Tunnelled CVAD in pediatric patients

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Types of Vascular Access in Children

- **Arterial**
  - Umbilical arterial catheter *
  - Radial
  - Posterior tibial

- **Venous**
  - **Central**
    - PICC †
    - Non-tunnelled catheter
    - Tunnelled catheter
    - Implantable ports
  - **Peripheral**
    - Umbilical vein catheter *
    - Midline catheter
    - Peripheral canula
    - Scalp veins †
    - External jugular veins
    - Limb veins

- **Intraosseous**
  - Proximal tibia
  - Distal tibia
  - Distal Femur
  - Humerus
Insertion – Pressure of Time

[Flowchart diagram showing decision-making process for insertion based on various indications, including emergency, urgent, elective, anticipated difficulty, critically ill, infusate characteristics, and peripheral versus central placement.]

- Indication: Emergency → Urgent → Elective
- Anticipated difficulty:
  - Yes → Intraosseous
  - No → Peripheral
- Critically ill?:
  - No → Non-tunnelled central
  - Yes → Peripheral
- Infusate characteristics:
  - Peripheral:
    - Short <7 days → Peripheral
    - Intermediate 7-14 days → Non-tunnelled central
    - Long >14 days → PICC
  - Central:
    - Short <14 days → Non-tunnelled central
    - Intermediate >14 days <3 months → Implanted Port
    - Long >30 days → Tunnelled central*
Proposed Duration of Treatment and using of devices

<table>
<thead>
<tr>
<th>Device Type</th>
<th>Proposed Duration of Infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤5 d</td>
</tr>
<tr>
<td>Peripheral IV catheter</td>
<td></td>
</tr>
<tr>
<td>US-guided peripheral IV catheter</td>
<td></td>
</tr>
<tr>
<td>Nontunneled/acute central venous</td>
<td>Central venous catheter</td>
</tr>
<tr>
<td>catheter</td>
<td>preferred in critically ill</td>
</tr>
<tr>
<td></td>
<td>patients or if hemodynamic</td>
</tr>
<tr>
<td></td>
<td>monitoring is needed for 6–14 d</td>
</tr>
<tr>
<td>Midline catheter</td>
<td></td>
</tr>
<tr>
<td>PICC</td>
<td>PICCs rated as appropriate at all proposed durations of infusion</td>
</tr>
<tr>
<td>Tunneled catheter</td>
<td>Tunneled catheter neutral for use ≥15 d</td>
</tr>
<tr>
<td>Port</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No preference among port, tunneled catheter, or PICC for ≥31 d</td>
</tr>
</tbody>
</table>

**Legend:**
- Appropriate
- Neutral
- Inappropriate
- Disagreement
Classification of tunnelled CVAD

- **CVAD**
  - CICC
  - FICC $\downarrow$ CRBSI, $\downarrow$ trombosis
  - PICC $\uparrow$ lifetime, $\uparrow$ gripping
  - tunnelled CICC
  - tunnelled FICC
  - tunnelled PICC

- **Tunneled CVCs**
  - Hickman catheters
  - Broviac line
  - Groshong
  - Pro-Line

- **Implantable Port**
Indications tunneled CVAD

- Identical like CICC (sequence change)
  - Longlife necessity of i.v. administration - chemotherapy, antibiotics, blood derivatives treatment (months till years)
  - Necessary repeated and frequent sampling
  - ↓CRBSI, ↓trombosis, ↑lifetime, ↑gripping
  - Exhaustion of peripheral venous system
  - Lower age groups
  - Drugs with pH ≥ 9 nebo ≤ 5
  - Medicines with osmolarity ≥ 900mOsm/l (incl.TPN)
  - Drug is irritant
  - Hemodialysis methods
  - „Rescue“ access for home or pre-hospital i.v. application of life-saving drugs
Tunnelled CVAD with cuff - CTC

- Broviac, Hickman, Pro-Line....
- Several sizes for children - at least 2.7 Fr
- Silicone, polyeurethane + dacron cuff
- Suitable for use in hospital, ambulance care, home care
- Time aspect - several months to years (from about 3 months)
- Older patients (↓self-destruct)
- Frequent use - more times a week
- Patients: oncology, haemato-oncology, paediatrics - eating disorder, short intestine syndrome (TPV)
Tunnelled CVAD with cuff - CTC

Method and technique of introduction:

