Compartment syndrome of the hand with acute bullous eruption due to extravasation of Computed Tomography contrast material

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Abstract. – This article presents a case of an 80 year-old woman with severe hematoma and consequently a compartmental syndrome of the hand complicated with acute bullous eruption due to extravasation of contrast material.

Compartment syndrome of the hand has been linked to a number of various etiologies. Failure to adequately diagnose and treat compartment syndromes of the hand can lead to irreparable functional loss.

In the majority of the cases extravasation results only in minimal swelling or erythema. However, severe skin necrosis, ulceration and compartment syndrome may occur with extravasation of large volumes.

Compartment syndrome was diagnosed, and the patient underwent immediately fasciotomy. After fasciotomy we weekly followed up our patient with medications and after she regained the full use of the hand.

We report this case to assess the importance of a careful evaluation of the intravenous administration site and close monitoring of the patient during contrast material injection to obtain minimal or prevent every kind of extravasation injuries.

Key Words: Compartmental syndrome, Extravasation of contrast material, Cutaneous extravasation injuries, Fasciotomy.

Introduction

Small extravasation of contrast medium may occur during intravenous administration for urography, computed tomography (CT) scanning, and peripheral venography, especially in patient with difficult venous access. Usually small extravasations don’t need any treatment and induce pain, minimal swelling and localized erythema which rapidly diminish. However, an extravasation of 25-50 ml of contrast media may result in severe complications, including skin and subcutaneous tissue necrosis. Compartment syndrome may also be associated with extravasation of large volume of contrast material.

This severe complications may require debridement, skin grafting, or occasionally, plastic reconstructive surgery. Compromised limb function may result.

Case Report

An 81 years old woman underwent pulmonary CT with contrast material injected intravenously into the dorsum of her left hand. Medical history was significant for pulmonary diseases. She underwent CT with contrast for diagnostic investigations.

Approximately 100 ml of non-ionic, water-soluble contrast medium was injected intravenously through a rapid system on the dorsum of the hand. During CT exam the radiologist did not visualize injected contrast material due to extravasation in the subcutaneous tissues. The nurse repeated the injection of contrast material and the exam was successfully executed. Immediately following CT the patient reported an acute pain in the injection site with a large area of haematoma.

Eight hours after the procedure the patient was admitted to our Emergency Department with complaints of an intense and acute pain on the left hand. Physical examination revealed a dusky, swollen and tense hand with a bullous eruption on the dorsal area. The hand appeared warm with loss of the superficial sensitivity. The fingers were severely swollen and capillary refill was sluggish and passive stretching of the hand was painful in all fingers. Radial and ulnar pulses were not palpable but were audible using a Doppler stethoscope.
The patient referred us that from the time of the procedure to the admission in our Emergency Department she treated the hand with glicosamynoglicanepolsulfategel(Hirudoidgel®)withoutthe improvement of the symptomatology.

Initial approach to the treatment was conservative (corticosteroid and antibiotic intravenously therapy, elevation of forearm, fine needle punctures to evacuate serum of bullous eruptions). Conservative management did not improve the patient’s clinical conditions.

Compartment syndrome was finally diagnosed. The patient was taken to the operating theatre immediately for management of the hand compartment syndrome with a fasciotomy.

The interosseous and adductor compartments were released through dorsal longitudinal incisions centered over the second and fourth metacarpals. Surgical wounds were not sutured to permit draining of ematoma, serum and contrast medium. The patient was then medicated at our ambulatory of advanced medications to promote wound healing by secondary intention.

Discussion

Extravasation of contrast material is a not infrequent complication of enhanced imaging studies and a large volume extravasation may result in a severe damage. Early identification is important and the conservative management is effective in most cases. An hypertonic solution usually six times much more of plasma causes an increment of oncotic tissue pressure leading to the extravasation of intravascular fluid into the extra-vascular space. This causes a rapid exchange of fluid with edema and worsening occlusion of blood flow. A second factor is the cytotoxicity of the contrast medium, with conflicting evidence presented in the literature.

Compartment syndrome is due to the increased pressure in a closed fascial space reducing the capillary blood perfusion below the level necessary for the tissue viability. This compromise to the circulation will affect all the structures within the involved compartment. The foundations of our understanding of this syndrome begin with Volkmann whose work described the post traumatic contracture as an ischemic phenomena rather than a neurologic entity as previously believed. Volkmann® first opined that these contractures were a result of a muscle necrosis. Rowlands and Lond, and later Brooks at al, advanced the premise that not only the ischemia but also the reestablishment of blood flow were contributory to contracture after injury. Griffiths argued that the arterial injury and the spasm rather than the pressure were the cause. The role of the sympathetic nervous system and reflex spasm maintained great importance until Kinmonth showed that the arterial spasm commonly is precipitated by a direct injury and can be independent of the sympathetic nervous system reaction. In 1948, Bunnell and Doherty described compartment syndrome in the hand based on clinical findings. Reneman asserted that the increased lower extremity pressures resulting in compartment syndromes were akin to Volkmann’s contracture. Matsen and Clawson proposed a unified theory in 1975 that
the core pathophysiology was either a decreased size or increased volume of an anatomic compartment that resulted in an increased interstitial tissue pressure causing ischemia and, possibly, muscular necrosis.

One of the earliest descriptions of fasciotomy was presented by Bardenheuer in 1911, in which he described "aponeurectomy" for prevention of Volkmann's contracture. Sequelae of this syndrome are now seen infrequently because the fasciotomy is usually performed as soon as the diagnosis is made. Regarding extravasations in the hand, if a compartment syndrome develops, emergency dorsal fasciotomy must be performed within the first 6 h to relieve neurovascular compromise. With an early fasciotomy for an isolated compartment syndrome, most patients can regain excellent function.

The forearm and hand with compartment syndrome presents as a tense, swollen extremity, often with fingers partially flexed and the wrist in neutral position. Severe hand swelling causes the palm to appear convex and places the fingers in the intrinsic minus position. The classic 5Ps (pain, pallor, paresthesias, paralysis, and pulselessness) as well as palpable fullness (the sixth P) and pain with passive extension have been described for the clinical diagnosis of the compartment syndrome. With the exception of pain, however, all appear as relatively late findings in this diagnosis. Once the diagnosis of compartment syndrome has been confirmed, a prompt fasciotomy is the treatment of choice and offers the best chance at decreasing compartment pressure and preventing further damage. Despite prompt diagnosis and treatment, the extent of tissue damage at the time of injury and other comorbidities can have a negative effect on patient outcome.

In conclusion the early diagnosis of the compartment syndrome is very important and the conservative management is effective in most cases.

References

7) MCLAISTER WH, PALMER K. The histologic effects of four commonly used media for excretory urography and an attempt to modify the responses. Radiology 1971; 99: 511-516.