

# Intraarticular extravasation, an unusual complication of computed tomographic angiography performed with intraosseous needle intravenous access

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**Abstract:** Off label use of intraosseous needles (IONs) for contrast media (CM) injection during computed tomographic angiography (CTA) has been reported in small case series and isolated case reports. Presently, complications specific to this novel indication are essentially unknown. In this communication, we report an extravasation of CM from the intramedullary space of the humerus into the glenohumeral joint space during an ION injection of CM during a CTA of the head, neck, and chest. Although clinically insignificant in this case, a more severe intraarticular extravasation could have had both short or long term adverse sequelae. Practitioners of CTA should be aware of this potential complication.

**Keywords:** Contrast media (CM); angiography; extravasation; intraosseous needle injection (ION injection); emergency radiology

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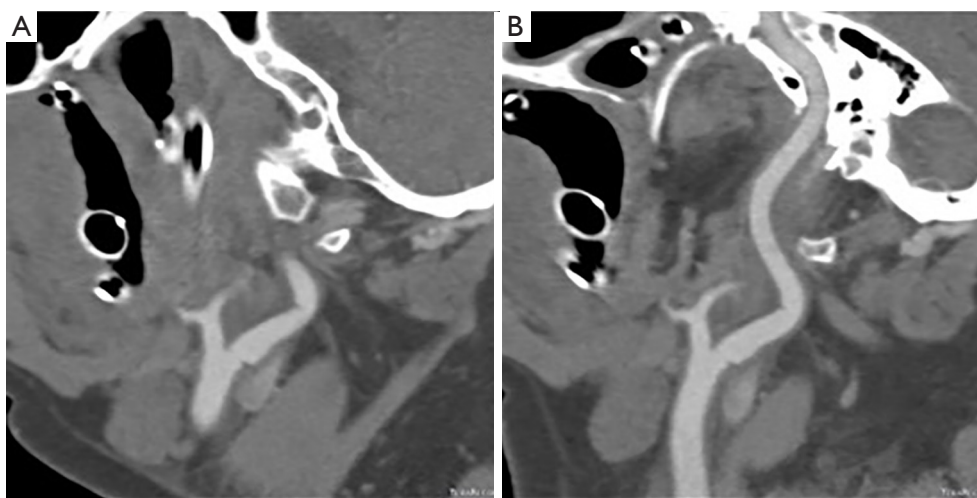
## Introduction

Intraosseous needle (ION) intravenous access (IVA) is a rapid and safe alternative for central venous access that is frequently utilized by paramedics and emergency medicine personnel for patients in shock. This is particularly useful in patients with obesity or chronic intravenous drug use that make conventional peripheral venous access more difficult (1). Many of the patients who receive ION require computed tomographic angiography (CTA) during the course of their emergency medical care. There is an increasing awareness on the use of ION IVA for contrast media (CM) injection during CTA, predominantly from animal studies or small case series (2-9). Until now, there have been no complications of this technique reported. However, complications, such as the one discussed herein, related to new procedures are important to report, so that recommendations and procedural techniques can be modified to ensure that they are a rare occurrence.

