

Music as Medicine: The Therapeutic Potential of Music for Acute Stroke Patients

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Nurses caring for patients with acute stroke are likely to administer both music and medication with therapeutic intent. The administration of medication is based on accumulated scientific evidence and tailored to the needs of each patient. However, the therapeutic use of music is generally based on good intentions and anecdotal evidence. This review summarizes and examines the current literature regarding the effectiveness of music in the treatment of critically ill patients and the use of music in neurologically injured patients. The rationale for hypothesis-driven research to explore therapeutic music intervention in acute stroke is compelling. (*Critical Care Nurse*. 2016;36[2]:e1-e7)

“Music hath charms to soothe the savage breast.”
W. Congreve, *The Mourning Bride*

Music has long been used in health care for its healing powers and has given rise to the practice of music therapy. The American Music Therapy Association defines music therapy as the “clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program.”¹ Board-certified music therapists employ customized music therapy interventions based on the best evidence from published literature, their training and expertise, and the needs of the patient.¹ Music therapy is powerful, physically noninvasive, and can mediate positive outcomes when

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1. Differentiate between music as a therapeutic intervention and music therapy
2. List strategies to promote the use of music as a therapeutic intervention
3. Identify gaps in the current literature that require nursing research

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interventions are directed to reduce pain, anxiety, stress, and depression.²⁻⁸ Music is often employed as an ambient or adjunct tool during medical procedures and for chronic pain management. However, no consensus has been reported regarding protocols for listening to music, its effectiveness in certain procedures, and which type of music is most effective. Furthermore, distinct differences are apparent between music-supported therapy (use of musical instruments in motor rehabilitation therapy),⁹ music as a therapeutic intervention (eg, music listening to affect vital signs, changes in analgesia),¹⁰⁻¹² and formal music therapy, which can be provided only by a music therapist.¹ Nonetheless, nurses and family members often play music with therapeutic intent in the presence of the patient.¹³

Following acute stroke, patients with severe brain injuries may benefit from mechanical ventilation to prevent secondary injury by providing airway protection and to ensure adequate oxygenation. Mechanical ventilation may also facilitate short-term goals to reduce brain swelling with the use of sedative, osmotic, or vasoactive medication therapy to reduce intracranial pressure¹⁴ and augment blood pressure.¹⁵⁻¹⁷ Patients with acute stroke who are receiving mechanical ventilation are often given sedative and hypnotic medications to prevent self-harm, facilitate nursing, and minimize their memory of the unpleasant experience of being intubated.¹⁸ However, oversedation of acute stroke patients may affect neurological performance on assessment examinations and result in inaccurate measures of

progress or deterioration. Care providers are constantly balancing the use of sedatives to keep patients comfortable with the need for minimal impact on their neurological state. Therefore, identifying nonpharmacotherapeutic interventions that help reduce anxiety and stress would markedly help staff caring for acute stroke patients to obtain a more precise assessment of their status, which could lead to the administration of appropriate interventions, decreased length of stay, and promotion of long-term recovery.^{19,20}

Music reduces postoperative pain, agitation, and narcotic requirements for critically ill cardiovascular and medical-surgical patients.²¹⁻²⁶ Although playing music has been associated with lower anxiety, pain, and agitation in patients undergoing mechanical ventilation,^{3,5,7,27-30} few studies have addressed the effect of music on patients with acute stroke in critical care.³¹⁻³³ The goal of this review is to explore the utility of music intervention as a means to influence outcomes in acute stroke patients.

Music and the Environment of Care

Nurses have long been recognized for their role in maintaining the environment of care³⁴ and establishing the therapeutic milieu to provide calm and foster optimal healing.³⁵ Milieu therapy, which includes controlling the levels of audio and visual stimulation the patient receives, promotes rest and sleep in neurocritically ill patients.³⁶⁻³⁸ A recent neurocritical care practice survey¹³ indicates that nurses and physicians often play music or turn the television on or off with therapeutic intent, despite a lack of best practice guidelines. Nevertheless, it has been demonstrated that music therapy can affect electroencephalographic brainwave activity, which is closely related to cerebral brain function.^{39,40} Playing music with a beat of roughly 60 to 66 beats per minute, such as classical baroque music,⁴¹ helps produce alpha waves in the brain⁴² and a state of relaxation, alertness, and meditation. Music was described in 1946 as an intervention that could alleviate pain and anxiety related to being in an intensive care unit (ICU) and reduce length of stay and sleep deprivation by providing a more patient-friendly ICU environment.⁴³ Furthermore, research on the use of relaxing music in the operating room, ICU, and critical care areas has been done before.^{21,40,44}

Chlan and Tracy⁴⁵ reported that allowing critically ill patients to choose the music played for intervention and providing uninterrupted listening periods gave patients

