# Contrast Media Shortage: What Should We Do About It?

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I recently learned that there is a worldwide shortage of the iodinated contrast agents (Omnipaque, Visipaque [both GE Healthcare], Isovue [Bracco Imaging], and Optiray [Guerbet]) used for computed tomography (CT) exams for general radiology and cardiac diagnostic studies (the FDA reports drug shortages at accessdata.fda.gov/scripts/drugshortages/default.cfm). I am sure you have heard as well, and the internet is full of hospitals posting their approach to this problem. For example, Vanderbilt University Medical Center shared that it is taking extraordinary steps to conserve their supplies of iodinated contrast.[1] These steps include restricting outpatient contrast CT examinations. Inpatient, transplant-related, and emergency contrasted CT scans will be performed as normal. Vanderbilt has requested that ordering clinicians will need to acknowledge they are taking conservation precautions. Clinicians will need to review upcoming requests for contrast CT exams and based on the patient's condition, decide whether to select an alternative imaging exam, refer the patient to a non-Vanderbilt facility for the exam (with no guarantee that other imaging sites will have the contrast agent in stock), or reschedule the patient for a date after August 2022.

**Modern CO2 delivery systems with advanced digital subtraction angiography techniques and hybrid angiography have improved imaging accuracy and reduced the incidence of contrast-induced nephropathy.**

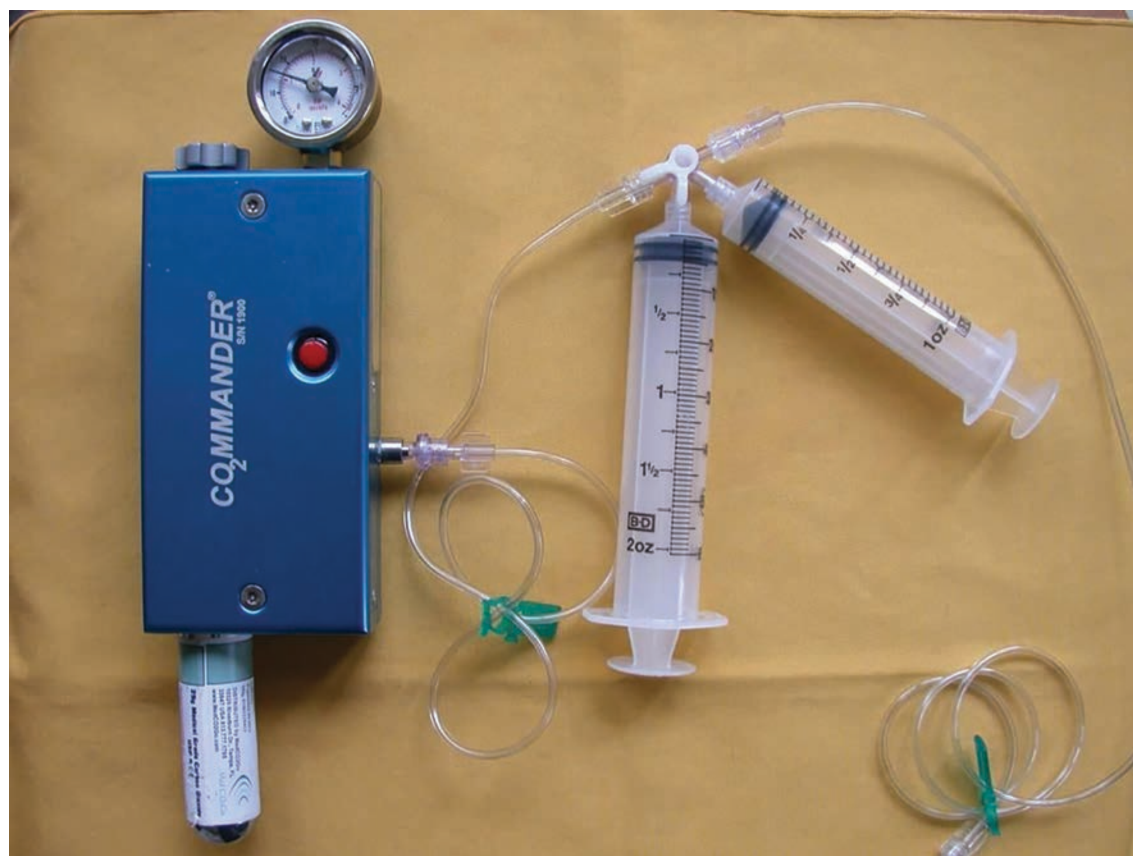


**Figure 1. CO2 cartridge with pressure gauge and tubing connecting to a reservoir, and injection syringe with specialized stopcock to transfer gas.**

