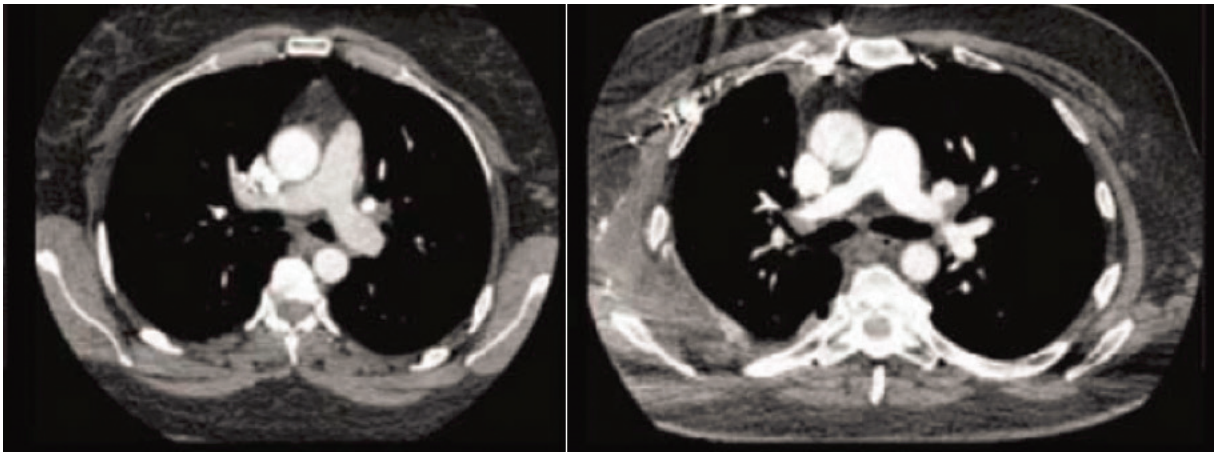
Importance of Larger IV Catheter Sizes in Advanced CT Scanning

The high flow rate necessary for adequate vascular delineation requires intravenous access with a catheter capable of administering iodinated contrast at a high injection rate using a power injector[4]. The rate and volume of contrast injection and the scan delay should be customized to the specific catheter and injection site utilized. Preferably a 20-gauge or larger needle is placed in the vein at the elbow level or above[1].

Injector technology, including Bayer's Personal Patient Protocol Technology (Certegra® P3T® Technology) has revolutionized how we approach contrast injection in CT. This improved technology requires more attention to IV contrast and flow rates. The use of higher flow rates to help us capture detailed vasculature is an important factor in CTA as well as certain lesion detection, which requires information from the arterial phase for some abdominal imaging studies[3].

Images courtesy of University of Pittsburgh Medical Center (UPMC)



Example of Poor Enhancement

Example of Appropriate Enhancement

CT Scanners have evolved to provide us with faster and better imaging techniques. For example, what once took 30 seconds to acquire a single slice now requires only a few seconds to cover complete organs or systems. Evolving scanner technology and faster scan times offer new opportunities for **cardiac** and **body** imaging. However protocol design and contrast media delivery become more difficult and less forgiving at the same time[7].

The *iodine administration* rate is directly proportional to arterial enhancement and can be controlled by the injection flow rate and the iodine concentration of the contrast media[2]. Thus, an increase in the injection rate and a higher iodine concentration of the contrast medium directly translate into increased vascular enhancement. Injection flow rates of 5 mL per second are quite common and up to 8 mL per sec has been reported in published literature[3]. These higher flow rates are becoming main stream and are critically important to acquiring a diagnostic study with Multiple Detector Computed Tomography (MDCT).

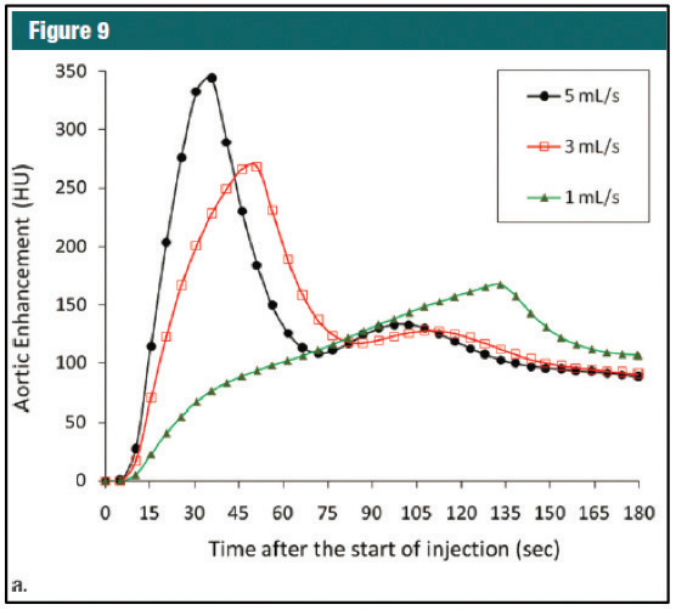
Injection Flow Rate

If contrast volume and iodine concentration are kept constant, a faster injection leads to:

- A greater magnitude of arterial enhancement
- A reduced time-to-peak arterial enhancement
- A narrower arterial peak width
- The need for a shorter scan delay to scan during peak arterial enhancement, particularly if the scan duration is long

Note: These parameters are good for fast scans and useful for CTA and biphasic applications.

KT Bae, Multidetector CT Protocols, MDCT.net's, Guide to Technology and Protocols



Simulated contrast enhancement curves with three different contrast medium injection rates.

Simulated enhancement curves of the aorta based on a dose of 150 mL of 370 mgI/mL contrast medium injected at 1, 3, and 5 mL/sec. The curves show that for a constant volume of contrast medium, as the rate of injection increases, the magnitude of contrast enhancement increases while the duration of high-magnitude contrast enhancement decreases. Modified with permission. **(Bae, K. T. "Intravenous Contrast Medium Administration and Scan Timing at CT: Considerations and Approaches." Radiology 256.1 (2010): 32-61)[5]**

IV Considerations for Use with a Power Injector:

1. Place a large access line (e.g. 18G needle) in the antecubital vein[6]

   Note: Follow catheter manufacturer recommendations for maximum flow rates and pressure ratings.
2. Documenting contrast administration and patient complications is necessary to ensure patient safety. Required documentation includes the contrast agent name and dose amount, along with the date, time and method of administration. The injection site and number of attempts also must be recorded.[8]
3. Contrast warmed to mean body temperature of 37 degrees C reduces viscosity.[6]
4. All catheters used for the CT angiogram should first be tested with a rapidly injected bolus of sterile saline to ensure that the venous access is secure and can accommodate the rapid bolus.[1]

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