Extravasation of Radiologic Contrast

Extravasation of radiologic contrast media accounts for a substantial proportion of reports submitted to PA-PSRS. Intravenous complications account for approximately 5% of all reports submitted to PA-PSRS. Complications related to administration of radiologic contrast media account for approximately 11% of these IV complications.

Occurrences related to radiologic contrast administration are reported to PA-PSRS as either infiltrations or extravasations. Over half of the contrast administration issues are categorized as infiltrations. The terms “infiltration” and “extravasation” seem to be used interchangeably as they relate to contrast media. However, there is an important difference between these terms.

The Infusion Nurses Society (INS) defines an infiltration as the inadvertent administration of a nonvesicant solution into surrounding tissue, instead of into the intended vascular pathway. Extravasation is the inadvertent administration of a vesicant solution into surrounding tissue, instead of into the intended vascular pathway. A vesicant is an agent that has the potential to cause blistering or tissue necrosis. Radiologic contrast media are considered to be vesicant solutions.

Though chemotherapy/antineo-plastic medications are well-known vesicants, other vesicant solutions include certain vasodilators and vaspressors, parenteral nutrition, certain antibiotics, and certain electrolyte solutions. See the inset article “Common and Lesser Known Vesicants” for a detailed list.

Vesicant solutions are capable of causing significant injury to patients. Such injuries depend upon such factors as: the type of vesicant, amount and concentration infused, and the length of time the drug remains in the tissue. Once extravasation occurs, damage can continue over a long period of time, involving skin, nerves, connective tissue, and joints. Consequences of extravasation may include infection, loss of function, necrotic ulcers, disfigurement, reflex sympathetic dystrophy, surgical debridement/plastic surgery, skin grafting, amputation, and skin sloughing. Severe extravasation injuries associated with contrast media include: skin ulceration, necrosis, hypoasthesias, marked deformity of the extremity involved, weakness, pain, decreased range of motion, flexion contractures, difficulty performing activities of daily living, and surgical debridement including skin graft procedures.

Approximately 3% of PA-PSRS reports relating to contrast occurrences categorized as infiltrations or extravasations were Serious Events with harm scores of E or F. In one case, the “hold” button of the power injector used to administer a vesicant did not function. A clinician had to shut off the main power to the injector to stop the injection. Thereafter, the patient was admitted to the hospital for three days for treatment of the extravasation site. In another case, a patient developed compartment syndrome, resulting in an operative procedure.

Risk factors for contrast extravasation and subsequent severe injuries include the following. Table 1 indicates how some risk factors are reflected in PA-PSRS. Patients with major extravasation injury tend to be under 11 or over 70 years of age. Approximately half of the contrast extravasation events reported to PA-PSRS occurred in patients within those age ranges. Greater morbidity from extravasations occurs when the dorsum of the hand, the foot or the ankle are used to inject contrast media. Patients with arterial insufficiency compromised venous/lymphatic drainage, venous thrombosis, altered perfusion in the extremity injected are at increased risk for contrast extravasation. Health problems reflecting abnormal circulatory/perfusion may include: atherosclerotic peripheral vascular disease, diabetic vascular disease, connective tissue disease, Raynaud phenomenon, regional node dissection, prior radiation therapy to limb injected. Also considered at increased risk are non-communicative/unconscious patients, severely debilitated/chronically ill patients, and those with regional node dissection, prior radiation therapy to limb injected.

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## CHEMOTHERAPY DRUGS – VESICANTS

**Vinca Alkaloids**
- Vinblastine sulfate (Velban)
- Vincristine sulfate (Oncovin)
- Vindesine (Eldisine)
- Vinorelbine (Navelbine)

**Alkylating Agents**
- Cisplatin (Platinol)
- Dacarbazine-Dric-Dome
- Mechlorethamine HC. – Mustargen
- Nitrogen mustard

** Anthracyclines/Antitumor Antibiotics**
- Dactinomycin (Actinomycin D)
- Daunorubicin HCl (Cerubidine)
- Doxorubicin HCl (Adriamycin)
- Mitomycin (Mutamycin)
- Mitoxantrone, Novantrone
- Epirubicin HCl (Ellence)
- Idarubicin (Idamycin)
- Esorubicin
- Paclitaxel (Taxol)
- Carmustine
- Pliamycin
- Streptozocin
- Amsacrine
- Mithramycin
- Mustine
- Melphalan

**LESSE R-KNOWN VESICANTS**

**Hyperosmolar Agents**
- Calcium chloride
- Calcium and Calcium-containing compounds
- Calcium gluconate 10%
- Glucose/dextrose in concentrations ≥10%
- Hypertonic saline ≥10%
- Magnesium sulfate
- Mannitol 10% and 20%
- Parenteral nutrition/hyperalimentation
- High concentrations of potassium chloride
- High concentrations of sodium bicarbonate
- Radiographic contrast media
- Solutions with pH <5.0 or >9.0 or osmolarity >500mOsm/L

**Vascular Regulators**
- Norepinephrine
- Metaraminol bitartrate (Aramine)
- Phenylephrine
- Dobutamine
- Dopamine
- Vasopressin
- Antibiotics
- Vancomycin
- Nafcillin
- Doxycycline
- Piperacillin
- Zosyn (Piperacillin/Tazabactam)

**Miscellaneous**
- Amphotericin B
- Phenytoin (Dilantin)
- Promethazine (Phenergan)
- Diazapam (Valium)
- Doxapram
- Lorazepram
- Thiopental

