Literature Review

TEXTO & CONTEXTO ENFERMAGEM
TEXT & CONTEXT NURSING TEXTO & CONTEXTO ENFERMERÍA

PREVENTION AND CONTROL OF INFECTION RELATED TO PERIPHERAL ARTERIAL CATHETER MANAGEMENT

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ABSTRACT

Objective: to describe scientific evidence on good practices for peripheral arterial catheter management.
Method: this is an integrative review, carried out through a search in the Latin American and Caribbean Literature in Health Sciences, Virtual Health Nursing Library, National Library of Medicine, Cochrane Library, Cumulative Index to Nursing & Allied Health, Excerpta Medica dataBASE, SciVerse Scopus TopCited and Web of Science databases in March 2021. Articles in Portuguese, English and Spanish, without time limits in the search, were included.
Results: forty-nine articles were found. At insertion, measures involved hand hygiene, skin preparation, no-touch technique, aseptic technique and protective barrier, sterile components and transducers, peripheral arterial catheter insertion, insertion attempts, ultrasound and comfort measure use. During maintenance, issues regarding insertion site, invasive blood pressure circuit, connectors, dressing and stabilization were identified, and, during removal, aspects such as local and systemic complications after peripheral arterial catheter removal.
Conclusion: the study provides crucial information for the effective management of peripheral arterial catheters, contributing to the reduction of complications and improvement of clinical results. By updating their practices, healthcare professionals can ensure greater safety and well-being for patients, always seeking to provide excellent care.

DESCRIPTORS: Vascular access devices. Sepsis. Catheterization, peripheral. Adult. Nursing.

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PREVENÇÃO E CONTROLE DE INFECÇÃO RELACIONADA AO MANEJO DE CATETER ARTERIAL PERIFÉRICO

RESUMO

Objetivo: descrever as evidências científicas sobre as boas práticas para o manejo de cateter arterial periférico.
Método: revisão integrativa, realizada por meio de busca nas bases de dados Literatura Latino-Americana e do Caribe em Ciências da Saúde, Biblioteca Virtual em Saúde Enfermagem, *National Library of Medicine*, *Cochrane Library*, *Cumulative Index to Nursing & Allied Health*, *Excerpta Medica dataBASE*, *SciVerse Scopus TopCited* e *Web of Science* em março de 2021. Foram incluídos artigos em português, inglês e espanhol, sem delimitação de tempo na busca.
Resultados: foram encontrados 49 artigos. Na inserção, as medidas envolveram higienização das mãos, preparo da pele, técnica *no touch,* técnica asséptica e barreira de proteção, componentes estéreis e transdutores, inserção do cateter arterial periférico, tentativas de inserção, uso do ultrassom e medidas de conforto. Na manutenção, questões sobre o sítio de inserção, circuito da pressão arterial invasiva, conectores, curativo e estabilização foram identificadas e, na retirada, aspectos como complicações locais e sistêmicas, após retirada do cateter arterial periférico.
Conclusão: o estudo fornece informações cruciais para o eficaz manejo do cateter arterial periférico, contribuindo para a redução de complicações e aprimoramento dos resultados clínicos. Ao atualizar suas práticas, os profissionais de saúde podem assegurar maior segurança e bem-estar aos pacientes, buscando sempre oferecer um atendimento de excelência.

DESCRITORES: Dispositivos de Acesso Vascular. Sepse. Cateterismo Periférico. Adulto. Enfermagem.

PREVENCIÓN Y CONTROL DE INFECCIONES RELACIONADAS CON EL MANEJO DEL CATÉTER ARTERIAL PERIFÉRICO

RESUMEN

Objetivo: describir la evidencia científica sobre buenas prácticas para el manejo de catéteres arteriales periféricos.
Método: revisión integradora, realizada a través de una búsqueda en las bases de datos Literatura Latinoamericana y del Caribe en Ciencias de la Salud, Biblioteca Virtual en Enfermería en Salud, National Library of Medicine, Cochrane Library, Cumulative Index to Nursing & Allied Health, Excerpta Medica dataBASE, SciVerse Scopus TopCited y Web of Science en marzo de 2021. Se incluyeron artículos en portugués, inglés y español, sin límite de tiempo en la búsqueda.
Resultados: se encontraron 49 artículos. En la inserción, las medidas incluyeron higiene de manos, preparación de la piel, técnica de no contacto, técnica aséptica y barrera protectora, componentes y transductores estériles, Inserción de catéter arterial periférico, intentos de inserción, uso de ultrasonido y medidas de comodidad. Durante el mantenimiento se identificaron problemas relacionados con el sitio de inserción, circuito de presión arterial invasiva, conectores, vendaje y estabilización y, durante el retiro, aspectos como complicaciones locales y sistémicas, luego del retiro del catéter arterial periférico.
Conclusión: el estudio proporciona información crucial para el manejo eficaz de los catéteres arteriales periféricos, contribuyendo a la reducción de complicaciones y mejora de los resultados clínicos. Al actualizar sus prácticas, los profesionales de la salud pueden garantizar una mayor seguridad y bienestar a los pacientes, buscando siempre brindar una excelente atención.

