

Implementing 3D Imaging into the Workflow at Kettering Medical Center

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Introduction

When we first decided to improve 3D imaging capabilities at Kettering Medical Center, we had to find the proper 3D reconstruction system to allow us to implement our goal. In the past, the 3D equipment we used required that the physician go to the workstation to review or read the case. These systems proved ineffective. We wanted a system that allowed us to bring the case to the physician. In reviewing such systems, we found that most of them were bundled with the CT scanner and required the physician to review the case from that station. Alternatively, we found some independent workstations that would allow us to reconstruct the case and then send it to another viewing station where the physician could manipulate the images. However, the vendors charged a licensing fee for

every viewing station. The TeraRecon AquariusNET system (TeraRecon, Inc., San Mateo, CA) allowed us to reconstruct images, then view and manipulate them on the “thin client”, which we could place anywhere without further cost. Furthermore, AquariusNET was flexible enough to interface with CT and MRI systems from all vendors.

In order to insert the AquariusNET system into our workflow without disrupting or slowing everything down, we decided to set up a dedicated 3D laboratory. We networked all of our CT scanners, MRI scanners, and scanners from our satellite hospitals to send images to the 3D lab, where all of the 3D reconstructions and other manipulations would take place.

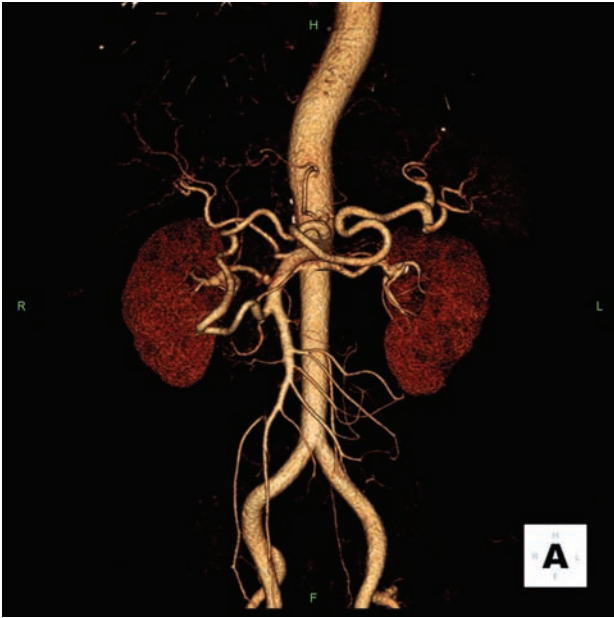


Figure 1: Volume-rendered image of the abdominal vasculature.

In setting up a 3D lab, some things had to be put into place. First, we had to find qualified and dedicated personnel to do the reconstructions. This required someone with an excellent knowledge of anatomy and technical skills in CT and/or MRI. The individuals we found had strong backgrounds in the angiography lab, cardiac catheterization lab, electrophysiology lab and CT scanning.

After hiring the personnel, we needed to work with the radiologist and set protocols for the reconstructions. For example, an abdominal CTA would consist of a batch of 3D-rendered images of the abdominal vasculature (Figure 1), multiplanar reconstructions (MPRs) of the renal arteries (Figure 2), sagittal MPRs of the aorta to show the origin of the celiac and mesenteric arteries (Figure 3), and 2 or 3 mm coronal and sagittal reconstructions of the entire abdomen (Figure 4). Similarly, protocols were established for all types of exams.

