

Effectiveness of cyanoacrylate glue in the fixation of midline catheters and peripherally inserted central catheters in hospitalised adult patients: Randomised clinical trial (CIANO-ETI)

SAGE Open Medicine

Volume 11: 1–9

© The Author(s) 2023

Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/20503121231170743

journals.sagepub.com/home/smo



Ferran Padilla-Nula¹ , Alejandro Bergua-Lorente¹,
Jordi Farrero-Mena¹, Anna Escolà-Nogués¹, Miriam Llauredó-Mateu¹,
Carme Serret-Nuevo¹ and Filip Bellon²

Abstract

Objective: The objective of the study was to assess the efficacy of the use of cyanoacrylate glue (CAG) as a means of securing midline catheters and peripherally inserted central catheters with the modified micro-Seldinger technique in adult hospitalised patients.

Methods: Randomised clinical trial with two groups (1:1): control and intervention. The control group received a securement method with a sutureless device plus transparent dressing and the intervention group received the same securement method plus the CAG. The study was approved by the Drug Research Ethics Committee of the Lleida Health Region.

Results: A total of 216 patients were assessed. The two groups of the trial were homogeneously distributed in terms of sociodemographic and clinical variables. The intervention group had a statistically significant lower incidence of peri-catheter bleeding and/or oozing during the 7-day study period (odds ratio (OR), 0.6; 95% confidence level (CI), 0.44–0.81; $p < 0.001$) and a statistically significant lower incidence of catheter dislodgements during the first 24 h (OR, 0.2; 95% CI, 0.04–0.91; $p = 0.03$). There were no statistically significant differences in the incidence of phlebitis (OR, 1.30; 95% CI, 0.60–2.83; $p = 0.56$) or catheter-related pain (OR, 0.88; 95% CI, 0.40–1.94; $p = 0.84$).

Conclusion: Midline catheters and peripherally inserted central catheters secured with CAG had fewer complications than catheters not secured with this adhesive.

Keywords

Nursing, cyanoacrylate, vascular access, peripherally inserted central catheters, midline catheter

Date received: 24 September 2022; accepted: 3 April 2023

Introduction

Recently, in clinical practice there has been growing interest in products for the safe securement of vascular access devices (VADs) to try to decrease their associated complications. One such product is cyanoacrylate glue (CAG),^{1–3} with octyl-butyl-cyanoacrylate (e.g. Secure-Port IVTM) being one of the most commonly used types today. Thanks to its inherent properties, CAG can result in improvements^{3–5} that include greater safety thanks to its resistance to traction, wound closure through a protective barrier, the minimisation of haematic and/or fluid discharge from the puncture zone, and the prevention of infection from various types of bacteria, yeasts and fungi.

Numerous studies have shown the safety of the use of CAG in different VADs,⁶ and more specifically in peripherally inserted central catheters (PICCs),^{7,8} peripherally

¹Vascular Access Unit and Angioradiology Unit of the University Hospital Arnau de Vilanova, Catalan Institute of Health, Lleida, Spain

²GESEC Group, Department of Nursing and Physiotherapy, Faculty of Nursing and Physiotherapy, University of Lleida, Lleida, Spain

*Filip Bellon is also affiliated to Healthcare Research Group (GRECS), Institute of Biomedical Research Lleida (IRBLleida), Lleida, Spain

Corresponding author:

Ferran Padilla-Nula, Hospital Universitari Arnau de Vilanova, Av. Alcalde Rovira Roure, 80, Lleida, Catalonia 25198, Spain.

Email: FPADILLA@gencat.cat



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons

Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

inserted central catheters-Ports,^{9,10} centrally inserted central venous catheters (CICCs),¹¹ midline catheters¹² and arterial catheters.¹³ Their safe use has been verified in adults,¹⁴ paediatric patients¹⁵ and neonatal patients.^{16,17} CAG has also been shown to have a strong haemostatic effect in the presence of blood,¹⁸ and its long-term use does not damage polyurethane catheters.¹⁹ On the negative side, it has been suggested that its use might not be suitable for patients with sensitive skin or cutaneous diseases, and healthcare personnel training has been recommended as cases have been reported of tissue damage due to incorrect removal of the product.⁴

No randomised clinical trial (RCT) has been found in the literature that has tested the effectiveness of securement with CAG in adult hospitalised patients in acute condition who require insertion of a VAD using the modified micro-Seldinger technique (MST) with an incision to dilate the insertion site. This is important because presently it is the most commonly used technique for the insertion of midline catheters and PICCs. However, it is not without complications and the catheters continue to have an unacceptably high failure rate.²⁰ It is of fundamental importance to study and test products that aim to reduce this failure rate. This is especially the case in situations in which there is constant handling of VADs by healthcare professionals for blood extractions and/or IV drugs.

The main aim of the present study was to assess the efficacy of the use of CAG as a post-insertion securement method of midline catheters and PICCs using the MST in hospitalised adult patients in order to determine whether protocol-led application of CAG reduces the main complications associated with this technique: peri-catheter bleeding or oozing, catheter dislodgment, phlebitis and catheter-related pain.

