

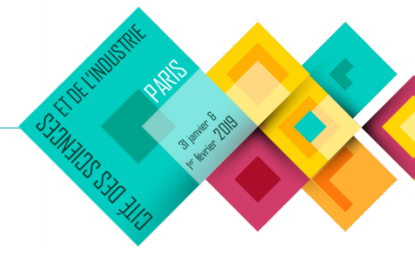
Cyanoacrylate glue for venous access devices

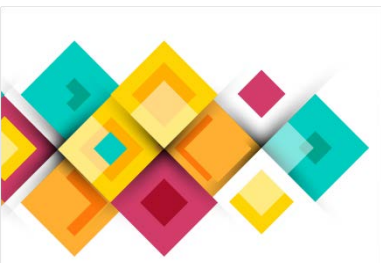


UNIVERSITÀ
CATTOLICA
del Sacro Cuore

Mauro Pittiruti

WoCova
World Congress Vascular Access



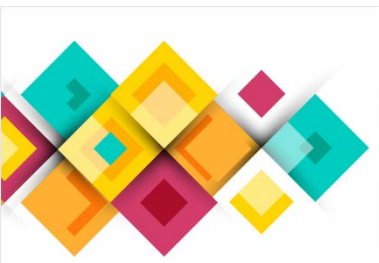


Glue

One of the most relevant novelties of the last six years in the field of venous access devices:

- 100% control of bleeding from the exit site
- Improved securement for at least 7 days
- Safe and effective method for skin closure
- Sealing of the exit site against the risk of extraluminal contamination





Topical Tissue Adhesive

- ▶ N-butyl-cyanoacrylate (BCA)*
 - ▶ Dries faster
 - ▶ More rigid - protection against straight pull-out forces
 - ▶ Less expensive
 - ▶ Requires minimum 24 hours before fully water resistant
- ▶ 2-octyl-cyanoacrylate (OCA)*
 - ▶ Higher tensile strength
 - ▶ More flexible - protection against lateral and shear forces
 - ▶ Less cyto-toxic and reduced thermal reaction
 - ▶ Immediately water-resistant

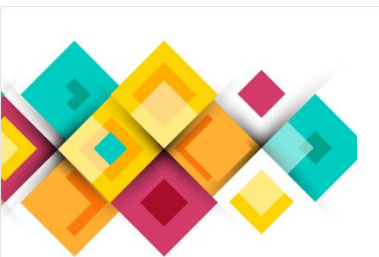
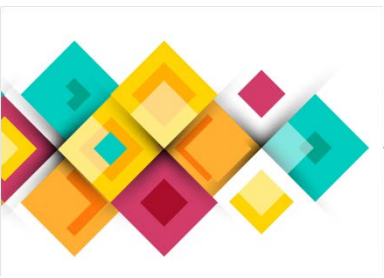


Table 1. A selection of tissue adhesives used for skin closure or with vascular access devices*

Brand name (manufacturer)	Chemical constitution	Presentation (ml)	Storage (Celsius)	Time to degradation (days)	Properties
Histoacryl/Histoacryl Blue (B.Braun, Melsungen, Germany)	NBCA	0.5	< 22	7–10	<ul style="list-style-type: none"> ■ High tensile strength ■ Microbial barrier ■ Quick setting time
Histoacryl Flexible (B.Braun, Melsungen, Germany)	NBCA + softener	0.5	< 25	7–10	<ul style="list-style-type: none"> ■ High tensile strength ■ More flexible than NBCA ■ Less heat production on application ■ Microbial barrier
Dermabond (Ethicon, Somerville, NJ, USA)	OCA	0.36, 0.7	< 30	5–10	<ul style="list-style-type: none"> ■ Higher tensile strength than NBCA ■ More flexible than NBCA ■ Microbial barrier
Surgiseal/SecurePortIV (Adhezion Biomedical, Wyomissing, PA, USA)	OCA	0.35, 0.5 (Surgiseal) 0.15 (SecurePortIV)	< 30	5–10	<ul style="list-style-type: none"> ■ Higher tensile strength than NBCA ■ More flexible than NBCA ■ High moisture vapour transmission rate ■ Microbial barrier
Glubran Tiss2 (GEM, Viareggio, Italy)	NBCA + OCA	0.25, 0.35, 0.5	0–4	5–8	<ul style="list-style-type: none"> ■ Improved flexibility ■ High tensile strength ■ Breathable ■ Less heat production on application ■ Microbial barrier
Indermil flexifuse (Connexicon, Dublin, Ireland)	NBCA + OCA	0.75	4–30	5–8	<ul style="list-style-type: none"> ■ Flexibility ■ High tensile strength ■ Minimal heat produced ■ Microbial barrier

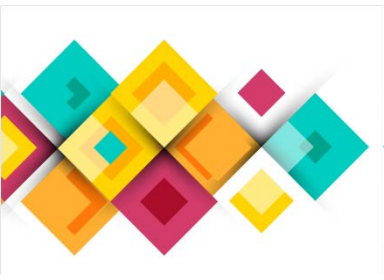
*Information in this table is obtained from manufacturers' website and/or product information brochures; NBCA, N-butyl-2-cyanoacrylate; OCA, 2-octyl-cyanoacrylate.



Glue = protection of the exit site

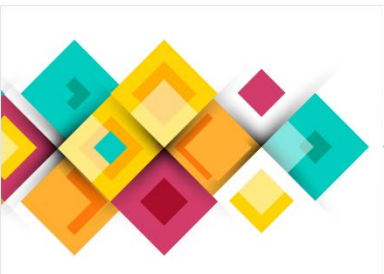
- From bleeding
- From bacterial contamination
- From dislodgment



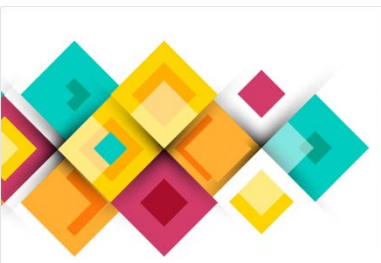


Different endpoints

- Securement?
- Prevention of bleeding?
- Prevention of extraluminal contamination?
- Skin closure?



Glue for securement



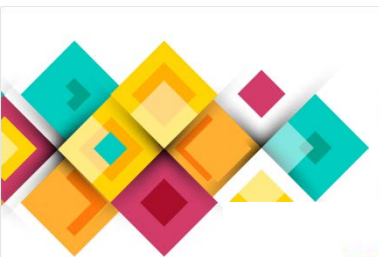
A few papers on securement of CVC

2007 – Wilkinson et al.: Tissue adhesive as an alternative to sutures for securing central venous catheters (Anaesth)

2008 – Smith et al.: Reply to Wilkinson et al.