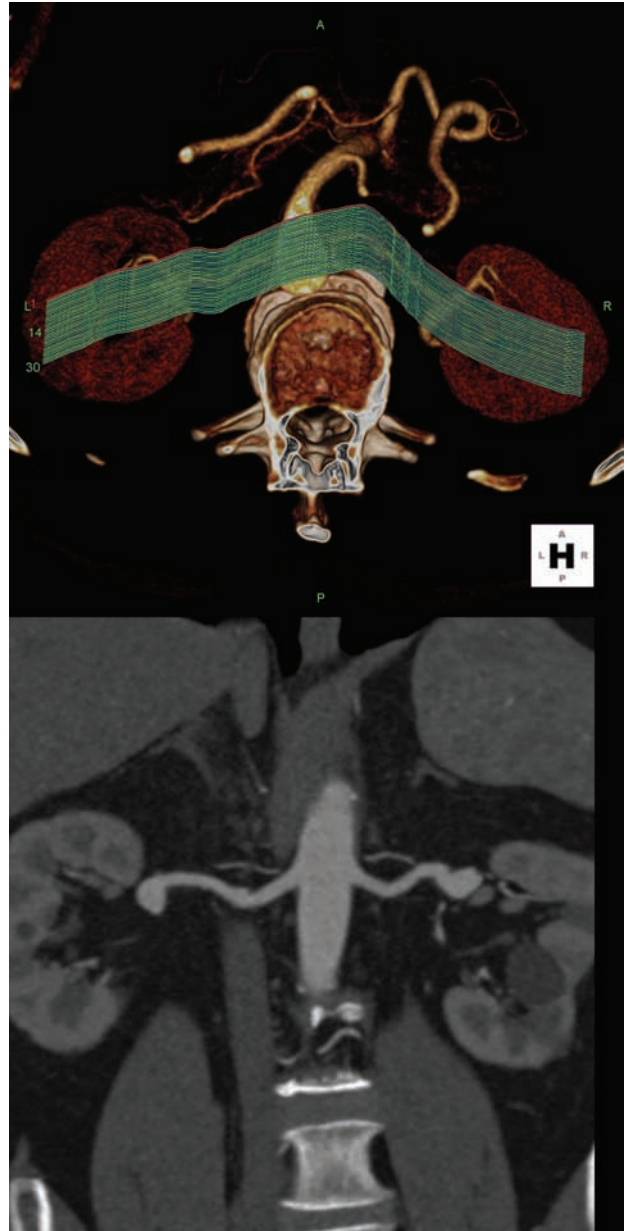


Figure 2: Volume-rendered and multiplanar reconstruction (MPR) of the renal arteries.

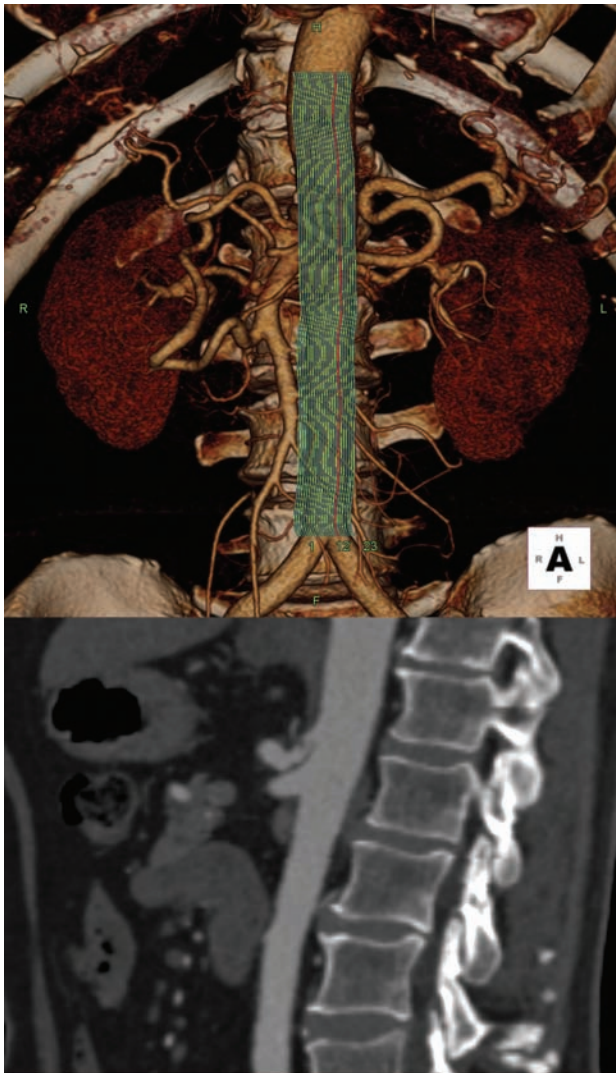


Figure 3: Volume-rendered and sagittal MPR of the aorta showing the origin of the celiac and mesenteric arteries

Since the 3D lab was established as the central hub for reconstructions, the CT scanner and CT scan personnel were free to scan without interruption, speeding up workflow considerably. The use of a 3D lab has allowed us to perform multiple CTA or MRA cases daily. In the past, for a typical diagnostic angiogram, the patient would be required to go to the hospital and spend about an hour in the “same-day” or “pre-admission” area. They would then be brought to the vascular lab and usually given some medication for comfort, and the test would be performed. After the test, the patient would be watched from 1 hour to 6 hours, to watch for post-arterial bleed. The patient essentially had to take the entire day to have a diagnostic test. Now, CTA and MRA with 3D reconstruc-

