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Distraction and relaxation techniques to overcome claustrophobia during magnetic resonance imaging: a literature review

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Claustrophobia, MRI, distraction and relaxation techniques

Abstract

Claustrophobia can be a contraindication for patients undergoing MRI scans. This re-view investigated distraction and relaxation techniques for overcoming claustrophobia during MRI scans through scientific literature available on PubMed, Cochrane Library, Scopus, and Google Scholar. Thirty peer-reviewed articles were selected, which high-lighted an improvement in the tolerability of the examination through the use of mu-sic, virtual reality, relaxation techniques, patient reassurance, pet therapy, and aro-matherapy. The purpose of this review is to identify new and/or proven strategies that do not require the use of anesthetic drugs to reduce patient anxiety related to MRI examinations.

Introduction

Magnetic resonance imaging is a diagnostic method used to monitor various medical conditions. It is considered safe, due to the absence of ionizing radiation, even for pregnant women and children. However, its use may be limited by the experience of patients, who report feelings of moderate anxiety (in approximately 25%–30% of cases) [1] and claustrophobia (1%–15%) [2]. The patient's perception during the MRI scan, including discomfort and anxiety, can positively or negatively influence the conclusion of the diagnostic examination and the presence of artifacts from movements related to the experience of discomfort. The percentage of magnetic resonance imaging (MRI) examinations not performed due to claustrophobia varies but is estimated to be around 3-4%. To increase patient compliance with these examinations, the architecture of the scanner is fundamental (reduction of the gantry length, increase in the gantry diameter, "open MRI" configuration). In addition to the architecture of the scanner, the use of an acquisition protocol suitable for the specific clinical question, optimizing imaging parameters with faster sequences, noise reduction [3,4], and the use of "silent sequences," as well as hardware modifications, such as new gradient and shielding designs, have positive effects on claustrophobia and anxiety related to MRI examinations. Technical aspects are not the only factors that have a positive impact on patients, but relaxation and distraction techniques have proven to be effective tools in creating less anxiety-inducing environments. Music, thanks to its calming properties, can reduce anxiety and improve patient tolerance to the procedure [5], while virtual reality offers an immersive experience that distracts and diverts attention from the feeling of confinement, helping to decrease the perception of claustrophobia [6]. In addition, the integration of guided breathing techniques, such as diaphragmatic breathing and relaxation exercises, has been shown to be useful in modulating physiological responses to stress, promoting a sense of calm and control. However, in addition to these multimedia and therapeutic techniques, the role of healthcare staff remains fundamental. Their expertise allows them to manage the procedure in the best possible way, clearly explaining what will happen and reassuring the patient, while their empathy makes the patient feel listened to and understood, reducing anxiety and fear. The combination of these qualities with innovative approaches creates a more reassuring and comfortable environment, which can make a big difference in reducing claustrophobia and improving the overall patient experience during MRI.

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Materials and Methods

A total of 289 peer-reviewed articles identified through research on PubMed, Cochrane Library, Scopus, and Google Scholar were selected for this review. The keywords "Claustrophobia+MRI" were used to search for these articles, and all those available up to May 25, 2025, were considered in order to include as many studies as possible dealing with relaxation and distraction techniques in patients undergoing MRI. After a preliminary screening process, the final number of peer-reviewed studies included was 30 out of the 289 articles, based on relevance. After the analysis, the bibliographic references of the selected publications were also searched (Table 1, Figure 1).



The studies included were selected based on well-defined inclusion and exclusion criteria. The inclusion criteria were:

- Studies addressing claustrophobia during imaging procedures, particularly magnetic resonance imaging.
- Research into non-pharmacological interventions aimed at reducing anxiety and claustrophobia, such as relaxation techniques, music, virtual reality, and guided breathing techniques.
- Studies published in English, with a focus on adults and pediatric patients.

Exclusion criteria included:

- Studies that focused exclusively on pharmacological interventions for the management of claustrophobia.
- Research that did not specifically address the issue of claustrophobia during imaging procedures.
- Studies with populations with psychiatric comorbidities not relevant to the focus of the review.

