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Case Report

Transarterial chemoembolization in a patient with severe reactions to iodinated contrast: Successful treatment using gadolinium contrast with C-arm computed tomography

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ABSTRACT

Severe reactions to modern iodinated contrasts are uncommon. Breakthrough reactions in the setting of pretreatment with corticosteroids are even rarer. Patients with a history of these refractory reactions can create challenging situations in the diagnostic and therapeutic process. Here, we present a case of an 83-year-old male with hepatocellular carcinoma and a history of multiple severe reactions to iodinated contrast. The patient required a transarterial chemoembolization but the conventional technique was unavailable due to the allergy. Gadolinium-based contrast was substituted and used in conjunction with C-arm CT and a percutaneous ethanol injection to treat the tumor. After nearly 3 years, there is no evidence of residual or recurrent hepatocellular carcinoma.

Introduction

Iodinated contrast reactions can create challenges for radiologists. Over the past 30 years, contrast agents have been improved to reduce these allergy-like reactions. Modifications included lowering the osmolarity and converting to nonionic solutions. Subsequently, improved tolerance has been observed but 3.1% of injected patients still develop reactions and 0.04% have severe reactions [1] which can prevent patients from receiving contrast-enhanced diagnostic imaging. This can be particularly troublesome for patients needing interventional procedures that require angiography.

There are a few options for patients with reactions to contrast. Typically, the first option is pretreatment with a corticosteroid and diphenhydramine before contrast administration [2]. However, 10% of high-risk patients will have a reaction despite proper premedication [3]. Unfortunately, when a breakthrough reaction occurs the degree of the reaction is not usually attenuated. In fact, 81% of the reactions are similar to the original reaction and 8% are more severe [4].

When premedication is inadequate, the primary options include iodinated contrast substitutions with carbon dioxide or gadolinium. Carbon dioxide is a nonallergenic and inexpensive alternative. It also has the advantage of being nonnephrotoxic and can be used safely in patients with renal

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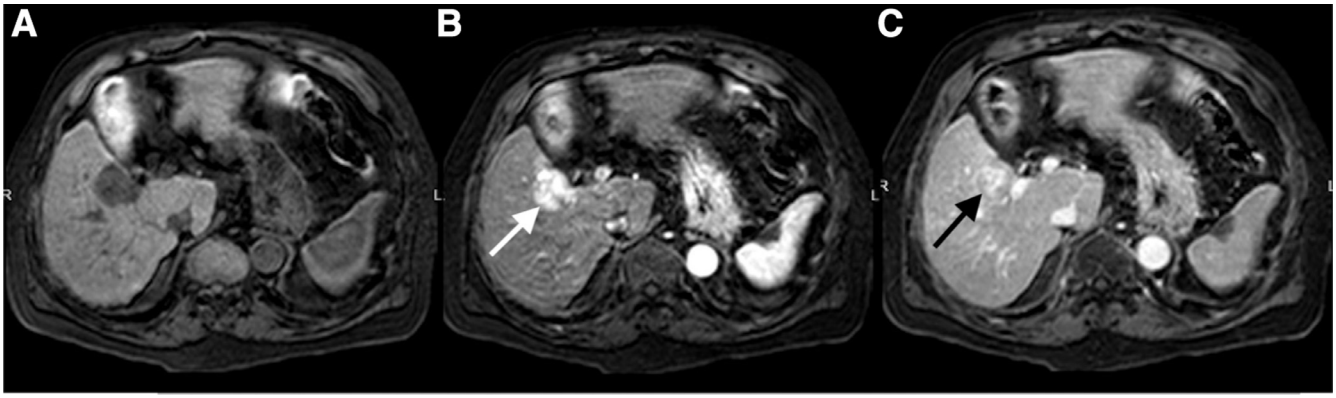

Fig. 1 – Initial liver protocol MRI in native (A), arterial (B), and venous (C) phases demonstrating the 3.3 cm lesion near the porta hepatis with the white arrow demonstrating arterial enhancement and the black arrow demonstrating washout.

disease. Lastly, because of its low viscosity, carbon dioxide can improve the visualization of subtle hemorrhage or collateral vessels. The disadvantages of carbon dioxide are neurotoxicity if used above the diaphragm and the complexity of its use [5,6].

