

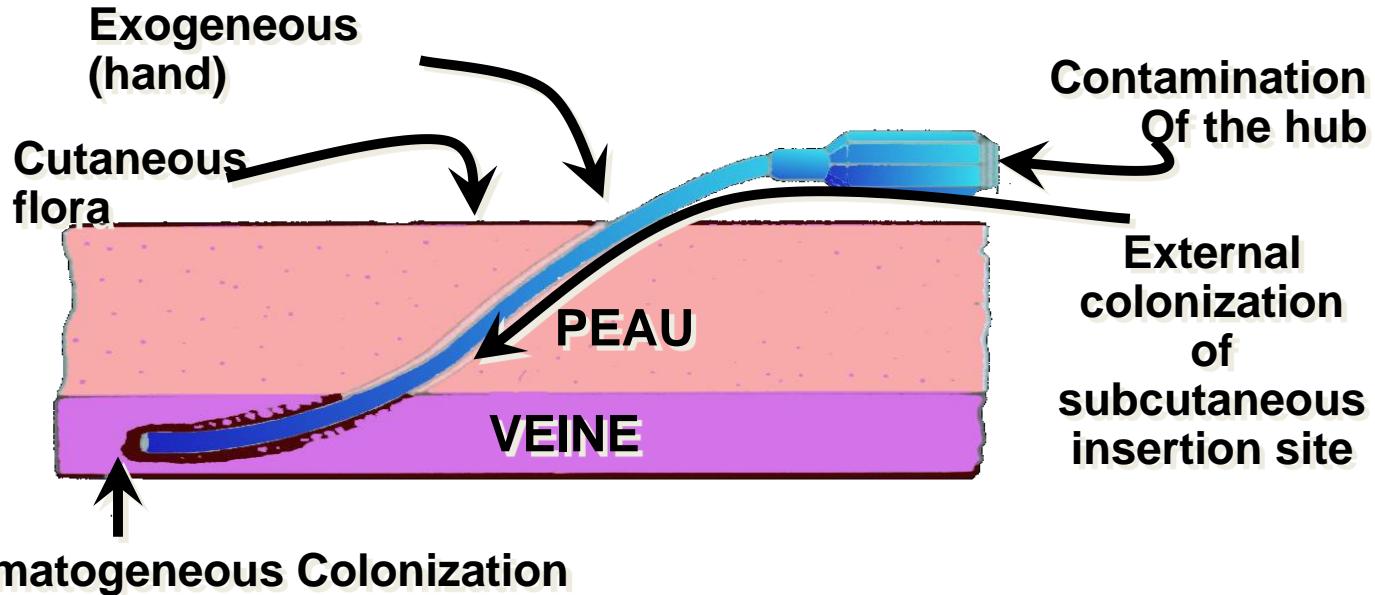


Données récentes sur diagnostic et prévention des infections liées aux cathéters

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FRANCE



Routes of catheter colonization



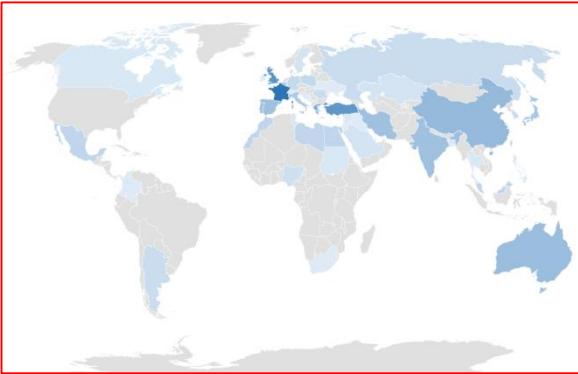
D'après Maki DG et coll., in "Hospital Infections", Bennett JE & Brachman PS, 1992, 849-98.

Extra-luminal: short term catheters → asepsis at insertion, dressings
Endo-luminal: long-term catheters → CVCs manipulation

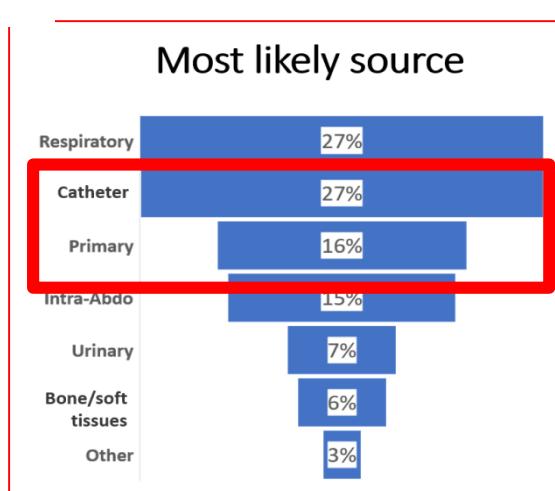


Epidemiology and outcomes of hospital-acquired bloodstream infections in intensive care unit patients: the EUROBACT-2 international cohort study

Alexis Tabah^{1,2,3,4} , Niccolò Buetti^{5,6}, Quentin Staquily⁷, Stéphane Ruckly^{6,7}, Murat Akova⁸, Abdullah Tarik Aslan⁹, Marc Leone¹⁰, Andrew Conway Morris^{11,12,13} , Matteo Bassetti¹⁴, Kostoula Arvaniti¹⁵, Jeffrey Lipman^{4,6,17}, Ricard Ferrer¹⁸, Haibo Qiu¹⁹, José-Artur Paiva^{20,21,22}, Pedro Povoa^{23,24,25}, Liesbet De Bus²⁶ , Jan De Waele^{27,28} , Farid Zand²⁹, Mohan Gurja³⁰ , Adel Alsis^{31,32}, Khalid Abidi³³, Hendrik Bracht³⁴, Yoshiro Hayashi³⁵, Kyeongman Jeon³⁶, Muhammed Elhadji³⁷, François Barbier³⁸, Jean-François Timsit^{39,40} on behalf of the EUROBACT-2 Study Group, ESICM, ESCMID ESGCIP and the OUTCOMERE Network



Epidemiologie



Eurobact2 study (2019-2021):

