

What is the optimal management of central venous lines in the NICU?

Prof. Daniele De Luca (MD, PhD)

Full Professor of Pediatrics

Division Chief

Pediatrics, Transportation and Neonatal Critical Care

APHP, Paris Saclay University Hospitals, Medical Center “A.Beclere”

Physiopathology and Therapeutic Innovation Unit,

Paris-Saclay University

Immediate Past President - European Society for Pediatric and Neonatal Intensive Care



What does this title mean?

- Choice of catheter and site
- Choice of technique and its details
- Maintenance (locks, infusions...)
- Dressing change
- Tubings change
- Serial checks
- Others...



**There is no hard evidence but all
these issues matter!
and...probably good results can be
achieved by several (combined)
interventions!**



Open, multilateral, living approach is the key! The goal is shared!

Doctors and NNS/NNP (insertion of CVL and dressing change)

Surgical handwash up to the elbows for 3 minutes with 2% Chlorhexidine skin cleanser and water. Dry thoroughly with sterile towels.

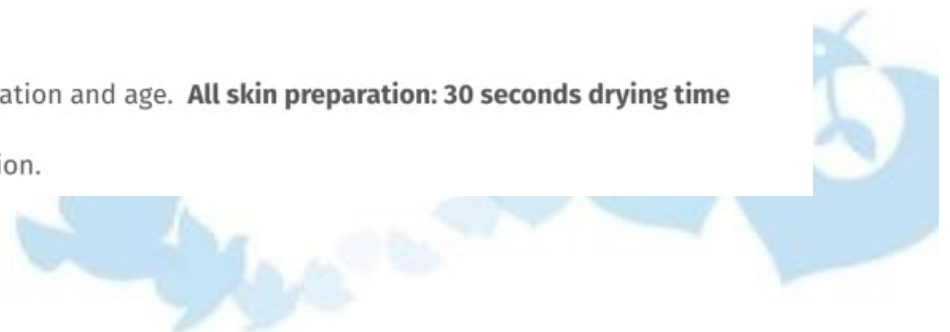
Nurses (central line fluids and medications/dressing change)

- Administering nurse: aseptic handwash up to the elbow for 1 minute with 2% Chlorhexidine skin cleanser or liquid soap and water. Dry thoroughly with sterile towels.
- Assisting nurse can use alcohol gel.

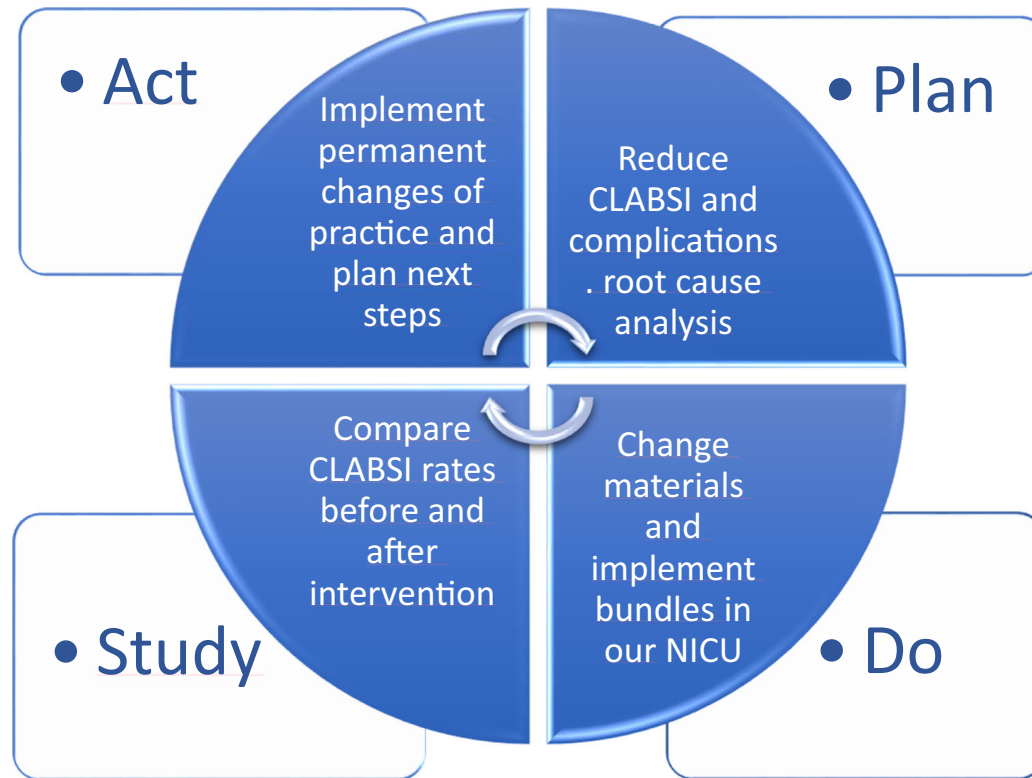
Setting up and maintenance

UAC/ UVC/long lines: All the tubing, priming and solutions used, must be set up using sterile technique.