DESCRIPTORES: Dispositivos de acceso vascular. Sepsis. Cateterismo periférico. Adulto. Enfermería.

INTRODUCTION

Healthcare-associated infections (HAIs) occur in hospital settings or after discharge, and can cause serious complications for patients, such as prolonged hospitalization, increased treatment costs and, in more serious cases, even risk of death[1].

It is noteworthy that the Intensive Care Unit (ICU) and the sectors that care for critical patients are places with a higher risk of HAIs, due to patient characteristics, greater consistency in antibiotic use, greater professional contact with patients and disruption of tissue barriers during invasive procedures[1–5]. Among the invasive procedures necessary for critically ill patients, invasive blood pressure (IBP) stands out, which includes peripheral arterial catheter (PAC) insertion[6].

IBP is considered the gold standard in critically ill hospitalized patients, as it provides a accurate and rigorous measurement, making it crucial for decision-making[6–8]. Vascular or infectious complications may arise during PAC use, such as pain, edema, ischemia and others[9]. This justifies the importance of professionals' theoretical-scientific knowledge regarding device management to avoid complications that may arise.

Continuous improvements to PAC management and adherence to team and patient care practices are necessary to prevent HAIs. Systematic care use will guarantee safety and quality of work for ICU professionals and reduce these infections[10–11]. In this regard, this research will contribute to safe healthcare practice, in order to direct strategies with a view to reducing occurrences of PAC. Therefore, this study aimed to describe scientific evidence on good practices for PAC management.

METHOD

This is an integrative literature review, carried out through six steps[12]: theme or research question definition; investigation in databases according to adopted search criteria; data collect; critical analysis of studies and classification of the level of evidence; interpretation and synthesis of results; synthesis of knowledge. To this end, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart was followed[13]. The integrative review question was created based on the PICO[14] strategy, which considered (P) patient – "adult admitted to the ICU", (I) intervention – "PAC", (C) comparison – "not applicable" and (O) Outcome – "infection", which generated the following guiding question: what is the scientific evidence regarding prevention and control measures for bloodstream infections related to PAC management in hospitalized adult patients?

The search for articles took place in March 2021 in the Latin American and Caribbean Literature in Health Sciences (LILACS), *Biblioteca Virtual em Saúde Enfermagem* (BDENF), Cumulative Index to Nursing & Allied Health (CINAHL), National Library of Medicine (PubMed), Cochrane Library (Cochrane), Excerpta Medica dataBASE (Embase), SciVerse Scopus TopCited (Scopus), and Web of Science databases described in the Figure 1.Crossing occurred through the controlled descriptors "Vascular Access Devices", "Sepsis", "Peripheral Catheterism", "Adult" and "Nursing", belonging to the Medical Subject Headings (MeSH) and the Health Sciences Descriptors (DeCS).

Articles, protocols, guidelines and guidelines, published in Portuguese, English or Spanish, without delimiting publication time related to PAC and covering the adult population, were included. It is noteworthy that studies with other catheters were also included, such as peripheral venous intravenous catheter (PVIC) and central venous catheter (CVC), due to the scarcity of articles on specific PAC care, in addition to the fact that some care aimed at PVIC and CVC may be useful for PAC. Duplicate articles, editorials, dissertations, theses, works in other languages and that did not cover PAC in the adult population were excluded. The results were extracted using an adapted data collection instrument[15]. To define the level of evidence, classification according to Evidence-Based

Practice, Step by Step[16] was used. Afterwards, categories and subcategories were produced to designate PAC care in its insertion, maintenance and removal.

