

# Appropriate choice of central venous access device: The DAV-expert algorithm

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## The GAVeCeLT algorithm: the DAV-EXPERT

- Born in **2015**; in **2019 updated** and **expanded** to pediatric and neonatal patients
- First to cover **all clinical situations**: emergency, election; intensive, non-intensive
- Covers **all devices**: short, medium and long-term VAD
- This new version is an "**expert system**", which is both an algorithm and a guide that offers evidence behind each suggestion

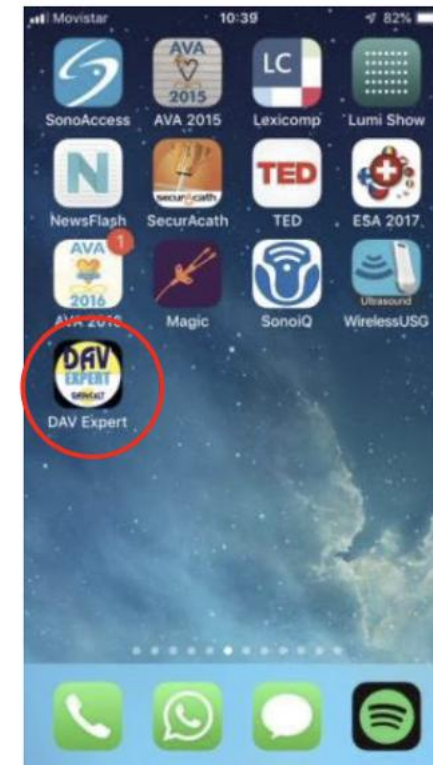
# The GAVeCeLT algorithm: the DAV-EXPERT



Currently available on the web site

[www.gavecelt.info](http://www.gavecelt.info)

Available in Italian - Spanish - English - Portuguese



## Choice of VAD in the adult patient

- Peripheral or central?
- Election or emergency?
- DIVA or not DIVA?
- Expected duration?
- Hospital or out-of-hospital use?




