



Clinical Radiology: Past, Present, and Future—Whither are We Going?

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It is high time we radiologists in India pondered this question. In this context, it is apt to review the growth of our specialty worldwide, particularly in India and discuss the factors influencing the same, globally and in the Indian scenario.

Evolution of Diagnostic and Interventional Radiology—Global Perspective

Radical changes in radiology happened in the '60s in Charles Dotter's time. Dr. Dotter recognized the critical differences in training and practice needed between radiation oncologists and diagnostic radiologists. He was instrumental in setting away an independent department of radiation therapy separate from the department of radiology. His department was the first one to secure admitting privileges for radiologists, much to the consternation of others.¹ The '70s and '80s saw unprecedented changes in diagnostic radiology (DR) with the advent of ultrasound (US), computed tomography (CT), and magnetic resonance imaging (MRI) scanners. Simultaneously, changes with fine refinement happened in the image-guided and catheter-based percutaneous procedures. The '80s and '90s saw the evolution of interventional radiology (IR). Radiologists had to face the following challenges: (1) To keep pace with the advancements happening in DR. (2) To master the interventional procedures with newer devices and techniques. Additionally, patient care was also added to it. With rapid advancements in all the realms of radiology, the need for specialization in radiology was also felt.² A consensus statement was developed by the Society of Interventional Radiology, USA and was signed by 42 other IR organizations across the globe. This statement included the various elements of IR under various heads like clinical scope

and practice, training, certification, quality improvement, and research.³

IR practice varies according to local factors in each country and region. In some countries, IR is formally recognized as a unique subspecialty of DR, whereas in other countries, IR is formally recognized as a distinct radiologic specialty. Nevertheless, it was agreed upon worldwide that an IR should have a firm foothold in DR.^{3,4} This was commensurate with patient care issues and the demand in the private sector.

The American Board has amalgamated DR and IR in the basic curriculum and in system-wise specialties like gastrointestinal (GI) and vascular radiology, apart from the already existing neuroradiology.⁵ Hopefully, this will bring about the ultimate change on par with any other specialties like cardiology and neurosurgery.

Evolution of Radiology: Indian Scenario

The wave of evolution in radiology just described above reached India a decade or two later. The bifurcation of radiodiagnosis (RD) and radiotherapy was established in the late '70s and early '80s, when Doctor of Medicine (MD) training program in RD was also introduced. All conventional special investigations like barium studies of the GI tract, Dionosil bronchogram, intravenous urogram, and other similar procedures were in vogue and were widely performed in private practice. All invasive procedures ranging from trans-lumbar aortogram and direct puncture carotid angiogram were done under fluoro guidance. At that time, many talented and dedicated radiologists tried to maintain a self-identified specialization of their interests. They acquired skills in a specific system as a part of continued self-education.

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Professional giants focusing on systems like Alexander R. Margulis, Benjamin Felson, and Howard M. Pollack were their role models. There was a great emphasis on clinical examination before any investigation and defining indications. The term “clinical radiology” was coined and was used frequently. General medicine and general surgery training were also included in the curriculum (e.g., Barnard Institute, Chennai, Tamil Nadu, India), with separate examination papers for clinical aspects in MD (RD). With the advent of US in the late '80s, there was a change in focus toward the noninvasive modality, which demanded hands-on experience and expertise. Many youngsters then became expert sonologists and kept pace with its advancement. It became an easy source of income for many radiologists.

In the '90s and 2000s, further major changes happened in DR, as CT and MRI scans were introduced. Both demanded different types of expertise. Since then, many advancements and refinements happened in the realm of CT scans and MRI scans. Cross-sectional imaging and post-processing had a charm of their own. In the chaotic bustle of mastering the various modalities, we somewhat drifted away from the patient's problems. We started working as a “service department” catering to the needs of referring clinicians.

