The European Society
of Regional Anaesthesia
& Pain Therapy
ESRA ITALIA

ESRA ITALIAN CHAPTER

30° NATIONAL MEETING

13-15 NOV 2025

NAPOLI
HOTEL RAMADA

Presidents:
Giuseppe Servillo, Fabrizio Fattorini

MZ EVENTS

The RAVESTO protocol and tunneling techniques for short-to medium term central venous access

Vascular access team Bolzano

Giuseppe Capozzoli

Südtiroler Sanitätsbetrieb | Azienda Sanitaria dell'Alto Adige | Azienda Sanitera de Sudtirol
GESUNDHEITSBEZIRK**BOZEN** | COMPRENSORIO SANITARIO DI **BOLZANO**

Anästhesie und Intensivmedizin 1 | Anestesia e Rianimazione 1

Central line placement

- **Operators**:

Anesthesiologists, surgeons, nurses, nephrologists, cardiologists, interventional radiologists.

- **Intraprocedural methods of tip location**:

Ultrasound
Fluoroscopy
Intracavitary electrocardiography

Methods for confirming the position of the catheter tip include chest radiography, fluoroscopy, or point-of-care transthoracic echocardiography or continuous electrocardiography (1).

Malpositions and complications ↓

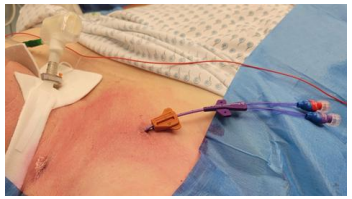
- **Tunneling**

Consider the risk versus benefit of direct venous approach compared to **subcutaneous skin tunnel** approach (3).

!Coagulopathic patient (5)

Small-bore central catheters (6)

3F power uncuffed



5F PASV power uncuffed

Optimization of the exit site

Catheter stabilization ↑ VAD duration

↓ Infections

For intermediate-term central access, such as in patients in an ICU, this analysis suggests that **tunneling a non cuffed CVC** reduces the risk of CVC-related BSI by 33% (1.7 vs 2.7 per 1000 IVD-days) (4) Chlorhexidine-impregnated site dressings is more simple and at least as effective at reducing the risk of CVC related BSI and **can obviate the need to tunnel a CVC catheter** as an infection control strategy (5).

Bedside-placement of tunneled central venous catheters

The perception of increased infection and complications from bedside-placed tunneled central venous catheters appears to be **hyperbolized** (7). For CVCs tunnelled at the patient's bedside, catheter placement is guided exclusively by ultrasound.

1. Practice Guidelines for Central Venous Access 2020 Anesthesiology 2020; 132:8–43
2. Frasca D.; Prevention of central venous catheter-related infection in the intensive care unit; Critical Care 14:212, 2011
3. Gorski LA. Update: The 2024 Infusion Therapy Standards of Practice. Home Heathc Now. 2024 Jul-Aug; 42(4): 198-205.
4. Randolph AG. Tunneling short-term central venous catheters to prevent catheter-related infection: a meta-analysis of randomized, controlled trials. Crit Care Med. 1998;26:1452-1457.
5. Maki DG. The Risk of Bloodstream Infection in Adults With Different Intravascular Devices: A Systematic Review of 200 Published Prospective Studies. Mayo Clin Proc. 2006;81(9):1159-1171.
6. Chopra V. The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC): Results From a Multispecialty Panel Using the RAND/UCLA. Appropriateness Method. Annals of Internal Medicine, Vol. 163 N.6 (Supplement) 9/2015.
7. Chau A. Equivalent success and complication rates of tunneled common femoral venous catheter placed in the interventional suite vs. at patient bedside. Pediatric Radiology (2018) 48:889–894

Contraindications for placement of tunneled CVCs

- **Relative Contraindications**

Mild to moderate coagulopathy (this should be corrected before catheter placement to prevent bleeding and hematoma formation)

Thrombosis can be considered a relative contraindication

- **Absolute Contraindications**

Severe, uncorrectable **coagulopathies**,

Uncontrolled **sepsis**, and/or bacteremia

International normalized ratio, (INR, >1.5 or platelet count, <50 × 10^9/L) and active septicemia. In these situations, temporary, noncuffed, nontunneled catheters should be used (2). Conditions for catheter insertion: platelet count >50,000/L, INR <1.5, and partial thromboplastin time <50 sec. If these critical thresholds are not reached, platelet substitution or specific clotting factor administration should be performed (3).

1. Clark E. Practical Aspects of Non tunneled and Tunneled Hemodialysis Catheters. Can J Kidney Health Dis. 2016 Sep 27;3
2. Bishop L, Dougherty L, Bodenham A, et al. Guidelines on the insertion and management of central venous access devices in adults. Int J Lab Hematol. 2007;29(4):261-278.
3. Teichgräber U et al. Langfristigezentralvenöse Zugänge undderen Komplikationsmanagement. Fortschr Rntgenstr 2004; 176: 944–952

CENTRAL VENOUS ACCESS DEVICES

• **SHORT TERM** (hospitalized patients only)

- CICC NT
- FICC NT

Axillary CICC 7F 20 cm

Limit use of temporary, non-cuffed, non tunnelled hemodialysis CVADs to a maximum of **2 weeks** due to increased risk for infection and consider their use only in patients with need for emergent access (2).

KDOQI considers it reasonable to limit the use of temporary, noncuffed, nontunnelled dialysis catheters to a maximum of **2 weeks** due to increased risk of infection, and this should be considered only in patients in need of emergent access.... no studies have ascertained an ideal dwell time; cuffed, tunneled CVCs have a lower risk of infection than NT-CVC(4)
Convert any short-term catheter (NT-CVC) to a long-term catheter (CVC) within 1 week. (KDOQI 2006)

Nontunneled CVCs as appropriate when the expected duration of use was **14 or fewer days** (5).

The expected duration of catheter use must exceed two weeks in order to justify the insertion of a tunneled catheter (6).

