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Current Status of MRI in India

Dear readers and friends,

We have been asked to introduce this edition of MAGNETOM Flash by talking about the status of magnetic resonance imaging in India. We are doing so at a very difficult time, as India is facing its worst-ever wave of the COVID-19 pandemic. Many other parts of the world are also fighting this pandemic. We convey our sincere wishes for the good health and safety of the international MR community and the world at large.

India is an emerging economy on the global horizon and is rich in human resources. Like elsewhere in the world, MRI indications are expanding in India – especially with the growing geriatric population, the burden of chronic non-communicable diseases, and the increased reliance on non-invasive diagnostic procedures. However, a major constraint in India is poverty and the very large population, which is spread unevenly across the country. A large part of the population still resides in rural areas. It is against this unique backdrop that we have to understand the status of MR in India.

The medical device industry in India is expected to grow to US$50 billion by the year 2025. Currently, India is among the top 20 medical-device markets in the world and the fourth largest in Asia after Japan, China, and South Korea.

According to figures from 2019, there is an estimated annual market of approximately 270 to 280 MRI scanners shared by all the major vendors. The estimated number of MRI scanners installed across India is around 2,800 (including permanent magnet, 1.5T, and 3T scanners), of which the majority are 1.5T systems. 3T scanners are more common in metro and Tier-1 cities, and account for approximately 50–65% of the MRI market in those regions. Although 1.5T scanners still have the largest market share, the 3T systems are the ones contributing to the market growth. On an average, the annual market across government hospitals and medical colleges amounts to 40–60 MRI scanners and is cyclical. Private hospitals and diagnostic imaging centres account for about 220 new MRI scanners in a year. The volume of low-field-strength systems is stagnant at present.

The prohibitive cost of MR scanners limits their accessibility for the general population in our resource-poor environment. Most of the MR scanners are concentrated in the metro and Tier-1 cities. Penetration in rural areas is negligible. Also, the stringent requirements regarding power supply, a trained workforce, service, and maintenance are difficult to address at the peripheral level. On the positive side, in the last decade there have been many government initiatives to equip teaching hospitals across India with high-end MR scanners. Also, many new tertiary-care teaching hospitals are being set up across the length and breadth of the country, and are being equipped with state-of-the-art imaging equipment. The corporate sector has also set up hospitals in Tier-2 and Tier-3 cities, which will help to improve accessibility for the rural population. In the year lost to the COVID-19 pandemic, there has been a slump in the addition of new MRI scanners, although government-aided hospitals have perhaps been ahead of the private sector in the acquisition of new scanners. The government has also been promoting a Make in India campaign to bring down costs, adapt MRI to local requirements, and boost the domestic economy. As a result, a number of promising lightweight MRI scanners are in an advanced stage of development here.

Major limiting factors in MRI are the prohibitive cost, the need for trained personnel, and the complex infrastructure requirement for MR scanners. A cheaper lower-field-strength scanner that requires simpler infrastructure and can leverage recent advances – such as automated study planning, compressed sensing, innovative *k*-space filling strategies, remote support for troubleshooting, and deep-learning-aided image generation – would go a long way to making MR available to the Indian population. It would reduce both the capital and operational expenditure required for things such as helium top-ups, and could be used in areas where trained personnel is scarce. By utilizing the currently available technologies, it is possible to achieve good-quality diagnostic images with lower-field-strength scanners without a significant time penalty. There is a distinct need for low-cost MR scanners which can use optimum technology and provide good-quality images. In countries like India where trained personnel may not be available in small cities, it would further help if such scanners allowed the remote execution of MR protocols. This would be a major step toward making MR imaging more accessible in resource-poor regions of the world.

As far as the usage pattern is concerned, the bulk of the work at most sites is craniospinal imaging, followed by musculoskeletal imaging. Use of MR imaging for the evaluation of abdominal and chest diseases is generally confined to large tertiary-care and academic centres. In metro cities, there are many centres of excellence engaged in high-end research, including advanced applications like whole-body imaging, MR elastography, diffusion-weighted imaging (including intravoxel incoherent motion and diffusion kurtosis imaging), perfusion imaging, and texture analysis. These techniques have been used in India not only for the traditional oncology applications but also for diseases endemic in India, such as tuberculosis. Many groups in India, including ours, have published extensively on advanced MR applications.

This issue of MAGNETOM Flash contains some very interesting articles on the use of techniques for improving throughput, on the application of deep learning and AI to the field of MRI, and on iterative denoising. There is also an impressive gallery of images that were generated on the upcoming 0.55T system[1] using advanced technology. Happy reading!

Dr. Raju Sharma **Dr. Devasenathipathy Kandasamy** **Dr. Ankur Goyal**

[1]*MAGNETOM Free.Max is pending 510(k) clearance, and is not yet commercially available in the U.S.*

We appreciate your comments.
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