1. UAC: Drawing up of blood and flushing of the tubing, from the UAC, is done with the ANTT technique.
2. All hub cleaning; **30 seconds scrub and 30 seconds drying time**
3. Clean the skin with the disinfectant appropriate for the infant's gestation and age. **All skin preparation: 30 seconds drying time**
4. Ensure early review of pump alarms as this may indicate line occlusion.



Critical, living appraisal of existing practices



Variously combined interventions

Table 2. Classification of Quality Improvement Interventions and Number of Studies

Quality Improvement Intervention (No. of Studies)	Definition and Examples
Education (n = 33)	Teaching lectures transmitting theoretical knowledge concerning CLABSI • Monthly sessions or a single lecture concerning CLABSI epidemiology or preventive interventions • Educational modules with pre- and posttest
Training (n = 4)	Training sessions for practical skills associated with CVC care and maintenance • Personnel training for aseptic CVC insertion on patient simulators
Feedback (n = 20)	Reporting of CLABSI or care item compliance rates to ICU personnel • Monthly reporting of infection rates at staff meetings • Posters of improving prevention measure compliance or CLABSI rates
Clinical reminders (n = 15)	Reminders of optimal clinical practice strategically placed to improve awareness or application of prevention measures • Posters advertising proper hand hygiene or monthly CLABSI rates • A daily reminder per patient asking whether a CVC can be discontinued • Stickers placed on CVCs or wearable lapel buttons reminding personnel of the importance of care processes • Procedure fact sheets, flowcharts, algorithms, or daily goals sheet
Bundle (n = 11)	A short list of at least 2 IHI prevention measures to be used during CVC insertion and/or maintenance • A bundle consists of 2–5 IHI care items • A bundle does not contain quality improvement interventions aiming at improving compliance with prevention measures
Checklist (n = 18)	Checklist of bundled care item prevention measures to increase adherence to evidence-based infection prevention practices • A checklist of 2–5 IHI care items is used during CVC insertion to improve adherence to a bundle of care items
Empowerment to stop procedure (n = 10)	Nurses are empowered to halt and restart CVC insertion care or maintenance when a prevention measure is not implemented correctly to ensure optimal catheter care
Surveillance: compliance monitoring (n = 12)	Nurses intermittently or continually supervise CVC insertion or maintenance prevention measures, with/without use of a bundle/checklist
Leader designation (n = 11)	A leader is designated to facilitate implementation of quality intervention processes by planning activities to improve awareness or introduction of bundled care items
Prepackaging of CVC materials (n = 16)	Use of a CVC cart or kit stocked with all necessary supplies to insert or maintain a central line
Infrastructure changes (n = 2)	Changes to hospital infrastructure to facilitate adherence to prevention measures • Installation of hand-rub dispensers to lower the threshold for personnel to apply antiseptic hand hygiene
Organizational changes (n = 4)	Organizational changes in personnel staffing or duties to improve adherence to prevention measures • Staffing of extra personnel to decrease the patient-to-nurse ratio • Only trained personnel may insert CVCs • Assistance in central line insertion or trainee supervision

Bundle/checklist interventions (n = 19)

Chua 2010 [59]	2	2408	6	1696		0.23	[.05–1.16]	0.8%
Duane 2009 [41]	35	3155	19	1152		0.67	[.38–1.17]	2.7%
Galpern 2008 [43]	7	7950	10	1988		0.17	[.07–0.46]	1.7%
Gozu 2011 [44]	6	7521	10	1678		0.13	[.05–0.37]	1.6%
Guerin 2010 [45]	3	2825	25	4415		0.19	[.06–0.62]	1.3%
Kim 2011 [47]	50	17 292	275	30 618		0.32	[.24–0.43]	3.6%
Koll 2008 [37]	349	167 015	364	91 615		0.52	[.45–0.61]	4.0%
Longmate 2011 [27]	8	6906	9	2660		0.34	[.13–0.89]	1.7%
Marra 2010 [8]	62	24 480	146	26 902		0.47	[.35–0.63]	3.6%
McLaws 2012 [35]	31	20 226	34	8981		0.40	[.25–0.66]	3.0%
Miller 2010 [28]	14	4116	28	3283		0.40	[.21–0.75]	2.5%
Peredo 2010 [63]	8	3572	24	3296		0.31	[.14–0.68]	2.0%
Render 2011 [38]	1630	656 115	681	117 058		0.43	[.39–0.47]	4.1%
Seddon 2011 [33]	5	2444	14	2059		0.30	[.11–0.83]	1.5%
Shannon 2006 [52]	20	19 473	49	4687		0.10	[.06–0.16]	2.9%
Tsuchida 2007 [53]	16	9699	23	5754		0.41	[.22–0.78]	2.5%
Venkatram 2010 [54]	8	4794	18	1670		0.15	[.07–0.35]	2.0%
Wall 2005 [55]	1	263	25	3571		0.54	[.07–4.01]	0.6%
Yoo 2001 [57]	2	1591	4	948		0.30	[.05–1.62]	0.7%
Random-effects model		961 845		314 031		0.34	[.27–0.41]	42.8%

