The Effect of Musical Therapy on Postoperative Pain after Caesarean Section

SUMMARY

AIM: We reasoned that addition of musicotherapy - a simple and convenient method with no adverse effects - in the preoperative period would have favorable effects pertaining to postoperative pain.

METHODS: One hundred patients, between the ages of 20–40 years, who were undergoing elective caesarean delivery under general anaesthesia, were enrolled. The patients were randomly allocated into two groups (with 50 patients in each) and in group 1, patients listened to music through a headphone for one hour immediately before surgery whereas in group 2, patients did not listen to any music during the same period. The anaesthetic technique was standardized. All neonates were also assessed and Appgar scores were recorded. In the postanaesthesia care unit, patients were connected to i.v.-PCA device when they were able to respond to commands. The patient’s level of satisfaction with perioperative care was assessed by a 10-cm visual analogue scale and the severity of postoperative pain was assessed with VAS.

RESULTS: Postoperative tramadol consumption, total amount of tramadol consumption, additional analgesic use and all VAS values were lower in group 1 (p<0.05). Appgar scores were significantly greater in group 1.

CONCLUSION: We imply that music therapy given before surgery decreases postoperative pain and analgesic requirement.

INTRODUCTION

Postoperative pain is an important factor during the early recovery after surgery. Its management entails reducing painful symptoms, improving the quality of recovery and resuming normal activities of daily living.(1) It has been reported that despite the widespread use of opioid analgesics in the postoperative period, the overall incidence of moderate-severe pain was 30% (severe pain 11%).(2) Accordingly, a concept of preemptive analgesia has been introduced for postoperative pain control.(3-7) Blockade of noxious stimuli generated during surgery and in the postoperative period reduces subsequent pain, therefore antinociceptive treatment started before surgery seems to be more effective for the treatment of postoperative pain than the treatment given on recovery from general anaesthesia. This can be achieved with local anaesthetics and systemic or epidural opioids.(8) On the other hand, adjunct medications, not only for pain management but also to reduce the dose requirements and therefore the side effects of opioids, have been tried.(9) These include nonsteroidal antiinflammatory drugs (NSAIDs) (10-12) tramadol and N-methyl-D-aspartic acid (NMDA) receptor antagonists.(13) Besides pharmacological...
methods, it has been recommended that perioperative stress can also be controlled with non-pharmacological methods. (14-16) In this regard, music has been shown to reduce patients’ anxiety and decrease sedative requirements. (14, 17-19) Similarly, in this study, we reasoned that addition of musicotherapy—a simple and convenient method with no adverse effects— in the preoperative period would have favorable effects pertaining to postoperative pain.

MATERIALS AND METHODS

The study was approved by the local Ethics Committee and all subjects gave informed consent before they participated in this prospective single-blind study.

One hundred patients (ASA-I), between the ages of 20-40 years, with uncomplicated singleton pregnancies of at least 36 weeks’ gestation, who were undergoing elective caesarean delivery via a Pfannenstiel incision were enrolled. Those patients for whom general anaesthesia were planned on the preoperative day were chosen to standardize the type of anaesthesia. Women who had any of the followings were excluded: history of allergy to non-steroidal antiinflammatory agents or opioids, bleeding tendency, bronchial asthma, peptic ulcer, liver or kidney disease, hearing impairment, alcohol or drug abuse, any known psychiatric or memory disorder, inability to operate a patient controlled analgesia (PCA) device, pregnancy-induced hypertension, placenta praevia, abruptio placentae, evidence of intrauterine growth restriction or other fetal abnormalities and professional musical background were excluded from the study. All operations were performed by the same surgeon.

On the preoperative evaluation, the day before surgery, patients were assessed with regard to habitual music listening and musical background (training, interest and frequency of listening). The PCA technique and visual analog score (VAS) were also explained. All patients were fasted for at least eight hours and received aspiration prophylaxis consisting of metoclopramide 10 mg and ranitidine 50 mg, one hour before surgery.

The patients were randomly allocated into two groups (with 50 patients in each) according to computer-generated randomization. In group 1, patients listened to music through a headphone (whatever she liked) for one hour immediately before surgery whereas in group 2, patients did not listen to any music through headphones during the same period.