- 333 ICUs, 52 countries
- 2600 ICU-BSIs
- Day 28 mortality 37%

- Les cathéters représentent la première cause de bactériémie nosocomiale en réanimation



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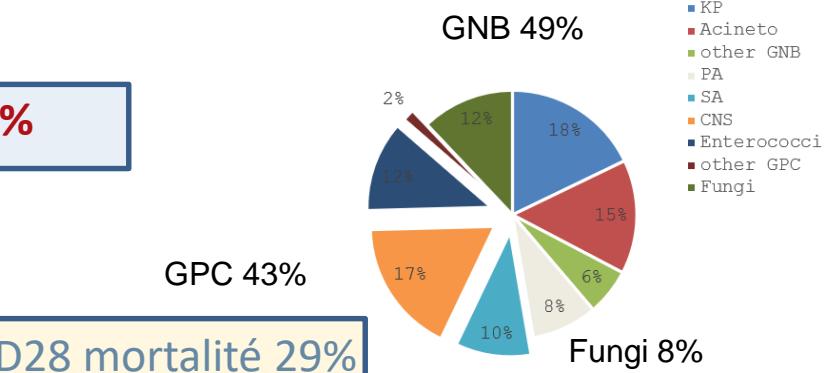
Alexis Tabah^{1,2,3,4}, Niccolò Buetti^{5,6}, Quentin Staiquly⁷, Stéphane Ruckly^{6,7}, Murat Akova⁸, Abdullah Tarik Aslan⁹, Marc Leone¹⁰, Andrew Conway Morris^{11,12,13}, Matteo Bassetti¹⁴, Kostoula Arvaniti¹⁵, Jeffrey Lipman^{4,6,17}, Ricard Ferrer¹⁸, Haibo Qiu¹⁹, José-Artur Paiva^{20,21,22}, Pedro Povoa^{23,24,25}, Liesbet De Bus²⁶, Jan De Waele^{27,28}, Farid Zand²⁹, Mohan Gurja³⁰, Adel Alsis^{31,32}, Khalid Abidi³³, Hendrik Bracht³⁴, Yoshiro Hayashi³⁵, Kyeongman Jeon³⁶, Muhammed Elhadji³⁷, François Barbier³⁸, Jean-François Timsit^{39,40} on behalf of the EUROBACT-2 Study Group, ESICM, ESCMID ESGCIP and the OUTCOMEREA Network

CLABSI/CRBSI 969 cas, mortalité J28 37%

Cathéter enlevé (77%)

Cathéter laissé (23%)

