Case Report

Liposuction and extravasation injuries in ICU

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Liposuction is a minimally invasive surgical technique, occasionally used to minimize the risk of devastating soft tissue necrosis following extravasation of noxious substances. Anaesthetists and intensive care physicians frequently use agents that may cause serious tissue injury if extravasated. Therefore, knowledge on how to manage this complication is important. We present two cases of percutaneous extravasation of noxious agents in intensive care patients and discuss their subsequent management.


Keywords: complications, extravasation, contrast media; surgical technique, liposuction

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Extravasation of numerous drugs administered frequently to intensive care patients may result in a spectrum of injuries ranging from minor, self-limiting, localized irritation to fulminant, tissue destruction with consequent functional and aesthetic sequelae. Early intervention can limit the extent of soft tissue damage and reduce the associated morbidity in an already compromised patient. Liposuction and saline lavage is a minimally invasive surgical technique, efficacious in the removal of toxic substances. This report describes two patients who were treated with this modality following the extravasation of thiopentone and iodinated contrast media.

Case 1

A healthy, 18-yr-old male was admitted to the accident and emergency department following a road traffic accident. Initial assessment revealed a Glasgow Coma Score (GCS) of 13/15 and an acute abdomen. Two 18G peripheral i.v. (p.i.v.) cannulae were placed, one in each forearm and connected to an i.v. infusion. Extravasation of thiopentone 2.5% was noted after injection of 15 ml (325 mg). The contralateral p.i.v. was used to repeat the injection but a further 15 ml of thiopentone were extravasated at this site also. A third 18G p.i.v. cannula was placed in the left forearm, enabling induction of anaesthesia and orotracheal intubation. Shortly thereafter, extensive s.c. oedema and erythema was observed at the sites of the first two p.i.v. cannulae and in both antecubital fossae. The radial and ulnar pulses remained palpable in both arms. Further investigations demonstrated a ruptured spleen and multiple bone fractures for which a splenectomy and open fracture reduction with internal fixation were performed. Upon the return of the patient to the ICU, the extravasation injury was treated using liposuction and saline lavage through four 4-mm blunt tipped liposuction cannulae inserted into each forearm. After instillation of 180 ml of saline into the left forearm, 250 ml of material was aspirated. In the right forearm, 120 ml of saline was instilled and 120 ml of material aspirated. Aspirate analysis confirmed the presence of thiopentone: 76 ng ml⁻¹ from the left and 67 ng ml⁻¹ from the right forearm. Six hours had elapsed between the extravasation injury and liposuction. The tissue oedema dissipated over the ensuing days, resulting in complete resolution without any adverse sequelae.

Case 2

A 37-yr-old male was admitted to the hospital with head injuries following a road traffic accident. As part of his initial management, two p.i.v. cannulae were inserted; a 16G in the left antecubital fossa (ACF) and an 18G in the right forearm. The patient was then intubated (GCS 6/15), sedated (midazolam and fentanyl continuous i.v. infusions), mechanically ventilated, and transferred to the radiology department for contrast enhanced CT scans of brain, thorax, and abdominal cavity. Iobitridol 120 ml, a non-ionic, low osmolality, tri-iodinated contrast media was injected at a rate of...
2 ml s⁻¹ via an automated syringe through the 18G cannula. Failure to visualize radioopaque blood vessels indicated contrast media extravasation. The CT scans were completed following a second injection of contrast media through the contralateral 16G p.i.v. Shortly thereafter, extensive erythema and oedema of the skin overlying the anterior aspect of the right arm and forearm was observed. Following discussion with our surgical colleagues, the extravasated contrast media was aspirated through two blunt tipped liposuction cannula inserted in the right forearm, in ICU, 2 h after the injurious event, and effected an uneventful recovery.

Discussion
Chemotherapeutics frequently are incriminated for causing serious extravasation injuries.⁶⁻¹⁴ Also, cationic solutions (bicarbonate, concentrated calcium, and potassium preparations), hyperosmolar agents and vasopressors, may cause extravasation injuries accounting for 30, 20, and 10% of cases reported in the last 20 yr.¹⁻⁴

Multiple risk factors have been identified. Infants and elderly patients may have fragile veins that are often difficult to cannulate. Patients who are comatose, anaesthetized, or have a hypoaesthetic limb cannot indicate pain on injection. In addition, malnutrition and immunosuppression facilitate lesion propagation. Automated syringe drivers, forceful injections, and decreased vigilance during the administration of noxious agents also represent an increased risk.¹⁵

Risk factors inherent to the nature and location of i.v. cannulation include vessel wall trauma caused by injection through metal needles as opposed to plastic cannulae.⁶

Common extravasation sites include the forearm (33%), the dorsum of the hand (30%), and the antecubital fossa (12%); areas where the s.c. adipose tissue is relatively sparse thereby affording little protection to critical underlying structures including arteries, nerves and tendons.¹⁻⁷⁻⁸

Five pathophysiological phenomena explain the evolution of tissue damage following drug extravasation: (1) vasoconstriction and ischaemic necrosis; (2) direct toxicity; (3) osmotic damage; (4) extrinsic mechanical compression by large volumes of extravasated solutions; and (5) superimposed infection.¹⁹⁻¹²

The pathogenesis of tissue damage induced by contrast media is multifactorial. Hyper-osmolar agents are more toxic than low osmolar agents; viscous, ionized media are more harmful than non-ionized media. In addition, extravasation of large volumes may cause a compartment-like syndrome.³⁻¹³ Thiopentone toxicity results from its alkalinity and ability to induce vasospasm. Thiopentone 2.5%, the currently recommended concentration, is isotonic, thereby resulting in fewer problems when extravasated relative to the former 5% solution.

