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Review Article

Music in medicine: An overview

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ABSTRACT

Music in medicine is in use in various medical areas like neurological disorders, developmental abnormalities, psychiatric disorders, addictive disorders, terminal disorders, etc besides perioperative care. Music in perioperative care is aimed at reducing anxiety, stress, and fear besides decreasing postoperative pain. The authors (first two) have experience in the use of pre-recorded music medicine in perioperative patient care. Preoperative music is mainly used to reduce patients' anxiety, stress, and fear. The use of intraoperative music is controversial in surgical procedures under general anesthesia. Postoperative music, in general, is beneficial for pain management. This write-up provides an overview of published information on music in medicine, including historical and in particular perioperative care in anesthesia practice including use in cesarean section delivery. We searched PubMed and PubMed Central besides google search on "music in medicine" up to March 2022. There was no language restriction. Almost all present studies were conducted by listening to pre-recorded music, mostly via headphones. This work indicates that music in medicine, in particular music therapy, has been in use since ancient times (before the common era) and is presently incorporated intermittently in perioperative care. Music in medicine may have a beneficial effect on perioperative care. Music is inexpensive, easily administered, and without adverse effects, and can serve as a complement for reducing perioperative stress and pain besides its beneficial effects on cardiovascular & respiratory systems. Therefore, we conclude that music interventions may provide a viable adjunct to perioperative care. However, music in medicine is still an important research area and needs more properly conducted research before introduction into routine practice.

1. Introduction

To reduce patient anxiety and pain during the perioperative period various drugs like analgesics, sedatives and anxiolytics are regularly used. However, these drugs often have side effects and may interfere with smooth patient recovery. Therefore, attention is being paid to various non-pharmacological interventions such as music to reduce perioperative anxiety and pain. Music is a known non-pharmacological inexpensive and noninvasive method without side effects to reduce perioperative anxiety and pain.[1,2] Perioperative music interventions can modulate response to stress and minimize sedative requirements.[3]

Music therapy is a technique of music used in medicine by trained music experts. It requires an expert in music who has the ability of the individualized tailoring of music. It is used in various places like hospitals, rehabilitation centers, homes, etc to overcome physical or emotional distress besides lowering perioperative stress and chronic pain or improving neuromuscular coordination. It has an important role in terminally ill, in particular bedridden patients. Music medicine is passive listening to pre-recorded music for the clinical benefit of the patient and

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is offered by a medical doctor. It is still a research area, in particular for perioperative pain management. The International Association for the Study of Pain defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage.[4] Pain is caused by damaging stimuli and mostly resolves once the noxious stimulus is removed or damaged tissue is healed. The intensity of pain varies from person to person and is subjective in nature. Psychological factors like social support, hypnotism, meditation, or distraction can significantly affect the intensity of the pain.[5] Music reduces anxiety by activating auditory pathways and the limbic system. In addition, music also distracts the brain and also activates the parasympathetic system.[1] Various author also have studied the level of hormones and neurotransmitters while listening to music.[6,7] Music also induces alterations in endorphin levels, which have a role in relieving stress and pain.[8]

We searched PubMed, PubMed Central, and google (up to March 2022) to collect information on music in medicine. There was no restriction on language. Non-English abstracts were translated into English with the help of Google online help. This write-up will provide an overview of music in medicine, including a historical review and relevant research on the use of music in perioperative care. We did not attempt to provide any comparison between methods as music in medicine is still under investigation.

2. Discussion

2.1. Music in medicine

Music in medicine is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional (music therapy) who has completed an approved music therapy program (American Music Therapy Association) or by a medical professional (music medicine). In other words, music in medicine is a musical intervention to improve the comfort of patients. Music in medicine has various facets like physical, emotional, mental, social, aesthetic, and spiritual. Some common music in medicine usages is developmental work (communication/motor skills) for individuals with special needs, relaxation, physical rehabilitation, alcohol/drug recovery programs, etc.[9] Music in medicine is also used for pain & depression management in palliative cancer care & psychiatric management.[10,11] Music may be beneficial for everyone with either physical or mental disabilities. Music may improve heart rate, reduce anxiety, reduce CNS stimulation and improve learning. Music therapy/medicine is also applied for stress relief before and after surgery besides areas like memory loss viz., Alzheimer's disease, or severe dementia.[12] A pediatric patient who listened to music during venepuncture shows less distress and less pain.[13] Similarly, patients with mental disorders such as anxiety, depression, and schizophrenia have shown some improvement in their mental health following music therapy/medicine.[14]