All staff in the operating room were unaware of the randomization. A 20-gauge i.v. cannula was inserted into the forearm and an infusion of 1000 mL lactated Ringer's solution was given (10 mg kg⁻¹ h⁻¹) during anaesthetic induction. Patients were positioned supine with left lateral tilt using a pillow under the right hip. The anaesthetic technique was standardized. Subjects were monitored with mean arterial blood pressure (MAP), heart rate (HR), peripheral oxygen saturation (SpO₂) and end-tidal carbon dioxide concentration (EtCO₂). After pre-oxygenation for 5 min, rapid-sequence induction was performed with thiopental 4 mg kg⁻¹ followed by succinylcholine 1 mg kg⁻¹ after loss of verbal response. Cricoid pressure was applied after loss of consciousness and was released after correct placement of the tracheal tube had been confirmed. Atracurium 0.3 mg kg⁻¹ was given to maintain neuromuscular block after recovery from succinylcholine. Ventilation was controlled to produce normocapnia. Anaesthesia was maintained with a mixture of sevoflurane and 50% nitrous oxide in oxygen. After the umbilical cord was clamped, intravenous fentanyl 1.0 µg kg⁻¹ was given and a 10-unit infusion of oxytocin was started. The obstetrician assessed uterine tone by palpation every minute after delivery of the placenta and rated the degree of uterine relaxation on a 4-point-scale (1: bad, 2: moderate, 3: good, 4: excellent). If uterine tone remained unsatisfactory after 5 min, an additional 5-unit bolus of oxytocin was administered.

Sevoflurane and nitrous oxide were discontinued at the start of skin closure and 0.5 mg kg⁻¹ i.v. tramadol was administered. At the end of surgery, residual neuromuscular block was antagonised with neostigmine 30 µg kg⁻¹ and atropine 15 µg kg⁻¹. After extubation was terminated, the patients were evaluated by using Aldrete score. The time to reach an Aldrete score ≥ 9 was recorded as the time of the recovery. Duration of anaesthesia was noted as the time period between induction and extubation. The time periods from induction of anaesthesia until delivery of the newborn (I–D time) and from the uterine incision to the delivery (U–D time) were recorded.

All neonates were assessed by a single pediatrician unaware of the mothers’ randomization. Apgar scores were recorded at 1st and 5th min. MAP, HR, SpO₂ and EtCO₂ were recorded preoperatively and intraoperatively on the 1st, 3rd, 5th, 7th, 10th, 15th, 20th, 30th, 40th, 50th and 60th minutes.

In the postanaesthesia care unit, patients were connected to i.v.-PCA device (Pain Management
Provider; Abbott, North Chicago, IL) when they were able to respond to commands. The PCA device (tramadol 3 mg/ml) was set to deliver a bolus of 20 mg, with a lockout interval of 15 min and 4-h maximal dose of 150 mg. PCA was continued for a minimum of 24 hours. 75 mg i.m. diclofenac was given when VAS ≥ 4 and the time for initial analgesic requirement was noted.

The patient’s level of satisfaction with perioperative care was assessed by a 10-cm visual analogue scale (no satisfaction: 0, maximum satisfaction 10) on the postoperative 24th hour. The severity of postoperative pain during sitting and lying were assessed with VAS.

The presence and intensity of any side effects were assessed on the 1st, 4th, 8th, 12th, 16th, 20th and 24th hour after surgery; e.g. sedation (4-point verbal rating scores (VRS) 1: awake, 2: drowsy, 3: arousable, 4: deep sleep), nausea and vomiting. On patient request or if nausea and vomiting occurred, ondansetron 4 mg i.v. was given.

Postoperative MAP, HR, SpO2, respiratory rate (RR), VRS, VAS (sitting and lying); consumption, demand and delivery of tramadol were recorded on the 1st, 4th, 8th, 12th, 16th, 20th and 24th hour.

All measurements were recorded by the same anaesthesiologist that was blinded to the study groups.