Heterogeneity: $I^2 = 71.4\%$

Non-bundle/checklist interventions (n = 22)

Bijma 1999 [39]	8	1062	15	1146		0.57	[.24–1.36]	1.9%
Bonello 2008 [36]	25	8929	37	9487		0.72	[.43–1.19]	2.9%
Cherry-Bukowiec 2011 [26]	20	16 839	68	16 465		0.29	[.17–0.47]	3.0%
Coopersmith 2004 [22]	49	15 505	74	6874		0.29	[.20–0.42]	3.4%
Dixon 2010 [40]	7	3346	27	3148		0.24	[.11–0.56]	2.0%
Fraher 2009 [18]	204	13 900	113	5522		0.71	[.57–0.90]	3.8%
Frankel 2005 [42]	4	2353	26	2363		0.15	[.05–0.44]	1.5%
Gastmeier 2006 [34]	1064	613 686	651	306 419		0.82	[.74–0.90]	4.1%
Higuera 2005 [46]	55	2824	28	605		0.41	[.26–0.65]	3.1%
Lobo 2005 [60]	38	3182	48	2540		0.63	[.41–0.96]	3.2%
Lobo 2010 [66], ICU A	3	843	11	940		0.30	[.08–1.08]	1.1%
Lobo 2010 [66], ICU B	9	1694	30	2175		0.38	[.18–0.81]	2.2%
Lopez 2011 [48]	1	4171	28	4875		0.04	[.01–0.31]	0.6%
Perez Parra 2010 [64]	34	11 582	45	10 661		0.69	[.44–1.09]	3.1%
Rosenthal 2003 [49]	51	4726	56	1219		0.23	[.15–0.33]	3.4%
Rosenthal 2010 [24]	53	7206	134	8378		0.46	[.33–0.63]	3.6%
Santana 2008 [50]	8	1473	16	1679		0.57	[.24–1.33]	1.9%
Seguin 2010 [51]	2	2770	12	4297		0.26	[.06–1.15]	0.9%
Warren 2003 [61]	11	5210	30	6110		0.43	[.21–0.86]	2.3%
Warren 2004 [65]	41	7455	74	7876		0.58	[.40–0.86]	3.4%
Warren 2006 [56]	508	57 347	229	20 381		0.79	[.67–0.92]	4.0%
Zingg 2009 [58]	7	7279	24	6200		0.25	[.11–0.58]	1.9%
Random-effects model		793 382		429 360		0.45	[.36–0.55]	57.2%

Heterogeneity: $I^2 = 83.3\%$

Random-effects model

Heterogeneity: $I^2 = 85.4\%$

1 755 227 743 391

0.39 [.33; 0.46]

100%

0.01 0.1 1 10 100
favors intervention favors baseline



What are the hottest areas of interest ?

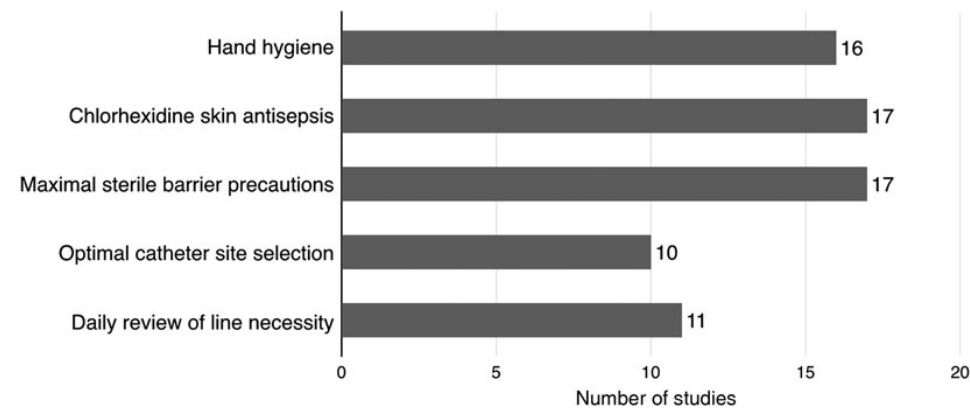


Figure 2. Frequency of included care items in bundles and checklists. Eighteen trials implementing bundle or checklist interventions reported which care



They actually work!