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an enhanced sense of control. Music therapy delivered by trained music therapists was associated with lower stress, as measured by lower apical heart rates and elevated peripheral temperatures, and lower incidence of complications compared with no music in patients with acute myocardial infarction.²² However, a recent Cochrane review noted that the majority of trials that used music as the main intervention did not use a trained music therapist.²⁶ Good²³ reported that playing music for patients was associated with a reduction in postoperative pain. In a review article examining music as a therapeutic intervention in the ICU, Chlan²⁹ reported that a majority of patients who receive mechanical ventilation experience some stress and anxiety, and although the use of music has the potential to benefit these patients by reducing anxiety, evidence to support music as a therapeutic intervention for a diverse group of patients is inadequate.

In a Cochrane review of music therapy for acquired brain injury published in 2010, 7 studies of music therapy for stroke patients were considered (N = 184).³¹ Notably, the participants in these studies were described as not having acute stroke and not being cared for in the ICU.³¹ A 2014 Cochrane review of music therapy for patients receiving mechanical ventilation reported on 14 studies.¹² Of these, 1 study⁴⁶ included only 3 patients with neurological injury and showed no benefit of listening to music for those patients. However, the review indicated that on average, music listening had a large and clinically significant effect on anxiety, causing a reduction of 1.1 standard deviation units more than in the standard care group (95% CI, -1.75 to -0.47, $P < .001$).¹² Because the meta-analysis performed revealed that music listening may reduce physiological responses, including the respiratory rate and systolic blood pressure, in addition to reducing anxiety in critically ill patients receiving mechanical ventilation, the authors recommend that music listening be offered as a stress management intervention.¹² However, they acknowledge that further studies including music therapists and using a randomized clinical trial design are needed to determine if and how music influences the environment of care.¹²

Music and Critically Ill Patients

A growing body of literature examines the utility of playing music to reduce anxiety and stress during critical illness.^{3,21,22,26,27,32} The use of music reduced postoperative pain sensation and distress 2 days after the procedure in

89% of patients who had undergone abdominal surgery, compared with control patients who did not have music played for them.²³ Studies that used music interventions in patients with myocardial infarction have consistently shown that music induces anxiety-reducing effects, with a mean anxiety reduction of 5.87 units on a scale of 20 to 80 units ($P < .001$).²⁶ One study⁴⁷ examined the effect of a 20-minute uninterrupted music intervention, versus 20 minutes of uninterrupted rest, in both intubated and nonintubated patients. Music intervention significantly decreased heart rate ($P < .05$), systolic blood pressure ($P < .05$), respiratory rate ($P < .05$), bispectral index ($P < .01$), agitation measured by the Richmond Agitation-Sedation Scale ($P < .05$), and pain measured by the Numerical Rating Scale ($P < .01$) in both intubated and nonintubated patients compared with patients who got rest only.⁴⁷ Thus, the use of music has been demonstrated to reduce postoperative agitation and narcotic requirements for critically ill cardiovascular and medical-surgical patients.^{23,26} A recent multicenter randomized clinical trial provides additional evidence that playing music is associated with lower anxiety, sedation intensity, and sedation frequency compared with usual care and noise ablation in patients undergoing mechanical ventilation.²⁷ However, the study excluded patients who could not provide self-consent (ie, stroke patients receiving mechanical ventilation).²⁷ Music has been associated with decreased anxiety, pain, and agitation in patients receiving mechanical ventilation.^{3,5,7,27-30} However, few studies have examined music intervention for patients with acute stroke in critical care.³¹⁻³³

The use of music reduced postoperative pain and distress in 89% of patients after abdominal surgery.

Stroke patients transition early, and often, to receive rehabilitation.⁴⁸ Stroke patients are also at higher risk of emotional, cognitive, and consciousness disorders. Results from the Healthy Ageing and Intellectual Disabilities study in the Netherlands demonstrated that anxiety and depression were common following illness.⁴⁹ Moreover, anxiety and depression are both prevalent in rehabilitative care and may limit recovery.⁵⁰⁻⁵⁴ Anxiety manifests in 2 ways: emotional symptoms, such as fear and worry, and physical symptoms, such as dry mouth, dizziness, increased heart rate, sweating, rapid breathing,

Role of Music in Stroke Rehabilitation

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and possibly fatigue.⁵⁵ Depression is a disorder that has been characterized by low mood or loss of interest in things that once one found enjoyable, both of which affect the activities of daily living.⁵⁶

It has been demonstrated that music-supported therapy can induce changes to the brain, or plasticity, and cause the activation of the auditory-motor circuits that improve motor skills after acute or chronic stroke.⁹ The analysis of structural magnetic resonance imaging data of patients who listened to music for 6 months after stroke revealed an increase in the gray matter volume and reorganization in the frontal areas of the brain (left and right superior frontal gyrus and the middle frontal gyrus) that enhanced the recovery of verbal memory, focused attention, and language skills.⁹ Emotional effects induced by music learning, performing, and listening could engage reward-learning networks and corresponding neurotransmitter systems^{57,58} that help to consolidate new information and increase the likelihood of voluntary practicing of new movements.

