









Non-pharmacological strategies to reduce stress and anxiety in endovascular procedures: A scoping review

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Abstract

Aim: This study aimed to identify and map the production of knowledge on non-pharmacological strategies to reduce stress and anxiety in patients undergoing endovascular procedures.

Design: Scoping review.

Methods: The review was performed using the PRISMA-ScR guidelines. The searches were conducted in Scopus, PubMed, Web of Science, Wiley Online Library, BVS/BIREME, Lilacs, Gale Academic OneFile, SciELO, Cochrane Library, CAPES Catalog of Dissertations and Theses, Oswaldo Cruz Foundation Portal of Theses and Dissertations, and Theses and Dissertations from Latin America.

Results: Twenty-two articles were selected. The articles were published from 2001 to 2022, mostly in Iran, and there was a predominance of randomized clinical trials. The Spielberger State-Trait Anxiety Inventory was the most used instrument. The findings indicated that music therapy, educational guidelines or videos on the procedure, massage, psychological preparation and aromatherapy were the main non-pharmacological therapies used to reduce anxiety and stress in patients undergoing vascular procedures.

KEYWORDS

adult, aged, anxiety, complementary therapies, endovascular procedures, psychological stress

The authors affirm that the methods used in the data analyses are suitably applied to their data within their study design and context, and the statistical findings have been implemented and interpreted correctly.

Reporting method: The review was performed using the PRISMA-ScR guidelines. Patient or Public Contribution: Not applicable, since this is a scoping review.

Protocol Registration: The protocol has been registered in Open Science Framework (<https://osf.io/y8kpf/>).

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1 | INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality worldwide and has become a major health concern in developing countries. In 2010 alone, CVDs were responsible for around 35 million deaths, 30% more than in the 90s. In 2012, ischemic heart diseases and cerebrovascular diseases, the main representatives of diseases of the circulatory system, together accounted for more of 15 million deaths (Pellense et al., 2021; Rejeh et al., 2020).

Coronary cineangiography, cinecoronary angiography, coronary angiography and cardiac catheterization have been recognized as the best methods for diagnosing CVD, especially obstructive coronary lesions and the analysis of heart valves. This is an invasive procedure with the placement of a catheter through a puncture in the femoral, brachial or radial artery, up to the aorta and left ventricle through a vascular introducer (Leão et al., 2022). In this sense, despite low mortality rates, there is a risk of complications such as anxiety attacks, pseudoaneurysm formation, hematomas, bleeding, ischemia, arterial occlusion, acute kidney injury and arteriovenous fistula formation (Francisco et al., 2022).

Anxiety is characterized by an altered emotional state that triggers abundant production of norepinephrine and epinephrine related to restlessness, tension and a feeling of uncontrollable fear (Esfandiari et al., 2022). Stress is a temporary disorder when the individual is subjected to a stressful context that triggers negative repercussions and can lead to post-traumatic stress (Murakami et al., 2022).

In the meantime, note that a percutaneous intervention may provoke moderate to high anxiety and stress due to waiting time, concern about the procedure, possible complications, the possibility of hospitalization and receiving the hospital and surgical context in which the patient will be involved (Esfandiari et al., 2022). These feelings associated with fear due to changes in health status can activate the central nervous system, altering specific signs and worsening the progression of the disease. The appearance of these signs and symptoms during the procedure can also increase the duration and complexity of the intervention, alter the results of the exams and cause unwanted harm to the patient (Maciel et al., 2016; Murakami et al., 2022).

The role of nursing stands out in the area of cardiology and hemodynamics through care related to the prevention of complications and immediate intervention. Therefore, to guarantee quality care and reduce adverse events, nurses seek knowledge based on scientific evidence about the main benefits, risks and complications arising for the patient (Francisco et al., 2022). Therefore, considered a holistic art and science, nursing supports non-pharmacological complementary therapies as a multimodal approach to reduce the patient's anxiety, pain, nausea and other symptoms (Knoerr, 2018).

Non-pharmacological strategies are subdivided into physical – involving massage, heat or cold application and transcutaneous electrical nerve stimulation (TENS) – and psychological – such as

music, distraction and relaxation techniques. However, this classification varies with the literature and may include physical and mental interventions such as hypnosis, manual healing methods such as aromatherapy and herbal medicine (Bonilla-Marciales et al., 2020).

Different strategies can reduce anxiety and stress. Studies have shown that massage therapy, aromatherapy, music therapy and educational nursing interventions are among the main strategies that help these patients develop greater self-control over their feelings. Among the non-pharmacological nursing disciplines for stress reduction, massage consists of the manipulation of soft tissues to relieve pain, anxiety and stress (Alimohammad et al., 2018). Music is also an important resource due to its effects on human emotions by inspiring, relaxing, enthusing, energizing and reducing the level of anxiety and hemodynamic parameters in patients before cardiac catheterization (Esfandiari et al., 2022).

The importance of this review is justified by collaborating with the academic and scientific community by compiling non-pharmacological strategies used to reduce stress and anxiety in patients undergoing hemodynamic endovascular procedures; in this way, it makes it possible to identify possible gaps in this thematic axis.

Furthermore, the present study contributes to nursing practice by providing alternative strategies for quality and humanized care and assistance, highlighting the patient's emotional state, which, at times, may not be a priority given the complexity of the endovascular procedure, but which, however, is significant for the individual's good prognosis.

A preliminary search for other reviews was conducted to verify the existence of other studies with the same purpose as our review and to strengthen the discussion. The initial search was carried out in August 2022 on the following platforms: the International Prospective Register of Systematic Reviews (PROSPERO), Open Science Framework (OSF), Cochrane Library, the Clinical Online Network of Evidence for Care and Therapeutics (JBI CONECT+) and the Database of Abstracts of Reviews of Effects (DARE). No previous or ongoing studies on the topic of interest were identified.