2014 – Lawrence et al.: Histoacryl for securing central venous catheters: not so sticky (Anesth)

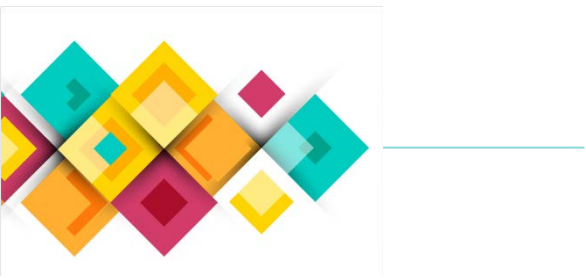
2016 - Rickard et al.: A four-arm randomised controlled pilot trial of innovative solutions for jugular central venous access device securement in 221 cardiac surgical patients (J Crit Care)



Tissue Adhesive - Acute Care IJ CVADs

- 4-arm randomized trial elective cardiac surgical patients, 5th arm added ¹⁸
 - 8.5 Fr, 20 cm quad lumen or 7 Fr, 16 cm triple lumen, all chlorhexidine impregnated, all inserted by IJ vein.

	Suture + BPU	Suture + lattice pad dressing	SSD + SPU	TA + SPU	TA + Suture + SPU
Number	55	56	55	23	30
Catheter failure (%)	2 (4)	1 (2)	4 (7)	4 (17)	0 (0)
Median dwell time in hours	69	68.2	67.8	69	72.2



2012

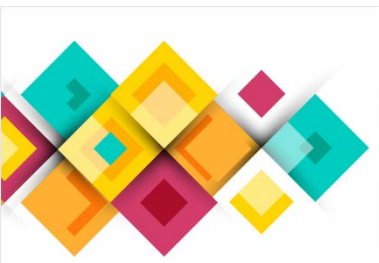
Anaesth Intensive Care 2012; 40: 460-466

Cyanoacrylate tissue adhesives – effective securement technique for intravascular catheters: in vitro testing of safety and feasibility

G. SIMONOVA*, C. M. RICKARD†, K. R. DUNSTER‡, D. J. SMYTH§, D. MCMILLAN**,
J. F. FRASER††

Critical Care Research Group, University of Queensland and Prince Charles Hospital, Brisbane, Queensland, Australia

TA was quick and easy to apply to IVCs, with no irritation or skin damage noted on removal and no bacterial colony growth under either TA.



2015

R E V I E W A N D C O M M E N T A R Y

CE

Examining the Role of Securement and Dressing Products to Prevent Central Venous Access Device Failure: A Narrative Review



Amanda J. Ullman, MAppSci, RN, GCert PICU

Marie Cooke, PhD, RN

Claire M. Rickard, PhD, RN

School of Nursing and Midwifery, Griffith University, Nathan Campus, Queensland, Australia; and National Health and Medical Research Council Centre of Research Excellence in Nursing, Centre for Health Practice Innovation, Menzies Health Institute Queensland, Griffith University, Nathan Campus, Queensland, Australia

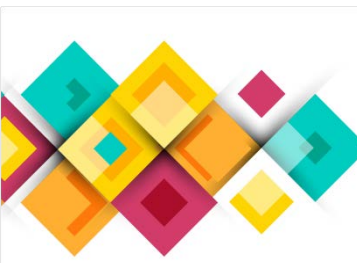


Figure 2. Application of skin glue: 1 drop to the skin insertion site and 1 drop under the peripheral intravenous catheter hub.

2015

Peripheral intravenous catheter failure was 10% lower with skin glue (17%) than standard care (27%), and dislodgement was 7% lower.

THE PRACTICE OF EMERGENCY MEDICINE/ORIGINAL RESEARCH

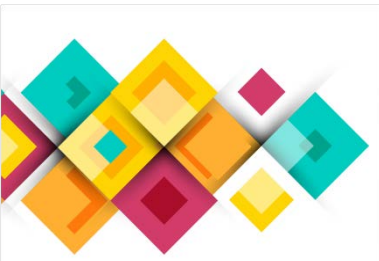
Skin Glue Reduces the Failure Rate of Emergency Department–Inserted Peripheral Intravenous Catheters: A Randomized Controlled Trial



Simon Bugden, MBChB, FACEM*; Karla Shean, RN; Mark Scott, MBBS, FACEM; Gabor Mihala, MEng(Mech), GradCert(Biostatistics); Sean Clark, MBBS, FACEM; Christopher Johnstone, MBChB, FACEM; John F. Fraser, MD, PhD; Claire M. Rickard, PhD, RN

*Corresponding Author. E-mail: simon.bugden@health.qld.gov.au.

2015



JVA

ISSN 1129-7298

J Vasc Access 2015; 16 (3): 237-244

DOI: 10.5301/jva.5000348

ORIGINAL ARTICLE

Securement methods for peripheral venous catheters to prevent failure: a randomised controlled pilot trial

Nicole Marsh^{1,2}, Joan Webster¹⁻³, Julie Flynn^{1,2}, Gabor Mihala^{2,4}, Barbara Hewer¹, John Fraser^{4,5}, Claire M. Rickard^{1,2,5}

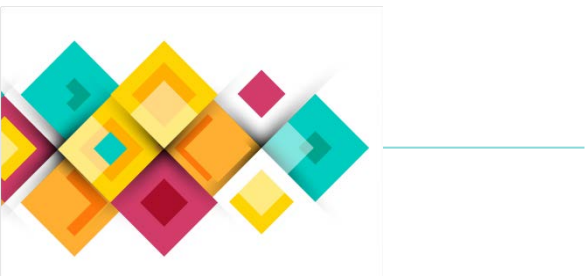
¹ Centre for Clinical Nursing, Royal Brisbane and Women's Hospital, Herston - Australia

² NHMRC Centre for Research Excellence in Nursing, Centre for Health Practice Innovation, Griffith Health Institute, Griffith University, Brisbane - Australia

³ School of Nursing and Midwifery, University of Queensland, Brisbane - Australia

⁴ School of Medicine, Griffith Health Institute, Griffith University, Meadowbrook - Australia

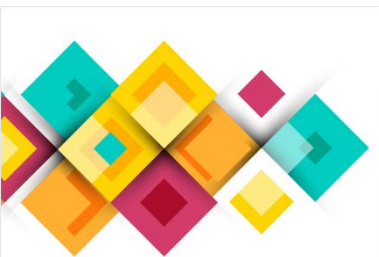
⁵ Critical Care Research Group, Adult Intensive Care Services, The Prince Charles Hospital and University of Queensland, Queensland - Australia



2017

Tissue adhesive for vascular access devices: who, what, where and when?

Amanda Corley, Nicole Marsh, Amanda J Ullman and Claire M Rickard



2015

Downloaded from <http://bmjpaedsopen.bmj.com/> on March 29, 2018 - Published by group.bmj.com

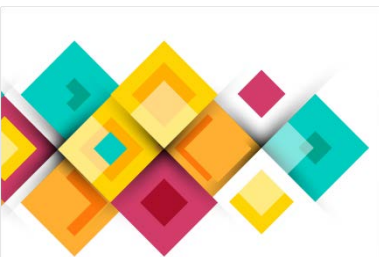
Open Access

Original article

BMJ
Paediatrics
Open

Ultrasound-guided placement of long peripheral cannulas in children over the age of 10 years admitted to the emergency department: a pilot study

Angela Paladini,¹ Antonio Chiaretti,¹ Kidane Wolde Sellasie,² Mauro Pittiruti,³ Giovanni Vento¹



Glue as securement for ECC in neonates

Use of cyanoacrylate glue for the sutureless securement of epicutaneo-caval catheters in neonates.