Methods

Trial design

An RCT was developed and carried out in the University Hospital Arnau de Vilanova (HUAV) in Lleida (Catalonia, Spain) by the Vascular Access Team (VAT) from 16 September 2020 to 30 September 2021, following CONSORT Guidelines.²¹

The hypothesis employed in the study was that the application of CAG plus standard care after insertion of a VAD using the MST decreases the main complications related to these catheters.

Participants

In the study, the inclusion criteria were as follows: legal adults; patients that required insertion of a midline catheter (BD-PowerMidline™) or a PICC (BD-PowerPICC™) according to the decision-making algorithm of the VAT of

the HUAV; patients who had voluntarily accepted and signed the informed consent form; and patients who had been admitted to a hospital unit (expected minimum 7-day hospital stay). The exclusion criteria were: patients with cutaneous conditions for which the application of a skin adhesive is contraindicated; and patients with a known allergy to CAG.

Interventions

The control group (CG) was treated with standard care^{6,22}: transparent dressing (3M®-1655-Tegaderm™ IV), a sutureless stabilisation device (BD-19940-StatLock™ PICCPlus) and sterile gauze at the insertion site. The treatment group (TG) received the same standard care, without the sterile gauze, plus the application of CAG (SP-015V50-SecurePortIV™ AdhezionBiomedical, Topical Skin Adhesive, Volume 0.15).

Catheter insertion was performed on the basis of a pre-insertion, during insertion and post-insertion checklist in order to avoid any variability of criteria among the investigators. A haemostatic protocol of timed 2-min compression was applied after insertion of the catheter. If bleeding continued after 2 min, compression was maintained until its cessation.

Outcomes

The primary outcome measure was the number of participants with post-intervention peri-catheter bleeding and/or oozing assessed by observation (Yes/No). For this, the percentage of participants with peri-catheter bleeding and/or oozing after insertion of a midline catheter or PICC with the MST technique was calculated. Four inspections were carried out (post insertion, at 24 h, 72 h and 7 days) in which the puncture site was visualised for signs of bleeding and/or oozing.

The secondary outcome measure was the number of participants with post-intervention catheter displacement assessed by observation (Yes/No). For this, the percentage of patients with catheter displacement after insertion of a midline catheter or PICC with the MST was calculated. Four inspections were carried out (post insertion, at 24 h, at 72 h and at 7 days) in which the puncture site was visualised to check if the catheter was still in the same point or if it had been displaced.

In addition, the number of participants with post-intervention phlebitis was assessed on the basis of the Maddox visual phlebitis rating scale.²³ The percentage of patients with signs of phlebitis after insertion of a midline catheter or PICC with the MST was then calculated. Four inspections were carried out (post insertion, at 24 h, at 72 h and at 7 days) in which the puncture site was visualised to check for signs of phlebitis.

Finally, an assessment was made of the number of participants with post-intervention pain on the basis of the Visual

Analogue Scale (VAS).²⁴ The percentage of patients with pain after insertion of a midline catheter or a PICC with the MST was then calculated. Four inspections were carried out (post insertion, at 24 h, at 72 h and at 7 days) in which the patient was asked to describe on a scale from 1 to 10 the pain they were feeling in the extremity related to the catheter.

Sample size

The sample size was calculated based on the proportion of peri-catheter bleeding and/or oozing after insertion of a VAD with the MST.

To calculate the sample size an alpha risk of <0.05 and a beta risk of <0.2 were chosen. The expected proportion for the CG was 0.75 (75% catheters not bleeding/oozing) according to current scientific evidence,²⁵ and 0.91 for the TG (91% catheters not bleeding/oozing), a clinically significant difference. A follow-up loss rate of 23% was estimated according to internal data of the team.

Randomisation, sequence generation, allocation concealment mechanism, implementation and blinding

The project investigators carried out subject recruitment, participant enrolment and randomisation to a CG or TG in a parallel group design with the help of the website <http://randomization.com/>. The resulting randomised list was printed and kept in a closed non-transparent folder. When a patient met the criteria to form part of the study and had agreed to participate, the list was consulted to determine which group that patient had been assigned to. The patient did not know which group he would be part of (single-blind); however it was impossible for the nursing and medical staff and the investigator/s to be blinded, as they were the ones performing the insertion and carrying out the standard care.

Data collection

The recorded variables were divided into categories. The main sociodemographic and health variables were collected: age, gender, date of admittance, diagnosis, pharmacological treatment, blood test results in last 7 days, hospital unit of admittance and date of catheter insertion and withdrawal. The variables of the VAD were also collected: reason for insertion, number of punctures, type of catheter, gauge, length, side and vein. With respect to VAD complications, four data collections were performed (on the day of insertion, 24 h, 72 h and 7 days post insertion), and if any additional treatment had to be carried out by the healthcare professionals, this was entered onto a data collection sheet.