While these developments were occurring in DR, simultaneously, IR also progressed to a great extent. There was the introduction of new techniques and devices to tackle previously untreated disease entities. Unlike earlier, IR was taking away considerable time of a practicing radiologist. There was reluctance to take up this specialty, as it entered the realm of patient care, call duties, and follow-up. Misconception and trepidation were not limited to the radiology community alone. The clinical counterparts never considered interventional radiologists as their peers and instead found much comfort in relegating their status to skilled technicians. Thus, IR in India carried the label of a nascent field with an identity issue.

Turf War in Radiology

With the rapid growth of radiology as described above, conflicts of interest also evolved globally, India being no exception. Turf war in radiology is as old as Charles Dotter. He warned the radiology fraternity about the risk of being considered skilled plumbers unless they took up the responsibility for their patients.¹

The turf war has not been confined to procedures alone but involved imaging too. An example worthy of quoting is an advertisement in a 2005 issue of *Journal of the American College of Cardiology* regarding a 2-day course on CT angiography (CTA) of coronaries—read as “CT Angiography for the Cardiologist.” No radiologist or radiologic physicist was part of the course faculty! The American College of Cardiology (ACC) which sponsored the course believed that after a 2-day exposure to a workshop and lectures, cardiologists would be ready to perform and interpret CTA studies.⁶ It is pertinent to note that ACC prescribes rigorous training standards when it comes to the core or standard procedures in cardiology, for

example, electrocardiogram, echocardiography, etc. This example brings out the uneven standards of training in diagnostic imaging, especially for a “physician imager.” In a world of reimbursement with a congenial insurance policy, a radiologist cannot even play the role of a gatekeeper to ward off unwanted investigations.⁷

Similarly, interventional radiological procedures are also considered, by these “other” specialists as mere techniques that can be learned quickly in addition to their routine clinical work. To cite a few examples—vascular surgeons and cardiologists foraying into peripheral vascular intervention, neurosurgeons and neurologists into neurointervention. Novel names like endovascular surgery, minimally invasive surgery, and interventional neurology fortify their ventures. Endovascular surgical neuroradiology is considered an emerging subspecialty in neurology.⁸ The unique needs and frustrations of IRs in private practice are well elaborated by Raj Pyne in his article.⁹

Curriculum

The curriculum of radiology in most countries, especially in the Western world, spans 5 or 6 years. A typical core training of Fellowship of the Royal College of Radiologists is as follows. The first year of training includes basic sciences, physics of radiographic techniques and procedures, clinical skills, communication skills, and reporting styles.¹⁰ From the second to fourth year, there is a systematic rotation in all specialties, which are system-based, technique-based (IR, nuclear medicine), disease-based (oncology), and age-based (pediatric). In addition, modality-wise (US, CT, MRI, nuclear medicine) training includes indication, technical aspects of doing a case, modification of protocols based on the clinical scenario, interpretation, etc. The training is mostly compartmentalized and assessed periodically. Thus, the set targets are reviewed annually to verify the competence gained during that period by competent authorities. The trainee portfolio and log book during the period facilitate the review. Specialty is taken up normally in the 5th year, as per the trainee's requirement. This includes continued training of core competency to a higher professional level or developing a subspecialty skill of their choice. Further training in a single specialty in the 6th year is also possible. Thus, it takes 5 to 6 years of training to be a competent specialist. Training in IR also has been transformed from a 1-year fellowship to a completely separate residency program spanning 4 to 5 years. At this point, it is noteworthy that the branching of general radiology (specialty) is mainly system-based, and subspecialties are disease-based in a particular system, for example, specialty-GI radiology with a subspecialty in liver disorders and related interventions.

In India, the scenario is different. After 3 years of training in general radiology, the young qualified consultant can take up specialization if required. Some go for short-term fellowships which are usually for 3 to 12 months. Some institutions offer 3-year Doctorate of Medicine (DM) programs with

different names and syllabi. Recently, IR transformed from a 1-year fellowship in a few institutions to a separate residency program spanning 3 years.

