Advanced Imaging Programs: Maximizing a Multislice CT Investment*

By Robert Falk, MD

EXECUTIVE SUMMARY

- Advanced image processing has moved from a luxury to a necessity in the practice of medicine. A hospital’s adoption of sophisticated 3D imaging entails several important steps with many factors to consider in order to be successful.
- Like any new hospital program, 3D post-processing should be introduced through a strategic planning process that includes administrators, physicians, and technologists to design, implement, and market a program that is scalable—one that minimizes up front costs while providing top level service.
- This article outlines the steps for planning, implementation, and growth of an advanced imaging program.

It’s coming. In many hospitals, it has already arrived. Multidetector CT (MDCT), CT angiography, and advanced 3D imaging. This new technology offers the promise of evaluating disease processes from atherosclerosis to cancer to trauma more quickly, safely, and accurately than older techniques.1–4 CT angiography is already replacing diagnostic catheter angiography in many institutions. The emergency evaluation of chest pain is changing rapidly, with MDCT utilized for evaluating the coronary arteries, pulmonary arteries, and aorta often in a single breath hold, while at the same time being able to see adjacent soft tissues for lung disease, chest wall abnormalities, and upper abdominal disease. Complex fractures are being evaluated in 3D for presurgical planning with the anticipation of shorter, smarter surgical procedures and improved outcomes. Complex organs like the liver and pancreas can now be evaluated in detail prior to surgery, allowing surgeons to define optimum dissection planes for resection of disease. CT perfusion is being utilized more and more in the acute setting of stroke in order to guide patient management in the crucial early hours after the onset of symptoms. New applications for this technology are being developed every day. Advanced image processing has moved from a luxury to a necessity in the practice of medicine.

A hospital’s adoption of sophisticated 3D imaging, however, entails several important steps with many factors to consider in order to be successful. Consider the following hypothetical example:

Metropolitan Community Hospital decides that it needs a 64 slice CT scanner so they can “do hearts.” The cardiologists want to read the coronary CTAs and the radiologists don’t believe the cardiologists are qualified. This discussion is the first communication between these groups in 15 years. The scanner is purchased, as well as 3 workstations for 3D post-processing: one for the CT techs to use to do cases, one for the radiology reading room, and another for the cardiac cath area. The big day arrives for installation and the technologists are given 3 days of on-site applications training for the 3D workstations, divided amongst 3 techs during

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regular work hours of a busy day. After the applications person leaves, the techs know how to turn the machine on and do a few basic tasks. One of the radiologists has been to a course on 3D processing more than 2 months ago and hasn’t given it a thought since. There has been no marketing to referring physicians and no research into billing, coding, and reimbursement.

The first few cases occur and the images are sent without difficulty to the workstation, where the tech struggles to do the reconstructions. The radiologist can’t really remember how to do them but tries to. It takes an hour and it still isn’t right. He will spend hours over the next 9 months to 2 years working with the techs to teach them the skills and knowledge needed to process cases correctly. Since no marketing was done, few cases are ordered. Which is just as well because no one wants to do them and, by the way, the administrator just realized that the reimbursement is poor to nil for the amount of effort involved. His best techs are taken away from scanning for hours at a time to do the reconstructions and this is impacting scanner throughput. Everyone realizes that it’s just easier to use the 64 slice scanner just like they used to use the 16 slice machine; concentrate on routine CT work and not worry about CTA and “doing hearts.” Six months down the road, Metropolitan Community Hospital has 3 workstations functioning as coffee tables and coat racks and no 3D program to speak of.

This scenario can be avoided by tackling 3D post-processing like any new hospital program—through a strategic planning process that includes administrators, physicians, and technologists to design, implement, and market a program that is scalable. One that minimizes upfront costs while providing top level service. This should include the concept of “right-sourcing” 3D supertechs and workstation technology by the judicious use of a centralized 3D laboratory. In cases where the laboratory is in-house rather than outsourced, this should include adequate attention to robust technologist training—training that should occur prior to the ramping up of services.

Planning

Poor planning dooms many projects before they even begin. An advanced imaging program should be undertaken by an organization through a strategic planning process, just as any new, large, complex project would be. A hospital would never think of beginning a new surgical program by talking with equipment vendors, selecting the equipment needed, purchasing the equipment, installing the equipment, and then think about staffing, quality assurance, budgets, proformas, marketing, etc. Yet that is exactly how MDCT begins at many hospitals. A hospital has been expensive investments in time and equipment. While each medical community has unique issues, there are several common threads to success. It is vital to develop a level of communication and trust amongst competing specialists. The best way to do this is to identify physician champions from each specialty and get them involved in the planning process early. Strong administrative leadership is critical.