• **MID-TERM** (non-hospitalized and hospitalized patients)

- PICC (Tnc-PICC) e NT
- CICC (Tnc-CICC)
- FICC (Tnc-FICC) (3)

- Jugular Axillo-Subclavian Central Catheter (JACC)
- Hohn-PowerHohn

5F power PASV uncuffed distal trimming

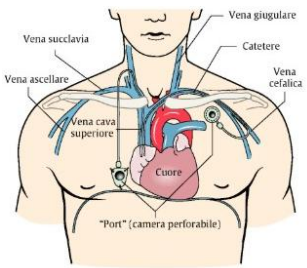
Tunneled PICCs had a lower incidence of venous thrombosis and lower costs of catheter maintenance compared to non tunneled PICCs (1)

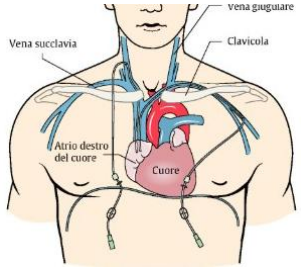
1. Dai C et al. Effect of tunneled and non tunneled peripherally inserted central catheter placement: a randomized controlled trial. J Vasc Access. 2020;21(4):511-519
2. The 2024 Infusion Therapy Standards of Practice.S108-95
3. Van Rens M. The NAVIGATE project: A GloVANet–WoCoVA position statement on the nomenclature for vascular access devices. JVA 9/2024
4. KDOQI CLINICAL PRACTICE GUIDELINE FOR VASCULAR ACCESS: 2019 UPDATE; AJKD Vol 75 | Iss 4 | Suppl 2 | April 2020 S71.
5. Chopra V et al; The Michigan Appropriateness Guide for Intravenous Catheters (MAGIC). Ann Intern Med. 2015;163:S1-S39
6. Teichgräber U et al. Langfristigezentralvenöse Zugänge undderen Komplikationsmanagement. Fortschr Rntgenstr 2004; 176: 944–952

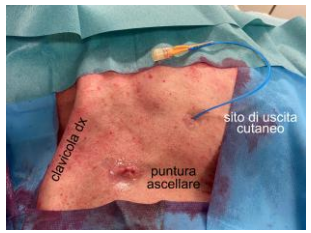
Goal of tunnelling

Long term

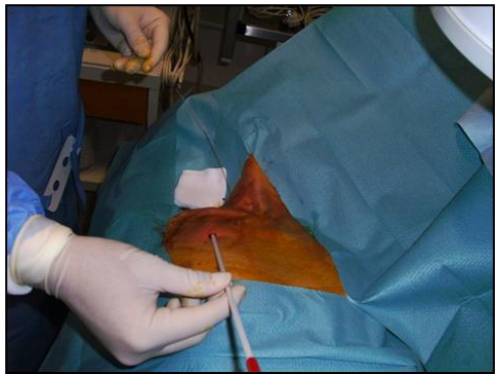
Exit site ..... Puncture site

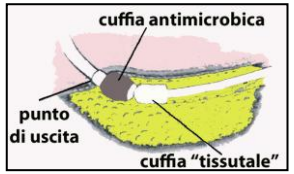


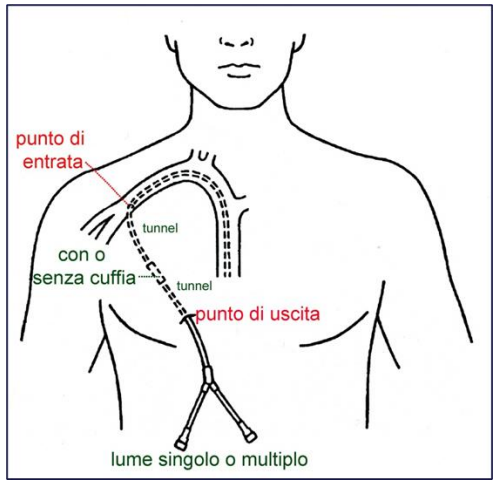




- Cuffed catheters
- Catheter connected to a subcutaneously implanted PORT







- Consider a tunneled, cuffed CVAD for **continuous long-term infusion** therapy (eg, antineoplastic therapy, PN).
- Consider use of an implanted vascular access port in patients who require **infrequent/intermittent** vascular access (1) .

Non cuffed tunnelled CVAD

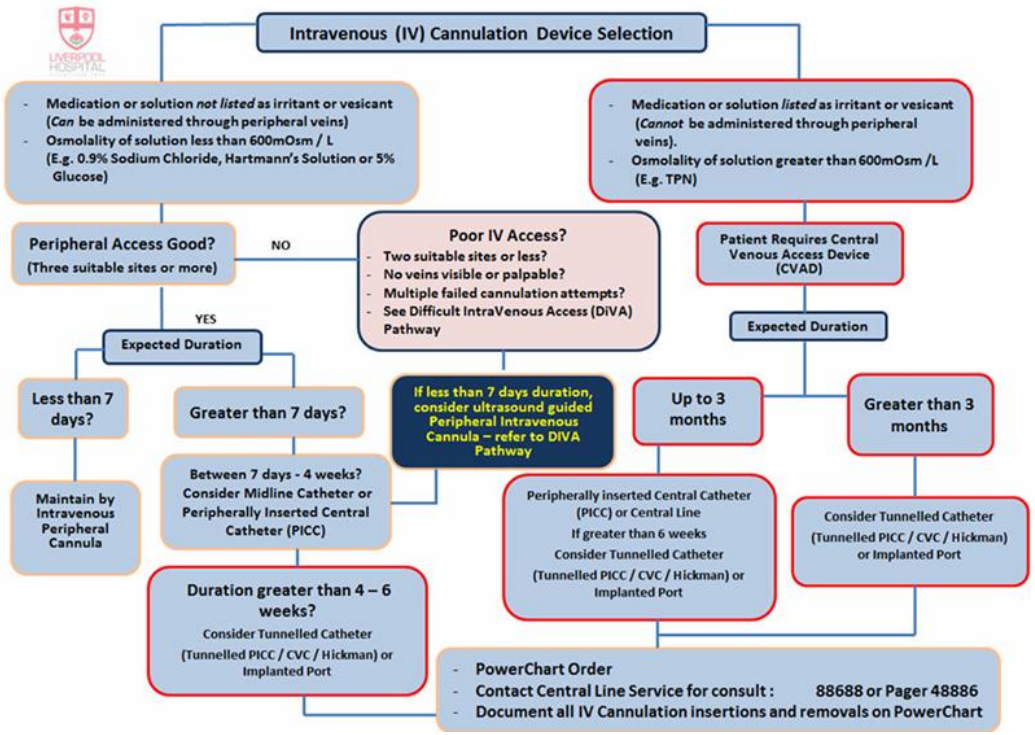
- Optimize VAD choice
- Reduce complications

