-operative care (5) and studies have shown that music can be used as an adjunct during therapeutic suggestions (6). However, other studies have not found improvement with postoperative music intervention (7–9). These studies involve small numbers of participants and maybe therefore lacked power to detect beneficial outcomes (10). To our knowledge there are no studies with music in combination with therapeutic suggestions, during emergence from anaesthesia. It is possible that patients may be more receptive to the beneficial effect of music or music in combination with therapeutic suggestions during the early postoperative period as opposed to late postoperative period.

The study hypothesis was that music alone or music combined with therapeutic suggestions during emergence from anaesthesia in the immediate post-operative period has an impact on the patient's postoperative recovery.

Methods

One hundred and eighty-three ASA I-II patients were included in a prospective randomized clinical

investigation. The local ethics committee approved the study and all patients gave their informed consent. The patients were scheduled for daycare surgery of varicose veins or open inguinal hernia repair surgery (Lichtenstein) under general anaesthesia. They were from two hospitals (A/B), and all had a good understanding of Swedish. None had any hearing impairment, drug abuse, or any known psychiatric or memory disorder. One patient was withdrawn because of change of diagnosis intraoperatively, i.e. lipoma instead of inguinal hernia.

The patients received no premedication. Anaesthesia was induced with propofol 1–2 mg kg^{-1}, fentanyl 1–2 μg kg^{-1} and was maintained with 70% nitrous oxide in oxygen and with at least 1.2 end-tidal anaesthetic gas concentration of sevoflurane. At the end of the operation all the inguinal hernia patients received local infiltration with 10 ml 0.5% bupivacaine in the surgical wound. Postoperatively patients received 100 mg of diclofenac as a suppository and on request i.v. morphine 1–3 mg until analgesia was adequate, i.e. visual analog scale (VAS) ≤ 3 (11). At arrival and the first 2 h at PACU all patients received 2 l min^{-1} oxygen.

The patients were randomly allocated to three groups: two intervention groups, music (M), and music combined with therapeutic suggestions (M/TS), and a control group exposed to a blank tape. A computer generated the randomization list. Patients in the M group listened to soft classical music (12), reported to be relaxing and calming (13). Patients in the M/TS group listened to relaxing and calming music accompanied by relaxing and encouraging suggestions recorded in a male voice by a person with extensive experience in hypnotherapy (14). The taped voice suggested a feeling of relaxation, security, rapid healing, return to normal appetite, quick recovery, absence of pain and nausea together with encouragement of comfort. The control group listened to a blank tape, i.e. silence. Each tape was set on an auto-reverse mode and played from the time of arrival at the PACU to the time when the patient wanted to stop listening. All audio cassette tape players were set to the same audio settings and all the patients had headphones allowing conversation between the patient and the nurses and physicians at the PACU. The anaesthesiologist, nurse anaesthetists, surgeon, physicians and nurses at the PACU were blinded to the tape selection.

At the PACU heart rate and oxygen saturation (SpO_2), were monitored at the arrival at PACU, before the intervention and 1 h by pulse oxymetry monitory technique (Ohmeda 3800).

Pain intensity was estimated on VAS, calibrated from 0 = no pain to 10 = maximal possible pain (11) every half hour until the patient reported ≤ 3 on the scale (15).

On the evening of the day of surgery signs of fatigue, psychological well-being, nausea, headache and urinary problems were rated and recorded by the patient in a symptom check-list (16). Postoperative fatigue was evaluated on a 5-grade scale (no fatigue, mild fatigue, moderate fatigue, severe fatigue, very severe fatigue).

Psychological well-being was estimated by the patient on a 5-grade scale (very good, good, neither good nor bad, bad, very bad).

Nausea, headache and urinary problems were evaluated on a 4-grade scale (none, mild, moderate and severe).

The symptom check-list also included two open-ended questions regarding the subjects' perception of the interventions.