**Sources**
significant weight loss or extensive metastatic disease. Severe damage to extravascular tissue is more likely to occur when large volumes of contrast media are extravasated.\(^5\) While serious extravasation injuries are more likely with ionic contrast\(^8\), the clinical literature also contains case reports of significant extravasation injury associated with nonionic contrast.\(^9,10\)

The use of certain equipment may also increase the risk of contrast extravasation.\(^4,5\) Extravasation is more likely when a tourniquet is used but not released during injection. Administering contrast via indwelling intravenous lines in place longer than 20 hours also increases extravasation risk. Extravasations are more likely to occur through metal needles than through plastic catheters. Multiple attempts at intravenous access at the same site or through different sites in the same vein also increase extravasation risk. Finally, the risk of extravasation of contrast media is greater when using an automated power injection device, compared to hand injection or drip infusion.

To treat contrast extravasation, the clinical literature suggests elevation of the extremity to disperse the contrast for quicker absorption\(^2,3,5,8,11,12\) and contrast aspiration using the needle through which the extravasation occurred.\(^7,8\) There appears to be some difference of opinion in the literature concerning the issue of skin temperature pertaining to treatment of contrast media extravasation. One resource indicates the use of warm compresses,\(^13\) while another indicates that cold or warm packs are appropriate to apply to the extravasated area.\(^11\) Most of the clinical literature indicates that application of cold significantly reduces skin toxicity in the event of a contrast extravasation.\(^2-6,8,14-17\) Most reports of contrast extravasation submitted to PA-PSRS (65%) do not specify a treatment regimen. Ice or cold compresses are specified in 25% of the reports, while 11% indicate hot compresses. Elevation is indicated in 10% of the reports. Warm, then cold compresses were documented in one report.

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A formal policy/protocol concerning the administration of contrast media may be a helpful first step in reducing the incidence of contrast extravasation.\(^5,7\) Currently some facilities may address extravasation protocols within their policies on the use of chemotherapy agents. However, these policies may not be accessible or perceived as applicable when extravasation of a non-antineoplastic agent occurs.\(^14\)

Some elements to consider in an extravasation prevention/treatment program include: education and training required to administer contrast;\(^15,11\) identification of patients with selected risk factors; interventions based on volume of extravasation and type of contrast;\(^5,8,11\) and observation, follow-up, and availability of extravasation response/antidote kits.\(^2,5,15\)

In terms of tracking cases of extravasation, elements to consider documenting include:\(^5,15\)

- Description of symptoms
- Interventions
- Date/time orders received from physician
- Date/time nursing unit notified
- Date/time of discovery
- Time of vesicant administration
- Time elapsed since onset of extravasation
- Vein location

Table 1. Presence of Risk Factors in PA-PSRS Reports Categorized as Contrast

<table>
<thead>
<tr>
<th>Selected Risk Factors</th>
<th>Reports Citing Risk Factor (%)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age: &lt;11 or &gt;70</td>
<td>48%</td>
<td></td>
</tr>
<tr>
<td>IV Site: dorsum of hand, foot, ankle</td>
<td>11%</td>
<td>39% site was arm or upper extremity 50% site not documented</td>
</tr>
<tr>
<td>Large volume contrast extravasated</td>
<td>9% 100-150 cc 14% 21-80 cc 29% 1-20 cc 48% volume not documented</td>
<td></td>
</tr>
<tr>
<td>Use of Ionic Contrast</td>
<td>Unknown 16% documented nonionic contrast 84% contrast type not documented</td>
<td></td>
</tr>
<tr>
<td>Use of power injector</td>
<td>9% documented</td>
<td>One report indicated hand injection. Remaining reports did not specify mode of delivery or indicated some form of the word &quot;inject.&quot;</td>
</tr>
</tbody>
</table>

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Extravasation of Radiologic Contrast (Continued)

- Type, gauge, and size of catheter
- Type of media administered
- Amount of contrast infused
- Mode (e.g., power injector, hand injection)
- Patient complaints
- Clinical signs (e.g., estimated size/extent of extravasation)
- Image of extravasation site for medical record
- Patient education/instructions

Cohan, et al.,5 and the Oncology Nursing Society2 describe the use of an extravasation form to capture the above information. Such forms can be placed in the medical record or outpatient notes and can be used to collect data as part of a quality management/performance improvement program. Collection of such data will help to identify trends that may be useful in educational programs and policy or protocol revisions, as indicated.11,16,19

Reports submitted to PA-PSRS suggest that several facilities provide an instruction sheet to patients who have a contrast extravasation. Some injuries from extravasation may not become apparent for several days (sometimes after a patient has been discharged). Instruction sheets may be helpful for reminding patients about what types of symptoms to report.

The following selected resources may be useful in developing or evaluating extravasation protocols.

Resources


Notes

Extravasation of Radiologic Contrast (Continued)

Resources (Continued)

The Patient Safety Authority is an independent state agency created by Act 13 of 2002, the Medical Care Availability and Reduction of Error ("Mcare") Act. Consistent with Act 13, ECRI, as contractor for the PA-PSRS program, is issuing this newsletter to advise medical facilities of immediate changes that can be instituted to reduce serious events and incidents. For more information about the PA-PSRS program or the Patient Safety Authority, see the Authority’s website at www.psa.state.pa.us.

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