CLINICAL MRI SITUATION IN IRAN

In Iran, during the past few years, there has been an outburst of chronic inflammatory diseases, cancers of the stomach, breast, lung, and prostate, and neurodegenerative diseases, such as Parkinson’s disease, Alzheimer’s disease, and multiple sclerosis. Late-stage referral of patients is a major factor contributing to health care failures. As a result, for most of these conditions, treatments are ineffective. Patients undergo frustrating and redundant examinations at high expense, and they are left desperate and with poor quality of life and survival.

In addition to these intrinsic factors, other important influences have negatively affected Iranian health care. During the past several years, the international sanctions against Iran and consequent currency collapse have adversely affected the Iranian health care system by restricting the import and transport of essential medical products. This has empowered the black market. The currency changes have increased the expense of purchasing, refurbishing, and maintaining MRI equipment to the extent that MRI centers ignore the exploitation of advanced equipment, raise the costs of imaging, and mandate increasing the number of patients imaged on a daily basis to compensate for rising expenditures. Meanwhile, the average income of ordinary Iranians has descended to almost half of what they earned before the sanctions. Insurance companies have become incapable of reimbursing health care costs, imposing an even greater burden on the patients.

Iranian radiologists and radiographers have a busy schedule, imaging about 80 to 90 cases per day per magnet. In these circumstances, the value of research for exploring novel MRI and analysis and quantification techniques is disregarded. The Iranian radiology community fails to pay heed to the cardinal role of MR physicists in establishing optimized, case-specific protocols and imaging procedures and in conducting research intended to provide specialized care for patients.

The situation is more severe at MRI facilities outside the capital, which are equipped with obsolete MRI scanners, outdated software, and radiologists and radiographers who are poorly trained in clinical research methodology.

As a consequence, the physicist’s role is increasingly poorly defined, and many prescribed MRI examinations are acquired unnecessarily and according to routine protocols, with insufficient information to provide patient-specific diagnosis. Not only do patients bear the heavy burden of their disease, but they are also exposed to repetitive and expensive diagnostic examinations, often followed by redundant or scant treatments. This leaves patients distressed and bewildered; medical centers overcrowded beyond their capabilities and resources; radiologists with inadequate imaging information to support the accuracy of their reports; and referring physicians indecisive about the optimal treatment strategy. Ultimately, patients are either under- or overtreated, with resultant poor quality of life and survival rates.

In Iran, there exists approximately one MR scanner for every 600,000 people. At the root of the problem is excessive exploitation of clinical MRI, aiming to raise the benefit of MRI centers, with little thought to ensuring the quality of imaging. As an example, it is not infrequent that a center maximizes revenue and minimizes costs by using head coils to replace broken knee coils. Patients with ambiguous indications who might require more scanner time are treated with routine but often inadequate clinical imaging protocols. Because of restrictions on access to novel pulse sequences and protocols and, consequently, absence of research for exploring alternative advanced imaging technologies, clinical imaging in such critical cases fails to enhance the diagnosis and treatment of patients.

At a 1991 radiology summit meeting, Charles Putman called research an “eccentric uncle of radiology,” whose presence is acknowledged by radiologists and
which is brought out at appropriate occasions to be admired, but its role in the specialty has been overlooked [1]. Research has long been an indispensable component of the practice of radiology in developed countries. In Iran, clinically applicable research is still an impotent relative, playing a marginal role in patient-specific treatment planning. Extravagant funds are sometimes awarded to researchers for projects that have only poor associations with clinical demand and hence have only a minor impact on diagnostic outcomes. Research that could significantly influence the diagnosis of complicated clinical cases is not being satisfactorily supported.

WHAT IS THE SOLUTION?
Medical decision making should be an evidence-based practice derived from objective scientific data interpretation. It is proclaimed that the only certainty in medicine is the prevalence of uncertainty [2]. This uncertainty, which is an Achilles’ heel of radiology reports [3], arises as a result of a number of factors, including technical issues (improper image quality), insufficient clinical information, anatomic variations, and a lack of approved standards. This issue becomes even more severe when radiologists are forced to manage a large workflow in a limited period of time.

Given the issues of accuracy, organ- and patient-specific protocol implementation, and the clinical feasibility of developed techniques, diagnostic MRI requires a research-oriented structure in clinical practice. MRI protocols and innovations must be amended by clinical feedback in a controlled scheme. This research-practice scheme could be described as a triangle constructed of three main vertices with close interactions: a clinician who knows the clinical demands and the place for innovations or modifications to emerge and a radiologist who can exploit the developed tools in diagnostic practice; an MRI physicist (basic scientist) who is aware of the existing and evolving technologies, how they can be optimized to be incorporated in clinical practice and case-specific treatment planning; and a technician who applies the MRI technology according to the radiologist’s prescription and the physicist’s recommendations (Fig. 1).