Gadolinium-based contrast medium is a viable alternative in patients with iodinated contrast allergies because the 2 have no cross-reactivity [7]. However, it is limited to patients who have normal renal function because of its association with nephrogenic systemic sclerosis when used in chronic kidney disease patients [7]. Even in healthy individuals, dose limitation is recommended not to exceed a dose of 0.3 mmol/kg with 0.4 mmol/kg considered the absolute limit [8]. A disadvantage is its poor image-quality when using standard fluoroscopic settings [5] which can be improved by subtraction angiography [9]. C-arm computed tomography can further enhance visualization [10] offsetting the disadvantage of lower x-ray absorption of gadolinium (iodinated contrast is often diluted for this application) and, importantly with regards to Gadolinium dose limits, requires smaller amounts of contrast. We present a case where gadolinium-based contrast and C-arm CT technique were used to perform a transarterial chemoembolization in a patient with a history of anaphylaxis to iodinated contrast.

Case presentation

An 83-year-old male with a history of alcoholic cirrhosis and recently diagnosed hepatocellular carcinoma presented for a transarterial chemoembolization. The right lobe liver mass and cirrhosis were discovered on a routine ultrasound. A subsequent MRI was obtained to further characterize the lesion. The lesion was 3.3 cm in diameter, had arterial enhancement,

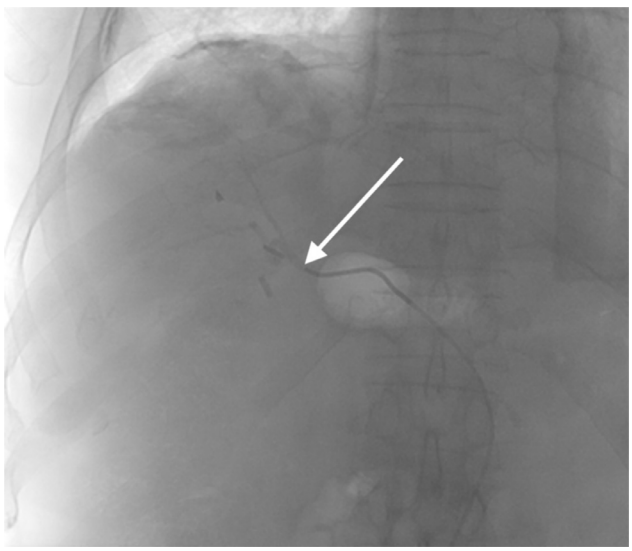

Fig. 2 – Gadolinium contrast injection for C-arm computed tomography. The white arrow demonstrates the catheter tip with injection into the right hepatic artery.

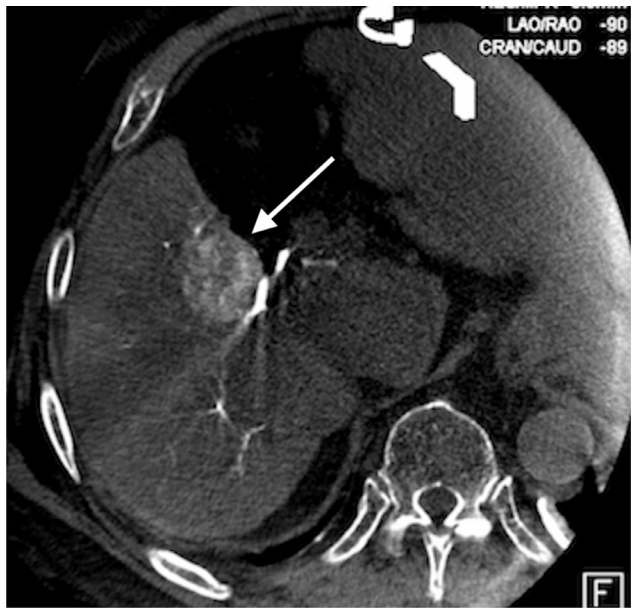

Fig. 3 – C-arm CT image after gadolinium contrast injection with the white arrow demonstrating tumor blush in the right hepatic lobe.