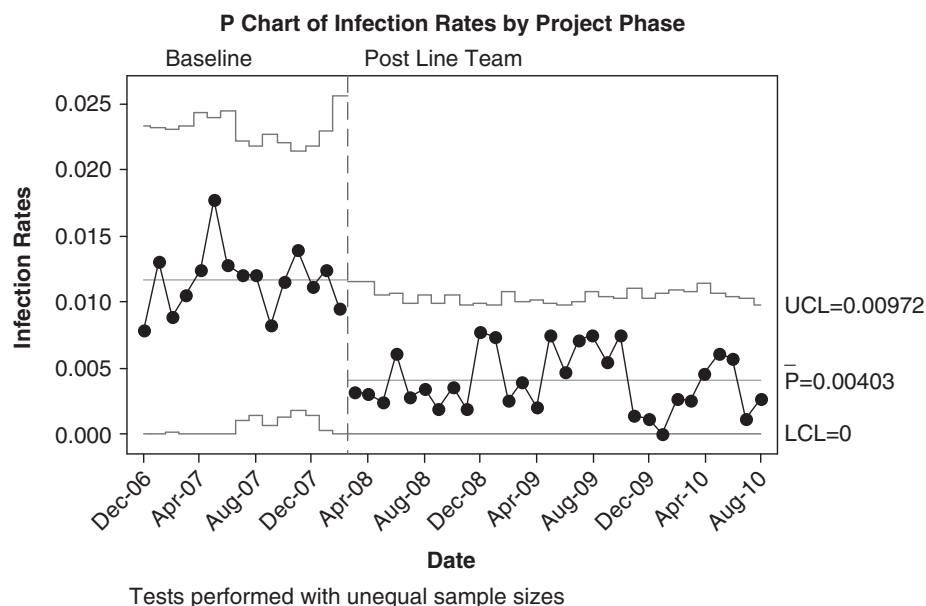


Figure 3 Plot of overall CLABSI rates before and after implementation of line team.

the unit. Training utilized standardized written protocols developed by infection control and NICU nursing leadership that formalized established guidelines for performance of line maintenance including: tubing changes, dressing changes and accessing of central lines for blood draws or medication administration (see Figures 1 and 2). Every member of the line team had to learn proper procedures and techniques for line maintenance, perform the procedure while being observed by a trainer and be checked off upon satisfactory demonstration of competence. Starting in March 2008, the line team took over performance of all tubing changes, accessing of central lines for blood draws and all dressing changes. Line team members worked in teams of two to perform dressing changes and tubing changes. Only members of the line team could perform these functions on any central line. Through September 2009, NICU nursing staff performed medication administration through central lines, however in October 2009, the line team took over this function as well.

Table 1 Birth-weight-specific CLABSI rates before and after line team implementation

Birth weight category (g)	Pre line team CLABSI rate ^a	Pre line team median rate	Post line team CLABSI rate	Post line team median rate	NHSN median rate	P-value ^b
<750	15.6	13.3	6.1	4.3	3.2	0.012
751–1000	9.7	8.8	5.3	4.9	2.5	0.095
1001–1500	12.8	14.9	3.2	0	1.4	0.001
1501–2500	9.8	9.0	2.1	0	0.7	0.001
>2500	9.5	10.0	2.5	0	0.0	<0.001

Abbreviations: CLABSI, central-line-associated bloodstream infections; NHSN, National healthcare safety network.

^aRate = CLABSI per 1000 line days.

^bχ² test of proportions for pre and post line team CLABSI rates.

How it is *certified* in Houston

Critical Element To prevent contamination and minimize the risk of sepsis in central venous catheters.	Met	Not Met
Demonstrates the procedure for changing IV fluids in umbilical, Percutaneous central, and surgically placed central lines. Line Team nurse refers to sterile nurse. A. Hand wash per unit policy B. Gather equipment. IV fluid, 1 hat, 1 mask, gloves, chlorhexidine gluconate (3.1%). C. Check IV fluids against the physician's order. D. Close vents at top of buretrol, turn buretrol upside down and remove old IV fluid from buretrol to old IV bag. Clamp off old IV bag fluids to prevent refilling of buretrol. If changing fluids in a syringe and the line has a syringe adaptor proceed step E. E. Prep site at connection of IV bag and spike or (syringe and syringe adaptor) from line for 20 secs. using chlorhexidine gluconate (3.15%) and a friction scrub. Allow site to dry for minimum of 30 secs. Remove old IV bag (syringe) and spike new fluids. F. Fill buretrol and drip chamber with new IV fluid. G. Prep access port (top and sides) closest to patient on main IV line with a friction scrub with chlorhexidine gluconate (3.15%) for 20 secs. and allow to dry for a minimum of 30 secs. Attach a sterile 30 cc syringe to access port. Clamp central line and crimp tubing below access port. Remove set-up from pump and open air detector clamp. Gently and slowly aspirate 10 cc's of fluid from line (thus bringing new IV fluids into line). If IV fluids are running faster than 10 cc's an hour there is no need to purge new fluids through system as the rate of IV fluids will deliver new fluids to patient within an hour (if in doubt pull the new fluids thru). Note: If IV fluids are pulled too quickly from line there is a risk of causing negative pressure thus having blood backup from central line once procedure is completed. Return IV fluids to IV pump. Unclamp central line after placing fluids on pump. H. Set rate per order and double check with another nurse.		
Evaluator's Signature:		
Employee's Signature: I understand that it is my professional responsibility and a part of my job description to Follow this practice safely and accurately for the patients.		
Date Completed:		
Comments:		

Figure 2 Criterion checklist changing IV fluids in umbilical, percutaneous central, and surgically placed central lines.