Initial sample size estimation showed that approximately 47 patients were needed in each group to detect reduction of morphine consumption by 20% with a power of 0.90 and a level of significance of 5%. Statistical analysis was performed with SPSS for Windows version 11.5 (Chi., Il., USA). All variables were tested for normal distribution by Kolmogorov-Smirnov test. According to the distribution of the data; Mann Whitney U test, t test and Chi-square tests were performed. Data were mean (SD), number (%), or median (min-max). A p value of <0.05 was accepted as statistically significant.

**RESULTS**

Patient characteristics are given in Table-1. The two groups were statistically similar with regard to age, height, weight and duration of surgery (p > 0.05). I-D time and U-D time values did not differ between the groups (p > 0.05). Intraoperative values for MAP, SpO2, HR, EtCO2 and postoperative values for MAP, SpO2, HR, RR ve VRS were statistically similar between the groups (p > 0.05). Table-2 summarizes the musical background of the two groups which were indifferent (p > 0.05).

There was no significant difference between the two groups for the PCA demand frequency at any time postoperatively (p > 0.05). There was significant decrease in group 1 regarding the PCA delivery frequency at the 24th hour postoperatively (14.92 ± 3.69 and 18.16 ± 5.35, respectively) (p < 0.05). Concerning the postoperative tramadol consumption, values measured on the 1st, 4th, 8th, 12th, 16th hours were similar between the groups; however, values measured on the 20th and 24th hours were significantly lower in group 1 (p < 0.05). In addition, total PCA tramadol use was decreased by 21% groups 1 compared with group 2 (Table-3). Although the initial time of diclofenac requirement was indifferent, the total amount and the number of patients concerning additional analgesic use were lower in group 1 (p < 0.05) (Figure 1-2).

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**Table 1. Patient characteristics. (mean ± SD)**

<table>
<thead>
<tr>
<th>Group 1 (n = 50)</th>
<th>Group 2 (n = 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age; years</td>
<td>29 ± 5</td>
</tr>
<tr>
<td>Weight; kg</td>
<td>75 ± 7</td>
</tr>
<tr>
<td>Height; cm</td>
<td>165 ± 5</td>
</tr>
<tr>
<td>Duration of anesthesia; min</td>
<td>39 ± 8</td>
</tr>
</tbody>
</table>

No significant differences were found between the two groups.

**Table 2. Patient’s characteristics regarding music (number)**

<table>
<thead>
<tr>
<th>Music group (n = 50)</th>
<th>Noise group (n = 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Like</td>
<td>50</td>
</tr>
<tr>
<td>Ambivalent</td>
<td>0</td>
</tr>
<tr>
<td>Dislike</td>
<td>0</td>
</tr>
</tbody>
</table>

Music perception

<table>
<thead>
<tr>
<th>Music exposure frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few times a day</td>
</tr>
<tr>
<td>Once a day</td>
</tr>
<tr>
<td>Once a week</td>
</tr>
<tr>
<td>Less than once a week</td>
</tr>
</tbody>
</table>

Level of music education

| None                | 50          |
| Self-taught         | 0           |
| Primary             | 0           |
| Moderate            | 0           |
| Advanced            | 0           |

No significant differences were found between the two groups.

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**Table 3.** Cumulative Tramadol consumption with patient-controlled analgesia (PCA) device.

<table>
<thead>
<tr>
<th>Time (h)</th>
<th>Group 1 ((n = 50))</th>
<th>Group 2 ((n = 50))</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>54 ± 20</td>
<td>57 ± 28</td>
</tr>
<tr>
<td>4</td>
<td>126 ± 34</td>
<td>132 ± 40</td>
</tr>
<tr>
<td>8</td>
<td>183 ± 49</td>
<td>196 ± 64</td>
</tr>
<tr>
<td>12</td>
<td>224 ± 55</td>
<td>245 ± 80</td>
</tr>
<tr>
<td>16</td>
<td>253 ± 61</td>
<td>278 ± 91</td>
</tr>
<tr>
<td>20</td>
<td>274 ± 63 ‡</td>
<td>320 ± 101 ‡</td>
</tr>
<tr>
<td>24</td>
<td>289 ± 64 ‡</td>
<td>364 ± 107 ‡</td>
</tr>
</tbody>
</table>

Values are expressed as means±SD, ‡ \(P<0.001\), compared to control group. \(\ast P<0.05\), compared to control group.