The State-Trait Anxiety Inventory (STAI) was used to assess the patient's level of anxiety preoperatively at the hospital and postoperatively at home the day of surgery. STAI consists of 20 inventory items with responses on a four-point Likert scale (1 = absence of anxiety and 4 = high anxiety) and evaluates the level of anxiety at the time of assessment. The total score is the weighted sum of all 20 responses ranging from 20 to 80: low anxiety (20–30), moderate anxiety (40–59), and high anxiety (60–80). Scores are reported to be considerably higher under stress than under normal conditions (17). The STAI has been validated and tested for reliability (17) even in Swedish populations in different strata (18).

Descriptive statistics are presented as arithmetic means and standard deviation for the sake of clarity, although the questionnaire is referred to as an ordinal scale. ANOVA or Kruskal–Wallis ANOVA followed by Mann–Whitney *U*-test and a Bonferroni correction were used to test differences between groups. A *P*-value of less than 0.05 was considered statistically significant. For each individual median value are shown for repeated VAS scores over time. These median values were used to test differences between the groups and in the results mean values for each group are presented. Graphically the VAS distributions between the groups over time are presented with box-and-whisker plots. The computer program SPSS for windows was used for all statistical analysis.

Calculation of sample size was based on following assumptions concerning a one-way analysis (three groups) for pain, i.e. VAS: Significance level 5%, power 80%, common standard deviation 2 and a difference in mean characterized by a Variance of

Table 1

Demographic data, anaesthetic, surgical factors and preoperative anxiety. No statistical differences between the groups.

	M group ($n=62$)	M/TS group ($n=57$)	Control ($n=63$)
Age (year)*	53 (14.1)	50 (15.2)	52 (13.2)
Gender (male/female)	44/18	40/17	48/15
Type of surgery (inguinal hernia/varicose vein)	38/24	36/21	40/23
Hospital (A/B)	45/17	45/12	46/17
Duration of anaesthesia (min)*	68 (27.6)	64 (30.0)	67 (28.6)
Duration of surgery (min)*	40 (22.9)	38 (25.6)	40 (22.1)
Periopertive use of fentanyl (mg)*	92.3 (32.2)	97.6 (30.6)	106.3 (35.9)
Preoperative STAI*	35.5 (8.7) $n=59$	33.2 (8.9) $n=55$	33.6 (7.8) $n=61$

M, music group; M/TS, music in combination with therapeutic suggestions; STAI, State-Trait Anxiety Inventory.
*Mean (±SD).

Table 2

Listening time, morphine requirement and postoperative mean pain intensity for patient's median score on Visual Analog Scale (VAS) during the first 120 min at the PACU.

	M group $n=62$ mean (SD)	M/TS group $n=57$ mean (SD)	Control $n=63$ mean (SD)	*P*-value
Duration of listening time (min)	117.0 (50.6)	103.9 (51.8)	80.2 (44.9)	<0.001[a]
Morphine (mg)	2.6 (3.2)	2.5 (3.9)	3.4 (3.9)	0.382
VAS (0–10)*	2.1 (1.4)	1.9 (1.5)	2.9 (1.6)	0.002[b]

M, music group; M/TS, music in combination with therapeutic suggestions.
[a]Difference between M and control, $P<0.001$ and M/TS and control, $P<0.05$.
[b]Difference between M and control, $P<0.01$ and M/TS and control, $P<0.01$.
*VAS (mean of median VAS scores during 120 min).

means of 0.222. These assumptions suggested a sample size of 59 in each of the three groups.

Results

There were no significant differences in the demographic data, preoperative trait-anxiety (STAI), anaesthetic and surgical factors between the groups (Table 1).

The M-group patients (117.0 min) and the M/TS-group patients (103.9 min) listened significantly longer to the tape than the control patients (80.2 min) (Table 2). Patients exposed to music and music in combination with therapeutic suggestions had significantly lower pain intensity postoperatively at the PACU compared with the patients in the control group (Table 2 and Fig. 1). There were no significant differences in postoperative morphine requirement (Table 2) between the groups.