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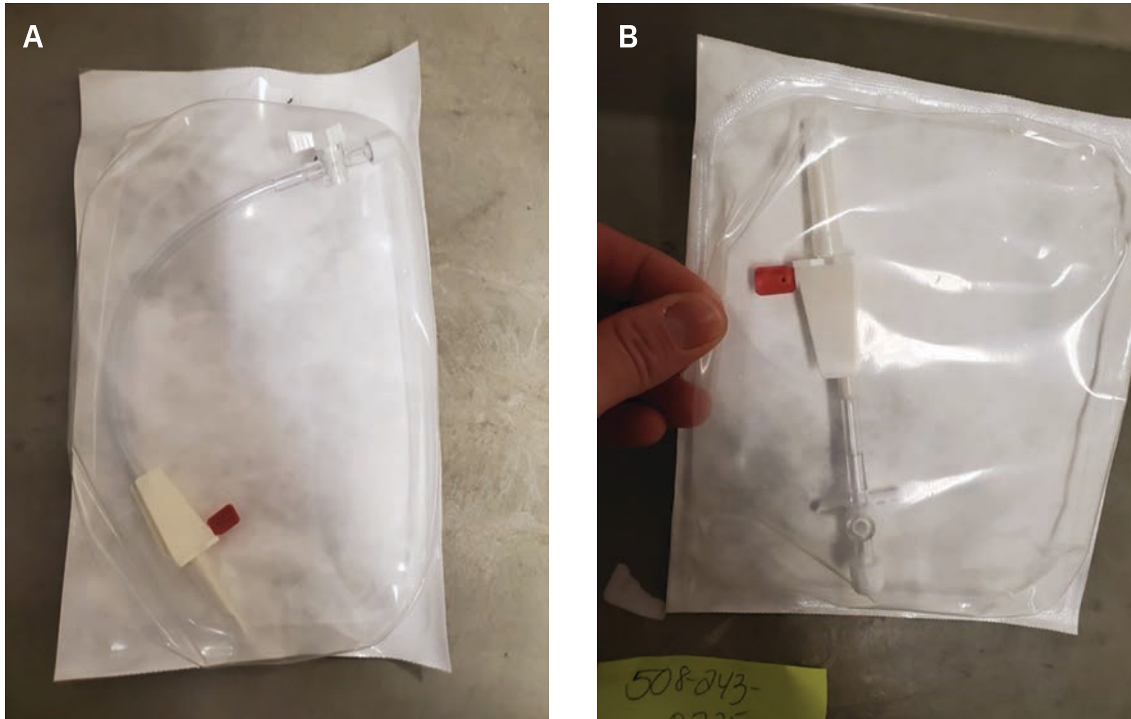
Similarly, another regional health care system, Greater New York Hospital Association [GNYHA]), also reported a temporary shortage of GE Healthcare's iodinated contrast media — specifically, all concentrations and formulations of its Omnipaque (iohexol) products that are manufactured in a single facility in Shanghai, China (Shanghai is currently under COVID-19 lockdown).[2] While the facility has reopened and ramped up production, GE anticipates an 80% reduction in supplies for the next 6-8 weeks (through mid summer). GNYHA is working with the New York State Department of Health, the Department of Health and Human Services, and supply chain partners to minimize the potential impact on patient care. Hospital-recommended contrast media conservation strategies will include the evaluation of on-hand inventory, alternate wholesalers and distributors, and the review of CT and x-ray study orders to have physicians consider alternate imaging modalities when appropriate. Physician teams performing contrast studies are advised to adjust contrast injector protocols to reduce the amount of contrast, and increase awareness of wasted contrast media to CT, x-ray, interventional, and catheterization lab technologists.