2 | OBJECTIVE

To identify and map the production of knowledge on non-pharmacological strategies to reduce stress and anxiety in adults and older patients undergoing endovascular procedures.

3 | METHODS

3.1 | Study design

A scoping review was conducted – a methodology aimed at mapping key concepts or characteristics of a particular area of research, leading to the elaboration of a synthesis of the evidence, the

identification of gaps that still exist and the recognition of the need for new studies in an exploratory or descriptive way.

The review was developed according to the Joanna Briggs Institute's (JBI) Review Manual (Peters et al., 2020) and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) checklist (Tricco et al., 2018). The research protocol was registered in the Open Science Framework at <https://osf.io/y8kpf/> (identifier: 10.17605/OSF.IO/Y8KPF).

The following steps proposed by the JBI were used to develop the scoping review: (1) identifying the review objective and question, (2) defining the inclusion and exclusion criteria based on the review objective and question, (3) planning the search, selection, extraction and presentation results steps, (4) bibliographic search, (5) selection of studies, (6) data extraction, (7) analysis, (8) presentation and (9) synthesis of the results (Peters et al., 2020).

3.1.1 | Identifying the review objective and question

The Population, Concept, Context (PCC) mnemonic was used to develop the following research question: "What are the non-pharmacological strategies for reducing stress and anxiety in adult and older patients during endovascular procedures?". The mnemonic was outlined as follows: (P): adult and older patients undergoing endovascular procedures, (C): non-pharmacological strategies to reduce stress and anxiety and (C): hemodynamics unit.

3.1.2 | Defining the inclusion and exclusion

Scientific articles available online, dissertations, theses and guidelines on non-pharmacological strategies used during endovascular procedures were included. The studies were made available through the Federated Academic Community (CAFe) – an identity federation encompassing education and research institutions. No time or language restriction was applied. Studies in conventional surgery environments, studies with patients with neurological deficits, studies aimed at the paediatric public and those that did not answer the research question were excluded.

3.1.3 | Search, selection, extraction and presentation results steps

The study selection process took place in two stages: title and abstract screening by two independent reviewers. In the second stage, the studies were analysed through a full-text screening and identification of characteristics such as reference, country of origin, year of publication, study design, objectives, sample size and outcomes. Also considered were the type of non-pharmacological strategy used, the study design, the type of medical procedure (endovascular procedures) and the stress and anxiety scales used.

3.1.4 | Bibliographic search

The following descriptors used in the construction of the search syntax were selected using Medical Subject Headings (MESH): patients, endovascular procedures, adult, aged, complementary therapies, anxiety, stress, hemodynamics, cardiac catheterization and angioplasty. Two keywords were also used, as follows: non-pharmacological therapies and complementary and integrative practices.

From the PCC framework, the following search strategy was constructed: Patients OR (Endovascular Procedures OR Adult OR Aged) AND Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress) AND Hemodynamics OR (cardiac catheterization OR Angioplasty). Crossings were performed using the Boolean terms "AND" and "OR" to identify studies aligned with the elements of the PCC framework (Table 1).

The bibliographic search was carried out in September 2022 by consulting twelve electronic data sources: Scopus, PubMed, Web of Science, Wiley Online Library, *Biblioteca Virtual em Saúde* (BVS/BIREME), Latin American and Caribbean Health Science Literature Database (LILACS), Science Direct, Scientific Electronic Library on Line (SciELO), Cochrane Library, CAPES Catalogue of Dissertations and Theses, Oswaldo Cruz Foundation Portal of Theses and Dissertations and Theses and Dissertations from Latin America. Table 2 presents the study search syntax adapted for each data source.

3.1.5 | Selection of studies

As mentioned above, the selection of studies occurred through the development of two stages. The first stage was conducted by two researchers who, independently and simultaneously, carried out an initial screening by analysing titles and abstracts. Then, the identified duplicates were removed, and only did they proceed to the second stage.

The second stage, in turn, was characterized by screening the material by reading the text in full, considering the eligibility criteria and the adequacy of the study to answer the objective and research question. In cases of divergence, the authors reached a consensus regarding the eligibility of the material, and when the divergence persisted, a third researcher was consulted as a tiebreaker. It is noteworthy that the reverse search, by consulting the reference lists of each of the studies included in the sample, was not carried out.

3.1.6 | Data extraction

In the second stage, by reading the materials in full, bibliographic and descriptive variables were extracted. Among the bibliographic variables, the following are mentioned: authorship of the studies, country, year of publication, study designs, objectives, sample size and outcomes.

TABLE 1 Descriptors and keywords used in the search.

PCC	MESH/DeCS		Keywords
Population	Patients/Pacientes OR Endovascular Procedures/Procedimentos Endovasculares OR Adult/Adulto OR Aged/Idoso	OR	Adults/Adultos OR Aged Population/População idosa
	AND		
Concept	Complementary Therapies/Terapias Complementares OR Anxiety/Ansiedade OR Stress/Estresse	OR	Non-pharmacological Therapies/Terapias Não Farmacológicas OR Complementary and Integrative Practices/Práticas Complementares e Integrativas
	AND		
Context	Hemodynamics/Hemodinâmica	OR	(cardiac catheterization OR Angioplasty)

Abbreviations: MeSH, Medical Subject Headings; PCC, Population Concept Context.

TABLE 2 Search syntax for articles in data sources.