Oxygen saturation was significantly higher ($P<0.001$) after 1 h at the PACU in patients exposed to music, 99.2% (±1.0) and music in combination with therapeutic suggestions, 99.2% (±1.1) compared to the control group, 98.0% (±1.7), although statistically significant the oxygen saturation changes are of minor clinical importance.

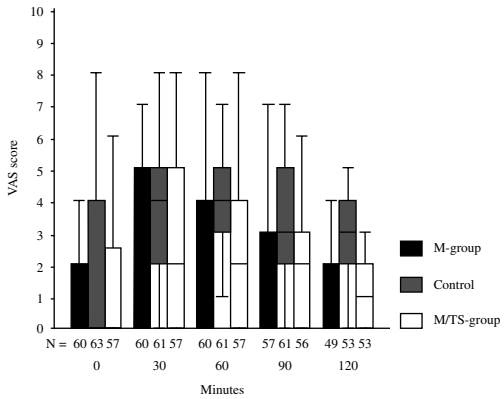

Fig. 1. Box-and whisker plots of pain measured by VAS, while listening to music (M-group), music in combination with therapeutic suggestions (M/TS group) or blank tape (control) at arrival and every 30 min thereafter for the first two hours in the PACU. The box indicates the range between the 25th and 75th percentiles. Capped bars (whiskers) indicates the 10th and 90th percentiles.

Table 3

Postoperative anxiety, nausea, well-being, fatigue, urinary problems and headache.

	Scale range	M group mean (SD) $n=59$	M/TS group mean (SD) $n=53$	Control mean (SD) $n=56$	*P*-value
Day of surgery					
STAI	20–80	30.7 (6.9)	28.9 (6.8)	29.3 (6.8)	0.304
Nausea	1–4	1.3 (0.7)	1.5 (1.0)	1.5 (0.9)	0.967
Well-being	1–5	1.8 (0.9)	1.6 (0.7)	1.5 (0.6)	0.099
Fatigue	1–5	2.8 (0.9)	2.8 (1.1)	3.1 (1.6)	0.802
Urinary problems	1–4	1.3 (0.7)	1.2 (0.5)	1.4 (0.9)	0.525
Headache	1–4	1.2 (0.4)	1.1 (0.4)	1.2 (0.4)	0.763
First day after surgery					
Nausea	1–4	1.1 (0.3)	1.1 (0.4)	1.1 (0.5)	0.967
Well-being	1–5	1.7 (0.9)	1.5 (0.7)	1.4 (0.6)	0.140
Fatigue	1–5	1.4 (1.0)	1.3 (1.0)	1.4 (1.0)	0.719
Urinary problems	1–4	1.1 (0.4)	1.1 (0.4)	1.2 (0.6)	0.495
Headache	1–4	1.1 (0.4)	1.1 (0.3)	1.1 (0.3)	0.703

M, music group; M/TS, music in combination with therapeutic suggestions; STAI, State-Trait Anxiety Inventory.

There was no difference between the groups regarding postoperative heart rate and the groups did not differ regarding the patient's own rating of postoperative anxiety (STAI), nausea, well-being, fatigue, urinary problems and headache on the day of surgery and the day after (Table 3).

All patients in the two intervention groups remembered that they had been listening to music or music in combination with therapeutic suggestions. The percentage of patients who thought that music could have a positive effect on patient's recovery was 61% in the music group, 67% in the music combined with therapeutic suggestions group and 52% in the control group.

Discussion

This is the first randomized controlled trial designed with the aim to study the effects of music and music in combination with therapeutic suggestions in the immediate postoperative period on postoperative outcomes. Our results are similar to previous reports that music can decrease postoperative pain (1, 2). The interventions of Good et al. (1, 2) were performed on postoperative day 1 and 2 while ours during emergence from anaesthesia at the PACU. A limitation in the present study is that pain scores were only assessed for the first 2 h and it can be expected that the differences would be more apparent if pain had been observed for a longer period after the analgesic effects of local anaesthetic infiltration had worn off. The pain scores were also generally low in this group of patients. Kalso (19) points out that the severity of initial pain is crucial and if the patient experiences mild initial pain, all drugs including placebos, can prove equally efficacious. However, there are conflicting reports regarding pain intensity after inguinal hernia and varicose vein surgery Callesen et al. (20), Aasbo et al. (21) and Rautio et al. (22) have shown that pain can be a significant problem in these two most common surgical procedures and that there is no general consensus as to what the optimal anaesthetic or surgical techniques are.