5F retrograde tunneling proximal trimming

1. The 2024 Infusion Therapy Standards of Practice.S90

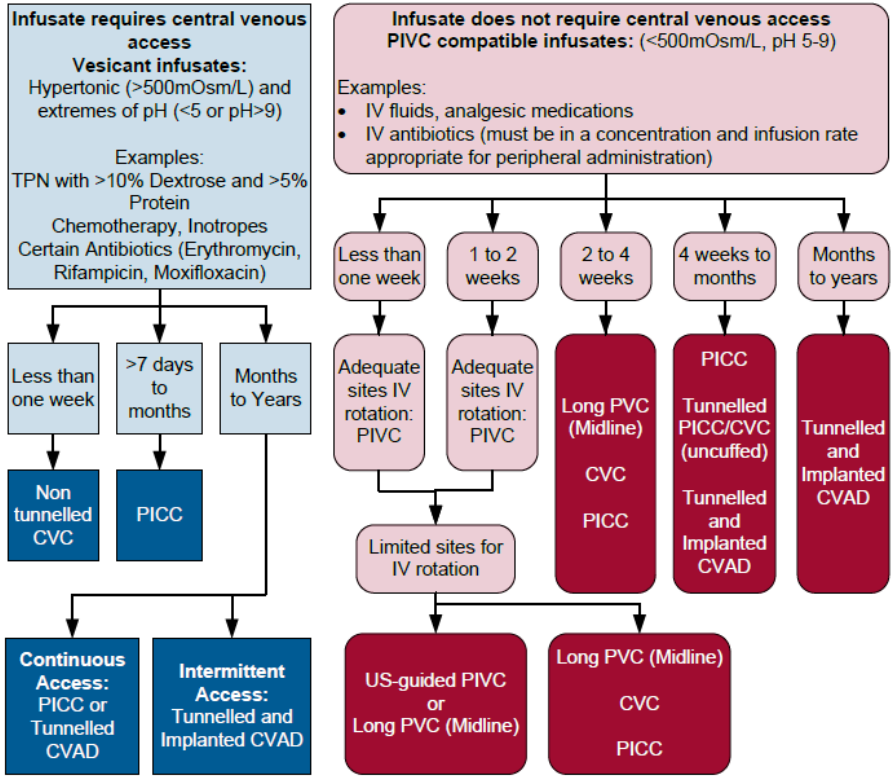
Vascular Access Decision Pathway - Vascular Access Decision Pathway

CVADs can be tunnelled or non-tunnelled



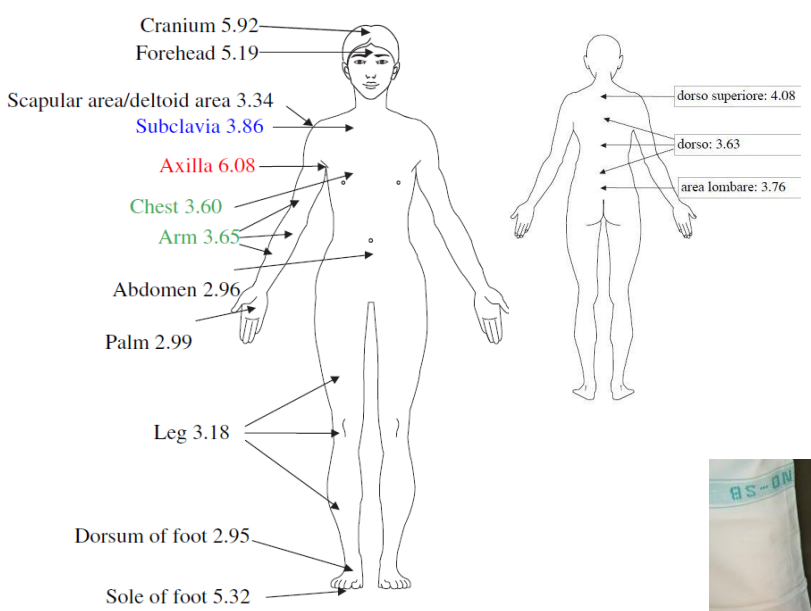
Factors to consider to decide type of CVAD for patients:

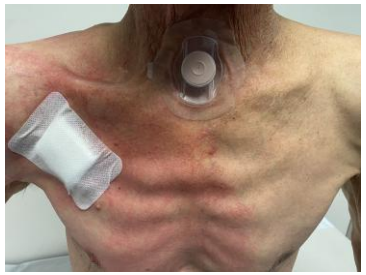
- Infusate characteristics
- Expected duration of treatment
- Patient factors (Age/Weight/Comorbidities/preferences)
- Indications: Difficult IV Access (DIVA) and requirements for blood draws
- Procedural management considerations of patient
- Vein status/venous health – any known abnormalities (thrombosis or stenosis)
- Medical history/chronicity of disease/course – includes need for multiple CVADs in future Inpatient or outpatient IV therapy



1. Sou V. A clinical pathway for the management of difficult venous access. Sou et al. BMC Nursing (2017) 16:64
2. Perth Children's Hospital "Vascular Access Decision Pathway" (CVAD and Midline Insertion and Management Guidelines, 2019)

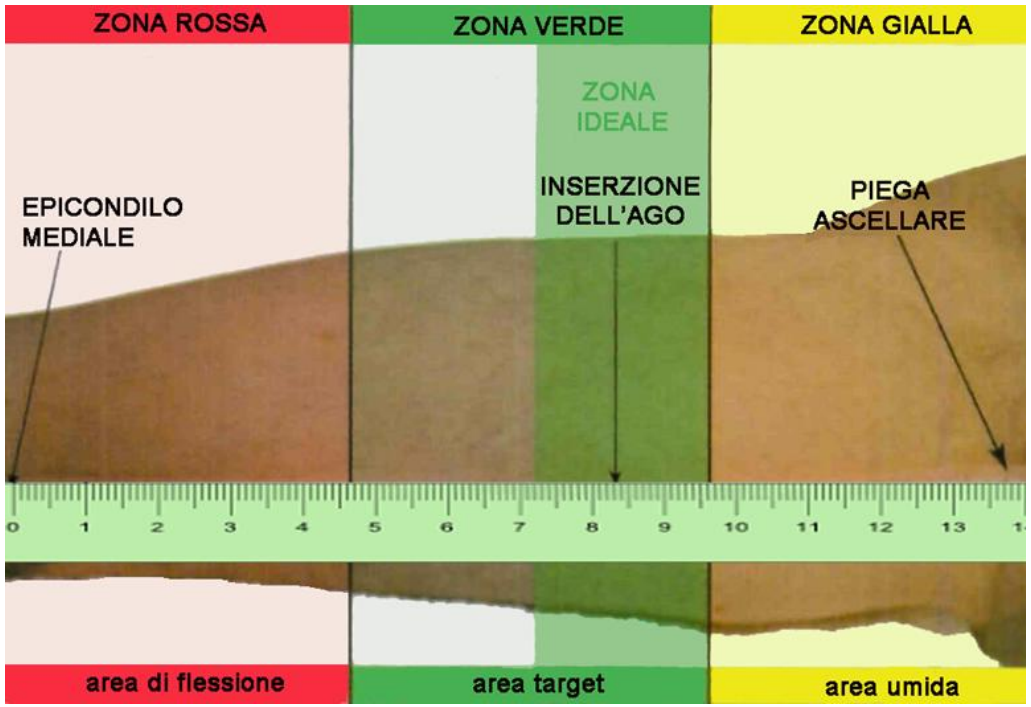
Patients with difficulty in placement of central venous catheters in the most appropriate area

