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Original Article

Effectiveness of 10% povidone-iodine drying time before Peripheral Intravascular Catheter insertion: preliminary results from an explorative quasi-experimental study

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Aim: to investigate the effectiveness of 10% povidone-iodine after a 30-second or 2-minute drying time on microbial count reduction at the point of a Peripheral Intravascular Catheter (PIC) insertion. A quasi-experimental design was adopted. In total, 53 patients were enrolled, 25 were exposed to a 2-m drying time and 28 to a 30-s drying time. From the preliminary results of this study, no differences in the occurrence of contamination have emerged between patients receiving 30-s and 2-m drying time for 10% povidone-iodine solutions.

Descriptors: Povidone Iodine/Therapeutic Use; Air Dry; Disinfection; Catheterization Peripheral; Microbial Count.

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Eficácia de iodopovidona a 10% de acordo com tempo de secagem antes da inserção do cateter intravenoso periférico: resultados preliminares de um estudo exploratório quasi-experimental

Objetivo: investigar a eficácia da solução iodopovidona a 10% sobre a redução da contagem microbiana no ponto de inserção do Cateter Venoso Periférico após tempo de secagem de 30s ou 2 min. Método: desenho quase-experimental. Foram incluídos 53 pacientes no estudo: 25 foram expostos a 2min de secagem e 28 foram expostos a 30s de secagem. Resultados: Os resultados preliminares não apresentaram diferenças na ocorrência de contaminação entre os pacientes que foram submetidos a 30s ou 2min de secagem após desinfecção com solução de iodopovidona a 10%.

Descritores: Iodopovidona/Uso Terapêutico; Desinfecção; Cateterismo Periférico; Contagem Microbiana.

Eficacia del tiempo de secado de la yodopovidona al 10% antes de la inserción de catéter venoso periférico: resultados preliminares de un estudio exploratorio casi-experimental

Objetivo: para investigar la eficacia de una solución yodopovidona al 10% tras tiempo de secado de 30 segundos o 2 minutos en la reducción del contaje microbiano en el local de inserción del Catéter Venoso Periférico, fue adoptado un diseño casi-experimental. Al total, fueron incluidos 53 pacientes, 25 expuestos a 2 min. de secado y 28 a 30 segundos. Con base en los resultados preliminares, no se encontraron diferencias en la ocurrencia de contaminaciones entre pacientes sometidos a un tiempo de secado de 30 s. o de 2 min tras desinfección con solución de yodopovidona al 10%.

Descriptores: Povidona Yodada/Uso Terapéutico; Desinfección; Cateterización Periférica; Recuento Microbiano.

Background

The Peripheral Intravascular Catheter (PIC) is widely used in nursing clinical practice. PICs can cause both local and systemic complications, the most common being phlebitis, varying from 1–70% in different observational studies[1-3], and originate most often from skin commensal flora. Recommended strategies to prevent PIC-related infections are hand hygiene, the use antiseptic techniques and adequate skin preparation[4-6]. Before the placement of a PIC, an effective reduction of the microbial count is recommended. While different antiseptic solutions should be used (e.g., >0.5% chlorhexidine, iodophor), there is a general lack of recommendations regarding the disinfection drying time, even in the most recent guidelines[4]. In the event of contraindication of the use of chlorhexidine[4], a solution with 10% povidone-iodine is recommended and drying time is necessary for it to release free iodine against the cell wall of the microorganism and to replace the content with iodine[7].The previous guidelines on intravascular catheters[5-6] recommend allowing for a drying time of 2 minutes, but no experimental data support this advice. Previously, commentary that likewise lacks support from experimental data reported that a 10% povidone-iodine solution would be effective after drying for 90 seconds[8].

In daily practice, nurses have many doubts about the time required and different strategies to facilitate drying are adopted: fanning, using gauze to dry, and blowing, which seems to be inappropriate as it increases the risk of infection[7]. These strategies are often adopted in the use of 10% povidone-iodine because its drying time appears to be longer than for other solutions. Contributing to knowledge regarding how long the 10% povidone-iodine should be left in place before applying the PIC is the main goal of this paper.

Objectives and study design

Aiming to investigate the effectiveness of 10% povidone-iodine after a 30-second or 2-minute drying time on microbial count reduction at the point of PIC insertion, a quasi-experimental design was adopted.

Materials and methods

In February 2012, an approachable Emergency Department (ED) located in northern Italy was involved after having obtained appropriate authorization from the Internal Review Board of the Hospital/University.