2.2. Historical perspective (global)

Music-based experiences were used to address various domains of human functioning viz., cognitive, academic, emotional, psychological, behavioral, physiological (sensory, motor, neurological, and other physical systems), pathological (pain), spiritual, etc in the ancient world. Music in medicine is in place for a long, but one can reliably trace around 500-400 BCE from Greek mythology (Apollo, Aesculapius, Plato, Aristotle, etc). Aesculapius, also known as the god of medicine in ancient Greek mythology, was a physician, who used to practice rejuvenation and healing aspects of the medical arts using various ways, including music. Similarly, Plato and Aristotle later relate music with healthy emotional responses and harmony between the three parts of the soul i.e., reason, spirit, and appetite (Table 1). Later, the use of music in medicine can be traced to Al-Farabi (870-950 CE), also known as a second teacher (Aristotle was known as the first teacher), a renowned early Islamic (Persian/Turkic origin) philosopher and jurist. He also wrote a book on music (Kitab al-Musiqa/The Book of Music). Al-Farabi, in his book, describes philosophical principles about music, its cosmic qualities, and its influences on a human beings. He also described music therapy and the effect of music on the soul.[15]

Ancient Arab hospitals (650-1300 CE) used to have music rooms for patients as part of healing. The kings of the Persians used to divert the melancholic by listening to music, distracting the sick, and keeping away from negative thoughts. Music therapy was considered a broad philosophical approach toward harmony (Table 1). Selection of music used to be carried out by a musician for the treatment of specific diseases, a unique concept in the history of music and medicine.[16]

The next important book on music and medicine was found in the book of Robert Burton (The Anatomy of Melancholy, 1621-1628) where music was used to treat melancholia, and thereafter from the book of Athanasius Kircher as Musurgia Universalis, 1650 that described details of the effect of music on the brain (music invokes specific emotional responses in the listener).[17,18] Later, in 1745 von Ernst Anton Nicolai, a medical professional from Germany published a book named 'Die Verbindung der Musik mit der Arzneygelahrtheit' where the author has shown an association of music with the science of medicine (Table 1). Later, John Brown (1780) in his book on Elementa Medicinae (commonly known as the Brunonian system of medicine) described stimulation of the nerves by music could directly improve health.[19] Peter Lichtenthal's (1807) book Der musikalische Arzt is similar to John Brown's book

Table 1: Showing historical landmarks of music in medicine

Year	Historical Landmarks	Key Figures/References
BCE 450-350	Cure diseases of the mind (mental illness) by using song and music	Apollo, Aesculapius, Hippocrates, etc (Greek mythology)
BCE 347	Music affects the emotions and influence character of an individual	Plato (ancient Greece)
BCE 322	Music affects the soul	Aristotle
CE 872-950	Therapeutic effects of music on the soul	al-Farabi (Haque 2004)[15]
CE 650-1300	Music rooms for patients	Arab Hospitals (Antrim 2006)[24]
1621-1628	The Anatomy of Melancholy (music in treating melancholia)	Robert Burton (1628)[17]
1650	Musurgia universalis	Athanasius Kircher (Major RH, 1939)[18]
1745	Die Verbindung der Musik mit der Arzneygelahrtheit (connection of music to medicine)	Ernst Anton Nicolai (1745)[25]
1780	Stimulation of the nerves by music could directly improve health	Brunonian system of medicine (Elementa Medicinae) by John Brown (1780)[19]
1807	Doses of music (Brunonian scale)	Lichtenthal (1807)[20]
1892	The St. Cecilia Guild (live music to hospital patients)	Harford (1892)[21]
1892	Music as a remedy	Lancet (1892)[22]
World Wars I & II	Music for soldiers suffering from war-related emotional and physical trauma	Davis et al (2008)[23]

and describes the effects of music on the body.[20] Lichtenthal mostly described "doses of music," which should be determined by using the Brunonian scale (Table 1).[20] Live music to hospital patients (by St. Cecilia Guild) was in use for the alleviation of acute pain; soft, slow music was used for the seriously ill, whereas brisk exhilarating dance music was reserved for convalescents.[21] This was followed by a publication in the Lancet journal 1892 on music as a remedy for diseases.[22] Music therapy was in use during world-war I (Wheeler et al. 1919) to heal wounded soldiers by music at Columbia University and world-war II to boost the morale besides physical and emotional rehabilitation of returning veterans (Table 1).[23]