Source	Search syntaxes
PubMed	((Patients OR (endovascular procedures OR Adult OR Aged))) AND (Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress)) AND (Hemodynamics OR (cardiac catheterization OR angioplasty))
Web of Science	Patients OR (Endovascular procedures OR Adult OR Aged) (Título) and Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress) (Título) and Hemodynamics OR (cardiac catheterization OR angioplasty)
Gele Academic Onefile	Patients OR (Endovascular procedures OR Adult OR Aged) AND Título do documento: Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress) AND Título do documento: Hemodynamics OR (cardiac catheterization OR angioplasty)
Lilacs	Patients OR (Endovascular Procedudres OR Adult OR Aged) [Palavras] and (Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress) [Palavras] and Hemodynamics OR (cardiac catheterization OR Angioplasty)
BVS/BIREME	(Patients OR (endovascular procedures OR adult OR aged)) AND (non-pharmacological therapies OR (complementary therapies OR complementary AND integrative practices OR anxiety OR stress) (título) AND hemodynamics OR (cardiac catheterization OR angioplasty))
Scopus	(TITLE-ABS-KEY (patients OR (endovascular AND procedures OR adult OR aged) AND TITLE-ABS-KEY (non-pharmacological AND therapies OR (complementary AND therapies OR complementary AND integrative AND practices OR anxiety OR stress)) AND TITLE-ABS-KEY (hemodynamics OR (cardiac AND catheterization OR angioplasty))
Cochrane Library	Patients OR (Endovascular Procedudres OR Adult OR Aged) AND Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress) AND Hemodynamics OR (cardiac catheterization OR Angioplasty)
SciELO	*Patients OR (Endovascular Procedudres OR Adult OR Aged) AND Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress) AND Hemodynamics OR (cardiac catheterization OR Angioplasty)
Wiley Online Library	"Patients OR (Endovascular Procedudres OR Adult OR Aged)" in Title and "Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress)" in Title and "Hemodynamics OR (cardiac catheterization OR Angioplasty)"
CAPES Catalog of Dissertations and Theses	Patients OR (Endovascular Procedudres OR Adult OR Aged) AND Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress) AND Hemodynamics OR (cardiac catheterization OR Angioplasty)
Oswaldo Cruz Foundation Portal of Theses and Dissertations	Patients OR (Endovascular Procedudres OR Adult OR Aged) AND Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress) AND Hemodynamics OR (cardiac catheterization OR Angioplasty)
Theses and Dissertations from Latin America	Patients OR (Endovascular Procedudres OR Adult OR Aged) AND Non-Pharmacological Therapies OR (Complementary Therapies OR Complementary and Integrative Practices OR Anxiety OR Stress) AND Hemodynamics OR (cardiac catheterization OR Angioplasty)

Among the descriptive variables, the following are mentioned: non-pharmacological strategies to reduce stress and anxiety; type of endovascular procedure performed; and stress and anxiety scales used. All the information from the selected studies was inserted into an Excel spreadsheet created and filled out independently by the researchers.

3.1.7 | Analysis of the results

Data analysis occurred in a descriptive way, through a qualitative synthesis, with the characterization of the studies, and in a quantitative way with absolute and relative frequencies.

3.1.8 | Presentation of the results

The results were arranged using figures and tables, in line with the objective of the scoping review. In addition, the PAGER methodology

was used for data analysis to establish greater methodological rigour in this review since it allows for addressing the weaknesses of the Arksey and O'Malley scoping method, providing a consistent approach for the analysis and reporting (Arksey & O'Malley, 2005). Table 3 shows the PAGER structure.

3.1.9 | Synthesis of the results

A narrative summary of the results was generated and displayed as a way of synthesizing and highlighting the main information, with quantitative data: absolute and relative frequencies.

3.2 | Ethical aspects

Since this is a scoping review of previously published data, ethical approval for the study is unnecessary.

TABLE 3 PAGER structure obtained from the analysis of the selected articles.

Standards	Advances	Gaps	Evidence for practice	Recommendations
Environment of application	The non-pharmacological strategies reviewed demonstrate a potential alternative for patients' health care in clinical practice, especially in diagnostic and treatment environments by endovascular methods	Despite the positive results of non-pharmacological strategies on stress and anxiety reduction, there is still a need for more extensive research in this area, especially intervention studies with greater depth (meta-analysis of multicentre studies)	The non-pharmacological strategies identified in the review (music therapy, educational activities, educational videos, massage, hand massage and aromatherapy) showed favourable results for reducing stress and anxiety in patients undergoing endovascular procedures (cardiac catheterization and coronary angioplasty)	Given the relevance identified in the use of pharmacological strategies in some endovascular methods (cardiac catheterization and coronary angioplasty), it is reasonable to continue with more advanced research that is included in other health intervention types
Clinical situation	Coronary disease patients require invasive approaches, especially cardiac catheterization or coronary angioplasty. These procedures cause fear and emotional imbalance leading to stress and anxiety, as reported in the literature	Despite the prevalence of randomized clinical trials, a systematic review with meta-analysis showed that only a small number of studies support the association between non-pharmacological interventions and reduction of clinical parameters such as heart rate (HR) and blood pressure (BP)	The results related to the reduction of stress and anxiety were evidenced through scales built for this purpose (Spielberger State-Trait Anxiety Inventory, Adapted Fear/Anxiety Questionnaire, Numerical Rating Scale, Visual Analogue Scale and Depression Anxiety Stress Scale 21)	Further studies are needed combining the different non-pharmacological interventions and studies associating stress and anxiety reduction and physiological and hemodynamic markers
Professional categories	The studies demonstrate nurses' critical role in researching non-pharmacological strategies to reduce stress and anxiety	The selected studies did not reveal an expressive participation of other professional categories besides nurses and physicians	In the context of Integrative Practices in Health (also called complementary medicine), where non-pharmacological strategies are inserted and the scientific literature on health reinforces the importance of professional nurses in conducting these studies, as evidenced in the review	The evidence points to the need for additional research in populations with different cultures and traditions

4 | RESULTS

From the data source search, 46,159 studies were initially identified and analysed in stages, as shown in Figure 1. A final sample of 20 studies was obtained.