Music has shown promise as an adjunct to treatment, and specific elements of music have been linked to significantly higher rates of positive emotion.^{45,58} For example, patients given music therapy experienced lower anxiety and a higher level of satisfaction with care provided, compared with patients who did not receive music intervention.^{45,59} Music therapy improves executive functioning and eases the adjustment to rehabilitation in patients with traumatic brain injury.^{60,61} Recently, it was reported that music listening significantly enhanced

Music therapy may help to maintain a positive outlook in stroke patients who are undergoing rehabilitation therapy.

cognitive functioning in verbal memory

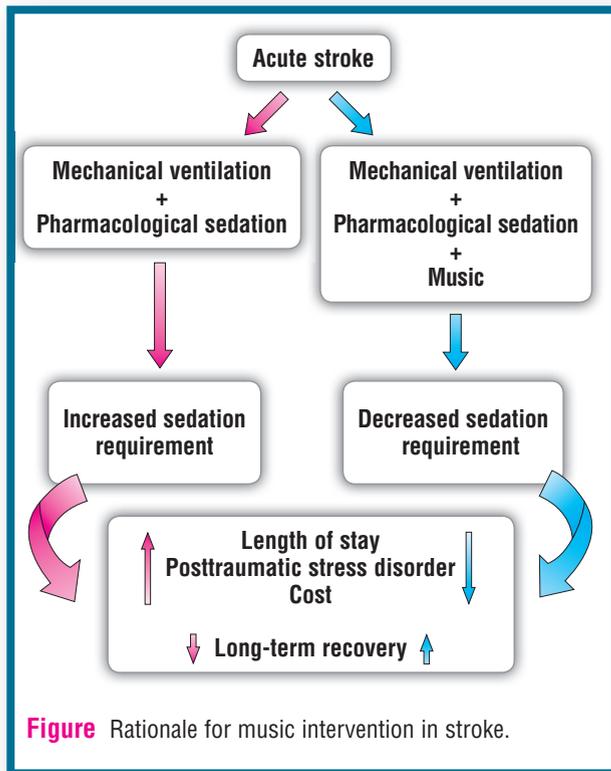
and focused attention ($P < .01$ and $P < .05$, respectively, mixed-model analysis of variance), and decreased depression and confusion (both $P < .10$, 1-way analysis of variance), or positive emotion, in patients after middle cerebral artery stroke compared with control participants.⁶² It is often difficult to maintain a positive attitude when experiencing sudden life-changing events, which is especially true for patients who are emergently admitted to the ICU. Improving patients' mood is also important because it may affect the patient-care partner relationship following discharge.⁶³ In a study of music and patients' mood that used a single subject design, Magee and Davidson⁶ used the Profile of Mood States instrument

in a cohort of 14 patients (4 with stroke, 5 with multiple sclerosis, and 5 with traumatic brain injury) and reported that composed-anxious, energetic-tired, and agreeable-hostile mood states were significantly improved from before to after a music therapy intervention. Thus, it is reasonable to consider that music therapy may also help to maintain a positive outlook in other neurologically injured stroke patients who are undergoing rehabilitation therapy.

Is Music Beneficial to the Recovery of Acute Stroke Patients?

Following primary brain injury caused by a cerebrovascular event (eg, stroke), the focus of care during the acute phase is the prevention of secondary brain injury.⁶⁴ Improving and maintaining adequate cerebral perfusion is a chief concern. Therefore, severely injured acute stroke patients may benefit from mechanical ventilation to protect the airways and ensure adequate aeration of the lungs and oxygenation of the blood. Mechanical ventilation may also facilitate short-term goals to reduce brain swelling that may involve the use of sedative, osmotic, or vasoactive medication therapy to reduce intracranial pressure¹⁴ and increase blood pressure.¹⁵⁻¹⁷ Additionally, patients may require a host of supportive therapies such as nutritional support and antibiotic therapy. Prevention of complications associated with an ICU stay (eg, deep vein thrombus prophylaxis) is also a key factor in acute phase recovery.⁶⁵⁻⁶⁸

