IRISH ASSOCIATION FOR EMERGENCY MEDICINE

IAEM Clinical Guideline

The use of Vasopressor Agents by Peripheral Intravenous Infusion in Adult Patients in the Emergency Department

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DISCLAIMER

IAEM recognises that patients, their situations, Emergency Departments and staff all vary. These guidelines cannot cover all clinical scenarios. The ultimate responsibility for the interpretation and application of these guidelines, the use of current information and a patient's overall care and wellbeing resides with the treating clinician.

Revision History	Section	Summary of Changes	Author
V1.0	All	Final version	HS/FC/RL/IO'S

CONTENTS

GLOSSARY OF TERMS

BP	Blood Pressure
CVC	Central Venous Cannula
ECG	Electrocardiogram
ED	Emergency Department
EM	Emergency Medicine
ICS	Intensive Care Society (UK)
IHD	Ischemic Heart Disease
ITU	Intensive Therapy Unit
IV	Intravenous
OR	Odds Ratio
PVC	Peripheral Venous Cannula

The use of Vasopressor Agents by Peripheral Intravenous Infusion in Adult Patients in the Emergency Department

INTRODUCTION

Commencing vasopressors early in the resuscitation of the acutely unwell patient is critical. Literature reports an increased mortality risk in patients with septic shock who had a delay in initiation of vasopressor therapy.[1,2] In one study, the odds ratio (OR) of death was 1.20 per hour delay, i.e. every hour delay was associated with a 20.4% increased probability of death.[1] Delay in initiation of vasopressors whilst awaiting CVC placement is therefore unacceptable.

Traditionally, vasopressor agents were administered via a CVC, with the risk of peripheral extravasation often cited as the motivation for this. The practice of administering vasopressor agents peripherally is emerging with a recent systematic review of over 1300 patients reporting that extravasation events were uncommon (event rate 3.4%) with no reported incidents of tissue necrosis or limb ischemia.[3]

PVC use for short-term resuscitation, until CVC can be safely placed, reduces time to initiation of vasopressors in critically unwell patients.[4] The use of a guideline provides standardisation of care, empowers local policy development and improves familiarity with its use.

This guideline is adapted in most part, with permission, from the Intensive Care Society UK (ICS) Guidance published November 2020, with interim update September 2022. With similar healthcare settings, patient demographics, and practice principles, we believe this guidance document to be wholly applicable to the Irish EM setting.

Since the latest ICS update, there has been clinically significant literature publications. We have reviewed and included these in our guideline recommendations.

PARAMETERS

Target audience	Emergency Physicians involved in the management of critically unwell adult patients in the ED. Vasopressor agents must only be administered by professionals trained in their use & competent to do so.
Patient population	Adult shocked patients in the ED: • Who remain shocked despite adequate, appropriate fluid resuscitation (other reversible causes excluded). • As a holding measure until CVC can be safely inserted.
Exclusion criteria	Paediatric patients (defined as under 16 years of age). Trauma patients.
Contraindications	Hypovolemia: Correct hypovolaemia before using vasopressor agent. Evidence support an individualised approach to timing of vasoactive medication initiation – after fluid resuscitation versus concurrent with. [5,6] Hypertension. Hyperthyroidism, IHD - increases risk of cardiovascular adverse effects. Clinical settings where outlined standards of care cannot be met.

AIMS

This document aims to provide guidance to EM professionals on the administration of vasopressor agents via PVC to adult EM patients and to set out safe principles and standard concentrations to **inform local policy**. We anticipate that in most circumstances this would be done as a **bridging measure** as an adjunct to good patient management, until such a time that CVC is available; or used for a short term under specific circumstances.

STANDARDS

1. Clear policies

- Each ED must have clear policies detailing the concentration, dose and infusion rate of selected vasopressor agent (**highlighting that this may differ from recommended standard concentrations for administration via a CVC**).
- EDs must provide clear guidelines on the choice of peripheral venous access devices and their siting.

2. Specific protocol

- EDs must specify a protocol for regular assessment, and documentation of indwelling intravascular catheters using a suitable scoring system.
- EDs must use an infusion pump for administration.

3. Management of extravasation

- Clear policies for management of extravasation events must be provided.