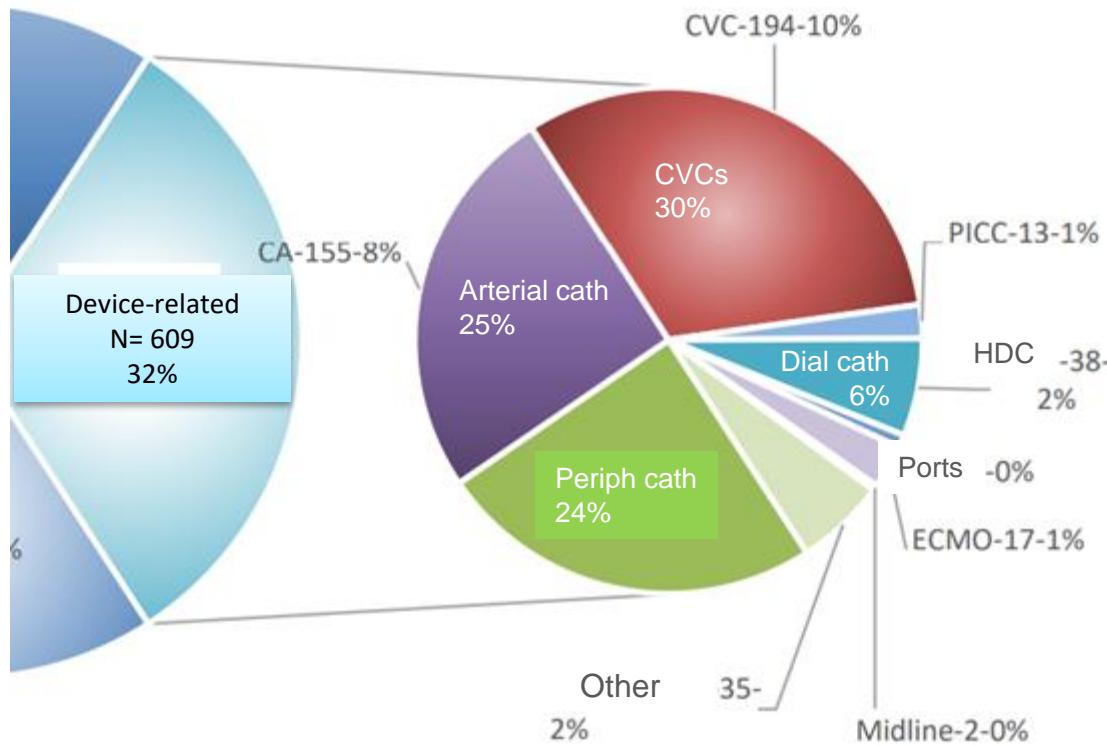
Epidemiologie



DTR organisms: 22,6% des décédés vs 11,9% des survivants

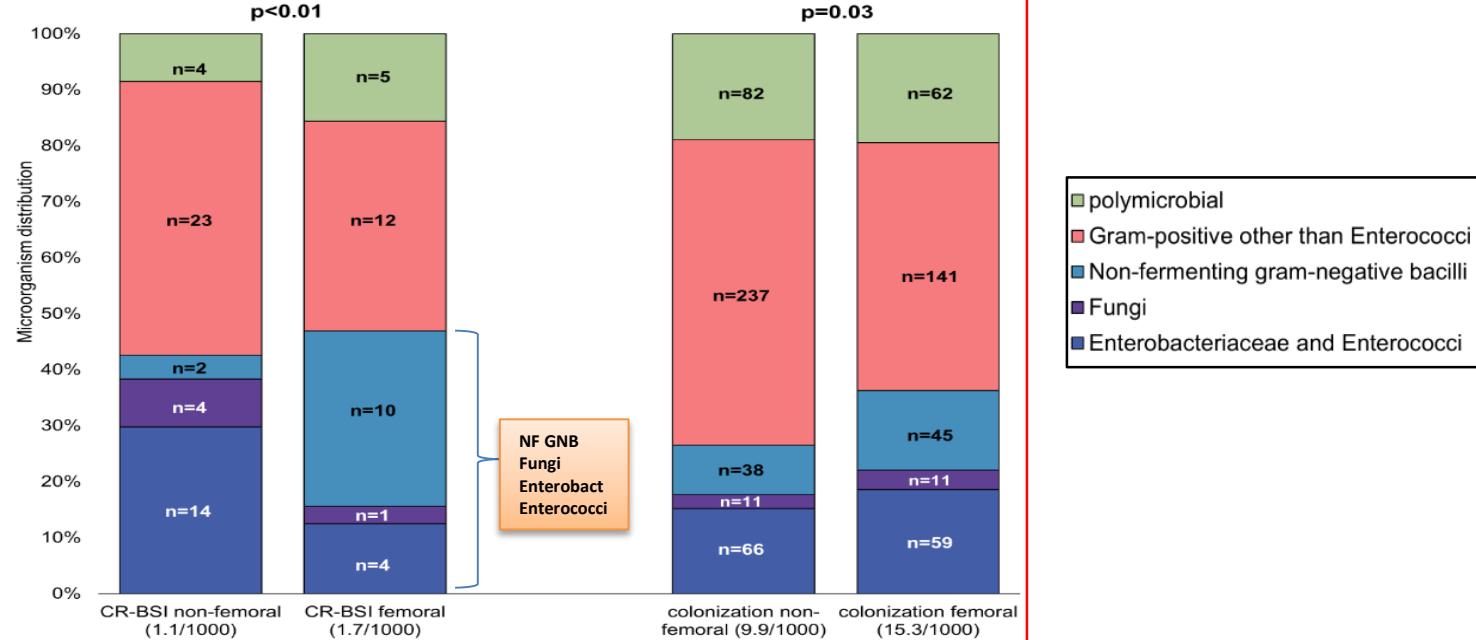


BLC en réanimation (data France)



Impact of the Insertion site

A: CR-BSI and colonizations among central venous catheters



CLABSI vs CRBSI??

Catheter tip colonization	Positive culture of the catheter tip that grew to ≥ 15 cfu/mL (semiquantitative), 10^2 cfu/mL (quantitative sonication), or 10^3 cfu/mL (quantitative vortexing)	Qualitative culture should no longer be used
Exit-site infection	Tenderness, erythema, or induration > 0.5 cm at the exit site. It may be associated with other signs and symptoms (e.g., fever or purulent drainage)	Positive culture of exudate confirms the exit-site infection microbiologically
Catheter-related bloodstream infection	One positive blood culture obtained from peripheral vein and clinical manifestation of infection and (1) a catheter-tip colonization or (2) a differential time to positivity of more than 120 min and no obvious source of bacteremia except the catheter or (3) simultaneous quantitative cultures of blood with a ratio of $> 3:1$ cfu/mL of blood (catheter vs. peripheral blood)	Simultaneous quantitative culture from a peripheral vein and the catheter of 3:1 ratio is rarely used
Central-line-associated bloodstream infection	One positive blood culture and clinical manifestation of infection in a patient with a catheter in place with no other source of bacteremia except the catheter	Easy to use for surveillance purposes. However, risk of overestimation of the BSI incidence due to catheter infection especially in ICU and in oncohematological patients
Catheter-related clinical sepsis	Clinical manifestation of infection that disappears within 48 h of catheter removal and a positive catheter-tip culture and no other obvious treated source of infection	Represent 30–50% of the catheter-related infections with general manifestation. Uneasy to collect in routine but may need antimicrobial treatment



Mais le sait-on vraiment? Le risque dépend de la mise en culture des cathéters. Est-ce fait en routine?



- Devenir des cathéters (96 ICUs n=23767 , 2021)
 - Enlevés cultivés 10 512 (44,2%)
 - Enlevés non cultivés 5 936 (25,0%)
 - Laissé en place 7 319 (30,8%)



Local signs at insertion site
and catheter-related bloodstream infections:
an observational post hoc analysis using
individual data of four RCTs

Niccolò Buetti^{1,10}, Stéphane Ruckly¹, Jean-Christophe Lucet^{1,2}, Lila Bouadma^{1,3}, Maité Garrouste-Orgeas^{1,4},
Carole Schweber^{5,11}, Olivier Mirouz^{6,7,8}, Bertrand Souweine⁹ and Jean-François Timsit^{1,3}



5RCTs/ 25 ICUs

6976 patients/14,590 catheters
(101,182 catheter-days)

114 CRBSI



Les signes locaux sont t-ils importants?

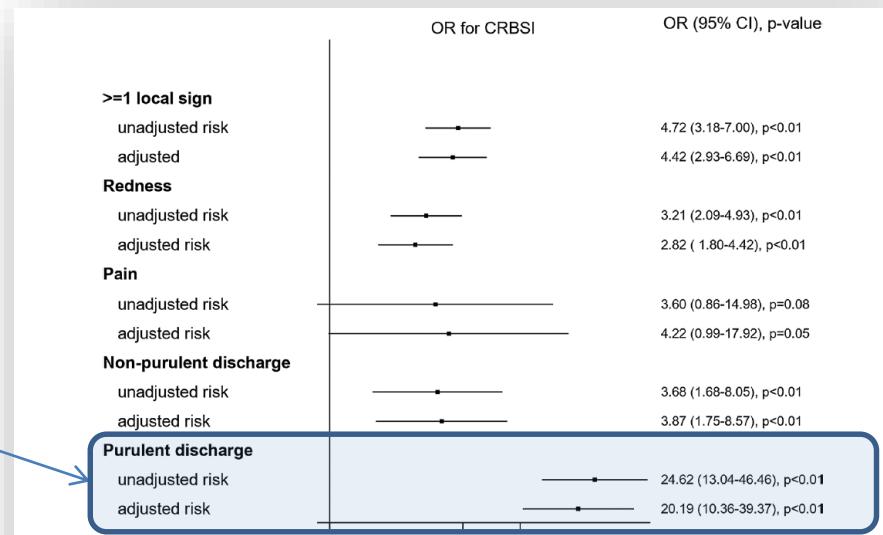


Fig. 1 Unadjusted and adjusted local sign risk for catheter-related bloodstream infection. We adjusted for the following confounding factors for CRBSI: Sex, SOFA, catheter days, catheter type, experience of the operator, insertion site, skin antisepsis, CHG-dressing and antibiotics at insertion. OR, odds ratio; CI, confidence interval; CRBSI, catheter-related bloodstream infection.