# A step back: terminology

Editorial

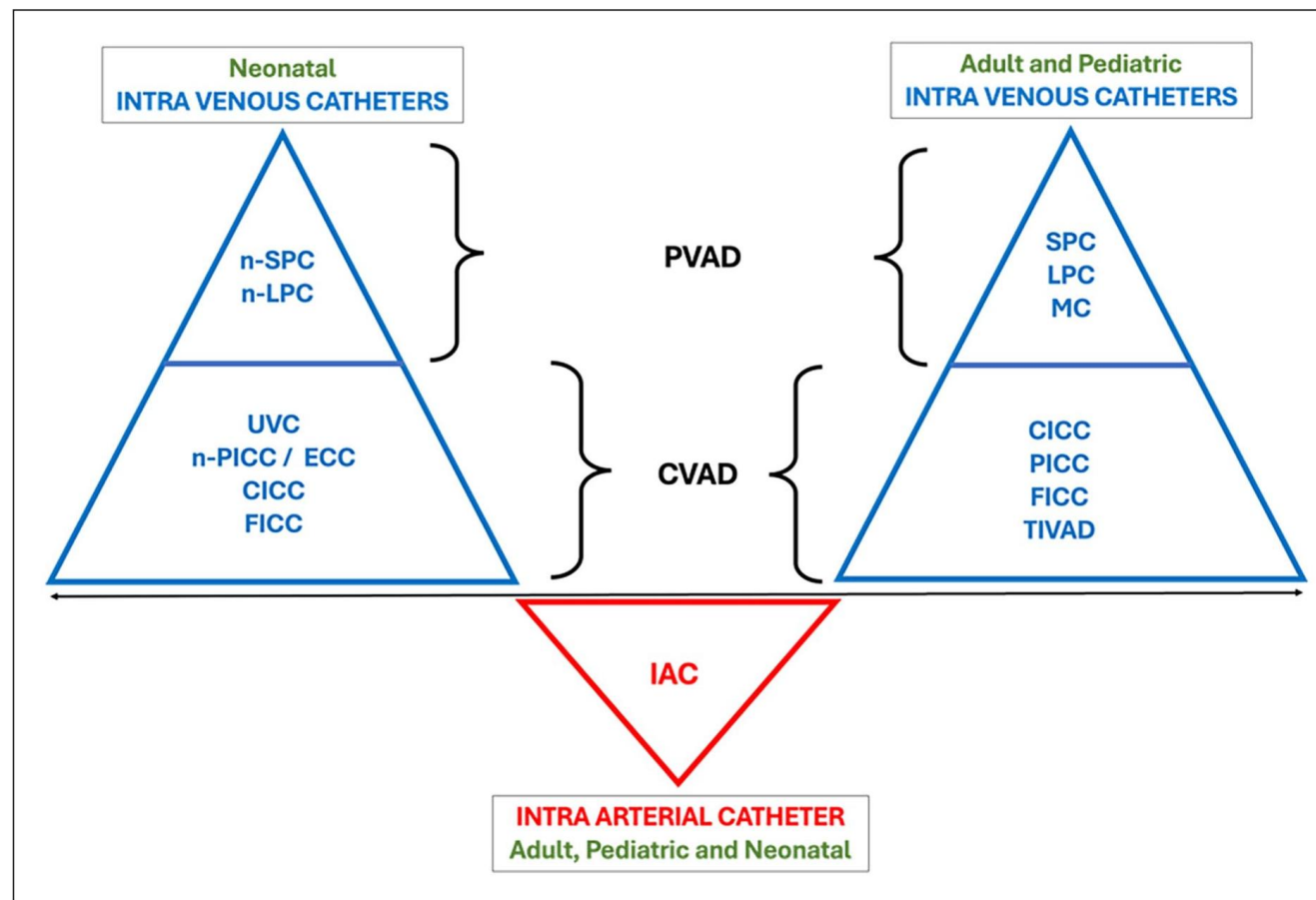
JVA | The Journal of  
Vascular Access

## The NAVIGATE project: A GloVANet– WoCoVA position statement on the nomenclature for vascular access devices

The Journal of Vascular Access  
1–8  
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DOI: 10.1177/11297298241291248  
[journals.sagepub.com/home/jva](https://journals.sagepub.com/home/jva)  


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Alessandro Crocoli<sup>5</sup> , Fulvio Pinelli<sup>6</sup> , Mauro Pittiruti<sup>7</sup> , on behalf of the WoCoVA  
Foundation (World Conference on Vascular Access) and of the Global Vascular  
Access Network (GloVANet)

# The NAVIGATE Project



## First step: Do I need a central VAD?

- Infusion of solutions not compatible with the peripheral route
  - Intravenous solutions with  $\text{pH} < 5$  or  $> 9$
  - Drugs with osmolarity  $> 600 \text{ mOsm/l}$
  - Parenteral nutrition
  - Vesicants
  - Any medication potentially associated with endothelial damage
- Hemodynamic monitoring
- Repeated daily blood draws
- Dialysis
- Need for long-term intravenous access (months or years)

Drugs in R&amp;D


<https://doi.org/10.1007/s40268-020-00329-w>

## ORIGINAL RESEARCH ARTICLE

Add note...



# Standardization and Chemical Characterization of Intravenous Therapy in Adult Patients: A Step Further in Medication Safety

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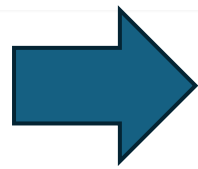
Accepted: 9 November 2020

