ISSN 1220-8841 (Print)
ISSN 2344-4959 (Online)

ROMANIAN
NEUROSURGERY

Vol. XXXVIII | No. 1 March 2024

Potential psychological responses in patients who underwent MRI scanning

Zainab A. Alaraji,
Oday Atallah,
Zinah A. Alaraji,
Sajjad G. Al-Badri,
Mustafa Ismail,
Samer S Hoz

DOI: 10.33962/roneuro-2024-014

Romanian Neurosurgery (2024) XXXVIII (1): pp. 87-89
DOI: 10.33962/roneuro-2024-014
www.journals.lapub.co.uk/index.php/roneurosurgery

Potential psychological responses in patients who underwent MRI scanning

Zainab A. Alaraji[1], Oday Atallah[2], Zinah A. Alaraji[3], Sajjad G. Al-Badri[4], Mustafa Ismail[5], Samer S Hoz[6]

[1] College of Medicine, Alnahrain University, Baghdad, IRAQ
[2] Department of Neurosurgery, Hannover Medical School, Hannover, GERMANY
[3] College of Medicine, Alnahrain University, Baghdad, IRAQ
[4] Department of Neurosurgery, College of Medicine, University of Baghdad, Baghdad, IRAQ
[5] Department of Neurosurgery, Neurosurgery Teaching Hospital, Baghdad, IRAQ.
[6] Department of Neurosurgery, University of Cincinnati College of Medicine, Cincinnati, OH, USA

Keywords
magnetic resonance imaging, psychological impact, mood changes, darkness therapy, depressive symptoms

ABSTRACT

This paper explores the potential impact of magnetic resonance imaging (MRI) on patients' psychological states, focusing on reported mood changes post-procedure. Factors influencing the psychological state during an MRI, including claustrophobia, noise, scan duration, and fear of the unknown, are discussed. We also draw parallels with darkness therapy, a stress and depression management technique, due to the similar environment. Notably, a subset of patients reported transient improvement in depressive symptoms following an MRI, suggesting a need for further research. The paper underscores the necessity for rigorous scientific exploration of these observations to validate them and better inform patients about possible mood alterations post-MRI.

BACKGROUND

Depression, a significant global contributor to disability, often goes undiagnosed due to its subjective diagnostic process, which primarily relies on clinical observations [16]. Recently, magnetic resonance imaging (MRI) has shown promise for enhancing our understanding and management of depression. MRI's potential lies in its ability to detect structural changes in the brain associated with depression. Notably, incidental mood improvement observed following MRI scans requires further examination [16]. This paper aims to investigate the potential psychological effects of undergoing an MRI, specifically the impact on mood disorders, and to explore the possible implications of these effects in a clinical context.

Corresponding author:
Samer S Hoz

Department of Neurosurgery, University of Cincinnati College of Medicine, OH, USA

hozsamer2055@gmail.com

ISSN online 2344-4959
© Romanian Society of Neurosurgery

First published
March 2024 by
London Academic Publishing
www.lapub.co.uk

MRI

MRI, introduced in the 1980s, has revolutionized diagnostic imaging with its diverse applications across neurological, psychiatric, cardiac, abdominal, musculoskeletal, and vascular fields. Despite MRI's general safety, certain contraindications exist, particularly for patients with cardiac implantable electronic devices (CIEDs) or metal/magnetic implants. Additionally, some surgical stents, implants, clips, wires, rods, patches, and tattoos require cautious evaluation before MRI use [5,7,18]. The duration of an MRI scan varies between 20 to 60 minutes [5]. Anecdotally, we've observed mood changes in patients post-MRI, a phenomenon yet to be well-documented in scientific literature.

The direct effects of magnetic fields on a patient's psychological state are poorly understood. However, FDA-approved repetitive transcranial magnetic stimulation (rTMS), which uses magnetic fields to treat medication-resistant depression, shows an average response rate of 29.3% in major depressive disorder cases [4,6,15]. Moreover, according to Wang et al., administering low-frequency pulsed magnetic field stimulation (a type of TMS) at a frequency of 1Hz could potentially alleviate depression symptoms in rats that have undergone prolonged unpredictable stress [17].

Hattapoğlu et al. studied cervical disc herniation patients using pulsed electromagnetic fields (PEMF). Studying different factors, including pain, anxiety, and depression, after the therapy, which lasted for 12th weeks, showed improvement in the pain, anxiety, depression, sleep, and quality of life scores as known pain can cause limitations and affect psychological state; however, no evidence can explain if the enhancement in the anxiety and depression state related solitary to the improvement of the pain, may the magnetic field have an unspecified role in this improvement [9].

Interestingly, studies suggest that fetuses develop memories six weeks before birth, possibly through exposure to low-level light passing through the human skin into the uterus [6]. The resemblance between the confined space and low light level of the uterus and an MRI machine may possibly induce a soothing effect, explaining post-scan mood changes. Given the similar magnetic principles underlying MRI and rTMS, the potential mood-altering effects of MRI warrant further investigation, particularly for patients with depressive disorders.