The variables were first recorded manually in a data collection notebook and subsequently the study data were collected and managed using Research Electronic Data Capture

(REDCap) electronic data capture tools hosted at <https://redcap.icslleida.cat>.^{26,27} REDCap is a secure, web-based software platform designed to support data capture for research studies, providing (1) an intuitive interface for validated data capture; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages; and (4) procedures for data integration and interoperability with external sources.

Statistical methods

The statistical analysis of the data was carried out with the SPSS[®] software (IBM Corp. Released 2020; IBM Corp., Armonk, NY, USA).²⁸ A descriptive analysis was made of all the study variables. Categorical variables were described through absolute and relative frequencies and continuous variables using the mean or median, standard deviation (SD) and minimum and maximum (min–max), including the total number of valid values. Frequency tables and graphs were also generated. The Chi-square test or Fisher's exact test was used for comparison of variables between subgroups of patients. Odds ratios (ORs) were calculated. A confidence interval (CI) of 95% was used.

Ethical considerations

The study was carried out following the ethical principles for medical research on human beings of the World Medical Association and the Helsinki Declaration, and respecting legal requirements for personal data protection and confidentiality as established by the General Data Protection Regulation.

An information sheet about the study was given to all participants before inscription and signed consent forms were obtained in all cases. Participation was voluntary.

Approval for the study was obtained from the Drug Research Ethics Committee (CEIC-2333, agreement 12/2020 dated 13 August 2020), and the study was registered in ClinicalTrials.gov (NCT05299060).

Results

Verification of the eligibility for participation in the study of 349 hospitalised patients resulted in the exclusion of 133. A total of 216 patients were therefore recruited who received a midline catheter or a PICC (Figure 1).

A total of 48 patients (22.2%) did not have the catheter in situ at 7 days, due to the following reasons: hospital discharge and/or end of treatment (58.3%), accidental catheter removal (18.7%), death (16.7%) and other (6.3%).

Sociodemographic and clinical characteristics

Mean age was 68.34 (SD ± 13.11), with 68.1% male (Table 1).

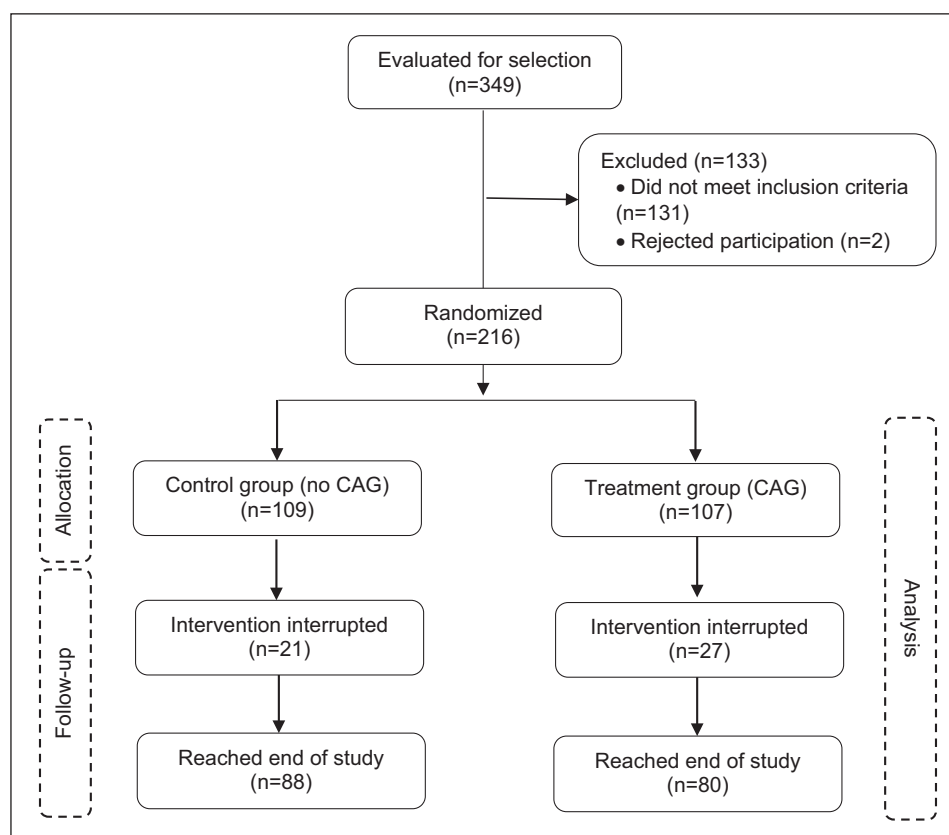


Figure 1. Flow diagram of participant recruitment, group allocation, follow-up and analysis (modified CONSORT 2010 flow diagram). CAG, cyanoacrylate glue.

Table 1. Socio-demographic data.