4. Training

- Vasopressor agents must only be administered by professionals trained in their use and competent to do so.

RECOMMENDATION

SITE

There is some evidence to show that the cautious selection of a suitable PVC site as well as the below preventative measures, may reduce the risk of extravasation of vasoactive medications.[5]

1. Intravenous (IV) line location and size requirements:
    - Well-sited large bore PVC, **18G or larger.**
    - Ideally **brachial or cephalic vein at or above the elbow** OR
    - In the antecubital fossa (avoid in awake patient due to risk of occlusion).
2. Locate in a site in the **arm, proximal to the wrist**, contralateral to blood pressure cuff (non-invasive BP).
3. Avoid sites requiring more than one venepuncture or distal to previous puncture site.
4. Ultrasound use recommended: aim to identify vein with diameter of **4mm or more**
5. Ensure **return of blood** following insertion of PVC and that PVC **flushes** easily with 5-10ml of 0.9% sodium chloride (every 2hours).
6. Site a **second PVC** in case of primary site failure.

STANDARD CONCENTRATIONS

Based on consensus opinion, we have provided a recommended standard concentration to be used and EDs to reduce the risk of error should variable concentrations be used. **We note that these may differ from recommended standard concentrations for administration via CVC and as such are not interchangeable.**

MAXIMUM RATE AND DURATION

Local policy should detail:

1. Which clinical practitioners and areas can initiate and maintain the use of vasopressors by peripheral infusion (competent practitioners with training).
2. Maximum rate and/or duration of administration.
3. Who, if anyone, may decide to deviate from the local policy.
4. Required time interval to review the administration sites and agents –

   We recommend continuous assessment of PVC integrity.

There is no wholly acceptable duration of administration defined in literature, although the median time stated in the referenced studies is 6-22h and safe for up to 72h (where these patients are monitored continuously and reviewed 2-hourly). [8]

For purposes of this guidance, in the absence of any adverse events after initiation of peripheral vasopressors, we recommend critical re-evaluation of PVC infusion appropriateness at **two hours.** This should involve the **most senior** physicians involved in the care the patient (EM and Anaesthetic/ITU consultants).

At this juncture, we recommend either CVC placement to continue vasopressor use if it is likely to be required for indefinite period; or continuation of vasopressor use by peripheral infusion if likely to be stopped in due course (1-2hours), i.e., transfer to critical care or other units, or on a case-by-case basis.

MONITORING

BP	Invasive BP monitoring is recommended. If not possible for practical reasons, regular non-invasive BP monitoring on contra-lateral arm is acceptable to avoid delays in initiating vasopressor infusion.
ECG	Continuous ECG monitoring recommended.
SITE	Monitor peripheral infusion site every hour for extravasation.

AGENTS

Please refer to table 1 for different type of vasopressors that can be used peripherally in the ED.

For all agents:

1. This guideline **ONLY** supports the use of vasopressors included in this table via PVC.
2. For dilution use either **0.9% sodium chloride or 5% dextrose.**
3. Administered via **infusion pump.**
4. Vasopressors should be used as a **single agent per line** (no concomitant administration of vasopressor and other medicines using a Y-connector or the like).
5. After discontinuation, **flush peripheral cannula** with 0.9% sodium chloride at the same rate that the medicine was infusing to avoid adverse hemodynamic effects.

