The Evolution of Interventional Radiology

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ABSTRACT

Interventional radiology was once considered “angiography,” or in some hospitals, “special procedures.” Angiographers usually did not perform evaluation and management services. In 1963, Dr. Charles T. Dotter recognized the potential of catheters to be used in performing intravascular surgery. By the mid-1980s a wide array of therapeutic interventions and devices had been developed. The emergence of interventional radiology as a dedicated specialty, where interventionalists practice solely interventional radiology, has been a tremendous boost to referrals for therapeutic interventions. However, the possibility for change depends on the practice environment in which interventionalists work. This may serve as a note of caution to young interventionalists just out of fellowship; they have the most to lose if a practice doesn’t support interventional clinical practice over the long haul in terms of time and resources.

KEYWORDS: Technical practice model, clinical practice model, accountability

Objectives: Upon completion of this article, the reader will gain an understanding of the evolution from the technical model of interventional radiology to the clinical practice model.

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Most practitioners accept interventional radiology as a robust clinical specialty at the present time. Interventional radiologists are now fully expected to perform rounds in the hospital, admit patients to the hospital, and see patients in clinical settings outside the hospital for consultation and management issues. However, the history of interventional radiology shows that this was not always so. In fact, interventional radiology was once considered “angiography,” or in some hospitals, “special procedures.” It was part of the radiology department, and radiology in the past was a hospital-based diagnostic specialty. In this context, angiographers usually did not perform evaluation and management services. Interventional radiology grew out

of this historical technical practice model. Although interventional radiologists provided clinical care to patients on whom they performed procedures and occasionally saw patients on hospital wards for procedural complications, clinical patient care outside of the context of procedures was lacking. This was angiography in its infancy, in the mid-1960s to mid-1970s. By and large, the specialty was one in which contrast studies were performed in arteries, veins, and lymphatics, looking for solid tumors, performing vascular mapping prior to surgery, and searching for trauma and gastrointestinal bleeding, as well as pulmonary and deep venous thromboembolic disease. Numerous other minor invasive procedures were also performed, including, for

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example, myelography and arthrography. Therapeutic interventions were originally absent when the specialty began. The volume and complexity of procedures was limited, and the scope of the specialty was limited to these techniques and procedures and did not include patient management.

The first arteriograms were performed by surgeons by direct cutdown.¹⁻³ In 1953, Seldinger published his ingenious method of introducing a catheter into the vascular system following needle access.⁴ This opened up the field of angiography in radiology. Over the next 10 years, these techniques became refined in Europe (particularly Sweden). Catheterization became increasingly popular in the United States in the late 1950s and early 1960s, and by the mid-1960s, angiography was a well-established diagnostic medical specialty.

In 1963, Dr. Charles T. Dotter recognized the potential of catheters to be used in performing intravascular surgery. He published his seminal article in circulation in 1964, showing dilation of femoral artery atherosclerotic lesions with serial dilators introduced using Seldinger's method.⁵ These techniques were not highly regarded in the United States but took root in Europe in the 1960s. It wasn't until the mid-1970s that transcatheter therapeutic procedures became common in the United States. These included embolization for spinal vascular malformations and infusion of vasoconstrictors to treat intestinal hemorrhage, thrombolysis, and angioplasty. Though these procedures were not commonly performed and were still regarded with some suspicion by the general medical community, they were well accepted in Europe.⁶ Dr. Charles Dotter noted that from 1964 to 1970 there were only 26 publications involving arterial angioplasty in the world literature.⁷ By 1980 there were 17 articles on the subject in a single issue of the *American Journal of Roentgenology*.⁷ The specialty clearly had taken a keen interest in performing catheter-based therapy in addition to diagnosis. Other therapeutic procedures were also introduced in the 1970s, including biliary and genitourinary system therapeutic interventions.

By the mid-1980s interventional radiology had entered a golden era where the specialty, based on several forces, had begun its transition from a diagnostic model to a therapeutic one. First, a wide array of therapeutic interventions and devices had been developed, including

devices to allow vena cava interruption, angioplasty, stenting, and portosystemic shunting. These therapeutic advances occurred simultaneously with an increase in the availability of cross-sectional imaging, such as computed tomography, ultrasound, and magnetic resonance angiography. Indeed, by the late 1980s, much of the bread-and-butter diagnostic work of the earlier generation of angiographers was subsumed by newer cross-sectional modalities. Vascular mapping, solid organ trauma evaluation, imaging of deep vein thrombosis, and so on had all shifted to cross-sectional imaging methods.