G. Barone, V. D'Andrea, G. Vento, L. Pezza, M Pittiruti.

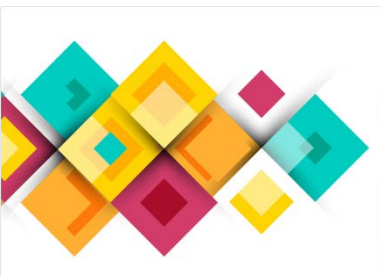
2019



In 2018, 134 ECC (1-2Fr polyurethane catheters) were inserted in 92 preterm and term neonates and all of them were secured with CG + TSD; 124 ECC inserted in 80 preterm neonates in 2017 were used as controls. The use of CG was not associated with any side effect. The incidence of accidental dislodgement was significantly reduced from 35% to 20% ($p < 0.007$). CG was safe and easy to apply, and it yielded the additional advantage of being very effective in preventing any bleeding/oozing at the puncture site. Removal of CG was consistently easy and uneventful.



Glue for control of bleeding



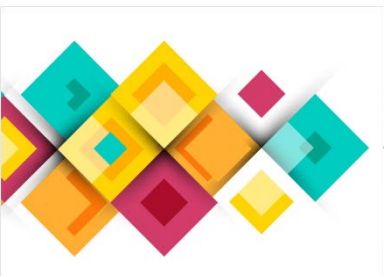
The first report in the literature:

Cyanoacrylate glue prevents early bleeding of the exit site after PICC placement

M.Pittiruti, G.Scoppettuolo, and A.Emoli

WoCoVA 2012, Amsterdam – Abstract published on JVA

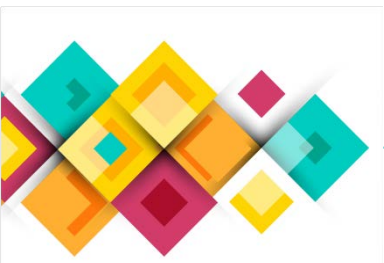
2012



Background

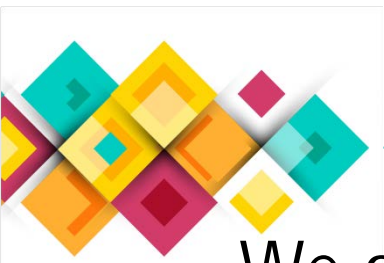
In our hospital, the rate of significant local bleeding after placement of PICCs *without reverse tapering* may be as high as 40% at 1 hour and 15% at 24 hrs.





Method

- The aim of this pilot study was to verify the efficacy of cyanoacrylate glue in reducing the risk of early bleeding at the exit site after PICC placement.
- We studied a group of adult patients consecutively undergoing placement of silicon and polyurethane PICCs without reverse tapering, in a non-intensive ward of our Hospital.

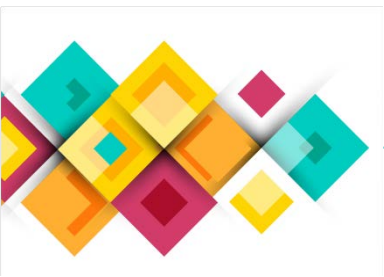


Method (2)

We adopted the same inexpensive cyano-acrylate glues commonly used for sutureless skin repair.

The glue was used on the exit site, at the end of the procedure, soon after the securement with a sutureless device, before dressing the wound.

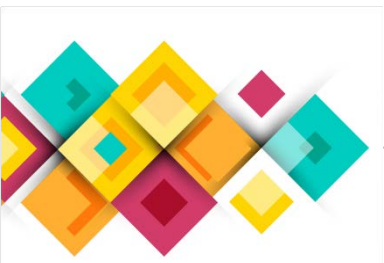




Method (3)

- Two minutes after placement of the glue, the exit site was covered with a temporary gauze dressing, which was replaced by transparent dressing at 24 hrs.
- All patients were assessed at 1 hour and at 24 hours.

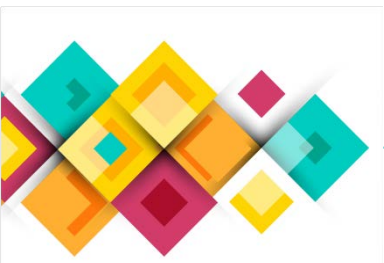




Results

- In 45 consecutive patients, there was no significant local bleeding at 1 hour or at 24 hours after PICC placement.
- No local adverse reaction occurred.

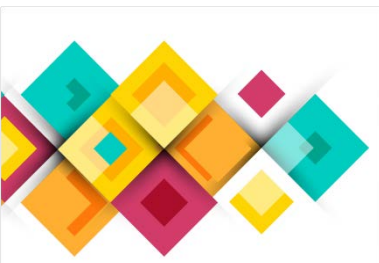




Conclusion

- Glue is a safe, inexpensive and highly effective tool for avoiding the risk of early bleeding of the exit site after PICC placement.





ESICM congress, 2013

2013

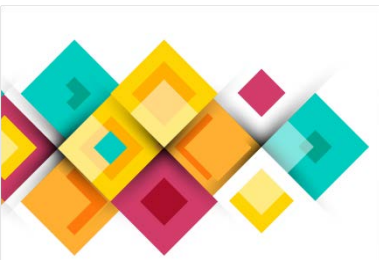
Cyanoacrylate glue prevents early bleeding of the exit site after CVC or PICC placement

G Scoppettuolo, MG Annetta, C Marano, E Tanzarella, M Pittiruti

Catholic University, Rome, Italy

Critical Care 2013, **17(Suppl 2):P174** (doi: 10.1186/cc12112)

Results In 65 consecutive patients (45 PICCs, 11 dialysis catheters and nine CVCs), there was no significant local bleeding at 1 hour or at 24 hours after catheter placement. No local adverse reaction occurred. No damage to the polyurethane of the catheters was detected.



A second study from our group was presented at AVA the following year, 2013

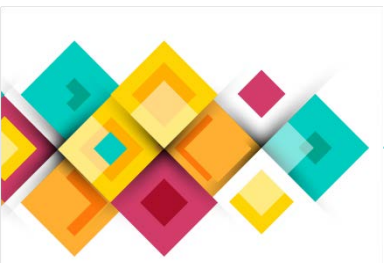


Randomized clinical study on the efficacy of metallic powder vs. cyanoacrylate glue in sealing the exit site of peripherally inserted central catheters: preliminary results.