- Elective procedure, operating room, aseptic technique
- Ultrasound-guided puncture in real time - risk minimization
- Rule 1/3
  1. Insertion into the veins in the region of the supra/subclavicle - subsequent tunneling into the area under the collarbone (cca 4 cm, front axillary line)
  2. Femoral vein insertion - subsequent tunneling into the abdominal or anterolateral area of thigh (relatively long)
- Tunneling reduces the risk of bacterial contamination
- Catheter stabilization - dacron cuff - placed subcutaneously 2-3 cm from catheter exit site
- The most recommended cannulation with risk minimization (PNO, artery puncture, hemothorax) - **SUPRACLAVICULAR AREA**
- Position of catheter end - Cavo-atrial junction - ECG, RTG, USG verification
Central Venous Port

- Many types
- Identical principle – different design and materials
- Port body with membrane connected to silicone catheter
- Several sizes – smallest 4.5 Fr
- MR, CT compatible
- Time aspect – months to several years
- Frequency of use - less than once per week
- Special Huber needle
- Unused – subcutaneous position
- Patients: oncology with long time chemotherapy, haemophilia, repeated hospitalization, chronic patients
Central venous port

Method and technique of introduction:

- Elective procedure, operating room, asepsis
- Canulation of veins in the area of the supraclavicle /subclavian – **THORACIC PORT**
- Specific situations - arm veins - **PERIPHERAL PORT (PICC PORT)**
- Tunneling to the area below the clavicle
- V. jugularis interna, v. subclavia, v. brachiocephalica, v.axillaris
- The most recommended cannulation with risk minimization (PNO, artery puncture, hemothorax) - **SUPRACLAVICULAR AREA**

- Ultrasound-guided puncture in „real time“
- Position of catheter end - Cavo-atrial junction - ECG, RTG, USG verification
10 reasons for using of USG

Before introduction:
1. Vein localization
2. Throughput of vein
3. Relationship of vein and artery
4. Relationship of vein and pleura

„Real-time“ cannulation:
5. Preference of right path
6. Cannulation of midsection of vein
7. Safety distance between top of needle and A-P wall
8. Watching of wire
9. Control of wire in VCS

After cannulation:
10. Control with USG – diagnosis/exclusion PNO, haematoma, trombosis
Correct location of distal part of CVAD

1. Proximal RA
2. SCV/RA
3. Distal 1/3 SVC
4. Middle 1/3 SVC
5. Proximal 1/3 SVC
6. BCV/SVC
7. BCV right
8. SCV right
9. VJI right
10. Distal RA
11. BCV
12. SCV left
13. VJI left
CVAD - Position of Distal Part - ECG

- Intracavitary ECG (lead II)
- The intracavitary electrode is the tip of the catheter
- Based on changes of P wave during the progression of the catheter into the central veins
- **CAVO-ATRIAL JUNCTION:**
  - maximal peak of the P wave
  (Stas, Yeon, Schummer, Pittiruti/La Greca, etc,)
  ( = CRISTA TERMINALIS)
Central venous port + CTC

Method and technique of introduction:

- Sutureless
- Cutaneous wound - tissue glue, Steristrip
- Securement, stabilisation - Statlock, Grip
- Venous port - fixation to m. pectoralis
- Huber needle
- Disinfection, control aspirations, larger volume syringe, flushing of system "start-stop" method
- Without heparin
- Transparent adhesive semi-permeable cover
Tunnelled CVT

Nursing procedure:

• Existence and compliance with defined protocols (bundless)
• Catheter cover - semi-permeable transparent with high breathability
• Check the site of catheter advertising daily
• Replacement every 5-7 days or earlier if damaged
• Use of needle free connectors – NFC with neutral or positive pressure
• Aseptic technique of system access („port protectors“)
• Or disinfect NFC with disinfectant squares for 15 sec
• Maintain patency – volume of saline for flushing - at least twice the internal volume of system with start-stop technique
• Prevention of CRBSI in repeated cases of infection – special antimicrobial and antifungal plugs
Tunnelled V Port

Nursing procedures:

• Very similar to CVT, some specifics
• Before placing Huber's needle disinfect 2% chlorhexidine in 70% IPA and dry
• Insertion of the needle in sterile gloves
• The Huber needle is immediately removed when the port is not in use
• Huber's needle with tubing is designed for long-term use, changes after 5 days (febrile neutropenia – 3 days)
• Huber's needle covered in a semi-permeable transparent cover
• Port - removal of Huber's needle - technique of maintaining positive pressure in the system
• Unused port - NS flushing at 4-6 weeks interval
Tunnelled CVAD - dysfunction

Catheter obstruction: various causes
1) Intraluminal thrombus (after blood sample, transfusions)
2) Lipid precipitate (TPN)
3) Inkompatibility of drugs
4) Conrasty substance
5) Fibrin sleeve

