Peripherally inserted central venous catheters in children with cardiac diseases

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Presentation topics

• Cardiac patient specificities

• CVC - how we used to do it

• Cardiac center PICC experience – beginnings, results, struggles
Pediatric cardiac patients

- neonatal age – intensive care
- complex surgery ⇔ complicated postop. course
  - transfusions, infections, chylothorax, respiratory complications...
- hemocoagulation abnormalities
- cardiac catheterization – patent central venous access
- single ventricle circulation – superior vena cava patency
- cardiology – heart failure, heart transplant
Pediatric cardiac patients - central venous access

- non-tunneled central venous catheter – ICU repeated exchanges → infection → ATBs → hemodynamic instability → sedation → ventilation → neuromuscular dysfunction → weaning → infection

- risk population – avoid standard CVC
  - neonates - umbilical catheter, short-term
  - epicutaneous catheter - ≠ hemodynamic monitoring
  - intracardiac lines – surgery, hemodynamic monitoring
Central venous access and deep venous thrombosis

- risk population
  - neonatal age – complex surgery, immature coagulation
  - teenage – cardiomyopathy, complex heart diseases – multiple reoperations
- critical disease – inflammatory and hypercoagulable state
- blood products transfusion, perioperative hemostyptic agents
- chylothorax – loss of anticoagulation proteins
- single ventricle ↑ venous pressure, cyanosis – coagulation abnormalities
Pediatric cardiac patients - central venous access
PICC as a central venous access

- first information – Venous access conference Prague November 2015

- IX. PICC day, IX. GAVeCeLT congress December 2015
PICC appealing for PCICU use

• safe in complicated, high risk and fragile patients (coagulation abnormalities, tracheostomy.....)

• low risk of infection (CLABSI)

• patient comfort

• mid/long – term access

• smaller catheters – neonates, infants

• vein/catheter ratio
PICC beginnings

- change „institutional“ policy for central access – new concept, many questions

- not easy, teamwork

- indications – cardiac children?

- who will insert – anesthesiologist 1...4

- which vein

- care for catheters – nurses

guideline core - ICU
PICC as CICC

- off label PICC - central vein and tunneled
- neonates and infants – small peripheral vessels
- v. axillaris, v. brachiocephalica, v. jugularis - low – tunneled to thorax
- FICC - CICC  v. femoralis and tunneled to thigh
- cardiac neonates distal femoral vein low 1/3 thigh – more difficult puncture technique
Pediatric cardiac center experience

- January 2016 - December 2019
- 191 patients, 207 catheters
- 1.9 Fr 4, **2.6Fr 185**, 3Fr 3, 4Fr 13, 5.5Fr 2
- age 34 days (1 day - 21 years), **85% up to 1 year**
- weight 3.6 kg (1.5 - 90kg)
- PICC 37, CICC 14, **FICC 156**
- PICC duration 27 (5 – 200) days
PICC insertion

- US guided
- 98% tunneled catheters
- general anesthesia 37%
- sedation + local anesthesia 55%
- local anesthesia 8%
- bed-side 64%
- holding room / cath. lab 36%
- tip control – USG + X - ray
PICC indications

<table>
<thead>
<tr>
<th>Indication</th>
<th>No.</th>
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<tbody>
<tr>
<td>Heart failure</td>
<td>33</td>
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<tr>
<td>Preop. ICU</td>
<td>67</td>
</tr>
<tr>
<td>Postop. ICU</td>
<td>66</td>
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<tr>
<td>TPN</td>
<td>27</td>
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<tr>
<td>Infection</td>
<td>14</td>
</tr>
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Preoperative ICU 32%

Heart failure 16%

TPN 13%

Infection 7%
PICC complications

- 7.5%

- CLABSI 1/1000 catheter days

- 4 x catheter rupture - 1/2 cc syringe

- artificial removal 3 x

- asymptomatic venous thrombosis - US detection 1x
PICC concept complications

- change is not easy - not every one want it
- there are still non-believers
- every fever $\nRightarrow$ catheter infection $\nRightarrow$ change catheter
- nurses fluctuation – re-education
- manage to move PICCs from ICU $\rightarrow$ Intermediate care $\rightarrow$ Ward $\rightarrow$ home
- database - on-line database planed
PICC Patient 1

- boy born with single ventricle circulation
- 2 cardiac surgeries during 1 year
- progressive heart failure
- 2 y old – waiting list heart transplant
- 3 y old - cardiac cachexia, multiple hospitalizations due to deterioration – inotropic support
- indication for venous access – CICC-PICC – TPN, inotropic support, blood drawings
- managed to be partially at home (3-4 days a week)
PICC Patient 1 - HTx

- 3 y old – heart transplant
- central venous access – PICC, standard CVC 3 days
- ICU stay - 1 week
- post HTx hospital stay 1 month
- PICC removal 3 months (83 d) – discharge home
PICC – Patient 2

- girl complex heart disease, Turner syndrome – aortic valve repair...Ross operation, ECMO

- 4 y old progressive heart failure

- CPR – femoral CVC line.....CPR.... ECMO

- PICC upper arm + PICC distal femoral vein, CVC ex

- 5th day - long-term support Berlin Heart implanted
PICC Patient 2 - HTx

- 6th week - heart transplant
- complicated posttransplant course
  - hemodynamic instability
  - recurrent respiratory infection – 6 antiinfection drugs
  - bilateral diaphragmatic paralysis
- extubation after 11 weeks
- femoral PICC removal (71d), right arm PICC in situ – transfer to cardiology ward
Conclusion 1

- PICC- suitable central venous access for pediatric cardiac patients from neonate to young adult

- preparation for surgery
- perioperative care
  - critical pts – ECMO, multiorgan failure, sepsis..
- heart failure ➔ acute, ➸ chronic
- Htx waiting list – home care
- if 2 lumen not enough – 2 PICCs
Conclusion 2

- Multidisciplinary team cooperation

1. indication – cardiologist, intensivist
2. venous access team – anesthesiologist
3. care - trained nurses

patient benefit