Catheter-related Thrombosis

Table 2 Comparison of the incidence and size of catheter-related thrombosis between the internal jugular, subclavian and femoral veins on the first day of diagnosis

	Internal Jug V	Subclavian V	Femoral V	p value
CRT Incidence (%)	23%	7.4%*	11.2% [#]	<0.001
Time to CRT onset (day)	3 (2–7)	5 (2–7)	4 (3–6)	0.28
CRT size Dis 1 (mm)	3.2 (2.1–4.5)	3.7(2.3–5.2)	2.8 (1–4)	0.11
CRT size Dis 2 (mm)	4.5 (3.4–7.3)	5 (2.9–7.2)	3.7 (2–5)	0.06
CRT Length (mm)	10 (6.3–19)	11 (4.3–20.5)	16 (9.5–28.6)	0.10
Total CVC duration (day)	7 (4–10)	7 (4–10)	7 (4–9)	0.55

Wu Intens care med 2023 Intensive Care Med <https://doi.org/10.1007/s00134-023-07006-x>

- Common

- Risk: elderly, IJV, duration of cath insertion, Acoag

Minet C et al – Crit Care (2015) 19:287

- Uncertain relationship with PE

– increased by lower-limb deep venous thrombosis but not by upper-limb deep venous thrombosis

Minet C et al - Crit Care Med 2012; 40:3202–3208)

- Not always related to infection

Timsit JF et al - Chest. 1998;114:207–13;
Joynt et al Chest 2000; 117:178



En cas de suspicion d'ILC: 2 options

- ablation immédiate en cas de choc ou de sepsis
 - Rôle diagnostique et thérapeutique
 - 1 dose d'antibiotique avant l'insertion d'un nouveau cathéter?
- La plupart du temps on a besoin d'éliminer le diagnostic
 - Méthodes diagnostiques cathéter en place



Attitude devant une culture de cathéter positive?

HC simplement non faites ou simple colonisation de cathéter?

Thrombose de la veine cathétérisé augmente la vraisemblance d'infection (cave sup)

Les complications des ILC sont fréquentes

- Avec certains germes

S aureus >Enterococci, Candida> BGN non fermentants

- Et certaines maladies sous-jacentes Neutropénie, transplantation, dispositif intra vasculaire

- Le traitement diminue le risque de complications secondaires

S. aureus++, BGN non fermentants

REVIEW

A state of the art review on optimal practices to prevent, recognize, and manage complications associated with intravascular devices in the critically ill

Jean-François Timsit^{1,2,3}, Mark Rupp^{3,4}, Emilio Bouza^{5,6,7}, Vineet Chopra⁸, Tarja Kärpänen⁹, Kevin Laupland¹⁰, Thiago Lisboa^{11,12}, Leonard Mermel^{13,14}, Olivier Mimo^{15,16,17}, Jean-Jacques Parient^{18,19}, Garyphalia Poulikou²⁰, Bertrand Souweine^{21,22} and Walter Zingg²³

2 options
Watchful waiting
Short ABx therapy

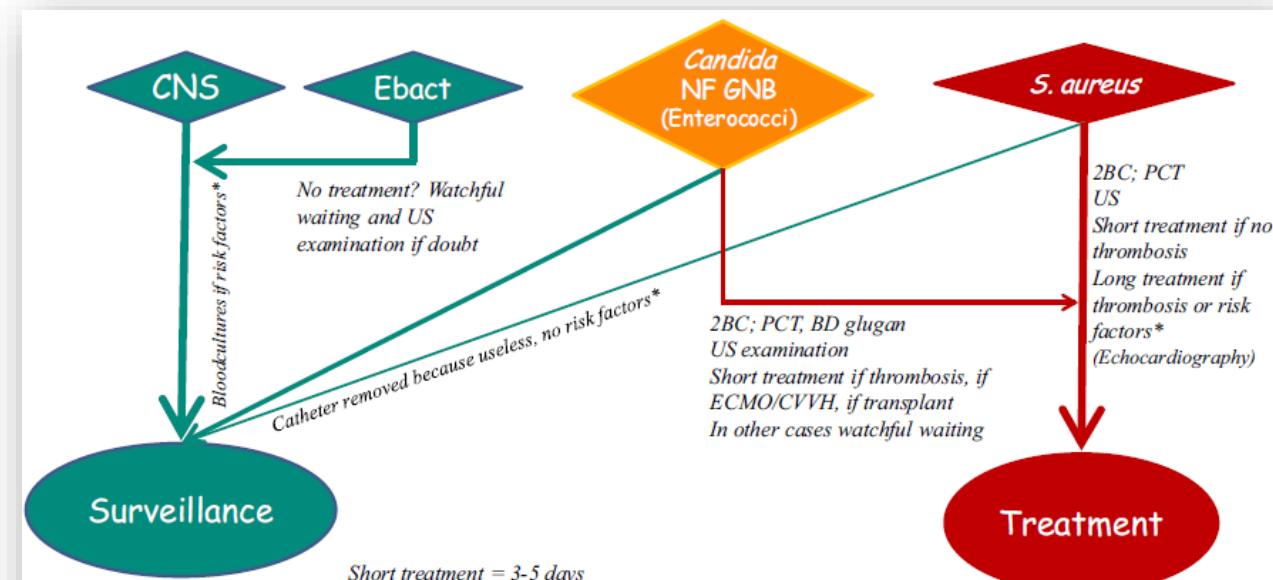


Fig. 1 Proposed strategy in case of positive catheter tip culture without positive blood culture. CNS coagulase negative staphylococci, Ebact Enterobacteriaceae, NF GNB non-fermentative gram-negative bacilli, US ultrasound examination, BC blood cultures, BDG 1,3-beta-D-glucan, ECMO extracorporeal membrane oxygenation, CVWH continuous veno-venous hemofiltration, PCT serum procalcitonin. Green boxes represent microorganisms for which the absence of therapy is reasonable most of the time. The risk of watchful waiting should be scrutinized for microorganism mentioned in the orange box. For *S. aureus* in red, the treatment is the most reasonable approach. *Risk factors: implantable devices or immunosuppression



Thromboses/Thrombophlébites?