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DRUG	CONCENTRATION	DILUENT	MEAN OSMOLALITY <sup>a</sup>	DENSITY <sup>b</sup>	MEAN OSMOLARITY <sup>c</sup>	pH	VESICANT
<b>ACYCLOVIR</b> (amp 25 mg/ml 10 ml) <b>TEDEC-MEIJ FARMAS, S.A.</b>	5 mg/mL (500 mg/100 mL)	D5W	287±0.58	1.043	300	10.46±0.02	YES
		NS	279±2.08	1.032	288	11.04±0.03	YES
<b>ALBUMIN HUMAN</b> (5% vial 250 mL, 20% <b>ALBUNORM®</b> vial 100 mL) <b>OCTAPHARMA</b>	5%	-	274±1.53	1.042	286	7.12±0.02	NO
	20%	-	274±0.58	1.059	290	7.04±0.01	NO
<b>AMIKACIN</b> (vial 500 mg/2 mL) <b>B.BRAUN MEDICAL, S.A.</b>	5 mg/mL (500 mg/100 mL)	D5W	308±1.00	1.047	322	4.42±0.01	NO
		NS	283±1.53	1.034	293	4.87±0.01	NO
	10 mg/ml	-	304±2.31	1.037	316	4.55±0.03	NO
<b>AMIODARONE</b> <b>(TRANGOREX® amp 150 mg/3 mL)</b> <b>SANOFI-AVENTIS, S.A.</b>	2.4 mg/mL (600 mg/250 mL)	D5W	298±1.53	1.020	304	3.84±0.01	YES
	3.6 mg/mL (900 mg/250 mL)	D5W	298±1.53	1.020	304	3.80±0.01	YES
<b>AMOXICILLIN SODIUM-CLAVULANATE</b> (vial 1 g) <b>SANDOZ FARMACEUTICA, S.A.</b>	10 mg/mL (500 mg/50 mL)	NS	350±1.53	1.036	363	8.91±0.01	NO
	20 mg/mL (2 g/100 mL)	NS	425±0.58	1.040	442	8.90±0.03	NO
<b>AMPICILLIN</b> <b>(GOBEMICINA® vial 500 mg, vial 1 g)</b> <b>LABORATORIOS NORMON</b>	10 mg/mL (1 g/100 mL)	NS	309±0.58	1.034	320	9.03±0.01	NO
	20 mg/mL (2 g/100 mL)	NS	347±2.08	1.038	360	9.04±0.03	NO

DRUG	CONCENTRATION	DILUENT	MEAN OSMOLALITY <sup>a</sup>	DENSITY <sup>b</sup>	MEAN OSMOLARITY <sup>c</sup>	pH	VESICANT
<b>EPINEPHRINE</b> (amp 1 mg/mL) <b>B.BRAUN MEDICAL, SA.</b>	40 µg/mL (10 mg/250 mL)	D5W	295±2.08	1.020	301	3.89±0.01	YES
		NS	276±0.58	1.008	279	3.91±0.01	YES
	100 µg/mL (10 mg/100 mL)	D5W	298±2.08	1.019	303	3.76±0.01	YES
		NS	277±0.58	1.008	280	3.72±0.01	YES
<b>DOBUTAMINE</b> (amp 250 mg/20 mL) <b>PFIZER, S.L.U</b>	1 mg/mL (250 mg/250 mL)	D5W	282±1.53	1.018	287	3.95±0.01	YES
		NS	266±1.73	1.007	268	4.55±0.01	YES
	120 µg/mL (30 mg/250 mL)	D5W	296±0.58	1.014	300	3.80±0.01	YES
		NS	278±0.58	1.006	280	3.82±0.00	YES
<b>DOPAMINE</b> (amp 200 mg/5 mL) <b>GRIFOLS MOVACO S.A.</b>	1.6 mg/mL (400 mg/250 mL)						
		NS	289±1.53	1.007	291	4.80±0.01	YES

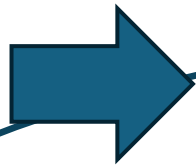
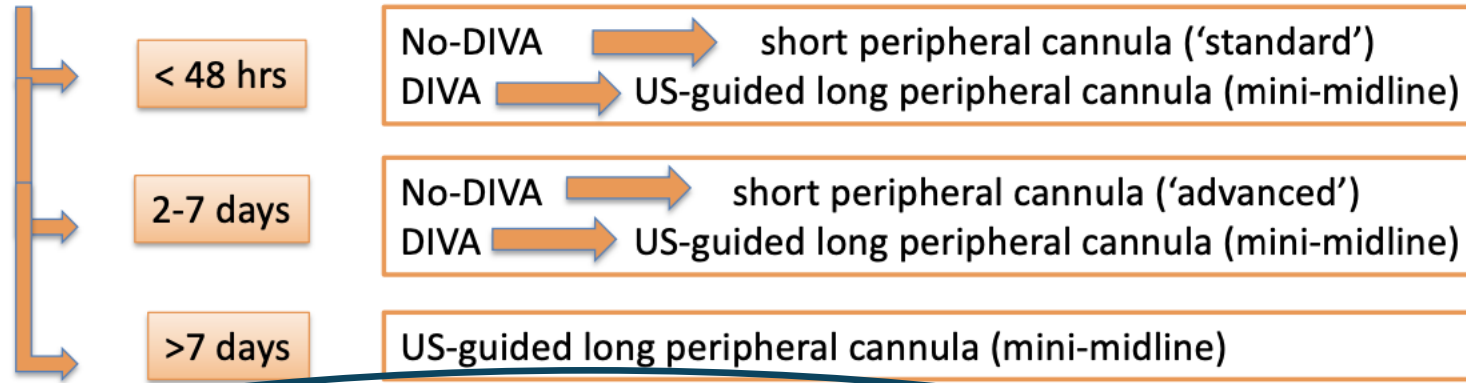