2.3. Historical perspective (Indian)

Sacred music therapy in north India (Table 2) was in place for a long (BCE) and can be traced from ancient Hindu mythology (goddess Saraswathi, God Krishna, Narad, etc), Vedic scripts, and local folk traditions.[26] This book provides information on North Indian traditional music therapy as well as other indigenous music healing traditions.[26] Ancient Hindu scripts describe the healing of illness by using hymns. Singing or listening to sacred hymns are believed to provide healing and improve mental health.[27] It is just one of the examples of the ways that sound and music have been used for thousands of years to promote healing in India.[27] Literature on the science of music (Gandharva tattva) in India dates back to the fourth century BCE.[28] "Raga Chikitsa," one of the ancient texts elaborates on the therapeutic role (suitable for emotional healing, particularly anxiety and stress) of musical melodies.[29] Swami Haridas, the guru of Tansen, a classical musician of 16 century India, is known to use music in treating illnesses.[28] Historical records indicate that he treated & recovered one of the queens of Emperor Akbar with raga. Another musical legend, saint Thyagaraja, brought a dead person back to life with the Bilahari composition Naa Jiva Dhara.[30] Ayurveda (a holistic approach rooted in Veda from the prehistoric era) also uses music (raga) to help balance the doshas.[30] Musopathy (mapping music and its medicinal benefits) term was coined by an Indian musician Ravikiran in 1990. It is intended to understand how and why music is good for health besides mood.[26] The Music Therapy Trust (of India) was founded by Dr. Margaret Lobo in 2005 to provide music therapy to those facing difficult psychosocial and physical challenges. The Indian Association of Music Therapy (IAMT) represents researchers, bio-musicologist, scientists, music therapists, etc to promote the use of music for the cure of various diseases and healthy life. IAMT was established in 2010. The objective was to establish music as a drug to cure disease and rehabilitate deformities. Later, in 2011 the association started its official peer-reviewed journal "International Journal of Music Therapy". Thereafter, the Music Therapy Academy in India was founded by Australian cricketer Brett Lee in 2012 to train Indian musicians by offering a year-long post-graduate diploma in clinical music therapy (Table 2).

2.4. Music in perioperative care

The earliest documentation of music therapy can be traced to 1789 in Columbia Magazine as Music Physically Considered (American Music Therapy Association/AMTA, 2011). The first music therapy intervention was reported in the 1800s but not until the 1900s, and in particular,

Table 2: Showing Indian historical landmarks of music in medicine

Year	Indian Historical Landmarks	Key Figures/References
Prehistoric times	Ancient Hindu Mythology (Goddess Saraswati, God Krishna, Narad, etc), Vedic texts (5000 BC), and local folk traditions besides Ayurveda	Cook et al (1997),[26] Sairam (2006)[30]
4^{th} century BCE	Gandharva tattva (science of music)	Sambamurthy (1999)[28]
600 CE	Raga chikitsa: dealt with the therapeutic effects of raga	Thanjavur library, Sairam (2014)[29]
1600s	Swami Haridas used music in treating illnesses	Sambamurthy (1999)[28]
18^{th} to 19^{th} centuries	Saint Thyagaraja could bring a dead person back to life with Bilahari composition (classical song)	Sairam (2006)[30]
1990s	Musopathy (derived from acoustic physics); The effects of music on mood	Chitravina N Ravikiran http://ravikiranmusic .blogspot. com/2010/04/musopathy.html
2005	The Music Therapy Trust (of India)	Dr. Margaret Lobo (https://en.wikipedia.org/ wiki/ The Music Therapy Trust)
2010	The Indian Association of Music Therapy	Dinesh C. Sharma (https://iamt.net.in/)
2011	International Journal of Music Therapy	Editor in Chief Dinesh C Sharma (https://iam t.net.in/ijmt-issue/)
2012	The Music Therapy Academy	Brett Lee

