Choosing the right access for long term parenteral nutrition: PICC lines or tunnelled catheters

G. Goossens (BE)
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G. A. Goossens, PhD, RN
CNS, University Hospitals Leuven, Belgium
Choosing the right access

- Which access is appropriate?
- Prevention and management of complications
- Impact on patients
- Choice of device
Requirements of safe access

• Vein preservation

- Venous Access
  - Non-irritant products
    - Peripheral
      - < 2 weeks
        - Peripheral
      - 2-4 weeks
        - Midline
  - Catheter tip position
    - ≤ 4 weeks
      - CVC
    - 4 weeks – 6 months
      - PICC
  - Central
    - Long-term therapy
      - Continuous
        - Tunneled catheter
      - Intermittent
        - Ports
Requirements of safe access

• Safe in home PN: prevention of air embolism

- Catheter tip position
  - Central
    - Long-term therapy
      - ≤ 4 weeks
        - CVC
      - 4 weeks – 6 months
        - PICC
      - Continuous
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        - Ports

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Requirements of safe access

• Ports
  – Implantable port: dead space
  – Risk of build-up of deposits of infusion fluids, like PN, and fibrin
  – Risk for malfunction and ideal potential nesting material for micro-organisms
Requirements of safe access

Ports: not the first choice if TPN is required on a continuous basis
Safe access starts with the right choice of access

Prevention/management of complications
- Infection
- Malfunction due to occlusion
- Damage

Use of the device

years

Implantation

HPN

Central

4 weeks – 6 months

PICC

Long-term therapy

Continuous

Tunneled catheter

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Preventive measures for infection

• Insertion: maximal sterile barrier precautions
• Manipulation: antiseptic care
• Locking?
  – Locking with heparin or taurolidin?
    • Higher incidence of CRBSI and occlusion with heparin*
    • No added value in low infection rate catheters°
    • Positive results in reduction of CRBSI in small observational studies°°
  – Instillation of ethanol?
    • Potentially positive results**

1. Flush with Sodium Chloride 0.9% (normal saline or NS)*

- Technique
  - Pulsatile flush technique
    - is more effective in reducing endoluminal contamination°

- After TPN administration
  - Volume: 20 ml
    - even a pulsatile flush with 10 ml is insufficient for a 100% removal of proteins**

- Before and after blood sampling
  - Volume: 10 ml

Flushing influences the risk for CRBSI in ports and might explain controversial results of higher risks in ports vs TC***

2. Malfunction management

Defining malfunction: Any condition where, at least, injection or aspiration is no longer easy but has become difficult or impossible.

**CINAS INjection/ASpiration classification**
1= easy
2= difficult
3= impossible
Unknown

- Identify malfunction type by the **CINAS classification**

* Goossens GA, 2015
Malfunction: Injection problems

Difficult or impossible injection combined with easy, difficult or impossible blood aspiration

IN2AS1, IN2AS2, IN2AS3
IN3AS1, IN3AS2, IN3AS3

Suspected intraluminal occlusion

*Goossens GA, 2015*
Causes of malfunction

• Intraluminal occlusion
  malfunction type: mostly difficult/impossible injection combined with easy/difficult or impossible aspiration
  1. Thrombotic
  2. Lipid micelles trapped in fibrin deposits
  3. Precipitates

• Extraluminal occlusion
  malfunction type: mostly easy/difficult injection combined with difficult or impossible aspiration
  – Mechanical: catheter trajectory/catheter tip (XR imaging)
  – Thrombotic: catheter tip thrombosis (linogram)
  – Sleeve formation: catheter tip occlusion (linogram)
1. Thrombotic cause:
Dissolve *fibrin clots* with a thrombolytic drug

- Injection in case of *difficult injection* (IN2AS1, IN2AS2, IN2AS3)
  - 2 ml of Urokinase 5000 IU/ml or tPA

- Instillation in case of *impossible injection and aspiration* (IN3AS3)
  - 2 ml of Urokinase 5000 IU/ml or tPA
  - 3-way stopcock method*
  - Film fragment declotting IN3AS3
2. **Lipid micelles trapped in fibrin deposits as cause of occlusion**
   1. Start with instillation of a thrombolytic agent
      - 2 ml of Urokinase 5000U/ml or tPA, if not resulting in IN1AS1
      *Use NS in between the two products*
   2. Proceed with instillation of Sodium Hydroxide solution (NaOH)
      - 2 ml of 0.1 N NaOH*
      - Yellow colour due to erythrocytes that are present in the lipid deposits

3. **Other deposits as cause of occlusion**
   1. Always start with instillation of a thrombolytic agent, thereafter
      - For lipid deposits: 70% ethanol instillation?
      - In case of extreme pH solutions°:
        • low pKa: e.g. Calcium salts: an acid solution Hydrochloric acid or L-cysteine
        • high pKa: e.g. Phenytoin: a basic solution 1 mEq/mL sodium bicarbonate or 0.1 N sodium hydroxide

   • If unsuccessful after 4 attempts: check catheter trajectory via radiological imaging!