- Si BLC + thrombus+ amélioration rapide et complète
 - Durée classique de traitement
 - Traitement anticoagulants?? / contrôle à J7
- Si thrombus + sepsis persistant/ HC positives persistantes
 - Traitement anticoagulant recommandé (bas niveau de preuve)
 - Durée de traitement prolongé 4-6 Semaines (bas niveau de preuve)



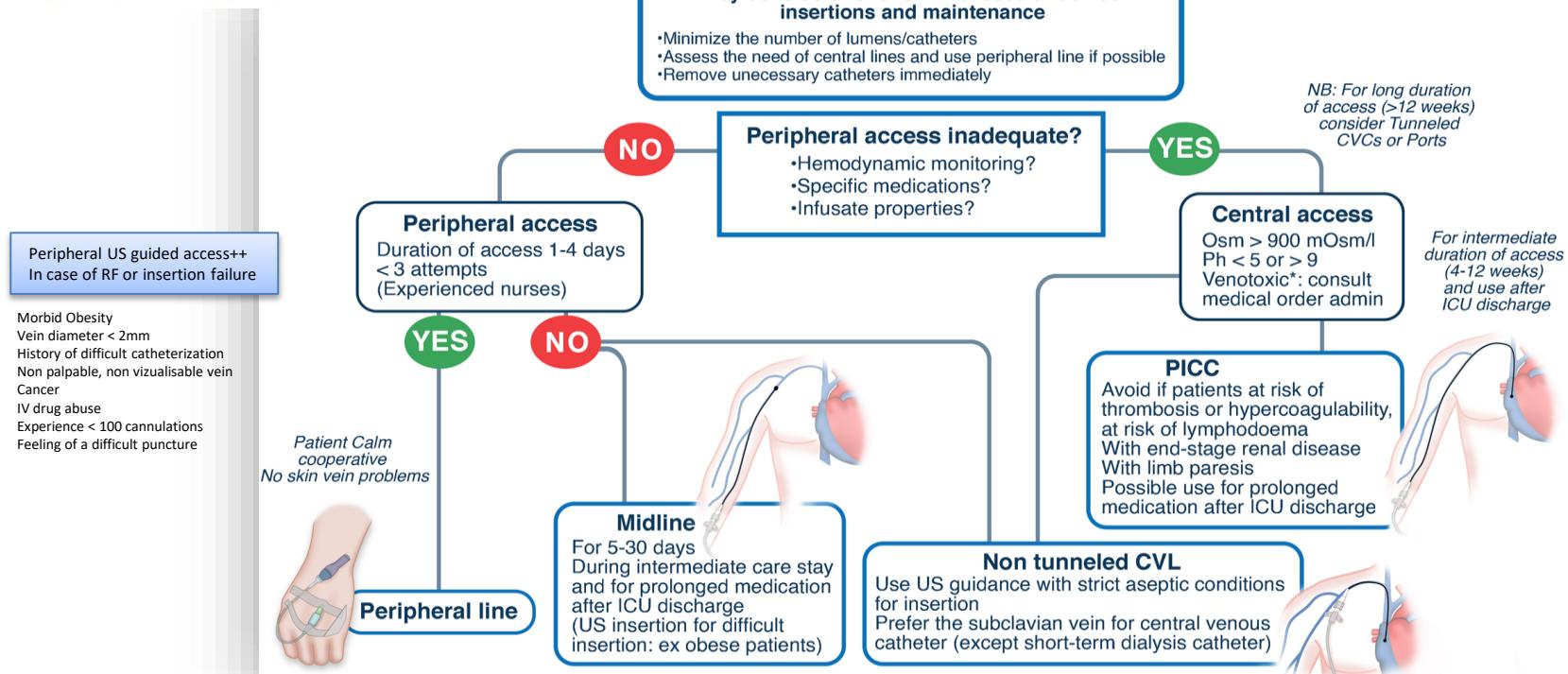
Règles de base pour le choix de la voie d'insertion du cathéter de l'urgence

- Préférer l'accès périphérique si possible (US)
- Midline échoguidée peut être une option intéressante?
- L'insertion d'un KT central doit utiliser l'abord ultrasonographique
- Enseignement/ simulation/ checklist à mettre en place avant de se lancer+++ (jamais la 1ere fois en urgence!!)

SPECIAL ISSUE INSIGHT

Update on prevention of intra-vascular accesses complications

Jean-François Timsit^{1,2*}, Alexis Tabah^{3,4,5} and Olivier Mimoz^{6,7}



Midline/ Piccs?

- Infectious risk AND thrombosis++
- Interest in case of **morbid obesity**
- Intermediate care units, prolonged medication after ICU discharge?
 - IV team++
 - US guided++
 - Experienced operator/ learning curve++- educational program and follow up+++



Figure 2.Midline for patient with difficult intravenous access (used with permission from Matthew Ostroff)



Figure 3 Peripherally inserted central catheter (PICC)
(Used with permission from PICC Excellence, Inc.)