Thus, interventional radiologists were straddling a professional practice model, wearing two hats: one of the hospital-based diagnostic specialists performing diagnostic tests and the other of the therapeutic interventionalist performing key procedures to treat patient's underlying diseases.

Although initially regarded by other specialties as quirky, unsafe, unjustified, or otherwise unsuitable to administer to patients, interventional radiology procedures rapidly proved to be so safe and effective that they began to be enthusiastically adopted and in some cases performed by those specialties that had previously derided them.

Had radiologists maintained the technical practice model typical of diagnostic radiology as a hospital-based specialty, their ability to effectively compete with clinical specialties would have been severely limited. The likelihood of referrals to the historical technical angiographer would be limited for several sound reasons. Primary care doctors, who have most of the patients in any region, are not qualified to evaluate appropriateness or indications for interventional procedures, often do not understand the natural history of the disease as well as interventional practitioners, and justifiably are loathe to admit patients in the hospital and manage complications from procedures that they poorly understand. On the other hand, practitioners in medical and surgical subspecialties would be at a strong competitive advantage in gaining referrals from primary care doctors as these practitioners have traditional office practices and have been historically very comfortable in evaluating patients, performing workups and ordering tests, and then determining treatment plans.

There are several impediments to interventional radiologists developing clinical practices (Table 1). It has

Table 1 Impediments to Transition to Clinical Interventional Radiology

Factors Supporting Clinical Interventional Radiology	Impediments to Clinical Interventional Radiology
Loss of diagnostic work to computed tomography, ultrasound, and magnetic resonance	Diagnostic specialty culture
Improved safety/efficacy of therapy versus surgery	General lack of subspecialization
Competition	Novelty of therapeutic focus
	Perceived (–)ROI of clinical care

(–)ROI, negative return on investment.

often taken a cultural change among the interventionalists and especially among their non-interventional radiology partners to enable clinical practices to flourish in the context of an umbrella structure of a diagnostic specialty. Namely, when radiology was a much smaller specialty, with much less diversity, radiologists could "cover" each other in the hospital. Because radiology was a diagnostic specialty, there were several reasons to encourage radiologists to be general in their practice focus and to not subspecialize in subsections of radiology such as, for example, barium. In most hospitals all radiologists could perform all of the services offered in radiology. As radiology has become more highly specialized, we have increasingly seen specialists that exclusively or almost exclusively provide services in the subspecialties of radiology. Because radiologists in general all did the same work, radiology practices were usually set up so that radiologists all earned roughly the same salary. Individual work wasn't tracked and reimbursement was not based on the individual's work. This is in contrast to most medical and surgical specialties and subspecialties where practitioners' incomes are based more on a fee-for-service basis. Generally, the more services they provide, the more money they earn. Given the more socialistic radiology reimbursement structure, a disincentive to taking on new work exists.

If a member of a diagnostic radiology group decides to take on a new line of business, learn a new service, or take on more responsibility, in many practices they do so with negligible increase in pay or time. In contrast, the medical and surgical specialists, who work in a more capitalistic reimbursement structure, get paid more and are under greater financial incentive to take on more work. As one can see, as new procedures come down the pike, it is very understandable how medical and surgical subspecialists would desire to perform those procedures. Indeed, interventional radiologists should be commended for taking on additional responsibilities and learning new procedures and providing them given that this usually entails increased responsibilities, worse call schedule, increased time at work, and more difficult work schedule, all with negligible increase in pay relative to their diagnostic counterparts.

Additionally, in many radiology practices, there were no dedicated interventional radiologists. That is, interventional radiologists took rotations in interventional radiology some days of the week but other days of the week were in other areas, or sometimes in free-standing imaging centers outside of the hospital. Clinical patient care makes this approach very difficult. That is, continuity of care is required to establish credibility with the referring community. The referring community needs to know who are the "go-to people" for various problems. They don't get a sense of confidence when people are not dedicated to a particular specialty but rather rotate in and out of diagnostic and therapeutic

specialties. The emergence of interventional radiology as a dedicated specialty, where interventionalists practice solely interventional radiology, has been a tremendous boost to referrals for therapeutic interventions.