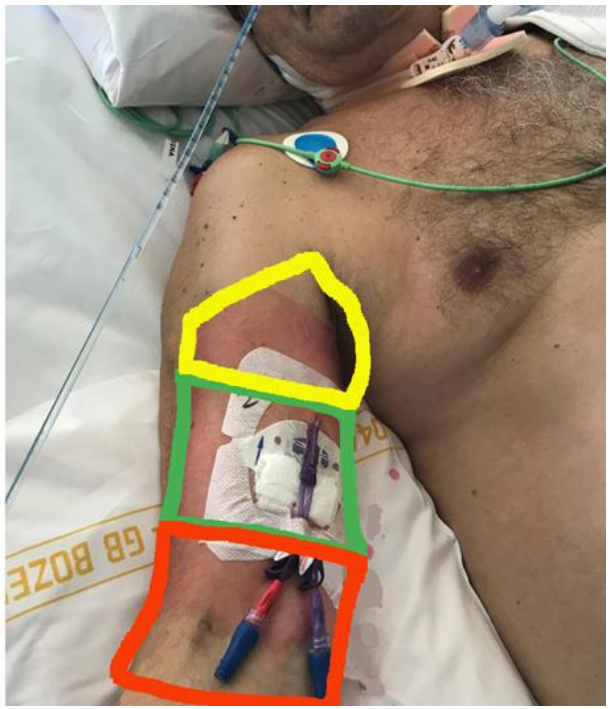




- Pathological BMI
- Peripheral vascular disease
- History of multiple PICC/MIDLINE/CICC/FICC placements
- Selection of a larger vessel for a larger caliber catheter (5-6F multilumen PICC, dialysis-apheresis)
- Difficult access due to proximity of nerve or arterial structures
- Skin damage at the access site of the chosen vein or chronic dermatological conditions
- Areas affected by recent surgical procedures
- Uncooperative patients who voluntarily remove CVADs.
- Pediatric patients

1. Ostroff MD. Report of Modification for Peripherally Inserted Central Catheter Placement; Journal of Infusion Nursing, volume 40, n.4 JULY/AUGUST 2017
2. Reichel M. et al. Identification of variables for aerobic bacterial density at clinically relevant skin sites. Journal of Hospital Infection 78 (2011)





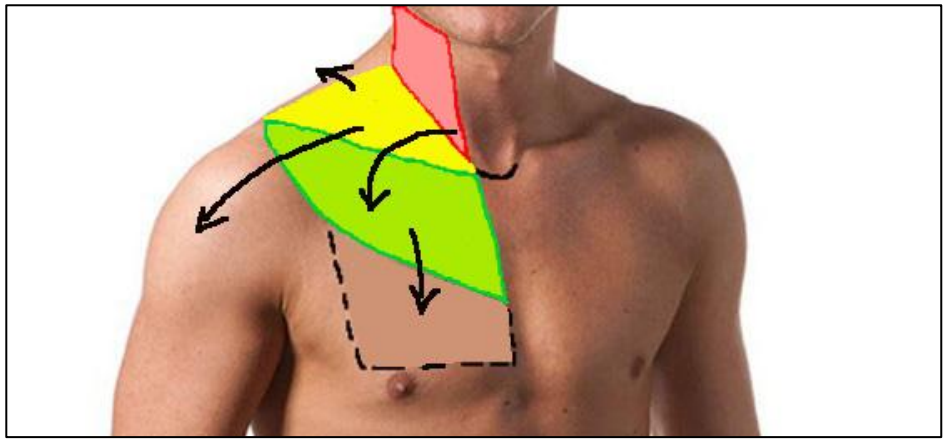
Tunneling the catheter allows for a puncture site in the yellow zone with an exit in the green zone (3).

Consider the use of a subcutaneous skin tunnel when the vein of choice is at its largest in the upper third of the upper arm near the axilla. This optimizes point of needle entry and subsequent catheter exit site in the **middle third of the upper arm** (2).

Subcutaneous tunnelling, which allows for puncturing of more proximal and larger veins, significantly decreased the incidence of VTE (P<0.001)

1. Dawson R. PICC **Zone Insertion Method™ (ZIM™):** A systematic approach to determine the ideal insertion site for PICCs in the upper arm. JAVA. 2011;16(3):156-165.
2. The 2024 Infusion Therapy Standards of Practice.S108
3. Ostroff MD and Moureau NL. Report of modification for peripherally inserted central catheter placement: subcutaneous needle tunnel for high upper arm placement. J Infus Nurs 2017; 40(4): 232–237.
4. Y. Sheng, L.H. Yang, Y. Wu, W. Gao, S.Y. Dongye. Implementation of tunneled peripherally inserted central catheters placement in cancer patients: a randomized multicenter study. Clin Nurs Res, 33 (2024), pp. 19-26

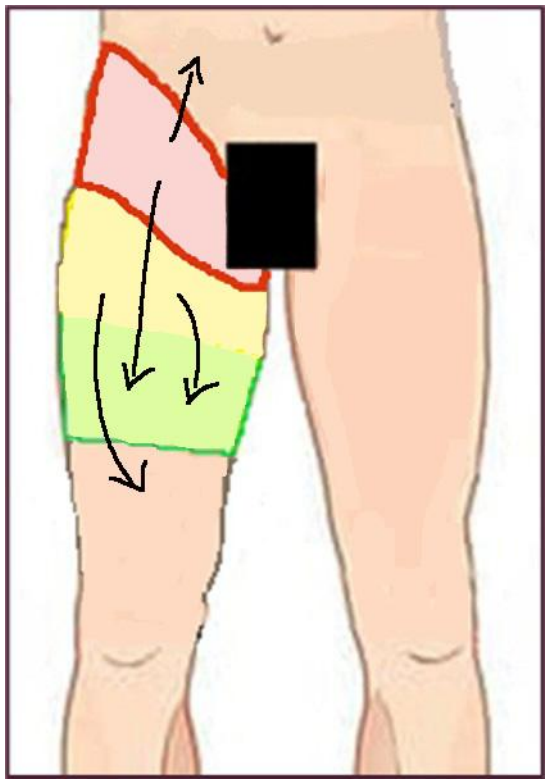
Options of subcutaneous tunneling and their indications in different clinical situations