• Clinical sign: persistent IN3AS3 after thrombolytic drug administration
  – Impossible injection/aspiration
Malfunction without injection problems

**Easy injection** combined with difficult or impossible blood aspiration
IN1AS2, IN1AS3

→ Suspected extraluminal occlusion

→ Suspect a thrombotic occlusion if the catheter trajectory and tip position are correct: imaging!
Chest X-ray front/side view (1)

- Catheter trajectory
- Catheter tip position
- Clinical sign: malfunction IN1AS3
IN1AS2/IN1AS3 with correct trajectory and tip position; always suspicion of a fibrin clot at the catheter tip: start with thrombolytic drug administration

- **Injection is easy** (IN1AS2, IN1AS3)
  - Infusion of urokinase 40000 IU in 100 ml of Sodium Chloride 0.9% over 1 hour

- **Injection is also difficult** (IN2AS2, IN2AS3)
  - Injection of urokinase 2 ml, 5000 IU/ml, instillation or lock for a minimum of 15 minutes

If not successful: repeat or further investigation (linogram)

Haire WD. 1994, Horne MK. 1997, Molinari AC. 2004
Catheter damage: prevention and management

Prevention

• Never apply force if resistance is met!
  – CINAS class: injection problems: IN2AS1, IN2AS2, IN2AS3, IN3AS1, IN3AS2, IN3AS3!

In case of damage

• Repair with repair kit for tunnelled catheters
• Sterile procedure
Local infection management

Limited inflammation
- CHG-containing dressings
  - Biopatch®
  - Tegaderm™ CHG

Phlebitis or purulent leakage:
- Remove catheter
Local infection with suspected CRBSI

- Tunnel infection
  - Remove catheter

- CRBSI
  - Blood cultures taken from catheter and peripherally
  - Further actions depending on the type of micro-organism
Venous thrombosis: prevention and management

- Prevention of vein damage
  - Insertion:
    - Limit attempts and use US for venipuncture
    - Limit catheter diameter

- Management
  - Don’t remove catheter
    - If uncomplicated and in close follow up,
    - Unpatent catheter is very rare
    - R/LMWH
PICCs: Migration is a known risk

- Catheter dislocation
  - Incidence 7.1%
- Accidental removal
  - Incidence: up to 3/1000 catheter days (ped.)
- A need for a permanent securement

Tunneled catheters may also migrate

Cuff will secure the catheter after a few weeks

Migration may occur but is not always that obvious
Access choice: what about the patient?

- Body image
- Sports e.g. swimming
- Needle phobia
- Experiences with catheters in the past
- Contact with young children
- Impact on daily living
  - E.g. Bathing/showering: autonomy
Bedalpatch for showering with or without connected infusion line

Impact of Availability of Showerpatch for Patients With Intravenous Catheters: **ISIC-study** (NCT02324868)
## Pro’s and con’s

<table>
<thead>
<tr>
<th>Benefits</th>
<th>PICC</th>
<th>Tunnelled catheter</th>
<th>Implantable port</th>
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<tbody>
<tr>
<td>No need for a dressing</td>
<td>🏷</td>
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<td>No need for a securement device continuously</td>
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<td>No need for an extension line in case of self manipulation</td>
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<td>No risk of mechanical complications/damage</td>
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<td>No continuously present external part</td>
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<tr>
<td>Skin barrier</td>
<td>?</td>
<td>🏷 if tunnelled</td>
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<td>Low insertion cost</td>
<td>🏷</td>
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<td>No need for surgery at removal</td>
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<td>No needle stick anymore</td>
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<td>Easy to access and connect</td>
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<td>No dead space in the device</td>
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<td>Visibility</td>
<td>?</td>
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Choosing the right access...

- **PICC catheter**
  - Cost becomes more important the longer the catheter is in use
  - Short and medium term recommendation*

- **Tunneled catheter**
  - Very good choice especially when daily infusions and for prolonged use*

- **Totally implantable venous access device**
  - Good choice if already present from earlier therapy (cancer patients)
  - High insertion cost therefore a good choice for prolonged use
  - Excellent choice when intermittent therapy (not daily) is needed*

Which catheter you might choose, FLUSING is paramount in the prevention of complications!

*Pittiruti M et al. 2009 Espen guidelines
Any questions?
godelieve.goossens@uzleuven.be