Characteristics	Control group		Treatment group		Characteristics total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Male	78	71.6	69	64.5	147	68.1
Age, years (mean, min–max)	67.6	33–93 (SD ± 13.2)	69.1	25–90 (SD ± 13)	68.3	25–93 (SD ± 13.1)
Age group, years						
18–39	3	2.7	3	2.8	6	2.8
40–69	55	50.5	50	46.7	105	48.6
70–99	51	46.8	54	50.5	105	48.6

The VAD and hospital variables are shown in Table 2.

The General and Digestive Surgery unit was the hospital service that made the most requests for the insertion of a VAD (48.1%), followed by Internal Medicine (19.5%).

The most commonly used anticoagulation and antiplatelet treatments in both groups were enoxaparin (36.1%), bemparin (12%) and acetylsalicylic acid (10.4%), with no statistically significant differences between groups ($p=0.06$).

Regarding coagulation and platelets, the mean international normalised ratio (INR) of the patients under study was

1.22 (SD ± 0.25, min–max: 0.81–2.5, $p=0.50$) and the mean platelet count was 269,019 (SD ± 136,064, min–max: 48,000–1,261,000, $p=0.55$), with no statistically significant differences between groups.

Inspection 24 h post insertion

With respect to the first inspection 24 h post insertion (Table 3), in the CG there was a higher incidence of peri-catheter bleeding and/or oozing (OR, 0.55; 95% CI, 0.32–0.96; $p=0.04$) and a higher number of dislodgements (OR, 0.20;

Table 2. Data variables with respect to the VAD and hospital unit petitioning service.

	Control group <i>n</i> = 109	Treatment group <i>n</i> = 107	<i>p</i> Value ^c
Main reason for insertion request			
Peripheral-line infusion of medication ^a	22	26	.27
Central-line infusion of medication ^b	59	63	
Difficult venous access	28	18	
Catheter type			
Midline	49	43	.50
PICC	60	64	
Gauge			
4 French	50	45	.60
5 French	34	31	
6 French	25	31	
Side			
Right	86	87	.73
Left	23	20	
Number of punctures			
1	89	87	.93
2	8	10	
3	7	6	
+3	5	4	
Chosen vein			
Basilic	84	79	.61
Brachial	19	24	
Cephalic	5	4	
Other (axillary)	1	0	

^aPeripheral-line IV drugs: treatments of more than 7 days with osmotic concentration <900 mOsm/l, pH 5–9 and/or non-irritating and non-vesicant.

^bCentral-line IV drugs: any treatment with osmotic concentration >900 mOsm/l, pH <5 or >9 and/or irritating or vesicant.

^cThe Chi-square or Fisher's exact test was used to calculate the *p*-value.

Table 3. Inspection data 24h post insertion.

	Control group		Treatment group		OR (95% CI)	<i>p</i> Value
	<i>n</i> = 109	%	<i>n</i> = 103	%		
Peri-catheter bleeding and/or oozing ^a	56	51.4	38	36.9	0.55 (0.32–0.96)	.04
Dislodgement ^a	10	9.2	2	1.9	0.20 (0.04–0.91)	.03
Signs of phlebitis ^b	4	3.7	8	7.8	2.21 (0.64–7.58)	.24
Pain ^b	4	3.7	6	5.8	1.62 (0.44–5.93)	.53

^aThe Chi-square test was used to calculate the *p*-value.

^bFisher's exact test was used to calculate the *p*-value.

95% CI, 0.04–0.91; *p*=0.03) than in the TG, with statistically significant differences.

No statistically significant differences were found for the appearance of signs of phlebitis (OR, 2.21; 95% CI, 0.64–7.58; *p*=0.24) or catheter-related pain (OR, 1.62; 95% CI, 0.44–5.93; *p*=0.52).

All patients with signs of phlebitis scored 1 or 2 according to the Maddox scale. Patients with pain recorded a mean score of 2.1 out of 10 according to the VAS scale (SD ± 1.3, min–max: 1–5).

Inspection data 72 h post insertion

In the inspection 72h post insertion (Table 4), in the CG there was a higher incidence of peri-catheter bleeding and/or

oozing (OR, 0.43; 95% CI, 0.23–0.79; *p*=0.007) than in the TG, with this difference being statistically significant.

In contrast, there were no statistically significant differences with respect to dislodgements (OR, 2.06; 95% CI, 0.50–8.49; *p*=0.50), or the appearance of signs of phlebitis (OR, 0.99; 95% CI, 0.28–3.53; *p*=0.99) or pain (OR, 0.99; 95% CI, 0.28–3.53; *p*=0.99).

Patients with pain scored a mean of 1.8 out of 10 (SD ± 1.03, min–max: 1–4).

Inspection 7 days post insertion

With respect to the inspection 7 days post insertion (Table 5), no statistically significant differences were found for peri-catheter bleeding and/or oozing (OR, 0.70; 95% CI,

Table 4. Inspection data 72 h post insertion.