Maria G. Annetta, Mauro Pittiruti, Giancarlo Scoppettuolo, Eloisa S. Tanzarella, Flavia Toni, Matteo Biancone, Massimo Antonelli

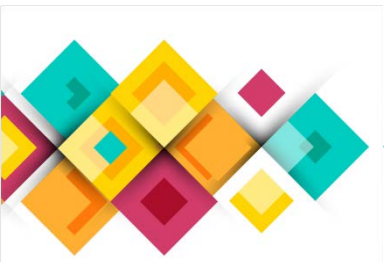
Catholic University Hospital, Rome, Italy





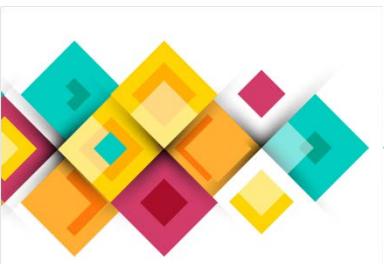
Goal of the study

- The aim of our study was to verify and compare the efficacy of metallic powder seal vs. cyanoacrylate glue in reducing the **risk of early bleeding** at the exit site after PICC placement.
- Other possible beneficial effects of *sealing* were also investigated:
 - Protection from the **risk of extraluminal contamination** (by reducing the entrance of bacteria in the space between the catheter and the skin)
 - Protection from the **risk of dislocation** (by increasing the stability of the catheter inside the skin breach).



Method

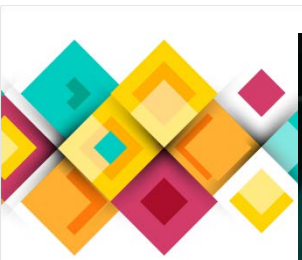
- We studied exclusively **non-tunneled, open-ended, power injectable polyurethane PICCs** (5Fr double lumen or 6Fr triple lumen, *without reversed tapering*), inserted in adult patients of our ICU.
- All PICCs were inserted according to the same protocol (**SIP Protocol, GAVeCeLT**), which includes 2% chlorhexidine antiseptis, maximal sterile barriers, ultrasound guidance, EKG guidance and securement with sutureless device.

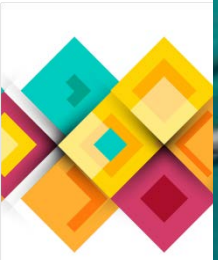


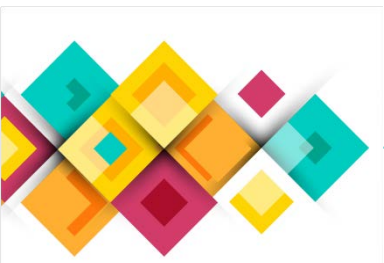
Method (2)

Patients were randomized in **two** groups.

At the end of the procedure, soon after the securement with a sutureless device, before dressing the wound, either **metallic powder seal (Group A)** or **cyanoacrylate glue (Group B)** was applied over the exit site.







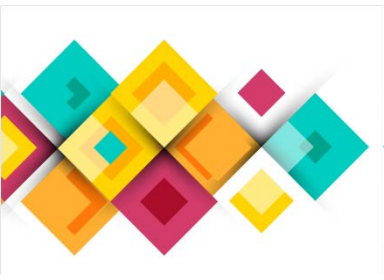
Method (3)

Two minutes after placement of the **seal** or of the **glue**, the exit site was covered with a temporary dressing, which was replaced by a transparent dressing at 24 hrs.

All patients were assessed **at 1 hr**, **at 24 hrs** and **every 7 days** for ruling out the presence of bleeding, dislocation, or local infection.

All catheters were removed or replaced over guidewire **after 3 weeks**, according to the following technique:

Removal of the dressing - skin antisepsis - 30 seconds to let chlorhexidine dry - removal of the catheter - **culture of 2 cm of catheter in the immediately subcutaneous tract + culture of 2 cm of tip of the catheter.**



Results - 30 randomized cases

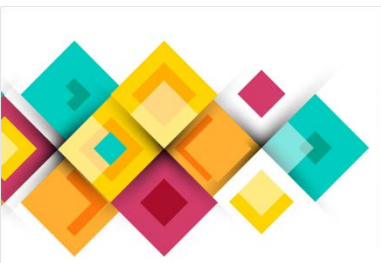
Bleeding:

- **at 1 hr:** no bleeding
- **at 24 hrs:** 2 cases of major blood stain in each group, requiring dressing change
- **at day 7:** 2 cases of minor blood stain in each group

No local adverse reaction, in either group.

No episodes of dislocation

No episodes of symptomatic venous thrombosis



Results - 30 randomized cases

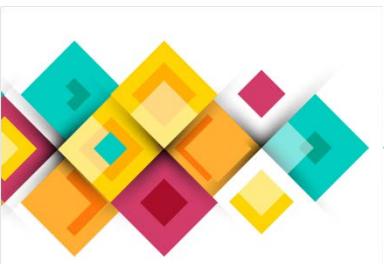
No infection of the exit site

No catheter-related bloodstream infection

One PICC in Group B (glue) was removed because of suspected infection, but the culture was negative.

One PICC in Group A (seal) had a tip culture positive for Candida, though blood culture was negative.

All cultures of the subcutaneous tract of the catheter were negative.

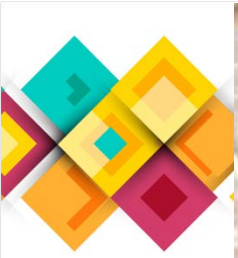


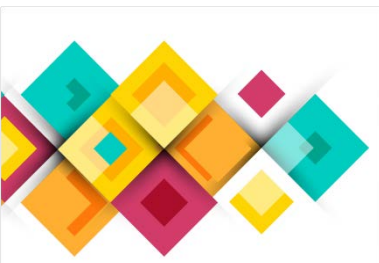
Results - 30 randomized cases

Placement of glue was simpler and faster than placement of metallic powder seal.

The compliance of nurses was very high in the glue group but quite low in the seal group

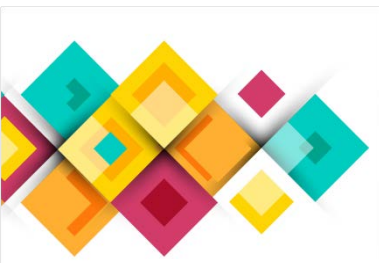
Most nurses and patients' relatives were concerned by the 'dirty' look of the exit site sealed with metallic powder seal.