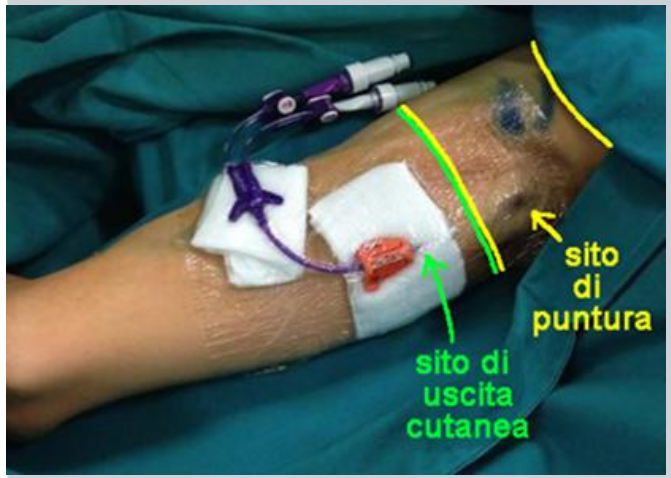
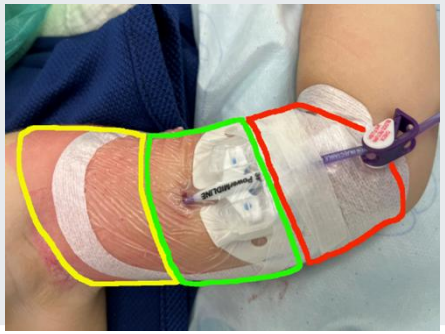
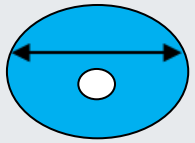
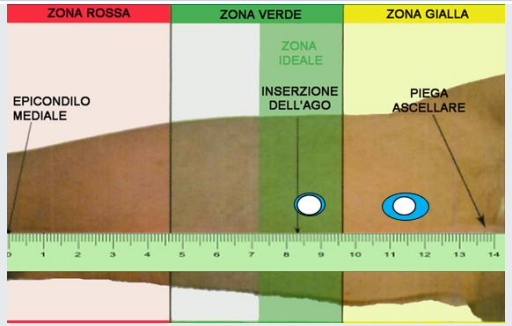
RAVESTO (Rapid Assessment of Vascular Exit Site and Tunneling Options), an assessment tool for suggesting the different options of tunneling and their proper indication in different clinical situations (1).

The exit site of the catheter should be chosen based on distribution of skin contaminants in the area or determined according to the risk for dislodgement, particularly in the cognitively impaired patient (1).

The ZIM approach as well as this strategy of tunneling to achieve the safest exit site can be applied to all central insertion sites (1).

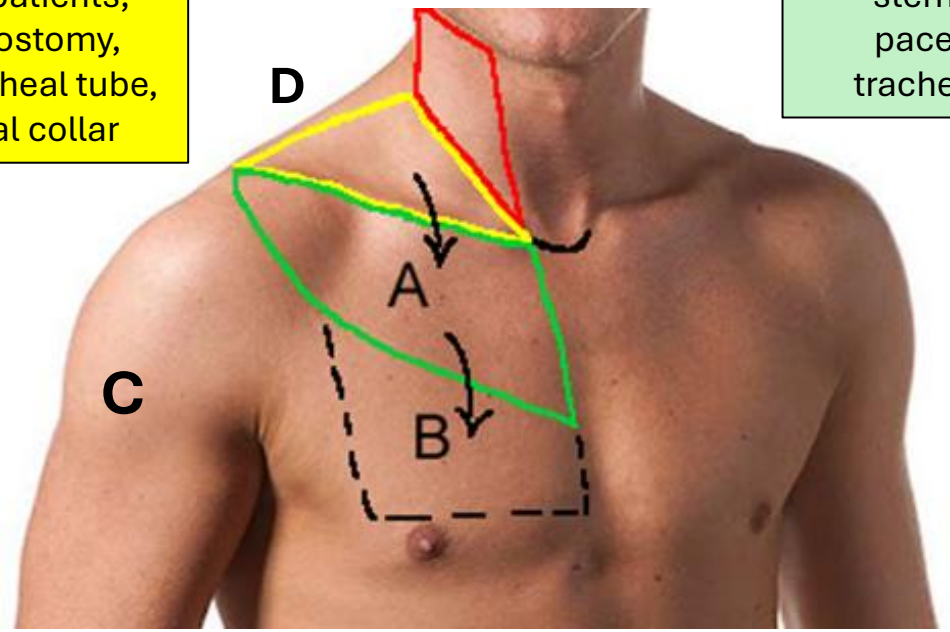


1. Ostroff M. Rapid Assessment of Vascular Exit Site and Tunneling Options (RAVESTO): A new decision tool in the management of the complex vascular access patients. The Journal of Vascular Access 2023, Vol. 24(2) 311 –317

PICC-Midline*	Type and path of tunnel	Indications for tunneling
	Tunneling to the green area of Dawson (1) PICC PICC with **distal trimming**/anterograde tunneling)PICC with **proximal trimming** (retrograde tunneling)	Puncture site in the yellow zone in a larger vein; non-hospitalized patients with planned long-term intravenous treatment; long-term PIVC - immunocompromised patients ZIM is a useful for establishing the length of the tunnel to be created and, therefore, the **material required**
	(**Midline*** 2-3cm) Anterograde tunneling	Catheter/vein ratio  

ZIM approach applied to all **central** insertion sites: cervical thoracic dorsal region

obese patients, tracheostomy, endotracheal tube, cervical collar



sternotomy pacemaker tracheostomy

Ultrasound-guided approach to the supraclavicular veins (internal jugular, external jugular, brachio-cephalic, subclavian: exit site preferred supraclavicular fossa