	Control group		Treatment group		OR (95% CI)	p Value
	n = 100	%	n = 101	%		
Peri-catheter bleeding and/or oozing ^a	42	42.0	24	23.8	0.43 (0.23–0.79)	.007
Dislodgement ^a	3	3.0	6	5.9	2.06 (0.50–8.49)	.50
Signs of phlebitis ^b	5	5.0	5	4.9	0.99 (0.28–3.53)	.99
Pain ^b	5	5.0	5	4.9	0.99 (0.28–3.53)	.99

^aThe Chi-square test was used to calculate the *p*-value.

^bFisher's exact test was used to calculate the *p*-value.

Table 5. Inspection data 7 days post insertion.

	Control group		Treatment group		OR (95% CI)	p Value
	n = 88	%	n = 80	%		
Peri-catheter bleeding and/or oozing ^a	27	30.7	19	23.7	0.70 (0.35–1.40)	.39
Dislodgement ^a	2	2.3	3	3.7	1.67 (0.27–10.29)	.68
Signs of phlebitis ^b	3	3.4	2	2.5	0.73 (0.12–4.46)	.99
Pain ^b	4	4.5	1	1.2	0.27 (0.03–2.43)	.37

^aThe Chi-square test was used to calculate the *p*-value.

^bFisher's exact test was used to calculate the *p*-value.

0.35–1.40; *p* = 0.39), catheter dislodgement (OR, 1.67; 95% CI, 0.27–10.29; *p* = 0.68), signs of phlebitis (OR, 0.73; 95% CI, 0.12–4.46; *p* = 0.99) or pain (OR, 0.27; 95% CI, 0.03–2.43; *p* = 0.37).

Patients with pain scored a mean of 1.6 out of 10 (SD ± 0.55, min–max: 1–2).

Additional care

With respect to additional care, performed by nurses of the hospital unit, a total of 34 urgent changes of dressing had to be made in 22 different patients, mostly for peri-catheter bleeding and/or oozing (33/34), with no statistically significant differences between groups (*p* = 0.44).

Grouped data of all inspections/care treatments

When grouping all the study data (day of insertion inspection, at 24 h, at 72 h, at 7 days and additional care), the total number of observations (inspections + additional care treatments) that was made amounted to 831 (425 in the CG and 406 in the TG). Peri-catheter bleeding and/or oozing was found in 33.9% of the total number of CG observations, compared to only 23.4% in the TG (OR, 0.60; 95% CI, 0.44–0.81; *p* < 0.001), with this difference being statistically significant.

Also in the grouped data, catheter dislodgement was found in 3.7% of the CG observations compared to 2.8% in the TG (OR, 0.74; 95% CI, 0.34–1.66; *p* = 0.55), with no statistically significant differences.

With respect to the appearance of catheter-related signs of phlebitis in the grouped data, no statistically significant

differences were found between groups (OR, 1.30; 95% CI, 0.60–2.83; *p* = 0.56).

Finally, with respect to catheter-related pain, again no statistically significant differences were found between groups (OR, 0.88; 95% CI, 0.40–1.94; *p* = 0.84).

Discussion

It has been possible to show in this study that using CAG plus a sutureless stabilisation device and transparent dressing after insertion of a midline or a PICC with the technique MST in adult hospitalised patients has advantages that help to decrease some of the main complications related to VADs.

Effect on bleeding and oozing

CAG has been shown to have very interesting haemostatic properties for common use in clinical practice. With the application of CAG at the insertion site, the nursing staff will not have to perform as many dressing changes due to peri-catheter bleeding and/or oozing. Nonetheless, they should visually inspect the insertion site 24 h post insertion as use of the CAG is not a 100% guarantee against such bleeding and/or oozing, as shown by the 36.9% of patients in the TG who suffered this complication during the first 24 h. Reducing the number of changes of dressing is of great interest according to Timsit et al.²⁹ In the case of VADs, there is an associated reduced risk of catheter colonisation when removing the dressing (*p* < 0.001).

In the same study of Timsit et al.,²⁹ earlier-than-scheduled changes of dressing were required in 67% of patients. In the present study, adherence was high in both groups, and

earlier-than-scheduled changes were required only in 4.1% of the inspections.

The overall incidence of peri-catheter bleeding and/or oozing in the CG in the present study was 33.9%, slightly higher than in other similar studies such as that of Leung et al.²⁵ in which 24.7% of patients suffered this complication. This may be related to the incision performed prior to catheter insertion.

There was a lower tendency for bleeding in the TG compared to the CG (OR, 0.60; 95% CI, 0.44–0.81; $p < 0.001$), showing that the probability of bleeding in the group without CAG is 67% higher during the first 7 days than in the group with CAG.

