



The influence of music during mechanical ventilation and weaning from mechanical ventilation: A review



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ABSTRACT

Mechanical ventilation (MV) causes many distressing symptoms. Weaning, the gradual decrease in ventilator assistance leading to termination of MV, increases respiratory effort, which may exacerbate symptoms and prolong MV. Music, a non-pharmacological intervention without side effects may benefit patients during weaning from mechanical ventilatory support. A narrative review of OVID Medline, PsychINFO, and CINAHL databases was conducted to examine the evidence for the use of music intervention in MV and MV weaning. Music intervention had a positive impact on ventilated patients; 16 quantitative and 2 qualitative studies were identified. Quantitative studies included randomized clinical trials (10), case controls (3), pilot studies (2) and a feasibility study. Evidence supports music as an effective intervention that can lessen symptoms related to MV and promote effective weaning. It has potential to reduce costs and increase patient satisfaction. However, more studies are needed to establish its use during MV weaning.

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Introduction

Initiation of mechanical ventilation (MV) to treat acute respiratory failure is a lifesaving intervention. Causes of acute respiratory failure include pulmonary disease, neuromuscular disease, shock, and major surgery.¹ Recent estimates have found that over half of all ICU patients require MV.² An estimated 800,000 patients undergo MV in the U.S. each year with a cost of approximately \$27 billion.¹ On average, patients who receive MV stay 4 days longer in the ICU and an additional 6 days in the hospital compared to ICU patients who do not.³

Generally, as patients recover from acute illness, they can be “weaned” from ventilatory support. Weaning is a gradual decrease in ventilator settings that leads to termination of MV support.⁴ Successful weaning depends on respiratory muscle strength, adequate respiratory drive, acid base balance, neurological status, as well as psychological readiness.^{5–7} Nationwide, the mean number of ventilator days is 5.6, but 5–20% of intubated patients

require support for at least 21 days.^{3,8} Delays in extubation can be due to severe respiratory muscle deconditioning, poor nutrition, upper airway edema, and decreased level of consciousness secondary to over-use of sedative medications.⁹ Extubation failure can lead to ventilator-associated pneumonia, airway trauma, increased costs and high mortality rates.¹⁰ Patients who require MV for greater than 3 weeks account for more than 50% of total ICU costs.¹ MV and MV weaning lead to an array of distressing symptoms such as pain, agitation, lack of sleep, and especially anxiety.¹¹ Unmanaged anxiety stimulates the sympathetic nervous system, increases work of breathing and fatigue, and severely impedes ventilator weaning⁴; it can be particularly severe for the ventilated patient, and, if not treated promptly, can increase recovery time and patient mortality.^{12,13}

Current symptom management practice for patients receiving ventilatory support primarily involves the administration of numerous sedative and analgesic medications which can prolong ventilation and increase length of ICU stay.^{11,12} Overuse of these medications can lead to fatigue, delirium, muscle weakness, and post-traumatic stress disorder (PTSD).¹⁴ However, sedative administration is only one symptom management strategy used to help alleviate anxiety. A number of integrative, non-pharmacological interventions have been shown to be beneficial

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for anxiety symptom management in non-ICU patients such as music, imagery, massage, and animal assisted therapy.¹¹

Music intervention is the non-pharmacological, integrative therapy of interest in this review; it has been shown to decrease anxiety during MV.¹⁵ Decreasing anxiety could help promote more efficient ventilator weaning and hasten ICU discharge. This is significant in that “even nominal decreases in length of time spent in the ICU or the duration of mechanical ventilation have the opportunity to significantly reduce hospitalization costs.”^{3(p1271)} Incorporating music into the care of the ventilated patient has strong potential to alleviate the symptom burden and the high cost of conventional treatments as well as increase patient satisfaction and promote efficient weaning.^{4,11,16,17}

The purpose of this narrative review was to describe the state of the science on music as an integrative intervention during MV and ventilator weaning, and to identify current gaps in knowledge regarding use of music intervention for symptom management, specifically during weaning. This review provides an evidence-based background for music intervention and supports the need for future studies on music intervention during weaning.