Occlusion: COMPLETE x PARTIAL

PWO: Persistent withdrawal occlusion- malfunction +aply/-aspirate

- Venous thrombosis at the site of catheter entry into a vein - PROXIMAL
- Venous thrombosis at the distal end of the catheter - DISTAL
Tunnelled CVAD - obstruction

Prevention:

- **Right technique of flushing**: „start-stop“
- Real time ultrasound guided canullation
- Rule 1/3
- Minimization of endothelial traumatization
- Distal end of catheter in C-A junction
- FICC – distal end of catheter in VCI
- Catheters of silicone or polyurethane
- Correct catheter fixation to prevent movement
- **Nursing or home care, education**, preventing backflow of blood - NFC (positive pressure)
Tunnelled CVAD - obstruction

Port, Catheter obstructions
bad tips and tricks:

1. Small volume syringe (high pressure)
2. V Port – system of 2 Huber needles, 2 syringes, 4 hands
3. Heparin - How much? How long?
4. Patient positioning
CVAD – maintain patency

ACTILYSE –
rt-PA - Recombinant Tissue Plasminogen Activator

Central Venous Catheter Occlusion

<30 kg
ACTILYSE: Instill 110% of the internal lumen volume of the catheter; not to exceed 2 mg in 2 mL

≥30 kg
ACTILYSE: 2 mg instilled into occluded catheter

Assess catheter function after 30 minutes of dwell time by attempting to aspirate blood; if unable to aspirate after 120 minutes dwell time, a 2nd dose may be administered and the process repeated.

If catheter function restored, aspirate 4-5 mL blood in patients 10 kg or more (aspirate 3 mL if <10 kg) to remove Actilyse and residual clot.

Gently irrigate with 0.9% NaCl.
CVAD – prevention of maintain patency

2 % Taurolidin – TAUROSEPT
• Catheter lock solutions (CLS)
• To be instilled into device before and et the termination of a cath session

IN ORDER TO:
• Treat and prevent bacterial or fungal growth (G+, G-, MRSA…)
• Avoid biofilm formation with following infection on cath lumen
• Maintain patency

• Taurosept has NO fibrinolytic activity
Summary – tunnelled CVAD

Conversation with parents, children:

- Empathetic
- Serious
- Information
- Uncomplaining
- Demonstration
What is a tunneled central line?

A tunneled catheter is a thin tube that is placed under the skin in a vein, allowing long-term access to the vein. It is commonly placed in the neck. It is most commonly placed in the neck (internal jugular) but may also be placed in the groin (femoral), chest (subclavian)

The catheter is tunneled under the skin. It has a cuff attached to it that allows tissue and skin to grow around it, giving the line more stability.
How is a tunneled central line inserted?

Using ultrasound and live X-ray (fluoroscopy) for guidance, the doctor will insert the catheter into a vein, usually in the neck, and thread it into the large vein that carries blood into the heart.

The other end of the catheter is tunneled under the skin and exits from the side of the chest.

Your child will be protected by an X-ray shield during the procedure.
Will my child be awake during the procedure?

Will my child feel any pain?

No. The procedure will be performed with IV sedation or general anesthesia.

After the procedure, some children may feel mild discomfort around the site for several days.
When can my child bathe after the catheter is placed?

Your child shouldn’t take a shower or bath for 48 hours, until you have removed the bandage at the insertion site.

After that, your child may shower or bathe with the catheter-site bandage in place. If showering, your child should face away from the spray so water does not hit the catheter directly.

If taking a bath, keep the bandage above the water. The clear tape is water resistant, but not waterproof.
What risks are associated with this procedure?

This procedure is considered low-risk. However, potential complications include:

- Bleeding
- Infection
- Puncture of adjacent structures (such as other veins or arteries)
- Collapse of the lung (pneumothorax)
- Bleeding into the chest (hemothorax)
- Catheter breakage (when it is being removed)
Tunnelled CVAD – information, recommandation

www.sppk.eu
GaVeCeLT
Thank you for your attention

My Central Line
By Angus Olsen

My Port
By Angus Olsen

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### Long Term

- **Tunneled Catheters: Hickman/Broviac/Groshong**
  - Silicone with a Dacron polyester cuff
  - Cuff embeds in the scar tissue with fibroblasts within 7-10 days – no suture required
  - Cuff protects from bacterial colonization
  - Seen often in patients receiving chemotherapy

- **Implanted Vascular Access Devices: Port-a-Cath/Infus-a-Port**
  - Port is made of Titanium/Plastic which is attached to a silicone catheter
  - Port is self-sealing, MUST use non-coring needle to access port (Huber needle)
  - Use sterile technique to access implanted devices
Indications for TauroSept®

For intensive care and other patients who are using singular or permanent intracorporal silicone or polyurethane central-based devices for

- Parenteral nutrition (TPN-HPN)
- Haemodialysis
- Oncology
- Port catheter systems (e.g. Port-a-Cath)

TauroSept® is meant to be used as a catheter lock solution (CLS). It can be used daily and repeatedly for months and is to be instilled into the device before and at the termination of a catheter session. It should be withdrawn prior to initiating subsequent catheter use.