<table>
<tr><th>Agent</th><th>Presentation</th><th>Dilution for peripheral infusion</th><th>Administration and Dose</th></tr>
<tr><td>Noradrenaline</td><td>1mg/mL solution</td><td>16mcg/mL =
4mg Noradrenaline
(4mL of 1mg/mL)
with 246mL 0.9% sodium chloride</td><td>Starting dose 0.05mcg/kg/min *
UP Titrate to desired effect
Maximum rate 8mcg/kg/h
<table>
<tr><td>Weight</td><td>40kg</td><td>50kg</td><td>60kg</td><td>70kg</td><td>80kg</td><td>90kg</td><td>100kg</td></tr>
<tr><td>Starting (mL/h)</td><td>7.5</td><td>9.5</td><td>11.5</td><td>13</td><td>15</td><td>17</td><td>18.5</td></tr>
<tr><td>Maximum (mL/h)</td><td>20</td><td>25</td><td>30</td><td>35</td><td>40</td><td>45</td><td>50</td></tr>
</table></td></tr>
<tr><td>Phenylephrine</td><td>10mg/mL solution</td><td>100mcg/mL =
50mg Phenylephrine (10mg/mL)
with 495mL 0.9% sodium chloride</td><td>Starting rate 10.8mg/h =
108mL/h of concentration provided
DOWN Titrate according to response
to 1.8-3.6mg/h (18-36ml/h)</td></tr>
<tr><td>Adrenaline</td><td>1mg/mL solution
(1: 1000)</td><td>16mcg/mL =
4mg (4ml Adrenaline 1mg/mL)
with 246ml 0.9% sodium chloride</td><td>Starting dose 0.05mcg/kg/min
UP Titrate to desired effect
Maximum rate 8mcg/kg/h
<table>
<tr><td>Weight</td><td>40kg</td><td>50kg</td><td>60kg</td><td>70kg</td><td>80kg</td><td>90kg</td><td>100kg</td></tr>
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</table></td></tr>
<tr><td>Metaraminol **</td><td>10mg/mL solution</td><td>0.5mg/mL =
20mg Metaraminol (2mL of 10mg/mL) with 38mL 0.9% sodium chloride</td><td>Starting dose 0.5mg/h (1mL/h)
UP Titrate to desired effect
Maximum dose 10mg/h (20mL/h)</td></tr>
</table>

Table 1: Different type of vasopressors. Source of information: Electronic Medicines Compendium http://www.medicines.org.uk[13]; Medusa Injectable Medicines Guide http://medusa.wales.nhs.uk[14]; Medicine Complete http://www.medicinescomplete.com[15]

** Starting dose Noradrenaline based on CENSER study[16]*

** * None of the sited observational studies have investigated the use of metaraminol as a vasoactive agent. However, it is commonly used in practice and therefore has been included in this guidance. Recommendations are made from the summary of product characteristics and consensus opinion*

SPECIAL CONSIDERATIONS

EXTRAVASATION

Extravasation describes the inadvertent leakage of any drug or fluid into the surrounding tissues. In the studies referenced, the incidence of extravasation is low with rate ranging from 2 - 5.5% with no documented tissue injury or need for surgical intervention. [10-11]

Extravasation is identified by regular observation in a 2:1 to 3:1 nursing environment by:

- Patient complains of burning, stinging, pain, or discomfort.
- Evidence of local tissue erythema, oedema, blanching or leakage at the site.
- Absence or change of infusion flow; increase resistance to IV saline bolus.
- Repeated infusion pump alarms.

Local guidelines should be followed in the event of extravasation and a conservative strategy may be considered sufficient in the first instance.

Extravasation Treatment with Phentolamine:

1. **Stop** the infusion and disconnect the line from PVC.
2. **Contact** prescriber immediately to assess site and initiate treatment.
3. Attempt to **aspirate** 3-5mL from PVC if able to do so.
4. **Remove cannula** and apply dressing. Do NOT apply pressure.
5. **Mark** the area of extravasation with skin marker to provide a baseline for monitoring.
6. **Elevate** the effected limb for 24hours to reduce swelling.
7. Consider application of 2.5cm **Nitroglycerin 0.2%** paste to area of extravasation.[12]

   Alternatively **Nitroglycerin 0.2 mg/hr patch**: apply to cover the extravasation area for one hour, and then remove. Not more than 0.8 mg/hr or 4 patches total dose. Monitor patient's BP and heart rate as it can decrease BP and cause tachycardia.

8. **Phentolamine**:

- 10ml 0.9% Sodium Chloride added to 1ml (5mg) vial Phentolamine powder for reconstitution to a final concentration of 0.5mg/mL.
- After full dissolution, the contents is drawn into a 10ml syringe.
- Using 25 - 27G needles, inject 10ml of Phentolamine subcutaneously into affected area as 5 separate 2ml clockwise injections around the leading edge of extravasation as marked prior. Needles are to be changed between each injection, meaning 5 needles will be required.

9. Request **Plastic Surgery consult** as soon as possible.

Reporting:

Where an adverse event occurs (i.e. extravasation of vasopressor agent), this should be reported and investigated using the local healthcare organisation's incident reporting system. All learning should be widely shared.

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