Adult patient- Elective

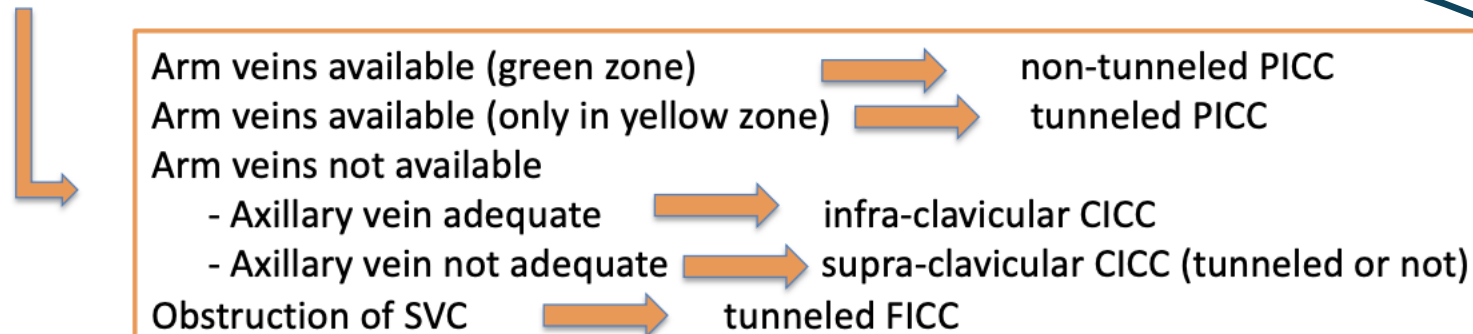
Intra-hospital use



Peripheral access is appropriate



Central access is required



## Three types of central VADs (WoCoVA definition)

- PICC
- CICC
- FICC

How do we choose?

# A CRUCIAL POINT IS THE EXIT SITE

Original Article




Journal of  
Infection  
Prevention

## Evaluation of Skin Colonisation And Placement of vascular access device Exit sites (ESCAPE Study)

*Journal of Infection Prevention*  
2019, Vol. 20(1) 51–59  
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DOI: 10.1177/1757177418805836  
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Nancy L Moureau<sup>1</sup> , Nicole Marsh<sup>2</sup>, Li Zhang<sup>3</sup>, Michelle J Bauer<sup>3</sup>, Emily Larsen<sup>3</sup>, Gabor Mihala<sup>4</sup>, Amanda Corley<sup>3,5</sup>, India Lye<sup>3,5</sup>, Marie Cooke<sup>3</sup> and Claire M Rickard<sup>3,6</sup>

**Results:** The chest and upper arm were significantly associated with fewer microorganisms compared to neck or forearm (odds ratio [OR] = 0.40, 95% confidence interval [CI] = 0.25–0.65,  $P < 0.05$ ). CFU levels under transparent dressings were not significantly different from outside (OR = 0.57, 95% CI = 0.22–1.45). *Staphylococci* were predominant at all sites. Other significant ( $P < 0.05$ ) predictors of higher CFU count included prolonged hospitalisation and medical/surgical patient status.