This indicates that CAG is a promising application at reducing bleeding after VAD insertion, but haemostasis must be in place prior to application. These properties have been observed in vitro and in vivo in pigs¹⁸ at 3, 6, 9 and 12 min after treatment. It has also been seen with different VADs: PICCs,^{7,14,30} CICCs¹¹ and arterial catheters.^{31,32} Application of CAG is therefore of particular interest in hospitalised patients where catheter handling by professional healthcare workers is constant. It is particularly of use in patients who are receiving an anticoagulation and/or antiplatelet treatment as it helps to reduce the risk of bleeding in a high percentage of patients.^{33,34} Although peripheral VADs and nontunneled PICCs are considered minimally invasive techniques,³⁵ this reduction in bleeding and/or exudate may help reduce the number of dressing changes by the healthcare professionals.

Effect on the number of catheter dislodgements

In the study by Lacostena-Pérez et al.,³³ post-insertion VAD dislodgement was observed in 6.94% of cases, and in the prospective cohort study of Grau et al.³⁶ the corresponding value was 8.9%. In another study by Bugden et al.,⁷ it was found that the CAG group had 7% fewer dislodgements than the non-CAG group.

In the present study, the total number of dislodgements in the CG (3.7%) was very similar to that of the TG (2.8%). Statistically significant differences were only found in the inspection 24 h post insertion (OR, 0.2; 95% CI, 0.04–0.91; $p = 0.03$), indicating that the probability of catheter dislodgement in the group without CAG is five times higher during the first 24 h than in the group with CAG. This datum surprised the investigators as the number of dislodgements in the inspections 72 h and 7 days post insertion was very low in both groups.

Effect on phlebitis incidence

In the present study, the suspicion of phlebitis was very low (3% in the CG and 3.8% in the TG). In addition, there was no infection or serious adverse effects associated to the VAD during the first 7 days post insertion, which is in line with the current evidence.^{4,37}

In a study by Lacostena-Pérez et al.³³ it was reported that 17.36% of patients had a suspected and 9.03% confirmed phlebitis. In another study by Leung et al.²⁵ it was reported that infection/phlebitis occurred in 9.7% of cases, but over a longer period of observation. In other RCTs, such as that of Rickard et al.¹⁴ and Edwards et al.³² no infection or catheter-related severe adverse effect was found in the group with CAG.

Consequently, as concluded in the study by Pittiruti et al.,² it appears that CAG may reduce the risk of infection by reducing bacterial contamination via the extraluminal route in all VADs.

Effect on the number of catheter-related pain reports

The main indicator of phlebitis in inserted VADs is pain at the puncture site. In a clinical study by Chan et al.³⁸ the incidence of pain reported in the groups with and without CAG was 14% and 10.5%, respectively. In contrast, the incidence of catheter-related pain in the present study was very low. This may be related to the fact that the catheters were inserted by a group of nurses who are experts in this technique. In a recent study by Fujioka et al.³⁹ it was concluded that catheter insertion by specialist VAT nurses following a structured protocol significantly reduced pain scores compared to when performed by bedside nurses.

Limitations

Certain limitations of the study should be acknowledged. Firstly, as sterile gauze was applied to the puncture site in the standard care of the CG, this may have absorbed blood and/or exudate during the first 24 h which might have had a masking effect and resulted in missed bleeding and/or oozing events at the 24 h inspection. Secondly, no patients were entered in the study with an INR > 2.5 or with a platelet count $< 48,000/\mu\text{l}$ in the previous 7 days, due to a lack of patients meeting the inclusion criteria. Finally, some of the variables, such as pain, were subjectively evaluated through patient questionnaires.

Conclusions

In this study, a comparison was made of the efficacy of a sutureless stabilisation device and transparent dressing with and without CAG after catheter insertion with the MST in hospitalised adult patients. It was found that the occurrence of peri-catheter bleeding and/or oozing during the first 7 days post catheter insertion was 67% higher when CAG was not used compared to when it was.

It was also found that the probability of catheter displacement was five times higher during the first 24 h if CAG was not used compared to when it was.

On the other hand, it was not possible to confirm a reduction in the incidence of phlebitis or catheter-related pain during the first 7 days post catheter insertion.

All this suggests that CAG shows promise in reducing the number of bleedings and the number of displacements after insertion of midline catheters or PICCs, provided that effective haemostasis has been performed prior to its application.

Finally, further researches are recommended to compare the efficacy of CAG in different patients and health situations.

Acknowledgements

We would like to express our appreciation for the selfless collaboration of all the nursing staff at HUAV who helped develop and carry out this study. We would also like to thank the heads of Innovation, Research and Training and the nursing management team of HUAV for their unconditional support. Our thanks also go to Dr Rubinat and Dr Blanco for their support and advice during the study design and management, as well as Dr Requena and Dr García for the critical analysis made of the study and the advice given before its submission for publication. We would also like to thank Mr Malcolm Hayes for the English language revision

Author contributions

FP-N: Conceptualisation, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, supervision, validation, preparation, creation and/or presentation of the published work, specifically visualisation/data presentation, writing – original draft, writing – review & editing. AB-L: Conceptualisation, data curation, investigation, methodology, software, validation, writing – original draft, writing – review & editing. JF-M: Conceptualisation, data curation, investigation, methodology, resources, writing – original draft, writing – review & editing. AE-N: Conceptualisation, data curation, investigation, methodology, preparation, creation and/or presentation of the published work, specifically visualisation/data presentation, writing – original draft, writing – review & editing. ML-M: Conceptualisation, data curation, investigation, methodology, writing – original draft, writing – review & editing. CS-N: Conceptualisation, data curation, investigation, methodology, writing – original draft, writing – review & editing. FB: Conceptualisation, formal analysis, investigation, methodology, project administration, validation, writing – original draft, writing – review & editing.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Lleida Official Nursing College [Grant 2020 to the best nursing research project].

