At Massachusetts General Hospital, radiology drives the addition of coronary CT angiography to emergency department treatment of chest pain patients, resulting in shorter stays.

By Kerri Reeves

Forget graduation or wedding photos; for many people, a CT scan is the most important picture they’ll ever have taken. According to Brian B. Ghoshhajra, MD, MBA, service chief of cardiovascular imaging at Massachusetts General Hospital (MGH), nowhere is that more true than in the emergency department (ED) when a patient presents with chest pain.

Cardiac CT scans offer a quick, noninvasive way to detect blockages in coronary arteries, which can cause angina and myocardial infarction. Most patients presenting with chest pain, however, do not ultimately have an acute coronary syndrome; yet they can’t be immediately distinguished from those having a heart attack.

As a result, chest pain patients must be assessed as expeditiously as possible in the ED to determine the most appropriate course of treatment. To achieve this critical goal, Ghoshhajra and a team of MGH radiologists implemented a coronary CT angiography (CTA) program for the workup of low- to intermediate-risk patients presenting in the ED with acute chest pain. The coronary CTA program screens patients who meet certain criteria for heart conditions quickly and safely.

While randomized trials have validated coronary CTA as a successful method of triaging chest pain patients — including CT-STAT, ACRIN-PA, and ROMICAT II — the program at MGH brought the research into clinical practice to tackle a real-world scenario, Ghoshhajra notes.

Transforming Research into Practice

Ghoshhajra was lead researcher on a multidisciplinary team that evaluated the efficiency and safety of CTA in MGH’s ED during a three-year clinical registry that included over 1,000 patients.³

Results of the initiative demonstrated a median time to discharge of 10.5 hours.³ That’s a 67 percent decrease compared to the standard of care — or 18 hours less than the typical 24-hour observation period, during which chest pain patients undergo repeated lab tests and ECGs to exclude heart attack.

“When a patient presents with chest pain, an ED cardiac CT can safely and dramatically reduce length of stay,” says Nina M. Meyersohn, MD, cardiovascular imaging faculty member at MGH and a key member of the coronary CTA program. “This is a great example of a clinical trial actually becoming clinical practice.”

Developing the ED Program

Ghoshhajra, Meyersohn, and John T. Nagurney, MD, an attending physician at the MGH Department of Emergency Medicine, participated in a broad-based committee to introduce cardiac CT into clinical care at MGH. “After all of these successful trials, we wanted our ED patients to get the benefits of cardiac CT,” Ghoshhajra says.
Case Study: Great Timing

The committee — which also included team members from cardiology and internal medicine — developed clinical practice protocols and strategies, with a forum for open communication. "When the group first came together, we were all talking about the same disease, but we needed to learn to speak the same language," Ghoshhajra says.

In regular meetings and email correspondences, committee members detailed their roles in the process of treating chest pain patients in the ED, while radiologists highlighted how additional clinical expertise could be provided with coronary CTA.

Following John Kotter's eight steps for leading change1, the committee established its clinical implementation process with the following to-dos:

1. **Establish urgency:** Set a deadline to launch the CTA program in the ED.

2. **Form a powerful coalition:** Get all specialties on board with the program, including radiology, cardiology, emergency medicine, and internal medicine.

3. **Create a vision:** Explain the value to all potential users (CTA will save the ED time and money and increase patient satisfaction).

4. **Communicate:** Use all channels, such as e-mail, YouTube tutorials, and in-person meetings to streamline logistics.

5. **Empower others:** Design the protocol so it's successful in leaders' absence (ED physicians, technologists, radiologists, and cardiologists should all play key roles for sustainability).

6. **Create short-term wins:** Encourage early and measureable team successes, such as lowering CT radiation dose.

7. **Consolidate improvements:** Analyze and adapt clinical and workflow processes (for example, patient transport, screening, or results sharing) for acceleration and scalability.

8. **Institutionalize approaches:** Establish protocols and care pathways specific to your organization's needs and demands.

Nagurney advises that radiologists educate potential cardiac CT users — ED physicians, cardiologists, and internists — about why it's an ideal option for their organization and their patients. "Seek out champions among these specialist populations and develop protocols together so everyone's on the same page. Later, if there's an error in protocol, review it, troubleshoot it, fix it, and then communicate the outcome to all involved for improved patient care."

Deploying the Process

MGH utilized an existing cardiac-capable scanner one floor away for kick-off, later installing a state-of-the-art cardiac-capable CT scanner directly in the ED for greater efficiency. Due to the demands of needing an on-site physician trained in coronary CTA, the program began in 2014 during weekday hours from 8 a.m. to 3 p.m. for ED patients.