Through this rigorous selection process, the review focused exclusively on non-pharmacological interventions effective in reducing anxiety and claustrophobia during MRI procedures, thus providing an up-to-date and targeted overview of the most promising strategies in this area.

Table 1.

INCLUSION CRITERIA	EXCLUSION CRITERIA
Research into non-pharmacological interventions aimed at reducing anxiety and claustrophobia, such as relaxation techniques, music, virtual reality, and guided breathing techniques	Studies that focused exclusively on pharmacological interventions for the management of claustrophobia.
Studies addressing claustrophobia during imaging procedures, particularly magnetic resonance imaging.	Research that did not specifically address the issue of claustrophobia during imaging procedures
Studies published in English, with a focus on adults and pediatric patients	Studies with populations with psychiatric comorbidities not relevant to the focus of the review

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a) b)

Figure 1. *(**a**) VR headset used during magnetic resonance imaging examinations; (**b**) Radiologic technologist management of a claustrophobic patient. Figures should be placed in the main text near to the first time they are cited.*

Discussion

Most studies in the literature are based on the implementation of information to be provided to patients undergoing magnetic resonance imaging, which is the most effective technique, as demonstrated by the study by AF Al-Shemmari et al. with a significant correlation between the level of education of the radiology technician ($r_s = +0.18$, $p = 0.028$) and experience ($r_s = +0.33$, $p < 0.001$) with their confidence in managing claustrophobic patients [8]. The implementation by radiology staff in communicating with patients can also be done through AI (Artificial Intelligence). In the study by GR Bonfitto et al, ChatGPT [OpenAI, 2023] was used to simulate conversations between radiology technicians and patients in the management of claustrophobia during magnetic resonance imaging. In this study, six radiology technicians were selected to participate in the study, and virtual patients of different ages, genders, and types of MRI diagnostic examinations were used, each with a different degree of claustrophobia and, therefore, a different level of difficulty in conversing with the patient. The simulations showed a success rate of 96.7% (58/60 simulations), which coincides with the virtual patient's consent to undergo the examination [9].

Communication with the patient is essential to reduce feelings of claustrophobia during the examination. Information about the examination can also be provided through audio-visual guides. In the randomized clinical trial conducted by Powell R et al., patients were provided with a DVD containing a 7-minute clip explaining the procedure and sensory information, followed by 12 minutes of relaxation training (n=41), as an intervention to reducing motion artefacts and to enhance scan completion [7]. The control group (n=42), on the other hand, was provided with generic informed consent information. The results of the study were evaluated based on the number of patients who completed the MRI examination and the absence of motion artifacts. Specifically, 35 patients in the experimental group and 23 in the control group completed the examination without the presence of motion artifacts, demonstrating the efficacy of the intervention.

In the study by Tugwell JR et al, the 74 subjects were divided into three groups [10]. The first group was given information through a video showing what to expect during an MRI scan, the second group through a semi-structured telephone conversation with a radiologist, and the control group through a routine information procedure. Anxiety reduction was assessed using the State-Trait Anxiety Inventory (STAI) questionnaire administered before and after the MRI scan, which showed a reduction in anxiety in the video group ($F = 13.664$, $p = 0.001$) and also in the telephone group ($F = 6.443$, $p = 0.015$) compared to control patients, but without finding any significant difference between the two interventions ($F = 0.665$, $p = 0.419$). This study also assessed the presence of motion artifacts,

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predictive of claustrophobia-related anxiety, but no difference in motion artifacts was observed between the three groups.

Audiovisual aids are also used to stimulate guided and self-directed imagery and autogenic suggestion, as in Lukins' study R, where a control group (n=52) was compared with a group that performed relaxation exercises before the scan (n = 44) and a group that practiced relaxation both before and during the scan (n = 43) [11]. Compared to the control group, patients who practiced relaxation showed a reduction in anxiety during the scan.

Another strategy used through self-guidance is guided self-hypnosis, studied by Napp AE in a cohort composed of 69% women, with a mean age of 53.6 ± 13.9, at high risk undergoing magnetic resonance imaging [12]. In this study, patients undergoing open MRI with a 1.0 Tesla magnetic field in the experimental group showed a significant reduction in claustrophobia (16%; 9/55) as assessed by the Claustrophobia Questionnaire (CLQ) compared to the control group (43%; 38/89). In addition, this group required less pharmacological sedation (2% vs. 16%; 1/55 vs. 14/89; odds ratio .1; p = .008) and other coping strategies (13% vs. 28%; 7/55 vs. 25/89; odds ratio .3; p = .02) to complete the MRI examination.

