Saudi Journal of Radiology
December 2024
Abstract Submitted to the 15th Annual Meeting of Radiology Society of Saudi Arabia (RSSA)

ADVANCEMENTS IN MRI TECHNOLOGY: EVALUATING THE SHIFT FROM HELIUM- COOLED TO HELIUM-FREE SYSTEMS

Meshaal M. Alenezi[1,2], Haifa Alqahtani[3], Sadeem Alasmari[4], Nora Alyami[5], Faleh H. Alenzi[6] and Sultan Alqahtani[7]

[1] Nuclear Medicine Department, King Khalid Hospital (KKHH), Hail Health Cluster, Ministry of Health, Hail, Saudi Arabia
[2] Radiology Department, King Fahad General Hospital (KFHJ), Jeddah Second Health Cluster, Ministry of Health, Jeddah, Saudi Arabia
[3] Department of Radiology, Alshefaa Specialized Hospital, Najran, Saudi Arabia
[4] Radiology and Medical Imaging Department, College of Applied Medical Sciences, Prince Sattam Bin Abdulaziz University, Alkharj, 11942, Saudi Arabia
[5] Department of Radiology, Alshefaa Hospital, Najran, Saudi Arabia
[6] MRI Unit, Radiology Department, Northern Area Armed Forces Hospital, King Khalid Military City, Hafr Al Batin, Saudi Arabia
[7] King Saud University for Health Sciences, College of Applied Medical Sciences, Al Ahsaa, Saudi Arabia

ABSTRACT

Introduction: This study highlights critical advancements in Magnetic Resonance Imaging (MRI) technology, with a specific focus on comparing cryogenic and cryogen- free MRI systems. Given the increasing significance of MRI in radiology, understanding the performance, cost-effectiveness, and sustainability of these technologies is essential for informed decision-making in the field. This review provides valuable insights into the current state of MRI systems, offering important considerations for future research and practical implementation.

Research Question/Hypothesis: The study hypothesizes that cryogen-free MRI systems offer comparable performance to traditional cryogenic systems while providing advantages in cost-effectiveness and sustainability.

Study design: This is a literature review focused on recent advancements in MRI technology, particularly the transition from helium-cooled to helium-free systems.

Methods: A comprehensive search of peer-reviewed articles was conducted. The review provides a comparative analysis of helium-free and helium-cooled MRI systems and discusses MRI advancements through Artificial Intelligence (AI). This comprehensive review sheds light on the current state and advancements in cryogenic and cryogen-free MRI systems. It underscores the potential benefits and challenges associated with each technology, providing valuable insights for researchers, practitioners, and policymakers in the field of MRI.

Data Analysis/Statistics: The collected articles were systematically analyzed to compare the performance, cost-effectiveness, and environmental impact of cryogenic and cryogen-free MRI systems. The analysis focused on qualitative comparisons of the key findings across the selected studies.

eISSN: 1658-8959

Results: The comparison between cryogenic and cryogen-free MRI technologies reveals that while cryogenic systems have traditionally offered superior image quality, cryogen- free systems have advanced significantly. These advancements allow cryogen-free systems to offer comparable performance with greater cost-effectiveness and sustainability. Cryogen-free systems are more affordable, easier to install, and environmentally friendly due to the absence of liquid helium. As these systems gain market adoption, future research will focus on enhancing their performance and reliability, particularly in high-field applications.

Conclusion: This research paper addresses whether cryogen-free MRI systems can serve as a viable alternative to traditional cryogenic MRI systems. The findings suggest that cryogen-free systems offer potential advantages in cost-effectiveness, operational simplicity, and comparable image quality. However, challenges such as optimizing cooling methods and integrating the technology into existing healthcare infrastructure remain. Further research and development are necessary to fully realize the benefits of cryogen-free MRI systems in medical diagnostics.