during World War II, that music can have an on one's sense of well-being (AMTA, 2011). Recorded music was first used in hospitals by treating doctors after the invention of phonograms (Table 3). In 1914, Kane was the first person to provide intra-operative music via phonogram to distract the patient's attention from the horror of the surgery.[31] Ilsen advocated the use of music, often classical music to alleviate physical pain in surgical patients in World War I reconstruction hospitals besides using it for insomnia and terminal illness.[32] Van de Wall began a career using music to treat and prevent mental illness. He also developed a therapeutic music program for Mental Disorders.[33] The organism-as-a-whole concept (mind and body integration) is essential to understanding the therapeutic effects of music therapy.[34] Use of magnetic recorder silent music during operation reported by Light et al. 1949.[35] In one experimental study Good et al, 1995 compared the effects of jaw relaxation and music, individually and combined, on sensory and affective pain following surgery and the author found the helpful nature of music for sensation and distress of pain.[36] Researchers also evaluated the effect of peri-operative music listened to through headphones on pain and anxiety levels and found that music helped to relax and distract.[37] In another study, researchers examined the effect of music on the level of patient pain in the immediate postoperative period but found no differences in the level of pain.[38] Similarly, Cepeda et al (1998) did not find any beneficial effect of perioperative music in patients undergoing lithotripsy following an RCT study.[39] Another study using western music (tape recorded) in Taiwanese patients for its effectiveness in reducing postoperative pain did not find any differences and suggested the use of culturally acceptable music.[40] In an RCT study researcher evaluated music influences on intraoperative sedative and analgesic requirements in awake patients and observed a decrease in sedative and analgesic requirements.[41] Another study on self-selected perioperative music in ambulatory geriatric ophthalmic surgery can ameliorate stress and hypertensive response.[42] Similarly, music in the intra-operative period under general anesthesia for hysterectomy can improve the recovery of patients.[2] A study that evaluated the effect of relaxing music on the pain level of mechanically ventilated patients found that music therapy reduced pain scores and physiological findings.[43] Later, a group of surgeons studied the use of music and found that music has a calming effect on normally tense and nervous patients.[3] Various studies examined the effect of music intervention on preoperative anxiety and/or physiologic parameters or perioperative anxiety, stress or pain, perioperative music in pediatric surgery, postoperative pain following gynecologic laparoscopy, or postoperative pain & stress in patients undergoing elective hysterectomy, intraoperative sedative requirements, etc.[44–49] Similarly, Chan et al. (2007) also observed that music was effective in managing pain after a percutaneous coronary operation.[50] Another study that investigated the effect of preoperative music therapy on postoperative pain found a significant decrease in postoperative pain and analgesic consumption.[51] Another study on music intervention following abdominal surgery observed milder pain & distress besides lower respiratory rate in the postoperative period.[52] A study on the effect of music on comfort, anxiety, and pain in the intensive care unit found a significant decrease in the VAS pain scores of the patients in the ICU after listening to music, which indicates the positive effect of music on reducing pain.[53] However, the study also suggests that there may not be a significant difference in the health care setting on the desired benefit of music interventions.[54] Music therapy is used with almost all surgery with variable results, some