On the referral side, it is important to identify who among the medical staff will be the biggest users of this technology and begin educating them as to how 3D can be a uniting force between specialists who have traditionally been at odds. Handled poorly, turf issues can prevent a CTA program from ever getting off the ground. This is an issue that must be addressed in the strategic planning phase before there have been expensive investments in time and equipment. While each medical community has unique issues, there are several common threads to success. It is vital to develop a level of communication and trust amongst competing specialists. The best way to do this is to identify physician champions from each specialty and get them involved in the planning process early. Strong administrative leadership is critical.

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help them in their practices. Departmental meetings are a great way to begin this process and, of course, it’s always most effective coming from colleagues. It is vitally important to remember that the 3D lab will be serving 3 different customers with different needs: the radiologist or cardiologist reading the study, the ordering physician treating the patient, and the patient. It will be the images produced by the lab that have the potential to improve diagnosis for the interpreting physician, improve outcomes for the treating physician, and improve understanding of disease planning and treatment for the patient.

Equipment and Network Issues
Equipment and networking issues should be addressed early on, including a careful evaluation of all options. Of course, in order to evaluate all options, one needs to be aware of them. Just a couple of years ago there was only one way to approach 3D, which was to buy an expensive, single user, “fat” client workstation (or 2 or 3), integrate them into the local area network (LAN), and begin learning 3D.

Today, many more options exist, including the option of not purchasing any workstation technology up front and outsourcing the entire process to an independent laboratory. The advent of thin client technology has allowed hospitals and healthcare networks to design an advanced imaging architecture that maximizes efficiency and support of the mission of the institution while minimizing cost both up front and down the road.

Equipment and networking considerations include: a discussion of where post-processing will occur and by whom and who will need access to the images and with what degree of additional post-processing expertise. Further, how will the 3D lab integrate with PACS and RIS, and will doctors (both radiologists and ordering physicians) need home or outside office access? Will post-processing be needed 24/7? Consider networking issues such as the speeds available both on the LAN and over VPN tunnels, the speed at which the various thin client workstations operate efficiently, and the number of concurrent users who will need to be on the software. Will any or all of the post-processing be outsourced, either for off hours coverage, workflow management, or quality considerations? If so, what architectural options are related?

Coding and Reimbursement
A thorough understanding of the billing process will allow hospitals to launch an advanced imaging program with a realistic expectation of revenues and return on investment (ROI). It is important to note that revenues will be small and ROI will be negligible. By itself, 3D post-processing is not and never will be a profitable venture. It is quite simply a necessary step in the multislice workflow. Reimbursement is spotty and often illogical, and the billing and coding process is a constant, moving target.

Today, for example, there are 2 add-on CPT codes for 3D reconstruction. The first, 76377, covers 3D rendering of CT, MRI, ultrasound, or other tomographic modalities requiring image post-processing on an independent workstation. It can be billed in addition to the technical code for the CT scan itself and covers the more complicated studies requiring advanced post-processing software and additional user time and expertise. Typical examples include reconstruction of complex fractures for presurgical planning, depiction of tumors and their relation to surrounding anatomy, or liver segmentation for transplant donors. The second code, 76376, covers 3D rendering requiring image post-processing on an independent workstation. Typical examples include the various “single click” simple tasks such as multiplanar reformatting or autosegmentation of skeletal or vascular structures that can typically be performed by the scanning tech right from the scanner console. The 76377 code pays significantly more than 76376. Further, if an institution is performing presurgical planning for stent grafts in the treatment of aortic aneurysms there is a technical code, G0288, that can be billed instead of the 76377 code.

Unfortunately, the CPT codes cannot be used with CT angiography, MR angiography, or virtual colonography. Those studies have their own CPT codes that cover both the technical costs of the scan itself as well as the post-processing. As most 3D cases will probably be CTAs, it is important to know the reimbursement rates for the studies that will be performed most frequently, and to fully understand that reimbursement covers both scanning and post-processing.

Today, the additional dollars allocated for the post-processing time and effort are generally low, in the range of $10–25. However, even getting those few dollars requires adherence to strict rules. For 3D exam codes 76376 or 76377, the accession number needs to be linked to the primary exam and go out together for billing. The 3D work performed needs to be documented in the report, whether performed on an independent workstation or not. Ideally, 3D should be requested by the
ordering physician. Other options for performing post-processing not specifically requested in the order include written departmental policy for certain clinical indications, or 3D specifically requested (and so documented) by the radiologist because of a positive or suspicious finding. Finally, the work must be performed on software that has FDA approval.