While we have not been affected at the Long Beach VA, it is likely that an intravenous (IV) contrast shortage will impact hospitals nationwide, perhaps in the next few months. In the Los Angeles region, I have heard that the University of California Irvine (UCI) Medical Center and a Santa Monica hospital are planning for a contrast media shortage. UCI issued a bulletin in part stating, "Situation [ALERT]: Critically Low stock of Iodinated IV Contrast due to a distribution problem in China. We currently only have enough stock to perform 10-15 emergent CT w/ IV contrast cases. The weekend average is 20 cases in 24 hours. Please review all measures to conserve contrast and/or delay contrast studies [as clinically appropriate]."

Dr. Peter Pelican from Santa Monica, California, asked, "What are you doing for an alternative to contrast media or to conserve contrast? Are you using gadolinium? Diluting the contrast 25%? Performing $CO_2$ angiography?" I asked my colleagues to comment on this issue.

### If a Contrast Shortage Comes to Your Hospital, What Should You Do?

**Mort Kern, Long Beach, California:** We have been informed of the shortage now affecting the VA. Here's our plan. Keep the contrast injector filled (100 mL) for the whole day whenever possible (typical average use is about 35-50 mL per case for diagnostic study and approximately 100 mL for percutaneous coronary intervention [PCI]). Do not spike any additional




**Figures 2A-B.** (A) Tubing with spike and stopcock for conserving and transferring contrast media. (B) Close-up view of the spike end of the tubing.

bottles until deemed necessary per the operator. Avoid left ventricular (LV) angiography. Defer complex cases that require larger amounts of contrast (if clinically indicated) until July 2022 (or sooner, if shortage breaks). Utilize intravascular ultrasound (IVUS) instead of injection where possible. Minimize angiogram views (eg, for normal studies, 3 views, not 4).

If the situation becomes more severe, we will dilute the contrast by 25%, leave opened contrast in the ACIST CVi injector (ACIST Medical Systems), and cap it off each day, instead of wasting it at the end of the day (this will require special permission to breach usual standard operating procedure).

Like most interventionalists, we have no experience with gadolinium. I fear the impact on those patients with renal dysfunction and the potential complication of nephrogenic systemic fibrosis (NSF). The Food and Drug Administration (FDA) approved 7 different gadolinium contrast agents that are used mostly in magnetic resonance imaging (MRI) studies.[3] I would not use gadolinium contrast agents for coronary angiography or other cath lab contrast studies.

I have no experience with $CO_2$ angiography, either. However, others use $CO_2$ angiography for patients with peripheral arterial disease (PAD) (Figure 1). $CO_2$ angiography is underutilized due to concerns regarding safety and image quality. Modern $CO_2$ delivery systems with advanced digital subtraction angiography techniques and hybrid angiography have improved imaging accuracy and reduced the incidence of contrast-induced nephropathy (CIN). Awareness of the need for optimal imaging conditions, contraindications, and potential complications have improved the safety of $CO_2$ angiography.[4,5] Reviews of the technique can be found in the literature.[6-8]

Let's see what our colleagues say.

**Ken Rosenfeld, Boston, Massachusetts:** When anticipating a shortage, contrast conservation is key. I, like many of my colleagues [*MK*: *Not all*], typically dilute all my intracoronary contrast injections by 10%-30%. This not only conserves contrast, but improves imaging by reducing viscosity and therefore resistance to injection, allows better reflux to the aorta, and allows for imaging of subtle findings within the vessel (as opposed to "blacking out" the entire lumen). It is also safer due to the reduced viscosity...less chance of hydraulic injury. We can also use more IVUS and physiology to reduce contrast.

For cardiac CT and other CT studies (computed tomography angiography [CTA] for pulmonary embolism [PE] or for peripheral arterial disease [PAD]), we have had success in convincing our radiology colleagues to reduce dosing (from their usual protocols) in cases of renal insufficiency...but we can ask for that across the board. The images, particularly with dual-source CTA and with careful timing, can be even better.

If this shortage becomes severe, our patients will suffer. We all will need to do our part, starting now. We will simultaneously reduce renal injury and associated hospitalization and medical expenses!

**Steve Ramee, New Orleans, Louisiana:** GE published a letter that I found on Google [*Editor's note: GE wrote a letter April 19, 2022 to its customers*] that states because of the COVID outbreak in Shanghai, there is a worldwide contrast shortage. We found that out yesterday when trying to order contrast, I'm told. For over a decade, I have been utilizing a low contrast technique for angiographic procedures where I utilize a 3 cc syringe for all cases. The images are excellent, and the average contrast use/case is under 25 cc. My acute tubular necrosis (ATN) rate is zero.