Table 3: Showing publications on use of music during perioperative periods

Year	Study	Findings/Music type	
1789	Music Physically Considered	Music therapy	AMTA (2011) http://www.musictherapy.org/about/history/
1800s	Music therapy intervention	Music therapy	AMTA (2011) http://www.musictherapy.org/about/history/
1914	Intra operative music to distract patient's attention	Phonograph	Kane (1914)[31]
1925	Use of music to treat and prevent mental illness	Use of Music in Hospitals	Van de Wall (1925)[33]
1926	Music to alleviate pain	Use of music in hospitals	Ilsen (1926)[32]
1945	Musical methods	Music Therapy	Altshuler (1945)[34]
1949	Use of music during operation	Magnetic recorder	Light et al (1949)[35]
1962	Use of music for terminal illness	Classical music	Boxberger (1962)[55]
1995	Postoperative after abdominal surgery	Cassette player with headphone	Good et al (1995)[36]
1997	Music during immediate postoperative recovery	Recorded music through head phones	Heiser et al (1997)[37]
1998	Postoperative hysterectomy	Cassette player with headphone	Taylor et al (1998)[38]
1998	Perioperative lithotripsy	Unspecified	Cepeda et al (1998)[39]
1998	Postoperative abdominal/ gynaecological surgery	Cassette player with headphone	Good & Chin (1998)[40]
1998	Urologic surgery with spinal anesthesia	CD player with headphone	Koch et al (1998)[41]
2001	Ambulatory ophthalmic surgery (perioperative)	Cassette player with headphone	Allen et al (2001)[42]
2001	Intraoperative Hysterectomy under general anesthesia	Cassette player with headphone	Nilsson et al (2001)[2]
2001	Music for patients receiving mechanical ventilation	Relaxing music	Chlan et al (2001)[43]
2002	Calming effect on tense and nervous patients	RCT using patient-selected music session	Wang et al (2002)[3]
2003	Perioperative gynaecological laparoscopy	Cassette player with headphone	Laurion & Fetzer (2003)[47]
2005	Decreases intraoperative sedative requirements	CD player with headphone	Ayoub et al (2005)[49]
2007	Music on percutaneous coronary interventions	Music intervention	Chan et al (2007)[50]
2010	Musical therapy on postoperative pain	Music intervention	Sen et al (2010)[51]
2011	Music on BP, HR, and RR in abdominal surgery	RR was significantly lower	Vaajoki et al (2011)[52]
2015	Music on postoperative pain & stress during hysterectomy	Decreases opioid administration, promote relaxation & improve patient satisfaction	Rafer et al (2015)[48]
2015	Music on comfort, anxiety and pain in the ICU	Music intervention	Çiftçi and Öztunç (2015)[53]
2015	Perioperative music in paediatric surgery	Significant effect in reducing post-operative pain, anxiety and distress	van der Heijden et al (2015)[46]
2017	Music therapy in health care system	Meta-analysis; no statistical differences observed	Llovet (2017)[54]
2018	Music therapy in relieving anxiety	Preoperative music can reduce HR, MAP & anxiety	Sharma et al (2018)[44]
2018	Music for anxiety & pain in surgery	Reduce anxiety and pain significantly	Kühlmann et al (2018)[45]

with a negative outcome and many with either positive or marginally improved outcomes (Table 3).

2.5. Music in labour/delivery/etc

The effect of music therapy on pain & anxiety of labor/delivery was studied by many authors (Table 4). One of the early studies that investigated the effect of music on pain level and vital signs in women undergoing cesarean section found that music therapy decreased blood pressure, pulse rate, respiratory rate, and pain level.[56] Another study from Iran on the effects of self-selected music (30 minutes postoperatively) on early postoperative pain following elective cesarean section under general anesthesia found encouraging results. Morphine usage and pain score (100 mm visual analog scale/VAS) was measured immediately after the music treatment period. Both pain scores and postoperative opioid usage in the postoperative period were lower in the music group. Measures of anxiety by VAS and hemodynamic parameters including heart rate and blood pressure were found to have no significant differences in the same time period between groups. The authors concluded that both pain scores and morphine usage were lower in the group that listened to favorite music in the first postoperative 30 minutes.[57] Another study on music therapy in labor on Taiwanese first-time mothers observed the effect of music in decreasing pain, inducing relaxation, and reducing anxiety during the latent phase of labor.[58] Similarly, a study by Li and Dong (2012) assessed preoperative music intervention for patients undergoing cesarean delivery with 30 min of Chinese classical music and found patients to have lower anxiety, heart rate, and pain score.[59] Similarly, the total behavioral pain rating scores, as well as the behavioral domains such as facial expression, restlessness, vocalization, and consolation, have shown a statistically significant reduction in the music group when compared to the control group.[60] Beneficial effect on HR, RR, VAS, and time to the requirement for rescue analgesia of preselected music of patient's choice during the postoperative period was also reported by the author.[61] Studies on the effects of music therapy on pain response following cesarean section or during labor are sparse with contradictory outcomes viz., no effect or positive outcome (Table 4).[62–65] Various studies found improved relaxation and smooth recovery whereas others could not.[66,67] Many researchers reported greater hemodynamic stability, including heart rate in patients administered music during a surgical procedure.[61,63,64] Other studies also found similar results but no changes in BP with music.[68]