Coronary CTA (CCTA) has received considerable attention this year from a reimbursement standpoint, given the CMS proposal in December 2007 to severely tighten the CCTA studies that were to qualify for reimbursement under a national coverage decision. Fortunately, after much lobbying from radiology and cardiology organizations, CMS chose to make no changes for 2008 and keep CCTA reimbursement decisions on a local level and issue no national coverage decisions for 2008.

Training and Workflow Analysis
An important step in implementing an advanced imaging program centers around the people involved. Physicians, technologists, and nurses will all need expanded skills.

Perhaps the most important consideration is the role technologists play in 3D post-processing. There are both objective and subjective factors to consider. Objective factors include the financial analysis of both the costs and benefits of using technologists to do post-processing, as well as understanding the department’s ability to deliver high quality post-processing services throughout the day (and night). In the world of multislice CT, the scanners are so fast that the rate limiting factors in CT department productivity centers around people resources. A recently published study by Boland et al at Massachusetts General Hospital drives home this point.

By assigning 3 technologists to each scanner instead of 1, annual productivity on the scanner improved by as many as 30,000 exams per year, yielding as much as $4 million per year in additional revenue. If a hospital is fully staffed and in a saturated market, it is probably best served by keeping at least some of the 3D in-house. On the other hand, if the scanner is busy and could be busier in the market, it is probably not in the financial best interest to pull technologists away from routine CT scanning to do post-processing. Subjective factors influencing the decision on 3D workforce planning include an analysis of the role the technologists and doctors wish to play in 3D post-processing, the talent level and interest of the technologists, and the role the department may play as a training and teaching institution.

If at least part of the 3D post-processing laboratory is kept in-house, the next step in implementing the program is the training of physicians, technologists, and nurses. For physicians, it is desirable to become certified for reading coronary CTA. There are many courses and mini-fellowships offered around the country that provide such training, including the requisite number of mentored cases. Depending on how much actual post-processing the doctors will do, additional training in software manipulation may be needed. In most hospitals, the bulk of 3D post-processing will fall to technologists, with the physician only wanting to do additional processing in selective instances. Unfortunately, robust technologist training has been neglected until recently and most only become proficient after a year or more of what amounts to on-the-job training and close physician mentoring. Technologists doing 3D should be well trained before the laboratory is launched.
Careful consideration to having people well trained and ready to go the day the advanced imaging program launches will ensure quality and promote satisfaction for doctors, staff, and patients.

Implementation and Growth

Assuming the process previously outlined has been followed, implementing the advanced imaging program should be the easy part. There are, however, a few decisions yet to be made. Some labs will open full force on day one, while others prefer to dip a toe in the water prior to jumping in. Additionally, the breadth of services provided needs as much careful consideration as the total volume of cases. The team may be comfortable with CTA, but not yet ready to display a complex skull base tumor for the neurosurgeon. It is more important to recognize weaknesses than strengths, since the referral base will certainly remember poor work long after they've forgotten best cases. Until recently, most hospitals started their advanced imaging programs slowly and cautiously, gaining confidence with experience. Today, with the ability to supplement in-house services with an outsourced laboratory, it is possible to begin the program with a greater market presence, both in sheer numbers of cases and in a broader clinical distribution.

Finally, a strategic plan for growing the advanced imaging program should be in place. Growth can occur in 2 main areas: clinical advances and marketing. Like any program, a commitment to keeping up with the latest technology, applications, and procedures is vital to long term success. Engaging a physician champion to serve as medical director of the lab and keep up with developing technology is a good way to address this.

Marketing the advanced imaging program, while seemingly obvious, is frequently overlooked. It does no good to have the ability to display a beautiful, clinically useful, complex shoulder fracture in stunning 3D for an orthopedic surgeon if he isn't aware of the program and never orders the test. The referral base needs to be aware of what can be done to help them take care of patients more efficaciously and economically. Their office staff need to know how to order the test. The doctor needs to know how to view the results and use the rendered images for patient education and clinical decision making. Time and effort devoted to simple, informative marketing will pay large dividends.

Conclusion

Too many hospitals have begun the journey into CTA and 3D imaging by putting the cart before the horse. There has been too much emphasis on acquiring hardware, software, and expensive technology without adequate analysis and preparation. Because of this, there are far too many $250,000 computers acting as coffee tables or dust collectors in some corner of the radiology department.

