



A case report of furosemide extravasation in the hand: a rare cause of compartment syndrome

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In emergency departments, many drugs, fluids, and materials for medical examinations and treatment are typically administered to patients intravenously. One of the most common complications of the intravenous bolus or infusion of drugs is extravasation injuries. These injuries may cause certain morbidities for the patient, increase the cost of treatment, and prolong hospital stays. At the same time, these injuries also carry medicolegal risks for health personnel. Furosemide is a potent diuretic that is commonly used in emergency departments for volume overload conditions. To the best of our knowledge, there have been no cases reported in the literature of furosemide-induced extravasation injury with subsequent compartment syndrome that has required surgical intervention. Presented herein is the case of a 70-year-old female patient who was administered intravenous furosemide from the dorsum of the left hand and whose extravasation injury progressed to compartment syndrome requiring an emergency fasciotomy.

Keywords Compartment syndromes; Emergency medicine; Extravasation of diagnostic and therapeutic materials; Furosemide; Case reports

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Capsule Summary

What is already known

One of the most common complications of the intravenous bolus or infusion administration of drugs or fluids is extravasation injuries in emergency departments. Many drugs, fluids, and materials for medical examinations and treatment may cause these types of injuries and may even result in compartment syndrome. Furosemide is a potent diuretic that is commonly used in emergency departments under general volume overload conditions.

What is new in the current study

To the best of our knowledge, this is the first case reported in the literature of furosemide-induced extravasation injuries with subsequent compartment syndrome that required surgical intervention.

INTRODUCTION

Intravenous (IV) fluids, drugs, or radiological contrast agent administration in emergency departments (EDs) pose a potential risk of extravasation injuries. Due to damage to the vascular endothelium for a variety of reasons, fluids or drugs leak into the surrounding tissue and may progress from minor sequelae to compartment syndrome that could possibly result in amputation and organ loss [1-4].

Furosemide is a drug that we frequently administer through the IV route in EDs [5]. To the best of our knowledge, there have been no cases reported in the literature that have progressed to compartment syndrome after extravasation due to IV furosemide administration. Presented herein is a case of a 70-year-old female patient who was administered IV furosemide on the dorsum of the left hand 3 days prior in another hospital and was diagnosed with compartment syndrome at Ankara Training and Research Hospital.

CASE REPORT

A 70-year-old female patient was admitted to the ED with complaints of pain, swelling, and redness in the dorsum of the left hand. An IV bolus of furosemide was administered to the patient 3 days prior in another hospital through vascular access in the dorsum of the left hand. In the meantime, the patient exhibited swelling and pain in the dorsum of the left hand. The catheter was removed, and the patient was subsequently discharged and advised to keep her left hand and arm elevated. There was no other medication or fluid administered through the same IV line. The patient had a history of atrial fibrillation, congestive heart failure, and hypertension, and regularly underwent treatment using metoprolol, furosemide, acetylsalicylic acid, and amlodipine. The patient had no history of any other drugs, substances, or history of smoking and alcohol use. There was no history of trauma or human/animal or insect bites on the patient's left hand. During the physical examination, the vital signs of the patient were stable. There was widespread swelling, redness, ecchymotic areas, pallor, coldness, and pain with movement in the left hand and wrist, extending to the distal forearm. As stated before, a bullous lesion that measured approximately 3 × 3 cm was observed on the dorsum of the left hand (Fig. 1). The nerve examination of the patient was normal, but there was limited flexion in the left wrist. On the bedside superficial ultrasonography, approximately 3 cm of heterogeneous fluid collection was observed in the thickest part of the left-hand dorsum in addition to an increase in soft tissue thickness. No acute pathology was observed in the left up-



Fig. 1. Image shows the left hand of the patient. Global tissue swelling, paleness, some ecchymotic areas, and a big bullous lesion in the dorsum of the left hand are markedly observed.

per extremity arterial and venous Doppler ultrasonography of the patient. Laboratory results of the patient were within normal limits. The patient underwent a consultation with the plastic surgery department and was given a preliminary diagnosis of extravasation injury/compartment syndrome. Decompression therapy was applied to the patient in the ED. Dense heterogeneous fluid was aspirated by the plastic surgeon and the patient was admitted to the plastic surgery department for a fasciotomy. On the 5th day after the surgical procedure, the fasciotomy scar was closed without the need for a skin graft. The patient was discharged 1 week afterwards and instructed to return for a polyclinic check-up examination. Sensory and motor examination was completely normal upon discharge.

Written informed consent was obtained from the patient, but the patient did not allow photographs of the hand to be taken or shared after the surgical procedure or during discharge. The Institutional Review Board approval was not required as it was an anonymously submitted case and did not contain any identifying information.

