

MAGNETNO REZONANČNA VARNOST IN OBRAVNAVA PACIENTOV S VSTAVLJENIMI KARDIOVASKULARNIMI ELEKTRONSKIMI NAPRAVAMI: PREGLED NAJNOVEJŠE LITERATURE IN ŠTUDIJA PRIMERA

MRI SAFETY AND MANAGEMENT OF PATIENTS WITH CARDIOVASCULAR IMPLANTABLE ELECTRONIC DEVICES: LITERATURE REVIEW AND CASE PRESENTATION

Matic Godec, Jani Izlakar, Gašper Podobnik

Onkološki inštitut Ljubljana, Zaloška cesta 2, 1000 Ljubljana, Slovenija /
Institute of Oncology Ljubljana, Zaloška cesta 2, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: matic.godec@gmail.com

Prejeto/Received: 15. 3. 2022

Sprejeto/Accepted: 16. 3. 2022

IZVLEČEK

Uvod: Magnetna resonanca je dolgo časa veljala za absolutno kontraindikacijo pri MR preiskavah pacientov z vstavljenimi CIED napravami. Tehnološki napredek na področju razvoja CIED naprav je doprinesel k uveljavitvi MR pogojno varnih kardiovaskularnih elektronskih naprav v kliničnem okolju. MR pogojno varne CIED naprave ne predstavljajo kliničnega tveganja za paciente s tovrstnimi napravami, če so upoštevani specifični pogoji uporabe. Varna izvedba MR slikanja je postala ključnega pomena pri zdravljenju tovrstnih pacientov.

Namen: Namen te raziskave je predstaviti pregled področja obravnave pacienta z vstavljenimi CIED napravami med MR slikanjem in predstaviti primer MR slikanja prostate pri pacientu s CIED napravo.

Metode: V študiji smo predstavili obsežen pregled literature na področju MR varnosti in obravnave pacientov z vstavljenimi CIED napravami. Predstavili smo tudi primer obravnave MR slikanja prostate pri pacientu s CIED napravo. Literaturo smo zbirali s pomočjo elektronskih podatkovnih baz PubMed, Cinahl, Wiley Online Library in ScienceDirect.

Rezultati in razprava: Preiskavo smo izvedli v skladu s priporočili, predstavljenimi v tem dokumentu. MR status naprave smo ugotovili na podlagi pregleda identifikacijske kartice naprave in proizvajalčevih priporočil o uporabi naprave v MR okolju. Preiskava je bila opravljena brez kliničnih zapletov. Na MR slikah ni bilo prisotnih popačenj zaradi prisotnosti CIED naprave.

Zaključek: Najnovejše klinične študije in izdana priporočila ugotavljajo, da je MR slikanje pacientov s CIED napravami relativno varno v specifičnih pogojih, ne glede na to, ali gre za MR pogojno varne naprave ali ne. Ključnega pomena pri zagotavljanju varnosti pri MR preiskavah tovrstnih pacientov je predhodno multidisciplinarno načrtovanje preiskave, natančen varnostni pregled oz. screening pacienta, kakovosten nadzor nad pacientom med preiskavo in ocena delovanja naprave po preiskavi.

Ključne besede: magnetno resonančno slikanje, varnost, srčno žilne elektronske naprave

ABSTRACT

Introduction: MRI has long been contraindicated in patients with CIED devices due to the risk of adverse effects through electromagnetic interference. Recent developments in engineering have led to the introduction of the MRI Conditional CIED devices that do not cause significant clinical harm to patients undergoing MRI, when specific imaging conditions are met. Safe access to MRI has become a crucial need for patients with CIED devices.

Purpose: The purpose of this paper is to present an overview of managing patients with implanted CIED devices and to present a case report of a patient with CIED undergoing prostate MRI examination.

Methods: This paper explores the MRI safety and management of patients with implanted CIED devices through an extensive literature review and case presentation. The literature search was conducted using medical scientific electronic databases such as PubMed, Cinahl, Wiley Online Library and ScienceDirect. We examined a patient with CIED device undergoing prostate MRI examination.

Results and discussion: We performed the examination of the described patient in accordance with the guidelines presented in this paper. MR conditionality status was determined using device identification card and manufacturers technical manual. The MRI examination of the patient was completed without complications, therefore; no adverse effects were reported. MRI images were without artefacts.