Port catheter systems too can be repeatedly instilled.
# Central Lines

<table>
<thead>
<tr>
<th>Line Type</th>
<th>Age/Size</th>
<th>Lumens</th>
<th>Population</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broviac</td>
<td>Infants, toddlers, and small children</td>
<td>Single</td>
<td>Daily, longterm use that is expected for a long period of time, greater than one year or lifelong</td>
<td>Can use ethanol locks; can be repaired</td>
<td>Breaks more easily</td>
</tr>
<tr>
<td>Hickman</td>
<td>School-age children and teens</td>
<td>Single, double, triple</td>
<td>Daily, longterm use that is expected for a long period of time, greater than one year or lifelong</td>
<td>Can use ethanol locks; can be repaired</td>
<td>Breaks more easily</td>
</tr>
<tr>
<td>Groshong</td>
<td>School-age children and teens</td>
<td>Single, double</td>
<td>Daily, longterm use that is expected for a long period of time, greater than one year or lifelong</td>
<td>Does not require heparin locking; can be repaired</td>
<td>Breaks more easily</td>
</tr>
<tr>
<td>Powerline</td>
<td>School-age children and teens</td>
<td>Single, double, triple</td>
<td>Daily use for a defined length of time, such as a 6-month period of treatment</td>
<td>Sturdy and difficult to break; power injectable</td>
<td>Cannot use ethanol locks; cannot be repaired</td>
</tr>
</tbody>
</table>
Indications for TauroSept®

TauroSept® is meant to be instilled into intracorporal catheters between treatments in order to

- treat and prevent bacterial and fungal growth
- avoid biofilm formation (DNA, Proteins and Polysaccharides) with following microbial infection in the catheter lumen
- maintain patency
- prevent Staphylo-coagulase biofilm and clotting

The solution should remain at least 15 to 30 min within the system
TauroSept® has no fibrinolytic activity; therefore it will not lyse existing clots.
SPPK - Doporučení Společnosti pro porty a permanentní katétry

- 18 stran textu
- doporučení vytvořeno mezioborovým týmem výboru SPPK, vychází z mezinárodních doporučení, zejména italských (společnosti GaVeCeLT)
- 1.část - Doporučení pro volbu žilního vstupu
- 2.část - Doporučení pro optimální zavedení žilního vstupu
- 3.část - Doporučení pro ošetřování žilního vstupu
Pěnové krytí se zacvakávacími křídélkami

- vydrží na kůži 7-15 dní
- lehce se aplikuje, rigidní
- vizualizace místa vpichu
- univerzální tvar
Fixace katetrů

Securement – zabezpečení, upevnění katetru
Stabilization – stabilizace katetru

ASSD - Adhezivní bezstehové upevňovací zařízení

Adhesive Sutureless Securement Device
Griplock®

Hypoalergenní bezlatexové krytí

- různé tvary
- vydrží na kůži 8-15 dní
- dobře tolerovatelná fixace
- bez tvrdých plastových částí
- vizualizace místa vpichu
Central Venous Anatomy

- Subclavian Vein
- Axillary Vein
- Cephalic Vein
- Jugular Vein
- Innominate Vein
- Basilic Vein
- Superior Vena Cava

Or Brachiocephalic Vein
**PICC s portovou komůrkou**

- Otevřený polyuretanový katetr 5Fr
- Mikropunkční usg navigovaná kanylace
- Nízkoprofilová dětská komůrka
- Kapsa komůrky nad m. biceps
- CT kompatibilní, max průtok 5ml/s
Léčba katétrové infekce

- **zátka** – antibiotická, antiseptická (Taurolock/Hep, Taurosept, citrát)
- **antibiotická zátka** se aplikuje nejméně 2 týdny (u portu déle), s výměnou á 24-48 hodin dle druhu antibiotika, v kombinaci s heparinem
- **antiseptická zátka** se aplikuje dlouhodobě, ke zvážení je změna antiseptické zátky při vzniku infekce
- antibiotická nebo antiseptická zátka se užívá **výhradně v kombinaci se systémovou ATB léčbou** systémové infekce
- v léčbě infekce je přípustné **použití 70% etanolu** s dostatečnou expozicí (2 hod. flush), není však doporučeno jeho užívání ve formě zátek, resp. dlouhodobá exposice vstupu