RESULTS

In total, 49 studies were included in the research, such as articles, guidelines and guidelines, subsequently emerging analytical categories and subcategories described below Figura 1. Of these 49 selected studies, 17 were included in more than one category.

PAC insertion[17–56]: PAC insertion. Hand hygiene. Skin preparation. No-touch technique. Aseptic technique and protection barrier. Sterile components and transducers. PAC insertion. Insertion attempts. Ultrasound (US) use. Comfort measures. PAC maintenance[17,20,21,24,26,35–37,40,42,48,50,55–64]: Insertion site. PAC circuit. Connectors. Dressing. Stabilization. Dressing and device protection. PAC removal[37,58,65] Local and systemic complications. Infection. Site care after PAC removal. Component disinfection.

Chart 1 presents the characteristics of studies included in the “Insertion” category according to article identification (ID), design, objective and approach and evidence level.

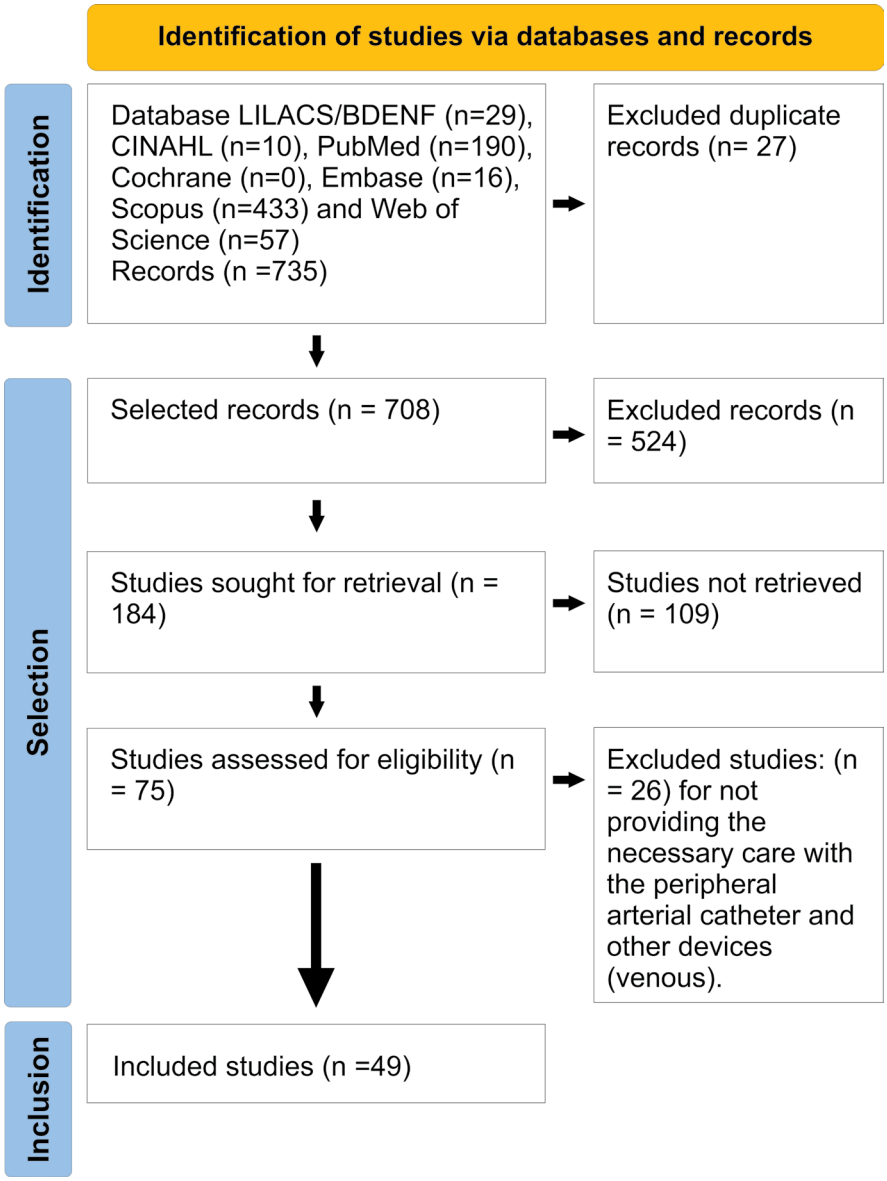

Figure 1 – Adapted PRISMA flowchart13. Uberaba, MG, Brasil, 2022.

