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Case Report

Receptive music therapy as an intraoperative aid for neuro-monitoring during growth rod surgery in a 5-year-old girl with severe congenital scoliosis: A case report

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ABSTRACT

Neuromonitoring with sensory and motor evoked potentials is an essential tool during spinal correction surgeries to prevent any unforeseen cord injury intraoperatively and neurological deficit in the post-operative period. The muscle contraction and twitches resulting from cortical stimulation with a 200-250mA current are picked up by various subcutaneous/intradermal electrodes placed in the arms, hands, and legs creating a real-time assessment of any spinal cord injury caused by spinal implants or corrective maneuvers. During the neuromonitoring phase most anesthetic drugs such as volatile agents, neuromuscular blockers, and propofol may cause an interference with the electrode signals and therefore cannot be used. This could lead to significant risk of intraoperative awareness. Cases of intraoperative awareness have led to medical negligence and such incidents are the cause for 2% of the legal claims against anesthetists while patients with intraoperative awareness experience describe it as the worst thing they have ever suffered from. We therefore decided to use receptive music therapy, a novel aid in reducing chances of awareness during neuromonitoring.

1. Introduction

Scoliosis correction surgery in the children entails major blood loss, positioning challenges, and the use of certain monitoring techniques that requires using minimal anesthetic drugs during certain periods. The anesthesiologist faces the challenge of maintaining anesthesia while preventing perception of any awareness and pain during the duration of neuromonitoring. Cases of intraoperative awareness[1] have led to medical negligence and such incidents are the cause for 2% of the legal claims against anesthetists while patients with intraoperative awareness experience describe it as the worst thing they have ever suffered from. Neuromonitoring with sensory and motor evoked potentials is an essential tool during spinal correction surgeries to prevent any unforeseen cord injury intraoperatively and neurological deficit in the post-operative period. The muscle contraction and twitches resulting from cortical stimulation with a 200-250mA current are picked up by various subcutaneous/intradermal electrodes placed in the arms, hands, and legs creating a real-time assessment of any unforeseen spinal cord injury. Most commonly used anesthetic drugs such as volatile agents, neuromuscular blockers, and propofol result in an interference with the electrode signals leading to an inaccurate response and an incorrect assessment of cord injury.

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Music Therapy[2] is the use of musical interventions to achieve non-musical goals such as a reduction in heart rate and blood pressure, and pain perception and anxiety. Our aim was to use music therapy to provide additional intraoperative sedation, reduce anxiety of unforeseen awareness and pain management during the neuromonitoring phases of the scoliosis correction surgery. Receptive music therapy is a form of passive listening to musical pieces to achieve comfort, calmness and sedation.

2. Case Report

A five-year old, healthy and active girl weighing 15kg, presented to the orthopedics department with progressive, severe congenital scoliosis (Figure 1), Cobb's angle of 90 degrees (Figure 2) and left rib cage impinging on the left pelvis. She had no breathing difficulty or any respiratory compromise, but complained of pain in left side of pelvis while standing for long hours. Motor power in both lower limbs was 4/5 and 5/5 in both upper limbs. A corrective surgery with growth rod to prevent further respiratory compromise and abnormal gait was planned.

Fig. 1: Scoliotic deformity in the 5 year old child

The pre-anesthesia work up was planned keeping in mind the long duration surgery and anesthetic requirements. She was cheerful and cooperative during the history taking and physical examination and it was her love for music and dance that provided us the opportunity to use music therapy as an additional aid for maintenance of anesthesia. Her father provided us with a playlist of her favorite songs, which was going to be used to provide receptive music therapy during the surgery using ear phones and the volume

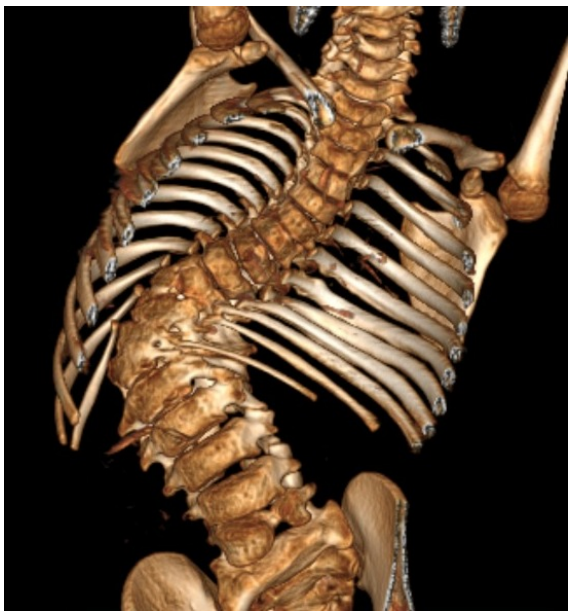

Fig. 2: Severe scoliosis- Cobb's angle 90 degrees

was set at 65 decibels by a standard sound level meter, compatible with prolonged listening without hearing risk.[3] All routine investigations were normal and included a room air ABG to ascertain PaO2 of 122 mmHg and PaCO2 of 36 mmHg, and C-Xray which revealed left mediastinal compression. After taking informed high-risk consent and arranging blood products and a PICU bed with ventilatory support, she was shifted to the OT for growth rod surgery under general anesthesia with neuromonitoring.

All routine monitors were attached after sedating the child with IV fentanyl 40 mcg and induction with IV propofol 2mg/kg and Isoflurane was started at 2%. A short muscle relaxant succinylcholine 1mg/kg was used for intubation since the neuromonitoring team needed to assess the baseline amplitude of the twitches in the supine position before making the patient prone. The child was intubated with a 5.5 mm flexometallic cuffed ETT, and after confirming ETCO2 and checking ventilation, tube was fixed at 15 cm at angle of mouth and an oral pack was placed. The earphones were attached to the mobile phone with playlist of her favorite songs and decibel volume was confirmed. They were placed inside the tragus of the child and cushioned with cotton pads from outside to prevent fall out and music was started to prevent chances of intraoperative awareness. Bispectral index forehead electrodes were attached followed by neuromonitoring electrodes which were applied to the head, arms and legs (Figures 3 and 4).