At MGH, once a patient is evaluated for chest pain, the ED physician consults with the radiologist at the point of care to determine whether CTA is appropriate to rule out a coronary event. Here's how the process unfolds in the ED:

- **If the risk score and other determining factors support the scan,** a radiologist approves it. Eligibility criteria are kept simple and in line with prior randomized, controlled trials: negative initial serum biomarkers (troponin levels), no definitive changes of ischemia on initial ECG, and no known history of stents or bypass surgery. If any of these “rules” are broken, the ED must first consult a cardiologist to evaluate the patient.
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- **During the scan, a physician (cardiac imaging fellow) supervises the process.** He or she briefly interviews the patient, answers any questions, and medicates, as needed. Then the technologist proceeds with the exam. A trained radiologist (or imaging cardiologist, at some institutions such as MGH) supervises the exam, which involves the administration of medication (nitroglycerin), and checks the images for artifacts at the scanner.

- **If the CTA scan is negative,** within one hour the radiologist delivers the good news about the patient to the ED provider: There are no signs of coronary artery disease (CAD) and, hence, no acute coronary syndrome (ACS). As a vital member of the treatment team, the radiologist quickly delivers results that previously took the ED physician 24-plus hours of tedious waiting and repeat testing to uncover.

- **If the scan confirms a blockage or other heart problem,** the radiologist has helped the ED physicians triage the patient quickly and with certainty, allowing them to proceed with taking the patient to cardiology, surgery, or other care pathway. Catheterization is a common outcome after a positive scan, Ghoshhajra explains. “Within an hour of the CT scan, the patient is on the way to the lab,” he says. “You don’t just shave time off the process, you have a more certain diagnosis. We send the right patient to the catheterization lab right away, knowing the procedure is necessary, and we will have helped this patient.”

As MGH reaped benefits from the addition of CTA in the ED and scan volume grew, radiologists expanded the CTA program hours to cover 8 a.m. to 7 p.m. during the week and added call shifts from 8 a.m. to noon on weekends and holidays. For a facility the size of MGH, this expansive coverage is possible. But Meyersohn suggests that even for a smaller facility, an 8 a.m. to 3 p.m. CTA program with a single trained radiologist could significantly reduce ED stays and associated costs.

“The time savings of this technology are very robust,” Ghoshhajra adds. “Cardiac CT compresses all those hours of workup into one scan. It’s been very powerful for us, and would be that much more powerful in a smaller, tertiary setting.” For example, in a hospital without an invasive coronary catheterization lab, or access to alternative cardiac imaging (such as nuclear stress testing), or access to subspecialty cardiologists, the benefits are even clearer. The cost of transferring a patient by MedEvac or helicopter flight can be very high, often with the financial burden imposed directly on the patient.5

**Spreading the Good News**

At MGH, using coronary CTA in the ED accelerates patient disposition and reduces downstream testing for the most efficient patient treatment. It also ensures that only patients who need invasive procedures, like cardiac catheterization, have them, Ghoshhajra says. Compared to the old standard of care, he continues, “CTA rules out heart attack right away; we don’t have misses, and we can often spare patients the cardiac cath.”

Nagurney encourages radiologists to collaborate with emergency physicians and to jointly share ownership of CTA technology and champion its advancement in emergency settings. “The ED is always scrambling for open beds, and patients are anxiously waiting for stretchers,” he says. To get buy-in from hospital leaders, it is important to spell out how CTA can significantly decrease wait times and give ED physicians the assurance to release patients who are not at risk for coronary events, he adds.

Once a CTA program is in full swing, radiologists must co-lead the team to troubleshoot issues and look for opportunities for continuous improvement, Nagurney notes. Radiology is in the ideal position to communicate developments to specialties across the board, and champion the technology for this emerging area of application in the ED.

“For a program like this to succeed, radiology must act as a link between the patient, the ED provider, and the cardiology teams,” Meyersohn explains. “We need to communicate well with members of the treatment team and take our role in evaluating ED patients very seriously.”

**Next Steps**

- Gather duration-of-stay data regarding standard of care treatment for chest pain patients in your ED.

- Confirm availability of an advanced CT scanner and seek a trained (coronary CTA) radiologist if one is not currently on staff.

- Create a multispecialty task force to establish broad-based protocols for clinical CT use in diagnosis of chest pain patients, meeting regularly to communicate about cases and leveraging the technology.

- Establish a cardiac CT champion in your ED to communicate its purpose to all stakeholders and convey a visionary strategy for implementation.

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End Notes


Join the Discussion

Want to join the discussion about how radiology can drive the addition of coronary CT angiography to emergency department treatment of chest pain patients, resulting in shorter stays? Let us know your thoughts on Twitter at #imaging3.

Have a case study idea you’d like to share with the radiology community? Please submit your idea to http://bit.ly/CaseStudyForm.