Ethics approval

Ethical approval for this study was obtained from Drug Research Ethics Committee of the University Hospital Arnau de Vilanova (HUAV) in Lleida (Catalonia, Spain) of the Territorial Management of Lleida – GSS (CEIC-2333, agreement 12/2020 dated 13 August 2020).

Informed consent

Written informed consent was obtained from all subjects before the study.

Trial registration

The study was registered in ClinicalTrials.gov (NCT05299060).

ORCID iD

Ferran Padilla-Nula  <https://orcid.org/0000-0001-5484-4434>

Supplemental material

Supplemental material for this article is available online.

References

- Zhang S, Lingle BS and Phelps S. A revolutionary, proven solution to vascular access concerns: a review of the advantageous properties and benefits of catheter securement cyanoacrylate adhesives. *J Infus Nurs* 2022; 45(3): 154–164.
- Pittiruti M, Annetta MG, Marche B, et al. Ten years of clinical experience with cyanoacrylate glue for venous access in a 1300-bed university hospital. *Br J Nurs* 2022; 31(8): S4–S13.
- Nicholson J and Hill J. Cyanoacrylate tissue adhesive: a new tool for the vascular access toolbox. *Br J Nurs* 2019; 28(19): S22–S28.
- Corley A, Marsh N, Ullman AJ, et al. Tissue adhesive for vascular access devices: who, what, where and when? *Br J Nurs* 2017; 26(19): S4–S17.
- Simonova G, Rickard C, Dunster K, et al. Cyanoacrylate tissue adhesives – effective securement technique for intravascular catheters: in vitro testing of safety and feasibility. *Anaesth Intensive Care* 2012; 40(3): 460–466.
- Gorski L, Hadaway L, Hagle M, et al. Infusion therapy standards of practice. *J Infus Nurs* 2021; 44(suppl 1): S1–S224.
- Bugden S, Shean K, Scott M, et al. Skin glue reduces the failure rate of emergency department–inserted peripheral intravenous catheters: a randomized controlled trial. *Ann Emerg Med* 2016; 68(2): 196–201.
- Brescia F, Pittiruti M, Spencer TR, et al. The SIP protocol update: eight strategies, incorporating Rapid Peripheral Vein Assessment (RaPeVA), to minimize complications associated with peripherally inserted central catheter insertion. *J Vasc Acces*. Epub ahead of print 27 May 2022. DOI: 10.1177/11297298221099838.
- Ntelezos K, Katsoula TT, Mariolis-Sapsakos T, et al. Original article comparing safety and colonization rates between octyl-isocyanacrylate glue and standard gauze sponge dressings for patients with PICC-PORTs: a pilot randomized controlled trial. *Int J Caring Sci* 2022; 15(2): 1275–1282.
- Delezos C, Katsoulas T, Mariolis-Sapsakos T, et al. The role of 2 – Octyl-Isocyanacrylate Glue, as a microbial barrier in peripherally inserted central catheter port VADS. A review of the literature. *Health Res J* 2022; 8(2): 68–79.
- Rickard C, Edwards M and Spooner A. A 4-arm randomized controlled pilot trial of innovative solutions for jugular central venous access device securement in 221 cardiac surgical patients. *J Crit Care* 2016; 36(1): 35–42.