Studies with randomized clinical trials were the predominant class in the sample, totalling 10 studies, followed by 2 quasi-experimental studies, 2 in the meta-analysis category, 2 integrative reviews, 1 systematic review, 1 pilot study, 1 protocol study and 1 exploratory and quantitative study. Table 4 provides a description and summary of non-pharmacological strategies, study designs, types of medical procedures and stress and anxiety scales used.

The main findings were categorized into five indicators: non-pharmacological strategy used, study design, type of medical procedure and stress and anxiety scale used. Ten articles on music therapy and seven on educational guidance were found. As for the study designs, randomized clinical trials represented the largest number of studies (12), followed by systematic reviews with meta-analysis (2). Cardiac catheterization/coronary angiography (19) and coronary angioplasty (2) were the most frequent types of medical procedure, and the Spielberger State-Trait Anxiety Inventory was the most used instrument (15).

The studies were also evaluated regarding the reference, country and year of publication, study design, objectives, sample and outcomes. These findings are summarized in Table 5, which presents the studies' characterization.

Five studies were from Iran, three from the United States, three from Brazil and two from England. Germany, Canada, China, South Korea, Taiwan, Greece, Wales, Indonesia and Jordan accounted for one study each. Five studies were published in 2022 and four in 2015. Only two studies were published in 2017 and 2014. The remaining years, 2001, 2002, 2003, 2004, 2010, 2011 and 2016, accounted for one article each.

Regarding the outcomes presented, 19 studies describe the effectiveness of interventions used to relieve anxiety, and four studies describe stress reduction, pain relief and hemodynamic parameters such as blood pressure and heart rate. Other benefits, such as reduction of tension, fear, use of opioids, complications during the procedure, induction of relaxation and well-being and better satisfaction and understanding of the procedure, can also be mentioned. However, one study showed no significance in the change in hemodynamic parameters, and another described that the intervention used was not effective.

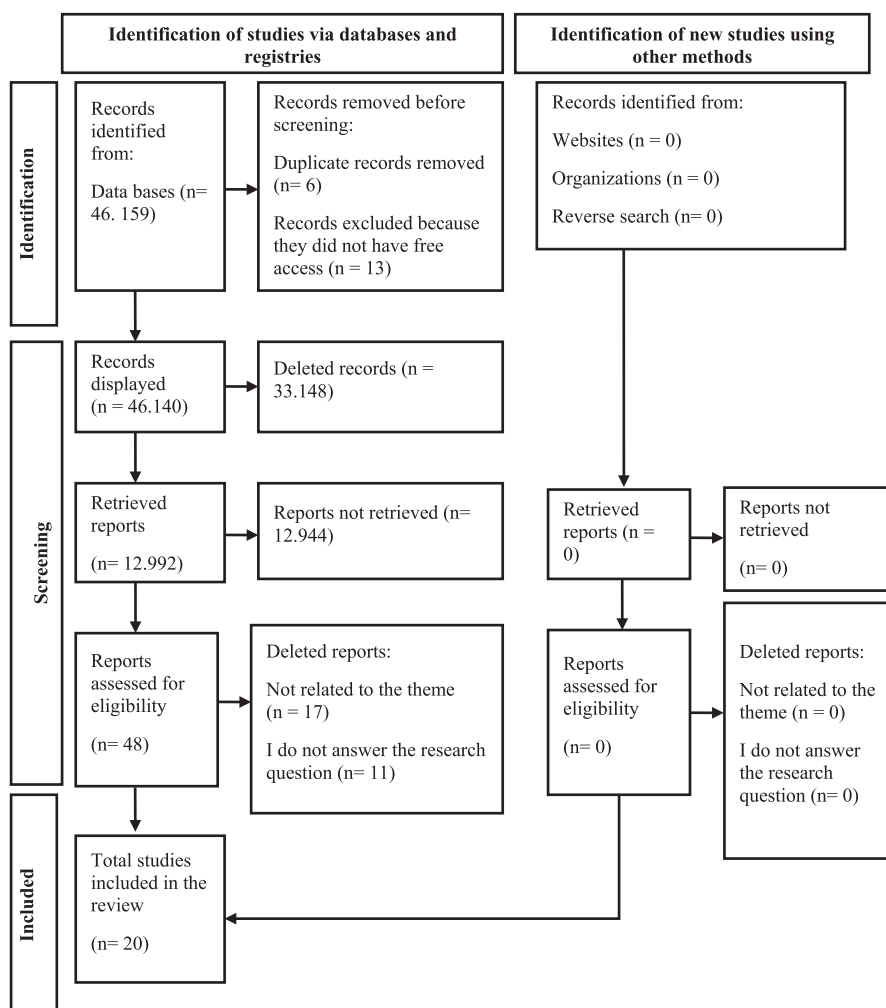


FIGURE 1 Flowchart of the process of study selection.

Considering the intervention studies included in the sample of this scoping review, Table 6 was prepared with the purpose of providing a characterization of these interventions regarding the type of intervention used and their respective application methods.

Among the intervention studies presented in Table 6, three studies portray musical intervention; two address informational education with the use of videos/multimedia; and the others address different interventions, such as massage, brochure information, eye masks, regular education, the use of instructional DVDs, guided imagination and immersive virtual reality.