# A CRUCIAL POINT IS THE EXIT SITE

- The risk of contamination (germs, beard, damp, etc.) + risk of dislocation (unstable dressing) + risk of thrombosis (unstable catheter) differs from site to site:
- **Areas at highest risk:**
  - Groin
  - Neck
- **Low-risk areas**
  - Infraclavicular
  - Mid Arm
  - Mid-thigh

# ANOTHER CRUCIAL POINT IS INSERTIONAL RISK

Risk of pneumothorax due to pleural injury + risk of arterial puncture bleeding

- **Maximum risk:**

- Infraclavicular and supraclavicular CICC

- **Minimal risk**

- PICC
- FICC

# RISK OF BLEEDING

Review

JVA | The Journal of  
Vascular Access

## Management of antithrombotic treatment and bleeding disorders in patients requiring venous access devices: A systematic review and a GAVeCeLT consensus statement

The Journal of Vascular Access  
1–12

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DOI: 10.1177/11297298211072407

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Domenico Prisco<sup>10</sup>, Tommaso Sanna<sup>8</sup> and Giancarlo Scoppettuolo<sup>1</sup>

## RISK OF BLEEDING

**Table 2.** Summary of the panel recommendations.

Type of venous access procedure				
		Minimally invasive ( <i>all peripheral VADs, nontunneled PICCs, nontunneled FICCs at mid-thigh</i> )	Moderately invasive ( <i>nontunneled CICCs, nontunneled FICCs at the groin, tunneled PICCs, nontunneled dialysis catheters</i> )	Highly invasive ( <i>tunneled CICCs, tunneled FICCs, tunneled-cuffed dialysis catheters, ports and PICC-ports</i> )
Bleeding disorder				
PT/INR > 1.5 and/or aPTT ratio > 1.3		No contraindication	Relative contraindication (see text)	Absolute contraindication
Platelet < 50 × 10 <sup>9</sup> /L		No contraindication	Relative contraindication	Absolute contraindication (see text)
Antithrombotic treatment				
VKA		Do not withhold	Aim for PT/INR < 3 (see text)	Maintain PT/INR in the low therapeutic range (see text)



## First option as an in-hospital CVAD: PICC

- Less invasive than CICC
- Infectious risk equal to CICC
- Thrombotic risk equal to CICC

# Infectious risk: identical for PICC and CICC

## Provided that the PICCs and CICCs are implanted correctly

Appropriate choice of emergence site = rational use of tunneling

Skin antisepsis with chlorhexidine 2% in isopropyl alcohol

Maximum barrier precautions

Sutureless stabilization

Exit site protection with cyanoacrylate glue

Use of semi-permeable transparent membranes

# Thrombotic risk: identical for PICC and CICC

## Provided that the PICCs and CICCs are properly implanted:

Appropriate choice of emergence site = rational use of tunneling

Catheter/vein ratio 1:3 (or less)

Ultrasound-guided venipuncture

Use of micropuncture kits

Accurate intraprocedural tip location (IC-ECG or echocardiography)

Correct stabilization of the catheter (sutureless + glue + semipermeable membrane)

## First option as an in-hospital CVAD = PICC

- If there are no bilateral local contraindications
- If there is no chronic renal failure stage 3b - 4 - 5
- If adequate caliber arm veins are present (at least 3 times the catheter)
- If such veins are only available in the yellow Dawson area, the PICC must be tunneled

# Tunnelling



## If the PICC is not indicated

- **Second option: Infraclavicular CICC**
  - **US-guided puncture of the infraclavicular axillary vein; Exit site in the infraclavicular area, with or without tunnelling**
- Third option: Supraclavicular CICC
  - US-guided puncture of the brachiocephalic, subclavian, or IJV
  - Exit site in the supraclavicular area or, by tunnelling, in the infraclavicular area
- Fourth option: FICC
  - US-guided puncture of common FV or SFV
  - Mid-thigh exit site, with or without tunnelling