Chart 2 presents the characteristics of studies included in the “Maintenance” category according to article identification (ID), design, objective, approach and level of evidence.

Chart 1 – Characteristics of studies included in the "Insertion" category. Uberaba, MG, Brazil, 2022.

ID* LoE† place and date	Design	Objective	Approach
O'Grady *et al*.[17] LoE†: VII USA/2002	Review, guideline	To create a guideline for the prevention of infections related to intravascular catheters.	Hand hygiene.
Maki, Crnich[18] LoE†: VII USA/2003	Review	To identify the risks of healthcare-related infections caused by catheters in intensive care.	Skin antisepsis.
Cousins, O'Donnel[19] LoE†: V USA/2004	Review	To examine the radial, brachial, axillary and femoral arterial puncture sites.	Puncture site.
Koh *et al*.[20] LoE†: VI Australia/ 2008	Descriptive, quantitative, observational	To measure colonization and rates of catheter-related bloodstream infection in arterial catheters.	The choice of the radial artery without specifying which side of the limb. Infection rate.
Martins *et al*.[21] LoE†: VI Brazil/2008	Descriptive, observational	To verify nursing professionals adherence to asepsis recommendations when installing and handling the PVC**.	Skin antisepsis.
Small *et al*.[22] LoE†: II United Kingdom/2008	Randomized clinical trial	To compare the effectiveness of 2% chlorhexidine gluconate in 70% isopropyl alcohol and 70% isopropyl alcohol for skin disinfection to prevent catheter-related healthcare-related infections.	Skin antisepsis.
Lee *et al*.[23] LoE†: II Taiwan/2009	Randomized clinical trial	To examine whether the scheduled change interval from 48 to 72 hours to 72 to 96 hours is a risk factor for PVC** infection.	Skin antisepsis.
López *et al*.[24] LoE†: II Spain/2009	Randomized clinical trial	To investigate the clinical performance of a closed infusion system compared to an open system in PVC**.	For skin antisepsis, 70% alcohol.
Lemaster *et al*.[25] LoE†: V USA/2010	Systematic review	To carry out a systematic review of CVC§ and PAC‡‡ studies inserted in emergencies.	Invasive line in emergency sectors and maximum barrier precautions.
Koh *et al*.[26] LoE†: IV Australia/2012	Descriptive, quantitative, prospective and observational	To determine catheter colonization rates after removal.	Skin antisepsis, maximum sterile barrier, sterile drape and glove.
Vezzani *et al*.[27] LoE†: VI Italy/2013	Descriptive, prospective, observational, review	To use ultrasound as a guide during vascular access procedures.	Ultrasound use, Allen test.

Chart 1 – Cont.

ID* LoE† place and date	Design	Objective	Approach
López *et al*.[28] LoE†: II Spain/2014	Randomized clinical trial	To compare closed system PVC** with open system PVC**.	Skin antisepsis.
Calero *et al*.[29] LoE†: V Spain/2015	Systematic review	To establish which antiseptic solution is most suitable for skin antisepsis to prevent healthcare-related infections caused by catheter use.	Skin antisepsis.
Melo, *et al*.[30] LoE†: VI Brazil/2015	Descriptive	To analyze the care provided by nursing professionals during peripheral venipuncture.	Skin antisepsis.
Choudhury *et al*.[31] LoE†: II Australia/2016	Randomized clinical trial	To determine bacterial community structures in the skin at insertion sites and associated PVC**.	Skin antisepsis.
Evans *et al*.[32] LoE†: IV Australia/2016	Descriptive, quantitative, comparative	To assess the sensitivity, specificity and accuracy of two in situ diagnostic methods for healthcare-related infection prevention related to catheter use in adults hospitalized for burns.	Skin antisepsis, sterile technique, maximum protection barriers, ultrasound use.
Kiefer, Keller, Weekes[33] LoE†: VI USA/2016	Descriptive and prospective	To assess the immediate and short-term incidence of complications from catheters in the internal jugular vein.	Ultrasound use.
Zhang *et al*.[34] LoE†: VI Australia/2016	Descriptive, quantitative	To assess the results of bacteriological culture of intravascular catheters.	PAC‡‡ colonization.
Marsh *et al*.[35] LoE†: II Australia/2018a	Randomized clinical trial	To compare two coverage methods for PVC**.	Skin antisepsis.
Rickard *et al*.[36] LoE†: II Australia/2018	Randomized clinical trial	To compare the effectiveness and costs of three types of PVC** polyurethane dressings.	Skin antisepsis.
Timsit *et al*.[37] LoE†: V France/2018	Review	To provide updated information on available knowledge on the epidemiology and diagnosis of CVC§ and PAC‡‡ complications in the Intensive Care Unit.	Ultrasound use.

