

Gangrene of hand due to faulty intravenous cannulation: Be cautious with hyperosmotic agents

Sir,

Extravasation, non-intentional leakage of infused fluid into the surrounding tissue, is an iatrogenic complication. Extravasations of drugs should be suspected as a possible differential diagnosis of bullous, vesicular swelling in perioperative settings. The reported incidence of extravasations ranges from 10 to 30%.^[1] The American Society of Anesthesiologists Closed Claims database revealed that intravenous catheters were an important source of liability for anesthesiologists, approximately half of which resulted from extravasation of drugs or fluid.^[2] Extravasation injuries are caused by a variety of hyperosmotic, viscid, and alkaline solutions.

An 18-year-old patient was received at the intensive care unit (ICU) in the postoperative period, after undergoing frontotemporal meningioma excision, for planned elective ventilation. The patient had no other disease. General examination revealed bullous, fluid filled vesicles and swelling on the dorsal aspect of the left forearm, hand [Figure 1], and right hand. On enquiry, the attending anesthesiologists revealed that the patient had received 20% mannitol on the morning of the surgery, after intravenous cannulation, on the dorsum of left hand. Ten minutes after starting the mannitol infusion, the nurse noted a swelling in the hand. The infusion was stopped; fresh intravenous cannulation was secured on the dorsum of the other hand and the infusion restarted. This time, however, a swelling over the skin, near the tip of catheter,



Figure 1: Bullous vesicular swelling in left hand and forearm

was noted immediately. Twenty milliliters of mannitol had already been infused. Both hands and the left forearm were covered by magnesium sulfate emulsion gel dressing. In the operating room, the anesthesiologist did not ask to uncover the dressed hands as a working 18G intravenous cannula in the left antecubital fossa was present. The right subclavian vein was cannulated using a triple lumen central venous catheter and all medications were given by a long extension line attached to this. The rest of the intraoperative period was uneventful. On the second day, the right hand showed signs of gangrenous changes. Bedside fasciotomy was done, as the radial pulse was not palpable and the pulse oximeter failed to show any waveform in the middle three fingers, indicative of compromised perfusion in the left hand [Figure 2]. Culture from the hand did not show any growth of organisms. After a written informed consent was obtained, hyaluronidase was infiltrated in the right hand and the magnesium sulfate emulsion gel dressing was continued. Supportive care with hand elevation and intermittent cold sponging was also done. The right hand recovered completely, while the left hand had residual gangrene after a few days.

Extravasation injury is an important cause of morbidity in the perioperative period, especially with the use of mannitol, phenytoin, antibiotics (erythromycin), and anesthetic agents (propofol, thiopentone).^[3,4] Tissue injury can be caused by hyperosmolarity (mannitol, sodium bicarbonate), vasoconstriction (adrenergic drugs), cytotoxicity (phenytoin, chemotherapeutic drugs, potassium salts), infusion pressure, and altered regional anatomy.^[5,6] Multiple risk factors like injection technique (automated syringe drivers, forceful injections), fragility of the patient's veins (as in infants and the elderly), number of venipuncture attempts prior to establishing an operational intravenous line, drug characteristics, and decreased vigilance during the administration of noxious agents, determine

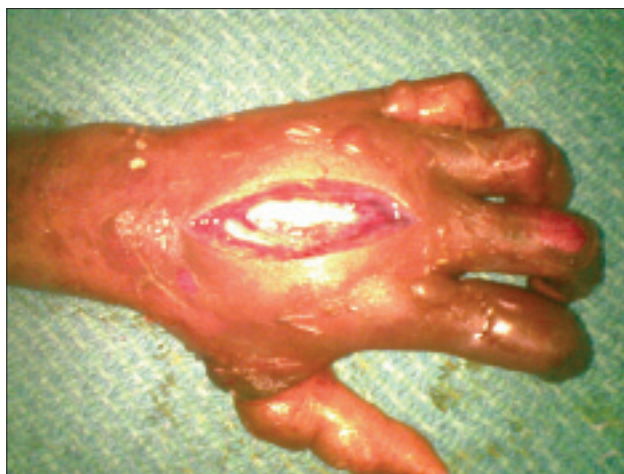


Figure 2: Fasciotomy for gangrenous changes

the likelihood occurrence of extravasation.^[6] Patients who are comatose, anesthetized, or have a hypoesthetic limb cannot indicate pain on injection and this may delay the detection of extravasation. Five phenomena involved in the evolution of tissue damage following drug extravasation are: (1) vasoconstriction and ischemic necrosis; (2) direct toxicity; (3) osmotic damage; (4) extrinsic mechanical compression by large volumes of extravasated solutions; and (5) superimposed infection.^[6]

The compartment syndrome develops when interstitial pressure of a given muscular compartment exceeds the capillary perfusion pressure. In the case reported, extravasation of 20% mannitol caused tissue injury and the compartment syndrome, leading to gangrene, due to its hyperosmotic nature. The osmolality of 20% mannitol is 1099 mosmol/kg. It is an acidic and irritating solution with a pH of 4.5 to 7.0.0.^[7] Several treatment options, surgical and medical, have been proposed for extravasation injuries. These include debridement and skin grafting, warm or cold compresses, saline flush-out, multiple punctures, hyaluronidase, phentolamine, dapsone, magnesium sulfate gel dressing, liposuction, and hyperbaric oxygen (HBO) therapy.^[6] We used hyaluronidase in our patient, as it degrades hyaluronic acid, which promotes an increase in tissue permeability and absorption of fluids through the tissues.^[8]

If a substance known to cause an extravasation injury is to be used, it is important to ensure that the vein cannula is appropriately placed and the area is monitored regularly. Multiple punctures of the same vein, a high infusion pressure, a tourniquet effect, and peripheral access sites in close proximity to tendons, nerves, or arterial vessels should be avoided. It will be prudent to infuse some crystalloid solution, like normal saline, prior to initiation of infusion of these agents.

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