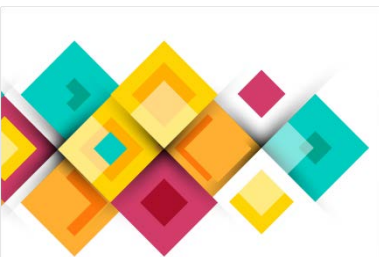
Conclusion

- Both metallic powder and cyanoacrylate glue **are effective in reducing the bleeding from the exit site**, though the compliance of the health operators was higher for glue.
- Culture data suggest that sealing the exit site (with either method) may be effective in **reducing extraluminal contamination.**



Tissue Adhesive – All CVADs

- Pittiruti, M., et al. Cyanoacrylate Glue and Central Venous Access Device Insertion ¹⁹
- Poster – AVA 2016 Scientific Meeting
 - 513 non-tunneled PICCs and CICC
 - 114 tunneled PICCs, CICC, and FICC
 - 802 implanted ports
- 100% effective in prevention of post-insertion bleeding



2018

Original research article

JVA | The Journal of
Vascular Access

Experimental study on the hemostatic effect of cyanoacrylate intended for catheter securement

The Journal of Vascular Access
1-8

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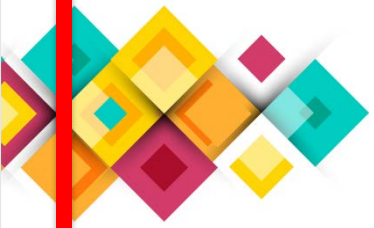
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DOI: 10.1177/1129729818779702

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 SAGE

Sheng Zhang¹, Amanda R Guido¹, Richard G Jones¹, Benjamin J Curry², Angela S Burke³ and Melanie E Blaisdell³



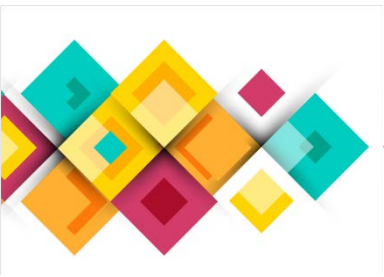
Multicenter clinical study

2018-2019

“Effect of cyanoacrylate glue on the reduction of bleeding complications after placement of peripherally inserted central catheters (PICCs)”

Prospective, observational study





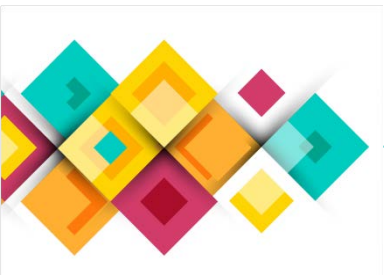
A study about SAFETY and EFFECTIVENESS

- SAFETY
- EFFECTIVENESS of glue in reducing bleeding



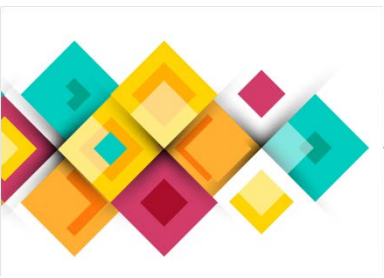
Endpoints

- Primary endpoints
 - Safety of glue (in terms of interactions with the skin and with the catheter)
 - Incidence of bleeding of the exit site at 24hrs and at day 7
- Secondary endpoints
 - Incidence of other catheter complications (dislodgement, infection, thrombosis, etc.)



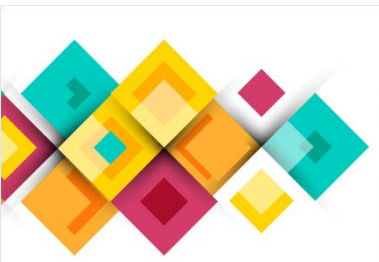
Inclusion criteria

- All adult patients candidate to PICC insertion



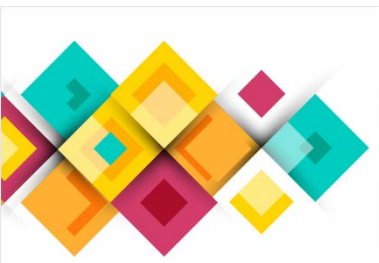
Methods

- All PICCs placed according to the SIP protocol
- Cyanoacrylate glue applied on the exit site
- All PICCs secured with sutureless device and covered with transparent membranes
- Follow-up for early and late complications



The SIP Protocol

1. Hand hygiene, 2% chlohexidine and maximal barrier protection
2. Bilateral US scan of all veins at arm and neck
3. Choice of the appropriate vein at midarm (vein mm = or > cath Fr)
4. Clear identification of median nerve and brachial artery
5. Ultrasound guided venipuncture
6. US scan of IJV during introduction of the PICC
7. EKG method for assessing tip position
8. Securing the PICC with a sutureless device



Preliminary results

- 180 PICCs from 5 centers
 - (expected number to reach: 230 PICCs)
 - No minor or major complications related to glue
 - No catheter lesions
 - No allergy – no skin lesions
 - Local bleeding at 24hrs : 1.2%
 - Local bleeding at day 7: zero
 - Data about other complications: not yet processed



Glue for avoiding bacterial contamination

A recent study from our group....

2017



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DOI: 10.5301/jva.5000797

ORIGINAL RESEARCH ARTICLE

Targeting zero catheter-related bloodstream infections in pediatric intensive care unit: a retrospective matched case-control study

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² Department of Surgery, "A. Gemelli" University Hospital Foundation, Catholic University of the Sacred Heart, Rome - Italy

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TABLE I - Insertion and maintenance bundle adopted in the group of cases

Insertion and maintenance bundle	Cases	Controls
1. Hand washing and maximal barrier precautions	Yes	Yes
2. Skin antisepsis with 2% chlorhexidine	Yes	Yes
3. Ultrasound pre-puncture evaluation through RaCeVA	Yes	No
4. Ultrasound guided venipuncture	Yes	Yes
5. Tunneling of the catheter so to obtain an exit site in the infraclavicular area	Yes	No
6. Sealing of the exit site with glue	Yes	No
7. Securement with sutureless device	Always	Inconsistently
8. Coverage with transparent semipermeable dressing	Yes	No
9. Chlorhexidine-impregnated sponges	After the 1 st week	Since insertion
10. Use of neutral NFC and port protectors	Yes	Yes
11. Simulation-based standardized training program	Yes	No

RaCeVA = rapid central vein assessment; NFC = needle free connectors.