How it is *certified* in Paris

Formal procedures for dressings, checks, changes and tubings management

	 Réfection du pansement du cathéter veineux central en réanimation néonatale
---	--

	PRENOM, NOM	FONCTION	DATE
REDACTION 	Claudine DUPORT		

MONTAGE DES DIFFERENTS CATHETER CENTRAUX

Voie DISTALE	Voie PROXIMALE
<u>Voie sur laquelle passe :</u> 1) La Base (NPP/NN1/NN2/PSOE...) au plus loin du patient. 2) Les sédations (qui peuvent subir de légers Bolus → éviter le DEXDOR®, l'ALFENTANIL®, et l'ULTIVA® sur cette voie) entre la base et la voie des discontinus. 3) La voie des intra veineux discontinus au plus près du patient. 5) Les SMOFLIPIDES® et VITALIPIDES® sont mis sur cette voie QUE s'il y a des catécholamines sur la proximale, ceci peut attendre lorsque le flux est fait. 6) Sur le KTEC simple voie en silicone mettre un raccord valvé car pas de clamp présent sur celui-ci.	<u>Voie sur laquelle passe :</u> 1) Une base de type NN1/NN2/PSOE ou G5%/ NaCl 0.9% doit être mis avec les catécholamines si le débit est <0.5ml/h, sinon les SMOFLIPIDES sont mis sur la proximale peu importe leur débit avec +/- d'autres médicaments compatibles. 2) La vancomycine en IVSE et toutes les sédations peuvent être mises sur la proximale afin d'éviter les interactions médicamenteuses.  IMPORTANT : Sur la VOIE PROXIMALE si présence d'amines faire un relais pour CHAQUE traitement présent.