All adults (≥18 years) admitted subsequently to the ED and who were candidates for PIC were eligible. Those affected by condition(s) contraindicating the adoption of 10% povidone-iodine (e.g., allergy, pregnancy) or affected by cardiac arrest or unconsciousness were excluded. After having obtained written informed consent from the patients included in the study, they were divided into two groups according to the priority given at triage: a) those receiving an ED white code (=not urgent condition) were exposed to a 2 minute (2-m) 10% povidone-iodine drying time, while b) those receiving green or yellow triage codes (=patients in sub-urgent conditions) were exposed to a 30 second (30-s) drying time. Clinical nurses disinfected the site with 10% povidone-iodine using sterile gauze, in accordance with the procedure adopted in the ward.

The microbial count was the primary end-point of the study, examined at two different points in time: the first, before skin disinfection, seeking to determine baseline skin contamination (T0), the second after the drying time (30-s *vs.* 2-m), in order to measure the effectiveness of 10% povidone-iodine on the microbial count at a different drying time (T1). The swabs were immediately seeded on chocolate agar and conserved in a thermostat-governed environment at 37° Degree Celsius (C) for 24 hours and then evaluated by two researchers in a blind fashion to count the colony-forming units (CFUs). The definition adopted for skin contamination was the presence of CFUs≥15[9].

A questionnaire investigating patient demographic characteristics such as age and gender, recent surgery (yes/no), health problems (cancer, diabetes, coagulopathies, fever -yes/no-), and antibiotic therapy (yes/no) according to their influence in the occurrence of PIC-related infection[10-14] was administered by interview.

Patient collaboration (or not) during the procedure, where the PIC was inserted (e.g., right or left upper limb, and vein approached), and its size, as well as factors increasing the risk of contamination[3,10-14], were also observed and documented by the researcher. Ultimately, skin preparation procedures adopted by the clinical nurse performing the PIC insertion (preliminary hand hygiene, the use of gloves, and the adoption of aseptic techniques during the procedure, in accordance with the available guidelines[4]) was then observed, with a grid filled in by the researcher.

Data was processed using the SPSS Statistical Package (Version 18). Indices of central position (mean, standard deviation), percentages and frequencies have been evaluated. Comparison between the two groups was performed adopting the T-test or non-parametric tests (according to the normal distribution [or not] of the variables), and the χ^2 test (or Fisher's Test, when appropriate). Relative Risk (Confidence Interval 95% [95% CI]) was also evaluated. The statistical significance level was set at p=0.05.

Results

In total, some 53 patients were enrolled, 25 were exposed to a 2-m drying time and 28 to a 30-s drying time. Thirty–one patients were male, and the majority (50/53, 94.3%) collaborated with clinical nurses during the PIC insertion. The exposed and control groups were homogeneous in their principal participant characteristics, as reported in Table 1. The procedure for PIC insertion and the characteristics of the PIC gauge and of the site chosen by the clinical nurse were also homogeneous between the exposed and control groups, as indicated in Table 1.

Table 1 - Patient demographics and PIC insertion data

	Exposed Group 30-s=28 (%)	Control Group 2-m =25 (%)	P value*
Patient characteristics			
Age	68.2 (SD 19.7)	63.2 (SD 18.8)	0.35
Male	17 (60.7)	14 (56.0)	0.47
Recent surgery (yes)	2 (7.1)	0 (-)	0.27
Cancer (yes)	2 (7.1)	1 (4.0)	0.54
Diabetes (yes)	3 (10.7)	3 (12.0)	0.60
Coagulopathies (yes)	14 (50.0)	10 (40.0)	0.32
Fever at the time of ED admission (yes)	3 (10.7)	2 (8.0)	0.55
Antibiotics at the time of ED admission (yes)	2 (7.1)	5 (20.0)	0.16
Patient collaboration (yes)	27 (96.4)	23 (92.0)	0.45
PIC insertion			
Site: Right upper limb	16 (57.1)	16 (64.0)	0.61
Antecubital fossa	14 (50.0)	17 (68.0)	
Forearm	11 (39.3)	8 (32.0)	0.16
Hand	3 (10.7)	0 (-)	

(continue...)