## CICC (intraclavicular puncture)





## CICC (infraclavicular puncture + tunnelling to the breast)





## If the PICC is not indicated

- Second option: Infraclavicular CICC
  - US-guided puncture of the infraclavicular axillary vein; Exit site in the infraclavicular area, with or without tunneling
- **Third option: Supraclavicular CICC**
  - **US-guided puncture of the brachiocephalic, subclavian, or IJV**
  - **Exit site in the supraclavicular area or, by tunnelling, in the infraclavicular area**
- Fourth option: FICC
  - US-guided puncture of common FV or SFV
  - Mid-thigh exit site, with or without tunnelling



**Non-tunnelled internal jugular  
CICC**



**Tunnelled Internal Jugular  
CICC**



**“Chest-to-arm” CICC  
(supraclavicular puncture)**

Courtesy Dr M. Pittiruti



## CICC “chest-to-back” (brachiocephalic vein puncture)



## If the PICC is not indicated

- Second option: Infraclavicular CICC
  - US-guided puncture of the infraclavicular axillary vein; Exit site in the infraclavicular area, with or without tunneling
- Third option: Supraclavicular CICC
  - US-guided puncture of the brachiocephalic, subclavian, or JV
  - Exit site in the supraclavicular area or, tunneling, in the infraclavicular area
- **Fourth option: FICC**
  - **US-guided puncture of common FV or SFV**
  - **Mid-thigh exit site, with or without tunnelling**

**Tunneled FICC  
(CFV puncture)**



**Non-tunnelled FICC (SFV  
puncture)**





## FICC (CFV puncture + tunnelling to the distal thigh)



# FICC in election: a fourth choice. Really?

*Editorial*

JVA | The Journal of  
Vascular Access

## Femoral venous access: State of the art and future perspectives

The Journal of Vascular Access

1-11

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DOI: 10.1177/11297298231209253

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## FICC in election: a fourth choice. Really?

- “*In the past 5 years, non-dialysis femoral venous access **has changed** in terms of **indications, techniques of insertion, and expected incidence of complications.**”*
- “***Ultrasound guided venipuncture, tunnelling, and ultrasound based intraprocedural tip location.**”*
- “*All these novelties have brought **a revolution** in the field of femoral venous access, so that this route may **be considered as safe and effective as other approaches to central venous catheterization.**”*

## To learn more...

Review

JVA | The Journal of  
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### A GAVeCeLT consensus on the indication, insertion, and management of central venous access devices in the critically ill

The Journal of Vascular Access  
1–19  
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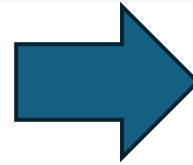
Fulvio Pinelli<sup>1</sup> , Mauro Pittiruti<sup>2</sup> , Maria Giuseppina Annetta<sup>3</sup> ,  
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Stefano Elli<sup>10</sup> , Adam Fabiani<sup>11</sup> , Fabio Fabiani<sup>7</sup>, Antonio Gidaro<sup>12</sup> ,  
Davide Giustivi<sup>13</sup> , Emanuele Iacobone<sup>14</sup> , Antonio La Greca<sup>2</sup>,  
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and Gilda Pepe<sup>2</sup>

## What about non-hospitalized patients?

- Short peripheral cannulas (SPC): no indication
- Short-term CVAD: No indication
- Long Peripheral Cannulas (LPC): limited period (< 3-4 weeks)
- Midline: useful for extended periods (months), but only for solutions compatible with the peripheral route
- **In most cases, a CVAD is required**

## MEDIUM TERM

<4-6 months



Adult patient - Elective

Extra-hospital use



Peripheral access is appropriate



< 3-4 weeks: mini-midline  
> 3-4 weeks: midline

Central access is required



Arm veins available: non-cuffed PICC, tunneled or not  
Arm veins not available: non-cuffed, tunneled CICC  
SVC obstruction: non-cuffed, tunneled FICC

## LONG TERM

>4-6 months



Frequent use

Arm veins available : PICC (tunneled-cuffed or tunneled + SAS)  
Arm veins not available: CICC (tunneled-cuffed or tunneled + SAS)  
SVC obstruction : FICC (tunneled-cuffed or tunneled + SAS)

Episodic use

Arm veins available: PICC- port  
Arm veins not available: chest port  
SVC obstruction: groin port or FICC (tunneled-cuffed or tunneled + SAS)

# Non-hospitalized patients: how to choose?

It depends on:

1. **Expected duration**

In the medium or long term?