Patients with acute stroke who are undergoing mechanical ventilation are often given sedative and hypnotic medications to prevent self-harm, facilitate nursing and medical care, and blunt their memory of what is an unpleasant experience.¹⁸ Simultaneously, stroke patients require frequent neurological examinations to monitor for deterioration. Thus, one must ensure that any change in findings on the patient's neurological examination is not due, in whole or in part, to medication therapy (eg, oversedation causing a decreased level of consciousness). This situation creates a conundrum wherein staff must balance the use of sedative and hypnotic medications with the need to minimize the use of medications that could affect the findings on the neurological examination.⁶⁹ Hence, although it is true that anxiolysis and sedation can be accomplished solely by the use of medications, nonpharmacotherapeutic interventions that reduce anxiety have the potential to reduce length of



stay and posttraumatic stress disorder, decrease the cost of care, and promote long-term recovery.^{19,20} Given that music, as therapy, is effective in reducing agitation in a diverse patient population, the potential exists that the therapeutic use of music may have similar benefit for patients with cerebrovascular illness (see Figure). If beneficial, this low-cost, low-technology therapy may be used to reduce the use of sedatives and help in resolving the sedation assessment conundrum.

Although advantageous to the recovery of critically ill patients, the use of music as an intervention has not been studied extensively in acute stroke patients. However, a variety of independent studies provide insight regarding how music may benefit critically ill, acute stroke patients. Listening to music has been associated with neuronal recovery.^{33,70,71} Soothing music was associated with improved self-reported sleep quality in a study of 28 ICU patients.²⁵ Participants who listened to 45 minutes of music at nocturnal sleep time had shorter stage N2 non-rapid-eye-movement sleep, where brain waves become slower and more synchronized, and longer N3 (deeper) sleep in the first 2 hours of nocturnal sleep, improved self-reported sleep quality, and significantly lower heart rates compared with the control group ($P < .003$).²⁵ During anesthesia for surgical procedures,

music was beneficial for recovery and reducing the stress response.^{72,73} Postoperative patients exposed to music in combination with therapeutic suggestions required less rescue analgesia, experienced more effective analgesia, and at discharge were less fatigued than were control participants.⁷² In a randomized controlled trial designed to evaluate the influence of intraoperative and postoperative music therapy on stress and the immune response, researchers reported a significantly greater decrease in the level of cortisol, a stress hormone, in the urine of the patients who had music therapy after 2 hours in the postanesthesia care unit.⁷³ Furthermore, the postoperative music group required significantly less morphine than did the control group, but the level of immunoglobulin A, blood glucose, blood pressure, heart rate, and oxygen saturation did not differ significantly between the groups.⁷³ The protocol of 1 study⁷⁴ ensured that 99% of patients identified with delirium were exposed to music administered by a nurse daily. However, no attempt was made to measure the impact of this intervention on patients' outcomes.⁷⁴

Interest in music as a therapeutic intervention in the ICU has been steadily increasing. Thus far, research studies rarely include patients with acute stroke. Moreover, while the effect of playing music for patients in the ICU has resulted in what would be considered favorable outcomes, such as decreased stress, anxiety, and pain, formal examinations have failed to measure the impact of music interventions on neurocritically ill patients' outcomes.³ Despite the lack of an evidence-based consensus for music as therapy for critically ill stroke patients, music interventions are being implemented every day by nurses, physicians, and family members who are trying to optimize care.^{12,13} The Coma Cue-Response framework provides a rationale for determining which interventions aid in recovery from brain injury and prevention of secondary brain injury, as well as providing an understanding of those interventions.⁶⁴ If an intervention, such as playing music, listening to music, or music therapy actually affects patients' outcomes, then that impact must be determined. Only upon doing so can the effect of the particular intervention be controlled as we explore supplementary interventions.

Future Directions and Considerations

Given recent studies that highlight the power of non-pharmacological music intervention in reducing anxiety

in critically ill ICU patients,^{27,29,31} it is reasonable to test the translation of music as an intervention in the acute stroke population. Future studies should be designed with rigor using music interventions that are known to be effective in other populations, such as music therapy. Future goals should be to determine the effectiveness of the music intervention, identify which music genre or type should be used for which indication, dose (duration of exposure to music), and frequency of dosage. Results from these studies will help to empirically determine if music intervention can reduce anxiety, pain, and ultimately sedative exposure, in acute stroke patients who are critically ill or undergoing rehabilitation. If music is proven to be an effective intervention for acute stroke patients, resulting in improved outcomes, including reduced ICU stay and decreased recovery time, then individualized music therapy may be incorporated into the standard of care for stroke patients. **CCN**

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None reported.

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To learn more about music therapy, read "Does Music Ease Pain and Anxiety in the Critically Ill?" by Chlan and Halm in the *American Journal of Critical Care*, November 2013;22:528-532. Available at www.ajconline.org.

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