Given its ease of implementation with the magnetic field of resonance, the use of music is extremely widespread and provides an economical solution for reducing claustrophobia [5,8].

The study by Földes Z. demonstrated that, in a sample of N = 60, patients were assigned to three groups: a no-music control group, an original tempo (random) music group, and a synchronized music group. Participants in both the random and synchronized music groups showed significantly reduced state anxiety levels after the MRI examination compared to the control group. However, no significant difference was found between the two musical conditions in terms of their effectiveness in reducing post-examination state anxiety [13].

Furthermore, Darcy D Walworth's study compared live music therapy interventions with preferred recorded music in a sample of N = 88 patients undergoing magnetic resonance imaging [14]. Participants who received the live music therapy protocol reported a significantly better perception of the MRI procedure ($p < 0.05$), with fewer requests for breaks between scans (2% vs. 17.6%).

The literature also mentions sensory stimulation involving both sound and smell, in which natural sounds were combined with the use of a pure, natural lavender fragrance [15].

The study focused on 106 patients, 64 cases and 42 controls. The cases underwent sensory stimulation during the scan, through the insertion of a scented cotton disc in the scanner near the head and/or the reproduction of relaxing bird sounds through headphones. After the scan, participants completed a questionnaire about their experience with MRI, which showed that on a scale of 1 to 4 (score 1 = relaxing and score 4 = intolerable), the average score for the patient experience in the control group was 1.74 ± 0.63 standard deviation (SD) and in the case group it was 1.67 ± 0.60 SD.

Motion artifacts were also evaluated using a scale ranging from 1 = no motion to 4 = intense motion. This evaluation showed that the average score for motion artifacts, as assessed by two radiologists, was 1.13 ± 0.53 SD in the control group and 1.08 ± 0.36 SD in the case group.

Aromatherapy alone has been shown to distract patients during MRI examinations in the study by W H Redd et al. [16]. In this study with a sample size of n=57, a 63% reduction in anxiety was observed in the experimental group that received a vanilla-like fragrance compared to the administration of humidified air alone via a nasal cannula.

Anxiety associated with claustrophobia during an MRI scan can also be reduced by familiarization with the environment. Familiarization through the use of VR (virtual reality) can transform threatening and bor-

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ing conditions into safe and pleasant states through simulation games. The use of this technology, which presents some implementation obstacles with the magnetic resonance method, is widely used especially in pediatrics, particularly in the preparation phase for the examination [17].

The most significant and innovative implementations are found in pediatrics, where, in addition to the one described above, the use of pet therapy has been documented to calm children in the waiting room, with a reduction in patient anxiety [18]. In this pilot study, it was noted that 90% (19/21) of pediatric patients, based on a comparison of pre- and post-scan questionnaires, showed a statistically significant improvement in anxiety levels ($P < 0.01$). The use of live music has also been tested in pediatrics. The percentage of images repeated due to motion artifacts was 26% in the live music group and 73% in the recorded music group [14]. Less innovative but economical and widely used is the presence of parents in the MRI room and, for children under 6 months of age, inducing sleep without deprivation or sedation. Non-nutritive sucking and sucrose reduce the discomfort of the newborn, with one center reporting success in 89% of cases [19].

Conclusions

This review highlighted how distraction and relaxation techniques, such as music, virtual reality, and breathing exercises, can make MRI procedures more manageable for those suffering from claustrophobia. These strategies, combined with empathy and clear communication from healthcare staff, can create a more reassuring and less anxiety-inducing environment. The majority of implementations and innovations in the use of relaxation and distraction techniques reported in the literature have been applied in the pediatric population, likely due to children's lower compliance. Human support, combined with innovative technologies, can help patients feel more in control and less frightened, improving not only the experience but also the quality of diagnoses during magnetic resonance imaging examinations.

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