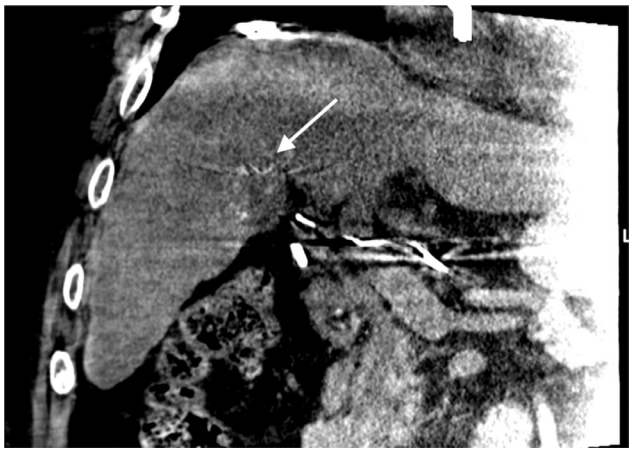

Fig. 4 – C-arm CT image using gadolinium contrast after chemoembolization with the white arrow demonstrating static contrast in the tumor periphery.

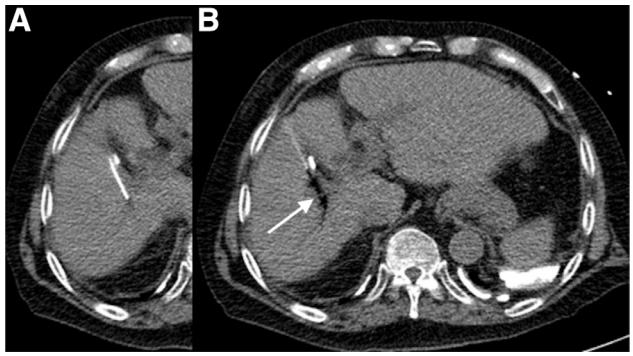

Fig. 6 – CT image demonstrating needle placement (A) and percutaneous ethanol injection to treat residual tumor (B) with white arrow demonstrating correlating tumor location.

and demonstrated washout (Fig. 1). The combination of these characteristics was sufficient for a diagnosis of hepatocellular carcinoma according to the American Association for the Study of Liver Diseases guidelines [11]. Radiofrequency ablation was excluded from consideration because the lesion was in close proximity to bowel and the porta hepatis structures.

During the consultation for the transarterial chemoembolization it was discovered that the patient had had multiple severe reactions to iodinated contrast including an episode that occurred despite medical pretreatment. The reactions included significant difficulty with breathing and diffuse edema. Anesthesiology was consulted and their evaluation came to the conclusion that the risk of iodinated contrast administration was too high even with full anesthesia support. Therefore, iodinated contrast was unavailable for the procedure and a substitute would be required. The patient had normal renal function which allowed for an attempt with gadolinium contrast. The recommended dose for Magnevist (Bayer HealthCare Pharmaceuticals Inc., Whippany, NJ) was 0.2 mL/kg amounting to 15.2 mL for the patient.

The patient was given moderate sedation with midazolam and fentanyl. After femoral access, a selective 5 French catheter was advanced into the right hepatic artery via the celiac artery. Twelve milliliters of nondilute gadolinium contrast were then injected (Fig. 2) while obtaining C-arm CT images which demonstrated tumor blush in the right liver lobe (Fig. 3) consistent with lesion location on MRI imaging. As no single vessel was identified as the main contributor to several tiny feeder arteries, an injection of 75 milligrams of doxorubicin loaded on 100–300 μm LC beads (Biocompatibles UK Limited, Farnham, United Kingdom) were administered. The beads were diluted with saline and mixed with gadolinium contrast to allow intermittent observation of antegrade flow with fluoroscopy during injection. A second set of C-arm CT images without simultaneous injection of contrast was obtained to identify status of contrast/bead accumulation in the tumor. Only subtle accumulation was observed at this point and an additional 25 milligrams of LC beads were administered. A third set of C-arm CT images, again without contrast injection, was obtained which demonstrated peripheral static contrast around the tumor as well as filling of an inferior right hepatic artery branch (Fig. 4) indicating peripheral stasis consistent with treatment end-point. The catheter was then withdrawn and the vascular sheath was removed utilizing a Mynx

Fig. 5 – 7-month post-chemoembolization liver protocol MRI in native (A), arterial (B), and venous (C) phases with the white arrow demonstrating small residual nodular arterial enhancement and the black arrow demonstrating washout.