	veronique PONTANIER		
VALIDATION	Daniele DE LUCA		



Le personnel ci-dessous a pris connaissance de la procédure décrite ci dessus

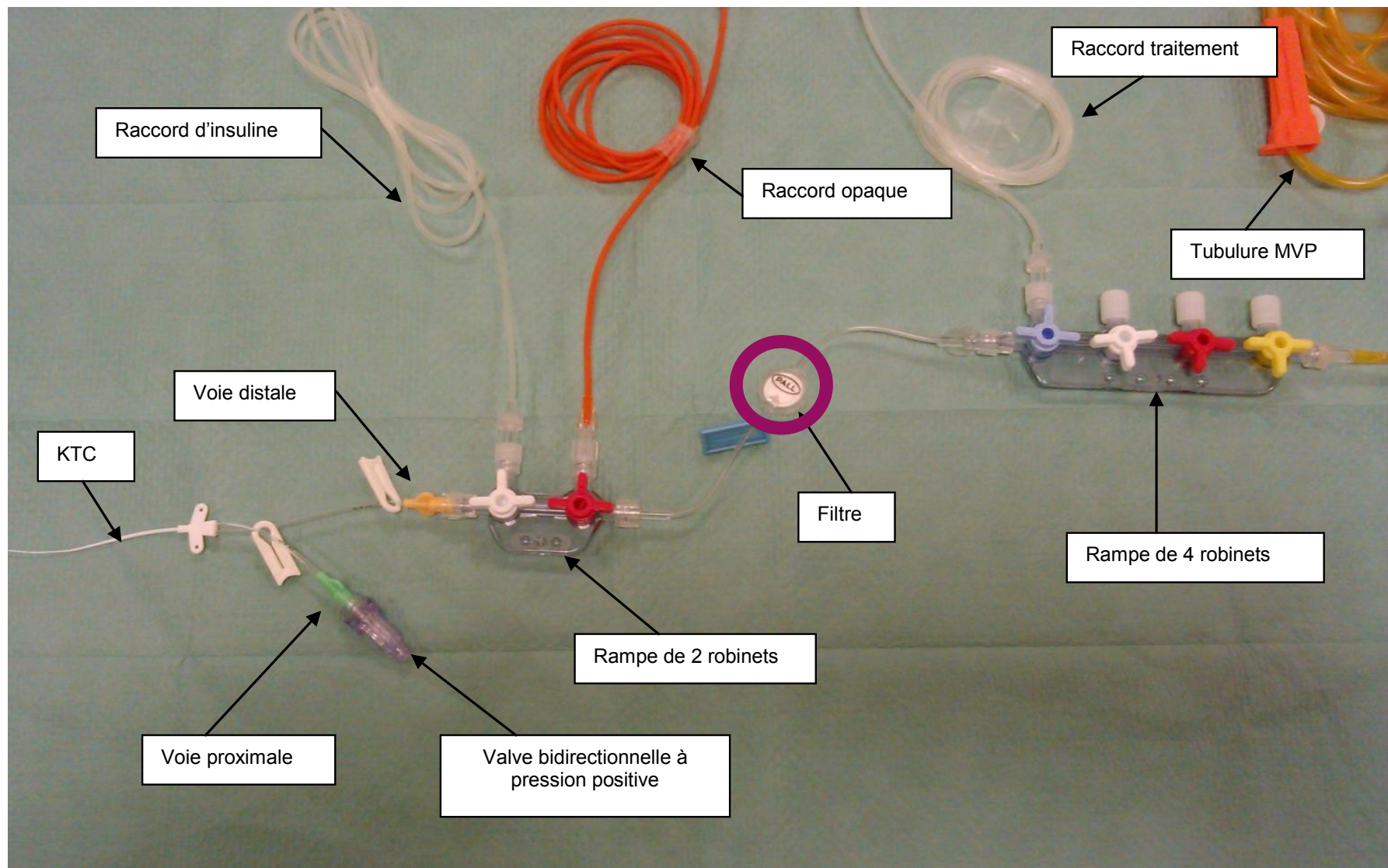
Nom

Fonction

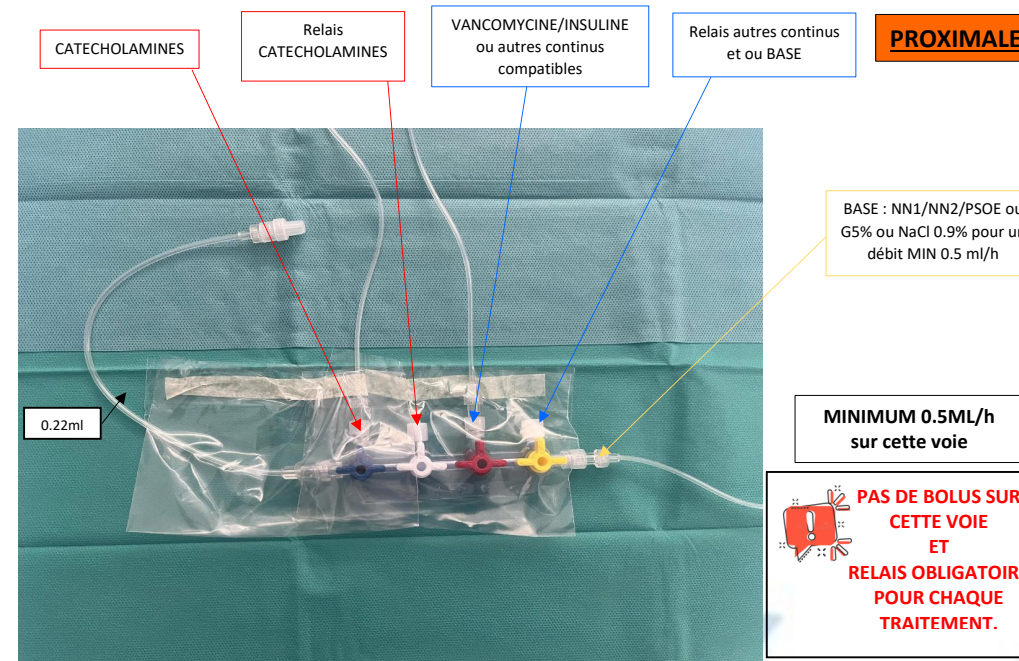
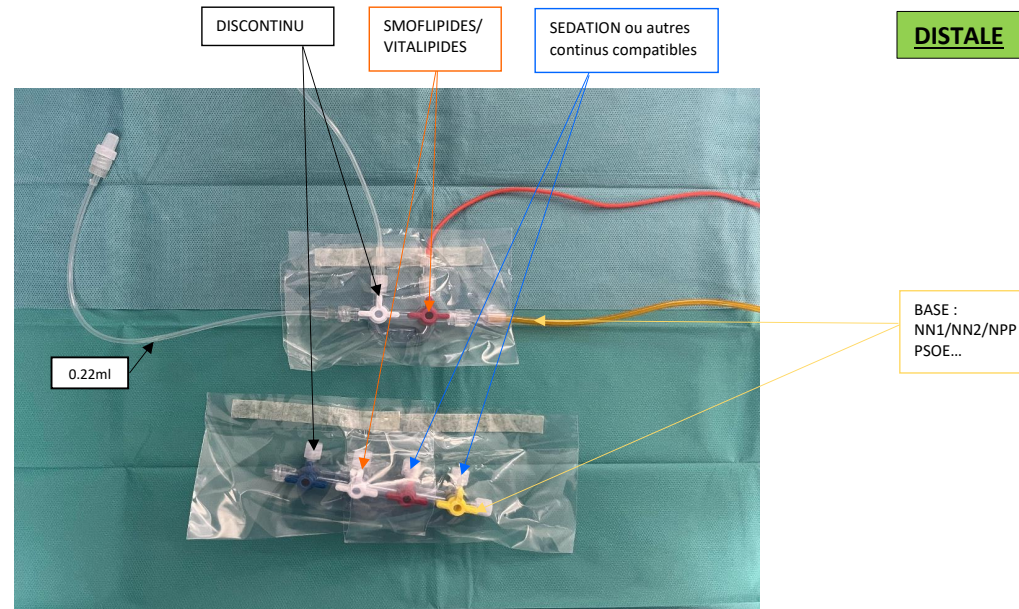
Date

