Venous access devices: current perspectives

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Overview

- Outline the different central venous access devices that may be used for parenteral nutrition
- Examine evidence base underpinning device selection
- Present emerging device technology
Vascular device complications

Which type of device for PN?
Catheter selection considerations

- Meets any safety standards
  - Allergies
- Long or short term
- Flow rate of intended therapies
  - Continuous or cyclical?
  - Any additional IV therapies
- Who will be providing the device?
  - Choice of devices?
- Who will be inserting the device?
- Who will be caring for the device?
Centrally or peripherally inserted

Central
CICC
Internal jugular
Subclavian

Peripheral
PICC
Basilic
Cephalic

Tip position
SVC
IVC

Direct or indirect puncture
Direct
Non tunelled
Indirect
Tunelled

FICC
Femoral
Non-tunnelled multilumen

Often referred to as “neck lines”, or “CVP lines” a non-tunnelled catheter directly enters the blood stream via the internal jugular, subclavian, or femoral vein. Double, triple, quad, and quin lumen versions are available.

Available in different lengths (16 & 20 cm) depending on if the left or right side being used.
A PICC is a peripherally inserted catheter between 40-60 cm with the tip in the superior vena cava. Usually inserted directly into basilic or cephalic vein, but can be tunneled.

Catheter inserted into basilic or cephalic vein.

Silicone or polyurethane.
Single, double and triple lumen available.

The PICC is held in place by anchoring the integral catheter fixation device with either sutures or a specific securement device, i.e., Statlock™.
Tunnelled cuffed “Hickman” type

The catheter is tunnelled under the skin and enters the superior vena cava from either the subclavian, or internal jugular vein. It is held in place within the skin tunnel by means of a small cuff of felt-like material (Dacron) which the body forms scar tissue around.

Single, double and triple lumens available
Totally implanted port “Port-a-cath™”

- Right Subclavian vein
- Vascular access port within subcutaneous skin pocket
- Single and double ports available
- Different size ports with different size silicone access discs available
- Tip in superior vena cava
- Ports can be peripherally inserted or centrally
- Removable winged infusion set with non-coring needle
Types of CVC: the evidence base

- Lower rates of infection reported with tunnelled catheters
  - Totally implanted ports lowest rates of infection
  - Increased risk factor in HPN
- The extent to which PICC affect risk and incidence of infection to be determined
- Studies not always in PN patients
  - Only consider infection as outcome measure

Size matters
Catheter size

- The external diameter of the catheter should not exceed \( \frac{1}{3} \) of the internal diameter of the vein
  - 4 Fr device = 4 mm vein or larger
  - 6 Fr device = 6 mm vein or larger
  - 9 Fr device = 9 mm vein or larger
  - Cephalic vein = 6 mm
  - Basilic vein = 8 mm

What about special characteristics?
Valved CVC

Groshong™ valve | Kimal PaSV™ valve | Bard Solo™ valve

- Positive pressure
- Negative pressure
- Neutral pressure

Groshong and PASV are available on PICC, Power CVC, Tunnelled Cuffed CVC and Ports. Solo valve only available on power PICC.
Valved CVC: the evidence base

- **PICC**
  - PASV more effective than Groshong (Hoffer et al 2001)
  - Valved devices do not reduce occlusion (Johnston et al 2012)

- **Ports**
  - PASV less complications vs non valved (Lamont et al 2003, Carlo et al 2004)

- **Tunneled CVC**
  - Less complications (Delmore et al 1989, Todd 1997)
Power devices

- Designed to be able to withstand power injection of CT contrast
- Available in midlines, non tunnelled, PICC, valved catheters, tunnelled cuffed, and ports
Power devices: the evidence base

- No increase in complications
  Annetta et al (2012)
  - Additional use in critical care setting
    Pittiruti et al (2012)
  - Safe in paediatrics Rigsby et al (2007)

- Increased risk of wrong route administration
  ISMP (2009)

- Increased risk of infection and thrombosis
  Baxi et al (2013)

- Tip malposition (63%)
  Lozano et al (2012)
There’s more to device selection than the CVC...
Needlefree connectors

- Introduced to reduce the incidence of needlestick injuries
- Individual specifications of devices vary, i.e., split septum, negative displacement, or positive displacement
- The extent to which they *may*, or *may not*, influence CRI and occlusion has yet to be determined

Needlefree connectors

- Factors affecting infection
  - Connection surface
  - Dead space
  - Fluid pathway
  - Intricacy of valve mechanism

- Factors affecting occlusion
  - Amount of fluid displacement

Jarvis (2010), Hadaway (2011)
Emerging technology

- Anti thrombogenic
  - Endexo™ technology (Bioflo™)
  - External, internal & cut catheter surface
  - Resistant to accumulation of platelets & thrombus
- In vitro testing showed Bioflo™ PICC had 87% less thrombus on surface, based on platelet count, than commonly used devices
  - Company plans to incorporate into ports but not tunnelled CVC
AV fistula: a viable alternative?

- Predates use of tunnelled CVC
  - Associated with stenosis
  - Attributed to hypertonicity of PN
  - Used in pts with recurrent device related complications Al-Amin et al (2013)

- Dutch case series, n=127
  - CRBSI lower than long term CVC
  - Occlusion higher Versleijen et al (2009)

- 1 patient 31 yrs on HPN
Are multi-lumen devices associated with more catheter related sepsis?
Multilumen CVC vs single lumen

- The number of lumens is an independent risk factor for infection
  - Each additional lumen increases the risk (Templeton et al 2008)
  - Each tip
  - Each insertion site

- Single lumen CVC should be used unless additional therapies are required (RCN 2010, O’Grady et al 2011, Loveday et al 2014)

If a multilumen is required the device with the minimum no of lumens should be used
If a multi-lumen CVC is used for PN which lumen should be used?
Which lumen for PN?

- No formal guidance
- There *may* be a theoretical benefit in choosing the smaller lumen (less catheter surface exposed to the nutrient solution) thereby less CVC colonisation and infection
- Choosing the most distal lumen (the one which exits lowest in the SVC) will reduce risk of thrombosis
Do anti-microbial CVC reduce the risk of infection?
Many different combinations exist; chlorhexidine-silver sulfadiazine, silver alloy, minocycline-rifampacin, silver iontophoretic and benzalkonium chloride. They have different modes of action. Available in non-tunnelled multilumen, PICC & tunnelled cuffed devices.

Antimicrobial CVC

- Systematic review & meta-analysis of 34 RCTs comparing antimicrobial CVC with standard CVC
- Antimicrobial CVC should be considered in adult pts, requiring short term catheterization who are at high risk of infection, &/or have restricted venous access/history of catheter related infection, if rates of infection remain high despite strategies to reduce infection

Casey et al (2009)
How long should a CVC remain in-situ?
Dwell time of multilumen CVC

- The duration of CVC has been associated with a slight risk of infection in patients receiving PN (Yilmaz et al 2007)
  - Risk from insertion site and CVC hub
- The routine replacement of non tunnelled multilumen CVC does not reduce the risk and incidence of infection (Warren et al 2006, Krein et al 2007)

Dwell time of other devices

- **PICC**
  - Unknown (Drewett 2009, INS 2006)
  - Reports of up to 4 yrs

- **Tunnelled ("Hickman") type**
  - Unknown (Drewett 2009, INS 2006)
  - Reports of up to 20 yrs

- **Ports**
  - Unknown (Drewet 2009, INS 2006)
  - Lifespan determined by size of silicone disc & size of needle
  - Local experience 9 yrs
Thank you