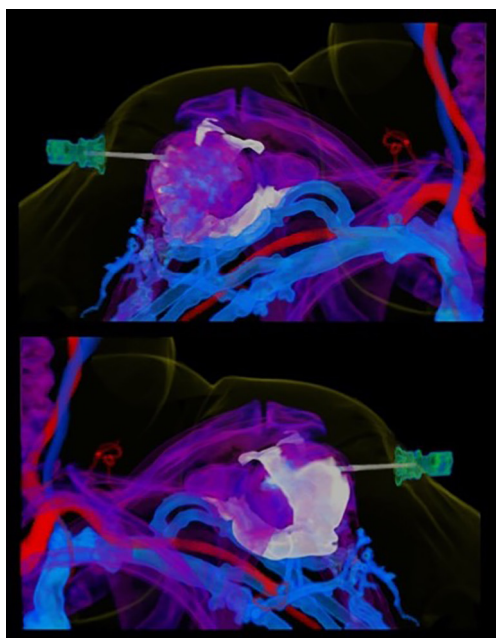
## Case presentation

A 66-year-old obese female presented to the emergency department after a traumatic fall and was found to have signs and symptoms of an acute stroke. Both trauma protocol and stroke protocol imaging were requested. Multiple attempts to achieve IVA via peripheral access veins failed and an intrahumeral IVA was subsequently achieved with an ION (Arrow<sup>®</sup> EZ-IO<sup>®</sup> Intraosseous Vascular Access System, Teleflex Medical, Limerick, Pennsylvania, USA).

Prior to use of ION IVA for CM injection, the needle position was confirmed by non-contrast computed tomography (*Figure 1*). Suitability of the access was further assessed with a 40 mL saline flush at 3.5 mL/sec. Subsequently, CTA of the head, neck, thorax, abdomen, and pelvis was performed with a Somatom Definition Edge scanner (Siemens Healthcare, Forchheim, Germany); 80 mL of Iohexol 350 (Omnipaque, General Electric Healthcare, Little Chalfont, United Kingdom) CM was injected at



**Figure 1** Double oblique multi-planar reformat (A) and curved planar reformat (B) images demonstrate the diagnostic quality of the exam (note that the right carotid bifurcation is free of significant disease, as was the remainder of the cerebral arterial circulation).



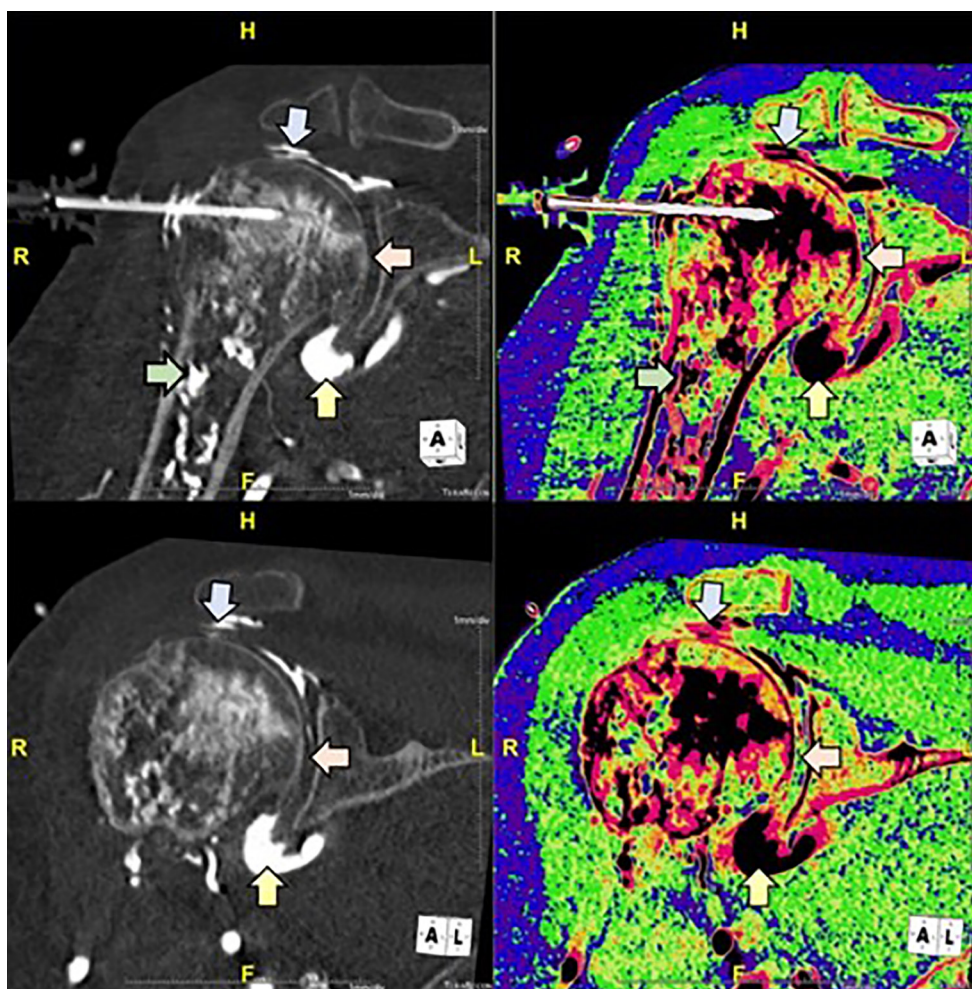
**Figure 2** Anterior (top image) and posterior (lower image) projection volume rendered images utilizing pseudocolor multimasking of right shoulder showing the intraosseous needle, CM within the intramedullary space, and contrast within the glenohumeral joint capsule. CM, contrast media.