Intravascular Complications of Central Venous Catheterization by Insertion Site

Jean-Jacques Parienti, M.D., Ph.D., Nicolas Mongardon, M.D.,
 Bruno Mégarbane, M.D., Ph.D., Jean-Paul Mira, M.D., Ph.D.,
 Pierre Kalfon, M.D., Ph.D., Antoine Gros, M.D., Sophie Marqué, M.D.,
 Marie Thuong, M.D., Véronique Pottier, M.D., Michel Ramakers, M.D.,
 Benoît Savary, M.D., Amélie Seguin, M.D., Xavier Valette, M.D.,
 Nicolas Terzi, M.D., Ph.D., Bertrand Sauneuf, M.D.,
 Vincent Cattoir, Pharm.D., Ph.D., Leonard A. Mermel, D.O.,
 and Damien du Cheyron, M.D., Ph.D., for the 3SITES Study Group*

Subclavian

- Less BSI
- less DVT
- more insertion failure
- more pneumothorax

If CVC optimal route?

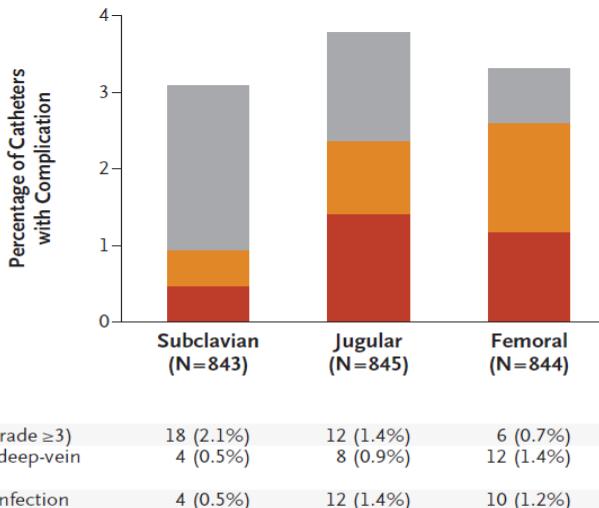


Figure 2. Complications in the Three-Choice Comparison, According to Insertion-Site Group.

The primary end point (the composite of symptomatic deep-vein thrombosis and bloodstream infection) differed significantly among the insertion-site groups ($P=0.02$ by the log-rank test), as did the principal safety secondary end point (mechanical complications) ($P=0.047$ by the chi-square test).

Parienti JJ et al – NEJM 2015; 373: 1320-29



Attention aux obèses morbides Risque particulier

Analyse post hoc de 5 ECT

2282 obèse ($BMI > 30$)

4275 catheters de 32 centres

Parmi les obèses,

1. **A $BMI > 40$ augmente le risque de BLC**
 1. Adj. HR 2.19, $p=0.01$
2. **Augmente le risque de décollement de pansement si $BMI > 40$**
3. **Sur-risque encore plus important si fémoral ou jugulaire.**



Prévention : les règles de base

- Bouquet de base
 - Hygiène des mains
 - Préférer la sous clavière
 - Asepsie chirurgicale à la pose
 - Utiliser de la chlorhexidine alcoolique (>1%)
 - Enlever les cathéters inutiles
 - Changement immédiat de pansement si souillés ou décollés
- Programme d'amélioration continue de la qualité adapté LOCALEMENT
- Surveillance, participation à un réseau

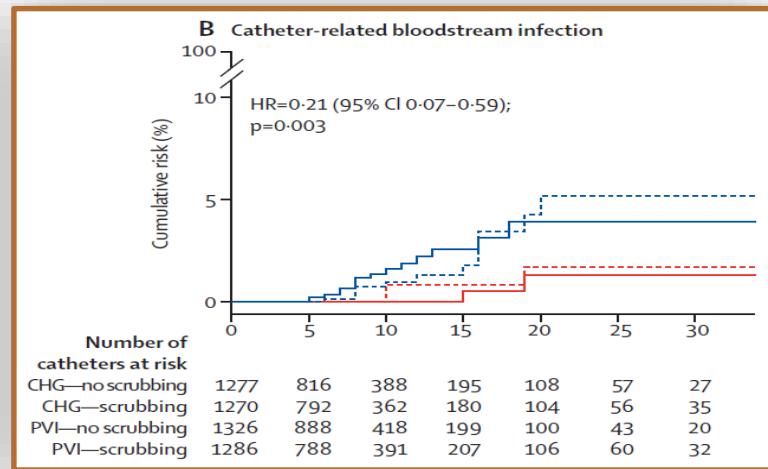


Niveau acceptable... (< 1 / 1000 par jour cathéter)

Antiseptis at insertion and for maintenance

R1.3—2% chlorhexidine-alcohol rather than povidone- iodine/alcohol should be used for skin disinfection before intravascular catheter insertion to decrease the infection rate.

GRADE 1+



Mimoz et al - Lancet 2016



Strict surgical aseptic condition at insertion

Strict surgical asepsis

- Closed room
- Sterile gloves,
- Long sterile gown
- Surgical mask
- Cap
- Sterile LARGE drapes

Improper



Proper



→ Should be the standard of care



<http://vimeo.com/1043633>

01:45

Minneapolis, MN

Strict surgical asepsis including US+++



Ultrasound Guidance and Risk for Central Venous Catheter-Related Infections in the Intensive Care Unit: A Post Hoc Analysis of Individual Data of 3 Multicenter Randomized Trials

Niccolò Buetti,^{1,2} Olivier Mimoz,³ Leonard Mermel,⁴ Stéphane Ruckly,¹ Nicolas Mongardon,⁵ Claire Dupuis,¹ Jean-Paul Mira,⁶ Jean-Christophe Lucet,^{1,7} Bruno Mégarbane,⁸ Sébastien Bally,⁹ Jean-Jacques Pariot,^{10,11} and Jean-François Timsit^{1,2}

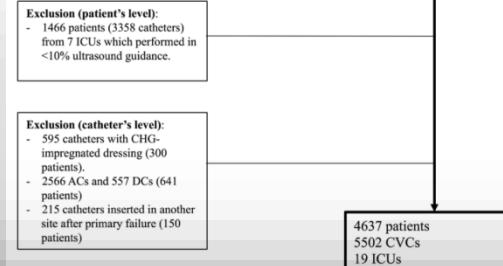


Table 3. Key Points for Optimal Ultrasound-Guided Central Venous Catheter Insertion With Focus on Infection Prevention Measures

1. Preprocedure

Operators should be familiar with the operation of their specific US machine prior to initiation of a vascular access procedure.

