UNDERSTANDING INVASIVE MONITORING 2: COMPLICATIONS

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This is the second part of a two-part unit on invasive monitoring. The first part explored the background and indications, and also looked in more detail at central lines and arterial lines. This part examines complications in invasive monitoring.

Some of the possible complications in invasive monitoring can be problematic and others may be life-threatening. Many of those identified in this article are also highlighted in the RCN’s Standards for Infusion Therapy (RCN, 2005).

PNEUMOTHORAX
This is a common complication in invasive monitoring. A chest X-ray should always be requested post-procedure in order to validate the position of the line and exclude a pneumothorax.

A patient with a pneumothorax may be asymptomatic if it is small, while those with a larger pneumothorax may be tachypnoeic and desaturating, hence the need for continuous pulse oximetry. Tachycardia and, potentially, hypotension may be present, especially in tension pneumothorax. For these patients, a chest drain will be required for ongoing management.

A small to medium-sized pneumothorax is less than 2cm from the lung border (British Thoracic Society, 2003). For a tension pneumothorax – confirmed by hyperresonance on percussion and absent or decreased air entry on the affected side – a large-bore cannula should be inserted into the second intercostal space, mid clavicular line (Ferrie et al, 2005; Resuscitation Council UK, 2005; Nimmo, 2004). Tracheal deviation is often cited as being the trademark of tension pneumothorax. However, it is a very late sign and not always evident (Leigh and Harris, 2005).

Immediate management (until skilled help arrives) involves:
- High-flow oxygen therapy;
- Gaining IV access if not already obtained;
- Monitoring blood pressure, pulse, oxygen saturation in the blood, respiratory rate;
- Supporting breathing and circulation as required.

CARDIAC ARRHYTHMIA
Where practitioners are a little overzealous in their insertion of the central line, cardiac arrhythmia may result due to over-advancement of the line causing myocardial irritability. These arrhythmias usually settle on gradual withdrawal of the line by a medical practitioner or experienced nurse trained in line insertion (Hamilton, 1995).

Early detection of this complication is a good argument for all patients having central lines inserted to be on a cardiac monitor throughout the process (Drewett, 2000).

AIR EMBOLISM
Air embolism is another potential complication from central line insertion. Patients’ clinical conditions may vary depending on the volume of the air embolus. They may be slightly confused or agitated. A more extreme response may be respiratory and haemodynamic compromise, quickly followed by cardiac arrest.

Patients should be positioned in a head-down tilt on their left side to attempt to keep the embolism in the right atrium (Ramrakha and Moore, 1999). High-flow oxygen should be administered, and the airway maintained in those with post-consciousness. Full resuscitation should be started in the event of cardio-respiratory arrest.

All connections should be tight and visible. Care should be taken not to damage the line while it is being sutured in place. Scissors should not be used to remove dressings from the line when these require changing, in case of accidental damage.

NURSING CARE
Regardless of the reason for insertion, the route or possible complications, it is vital that nurses are familiar with the equipment to be used if they are to be an effective assistant to colleagues and advocate for patients.

Central lines come in single, double, triple or quadruple lumen catheters (Mooney and Comerford, 2003).

In addition to preparing the equipment to facilitate insertion, it is important to prepare the monitoring equipment. The main components of this are the transducer and monitoring cables, and a pressure bag to maintain patency of the line (inflated to around 300mmHg). Some hospitals only use normal saline for keeping the lines patent, whereas others use heparinised saline. Practitioners must familiarise themselves with local protocols.

Where patients deteriorate after recent line insertion, thought should always be given to the line being an underlying cause. Some complications, such as pneumothorax or cardiac tamponade, may not manifest themselves until several hours later.

INFECTION
Infection is always a potential complication, increasing in risk if the femoral vein is used (Woodrow, 2001). Practitioners need an understanding of the possible complications of central line insertion to allow them to detect the signs of possible deterioration or complications. An aseptic approach should be taken throughout the procedure. This also applies to dressing changes and
general use and care of the line (Centers for Disease Control and Prevention, 2002a; 2002b). Frequent use of three-way taps attached to central lines further increases the potential exposure to infection, so these should only be used where required and not routinely.

OCCLUSION
Another possible complication of central lines is occlusion. It is the nurses’ role to help ensure that the line is kept patent. Blockages can be prevented by ensuring continuous infusions and appropriate flushing before and after medication administration. Local practice varies so local guidelines should be followed; some areas use heparin locks for lines not in continuous use to help prevent clot formation.

Simcock (2001a-d) explores the management of occluded central access devices in greater detail.

THROMBOSIS
Some earlier studies have shown that venous thrombosis occurs in up to 35% of patients with a central line (SIGN, 2002; Kaye and Smith, 1988).

If resistance is felt during injection, force should not be used as further damage may be caused. The use of a pressure bag and isotonic crystalloid may reduce the formation of thrombosis in the first instance (Woodrow, 2001).

ARTERIAL LINES
Arterial lines use different sites from central lines. Frequently used sites are the radial, femoral, ulnar and brachial arteries.

When using the radial artery, the Allen’s test should be carried out in case any complications arise from insertion that may jeopardise the remaining blood flow to the hand. This would become evident by the presence of cold and blanched peripheries, unlike in the other limb (Windsor, 1998).

Transducers should be placed around the fourth intercostal space, reflecting atria level, and should be zeroed at the start of each shift. This will help ensure the appropriate recording of results.

Where an arterial line has been inserted to facilitate frequent removal of arterial blood gas samples, it should be remembered that this should be a sterile technique. Alarms should be silenced as they will undoubtedly sound when an attempt is made to obtain the sample. It is good practice to explain this to patients to allay any fears. It is vital to ensure that the line is flushed following the procedure to prevent occlusion, as this would require removal and reinsertion in another site.

A system should ensure samples are delivered rapidly to the laboratory as time influences the quality of some results.

OTHER COMPLICATIONS
Occlusion of the line is only one possible complication. Infection is another and this increases with each sample obtained.

As the cannula is in the artery, there is a risk of exsanguination if it is dislodged or the connections become detached. There is also a risk of nerve damage, depending on the insertion process.

One hazard, where numerous lines are in place, such as peripheral venous lines, triple lumen central lines and an arterial line, is the accidental administration of drugs through this route. Under no circumstances should the arterial line be used for administration of medicines. This is easily avoided if the arterial line is labelled in a unique way.

CONCLUSION
Invasive monitoring can assist practitioners in the management of patients. It allows beat-to-beat measurement of the blood pressure and circulatory status. A central line allows a clearly accessible route for the administration of fluid and drugs. However, it comes with potential complications. Insertion and use of invasive lines increase the infection risk. Plus, they are generally used in patient groups who already have more serious illnesses.

Practitioners should ensure insertion is done safely, development of complications is detected immediately and corrective treatment and help sought promptly. Patency should be assessed frequently and results interpreted. Consistency in the management and measurement of these lines is essential if effective data is to be generated safely.

Nursing staff and ward managers should ensure that education and training is available to ensure staff are competent in the management of lines and aware of potential problems.

Immediate management is by the ABCDE approach (Watson, 2006), ensuring rapid administration of high-flow oxygen therapy, with respiratory and circulatory support as required.

Ultimately, it should be remembered that invasive monitoring assists in the management of patients – it is not a treatment as such but a means to guide treatment or interventions.

KEY REFERENCES


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