Unfortunately, in the majority of Iranian MRI and research centers, at the very least, the interactions of two vertices are either not present or malfunctioning, leading to a defective loop of treatment decision making in Iranian clinics, which causes failure of the health care system in the proper management of complicated referral cases to diagnostic radiology.

The solution to these problems at Iranian MRI centers could be addressed by establishing a decision-making team including the three components. Each of the vertices of the triangle should be committed to sharing opinions and to being responsible for achieving an acceptable diagnosis with a quantifiable estimate of uncertainty.

The “engagement” of a collaborative team of specialists in a long-standing and close relationship with one another provides the opportunity to reduce errors through effective communication and the existence of a feedback loop. Thus, the source of uncertainty would be identified and reduced accordingly: if the problem originates from poor image acquisition strategy, the physicist can advise; if it is relevant to imprecise clinical data, the referring physician deals with it; or if it corresponds to subjective error in rendering images according to the available evidence, the radiologist would take action. The triangle of shared decision making is missing from Iranian radiology. Currently, the radiologist is the sole responsible individual, who simultaneously must attempt to handle a huge workload, reviewing about 100 cases per day.

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### Fig 1. The Triangle of Research—Practice Scheme in Radiology.

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TEAM SETUP PRINCIPLES
According to the International Society for Magnetic Resonance in Medicine, team-based collaborations follow the principles of developing a partnership that could be induced by mutual benefits involving six principal ingredients:

1. Discover: Among millions of scientists worldwide, whom would you lay your glance on to start a collaboration? To embark on any purposeful relationship, it is of paramount importance that the right chemistry and the spin to resonate with the desired frequency are uncovered, to realize whether there would be a chance to harmonize with each other to generate a new insight into the problem.

2. Connect: After identifying your teammate, there comes the moment of bridging the distance to identify whether there exist mutual interests. This mysterious assessment is associated with the initiation of the team. At this point, both sides would frame the issue to be tackled and move forward to design the resolutions on the basis of the perspectives that each partner brings to the discussion to undertake the research procedure. A developed community would build on the establishment of strong conjunctions among the individuals, which bring about more confidence in the team-based relationships. This is where the spins are exposed to the external magnetic field.

3. Engage: After a connection becomes a relationship and the team is being organized, there comes the time when mutual interests hook into one another and both parties consider mutual benefits as their supreme aspiration. What we refer to as “collaboration engagement” is a blanket term for a set of principles that actively commit the partners of a collaborative team from the beginning through the end of the process. This means that all collaborators respect the knowledge that their partners offer to the problem of interest, leading to an effective partnership. A developed team would be organized as a consequence of the commitment of each individual team member to care for and adapt themselves to prioritize the welfare of the community. At this stage, the isochromatic spins become in phase with each other.

4. Develop: Growth blossoms when there is a common sense that pooling of ideas and insights, resources, engagement, and efforts from many are more worthwhile than relying on a few best individuals. Together the partners endeavor to understand the issues of interest, designing and implementing research-oriented solutions through lateral thinking originating from the collaborative engagement. They interpret the results on the basis of their significance to change the insights about the given problem and disseminate the findings. This is where the signal is generated and the insight into the nature of the problem is being captured.

5. Save: After the development of harmonized constituents in an effective collaboration, the production process is unobtrusively facilitated in such a way that there remain few or no conflicting ideas and methodologies. A running course of successive events and ideas would be initiated whereby obstacles are surpassed with the aid of flowing group elements and a large amount of energy is preserved. When there exists little inhomogeneity among the spins, the dephasing effects would diminish, and the signal-to-noise ratio would improve.

6. Access: The whole process of constructing collaborative relationships would ultimately produce an ocean of opportunities and resources for the whole team.

CONCLUDING REMARKS
Today in Iran’s MRI practice, the critical role of research is not being attended to as a component of medical practice. The abundance of excessive MR images acquired on a daily basis with imprecise and low-impact results on the survival and quality of life of patients with complicated conditions is indicative of an inefficient patient management strategy. Resources are extravagantly expended on unnecessary effort, while inadequate imaging fails to adequately address patients’ conditions.

Because the position of MR physicists is yet undefined in the Iranian profession of radiology, the significance of training medical physics and engineering graduates through a physics residency program has been disregarded and considered superfluous. This attitude results in suboptimal acquisition and analysis from both the financial perspective and the
viewpoint of patient outcomes. At the root of the problem is the ineffective setup of an MRI framework and the lack of a well-organized team of all experts for optimizing MR acquisitions.

Better involving MR physicists in integrating research with clinical practice could smoothly revolutionize MRI research in Iran and ultimately improve health care. Actions in this regard could illuminate the path of advancement for enthusiastic scientists and entrepreneurs who wish to make a change for the better and could ignite creativity and inspire exceptional endeavors toward achieving success. Iran could be a land of opportunity for those who believe and commit themselves to change the situation!

REFERENCES

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