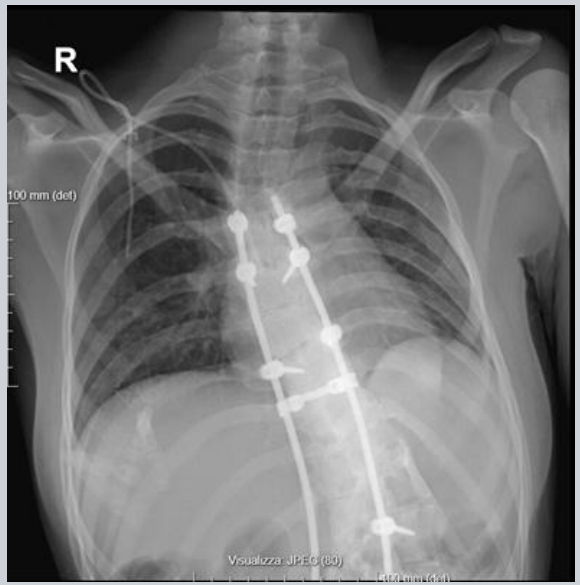
Ultrasound-guided approach to the infraclavicular veins (axillary): exit site preferred infraclavicular area

Red area: no puncture, no exit site

1. Ostroff M. Rapid Assessment of Vascular Exit Site and Tunneling Options (RAVESTO): A new decision tool in the management of the complex vascular access patients. The Journal of Vascular Access 2023, Vol. 24(2) 311 –317

	Supraclavicular veins: (internal jugular)	Type and path of tunnel	Indications for tunneling
Intravenous access is via a large vein of the chest (internal jugular or brachiocephalic); the catheter is predominantly tunneled to exit the anterior chest wall (2)	 	1. Tunneling with a cutaneous exit site in the **infraclavicular area**  2. Skin exit site on the **upper extremity**	Long-term intravenous treatment in **non-hospitalized patients** (antibiotics, parenteral nutrition, chemotherapy); anticipated difficulties in managing the exit site in hospitalized patients (beard, very moist areas, tracheostomy) **Hospitalized** patients with paretic/paralyzed limbs who have completed their ICU stay Compromised skin integrity in the chest area; oral or endotracheal secretions on the chest; implanted devices on the ipsilateral chest; recent chest surgery; contracted shoulder;

1. Ostroff M. Rapid Assessment of Vascular Exit Site and Tunneling Options (RAVESTO): A new decision tool in the management of the complex vascular access patients. The Journal of Vascular Access 2023, Vol. 24(2) 311 –317
2. The 2024 Infusion Therapy Standards of Practice.S89

Supraclavicular veins: (internal jugular)	Type and path of tunnel	Indications for tunneling
	Tunneling with cutaneous exit site on the back (scapular region) 	**Cognitive impairment** resulting involuntary removal of the venous device; Contraindication to the cutaneous exit site on the chest or on the arm 

1. Ostroff M. Rapid Assessment of Vascular Exit Site and Tunneling Options (RAVESTO): A new decision tool in the management of the complex vascular access patients. The Journal of Vascular Access 2023, Vol. 24(2) 311 –317

Type and path of tunnel

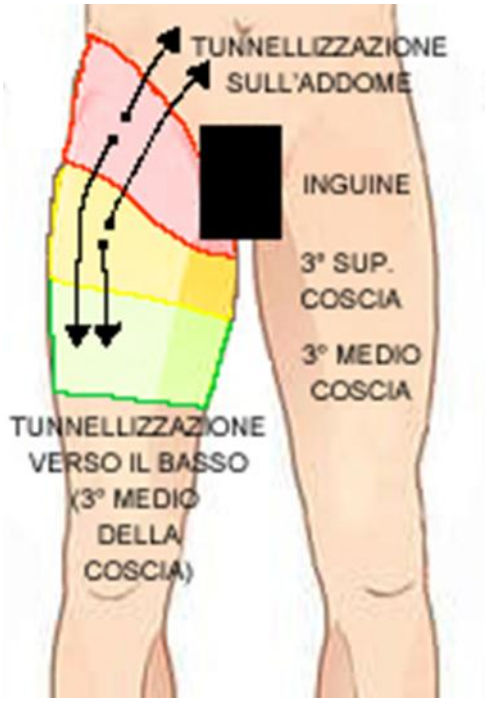
A) Tunneling with cutaneous exit site on the lower chest.

B) Tunneling with cutaneous exit at the upper limb (chest-to-arm) (1)

C) Tunneling with cutaneous exit on the back (chest to back)

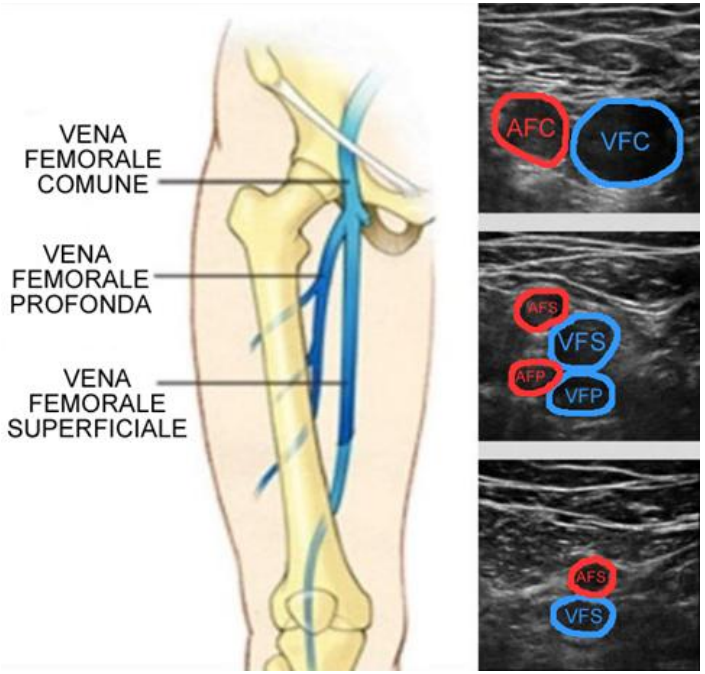
1. Ostroff M. Rapid Assessment of Vascular Exit Site and Tunneling Options (RAVESTO): A new decision tool in the management of the complex vascular access patients. The Journal of Vascular Access 2023, Vol. 24(2) 311 –317
2. Kehagias E and Tsetis D. The "arm-to-chest tunneling" technique: a modified technique for arm placement of implantable ports or central catheters. J Vasc Access 2019;20(6): 771–777.

ZIM approach applied to all central insertion sites: lower limb



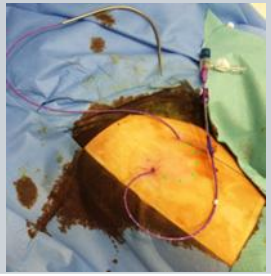
15F retrograde tunneling 55cm

3F 80 mm, pseudotunneling



- **Subcutaneously tunneled femoral vein cannulation** in preterm infants and term infants when traditional intravenous insertion sites are compromised or not suitable for the infusion needs of the individual patient.
- Lower extremity adult catheters carry an increased risk of infection because of all the skin flora at the site of insertion. The risk of CRBSI **is not dependent on where** the central line is placed but instead dependent on **how it is maintained**. Since the introduction of central line bundles, there has not been evidence of an increased risk of infection in femoral lines compared to the internal jugular (2).
- Tunneling toward the abdomen or upward: modelable **metal tunnelers**.