Table 1 - (continuation)

Veins approached			
Cephalic vein	16 (57.1)	14 (56.0)	0.19
Basilic vein	8 (28.6)	7 (28.0)	
Perforating vein	1 (3.6)	1 (4.0)	
Dorsal vein	3 (10.7)	0 (-)	
Median antebrachial vein	0 (-)	3 (12.0)	
PIC size			
18 gauge	20 (71.4)	13 (52.0)	0.24
20 gauge	8 (28.6)	11 (44.0)	
22 gauge	0 (-)	1 (4.0)	
Skin preparation procedure adopted by the nurse inserting the PIC			
Hand hygiene (yes)	2 (7.1)	4 (16.0)	0.31
Gloves (yes)	10 (35.7)	13 (52.0)	0.23
Aseptic technique respected (yes)	1 (3.6)	5 (20.0)	0.06

*χ^2 for categorical variables and U-Mann Whitney for continuous variables

At an overall level, 27 out of 53 (50.9%) sites selected for PIC placements were contaminated at the baseline (T0; 17 among the exposed group and 10 among the control group); after disinfection (T1), 20 sites (37.7%) were contaminated (13 among the exposed group and 7 among control groups). A total of 7 contaminated sites (13.2%) at T0 were not contaminated at T1 (4 among the exposed group and 3 among the control group). The differences that emerged were not statistically significant (Table 2).

Table 2 - Disinfection with 10% povidone-iodine: comparison between exposed group and controlled group

Characteristics	Exposed Group 30-s=28 (%)	Control Group 2-m=25 (%)	P value
Number of PIC sites contaminated (CFUs≥ 15) at T0	17 (60.7)	10 (40.0)	RR 1.49 (CI95% 0.87 to 2.54) p = 0.13
Number of PIC sites contaminated (CFUs≥15) at T1	13 (47.4)	7 (28.0)	RR 1.43 (CI95% 0.87 to 2.34) p = 0.16
Differences of PIC sites contaminated (CFUs≥ 15) (T1-T0)	4 (14.3)	3 (12.4)	RR 1.10 (CI95% 0.54 to 2.20) p = 0.80

Moreover, among the group with a 30-s drying time, the average of CFUs at T0 were 209 and 80 at T1 (-24.6%); among the control group (2-m drying time), the average CFUs at T0 were 4,527 and 502 at T1 (-35.3%). These differences are not statistically significant (p=0.268).

Discussion

According to its exploratory nature, this manuscript has several limitations: a monocentric center was involved and a limited number of participants were enrolled. Adopting the perspective of pragmatic trials[15], the researchers did not standardize the disinfection technique, given that the quantity of antiseptic solution used in daily practice for this procedure is adopted heterogeneously among clinical nurses. Further studies should address these limits, extending the study design also to those antiseptic solutions recommended by the up-to-date guidelines (e.g., >0.5% chlorhexidine, iodophor) and also at different sites, such as for surgical wound disinfection.

The study involved a homogeneous group of patients admitted into the ED under different urgency codes where the insertion of a PIC is considered a routine procedure. According to the need to have the PIC rapidly in place (in the case of urgent cases), a group was exposed to a 30-s drying time, while patients admitted in non-urgent conditions received a 2-m drying time. Considering the lack of evidence available in the field, the drying time was selected on the basis of the existing literature[7], which recommended 2 minutes, and on the basis of *in vitro* studies[16-17], which applied a 30-s drying time.

The analysis showed that drying time (30-s *vs.* 2-m) was not significantly associated with contamination (CFUs≥15) at T1: in its preliminary phase and among its several limitations, this exploratory study shows that the drying time should be less than 2 minutes and these results might help nurses in their practice. For them, waiting for the drying time is particularly difficult in the case of confused, unstable and at risk patients and/or in turbulent environments such as EDs[18], where multiple interruptions might threaten the safety of the procedure. In order to reduce this time, different strategies are adopted by clinical nurses, such as fanning, using gauze to dry, or blowing, which seems to be inappropriate as it increases the risk of infection[7].

Conclusions

Intravenous therapy is largely used for ED patients via PICs inserted by nurses. PICs can cause both local and systemic complications, the most common being phlebitis: aseptic techniques and adequate skin preparation are the main strategies to reduce contamination at the time of insertion. To our knowledge, no previous studies developed evidence regarding the drying time utilized after skin disinfection or its effectiveness in reducing contamination. From the preliminary results of this study, no differences

in the occurrence of contamination have emerged between patients receiving 30-s and 2-m drying time of 10% povidone-iodine solutions. These preliminary results should be confirmed with further large and multicenter studies addressing the lack of evidence in the field and the consequent uncertainly of clinical nurses: drying time increases the length of the procedure and the risk of accidental contamination of the site. Waiting for a site to dry for a longer time with some patients (e.g. critical, agitated patients), and in some turbulent environments (e.g. emergency departments) is not always advisable.