2. **Expected frequency of use**

Frequent or episodic use?

## Medium-term (<4 months)

- **First option:**

- PICC (tunneled or non-tunneled)

- **In case of contraindications to the PICC:**

- Uncuffed tunneled CICC (exit site below the clavicle)
- Uncuffed tunneled FICC (exit site away from the groin)

## Long-term (>4 months)

- **Episodic use (< 1/week)**
  - Chest-port
  - PICC-port
  - FICC- port
- **Frequent use (> 1/week)**
  - Tunneled catheter + cuff
    - PICC, CICC or FICC
  - Tunneled Catheter + SAS
    - PICC, CICC or FICC

# A new long-term device: FICC-port

*Original research article*

JVA | The Journal of  
Vascular Access

## Totally implanted central venous access devices inserted by the femoral route: A narrative review and the proposal of a novel approach, the FICC-port

The Journal of Vascular Access  
1-9

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and Mauro Pittiruti<sup>4</sup> 

2024

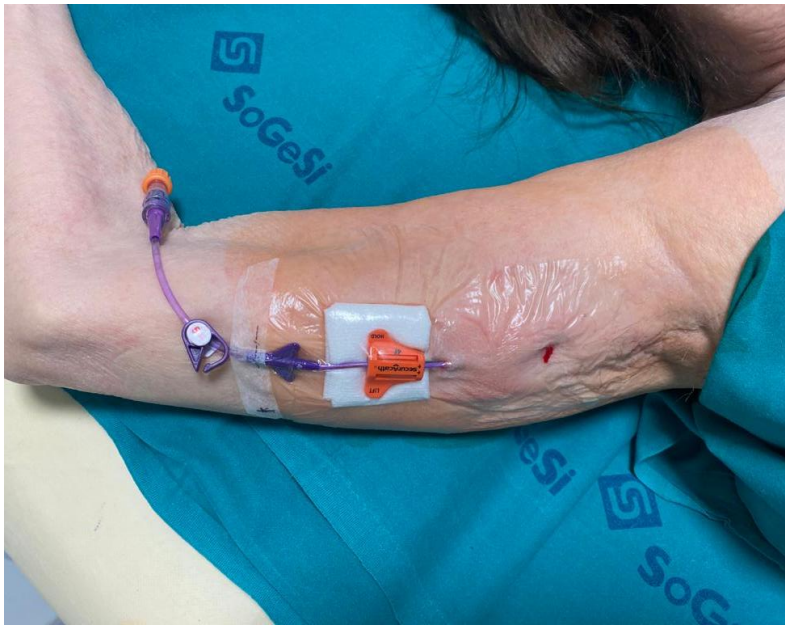


- 47 patients
- US-guided puncture of the superficial femoral vein at mid- thigh
- Intraprocedural location of the tip in the sub-diaphragmatic inferior vena cava, using ultrasound visualization by the transhepatic and/or the subcostal view
- Low-profile or very low-profile reservoir implanted above the quadriceps muscle, at mid-thigh
- **No immediate/early complication, and only three late complications**

## A new long-term device: CVAD + SAS

- PICC or CICC or FICC tunnelled and stabilized with SAS  
(subcutaneous anchored system)
  - Infection prevention: tunnelling
  - Stabilization: SAS
- As effective as the cuff, and perhaps better...

# A new long-term device: CVAD + SAS



# To learn more...

*Editorial*

**JVA** | The Journal of  
Vascular Access

## International experts consensus on optimal central vascular access device selection and management for patients with cancer

The Journal of Vascular Access  
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Jahanzeb M JVA 2024

# CONCLUSIONS

- The choice of CVAD must be made according to very specific criteria: the type of infusion; the setting; duration; the frequency of use; . . .
- We need an algorithm to choose the most appropriate CVAD
- The DAV Expert is based on the best available scientific evidence; its objectives are (a) minimizing the risks associated with VAD, (b) preserving the patient's veins, (c) reducing costs.
- The algorithm is not static and its suggestions are not dogmas: on the contrary, it must update continuously, based on new evidence (FICC, FICC port, SAS, etc.)

# Thank you for your attention

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