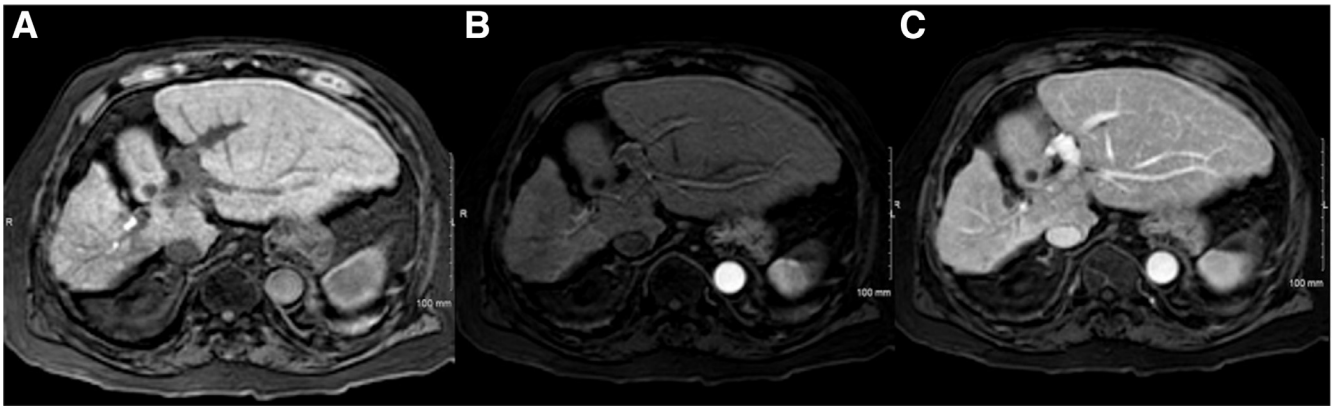

Fig. 7 – 34-month postchemoembolization liver protocol MRI in native (A), arterial (B), and venous (C) phases demonstrating no evidence of recurrent or residual hepatocellular carcinoma.

(AccessClosure Inc., Mountain View, CA) device for hemostasis. Fluoroscopy time was 9.7 minutes with 17 mL of gadolinium contrast utilized. There were no complications and the patient tolerated the treatment well.

Surveillance MRI imaging 5 months after the procedure demonstrated a decrease in the size of the lesion and largely absent enhancement with the exception of some nodular enhancement along the medial margin of the lesion. At that time, it was unclear if the enhancement represented persistent tumor or treatment effect. Another MRI was obtained 7 months postchemoembolization and continued to show nodular enhancement with washout (Fig. 5). An image-guided percutaneous ethanol injection of the site was proposed to treat the suspected residual tumor.

The ethanol ablation of the residual tumor was performed with CT-guidance 9 months postchemoembolization. Correlating with MRI images, a 22-gauge 5-inch spinal needle was advanced to the distal margin of the suspicious area. Ethanol was then injected in small aliquots at initial needle position and during stepwise retraction of the needle to proximal of the suspicious area (Fig. 6). A total of approximately 5 mL of absolute alcohol were used. There were no complications and the patient tolerated the procedure well.

Subsequent MRI surveillance revealed post-treatment changes with absence of residual tumor enhancement. The most recent MRI obtained 34 months postchemoembolization continued to demonstrate no recurrence of hepatocellular carcinoma (Fig. 7).

Discussion

Truly anaphylactic reactions to iodinated contrast are rare but create challenges in healthcare by greatly reducing the options available for diagnostic and therapeutic imaging. Most reactions can be prevented with pretreatment but severe reactions require contrast alternatives. This situation is scarce enough that the amount of literature describing therapeutic imaging alternatives is sparse. A literature search did reveal a 2013 study that addressed the dilemma in this case. The study compared the effectiveness of carbon dioxide as a contrast agent to gadolinium and iodinated contrast during treatment planning for hepatic chemoembolization. The findings suggest that when used with C-arm CT, carbon dioxide was comparable to gadolinium and iodinated contrast with 96% of segmental arteries being identified. However, subsegmental arteries were not reliably depicted and carbon dioxide only enhanced 60% of tumors [12]. In our case, carbon dioxide was considered but gadolinium was chosen primarily because the patient had normal renal function. Ease of use and image quality on C-arm CT also played a role in the decision process. Propitiously, gadolinium proved to be an effective and safe contrast alternative with only 17 mL of contrast needed to complete the procedure. With the patient remaining free of hepatocellular carcinoma nearly 3 years after chemoembolization, this case encourages the consideration of gadolinium-based contrast medium as an effective alternative to iodinated contrast when C-arm computed tomography is available.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2018.11.011.

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