Can Peripheral Central Venous Lines be inserted safely and successfully where X-ray facilities are not available?

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Abstract

Background:
Primary care settings often lack facilities for radiological evaluation of the
do the peripheral route were evaluated after insertion of
the catheter. The best basilic or median cubital vein in the cubital fossa
was used for insertion following a standard method. A number of 14
catheters were inserted in the right arm and 9 were inserted in the left
arm. The position of the placement was assessed by an AP supine chest
X-ray.

Results:
Successful placement was achieved in 91% of insertions (21 of 23
catheters).

Conclusions:
This study showed that central venous catheterisation with soft catheters
(ArrowPICC- Arrow PS-01651), via visible palpable peripheral veins in
the cubital fossa is easy to perform and is a safe procedure with a high
success rate for correct catheter placement. This route warrants serious consideration when central venous catheterisation is desirable,
especially in settings where X-ray facilities are not available to exclude complications or confirm placement.

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Introduction

Central venous lines are used for the
accurate monitoring of fluid admin-
istration in various clinical settings. It is
extremely valuable, but correct
placement is essential for accurate
monitoring.

Insertion is usually effected via the
supraclavicular or infraclavicular
routes. Complications, such as pneu-
mothorax, hemothorax, catheter
eMBOLISM, venous air embolism, nerve
injury, arterial puncture and chyloto-


rax, have all been documented following catheter insertion via these routes.

In an article discussing complications associated with central venous catheters, Scott states that a "Chest X-ray is mandatory to exclude immediate complications for e.g. a pneumothorax". Strong warnings appear in the package insert of these central venous catheters, advising that it should not be done without X-ray control. (e.g. ARROW product no AK-04650-E 8/92). Even standard textbooks make the point that this procedure is potentially dangerous and requires adequate assessment.

These guidelines and the weight of evidence concerning complications are a major deterrent to doctors inserting central venous lines when no X-ray facilities are available.

The insertion of supra- or infraclavicular central venous lines also requires special instruction and frequent use to maintain the skill and expertise to perform these procedures. Radiological control is often not available in primary care environments, especially after hours.

Rosen has shown that the insertion of central venous lines via the cubital fossa (peripherally inserted central catheters) is safe and has a low complication rate, similar to the insertion of a normal drip. However, previous studies with peripherally inserted catheters reported a low success rate — 77.7% correct placement with a Drum cartridge catheter, and 52.8% with the I-catheter (Bardic).

X-ray assessment following catheter insertion is performed to exclude the complications listed above and to ascertain whether the catheter tip is in the desired position.

Major complications needing X-ray assessment are unlikely to occur following peripheral venous insertion, so the major reason for X-ray assessment is to determine the correct placement of the catheter tip.

If peripherally inserted central venous lines can be successfully inserted (i.e. the catheter tip in the correct position to monitor central venous pressure), the necessity for radiological evaluation is far less critical.

This will be of tremendous help to primary health care doctors without radiological control facilities. Some authors have suggested that a medial cubital vein should be used in emergency conditions to reduce the number of complications. Cannulation of the superficial veins of the arm requires less skill than cannulation of the subclavian and internal jugular routes.

Peripherally inserted central venous pressure has been shown to reflect central venous pressure quite accurately under controlled circumstances. Rosen argues that for short-term use, central venous catheterisation through visible palpable peripheral arm veins is safe and remains the method of choice for those with little experience of sophisticated techniques. Primary care doctors are not always exposed to and therefore often have little experience with sophisticated techniques. This study was prompted by the fact that Mamelodi hospital has no X-ray facilities after 4 pm in the afternoon and practitioners working there have to deal with many patients who would benefit from the insertion of a central venous line. We believe there are many such settings where primary care doctors have to work in less than ideal circumstances and also have not had exposure to training in the insertion of catheters via the supra- or infraclavicular routes.

If we can find a method with the safety and the lack of major complications that peripheral vein cannulation offers but with an acceptable accuracy of placement of the catheter tip to ensure the benefits of central venous pressure monitoring, this would have obvious benefits.

The aim of this study was to determine whether the more flexible Arrow PICC (Arrow PS-01651 Peripherally Inserted Central Catheter) could be safely inserted via a peripheral vein with the catheter tip placed successfully in the desired position in the superior vena cava.

Materials and methods.

The Arrow PICC catheter was inserted in 23 patients needing a central venous line. The Arrow PICC (Arrow PS-01651) is a soft polyurethane radiopaque catheter, 55cm, 16Ga (Figure 1). The study was performed in the casualty unit of the Mamelodi hospital during 1997 to 1998. Informed consent was obtained from all patients or their family prior to insertion of the catheter and the study was approved by the Ethical

Figure 1: The Arrow PICC (Peripherally inserted central catheter) (Arrow PS-01651) with syringe, cannula and catheter (arrow heads).

SA Fam Pract 2002, 25(4)
show that the more rigid devices like the I-catheter do not demonstrate as high a success rate as the softer more flexible catheters. We used the Arrow PICC which is also a soft type of device. Our success rate supports this statement.

4. Reading of the central venous pressure should be done with the arm in 45° abduction. Further abduction or adduction of the arm can lead to movement of the catheter tip up to 2-3 cm. Adduction alone can result in the catheter being drawn into the thorax as much as 9 cm.

There is a risk of air embolism after the syringe is removed and the cannula is situated in the lumen of the vein and the proximal end is open to the atmosphere. This is usually the case with most central venous lines irrespective of their place of insertion. The central veins are however prevented from collapsing because of connective tissue surrounding them. Air embolism is therefore more likely to occur in them than the peripheral veins.

Authors have suggested that a medial cubital vein should be used in emergency conditions to reduce the number of complications. Cannulating the superficial veins of the arm require less skill than the subclavian and internal jugular routes.

The Arrow PICC is a safe catheter. It is a catheter-through-cannula device. The catheter is not inserted through a needle device. Therefore the catheter cannot shear if attempts are made to withdraw it while the needle is still in the vein. There is no flexible stylet wire stiffening the catheter throughout its length.

Three cases developed superficial inflammation at the site of insertion. None of these three developed thrombophlebitis. A superficial inflammation is not an indication to remove the catheter. However, if signs and symptoms of severe local infection and systemic infection appear, the catheter should be removed. An aseptic technique should be followed, and the catheter should be removed as soon as it is no longer needed.

Using the PICC Catheter Set (Arrow PS-01651) proves to be cost-effective. The cost of the catheter pack is two thirds of the price of a standard Central Venous Line Catheter Set.

**Conclusion**

We think that despite our small numbers this study confirms that central venous catheterisation with a soft peripherally inserted intravenous catheter (Arrow PS-01651) through visible palpable peripheral arm veins in the cubital fossa is safe and easy to perform.

It has a low complication rate and a high successful placement rate. According to Rogers this study confirms that central venous catheterisation with a soft peripherally inserted intravenous catheter (Arrow PS-01651) through visible palpable peripheral arm veins in the cubital fossa is safe and easy to perform.

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**References**