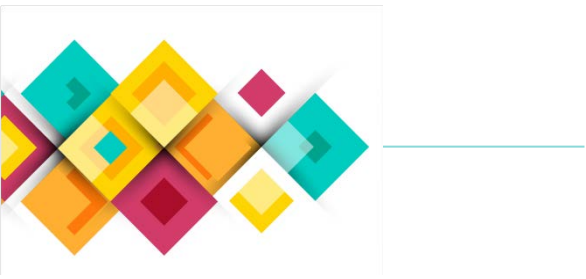


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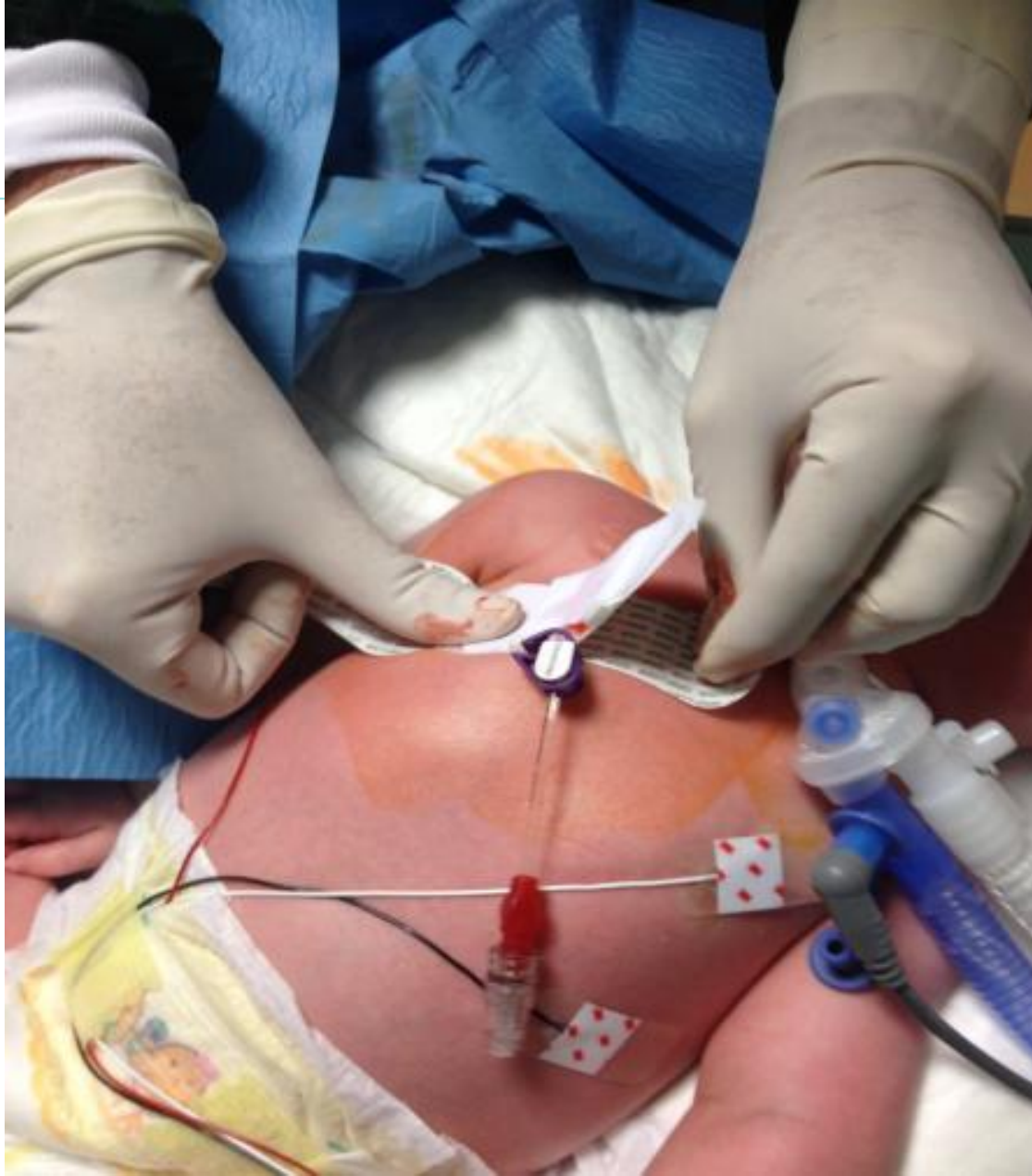






TABLE IV - Complication rates from insertion to PICU discharge

		Cases	Controls
Indwelling time (d)	Total	648	503
	Mean (\pm SD)	9.7 \pm 3.1	7.5 \pm 3.5
CR-BSI	No	1	8
	per 1000 catheter days	1.5	15
CR-DVT	No	0	1
Accidental dislodgements	No	0	3

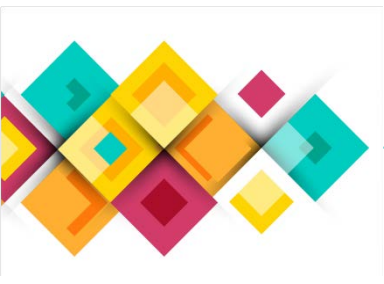
CR-BSI = catheter-related bloodstream infections; CR-DVT = catheter-related deep vein thrombosis; PICU = pediatric intensive care unit; SD = standard deviation.



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Biasucci, Pittiruti et al. – JVA 2017

An insertion bundle including **TUNNELLING + GLUE + SUTURELESS SECUREMENT + TRANSPARENT DRESSING** (*i.e.: abolition of the risk of extraluminal contamination*) was associated with a **ten-fold reduction of the incidence of CRBSI**



Glue for skin closure



Skin closure in VADs

- Closure of the primary incision (tunneled VADs)
- Closure of the skin incision for subcutaneous placement of reservoir (totally implantable ports)



Glue for CICC tunnelling in neonates





Glue for CICC tunnelling in neonates





2017

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ORIGINAL RESEARCH ARTICLE

Atypical use of PICC in infants and small children: a unicentric experience

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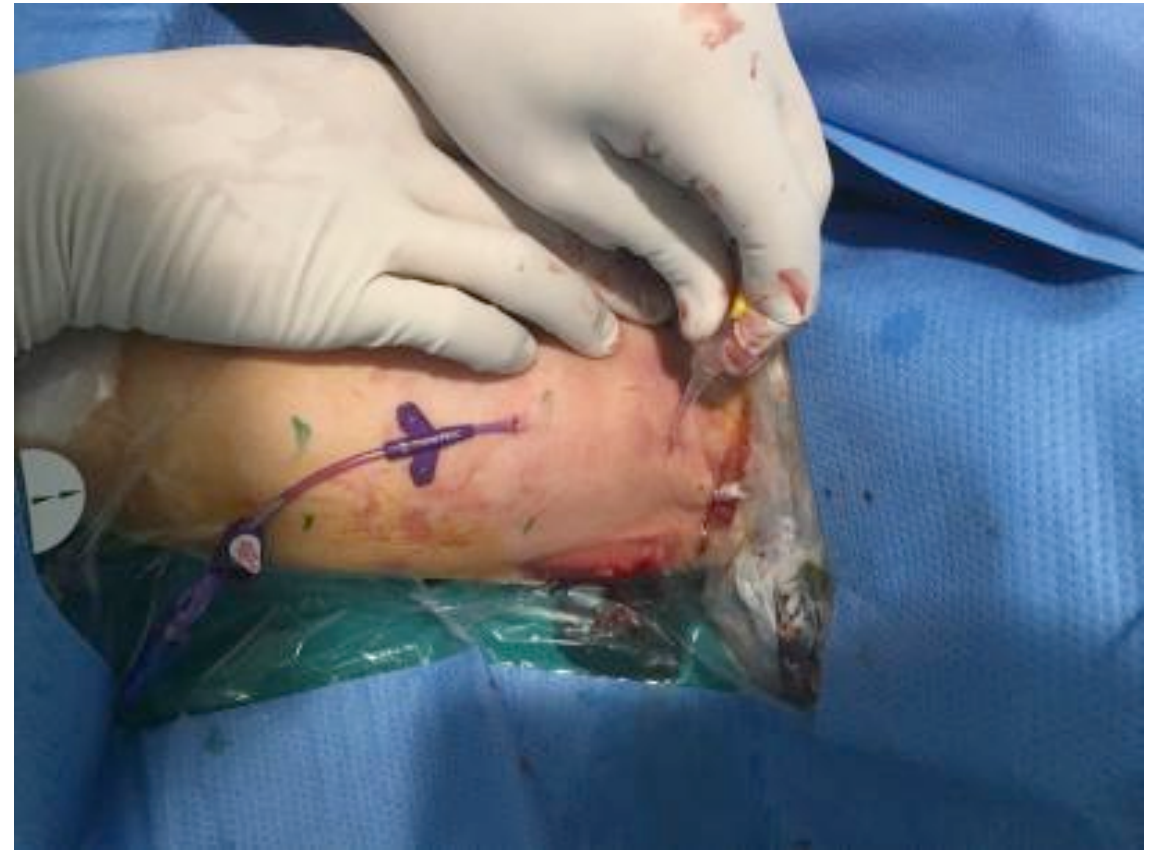
⁵ Department of Anaesthesia, Great Ormond Street Hospital, London - UK