**Table 4.** Patient characteristics regarding analgesic use.

<table>
<thead>
<tr>
<th></th>
<th>Group 1 ((n = 50))</th>
<th>Group 2 ((n = 50))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total amount of diclofenac consumption (mg)</td>
<td>48 ± 42</td>
<td>87 ± 41</td>
</tr>
<tr>
<td>Initial time of diclofenac (min)</td>
<td>60 (10-1200)</td>
<td>45 (10-1200)</td>
</tr>
<tr>
<td>Patient satisfaction scores</td>
<td>8.9 ± 0.7</td>
<td>7.6 ± 1</td>
</tr>
</tbody>
</table>

Values are mean±SD and median (range). \(\ast P<0.001\), compared to control group.

**Figure 1.** VAS scores of the patients in lying position \(\ast P<0.05\), \(\ast\ast P<0.001\)

**Figure 2.** VAS scores of the patients in sitting position \(\ast P<0.05\), \(\ast\ast P<0.001\)

The most common side effects during the postoperative period were nausea and vomiting (group 1: 4/50, group 2: 7/50), and the two groups were similar in this regard \((p>0.05)\). There were no other serious side effects during the study.

**DISCUSSION**

In this study, the effect of preoperative music therapy on postoperative pain was investigated and we have found that it significantly decreased postoperative pain and analgesic consumption.

Postcesarean section pain is an important issue in obstetrics. Several studies have shown the importance of adequate postoperative analgesia on well-being, mobilization, rehabilitation, and decreasing the length of hospital stay. Furthermore, it enhances bonding between the mother and the newborn. Opioids provide a high level of patient satisfaction, but are usually omitted at the induction of general anaesthesia for caesarean delivery because of concerns about placental transfer resulting in neonatal respiratory depression. The use of NSAIDs significantly reduces the need for opioids after caesarean delivery minimizing opioid-induced side-effects. For example, ketorolac and tenoxicam have been found to reduce postoperative pain and the need for opioid analgesics after surgery. However, there is still debate on their compatibility with respect to breastfeeding. Opposingly, music therapy has no adverse effects in this regard. Moreover, we have also shown that it had beneficial effects on the Apgar scores. Herewith, we may only speculate that music therapy would have favorably affected either the mother and therefore the baby, or directly the baby itself.

The flow of nociceptive information in the perioperative period has a bi-phased character. The
first phase is directly connected with nociceptive stimulation that accompanies injuries brought about by surgical procedures. The second phase, manifesting itself in the postoperative period, is the result of inflammatory responses related to this injury and is caused mainly due to central sensitization. Accordingly, pre-emptive analgesia is based on two general approaches; block of sensory conduction using local anaesthetics before incision (30-35) or prevention of central excitability using opioids (26,32,36) or a NMDA receptor antagonist. (31) Both approaches have been shown to produce some clinical benefit in several studies.(26,30-32,35,36) We believe that music therapy may exert its favorable effects via inhibiting this mechanism of central sensitization.

Pain reducing effects of postoperative or intraoperative music therapy has been reported in earlier studies.(16,37-40) Auditory stimuli may modulate human response to stress and the proposed explanation may comprise issues of control and distraction. Uncomfortable or unfamiliar environment, loss of control, and fear of disfigurement, all may be attenuated by the distracting and calming effects of music.(17) It has been suggested that pain and auditory pathways inhibit each other; thus the activation of the auditory pathway may play role in inhibiting the central transmission of nociceptive stimuli.(17)

The most important disadvantage of our study is that we had to use general anaesthesia. The conclusion may have been different if we can give the musical therapy to the patients preoperative and intraoperative under regional anaesthesia. But our studying group patients generally preferred general anaesthesia then regional anaesthesia.

CONCLUSION

To summarize, in the light of our first and preliminary findings, we conclude that music therapy-a simple and convenient method with no untoward effects- given before the surgery decreases postoperative pain and analgesic requirement. Keeping in mind the adverse effects of various drugs otherwise used in postcesarean pain management, further research on several dimensions of music therapy is necessary for better health of the mother and the newborn. Last but not least, this way music therapy can become an integral part of a multimodal analgesic regimen for patients undergoing surgery.

REFERENCES