Background

Weaning from mechanical ventilation

The weaning process involves a gradual decrease in ventilator settings as a patient’s respiratory status improves, leading to termination of MV support.⁴ As the acute cause of respiratory failure resolves and the patient can tolerate independent respirations, the artificial airway is removed.^{9,10,18} For some, weaning can be a lengthy process. Recent estimates state that more than 40% of the total duration of MV is spent enduring the weaning process.⁶ While advancements in ventilator management protocols have been made, a universal protocol to determine readiness to wean based on strict physiological measures has not been established.¹⁰ It has been predicted that patients’ subjective perceptions of weaning may strongly influence weaning outcomes, but the extent of their role in successful outcomes remains unclear.¹⁹ Most weaning guidelines require a formal assessment of readiness to wean before beginning weaning trials. Weaning trials generally require a patient to tolerate spontaneous respirations for at least 30 min. A patient is usually ready for extubation after two or more successful weaning trials. If a patient fails a weaning trial, extubation is not safe and weaning is continued. Up to 20% of ventilated patients experience extreme weaning difficulty and cannot be extubated.^{6,8,10}

Extubation failure is the inability to sustain spontaneous breathing after removal of the artificial airway with the need for reintubation within 24–72 h.⁹ Extubation failure can lead to airway trauma, ventilator-associated pneumonia, gastrointestinal bleeding, and blood clots. It can increase costs, result in longer ICU stays, and increase morbidity and mortality.^{6,9,10} It has been estimated that extubation failure occurs at least once in up to 47% of mechanically ventilated patients.⁹ Timely, effective weaning is critical to decreasing the personal and economic cost of MV and extubation failure.¹⁹

Anxiety during mechanical ventilation and ventilator weaning

Anxiety, a state marked by dread, fear, apprehension, increased motor tension and autonomic arousal, is a major psychological stressor with harmful physical manifestations that are often experienced during MV and ventilator weaning.^{17,20} High stress and anxiety levels in mechanically ventilated patients have been associated with increased patient morbidity and mortality.^{15,21} Up to 85% of ventilated patients experienced anxiety,¹³ and 60% of those

patients reported feeling scared most of the time.²² Sustained high levels of anxiety activate the sympathetic nervous system, which causes an increase in heart rate, blood pressure, and respiratory rate, and initiates an unfavorable neurohormonal response.^{23–25} Arousal of the sympathetic nervous system can cause serious complications including arterial and venous constriction, myocardial stimulation, and bronchoconstriction.²³ Arterial and venous constriction in the lungs severely impedes the ability to oxygenate tissues effectively,²⁶ which increases the work of breathing, induces fatigue, and can extend the need for MV.⁷

Weaning requires increased respiratory effort and can further exacerbate anxiety and its manifestations. If patients are not properly educated and encouraged during weaning, they may feel increasingly anxious, which can lead to increased dyspnea, panic, and a fear of abandonment as ventilator support is decreased.^{7,19} It has been shown that patients who did not wean successfully reported more fatigue, dyspnea, and less weaning self-efficacy.¹⁹

Symptom management with sedative medications

Nurses are responsible for ICU patient symptom management. Current practice to alleviate distressing symptoms involves the administration of sedative and analgesic medications which can lead to prolonged ventilation and increased lengths of ICU stays.^{11,12,17} At times, medication is necessary to facilitate patient comfort, safety, and promote recovery.²⁷ However, these highly potent medications can contribute to a multitude of complications such as fatigue, weakness, delayed weaning, and PTSD.¹⁴ Indeed, many side effects have been associated with sedative agents such as hypotension, increased risk for ventilator-associated pneumonia, and delayed ventilator weaning.^{28–33} Overall, deep pharmacological sedation during MV increases patient morbidity. A strong correlation exists between continuous sedation and prolonged ICU stays, increased rates of organ failure and reintubation.^{28,34} Over-sedation with continuous infusions can greatly alter routine neurologic assessments which may lead to the ordering of unnecessary costly diagnostic exams (i.e., CT scans, MRIs).³⁴ Sedative agents can cause severe short-term and long-term issues with memory and cognition.

There is growing evidence supporting the notion that mechanically ventilated patients can benefit from an increased awareness of their surroundings.³⁴ Recent studies indicate that patients who were most awake and aware of their surroundings during MV had the lowest PTSD-like symptoms after hospital discharge.³⁴ Continuous high doses of sedative medications can cause severe long-term psychological damage such as continued anxiety post-ICU discharge, depression, and paranoid delusions.²⁸ Neurological impairment from sedatives can necessitate reintubation and negatively impact the weaning process.⁹ Continuous sedation is a major risk factor for extubation failure.⁹ Integrative therapies such as music, in addition to sedative and analgesic medications, can synergistically enhance comfort and relaxation during MV.¹¹

Symptom management with music intervention

Music is a non-pharmacological intervention that integrates physiological and psychological components to reduce stress and anxiety and promotes overall well-being.^{23,24} Music intervention can abate the stress response, decrease anxiety during MV, and induce an overall relaxation response by reducing stimuli that cause stress, synchronizing body rhythms such as breathing and heart rate, and by positively influencing emotional feelings of the listener.³⁵ This relaxation response can lower cardiac workload and oxygen consumption, which promotes more effective ventilation

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