Fig. 1 - Peripherally-inserted central catheters (PICCs) placed atypically. White arrow: puncture-site. Black arrow: exit-site. The puncture-site and the exit-site were closed with cyanoacrylate glue. The catheter is secured with subcutaneous anchor system: SecurAcath® (Interrad Medical, Plymouth, Minnesota, USA) and stabilized with transparent semipermeable dressing.



Glue for PICC tunnelling





Glue for CICC tunnelling





Glue for CICC tunnelling





Glue for FICC tunnelling



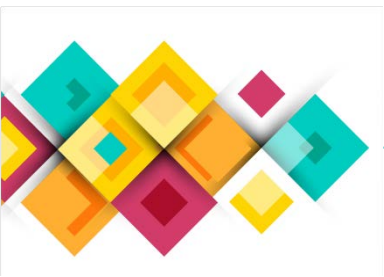


Glue for closing the port incision





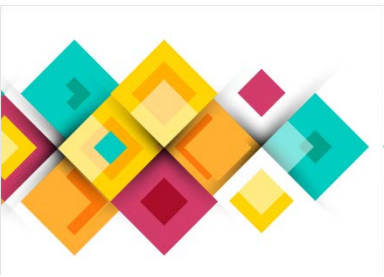
— One last issue: is it safe?



Safety

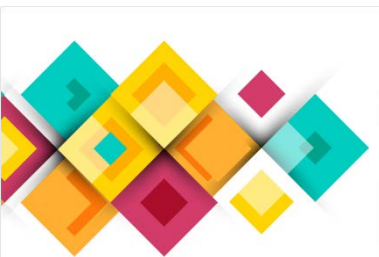
- Any risk for the skin?
 - No
 - We use glue in all patients, including premature newborns





Safety

- Any risk for the catheter?
 - Not for polyurethane catheters



2018

JVA

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ORIGINAL RESEARCH ARTICLE

JVA | The Journal of
Vascular Access

Experimental study on the chemico-physical interaction between a two-component cyanoacrylate glue and the material of PICCs

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2018, Vol. 19(1) 58–62
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SAGE

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¹ Dipartimento di Ingegneria Civile e Industriale, Università di Pisa, Pisa - Italy

² Fondazione Policlinico Universitario "A. Gemelli", Roma - Italy

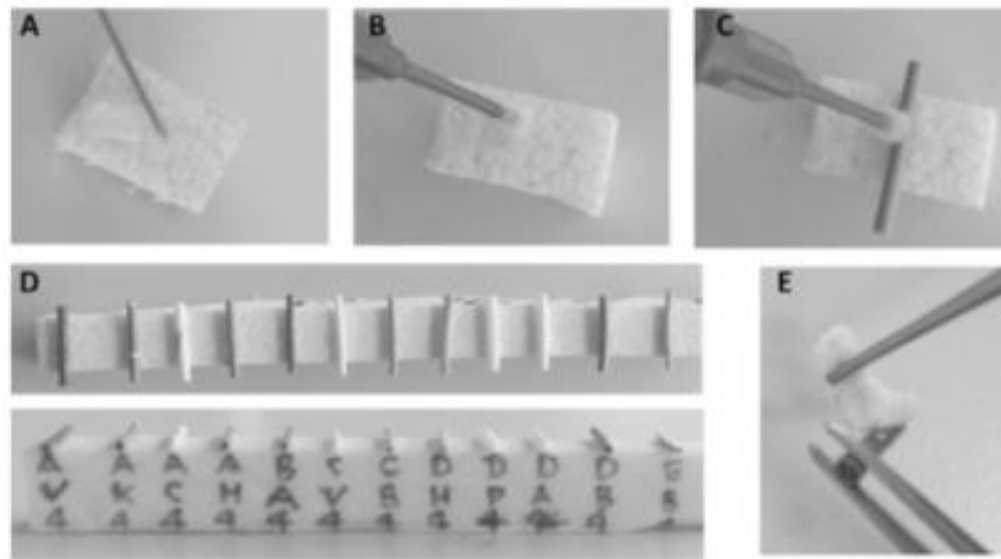


Fig. 1 - Sample preparation procedure: **(A)** a syringe puts a few drops of Earle solution over the artificial skin pad; **(B)** a layer of glue is dropped over the skin; **(C)** the sample is positioned on the skin pad and covered with the glue; **(D)** Pad of samples to be tested at week 4, ready to be put in the incubator; **(E)** Sample removal from the skin pad.

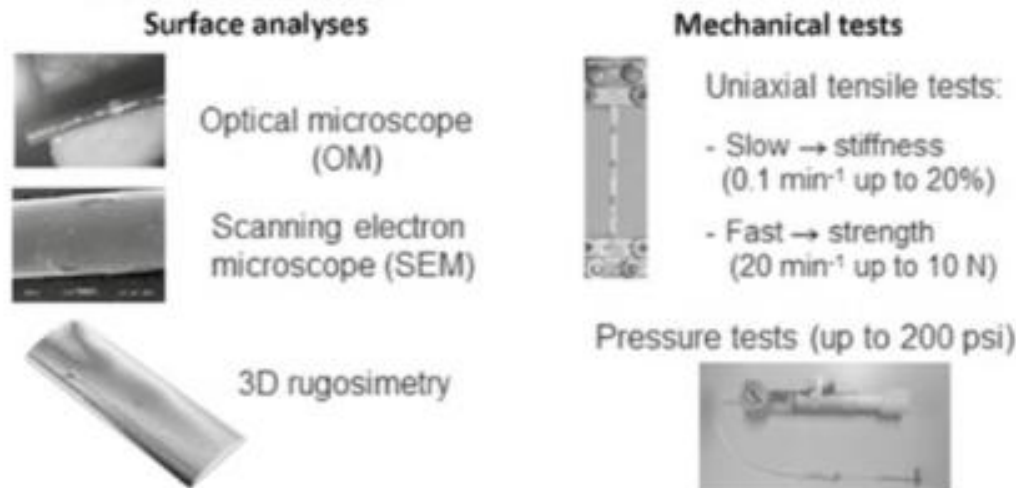


Fig. 2 - Experimental activities: both surface analyses and mechanical tests were performed to detect possible catheter degradation.