Conclusion: Recent clinical studies and published guidelines suggest that MRI of the patients with either MRI conditional or MRI non-conditional CIED device is relatively safe under specific conditions. Multidisciplinary pre-procedure planning, strict screening process, monitoring and device evaluation protocols are of key importance for ensuring safe MRI imaging in patients with CIED.

Keywords: magnetic resonance imaging, safety, cardiovascular electronic devices

LITERATURA / REFERENCES

- Abi-Samra F (2011). Cardiac Implantable Electrical Devices: Bioethics and Management Issues Near the End of Life. *Ochsner J*, Vol 11(4): 342-47.
- Bauer Rudolf W, Lau D, Wollmann C, McGavigan A, Mansourati J, Reiter T, et al. (2019). Clinical safety of ProMRI implantable cardioverter-defibrillator systems during head and lower lumbar magnetic resonance imaging at 1.5 Tesla. *Sci Rep*, Vol 9: 1-11.
- Blessberger H, Kiblboeck D, Reiter C, Lambert T, Kellermaier J, Schmit P, et al. (2018). Monocenter Investigation Micro MRI study (MIMICRY): feasibility study of the magnetic resonance imaging compatibility of a leadless pacemaker system. *EP Europace*, Vol 21(1): 137-41.
- Dahiya G, Wetzel A, Kyvernitakis A, Gevenosky L, Williams R, Shah M, et al. (2021). Impact of magnetic resonance imaging on functional integrity of non-conditional cardiovascular implantable electronic devices. *Pacing Clin Electrophysiol.*, Vol 44(8): 1312-19.
- Deshpande S, Kella D, Padmanabhan (2020). MRI in patients with cardiac implantable electronic devices: A comprehensive review. *Pacing Clin Electrophysiol.*, Vol 44(2): 360-72.
- Groner A, Grippe K (2019). The leadless pacemaker: An innovative design to enhance pacemaking capabilities. *JAAPA*, Vol 32: 48-50.
- Indik J, Gimbel R, Abe H, Verma A, Wilkoff B, Woodard P, et al. (2017). 2017 HRS expert consensus statement on magnetic resonance imaging and radiation exposure in patients with cardiovascular implantable electronic devices. *Heart Rhythm.*, Vol 14(7): 97-117.
- Korutz A, Obajuluwa A, Lester M, McComb E, Hijaz T, Collins J, et al. (2017). Pacemakers in MRI for the Neuroradiologist. *AJNR Am J Neuroradiol.*, Vol 38(12): 2222-30.
- Martinez J, Ennis D (2019). MRI of Patients with Cardiac Implantable Electronic Devices. *Curr Cardiovasc Imaging Rep.*, Vol 12(27): 1-9.
- Poh Ghim P, Liew C, Yeo C, Chong Roy L, Tan A, Poh A (2017). Cardiovascular implantable electronic devices: a review of the dangers and difficulties in MR scanning and attempts to improve safety. *Insights Imaging.*, Vol 8(4): 405-18.
- Santini L, Forleo G, Santini M (2013). Implantable devices in the electromagnetic environment. *J Arrhythm.*, Vol 29(6): 325-33.
- Schaller R, Bruncker T, Riley M, Marchlinski F, Nazarian S, Litt H (2021). Magnetic Resonance Imaging in Patients With Cardiac Implantable Electronic Devices With Abandoned Leads. *JAMA Cardiol.*, Vol 6(5): 549-56.
- Shinbane J, Colletti P, Shellock F (2011). Magnetic resonance imaging in patients with cardiac pacemakers: era of »MR Conditional« designs. *J Cardiovasc Magn Reson.*, Vol 13(63): 1-13.
- Verma N, Knight B (2019). Update in Cardiac Pacing. *Arrhythm Electrophysiol Rev*, Vol 8(3): 228-33.
- Vigen K, Reeder S, Hood M, Steckner M, Leiner T, Dombroski D, et al.(2020). Recommendations for Imaging Patients With Cardiac Implantable Electronic Devices (CIEDs). *JMRI*, Vol 52: 1311-17.
- Wilkoff B, Cantillon D (2011). Device Therapy in Heart Failure. V: Mann D, eds. *Heart Failure: A Companion to Braunwald's Heart Disease*. 2nd ed. Philadelphia: Saunders, 694-793.