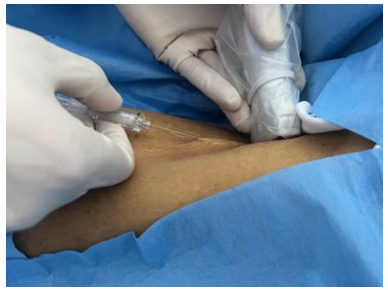
1. Ostroff M. Rapid Assessment of Vascular Exit Site and Tunneling Options (RAVESTO): A new decision tool in the management of the complex vascular access patients. The Journal of Vascular Access 2023, Vol. 24(2) 311 –317
2. Al-Sofyaniet al. Can inverse probability treatment weighting (IPTW) be used to assess differences of CRBSI rates between non-tunneled femoral and jugular CVCs in PICU patients? BMC infectious diseases, 07/2022, Volume 22, Fascicolo 1

TUNNELLED FICC	Type and path of tunnel	Indications for tunneling
	Tunneling on the abdomen Tunneling in the middle of the thigh (mid-thigh)	Non-emergency infusion line in ambulatory patients with contraindications to PICC/CICC; Non-emergency infusion line in bedridden patients with contraindications to PICC/CICC;

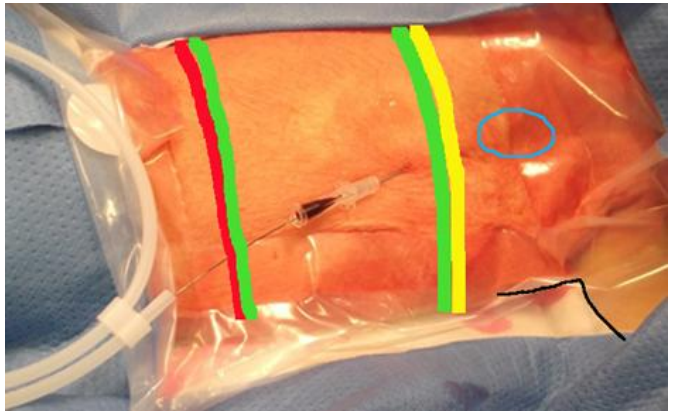
MID-THIG FICC	Type and path of tunnel	Indications for tunneling
	Tunneling on the abdomen Tunneling on the distal thigh 	Non-emergency infusion line in ambulatory patients with contraindications to PICC/CICC; Long-term intravenous treatment in bedridden patients with contraindications to PICC/CICC, uncooperative patients, young children 

1. The 2024 Infusion Therapy Standards of Practice.S17
2. The 2024 Infusion Therapy Standards of Practice.S89
3. Ostroff M, Zauk A, Chowdhury S, Moureau N, Mobley C. A retrospective analysis of the clinical effectiveness of subcutaneously tunneled femoral vein cannulations at the bedside: a low risk central venous access approach in the neonatal intensive care unit. J Vasc Access. 2021;22(6):926-934.
4. Chau A, Hernandez JA, Pimpalwar S, Ashton D, Kukreja K. Equivalent success and complication rates of tunneled common femoral venous catheter placed in the interventional suite vs. at patient bedside. Pediatr Radiol. 2018;48(6):889-894.

Pseudo-tunneling (extended subcutaneous route technique)



Approach using a one-shot technique
Useful for short tunneling: PICC, pediatric-neonatal age



Tunnel no longer than 5 cm (micro-puncture needles are 6 cm long)6 cm peel-away dilator (consider the shorter length of the introducer)

Ostroff MD. Report of Modification for Peripherally Inserted Central Catheter Placement; Journal of Infusion Nursing, volume 40, n.4 JULY/AUGUST 2017

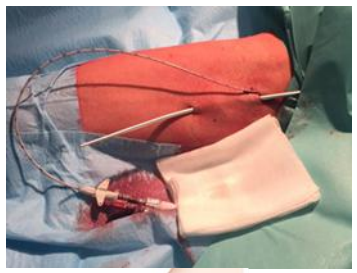
Bedside tunneling techniques

The addition of subcutaneous tunnelling to PICC placement is a simple procedure with no requirement for **dedicated equipment** and a relatively **short time for placement** and **removal**, in contrast to the Dacron cuffed device (2).

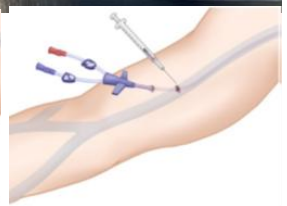
- 14-16G short peripheral cannula (PICC 4-3F)
- Pean forceps – Hemostatic clamp
- Dedicated tunneller (plastic or metallic)*
- Retrograde guide wire technique









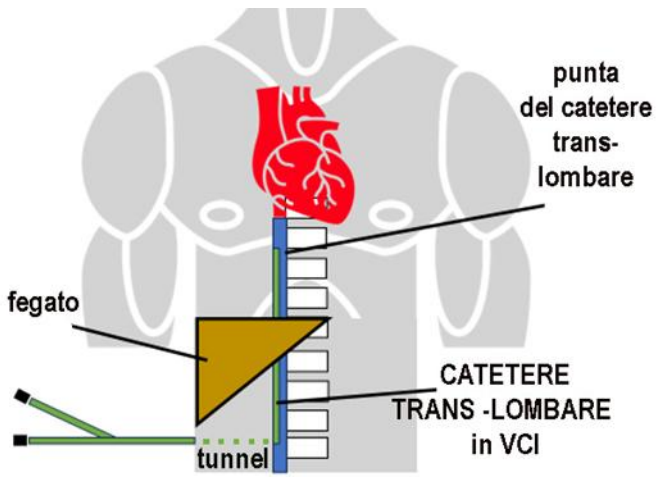



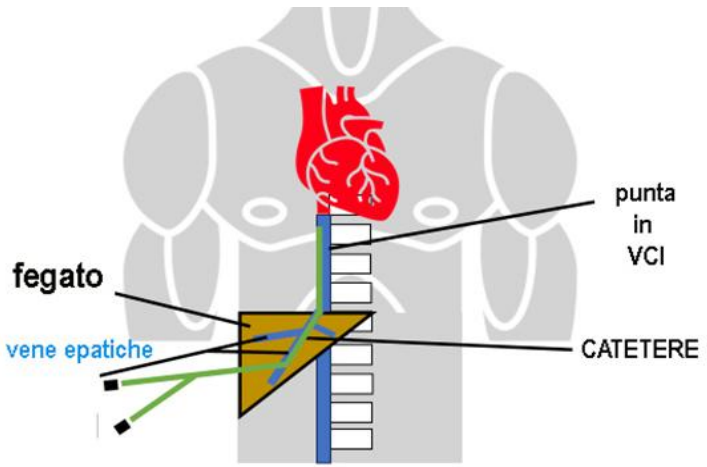
maximal tunnel length	Number of punctures required
4 cm !catheter size	2
3 cm	2
15-25 cm *non-linear tunneling: chest to back	2
2-5 cm	2