3.5 mL/sec for the CTA of the head and neck, and 100 mL for the thorax, abdomen, and pelvis. Significant acute traumatic injury was ruled out, and the arterial circulation was free of stenosis or thrombus (*Figure 1*).

Curiously, at the time of scanning approximately 20 mL (approximated with voxel-based morphometry) of CM was seen within the glenohumeral joint. During further off-line analysis (Aquarius Intuition, Terarecon, Foster City, CA, USA) CM could be seen passing a small distance retrograde along the path of the ION into the subdeltoid bursa, moderately distending the bursa and joint capsule (*Figures 2-4*). Fortunately, the patient denied post procedural pain, and physical exam failed to reveal a neurological or vascular deficit, either immediately after the scan, the following day or at 1-week follow-up.

## Discussion

In this case report, we describe contrast extravasation into the glenohumeral joint and associated bursae as a newly identified complication from ION. We believe that this unusual complication occurred because humeral ION can pass through the subdeltoid bursa during placement. Contrast passing retrograde along the ION tract could



**Figure 3** Greyscale and pseudocolored multi-planar reformat images showing the intraosseous needle, CM within the intramedullary space, and contrast within the glenohumeral joint capsule. Yellow arrows represent contrast within the sublabral recess of the glenohumeral joint space. Beige arrows represent articular surfaces of the glenoid fossa and the head of the humerus. Green arrows represent CM within the intramedullary space. Blue arrows represent incidentally noted full thickness supraspinatus tendon tear. CM, contrast media.

then enter the joint space via its connection to the bursa. However, in this case a cause for the retrograde flow could not be ascertained by inspection of the CT data, as needle position appeared to be optimal on both a scout pre-contrast scan and on the CTA. One possible explanation is that a subtle change occurred in the orientation of the needle driver during ION placement. This could have resulted in widening of the needle tract (at least microscopically) without damaging the needle. If so, then it becomes even more important for operators to maintain a straight course during ION placement to reduce the risk for this complication. Another possible explanation is that contrast passed directly into the joint space through an

interruption in the periarticular bone. As the patient's bone appears intact and its mineralization appears to be normal, we believe this is a less likely etiology.

To conclude, we believe this intraarticular extravasation of CM during CTA examinations may be unique to ION IVA. Now that it has been reported, others can recognize it and a greater understanding of the incidence can be ascertained. We hope this complication will prove to be rare and simply a curiosity. However, as ION IVA for CTA is becoming more routine, imaging specialists should be aware of this risk and monitor patients who experience it for both short term and delayed adverse sequelae, such as joint space infection or adhesive bursitis.



**Figure 4** Volume rendered cine clip utilizing pseudocolor multimasking of right shoulder showing the intraosseous needle, CM within the intramedullary space, and contrast within the glenohumeral joint capsule (10). CM, contrast media.

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### Acknowledgements

None.

### Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

*Informed Consent:* For this case report, which utilizes deidentified radiographic images, the authors' institutional review board did not require informed consent.

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