The seminal events involved in the evolution of the specialty and the international variations in the training of IR are well brought out in two recent articles.^{11,12} The basic competence entailed in IR training is well described by Ahmed et al.¹³

Future?

Before thinking of solutions, we can summarize the issues facing Indian radiology that we discussed so far as follows:

1. Curriculum and training standards are not uniform across the country.
2. The inertia of our community to play an active role in patient management or our incapacity to work as a team.
3. Encroachment of our specialty by multiple other specialties (turf war).

Some Suggestions

There can be many strategies to chart out a safe and productive future course. The author intends to share his thoughts in this regard here.

- ❖ The needs and welfare of the patient should be at the center of any solution envisaged.
- ❖ We, radiologists should not shy away from taking up the “additional” responsibility of patient care. Being content with modality practice or “enjoying the thrill” of doing the procedures and handing over the patients to other specialists will be detrimental to the future of our discipline.
- ❖ Genuine patient care and team spirit will take us a long way and our sincerity will be recognized in the long run. Turf wars will slowly melt away before a strong, genuine clinical radiologist. We have a bright future provided we start acting with the ultimate aim of specialization, as has happened in general medicine and general surgery.
- ❖ The strength of our specialty is the innovation and creativity in developing new techniques and procedures which ultimately reflect improved patient care and outcomes.
- ❖ Streamlining the curriculum and practice is the most important task in front. The concerned medical education regulatory authorities should know the need to implement a unified course curriculum with streamlined post-graduate and system-wise superspecialty DM courses.
- ❖ Introducing the subject of radiology in the undergraduate curriculum will be useful to comprehend the depth and vastness of the subject and its application in daily practice.
- ❖ During the early period of MD (RD) training itself, there should be a clear career-shaping channel in front of the trainees. The fundamentals of IR should be incorporated into the MD curriculum with enough exposure and confidence for basic diagnostic intervention, including catheter-based study. In this respect, the trainers also need orientation as to the nature of the curriculum which will ensure uniformity throughout the country. This guidance and channeling should be continued in the post-MD period also.

- ❖ A well-structured specialty course related to a system encompassing all basic sciences, imaging, and intervention (with all the requirements of an IR specialty like patient care, multidisciplinary team, etc.) will be ideal. Further subspecialization should be disease-specific in a particular system. This will take us closer to patient care and will promote teamwork with an air of mutual respect.
- ❖ To be specific, DM courses should be started in various disciplines like cardiovascular imaging and (vascular) IR, GI radiology (both imaging and intervention), etc. Also, the uniformity of the syllabus and names of the DM courses has to be ensured throughout the country. Collaboration with institutions of excellence and high-volume centers will ensure uniformity of training.
- ❖ We should not be disheartened by the hurdles on our way to achieving this ideal goal. We should resist all attempts of fragmentation of radiology nurtured by short, bread-winning courses and try to keep the sanctity of curriculum as is done in other medical and surgical specialties.
- ❖ On the other hand, if the opportunistic fragmentation continues, with whatever be the “justification and argument,” radiology will reduce to a status of an attractive bread-winning specialty, making us mere technocrats or glorified imagers with the perpetuation of the turf war.
- ❖ Modern developments like artificial intelligence and robotic interventions should be creatively imbibed into our working ecosystems. There need not be any undue apprehensions in this context as the versatility of human intelligence can never be replaced by machines. Proper clinical correlation and exercising logistics will always require a well-trained human brain.

The various societies formed in radiology has to work towards a common goal of streamlining the curriculum and practice of radiology in India.

To conclude with John A. Kaufman's words: “It will be up to us as individuals and collectively, to apply the dedicated effort necessary to make a future for DR and IR. Nobody will do this for us, and many others will do things that challenge us.”¹⁴ Only we can properly shape DR and IR's future.

Conflict of Interest

None declared.

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