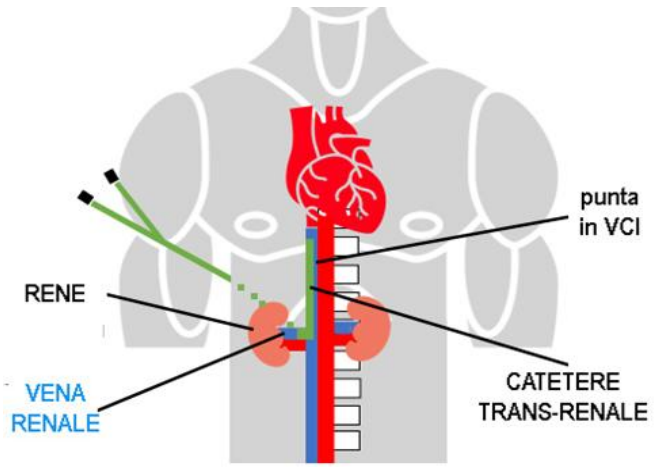

TUNNELLING ACCESSORIES


1. Vijaynanthan A et al. TUNNELLED PERIPHERALLY INSERTED CENTRAL CATHERER- HOW WE DO THEM; JUMMEC 2017:20 (2)
2. Kwon Y. Subcutaneous tunnelling versus conventional insertion of peripherally inserted central catheters in hospitalized patients (TUNNEL-PICC): a study protocol for a randomized controlled trial.

Unconventional Sites for Catheter Placement

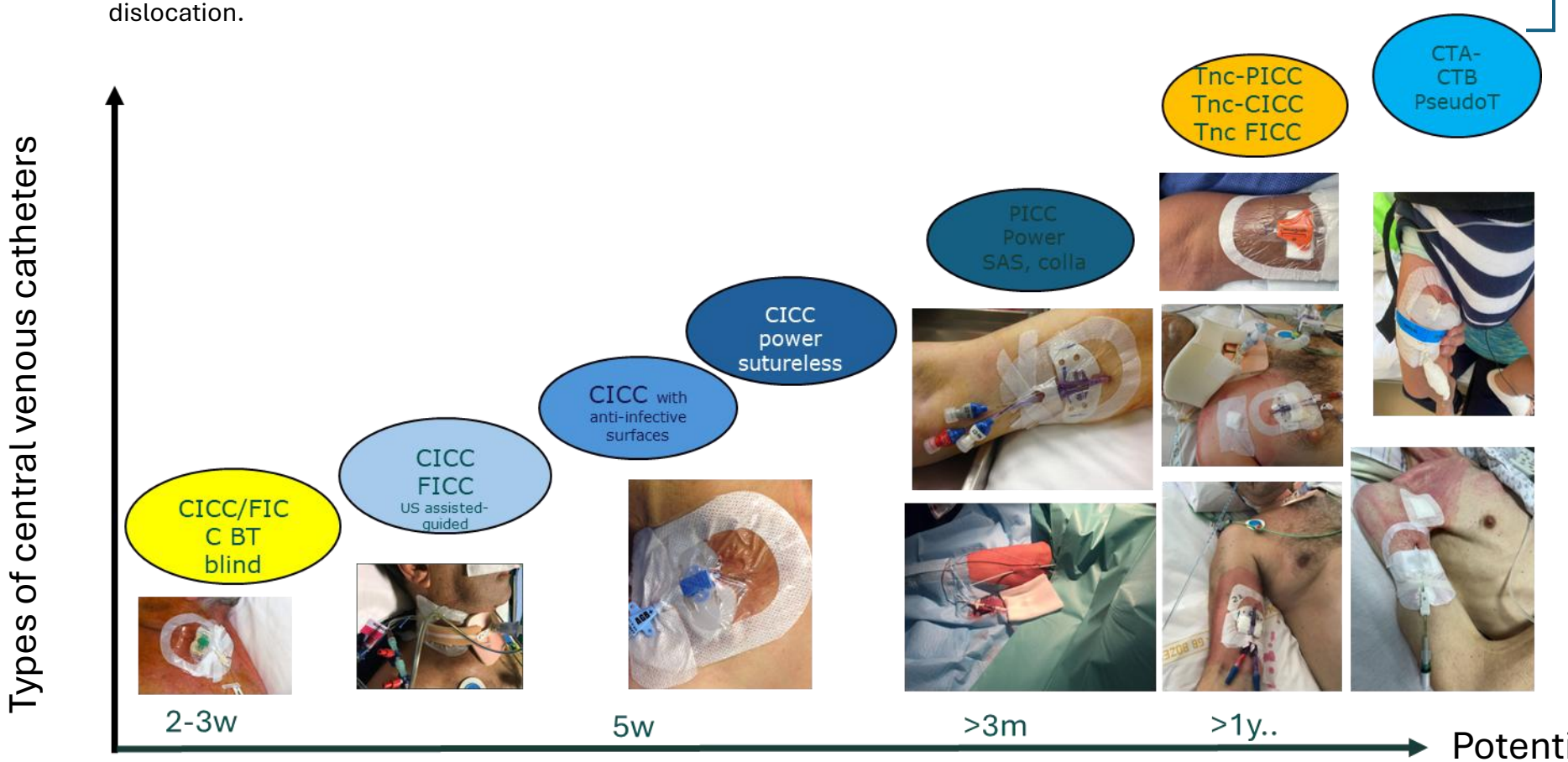






Technical evolution of devices for short- to medium-term central venous access

When the catheter exit site is inappropriate, **bedside tunneling of non-cuffed** devices driven by the RAVESTO protocol may be the solution for both home and hospital patients. This can reduce the risk of thrombosis, infection, and catheter dislocation.



3-8F catheters with proximal trimming

Multiple lumens, repairable.

Seldinger or modified Seldinger technique

Dedicated labeling