Use a high-frequency linear transducer with a long sterile sheath to perform vascular access procedures.

Use single-use sterile transmission gel.

Operators should evaluate the target blood vessel size and depth during preprocedural ultrasound evaluation.

2. Techniques

Operators should use a standardized procedure checklist that includes the use of real-time US guidance.

US guidance should be combined with aseptic technique and maximal sterile barrier precautions.

The needle tip should never be in contact with the sterile sheath of transducer.

3. Training

Novice operators should complete a systematic training program before attempting US-guided CVC insertion independently on patients.

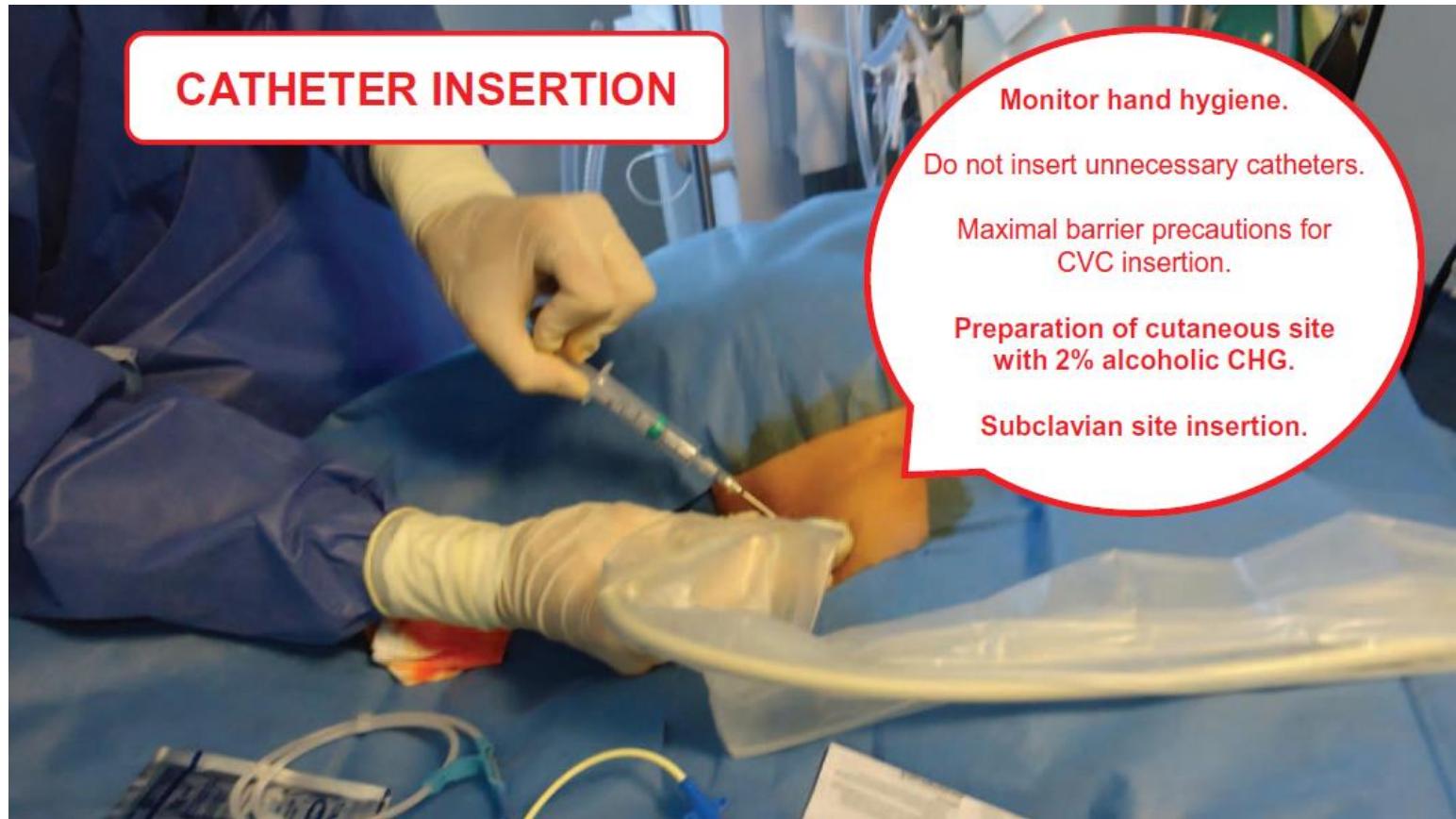
Cognitive training in US guided CVC insertion should include infection prevention strategies.

Trainees should demonstrate minimal competence in infection prevention measures before placing US-guided CVCs independently.

Competency assessments should include formal evaluation of knowledge in infection prevention measures using standardized assessment tools.

Periodic proficiency assessment of all operators should be conducted to ensure maintenance of competency.





CATHETER INSERTION

Monitor hand hygiene.

Do not insert unnecessary catheters.

Maximal barrier precautions for CVC insertion.

Preparation of cutaneous site with 2% alcoholic CHG.