signature





AVEC CATECHOLAMINES





CONNAITRE CARACTÉRISTIQUES DES CATHÉTERS ARTÉRIELS ET VEINEUX CENTRAUX

CATHÉTER ARTÉRIEL OMBILICAL



CATHÉTER VEINEUX OMBILICAL

CATHÉTER EPICUTANÉO - CAVE



CATHÉTER CICC

Hôpital
Assistance
AP-HP

ASSISTANCE
PUBLIQUE
HÔPITAUX
DE PARIS

COMPATIBILITES DES MEDICAMENTS INJECTABLES ADMINISTRES EN Y

Voici votre carte de compatibilité des médicaments injectables administrés en Y. Elle est à jour au 15/05/2017.

Recommandations générales :

- Compatibilité validée par nos soins : médicaments injectables administrés en Y.
- En cas de doute, consultez votre pharmacien ou votre infirmier.
- Pour tous les médicaments, vérifiez la compatibilité avec le solvant et le diluant.
- La compatibilité est validée pour les médicaments injectables administrés en Y.
- Consultez les notices des médicaments pour plus d'informations.
- Pour les médicaments administrés en Y, vérifiez la compatibilité avec le solvant et le diluant.
- La compatibilité est validée pour les médicaments injectables administrés en Y.
- Consultez les notices des médicaments pour plus d'informations.

Code couleur :

- compatible sans précaution
- compatible avec précaution
- incompatible
- aucune donnée publiée concernant la compatibilité
- référence analogique

Les données de compatibilité de ce tableau sont basées sur les données de compatibilité des médicaments injectables administrés en Y, validées par nos soins. Elles ne sont pas recommandées pour les médicaments injectables administrés en Y.

Si vous avez des questions ou des remarques, contactez votre pharmacien ou votre infirmier.

Document communiqué par : Pharmacie des Hôpitaux de Paris, 15/05/2017.

The scanty evidence we have

TABLE 1. Decision Table for the Central Line Maintenance Bundle

VAD	Skin Antiseptic	Dressing Type	Frequency of Dressing Change
Nontunneled PICC, PCVC, internal jugular, femoral, subclavian	For all CL after removal of dressing to clean skin <i>10% povidone iodine</i> : Use for infants <1500 g or 28-wk gestation. Use until 2 wk of life. ^{1,10,11} Also use for any patient not tolerant of chlorhexidine. After application of povidone iodine, allow to dry and use saline wipes to remove from skin ^{1,10} <i>Chlorhexidine</i> : Use for all other patients ^{7,10,11}	Transparent, bordered dressing with steri-strips. ^{2,6,9} <i>OR</i> Gauze dressings for patients who do not tolerate a transparent dressing, or who have skin breakdown or oozing ^{1,7,9}	<i>Only</i> if dressing becomes compromised ^{8,14} <i>OR</i> Gauze dressings, change every 48 h or when wet, loose/nonocclusive, or if the patient develops problems at the site that require further inspection ^{8,9,14}
Tunneled or cuffed CL (ie, Hickman, Broviac, implanted port-accessed)			Every 7 d, if dressing becomes compromised, or if the patient develops problems at the site that require further inspection ^{2,8,14}

Abbreviations: CL, central line; PCVC, percutaneous central venous catheter; PICC, peripherally inserted central catheter; VAD, vascular access device.



Summary of Recommendations for Practice and Research

What we know:

- The risk of CL compromise and infection far outweighs the potential benefit from frequent dressing changes.
- At a tertiary care center the needs are unique and different from the needs of other NICUs.
- Once a CL is placed, it is better to leave the line alone unless absolutely necessary to reduce complications.
- Complex physiology where abdominal flora or oxygen uptake may be compromised should heighten awareness about care management when there is a CL in place.

What needs to be studied:

- Can this process work equally as well for tunneled catheters?
- Can this process be expanded into other units?