Various researchers have also studied the effects of music on pain, anxiety, cardiovascular parameters, hormonal parameters, neurotransmitter levels, and doses of sedatives & analgesics.[1,6] Some other studies observed a decrease in heart rates or an increase in oxygen saturation level in the music group.[61,69]

2.6. Mechanisms of pain and stress reduction of music

The principle of music in medicine is based on the fact that while pain stimuli are occurring, the central nervous system is also receiving other stimuli. The central nervous system processes a limited number of messages in a given time, and these sensations compete with pain stimuli. Therefore, if consciousness and awareness (attention) can be focused on a strong, positive stimulus such as music, then the perception of pain could be attenuated.[52] Music reduces anxiety by activating auditory pathways and the limbic system. These communicate with the hypothalamus, reticular activating system, and hippocampus to attenuate excitatory neurotransmitters leading to relaxation. In addition, music also distracts the brain and also activates the parasympathetic system.[1] Various author also have studied the level of hormones and neurotransmitters while listening to music. They showed that music lowers hormones like cortisol, adrenocorticotrophic hormone, and catecholamines but increases oxytocin as well as serotonin.[6,7] Oxytocin has a boosting effect on psychology as well as emotion/bonding/maternal behavior whereas serotonin lowers pain, stress, and anger. Music also induces alterations in endorphin levels, which have a role in relieving stress and pain.[8] The experience of pain is often shows inter-individual variability and linked with individual differences in biological and psychosocial variables.[70] Psychological factors like hypnotism, meditation, or distraction can alter the intensity of pain.

Surgery is an indispensable method of health care but it causes severe perioperative stress. Surgery is associated with significant pain in the postoperative period. Pain compromises a person's overall health and well-being. Surgery-induced tissue trauma induces sustained activation of the sympathetic autonomic nervous system thus impairing physiological homeostasis and causing psychological stress, as well as metabolic and immune dysfunction. This affects postoperative recovery.

Present interventions in use to attenuate perioperative stress are pharmacological and invariably associated with adverse effects. Non-pharmacologic interventions in the perioperative period to decrease stress and analgesic use are warranted. Perioperative Music Medicine (PMM) can be an efficacious, safe, and low-cost non-pharmacologic intervention.[71,72]

The intact auditory pathway is a prerequisite for the effect of PMM. In rodent experiments, a shift from sympathetic to more parasympathetic autonomic activity, suppression of stress hormones, lowering heart rate, blood pressure, and anxiety, but increased immune functions were observed.[45] In human studies, there is a strong body of evidence supporting the efficacy of PMM in causing a reduction in pain and anxiety, and decreased

Table 4: Showing publications on music in association with Labour/ LSCS/other surgery