An advanced imaging program should be thought of as just that: a program. It should be planned from a strategic standpoint.
with an analysis of the talent and mission of the organization, should allow an organization to design, build, implement, and market an advanced imaging program as efficiently and economically as possible.

References

5. Walsh B. Preparing your CT workflow for the multislice data deluge. Health Imaging & IT. April 2006.

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QUESTIONS
Instructions: Choose the answer that is most correct.

1. The advanced imaging technology addressed in this article includes:
   a. Multidetector CT
   b. CT angiography
   c. Advanced 3D imaging
   d. All of the above

2. According to the author, what examination is already replacing diagnostic catheter angiography in many institutions?
   a. Functional MRI
   b. CT angiography
   c. Open heart surgery
   d. None of the above

3. Which of the following are uses for multidetector CT (MDCT) in an emergency evaluation of chest pain?
   a. Can evaluate coronary arteries, pulmonary arteries, and aorta with a single breath hold
   b. Can demonstrate adjacent soft tissues for lung disease and upper abdominal disease
   c. Can visualize chest wall abnormalities
   d. All of the above

4. A 3D post-processing program should be designed and implemented through a strategic planning process that includes:
   a. Physicians
   b. Administrators
   c. Technologists
   d. All of the above

5. The author recommends that an in-house centralized 3D laboratory should include robust technologist training that occurs:
   a. Prior to the ramping up of services
   b. After services are fully operational
   c. Before administration has committed to purchasing the equipment
   d. The timing of this training is unimportant

6. What key personnel should be involved in the strategic planning process?
   a. COO
   b. PACS administrator
   c. CT supervisor
   d. All of the above
7. It is important to consider the following clinical areas when planning for 3D studies:
   a. Angiography, orthopedics, and neurosurgery
   b. Plastic and reconstructive surgery, bronchoscopy, and oncology
   c. Virtual colonography, CT urography, and functional imaging of the brain
   d. All of the above

8. An important focus of the strategic planning process that is often overlooked or approached too late is the:
   a. Role of the vendor
   b. Role of the nursing staff
   c. Role of the medical staff
   d. None of the above

9. On the referral side, it is important to identify who among the medical staff will be the biggest users of the new technology and begin educating them on:
   a. The expense of the new equipment
   b. The complexity of the procedures to be offered
   c. How 3D can help them in their practices
   d. None of the above

10. Who are the customers to be served by the 3D lab?
    a. The ordering physician treating the patient
    b. The radiologist reading the study
    c. The patient having the study done
    d. All of the above

11. When considering equipment and network issues associated with a 3D program, it is possible to:
    a. Outsource the entire process to an independent laboratory
    b. Only buy expensive, single user workstations
    c. Incorporate the program into existing equipment
    d. None of the above

12. Other equipment and networking considerations should include:
    a. A discussion of where post-processing will occur
    b. Who will do the post-processing
    c. Who will need access to the images
    d. All of the above

13. By itself, 3D post-processing is a profitable venture.
    a. True
    b. False

14. Which add-on CPT code for 3D reconstruction covers 3D rendering requiring image post-processing on an independent workstation?
    a. 76376
    b. 76377
    c. GO288
    d. None of the above

15. Which add-on CPT code for 3D reconstruction covers 3D rendering not requiring image post-processing on an independent workstation?
    a. 76376
    b. 76377
    c. GO288
    d. None of the above

16. Add-on CPT codes cannot be used with which of the following?
    a. CT angiography
    b. MR angiography
    c. Virtual colonography
    d. All of the above

17. A recent study by Boland et al demonstrated that assigning 3 technologists instead of 1 to each CT scanner improved productivity by as many as:
    a. 70,000 exams per year
    b. 40,000 exams per year
    c. 30,000 exams per year
    d. None of the above

18. If CTA and 3D are to be used in the emergency department, it is important to train emergency room staff with the indications and limitations of CTA so that:
    a. The radiologist receives a complete history on the patient
    b. The study can be ordered appropriately
    c. There is a technologist on call at all times
    d. Additional CPT codes can be utilized

19. When implementing an advanced imaging program, the breadth of services provided needs as much careful consideration as:
    a. The total volume of cases
    b. The reimbursement rate for each case
    c. The training necessary for the radiologists
    d. None of the above

20. One factor often overlooked when planning and implementing an advanced imaging program is:
    a. The cost of the program
    b. Marketing the program
    c. Administrative support
    d. Technologist training
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