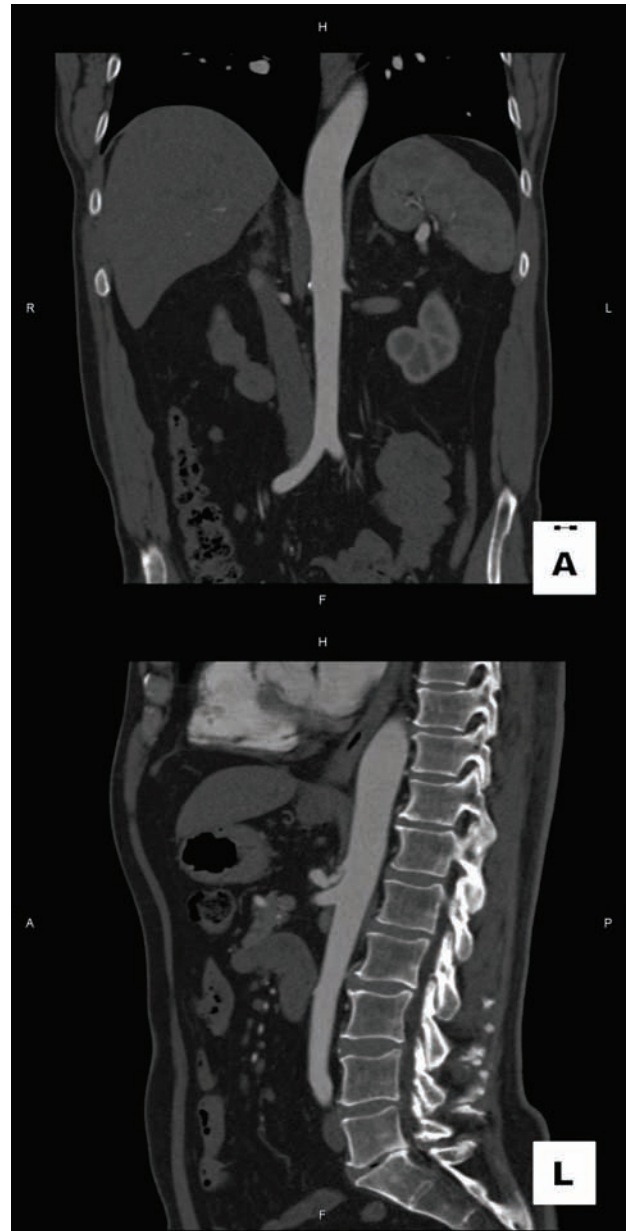


Figure 4: Coronal and sagittal MPR reconstructions of the entire abdomen

tion enable us to perform a diagnostic angiogram with as much, if not more, information than one would obtain from a regular angiogram, in a fraction of the time. The patient can literally come in on their lunch hour and have a CT carotid angiogram. The images are then sent to the 3D lab where they are reconstructed according to the protocol. The radiologist then reads the exam, and the referring physician can have the results within 24 hours. The patient can return to work and not give up an entire day.

The thin client was installed in the radiologist reading stations, in surgery, in the cardiac catheterization lab, in all satellite hospitals, and in the physicians' lounge. This allows cases to be viewed from all locations. The 3D lab is also used as a dictation and viewing area. With the technologist doing reconstructions, someone is always available to assist surgeons or referring physicians in using the software to view their cases, and a radiologist is always close by for consultation. The 3D lab also prints images or burns CDs of the exams for the patients or referring physician.

By using the TeraRecon system, the transferring of films has been eliminated. When surgery needs films, they simply call up the case on the thin client. This has become especially useful in vascular and orthopedic cases. The TeraRecon system has allowed us to treat 3D imaging as its own modality. Our radiology department has various sub-departments, including ultrasound, CT scan, MRI, special procedures, and now the 3D lab. Physicians know that if they want to view, consult, or acquire images of their patients, they simply need to go to the 3D lab. This arrangement allows us to do the majority of our diagnostic angiography in this manner. With an average about ten CTA or MRA cases a day, along with some orthopedic cases, the 3D lab stays busy. As the technology improves, and with the 3D lab's versatility, we feel it has been and will continue to be a strong asset to the radiology department.