What we can do today:

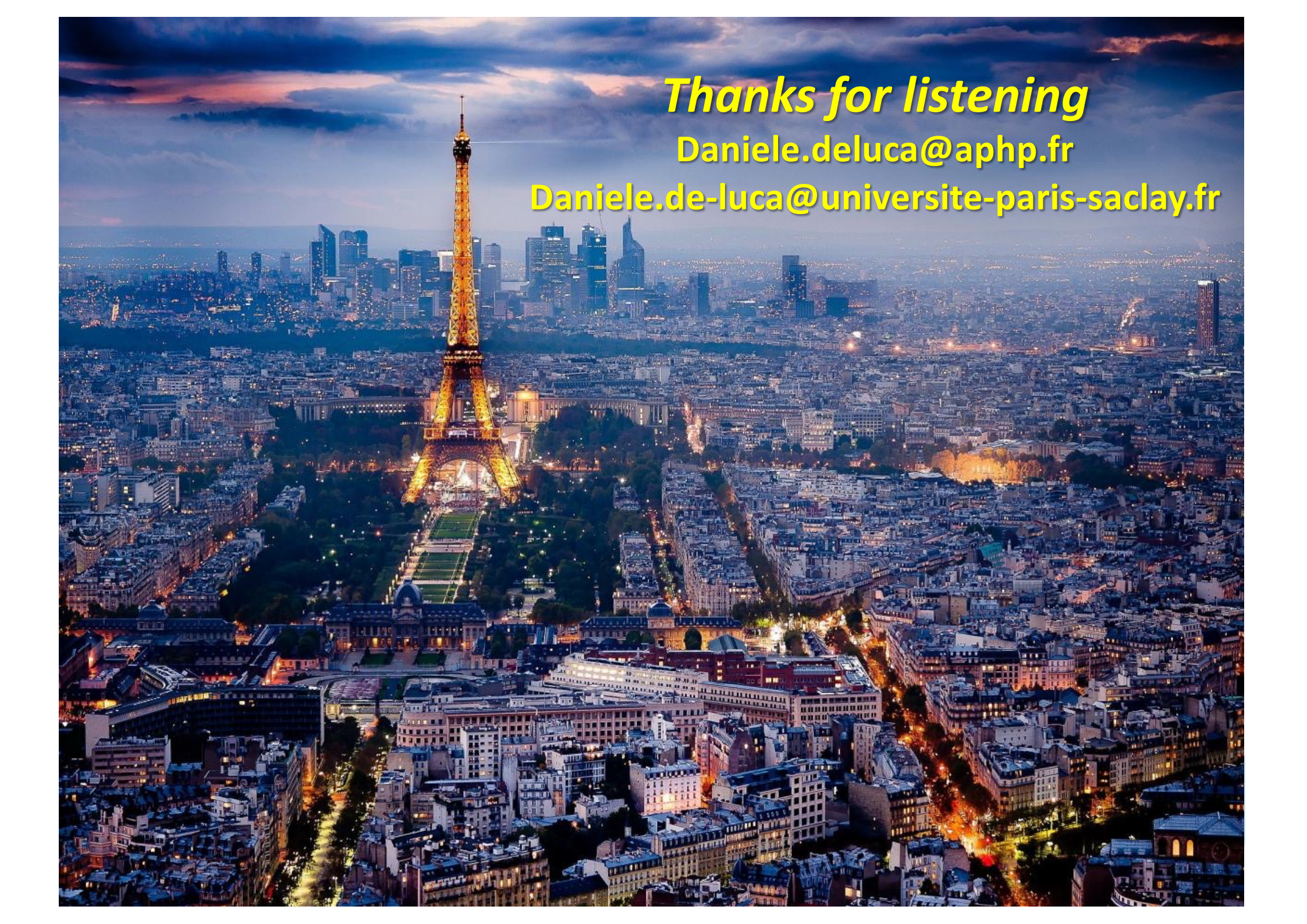
- Continue the new maintenance bundle for all nontunneled catheters and continue to monitor dislodgement and infection rates.
- Expand the protocol to tunneled PICC lines and monitor rates closely.
- Continue to stress the importance of a 2-person sterile dressing change technique.
- Every day during morning rounds, address the need for the central line.





- | | | |
|------|---|----------------------------|
| 9.d. | Consider removal of umbilical venous catheters and inserting a peripherally inserted central catheter (PICC) or other long-term central venous catheter at or before 7 days of umbilical venous catheter dwell time for neonatal intensive care unit (NICU) patients requiring long-term central venous access. | Conditional Recommendation |
|------|---|----------------------------|



An aerial night photograph of Paris, France. The Eiffel Tower is the central focus, brightly lit with golden lights. The city's dense urban landscape is visible, with numerous buildings and streets illuminated by city lights. The sky is dark with some clouds, and the overall atmosphere is that of a vibrant city at night.

Thanks for listening

Daniele.deluca@aphp.fr

Daniele.de-luca@universite-paris-saclay.fr