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References

1. Trinh TT, Chan PA, Edwards O, Hollenbeck, Huang B, Burdick N, et al. Peripheral Venous Catheter-Related Staphylococcus aureus Bacteremia. Infection Control Hosp Epidemiol. 2011;32(6):579-83.

2. Martinez JA, Piazuelo M, Almela A, Blecua P, Gallardo R, Rodrìguez S, et al. Evalutation of add-on device for the prevention of phlebitis and other complications associated with the use peripheral catheters in hospitalized adults: a randomized controlled study. J Hosp Infection. 2009;73:135-42.

3. Maki DG, Kluger DM, Crnich CJ. The risk of bloodstream infection in adults with different intravascular devices: a systematic review of 200 published prospective studies. Mayo Clin Proc. 2006;81(9):1159-71.

4. Centers for Disease Control and Prevention (CDC). Guidelines for the Prevention of Intravascular Catheter-Related Infections. Am J Infection Control. 2011;39:S1-34.

5. Centers for Disease Control and Prevention (CDC). Guidelines for the Prevention of Intravascular Catheter-Related Infections. MMWR. 2002;51(RR10):1-26.

6. Registered Nurses' Association of Ontario. Care and Maintenance to reduce Vascular Access Complications. Nursing best practice guidelines program; 2005.[acesso 13 nov 2012]; Disponível em: http://www.rnao.org/Storage/39/3381_Care_and_Maintenance_to_Reduce_Vascular_Access_Complications._with_2008_Supplement.pdf.

7. Hadaway L. What you can do to decrease catheter – related infections: Meticulous cleaning of skin and insertion site can keep bad bugs out of your patient's bloodstream. Nursing. 2002;32:46-8.

8. Aschenbrenner Diane S. A Question of Practice: Skin Preps and Protocol. Am J Nurs. 2000;100(4):78.

9. Maki DG, Weise CE, Sarafin HW. A semiquantitative culture method for identifying intravenous – catheter – related infection. N Engl J Med. 1977;296:1305-9.

10. Grice EA, Segre JA. The skin micro biome. Nature Rev Microbiol. 2011;9:244-53.

11. Forni C, Loro L, Tremosini M, Trofa C, D'Alessandro F, Sabbatini T, et al. Studio di coorte sulla popolazione ortopedica delle complicanze correlate all'utilizzo del catetere venoso periferico e identificazione dei fattori predittivi. Assistenza Inferm Ricerca. 2010;29(4):166-73.

12. Lee WL, Chen HL, Tsai TY, Lai IC, Chang WC, Huang CH, Fang CT. Risk factors for peripheral intravenous catheter infection in hospitalized patients: a prospective study of 3165 patients. Am J Infect Control. 2009;37:683-6.

13. Nassaji- Zavareh M, Ghorbani R. Peripheral intravenous catheter –related phlebitis and related risk factors. Singapore Med J. 2007;48(8):733-8.

14. Tagalakis V, Kahn SR, Libman M, Blostein M. The epidemiology of peripheral vein infusion thrombophlebitis: a critical review. Am J Med. 2002;113:146-51.

15. Zwarenstein M, Treweek S, Gagnier J, Douglas G, Tunis S, Haynes B et al. CONSORT and Pragmatic Trials in Healthcare (Practihc) groups. Improving the reporting of pragmatic trials: an extension of the CONSORT statement. BMJ. 2008;337:a2390.

16. Adams D, Quayum M, Worthington T, Lambert P, Elliott T. Evaluation of a 2% chlorhexidine gluconate in 70% isopropyl alcohol skin disinfectant. J Hosp Infection. 2005;61:287-90.

17. Federal Register. Department of Health and Human Services. Food and Drug Administration. Topical antimicrobials drug products for over-the-counter human use: tentative final monograph for healthcare antiseptic drug products – Proposed rule; 1994. Disponível em: http://www.fda.gov/ohrms/dockets/ac/05/briefing/2005-4098B1_02_03-FDA-TAB1.pdf.

18. Palese A, Cassone A, Kulla A, Dorigo S, Artico M, Camero F, et al. Factors influencing nurses' decision making process on leaving the Peripheral Intravascular Catheter after 96 hours: a longitudinal study. J Inf Nurs. 2011;34(5):319-26.

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