Year	Study	Findings	
1992	Effect of music on ketamine	Improved relaxation and smooth recovery	Kumar et al (1992)[66]
1996	Efficacy of therapeutic suggestions	No effect on postoperative morphine requirements	van der Laan et al (1996)[67]
2005	Music therapy during caesarean delivery	Lowers physiologic measures, anxiety and increases satisfaction	Chang and Chen (2005)[56]
2007	Impact of music on postoperative pain and anxiety following CS	Not effective in reducing postoperative pain after CS	Reza et al (2007)[62]
2008	Effects of music on early postoperative pain following elective caesarean sections under general anaesthesia	Pain scores & postoperative opioid usage were lower	Ebneshahidi & Mohseni (2008)[57]
2009	Music during caesarean section under regional anaesthesia	May improve pulse rate and birth satisfaction score	Laopaiboon et al (2009)[63]
2010	Music therapy on labour	Decreasing pain, inducing relaxation and reducing anxiety	Liu et al (2010)[58]
2011	Effects of music on cortisol levels and Propofol consumption	Lower cortisol levels (reflecting stress-reducing effects) and sedative requirements	Koelsch et al (2011)[6]
2012	Effects of music therapy on labour	Decreases pain and anxiety	Li and Dong (2012)[59]
2013	Effect of music on physiological, cognitive, and emotional effects	Cost-effective, emotion-focused coping strategy	Kushnir et al (2013)[69]
2015	Effects of music on patients undergoing caesarean section under spinal anaesthesia	Greater haemodynamic stability but no changes in BP	Sarkar et al (2015)[68]
2015	Effects of music therapy on anaesthesia requirements and anxiety	Helpful to manage preoperative anxiety	Palmer et al (2015)[1]
2018	Effects of culture-based chants on labour pain	Pain score significantly reduced	Ramesh et al (2018)[60]
2018	Music intervention during caesarean delivery	Effective way of reducing stress and anxiety	Hepp et al (2018)[64]
2019	Music during caesarean section under spinal anaesthesia	Better haemodynamic stability, lesser anxiety and higher patient satisfaction	Bansal et al (2019)[65]
2022	Effect of perioperative music therapy on postoperative pain in women undergoing elective LSCS delivery under spinal anaesthesia	Preselected music of patient's choice has beneficial effect during postoperative period on HR, RR, VAS and time to requirement for rescue analgesia	Halder et al (2022)[61]

opioid use.[72] PMM impacts both intensity and quality of pain and lowers anxiety.[71–73] PMM produces endogenous opioids and oxytocin as well as decreases cortisol and catecholamines.[73,74]

The effects of music on the ANS include reductions in heart rate.[75] PMM can modulate the neurohormonal response to surgery during general anesthesia thus reducing postoperative pain, analgesic use, anxiety, respiratory rate, blood pressure, cortisol levels, postoperative nausea, and vomiting.[76] PMM decreases sympathetic activation and helps the homeostasis of stress metabolism and immune function through activating parasympathetic output. This parasympathetic cardiac cholinergic output can be quantitated by changes in heart rate variability.[77] The interplay of the sympathetic & parasympathetic autonomic nervous system allows adaptation to stress (everyday challenges/surgery induced) via the hypothalamic-pituitary-adrenal axis leading to the release of corticosteroids and pro-inflammatory factors from the adrenal gland.[78]

3. Conclusion

Music in medicine has been in use since before the common era (BCE) and applied in various countries, prominently India, Greece, and Arab countries. Music therapy was frequently used in various army hospitals in the United States of America and European countries. Music medicine is still in the experimental stage despite its beneficial effect on the perioperative period, labor, mental/memory disorders, chronic painful end-stage disease, etc. Music

medicine ameliorates/decreases patient anxiety and improves cardiorespiratory parameters through its effect on the autonomic and central nervous systems. Music medicine use in labor/cesarean delivery is particularly important as analgesics & sedatives (mostly opioid derivatives) commonly used have adverse effects on newborns as well as maternal lactation. Hence, it is necessary that pain relief in labor/cesarean delivery should be safe and effective, and should not interfere with the mother's ability to care baby, and lactation and that it results in no adverse neonatal effects. Finally, the literature review suggests music medicine is cost-effective and safe adjuvant to perioperative care of patients.

Music in medicine can be implemented throughout the health care system either by self-administration or by treating doctors or with the aid of a music therapist. Chronic pain, stress, and heart rate variability are interrelated and strongly associated with the body's response to inflammation, stress, anxiety, and depression. The common factor underlying the benefit of music in medical interventions is to increase heart rate variability, through strengthening interaction between elements of emotional regulation, chronic pain, chronic stress, inflammation, depression, and anxiety.

4. Author's Contribution

First author was involved in the inception of concept and design of the review. He is responsible for acquisition of data, interpretation and drafting of the article. Second and third authors were involved in guiding, reviewing and refining the write up, besides inputs at various stages of this exercise. All authors read the manuscript, corrected appropriately and approved final manuscript.

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6. Conflict of Interest

The authors declare that there is no conflict of interest

7. Compliance with Ethics Guidelines

This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

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