12. Celentano D and Pittiruti M. Peripheral venous access: short cannulas, mini-midlines, midlines. In: Biasucci DG, Disma NM and Pittiruti M (eds.) *Vascular access in neonates and children*. Cham: Springer International Publishing, 2022. pp. 211–25.
13. Reynolds H, Taraporewalla K, Tower M, et al. Novel technologies can provide effective dressing and securement for peripheral arterial catheters: a pilot randomised controlled trial in the operating theatre and the intensive care unit. *Aust Crit Care* 2015; 28(3): 140–148.
14. Rickard C, Marsh N, Webster J, et al. Dressings and securements for the prevention of peripheral intravenous catheter failure in adults (SAVE): a pragmatic, randomised controlled, superiority trial. *Lancet* 2018; 392(10145): 419–430.
15. Biasucci D, Pittiruti M and Taddei A. Targeting zero catheter-related bloodstream infections in pediatric intensive care unit: a retrospective matched case-control study. *J Vasc Access* 2018; 19(2): 119–124.
16. van Rens M, Nimeri AMA, Spencer TR, et al. Cyanoacrylate securement in neonatal PICC use. *Adv Neonatal Care* 2022; 22(3): 270–279.
17. D’Andrea V, Pezza L, Barone G, et al. Use of cyanoacrylate glue for the sutureless securement of epicutaneo-caval catheters in neonates. *J Vasc Access* 2022; 23(5): 801–804.
18. Zhang S, Guido A, Jones R, et al. Experimental study on the hemostatic effect of cyanoacrylate intended for catheter securement. *J Vasc Access* 2019; 20(1): 79–86.
19. Di Puccio F, Giacomarro D, Mattei L, et al. Experimental study on the chemico-physical interaction between a two-component cyanoacrylate glue and the material of PICCs. *J Vasc Access* 2018; 19(1): 58–62.
20. Kang J, Chen W, Sun W, et al. Peripherally inserted central catheter-related complications in cancer patients: a prospective study of over 50,000 catheter days. *J Vasc Access* 2017; 18(2): 153–157.
21. Schulz KF, Altman DG, Moher D, et al. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *BMC Med* 2010; 8: 18.
22. O’Grady NP, Alexander M, Burns LA, et al. Guidelines for the prevention of intravascular catheter-related infections. *Clin Infect Dis* 2011; 52(9): e162–e193.
23. Gallant P and Schultz AA. Evaluation of a visual infusion phlebitis scale for determining appropriate discontinuation of peripheral intravenous catheters. *J Infus Nurs* 2006; 29(6): 338–345.
24. Huskinsson E, Jones J and Scott J. Application of visual-analogue scales to the measurement of functional capacity. *Rheumatology* 1976; 15(3): 185–187.
25. Leung T-K, Lee C-M, Tai C-J, et al. A retrospective study on the long-term placement of peripherally inserted central catheters and the importance of nursing care and education. *Cancer Nurs* 2011; 34(1): E25–E30.
26. Harris PA, Taylor R, Thielke R, et al. Research electronic data capture (REDCap) – a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inf* 2009; 42(2): 377–381.
27. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: building an international community of software platform partners. *J Biomed Inf* 2019; 95: 103208.
28. IBM Corp. Released 2020. *IBM SPSS Statistics for Windows, version 28.0*. IBM Corp, 2021, <https://www.ibm.com/analytics/spss-statistics-software> (accessed 1 August 2021).
29. Timsit J, Bouadma L, Ruckly S, et al. Dressing disruption is a major risk factor for catheter-related infections. *Crit Care Med* 2012; 40: 1707–1714.
30. Marsh N, Webster J, Flynn J, et al. Securement methods for peripheral venous catheters to prevent failure: a randomised controlled pilot trial. *J Vasc Access* 2015; 16(3): 237–244.
31. Raad I, Hanna H and Maki D. Intravascular catheter-related infections: advances in diagnosis, prevention, and management. *Lancet Infect Dis* 2007; 7(10): 645–657.
32. Edwards M, Rickard C, Rapchuk I, et al. A pilot trial of bordered polyurethane dressings, tissue adhesive and sutureless devices compared with standard polyurethane dressings for securing short-term arterial catheters. *Crit Care Resusc* 2014; 16(3): 175–183.
33. Lacostena-Pérez ME, Buesa-Escar AM and Gil-Alós AM. Complications related to the insertion and maintenance of peripheral venous access central venous catheter. *Enferm Intensiva* 2019; 30(3): 116–126.
34. Pittiruti M, Van Boxtel T, Scoppettuolo G, et al. European recommendations on the proper indication and use of peripheral venous access devices (the ERPIUP consensus): a WoCoVA project. *J Vasc Access* 2021; 24(1): 165–182.
35. Annetta MG, Bertoglio S, Biffi R, et al. Management of antithrombotic treatment and bleeding disorders in patients requiring venous access devices: a systematic review and a GAVeCeLT consensus statement. *J Vasc Access* 2022; 23(4): 660–671.
36. Grau D, Clarivet B, Lotthé A, et al. Complications with peripherally inserted central catheters (PICCs) used in hospitalized patients and outpatients: a prospective cohort study. *Antimicrob Resist Infect Control* 2017; 6(1): 18.
37. Gilardi E, Piano A, Chellini P, et al. Reduction of bacterial colonization at the exit site of peripherally inserted central catheters: a comparison between chlorhexidine-releasing sponge dressings and cyano-acrylate. *J Vasc Access* 2021; 22(4): 597–601.
38. Chan RJ, Northfield S, Larsen E, et al. Central venous Access device SeCurement And Dressing Effectiveness for peripherally inserted central catheters in adult acute hospital patients (CASCADE): a pilot randomised controlled trial. *Trials* 2017; 18(1): 458.
39. Fujioka G, Newcomb P, Hunchusky C, et al. Pain perception of a structured vascular access team approach to short peripheral catheter (SPC) placement compared to SPC placement by bedside nurses. *J Infus Nurs* 2020; 43(1): 33–38.