The musical intervention, in all three studies, was applied through headphones for 20–60 min. In two studies, instrumental music was used, and in only one, the patient's musical preference was considered at a sound intensity of 60 dB–70 dB. The multimedia interventions were presented on DVD, connected to the projector, containing information about the cardiac procedure to be performed with the aid, or not, of animation strategies, for 10–12 min. The massage was applied to the head, neck, shoulder and back for 20 min before surgery. However, the presence of standardized and conventional interventions by hospital stores also stands out, such as verbal educational instructions by medical professionals and nurses with the use, or not, of educational pamphlets also standardized by the services.

TABLE 4 Summary of non-pharmacological strategies, study designs, type of medical procedures, and stress and anxiety scales used.

Collection indicators	Main findings
Non-pharmacological strategy used	<ul style="list-style-type: none">• Music therapy—10• Educational guidance—7• Educational videos—6• Massage—3• Aromatherapy and complementary therapies—2• Psychological preparation—3• Electroacupuncture/electrical stimulation—2• Hand massage—1• Relaxation therapies—1• Acupressure—1
Study design	<ul style="list-style-type: none">• Systematic review with meta-analysis—2• Systematic review—1• Randomized clinical trial—12• Non-randomized clinical trial—1• Experimental study—1• Quasi-experimental study—2• Study protocol—1• Bibliographic review—1• Integrative review—1
Type of medical procedure	<ul style="list-style-type: none">• Cardiac catheterization/Coronary angiography—19• Coronary angioplasty—2• Cardiac surgery—1
Stress and anxiety scales used	<ul style="list-style-type: none">• Spielberger State-Trait Anxiety Inventory—15• Adapted Fear/Anxiety Questionnaire (FAQ)—4• Numerical Rating Scale (NRS)—3• Visual Analog Scale (VAS)—3• Depression Anxiety Stress Scale 21 (DASS-21)—2• 4-point Verbal Scale—1• Instrument assessing physiological parameter changes—1• No instrument—2

As presented early in this paper, the PAGER methodology was used for data analysis to establish greater methodological rigour in this review, and is presented in Table 3.

5 | DISCUSSION

The findings of this review revealed a high prevalence of studies published in Iran, followed by the United States and Brazil. The emphasis is placed on research in the thematic axis of non-pharmacological strategies to reduce stress and anxiety in the Asian region due to the region's natural and historical character. However, in recent years, Tesser and Dallegrave (2020) have identified a progression of research on alternative therapies in Western countries. Furthermore, a scoping review by Santos et al. (2022) identified the relevance of non-pharmacological strategies to relieve pain in adult and older adult patients before and during endovascular procedures.

Concerning non-pharmacological strategies, music therapy stood out. In a study in Indonesia, Sundanese kacapi music therapy effectively reduced anxiety in patients before catheterization, and this strategy was recommended as an independent nursing intervention (Handayani et al., 2018). Moreover, a randomized clinical trial in South Korea evaluated the effect of a music intervention

TABLE 5 Characterization of the studies included in the review.

Reference/Country and year	Study design	Objectives	Sample	Outcomes
E1 (Carroll et al.) USA/ 2017	Systematic review	To evaluate the effectiveness of non-pharmacological interventions (procedural education, relaxation techniques, psychological preparation) on the reduction of psychological stress during cardiac catheterization	29 studies, with 2504 participants in total	The study demonstrated that non-pharmacological interventions effectively reduce psychological stress in patients undergoing cardiac catheterization
E2 (Ferreira et al.) Brazil/ 2015	Integrative review	To identify studies in the literature that address the non-pharmacological strategies used to reduce anxiety in patients undergoing cardiac catheterization	12 studies, with 1295 participants in total	The prevalence of studies identified in the review showed that non-pharmacological interventions were effective, with music therapy being the most used, helping to eliminate pain and reduce stress and tension, in addition to inducing relaxation
E3 (Grazziano & Bianchi) Brazil/ 2004	Exploratory and quantitative study	To identify the anxiety level of 40 companions and 40 patients undergoing coronary angiography for the first time	80 participants: 40 patients and 40 companions	It was concluded that most clients, when undergoing coronary angiography for the first time, present a low level of anxiety. Most of the companions presented an average level of anxiety according to the State-Trait Anxiety Inventory (STAI)
E4 (Peng et al.) China/ 2015	A randomized clinical trial	To evaluate the effects of preoperative stress management based on massage therapy on the patient's physical and mental health	117 participants, 59 in the intervention group and 58 in the control group	Massage treatments reduced the preoperative anxiety level of patients with cardiovascular diseases before percutaneous coronary intervention. After the intervention, the patients' blood pressure, heart rate, anxiety, and pain improved significantly.
E5 (Liu et al.) England/ 2022	Meta-analysis	To investigate and rank the evidence for the effectiveness of non-pharmacological interventions on pain relief after cardiac surgery, using comprehensive comparisons	42 studies, with 4,253 participants in total	Transcutaneous electrical nerve stimulation, acupuncture, music, and massage promoted postoperative pain relief after cardiac surgery. Transcutaneous electrical nerve stimulation reduced opioid use. Music and aromatherapy reduced anxiety
E6 (Malliarou et al.) Greece/ 2022	A randomized clinical trial	To test the beneficial effects of an information brochure on cardiac catheterization for patients undergoing the procedure for the first time, and to understand the importance of informing patients before coronary angiography for reducing fear and anxiety, in a randomized controlled trial	88 participants, 44 in the intervention group and 44 in the control group	Providing information in the form of a brochure regarding cardiac catheterization reduced anxiety and fear in a short-term
E7 (Jayakar & Alter) England/ 2017	Meta-analysis	To assess whether musical interventions reduce anxiety in patients undergoing cardiac catheterization	15 studies, with 1,671 participants in total	The interventions significantly reduced anxiety, improving patient well-being. Effectiveness was measured using the Spielberger State-Trait Anxiety Inventory
E8 (Forooghhy et al.) Iran/ 2015	A randomized clinical trial	To investigate the effects of music therapy on anxiety and hemodynamic parameters of patients during percutaneous transluminal coronary angioplasty	64 participants, 32 in the control group and 32 in the intervention group	The intervention group showed a significant reduction in anxiety after the intervention and presented no significant changes in vital signs
E9 (Esfandiari et al.) Iran/ 2022	A randomized clinical trial	To examine the comparative effects of eye masks and music on anxiety levels and hemodynamic indices of patients undergoing coronary angiography	300 patients divided into four groups of 75 participants each	The intervention significantly reduced anxiety and hemodynamic indices in patients undergoing coronary angiography. The eye mask intervention group had increased vital signs compared to the other group, but still lower than the control group

