Emergency Medical Retrieval Service (EMRS)

www.emrs.scot.nhs.uk

Standard Operating Procedure

Public Distribution

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<th>Invasive pressure monitoring</th>
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<tr>
<td>Author</td>
<td>Hearns, Daly, Swanson</td>
</tr>
<tr>
<td>Reviewer</td>
<td>Corfield, McKiernan, Curatolo</td>
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Aims
To ensure that invasive pressure monitoring is utilised appropriately and safely by the EMRS team.

Application
EMRS team members
SAS airwing Paramedics

Background
The service carries equipment for the invasive measurement of arterial pressure and central venous pressure. Experience has shown that occasions where both pressures need to be measured simultaneously are rare and there is little requirement to measure CVP in transit. CVP should be optimised where necessary and possible before the patient is transferred.

The use of invasive arterial pressure monitoring is one of the service’s key performance indicators and the service’s use of arterial pressure monitoring is influenced by guidelines produced by the intensive care society.
Line insertion preparation

Laminated set up equipment lists are carried in the equipment packs. These can be passed to rural nursing staff to assist them in preparing for the procedure.

Minimising infection risk

The gold standard technique for insertion of invasive lines includes the use of sterile gowns, hats and sterile gloves as part of an overall aseptic technique. Use of sterile clothing should be aspired to whenever possible, this clothing will be available in rural general hospitals for example.

If gowns are not available the EMRS clinician should minimise any potential for equipment contact with flight suits. The upper half of the flight suit should be removed and tied around the waist. Plastic aprons should be worn if sterile gowns not available.

Each surgical procedures pack contains chloraprep. This should be used for line insertion sites.

The receiving unit should be informed about the quality of infection control which was used for line insertion. Some intensive care units may elect to remove central lines which were not inserted under optimal conditions.

Central venous lines

Patients requiring vasoactive infusions should, in all but exceptional circumstances, have a central line inserted and central venous pressure optimised. Exceptions to this rule may rarely occur when the mission is time critical due to aviation reasons or the need to transfer for a life saving intervention. In such cases adrenaline may be administered via a cannula into a large peripheral vein. The reasons for not inserting a central line in these patients should be clearly stated on the EMRS runsheet and handed over to receiving staff. A compromise may be the rapid insertion of a femoral venous line.

If a suitable ultrasound device is available in the rural site this should be used to aid insertion of the line, even if simply to confirm normal anatomy.
Arterial lines

The benefits of using invasive arterial monitoring when transferring critically ill patients are considerable. These include accuracy of measurements over non-invasive pressures.

EMRS indications (service KPI) for arterial line insertion are:

- Intubated patients
- Actual or potential haemodynamic instability (MAP <60 mmHg)
- Respiratory failure requiring repeated blood gas sampling.

It should be accepted that in certain circumstances patients with these indications may not have arterial lines inserted by the team. Reasons for this include time critical situations (eg aviation issue or urgent need for life saving surgery) and difficulty in inserting the line.

Transducer set preparation

1. Ensure all threaded connections are secured tightly
2. Open all three way taps fully before flushing
3. Flush line BEFORE pressure bag inflated
4. Tap three way taps and transducer as you flush the line
   - Minimises air bubble formation
5. Squeeze air out of drip chamber
   - Minimises risk of air embolus if chamber laid flat temporarily during transfer
6. Replace all three way tap bungs with bungs with no hole.
   - Bungs in the pack when you open it have holes in them. These carry risk of exsanguination.
7. Tape transducer to patient’s chest or upper arm using padding between transducer and skin.
8. Pressurise the bag to 300mmHg
   - Caution: The pressure bag operates a continuous flush through the set at 3ml/hr when open. This carries the risk of causing air embolus if the drip chamber is not upright. Removing air from the chamber reduces but does not eliminates this risk. Care should be taken when lying the pressure bag on the patient and if problematic during e.g. inter-vehicle transfer the bag should be clamped during these periods. The bag should ideally then be hung up whenever possible.
Security of arterial lines

The tubing from arterial lines should be placed over the thenar area into the thumb/ index finger webspace and brought back proximally to run along the dorsal aspect of the radial side of the forearm. It should be secured in this position with tape. It should not be placed underneath the tegaderm dressing.

Troubleshooting invasive pressure monitoring problems

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unable to zero</td>
<td>Three way taps not aligned correctly</td>
<td>Check bag, line and cable,</td>
</tr>
<tr>
<td></td>
<td>Transducer plugged into wrong port on monitor</td>
<td>Flush line</td>
</tr>
<tr>
<td></td>
<td>Bag not pressurised</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Line clotted</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Faulty transducer set</td>
<td>Change transducer set</td>
</tr>
<tr>
<td>Damped trace</td>
<td>Bubbles in tubing</td>
<td>Flush tubing as above</td>
</tr>
<tr>
<td></td>
<td>Incorrect scale selected</td>
<td>Change scale</td>
</tr>
<tr>
<td></td>
<td>Leak</td>
<td>Tighten all connections</td>
</tr>
<tr>
<td></td>
<td>Loss of bag pressure</td>
<td>Pressurise bag</td>
</tr>
<tr>
<td></td>
<td>Line position</td>
<td>Reposition patient’s wrist</td>
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