Several factors associated with the MRI procedure could potentially influence a patient's psychological state:

1. Claustrophobia: The confining nature of MRI machines can induce claustrophobia, a fear of enclosed spaces, which may provoke anxiety or panic in some individuals [10].
2. Noise: MRI machines' loud, recurring sounds during the scan can be distressing, leading to increased discomfort or anxiety for some patients [3].
3. Duration: The length of an MRI scan, which varies from a few minutes to over an hour, can exacerbate feelings of restlessness, impatience, or anxiety [2]. However, The duration and the frequency of the exposure play a significant role in the psychological state; according to a study by Ghotbi et al., workers at a copper electrolysis unit who were exposed chronically to static magnetic fields experienced a notable increase in depression, anxiety, and sleep disorders [8]. Furthermore, being subjected frequently to extremely low-frequency electromagnetic fields (ELF-EMF) has led to memory impairment, anxiety, stress-related behaviors, and behavior resembling depression in rats [1].
4. Uncertainty: Patients unfamiliar with the MRI procedure may experience fear or anxiety from the unknown, including potential health risks or apprehension about scan results.
5. Darkness therapy: This prevalent treatment technique, entailing a restful, solitary period in a dimly lit space for 24-48 hours, has demonstrated efficacy in managing stress and depression, providing self-recognition, and facilitating potential spiritual experiences [12]. Flotation rest, a form of darkness therapy, has been associated with mental and physical benefits like improved mood, reduced stress, enhanced athletic performance, and increased creativity. Some patients have reported contrasting experiences during MRI procedures, akin to aspects of darkness therapy [14].

In conclusion, while the majority of patients reported minimal mood changes post-MRI, a subset observed a temporary upliftment in depressive symptoms in the days following the procedure. These findings highlight a potential direction for future research: exploring the possible therapeutic effects of MRI on

mood disorders. As a part of ethical patient care, future considerations could involve informing patients about this potential "side effect." Despite the controversy surrounding this issue and the current lack of substantial scientific evidence, further studies are warranted to investigate this phenomenon.

References

1. Bagheri Hosseinabadi M, Khanjani N, Ebrahimi MH, Haji B, Abdolahfard M. Chronic exposure to extremely low-frequency electromagnetic fields affects sleep quality, stress, depression, and anxiety. Electromagn Biol Med. 2019;38(1):96-101.
2. Beker K, Garces-Descovich A, Mangosing J, Cabral-Goncalves I, Hallett D, Mortele KJ. Optimizing MRI Logistics: Prospective Analysis of Performance, Efficiency, and Patient Throughput. AJR Am J Roentgenol. 2017 Oct;209(4):836-844.
3. Bongers S, Slottje P, Kromhout H. Hearing loss associated with repeated MRI acquisition procedure-related acoustic noise exposure: an occupational cohort study. Occup Environ Med. 2017 Nov;74(11):776-784.
4. Cheng CM, Li CT, Tsai SJ. Current Updates on Newer Forms of Transcranial Magnetic Stimulation in Major Depression. Adv Exp Med Biol. 2021; 1305:333-349.
5. Edelstein WA, Mahesh M, Carrino JA. MRI: time is dose--and money and versatility. J Am Coll Radiol. 2010 Aug;7(8):650-2.
6. Ford H, Hahn L, Clarke P, Gill S, Carnell B, Galletly C. A comparison of 15-minute vs. 30-minute repetitive transcranial magnetic stimulation sessions for treatment-resistant depression - are longer treatment sessions more effective? J Affect Disord. 2021 Mar 1; 282:974-978.
7. Ghadimi M, Sapra A. Magnetic Resonance Imaging Contraindications. [Updated 2023 May 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan.
8. Ghotbi, M. R., Mardi, H., Khanjani, N., et al. (2015). Occupational exposure to steady magnetic fields and workers' mental health at the copper electrolysis unit. J. Saf. Stud. 1:1–10.
9. Hattapoğlu E, Batmaz İ, Dilek B, Karakoç M, Em S, Çevik R. Efficiency of pulsed electromagnetic fields on pain, disability, anxiety, depression, and quality of life in patients with cervical disc herniation: a randomized controlled study. Turk J Med Sci. 2019 Aug 8;49(4):1095-1101.
10. Iwan E, Yang J, Enders J, Napp AE, Rief M, Dewey M. Patient preferences for development in MRI scanner design: a survey of claustrophobic patients in a randomized study. Eur Radiol. 2021 Mar;31(3):1325-1335.
11. Lang A, Ott P, Del Giudice R, Schabus M. Memory Traces Formed in Utero-Newborns' Autonomic and Neuronal Responses to Prenatal Stimuli and the Maternal Voice. Brain Sci. 2020 Nov 11;10(11):837.
12. Malůš, Marek & Kavková, Veronika & Kupka, M.. (2014). The Darkness therapy is a tool for reducing anxiety, depression and increasing well-being (2014).
13. Reid et al., 2017 V.M. Reid, K. Dunn, R.J. Young, J. Amu, T. Donovan, N. Reissland The human fetus preferentially engages with face-like visual stimuli Current Biology: CB, 27 (12) (2017), pp. 1825-1828 e1823.
14. Reiter RJ, Tamura H, Tan DX, Xu XY. Melatonin and the circadian system: contributions to successful female reproduction. Fertil Steril. 2014 Aug;102(2):321-8.
15. Taylor R, Galvez V, Loo C. Transcranial magnetic stimulation (TMS) safety: a practical guide for psychiatrists. Australas Psychiatry. 2018 Apr;26(2):189-192. Epub 2018 Jan 17.
16. Vaziri-Bozorg SM, Ghasemi-Esfe AR, Khalilzadeh O, Sotoudeh H, Rokni-Yazdi Antidepressant effects of magnetic resonance imaging-based stimulation on major depressive disorder: a double-blind, randomized clinical trial. Brain Imaging Behav. 2012 Mar;6(1):70-6.
17. Wang L, Yang J, Wang F, Zhou P, Wang K, Ming D. Modulation of Low-Frequency Pulsed Magnetic Field on Hippocampal Neural Oscillation in Depression Rats. Annu Int Conf IEEE Eng Med Biol Soc. 2018 Jul; 2018:259-262.
18. Yousaf T, Dervenoulas G, Politis M. Advances in MRI Methodology. Int Rev Neurobiol. 2018; 141:31-76.