The mechanism of this pain-reducing effect can be explained by the gate control theory, which suggests that the transmission of potentially painful impulses can be modulated by a 'cellular gating mechanism' found in the spinal cord (23). Alternatively, the beneficial effects may be a result of distraction through cognitive coping strategies by competing stimuli that reduce pain perception (24).

In the present study the intervention lasted between 104 and 117 min. Good et al. (2) demonstrated a lasting effect of music and relaxation on postoperative pain in repeated interventions and Henry (25) states that the optimal duration for listening to music is not known but recommends a listening time of 25–90 min for several days in intensive care patients. It is possible that the beneficial effects can be prolonged if music thereby is repeated during the first two postoperative days.

The efficacy of music in reducing anxiety has been previously reported (26). In this study anxiety was not influenced, possibly because the levels of preoperative anxiety estimated by STAI were already low. These findings are consistent with other studies which have demonstrated relatively low levels of preoperative

anxiety as measured by the STAI among patients before coronary artery bypass grafting (8) and in ambulatory surgery patients (3). Our results are also similar to other studies in confirming that surgery is followed by an unchanged anxiety measured by VAS and STAI methods (9, 27).

We did not find any advantage in combining music with therapeutic suggestions. Soothing music appears to be as beneficial as actual verbal message and it is unclear which type of music is best suited for postoperative intervention. The questions that need to be addressed are: Should music be sedating or relaxing, and should the patient select the music? Relaxing music is generally thought to be instrumental, with slow, flowing rhythms that duplicate a pulse rate of $60\,\mathrm{min}^{-1}$ to $80\,\mathrm{min}^{-1}$ (28). However, some music therapists suggest that classical music is the best music for relaxation because of its consistent tone and form (13).

Heiser et al. (9) found that the patients were satisfied with listening to music in the PACU and that it helped them to relax and functioned as a distracter. In the PACU the noise level can sometimes be as high as $>70\,\mathrm{dB}$ (29) and the most common noises are generated by staff or equipment (26). It is conceivable that the effect seen in present study simply related to block off the PACU noises, a distracter from the environmental noise rather than to the behavioural intervention.

Our earlier study has demonstrated efficacy with intraoperative music and music in combination with therapeutic suggestions under general anaesthesia on postoperative pain, pain medication requirements, fatigue and mobilization (30). The present study also demonstrated beneficial effects on pain in the postoperative period. However, in comparing these two different studies it is difficult to draw any conclusion regarding the most effective timing for these interventions, i.e. during surgery or in the emergence period after surgery. In addition to the timing of music and therapeutic suggestions, the choice of music and the duration of the intervention are topics for further studies. In our opinion, taped music with or without therapeutic suggestions should be offered to surgical patients because the technique is inexpensive, non-pharmacological, non-invasive and has beneficial effects (10, 30).

In conclusion this randomized, controlled trial has shown that in patients undergoing daycare surgery music alone and music in combination with therapeutic suggestions during the immediate postoperative period has a beneficial effect on postoperative pain. However, the improvement is modest in this group of patients with low overall pain levels.

Acknowledgements

This study was supported by grants from the Research Committee of Örebro County Council, the Swedish Foundation for Health Care Science and Allergy Research (project V2000 328) and the Swedish Association of Nurse Anesthetists and Intensive Care Nurses.

The investigators thank Kerstin Jans CRNA and the nurses at the Department of Anesthesiology in Karlskoga Hospital and also Olle Bohlin MD, Johan Lagerfelt MD and the nurses at the operation theatre and PACU, Läkargruppen, Örebro, for assistance in data collection.

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