**Amir Kaki, Detroit, Michigan:** We have not been made aware of this shortage in southeast Michigan. To Dr. Pelican's questions, we do often use $CO_2$ for our lower extremity angiograms, particularly in patients with chronic kidney disease (CKD) that we are treating for claudication or chronic limb ischemia. These cases are usually not emergent and could often wait. I have no experience with the other strategies you mentioned.

**John Hirshfeld, Philadelphia, Pennsylvania:** Is it all nonionic contrast agents or only Visipaque? [*MK: According to an online search, only Omnipaque, Visipaque, Isovue, and Optiray.*]

**Duane Pinto, Boston, Massachusetts:** For damage control today, we are using 50 cc bottles, drawing that up into a 50 cc syringe, then using extension tubing to connect that to the manifold. That way, it doesn't affect the fellows' workflow, and we are not drawing contrast (and air) out of a bowl. We are ordering one-way valves for which we are in the process of getting approval from infection control to allow single contrast bottles for multiple use/patients. At that point, we will draw 30 cc at a time and save the rest in the 100 cc bottle and what would have been wasted (20-30 cc) in the manifold tubing in a regular case (Figure 2).

**"For over a decade, I have been utilizing a low contrast technique for angiographic procedures where I utilize a 3 cc syringe for all cases. The images are excellent, and the average contrast use/case is under 25 cc."**

**— Steve Ramee, MD**

**"The most significant approach we are taking at Scripps is to use the 'ultra-low contrast' protocol on all patients. We developed this protocol about 15 years ago to minimize contrast nephropathy in renal-impaired patients.[9] When using these very specific techniques to limit contrast, we can usually do a diagnostic angiogram with 10-20 cc or even much less, and an intervention with under 20 cc and sometimes with zero contrast."**
**— Paul Teirstein, MD**

**Paul Teirstein, La Jolla, California:** We are using Dr. Pinto's technique above. One tip is to start scavenging contrast as the case ends...open the stopcock on the supply syringe to air and carefully empty the tubing into your delivery syringe. Also, pull contrast from the balloon inflation device for your final injections. But the most significant approach we are taking at Scripps is to use the "ultra-low contrast" protocol on all patients. We developed this protocol about 15 years ago to minimize contrast nephropathy in renal-impaired patients.[9] When using these very specific techniques to limit contrast, we can usually do a diagnostic angiogram with 10-20 cc or even much less, and an intervention with under 20 cc and sometimes with zero contrast. Reference 9 describes our first two cases: (1) a case of a diagnostic angio and stent placement with 7 cc and (2) a case of complex stenting with zero contrast.

Key parts of the technique:

- Use a 3 cc contrast syringe. After filling the catheter (which takes about 6 cc), inject the coronaries with a forceful 1-2 cc injection, follow the bolus down the coronary. Do not expect to see the entire coronary outlined at the same time.
- In general, we don't dilute contrast for this technique. You only use about 1 cc per injection so it is best to have a high-resolution image.
- Put a road map up and use it to eliminate puffing. NO CONTRAST IS INJECTED WITHOUT YOUR FOOT ON THE ACQUIRE PEDAL (this forces you to reduce contrast delivery).
- Use guide extension catheters to (a) close guide catheter side holes, if present, during injection; (b) get a more selective injection during intervention (but carefully inject with a 3 cc syringe, do not dissect the coronary).
- Liberal use of IVUS before, during, and after the diagnostic/intervention.
- Be thoughtful, no extra injections.
- Caveat: There will be long periods of time with no contrast in the guide catheter....flush the catheter with saline every few minutes to prevent thrombus formation.

## The Bottom Line

To conserve radiographic contrast media, consider the following possible strategies:

- Keep the contrast injector filled (100 mL) for the whole day.
- Do not open any additional contrast bottles unless absolutely necessary.
- Avoid unnecessary imaging (eg, LV angiography). Minimize test shots and angiogram views.
- If safe, defer cases that will require larger amounts of contrast until after July 2022.
- Utilize IVUS where possible.
- If necessary, dilute the contrast by 25% .
- Review Dr. Teirstein's low contrast angiography techniques.

While I think the contrast shortage will be of brief, I agree with Yogi [Berra], when he says, "It's tough to make predictions, especially about the future." And this goes for the contrast media availability as well. ■

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