Dexmedetomidine infusion was started at maintenance rate of 0.5 mcg/kg/hour along with receptive music therapy. Isoflurane was switched off, and low flow anesthesia maintained with 50:50 O2:N2O to prevent any latency in the electrode signaling. Patient's heart rate and blood

Fig. 3: Neuromonitoring electrodes applied to the child

Fig. 4: Ear phones applied to the patient for receptive music therapy

pressure were maintained in the same range post induction with no evidence of any tachycardia or tubal response without isoflurane, muscle relaxant or propofol while we achieved a near awake state with a BIS of 68 using receptive music therapy (that included her playlist of 100 favorite songs). Once adequate sensory and motor evoked responses were picked up, the child was made prone after giving a small bolus of propofol. The surgery lasted for 8 hours out of which nearly 4 hours of neuro-monitoring was needed. During these 4 hours of neuromonitoring phase, BIS was maintained between 60-70) to achieve adequate evoked potential response, and anesthesia was maintained with receptive music therapy and a lower dose of dexmedetomidine infusion at 0.2 mcg/kg/hr maintenance infusion for intravenous sedation is 0.2-0.7mcg/kg/hr). The HR and BP was maintained within normal limits throughout the surgery with no evidence of tachycardia or hypertension, suggestive that the response to awareness and surgical pain was curtailed while receptive music therapy was being used and anesthetic drugs were minimized for neurological assessments.

The surgery was carried out uneventfully with a blood loss of 850 ml which was replaced by crystalloid and one unit of PRBC. The child was shifted to Pediatric ICU for monitoring. To evaluate pain and distress in mechanically ventilated and sedated PICU patients, van Dijk et al[4] validated the COMFORT behaviour scale (CBS), an observational tool developed from pre-existing COMFORT scale.[5] The CBS consists of six items: alertness, calmness, respiratory response for ventilated children or crying for spontaneously breathing children, physical movement, facial tension, muscle tone. Each item has five response options rated from one to five, describing the different intensities of the single studied behaviour. It also measures additional parameters, such as muscle tone and level of agitation. The scores of the CBS are divided into three ranges: excessively sedated (score between 6 and 10), adequately sedated (score between 11 and 22), under-sedated (score between 23 and 30). Our patient's comfort behavior score in PICU was 22, and she was extubated 2 hours later. Once she was fully awake, she was found to have a VAS score of 3/10 with stable vitals. The child was questioned about any anesthesia awareness, but she gave no recollection of the OT time and her father continued with the receptive music therapy in the post operative period as well.

3. Discussion

Music based interventions can be used in different ways to produce non-musical goals in patients in a hospital setting. The scientific basis of the effects of music therapy was the subject of several neurophysiology studies; the results of which established some evidence particularly on the effect of music on hormonal secretions and nociceptive reflexes.[6,7] The psychological and therapeutic effects of listening to music occurs due to the release of mood elevators and reward neurochemicals like dopamine, serotonin and oxytocin thereby enhancing neuroplasticity and helping patients cope with stress.[8–11]

Surgery and anesthesia are generally unpleasant experiences for patients and are the source of stress and anxiety that can hinder the desired therapeutic goal.[12,13] Music Therapy has been used for reducing anxiety[14] in the operating room for procedures under regional anesthesia and also to reduce the post-traumatic stress induced post-surgery. Several experimental studies have evaluated the effects of music therapy in improving the quality of

perioperative care.[15]

Our aim was to use music therapy to provide additional intraoperative sedation, reduce anxiety and hemodynamic disturbances due to unforeseen intraoperative awareness and pain management during the neuromonitoring phases of the scoliosis correction surgery. Receptive music therapy is a form of passive listening to musical pieces (familiar or as decided by the therapist) to achieve comfort, calmness and sedation.

Jayaraman et al. also confirmed the beneficial effects of music therapy on patient satisfaction. Music therapy improves satisfaction directly by its relaxing effect, and indirectly through its effects on other dissatisfaction factors such as perioperative pain and stress and postoperative nausea and vomiting. This effect is seen essentially when the music used is chosen by the patient.[15] They also analysed the effects of calming and relaxing music on 111 patients who underwent laparoscopic surgery for gallstones. Patients were randomly divided into two groups with or without music therapy. The intensity of pain measured

Our patient was also asked to choose the kind of songs she liked, and this playlist was created by her father one day before surgery, to aid in the maintenance of anesthesia and the use of preferential (familiar) music during anesthesia has been reported before.[3,15] We also observed a reduced VAS score with lower opioid requirements for pain management in the post-operative period.

Another beneficial effect of music therapy was intraoperative hemodynamic stability as evidenced by Binns-Turner et al. who demonstrated this effect on the hemodynamic profile especially for mean arterial blood pressure.[16] In our case we observed similar findings, a better hemodynamic stability and heart rate control, despite the lack of inhalational agent and neuromuscular relaxation during the neuromonitoring phase. The requirement of dexmedetomidine was also reduced with the use of receptive music therapy which was beneficial for the neuro-monitoring team as they needed a near normal MAP at the time of assessments.

4. Conclusion

In surgeries with neuromonitoring, music therapy as a non-pharmacological, in-expensive and noninvasive technique can significantly improve perioperative outcomes by reducing pain, anxiety and maintaining stable hemodynamics along with a reduction in intraoperative awareness.

5. Source of Funding

None.

6. Conflict of Interest

None.

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