No damage was observed in polyurethane PICCs, not even after 12 weeks of glue apposition.



2015

Letter to the editor

JVA | The Journal of
Vascular Access

Tissue adhesive and chlorhexidine gluconate interaction: Implications for vascular access device securement

**Amanda J Ullman^{1,2,3,4}, Tim R Dargaville^{1,5}
and Claire M Rickard^{1,2,3}**

The Journal of Vascular Access
1-2

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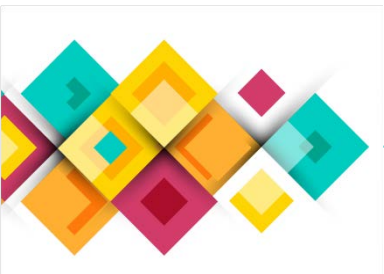
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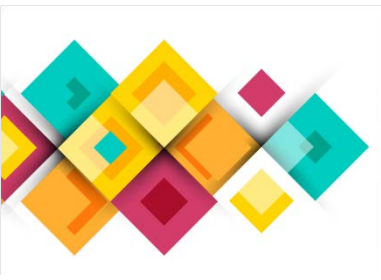
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If TA becomes a primary securement method for vascular access devices, clinicians must ensure adequate CHG drying time, prior to TA application.

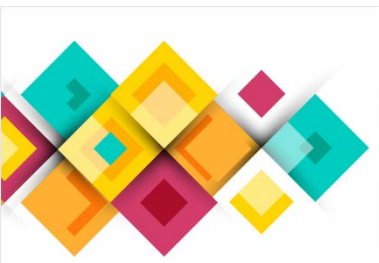


Conclusions

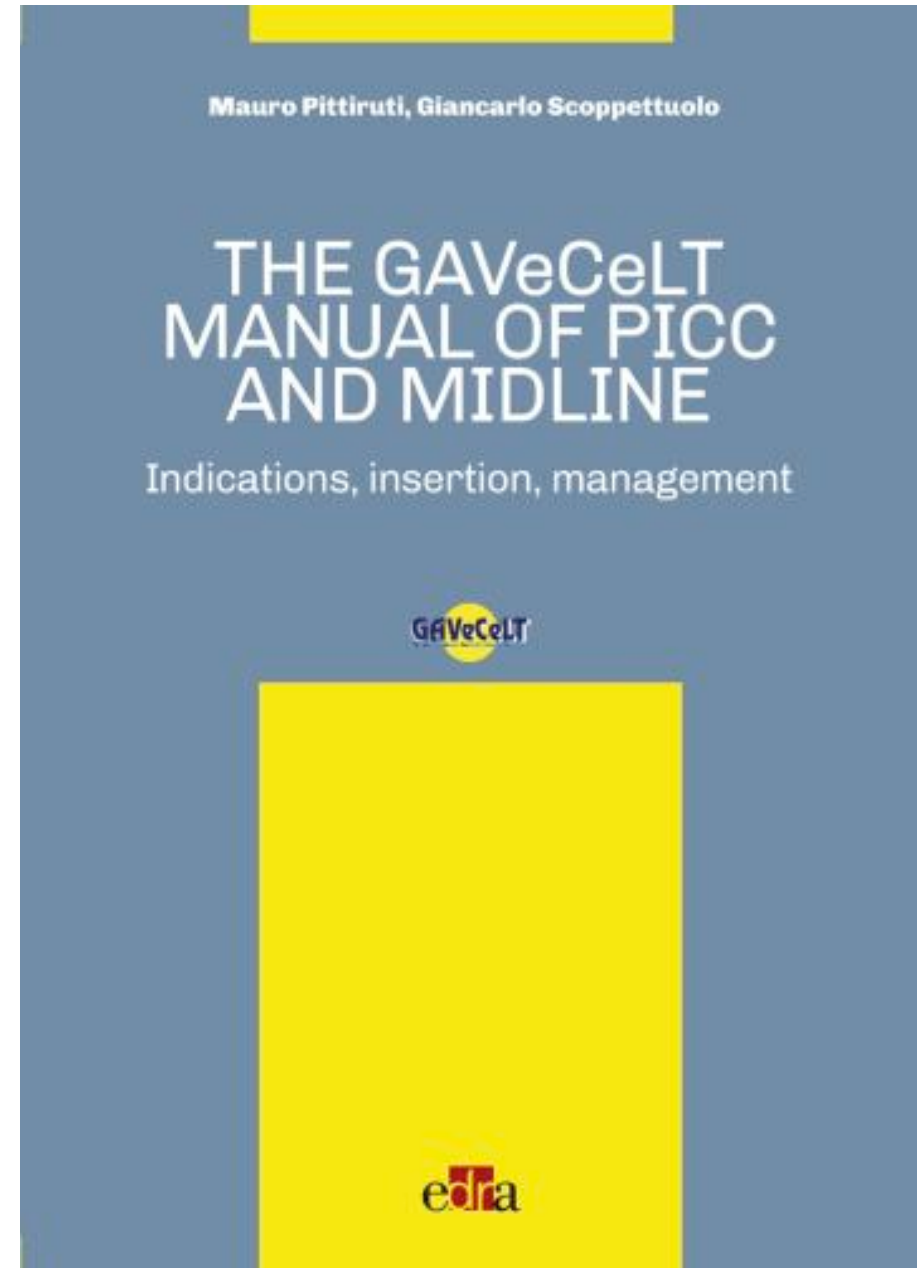


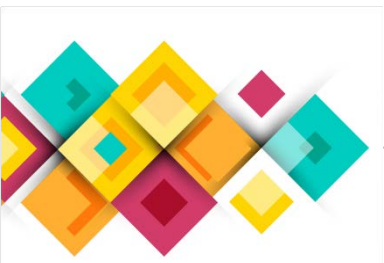
Glue

- Safe
- Inexpensive
- Effective on bleeding control
- Effective as securement for 7 days
- Potentially useful for reducing bacterial contamination



Use of glue is now discussed and described also in practical handbooks on venous access



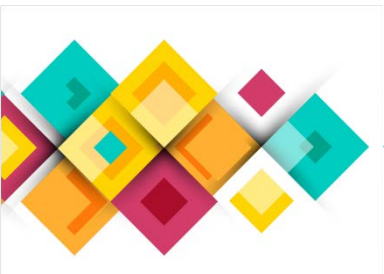


Glue, in summary:

A simple, inexpensive, powerful tool for reducing the risk of early/late bleeding of the exit site after the insertion of PICCs, CICC, midlines and short cannulas.

Its role as securement is probably limited to peripheral venous access devices (short cannulas).

Its role for prevention of infection (by reducing the risk of extraluminal contamination) is quite promising.



Thank you for your attention



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