TABLE 5 (Continued)

Reference/Country and year	Study design	Objectives	Sample	Outcomes
E10 (Buzzato & Zanei) Brazil/ 2010	Integrative review	To identify research related to anxiety and strategies to minimize it in patients in the pre-cardiac catheterization period	17 studies	Music therapy contributed to the reduction of anxiety levels
E11 (Handayani et al.) Indonesia/ 2018	Quasi-experimental	To examine the effect of music therapy with Sudanese zither (kacapi) music on the level of anxiety of pre-cardiac catheterization patients	56 participants, 28 in the intervention group and 28 in the control group	Sundanese kacapi music therapy was effective in reducing the levels of anxiety in pre-catheterization patients. It is suggested that Sundanese kacapi music can be used as an independent nursing intervention
E12 (Block et al.) Germany/ 2022	Study protocol	To develop and implement a stress management intervention for professionals and patients to reduce cardiac catheterization's psychological and physical strain	Not applicable	The intervention reduced anxiety, stress, and complications before and during the procedures
E13 (Bikmoradi et al.) Iran/ 2021	A randomized clinical trial	To evaluate the impact of inhaled aromatherapy with <i>Rosa Damascena</i> on anxiety in patients undergoing coronary angiography	98 participants	The intervention decreased anxiety in the intervention group
E14 (Wu et al.) Taiwan/ 2014	A randomized clinical trial	To evaluate the effectiveness of an educational multimedia informational program with enhanced accessibility in reducing anxiety and increasing satisfaction with information about patients undergoing cardiac catheterization	123 participants, 44 in the one group, 39 in the two group and 40 in the three group	The intervention reduced anxiety and increased satisfaction with the information provided through multimedia instructions
E15 (Hamel) USA/ 2001	Quasi-experimental	To determine the effects of music therapy on anxiety, heart rate, and blood pressure in patients awaiting their scheduled cardiac catheterization	101 participants, 51 in the intervention group and 50 in the control group	A considerable reduction in anxiety, heart rate, and blood pressure was observed in both the intervention and the control groups.
E16 (Ayasrah & Ahmad) Jordan/ 2016	A randomized clinical trial	To explore the effectiveness of an educational video in reducing periprocedural anxiety in Jordanian patients hospitalized for cardiac catheterization	186 participants	The video proved to have good effectiveness in reducing preoperative and postoperative anxiety in the intervention group compared to the control group
E17 (Foji et al.) Iran/ 2015	A randomized clinical trial	To evaluate the possible effect of guided imagery in reducing pain and anxiety and its possible effect on other hemodynamic symptoms before angiography	62 participants, 31 in the intervention group and 31 in the control group	The intervention had positive results in reducing anxiety, pain, and hemodynamic symptoms in patients undergoing catheterization by guided imagery
E18 (Moon et al.) South Korea/ 2022	A randomized clinical trial	To evaluate the effect of a musical intervention on anxiety and stress responses in patients undergoing cardiac catheterization	94 participants, 47 in the intervention group and 47 in the control group	The intervention effectively reduced the anxiety and stress response in patients undergoing cardiac catheterization, being an important strategy in the clinical management of cardiac patients
E19 (Behnammoghadam et al.) Iran/ 2014	A randomized clinical trial	To identify the effectiveness of eye movement desensitization and reprocessing on anxiety in patients undergoing cardiac catheterization	60 participants	In the study, eye movement desensitization and reprocessing proved to be an effective, useful, efficient, and non-invasive method for treating and reducing anxiety in patients undergoing cardiac catheterization

(Continues)

TABLE 5 (Continued)

Reference/Country and year	Study design	Objectives	Sample	Outcomes
E20 (Morgan et al.) Wales/2021	A randomized clinical trial	To assess the use of an immersive virtual reality (VR) experience on pre-procedure anxiety, procedural knowledge, and overall satisfaction compared to a video-based information	64 participants, 33 in the intervention group and 31 in the control group	Patients benefited from using immersive VR prior to cardiac catheterization in terms of reduced anxiety, better understanding of the procedure, and satisfaction compared to the group that utilized video-based information
E21 (Harkness et al.) Canada/2003	A randomized clinical trial	To examine the effect of a psychoeducational nursing intervention in the pre-cardiac catheterization period	223 participants, 110 in the control group and 113 in the intervention group	The educational intervention used during the waiting time before cardiac catheterization positively impacted patients' anxiety
E22 (Taylor-Pillai & Chair) USA/2002	Pilot study	To determine the effects of music therapy nursing interventions or sensory information on reducing anxiety and uncertainty and improving negative mood in Chinese patients before cardiac catheterization	45 participants, 15 in the one group, 15 in the two group and 15 in the three group	The study did not demonstrate efficacy in Chinese patients, despite the use of nursing interventions adapted to Western culture to reduce anxiety and uncertainty and improve mood

on the anxiety and stress responses of patients undergoing cardiac catheterization using the State Anxiety Inventory (SAI) and the numerical anxiety rating scale (NARS). The study revealed that the music intervention effectively reduced anxiety and stress responses that precede cardiac catheterization, emphasizing the importance of this type of intervention for anxiety management (Moon et al., 2022).