One last impediment to the transition to the clinical interventional radiologist practice has been alluded to. Interventional radiology developed within the culture of diagnostic radiology, which, as the name implies, is a diagnostic specialty, similar to pathology. Therapy is really foreign to most radiologists, as is patient evaluation and management. Experience has shown that the concept of developing a treatment plan, implementing it, and then being accountable to the patient periprocedurally and longitudinally is difficult for many non-interventional radiologists to grasp. That is not to say that they don't support it in concept or in theory or that they lack any understanding of what it entails, but simply to emphasize that the diagnostic radiology culture is really not aligned with that type of practice. Interventionalists have found quite a lot of resistance and difficulty in developing clinical practices because the non-interventional radiology partners often don't support them with time and/or resources. They often look at time spent doing clinical duties as wasted time, when in fact those duties are essential to correctly provide the procedures. Referrals for many of the services that are commonplace today, including embolization for liver cancer, angioplasty, and stents or fibroid embolization, could never have been successful without providing clinical patient care. Many noninterventionalists are unaware of this. They may think that the procedures would be there even if the patient care wasn't. Experience has shown this universally to be wrong.

Additionally, many non-interventional radiologists regard time in the clinic as underpaid and look at it as a money loser. They fail to link procedures ordered in the clinic including imaging tests and interventional procedures in the revenue stream. This is clearly very shortsighted. In fact, in the Society of Interventional Radiology Socioeconomic Survey of 2000–2001, only 50% of interventional radiologists said they were satisfied with the support they received from their partners for interventional clinical services. Radiology practices readily accept the need to open new radiology offices or order new imaging equipment. Ironically, a practice may find it a very straightforward decision to purchase a \$400,000 digital mammography machine that doesn't break even but may be reluctant to commit to a \$5000 a month lease for clinical office space that protects a revenue stream of over \$1 million. Many interventionalists embraced a clinical practice mindset long ago. Though they probably began to see patients clinically in the hospital, many or most with this mindset have moved to non-hospital office-based clinical practices. This is the ideal situation as it is not possible and may even be illegal for private practices to be supported by the

hospital without any rent or any consideration. More importantly, providing clinical care is about respecting accountability to the patient and the physician-patient relationship. It is not merely about hospital admitting privileges and physician extenders. It is a true mindset about being a doctor. It is about accepting the role of clinical caregiver and fundamentally acknowledging responsibility for one's patients' care.

On the other hand, many interventionalists resisted transitioning to a clinical practice model until they were desperate. That is, they had already lost a significant amount of the desirable business to competitors in traditional clinical specialties. As has often been said, a desperate salesman is a hungry salesman, and often the referring community doesn't truly believe that the interventionalists in this arena are making the transition in a heartfelt way. Rather, the appearance in this situation is that the change is reactionary, and often the referring community perceives the changes as little more than window dressing. For some practices that let interventional procedures escape their domain, there may not be a real understanding of and consequently a sincere commitment to accountability for patient management, despite the trappings of a clinical practice. For many in this situation, the efforts to regain business will fail. Fortunately, it is never too late to attempt to change. Those who truly accept the mindset of practicing as doctors and reform their practice model, either on their own or, perhaps ideally, by bringing in new people, can always increase referrals. This is because interventional radiology has much to offer primary care doctors, who often look with suspicion on interventionalists' chief competition, cardiologists and vascular surgeons. If the primary care referrer perceives a sincere interest on the interventionalist's part to utilize their skills for the benefit of patients, the practice will build itself.

However, the possibility for change depends on the practice environment in which interventionalists work. That is, noninterventionalists usually have a majority in a group practice and can vote in or vote out any ideas or suggestions that interventionalists have. Unfortunately, the noninterventional majority may perceive their challenges in maintaining service in other imaging areas as having priority over maintaining interventional work. Therefore, interventional requests may

not be given the priority that will allow adequate resources to be assigned to help intervention flourish. In this situation, many interventionalists have left their traditional practices, either to join radiologists in enlightened groups or often to practice on their own as solo practitioners, to practice in groups of interventional radiologists, or to join forces with cardiologists or vascular surgeons. This trend is unfortunate in that the fragmentation of radiology is clearly a bad precedent. Anecdotally, in instances that we are aware of where these situations have occurred, it is clear that the clinical pursuits of interventionalists were not supported by the group and that the changes that these interventionalists made were necessary and justified from their standpoint. Additionally, in virtually every circumstance the interventionalists are satisfied with the arrangements that they made.

This may serve as a note of caution to young interventionalists just out of fellowship or those looking to change jobs. They have the most to lose if a practice doesn't support interventional clinical practice over the long haul in terms of time and resources. For those sincerely dedicated to the practice of interventional radiology and looking toward the future, such practices should be carefully avoided.

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