DISCUSSION

Furosemide is frequently used as a potent loop diuretic in EDs for the treatment of ascites due to cirrhosis and peripheral, pulmonary, or generalized edema. Its main use in the ED is the optimization of the volume status of a patient in systolic and diastolic heart failure. It can be administered as either an IV bolus or infusion [5]. The preferred way to obtain rapid systemic responses from the treatments applied in EDs is through the parenteral route. However, IV therapy may also have potentially significant

risks. One of these is extravasation and infiltration damage, which occurs when IV-administered drugs or substances escape from the venous system and leak into the surrounding tissue, an important cause of morbidity in hospitalized patients [1,4]. In the emergency medicine literature on these injuries, vasopressor agents [1,4], high-concentration dextrose solutions [3,6,7], radiographic contrast agents [2,8,9], peripheral parenteral nutrition [10], antiarrhythmic and sedative-hypnotics [11,12], and antibiotics [1,4] have been implicated and frequently reported. There have not been any adult cases reported in the literature regarding extravasation injuries and compartment syndrome associated with the use of IV furosemide. One defined case of a patient who was under 18 years of age was found, but it was not presented as a classic case report with a discussion of its management and prognosis [1]. To the best of our knowledge, the case presented herein is the first case report in which this association was revealed in the literature.

Risk factors for extravasation injuries may be related to the material used, the patient, the drug or IV fluid, or the clinician. Conditions such as using vascular access material that is larger than the diameter of the vein or the use of metal needles, improper technique, poorly fixed catheters, or vascular access on or near a mobile joint such as the dorsum of the hand, wrist, or elbow, increase the likelihood of such injuries [1,4]. Conditions such as extreme age, lymphedema, and decompensated blood flow are also among the risk factors related to the patient [1,4]. The patient herein was also a relatively old and edematous patient, and the vascular access was on the dorsum of the hand. In a meta-analysis that investigated the efficacy of administering vasopressors through a larger vascular access (such as central venous catheters) to avoid the risk of complications, it was revealed that the infusion of vasopressors through a peripheral IV line did not have a significant effect on the direct complication rate [13]. In order to prevent extravasation injuries in the ED, it may be a rational precaution to administer high-risk agents through larger IV lines, but this is a well-known situation with an increased risk of infection and is time-consuming for emergency treatment. Again, in a study that investigated the safety of the peripheral administration of norepinephrine in terms of the risk of extravasation, the risk was determined to be quite low [14]. Hyperosmolar solutions, vasoconstrictive agents, cytotoxic agents, and substances that are not at physiological pH carry a higher risk for extravasation injuries [4]. However, in a study where hyperosmolar agents, such as 3% hypertonic saline or mannitol, were administered to 192 patients through the peripheral IV route, the occurrence of extravasation was not observed [15]. The administration of furosemide, despite its relatively low

osmolarity and nonacidic pH, caused extravasation injury in the patient in the current study, which has not been reported in the literature to date.

Nonpharmacological treatment options for extravasation injuries include stopping the infusion, withdrawing the needle or catheter, elevating the affected extremity, applying a warm/cold compress to the involved area, and debridement and excision of necrotic tissue [4]. Again, before this stage, surgical flushing with normal saline may be attempted for some hyperosmolar agents [4]. For the patient in this study, decompression was first applied to drain the fluid by a plastic surgeon, and then the patient was hospitalized for a fasciotomy. Although extravasation injuries rarely cause compartment syndrome, it is possible for compartment syndrome to occur from any such injury, as in this case. Although it is difficult to distinguish the precise cause, whether it is the volume status of the fluid or the drug, or the vesicant property of the drug (furosemide) or both, no other cases of compartment syndrome caused as the result of IV furosemide specifically have been reported in the literature thus far.

Pharmacological treatment options for extravasation injuries include hyaluronidase, phentolamine, terbutaline, topical nitroglycerin, and topical hydrocortisone [1,3,6]. In particular, hyaluronidase has been reported to be effective for the extravasation of many hyperosmolar agents and is gaining increasing importance in emergency medicine literature [3,6]. It exerts its effect mainly through the hydrolysis of hyaluronic acid, which is responsible for cellular adhesion. By weakening the viscosity of intercellular binding, it facilitates the passage of extravasated fluid back to the vascular bed [3,6]. For the patient in this study, no medication was administered and the treatment performed was mainly surgical in nature.

As a limitation, the patient did not allow for postoperative photographs of her hand to be taken. For this reason, it was not possible to share the postoperative recovery photos of the patient. We did not have the opportunity to measure the compartment pressure of the hand, but we consider the clinical status of the patient to be more important than pressure values for the emergency medicine literature.

Extravasation injuries due to IV fluids or drugs may progress to compartment syndrome in EDs. Furosemide has not been reported in the literature in this regard to date. It should be kept in mind that this agent, which is frequently administered through IV routes in EDs, may cause this complication. Compartment syndrome carries many health risks for the patient and awareness of its risks is important for patient management and potential medicolegal litigation.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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AUTHOR CONTRIBUTIONS

Conceptualization: all authors; Methodology: all authors; Data curation: all authors; Formal analysis: DUK; Writing–original draft: SG; Writing–review & editing: all authors. All authors read and approved the final manuscript.

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