Given the above and the results of this review, it can be concluded that there are beneficial effects of music interventions on patient treatment regimens, such as increased parasympathetic activity, respiratory rate, heartbeat regulation, improved attention and concentration, reduced stress, reduced agitation and body relaxation. Therefore, music can be considered a non-pharmacological therapy that promotes the individual's well-being and quality of life (Silva et al., 2020). The results also pointed out that music therapy can be an alternative to existing conventional care for patients undergoing Percutaneous Cardiovascular Procedures (PCPs) due to the benefits obtained in the reduction of levels of psychological stressors (anxiety and stress).

In addition to music therapy, educational guidelines, therapeutic massage and aromatherapy were evidenced in studies with patients undergoing cardiac catheterization or angioplasty. In this regard, appropriately planned educational actions are effective strategies to make patients aware of their condition, assist in treatment and alleviate fear and anxiety. In addition to guidance on the procedure, education on healthy habits contributes positively to changing eating behaviours and increasing physical exercise and smoking cessation (Teixeira et al., 2019).

A study in Greece by Malliarou et al. (2022) tested educational brochures about cardiac catheterization, the procedures performed in the hospital and possible complications. Similarly, in Wales, Morgan et al. (2021) observed the effects of educational guidelines on anxiety reduction through handouts and verbal explanations about an immersive virtual reality experience. A study protocol in Germany reinforced the effects of a pseudo-educational video and standardized medical information on reducing anxiety and stress before and during cardiac catheterization (Block et al., 2022).

Furthermore, a study by Lucena et al. (2020), with 25 patients admitted to vascular surgery wards, showed a significant reduction in anxiety levels through an educational intervention related to the surgical experience. Albums and folders were used about the preoperative, intraoperative and postoperative periods, with approaches to the myths and truths of the surgical environment. The Beck Anxiety Inventory was used to assess anxiety levels, and the authors concluded that clarifying doubts through health education contributes to patient care. Given the above, it is denoted that educational interventions are effective non-pharmacological strategies that can be used before, during and after endovascular procedures to obtain satisfactory outcomes in anxiety and stress reduction.

A randomized clinical trial in Saudi Arabia demonstrated a significant reduction in pain, stress and fatigue after performing a

TABLE 6 Characterization of interventions in the studies included in the review.

Reference/country and year	Study design	Types of interventions	Characterization of interventions
E4 (Peng et al.) China/ 2015	A randomized clinical trial	Massage	The massage time was 20 min before surgery, and the main massaged body parts were the head, neck, shoulder and back. First, taking up and rubbing on neck for 2 min. Second, taking up and rubbing on shoulders for 1 min
E6 (Malliarou et al.) Greece/ 2022	A randomized clinical trial	Information brochure	On the day of catheterization, each participant in both groups was assessed to identify their problems, knowledge, fear level, and anxiety level before and after the procedure. The instruments used were the Information Satisfaction Questionnaire (ISQ), and the stress questionnaire (temporary and permanent) STAI
E8 (Forooghy et al.) Iran/ 2015	A randomized clinical trial	Music therapy	Music was played using a digital MP3 player and a headphone. The music consisted of light instrumental music albums by Johann Sebastian Bach and Mariko Makino. Music therapy sessions lasted for 20 - 40 minutes, depending on the length of Percutaneous transluminal coronary angioplasty
E9 (Esfandiari et al.) Iran/ 2022	A randomized clinical trial	Music, eye mask, music + mask	Anxiety levels were measured using the STAI scale 10 minutes before and 20 minutes after the end of the procedure. In the music group, wireless headphones were used and non-verbal classical music was played for 20 minutes. In the mask group, a cotton eye mask was used on the inside to avoid eye damage, and linen on the outside to prevent light entry. The mask was kept on throughout the procedure. In the music + mask group, the interventions were applied simultaneously
E14 (Wu et al.) Taiwan/ 2014	A randomized clinical trial	Regular education, accessibility-enhanced multimedia informational education, instructional DVD education	Anxiety levels were measured using the STAI. Group 1: verbal and conventional instructions on cardiac catheterization and a standard educational pamphlet already used by the hospital with photos; Group 2: DVD player connected to a projector to present a 12-minute video about the purposes, importance and care before, during and after the procedure, respiratory relaxation instructions and an educational pamphlet; Group 3: DVD player connected to a projector to present a 12-minute video and education added to the standard care of the hospital service.
E16 (Ayasrah & Ahmad) Jordan/ 2016	A randomized clinical trial	Educational video	A randomized controlled trial with one experimental group and one control group was used. A sample of 186 Jordanian patients admitted for their first diagnostic CATH at a major specialized heart institute affiliated with the Royal Medical Services (RMS), Amman, Jordan were considered for the study. All patients were admitted to cardiac care units in the hospital and were placed in separate rooms prior to and after a CATH procedure. This separate room layout is very important to avoid contamination of the clinical trial intervention and facilitate the individuality of the educational sessions
E17 (Foji et al.) Iran/ 2015	A randomized clinical trial	Guided Imagery CD	The individuals in the control and experimental groups were placed in a silent environment, without any sound or light environmental stimuli. Using headphones, participants were encouraged to create guided mental images for 18 minutes. Anxiety levels were measured at two moments: before and after the intervention, using the STAI scale
E18 (Moon et al.) South Korea/ 2022	A randomized clinical trial	Music therapy	Musical intervention, considering patient preference, performed by a music therapist, through headphones, with a sound intensity ranging from 60dB to 70dB, for 20 minutes before cardiac catheterization and for 60 minutes during the coronary procedure. The patients' anxiety level was measured using the STAI scale and a numerical scale that ranged from zero to 10. Salivary cortisol samples were also collected on the day of the procedure, in the morning
E20 (Morgan et al.) Wales/ 2021	A randomized clinical trial	Immersive virtual reality	A 10-minute virtual reality video was shown to patients in the intervention group. The video presented information regarding the experience before cardiac catheterization and during this procedure. The video was presented on the day of the coronary intervention and the audio output was through headphones. As strategies, doctors and nurses from the cardiac catheterization laboratory provided instructions, combined with animated videos, to explain the procedure and the more technical aspects. The patients' anxiety level was measured using the STAI scale
E21 (Harkness et al.) Canada/ 2003	A randomized clinical trial	Information/education session	This was a 2-group randomized controlled trial. Intervention patients received a nurse-delivered detailed information/education session within 2 weeks of being placed on the waiting list for elective CATH. Control group patients received the usual care