Table 1 Staging of extravasation injuries according to Flemmer.¹⁵ *The presence of any one of these characteristics constitutes a stage IV infiltrate

<table>
<thead>
<tr>
<th>Stage</th>
<th>Clinical signs</th>
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<tbody>
<tr>
<td>I</td>
<td>Painful i.v. site</td>
</tr>
<tr>
<td>II</td>
<td>No erythema, no swelling</td>
</tr>
<tr>
<td>III</td>
<td>Slight soft tissue swelling (0-20%)</td>
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<tr>
<td>IV</td>
<td>Marked soft tissue swelling (&gt;50%)</td>
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Table 2 Guidelines for the prevention of extravasation

| 1     | Avoid running an infusion in a limb, which has been previously irradiated, has had an ipsilateral lymph node clearance, is hypo-aesthetic or has had a recent antecedent infusion. |
| 2     | It is preferable to site a cannula in the forearm rather than the back of the hand or antecubital fossa. |
| 3     | Aim to inject through a pliable plastic cannula in preference to a metal needle. |
| 4     | Where possible, administer noxious substances (vaseoactive drugs, concentrated potassium and calcium solutions, TPN, continuous thiopentone infusions, chemotherapeutic agents, etc.) through a central venous catheter. |
| 5     | Minimize the use of high pressure infusions. |
| 6     | Fix the cannula in place using a transparent, non-occlusive dressing so as to facilitate observation of the overlying skin. |
| 7     | When utilizing continuous infusions, change the i.v. line every 48 h, whilst trying to avoid repeated puncture of the same venous network. |
| 8     | Endeavour to change all i.v. lines that have been inserted under urgent circumstances. |
| 9     | Preceding the injection of noxious substances, clarify the patency of the line, the presence of venous return through it and the absence of any obvious local s.c. infiltration. |
| 10    | Instruct the patient to report any pain that he/she may experience at the cannula site. |
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should be removed, the affected limb elevated and a cold, dry dressing applied topically for 15 min, three times daily for 3 days.7 8 These measures are recommended in the absence of extensive tissue injury and adapting a conservative approach like this requires intensive injury surveillance. Pharmacological therapies include vasodilators, steroids, hyaluronidase, and free radical scavengers,17,18 the majority of which have only been proven efficacious in experimental studies.2 Several authors have advocated early surgical debridement of the affected area to minimize the evolution and/or extension of necrosis.19 However, results of early surgical debridement have been disappointing because of the difficulty in delineating appropriate tissue margins, frequently resulting in reconstructive surgery and functional impairment of the limb.12,20

Liposuction and saline lavage dilutes and directly eliminates the noxious substance whilst preserving the overlying skin. It is indicated in the management of extensive injuries (extravasation injury stages III–IV).4 In 1993, Gault2 studied 96 paediatric patients with extravasation injuries, 44 of whom underwent liposuction and saline lavage within the first 48 h. In patients treated conservatively, 15% recovered completely, 33% recovered with minor residual scarring, 52% experienced significant soft tissue damage necessitating extensive reconstructive surgery and in one case, a limb amputation had to be performed. In contrast, 86% of patients treated with liposuction and lavage within 48 h of injury healed fully and the remaining 14% recovered with minor residual scarring. Recently, Schummer and colleagues have again described the early use of liposuction and saline lavage. Four patients treated conservatively required multiple debridements and reconstructive surgery as opposed to the patient treated within 24 h of injury liposuction who had a complete resolution of his lesion.21 In addition, there are numerous other reports describing similar outcomes following the use of liposuction and saline lavage in extravasation injuries.12,20,22

Conclusion

Despite the lack of randomized controlled studies comparing this technique to early, ‘more invasive’ surgical intervention, liposuction and saline lavage may be regarded an interesting option in the early management of significant extravasation injuries.12 S.C. infiltration of noxious agents is an infrequent and often unrecognized occurrence, usually causing minimal tissue damage. Unfortunately, some incidences result in devastating cosmetic, psychological, and functional sequelae with costly medico-legal consequences. We have successfully applied the principles of therapy described in the paediatric literature to adult patients. We advocate plastic surgical consultation within 24 h after the extravasation of any potentially noxious agent, and the early use of liposuction and saline lavage in stage III–IV injuries or those involving extravasation of large volumes of contrast media regardless of its hydrosolubility.13 Undoubtedly the best treatment is prevention, and by systematic application of pre-emptive guidelines, the incidence of this complication should continue to decline.19

References

11 Larson DL. What is the appropriate management of tissue extravasation by antitumor agents? Plast Reconstr Surg 1985; 75: 397–405
17 Cox RF. Managing skin damage induced by doxorubicin hydrochloride and daunorubicin hydrochloride. Am J Hosp Pharm 1984; 41: 2410–4