

Biceps Brachii Compartment Contrast Media Extravasation With Surgical Correlation

Felix S. Chew, Carol A. Boles, Christopher T. Mattern

We describe a case in which 120 ml of contrast media was extravasated into the biceps brachii compartment with a power injector during the course of an attempted CT angiogram. The patient underwent surgical fasciotomy and drainage. The radiographic appearance and clinical implications of this event are discussed.

Case Report

66-year-old man was referred for CT angiogram. An 18-gauge needle was placed in the right antecubital fossa for injection of contrast media, and approximately 120 ml was administered with a motorized injector during the course of the scan. The patient did not complain of pain during or after the injection, and the injection site did not appear swollen when the needle was removed. Subsequently, it was noticed that the expected contrast enhancement was not present on the diagnostic CT images. Radiographs of the right upper extremity were obtained approximately one hour after the injection (Figure 1) showing contrast media extravasation into the soft tissues of the anterior upper right arm. The contrast collection showed sharp margins and appeared confined to the expected anatomic location of the biceps brachii muscle compartment.

The patient was referred to the plastic surgery service for management of incipient compartment syndrome. Approximately four hours after the injection, the patient was brought to the operating room for fasciotomy, washout, and

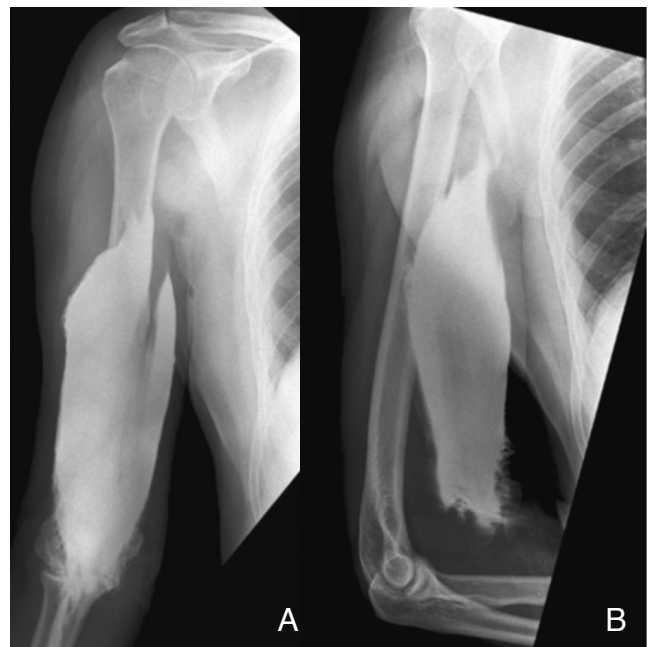


Figure 1. Contrast extravasation into the biceps compartment. A and B, External and internal rotation radiographs of the arm approximately one hour after injection show a soft tissue collection of contrast material in the expected location of the biceps compartment that is completely contained with sharp margins.

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Abbreviations: CT, computed tomography

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placement of a vacuum drainage device. At surgery, subfascial edema was found in the biceps compartment involving most of the mass of the biceps muscle, but the tissues appeared healthy and viable. The biceps fascia was divided longitudinally and the tissues were irrigated. A vacuum sponge drain was placed into the wound, and vertical mat-

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dress stitches were placed in anticipation of delayed primary closure. Follow-up radiographs showed that the contrast media had been cleared (Figure 2). The patient recovered uneventfully.



Figure 2. Radiograph of the arm following fasciotomy and surgical drainage shows successful removal of the contrast collection.

Discussion

Extravasation of radiographic contrast during CT with power injection is not rare. Various reported series show rates between 0.1% and 0.9% [1-5]. In aggregate, these series have a rate of 392 extravasations per 120,049 CT injections, or 0.33% (Table 1). The use of a power injector does not appear to change the frequency of extravasation relative to manual injection [6], and the rate of power injection does not appear to correlate with the frequency or amount of extravasation [2]. Contrast extravasation of low osmolar contrast is much better tolerated than extravasation of high osmolar contrast, and severe injuries using low osmolar contrast are rare [3]. Severe injuries reported with

extravasated low osmolar contrast include skin ulceration, skin necrosis, and compartment syndrome [7-12].

Table 1. Reported prevalence of contrast extravasation during computed tomography

Study	n	%
Cochran [1]	225 / 66,029	0.34%
Jacobs [2]	40 / 6,660	0.60%
Federle [3]	48 / 5,106	0.94%
Cohan [4]	51 / 22,254	0.23%
Sistrom [5]	28 / 20,000	0.14%
Aggregate	392 / 120,049	0.33%

There does not appear to be a general consensus regarding the optimal management of contrast extravasations, but therapies suggested in the literature include elevation of the affected limb, topical application of heat or cold, prevention of infection by the application of topical antibiotics, local injection of hyaluronidase, topical application of dimethylsulfoxide, aspiration of fluid from the site of extravasation, and surgery [13]. The effectiveness of any these therapies has not been tested in randomized controlled trials. The role of imaging in predicting patient outcome or the need for surgical intervention is also unclear. However, to the extent that contrast extravasation may lead to compartment syndrome, there may be some agreement regarding the appropriateness of surgical fasciotomy and drainage [14-15].

Compartment syndrome is typically the result of increased volume within a confined space. For a collapsible vessel, such as a vein, to remain open, the pressure on the inside of the vessel must be equal to or greater than the pressure on the outside of it. Extravasation of fluid into a compartment will increase the pressure within the compartment, which in turn will increase the pressure on the walls of the veins. If the extravasated solution is hyperosmolar, fluid drawn into the extracellular space will exacerbate the situation. The resultant increase in venous pressure will decrease the arteriovenous pressure gradient, leading to decreased local blood flow into the compartment. If blood flow decreases to the point where tissue hypoxia and cellular damage begin, then compartment syndrome is present. Symptoms of compartment syndrome include pain and paresthesias. Clinical findings may include a tense, swollen compartment, pain on passive stretching of the muscle, and sensory loss. Measurements of intracompartmental pressure will be elevated [14-15]. The optimal treatment for compartment syndrome is early surgical fasciotomy and decompression.

The antecubital fossa is a common location for injecting contrast medium. The skin over the antecubital fossa is

relatively thin, with little fat. A network of relatively large veins is immediately superficial to the subjacent fascial compartments. Although the flexor muscles are protected by the thick bicipital aponeurosis, the biceps and mobile wad compartments are vulnerable. The cephalic vein, a common site for injecting contrast, is just superficial to the biceps brachii tendon, and a misdirected needle would have direct access into the biceps compartment. Just lateral to the cephalic vein is the mobile wad compartment containing the brachioradialis, extensor carpi radialis longus and extensor carpi radialis brevis [16]. Not all patients with subfascial extravasation require fasciotomy [7,17]. If the fascial compartment is sufficiently capacious or if the extravasated volume is relatively small, intracompartmental pressures may not reach a level that would lead to compartment syndrome.

In terms of preventing or averting contrast extravasation, devices that detect the presence of extravasation as it occurs exist [18-19]. Power injectors with automatic shutoff mechanisms that instantaneously pause the flow of contrast when contrast extravasation is detected are also available [20]. Radiology departments should have a protocol in place to deal with this potential complication. This protocol should include recognition of the event, evaluation of the patient, referral plan if necessary, and documentation.

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