massage with odourless almond oil for 30 min from the patients' palms of the hands to the shoulders, back and legs. The intervention was used from the second to the fourth day after a cardiac catheterization, but no significant reduction in anxiety was found (Hassan et al., 2019).

Furthermore, a previous study evaluated the patient's psychological preparation for cardiac catheterization through nursing consultations in the preoperative period in a university hospital in Rio de Janeiro and showed that this intervention promoted trust between patients and nurses, clarified doubts, minimized insecurity and anxiety, improved adherence to established therapeutic actions and helped prevent adverse events (Nascimento et al., 2021).

The most prevalent scale used in the studies to identify anxiety and stress was the Spielberger State-Trait Anxiety Inventory (STAI). A meta-analysis on the use of STAI described a strong relationship between anxiety and the severity of depressive symptoms, identifying the presence of high anxiety scores in individuals with anxiety and depression compared to a control group. This scale has 40 items divided into two subscales: state (STAI-S) and trait (STAI-T). The first subscale measures momentary apprehension, the anticipation of anxiety and autonomic nervous system arousal. The second measures the tendency to develop anxiety by identifying patterns of personal feelings. A Likert scale of one to four is used to score each item (Knowles & Olatunji, 2020).

Furthermore, another non-pharmacological therapy found refers to the use of essential oils, including lavender oil, which was found to reduce anxiety (Donelli et al., 2019).

In addition to the STAI, the Visual Analogue Scale for Anxiety (VAS-A) was also used in the reviewed studies. The VAS-A consists of a ten-centimetre line representing the patient's subjective level of anxiety. The end of the line represents momentary minimum anxiety, while the opposite end corresponds to maximum anxiety. This scale allows for classifying the intensity of anxiety based on a distance measured from the beginning of the line to the marked point (Lin et al., 2019).

This scale has been mentioned in randomized clinical trials evaluating the effect of massage on the extremities, hands, or feet on preoperative anxiety. The non-pharmacological intervention was performed 10 min before the surgical procedure, proving effective anxiety relief based on the VAS-A scale (Farahani et al., 2020). Another scale found in the review is the Depression Anxiety Stress Scale 21 (DASS-21), which contains 21 items that measure depression, anxiety and stress. The score is ranked using a Likert scale ranging from zero to three, and high scores represent more intense emotions (Bakioğlu et al., 2021).

In addition, the practice of nursing care based on non-pharmacological therapies is in ascension in the world and Brazil, characterizing itself as an efficient alternative of care. Therefore, this study portrays tools that nurses can widely use in their practice with cardiac patients.

It is inferred that in the context of Integrative Health Practices (also called complementary medicine), where non-pharmacological

strategies are inserted, the scientific health literature reinforces the importance of professional nurses in conducting these studies, as evidenced in the review. It should also be noted that the research presents important contributions in the field of nursing, as it opens up a range of possibilities for future studies in the context of psychological stress reduction (anxiety and stress) in patients undergoing percutaneous endovascular procedures.

The limitations of this scoping review refer to the small number of recent studies on the topic. Furthermore, this study was limited to studies with adult and older adult patients. Therefore, paediatric patients were not included.

6 | CONCLUSION

Music therapy, educational guidelines and videos, massage, psychological preparation and aromatherapy were identified as the main non-pharmacological therapies used to reduce anxiety and stress in patients undergoing vascular procedures. To a lesser extent, interventions such as electroacupuncture, hand massage, relaxation techniques and acupressure positively reduced anxiety and stress. The STAI-S, STAI-T, VAS-A and DASS-21 were the major scales used in the studies.

Non-pharmacological therapies represent an effective alternative to drug treatment, increasing the patient's quality of life and health. Although our scoping review has not been funded, investments in studies on the patients are essential to increasing scientific knowledge about alternative therapies, enhancing the available knowledge and improving the quality of health care.

AUTHOR CONTRIBUTIONS

FCOM, KVGS and JKSD participated in the study's conception, methodology and design. FCOM and JKSD contributed to the acquisition and selection of studies in research data sources. FCOM, KVGS, JKSD, SCMA, FCT and KCSL participated in the analysis, writing, reviewing and editing of manuscript data. DVD and RAND participated in the supervision and coordination of the planning and validation of the research activities. All authors read and approved the final version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors of this article declare that there is no conflict of interest.

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