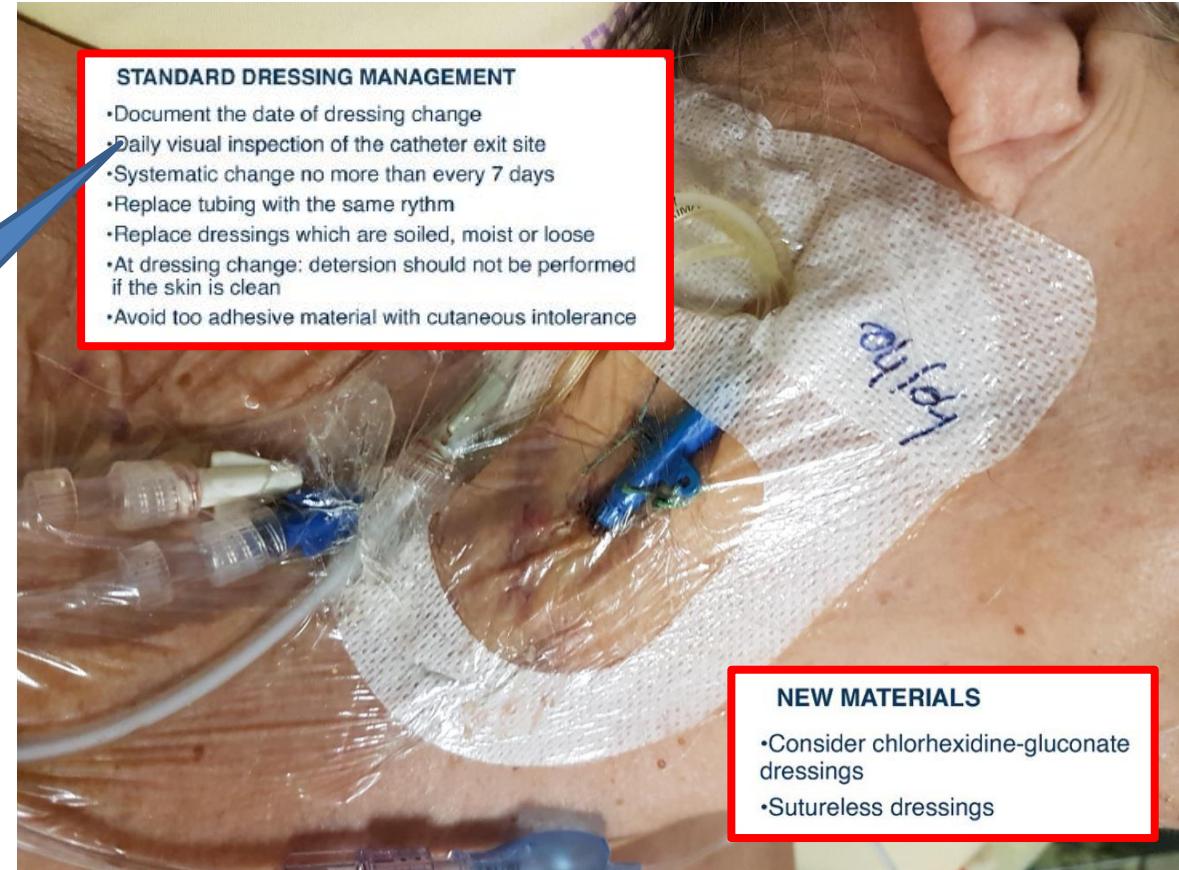
Subclavian site insertion.

LASTING LEGACY IN INTENSIVE CARE MEDICINE

Catheter dressings

Niccolò Buetti¹, Claire M. Rickard² and Jean-François Timsit^{3,4*} 

Dressing and tubing
every 7 days
Rapid dressing
change in case of
disruption





CHG Dressings



- **Halve the risk of CR-BSI**
- **Increased costs but cost effective**
- **Gels vs sponges??**
 - Gels: less dressing detachment
 - Sponges: less contact dermatitis

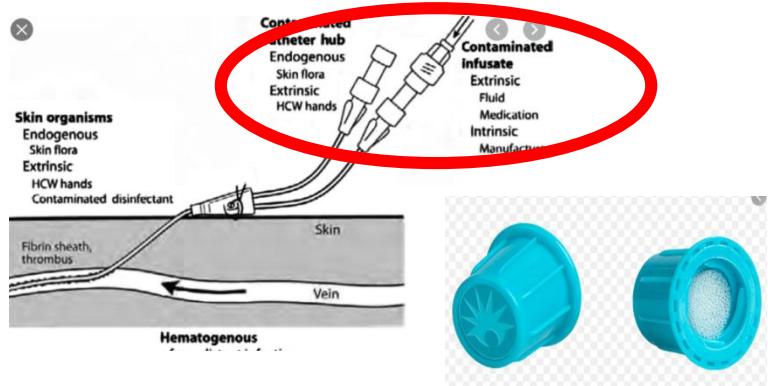
Timsit Jama 2009

Timsit AJRCCM 2012

Buetti N et al. Critical Care 2020. doi: 10.1186/s13054-020-03174-0.



Hub/connectors



1. Avoid manipulation
2. Lock be changed after each manipulation.
3. If valves lock friction with antisepsis of more than 5 sec. Decrease contamination
4. Role of the new impregnated valves? No data in ICU





Other innovative materials?

- Impregnated catheters
 - No definite proof if all the procedure is correctly made
 - In exceptional circumstances if the quality improvement program fails
 - Antibiotic or antiseptic Lock
 - Difficult in ICU (catheter use++)
 - A 10 min ethanol lock is effective in vitro but fails to reduce hemodialysis CRBSI in ICU
- Souweine B et al – AJRCCM 2015*
- Chlorhexidine bath
 - Discordant results
 - Effective on GP> GNB
 - Antiseptic (CHG) selection pressure..
 - Only in specific circumstances (outbreaks)



Messages

1. Les catheters sont la cause ppale des bactériémies nosocomiales en réanimation
2. L'ablation du catheter est l'attitude la plus prudente en cas de suspicion d'infection même si $\frac{3}{4}$ des catheters sont enlevés pour rien
3. Le traitement empirique doit etre actif non seulement sur les gram plus mais aussi sur les gram moins (écologie locale+++)
4. Si la fièvre persiste apres 2-3 jours / HC + → recherche de complications (EI, thrombophlébites)
5. Vous devez connaitre vos taux d'ILC, zero non réaliste
Cultivez vos catheters en cas de suspicion (definition large)
6. Adaptez les guidelines universels localement avec des incontournables
 1. Choix du site d'insertion (Periph. / (Midline) / Sous clavière)
 2. Asepsie chirurgicale/ incluant une insertion echoguidée stérile avec formation appropriée
 3. CHG-alc 2% en dehors des allergies
 4. Ablation des KT inutiles
 5. Changement immédiat des pansements décollés
7. Les pansements imprégnés de CHG sont efficaces
8. Les catheters imprégnés et les toilettes à la chlorhexidine doivent etre réservés à des situations particulières.



Jean-francois.timsit@aphp.fr



@JF_Timsit



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