Chart 1 – Cont.

ID* LoE† place and date	Design	Objective	Approach
Bakan, Arli[38] LoE†: No categorization Turkey/2019	Methodological study, review	To develop a scale to assess nurses' knowledge and attitudes about healthcare-related infection prevention related to PVC** and CVC§ use.	Hand hygiene before and after insertion; antiseptic and glove use.
Choudhury *et al*.[39] LoE†: VI Australia/2019	Descriptive, quantitative	To assess the impact of PVC** insertion site colonization and the occurrence of primary bloodstream infections.	Skin antisepsis.
Lanza *et al*.[40] LoE†: VI Brazil/2019	Descriptive	To analyze nursing professionals' adherence to preventive measures for PVC** infection.	Skin antisepsis.
Parreira *et al*.[41] LoE†: III Portugal/2019	Clinical trial	To assess the impact of single-use disposable tourniquets and polyurethane dressings with reinforced edges on the occurrence of complications related to PVC** use.	Skin antisepsis.
Simin *et al*.[42] LoE†: IV Serbia/ 2019	Descriptive	To determine the incidence, severity, and risk factors of PVC**-induced complications.	For skin antisepsis, 70% alcohol.
Simonetti *et al*.[43] LoE†: VI Italy/2019	Descriptive, cross-sectional	To determine nursing students' theoretical knowledge about evidence-based guidelines for managing PVC** insertion and investigate potential predictive factors associated with adherence to recommendations.	Skin antisepsis.
Buetti *et al*.[44] LoE†: IV France/2020	Descriptive, quantitative, comparative	To compare the use of two types of chlorhexidine gluconate-impregnated dressings for primary bloodstream infections prevention.	Skin antisepsis, hand antisepsis, sterile glove, sterile field, mask and gown use.
Keogh *et al*.[45] LoE†: II Australia/2020	Randomized clinical trial	To assess the impact of a multifaceted intervention focused on PVC** maintenance.	Skin antisepsis.
Jiménez-Martínez *et al*.[46] LoE†: VI M exico/2020	Descriptive	To analyze the benefits of cleaning the PVC** insertion site as a measure to maintain a functional short PVC** as a maintenance option.	Skin antisepsis.
Larsen *et al*.[47] LoE†: IV Australia/2020	Descriptive, prospective cohort	To identify modifiable and non-modifiable risk factors for PVC** failure.	Skin antisepsis, sterile gloves and sterile, disposable transducer kit.

Chart 1 – Cont.

ID* LoE† place and date	Design	Objective	Approach
Liu *et al*.[48] LoE†: VI China/2020	Descriptive	To identify the incidence, risk factors, and medical costs of complications related to PVC** use.	Skin antisepsis.
Pérez-Granda *et al*.[49] LoE†: II Spain/2020	Randomized clinical trial	To compare the phlebitis and colonization rates of PVC** tip.	Monitor the insertion site, skin antisepsis, 2% alcoholic chlorhexidine, connector disinfection, hand hygiene, change of gauze/dressing.
Schults *et al*.[50] LoE†: VI Australia/2020	Descriptive, quantitative, observational	To describe PAC‡‡ insertion and management practices and associated complications.	Skin antisepsis and ultrasound use.
Takahashi *et al*.[51] LoE†: II Japan/2020	Controlled clinical trial	To establish and assess an intervention method of a package of measures to prevent catheter failures.	Ultrasound use.
Timsit *et al*.[52] LoE†: VII France/2020	Review, guideline	To develop guidelines for CVC§, PAC‡‡ and dialysis catheter management in the Intensive Care Unit.	Skin antisepsis.
Vendramim *et al*.[53] LoE†: II Brazil/2020	Randomized clinical trial	To investigate the non-inferiority of clinically indicated PVC** replacement compared to routine replacement, every 96 hours, to prevent phlebitis.	Skin antisepsis.
Blanco-Mavillard *et al*.[54] LoE†: II Spain/2021	Randomized clinical trial	To determine the effectiveness and costs of a multimodal intervention to reduce PVC** failure.	Skin antisepsis.
Larsen *et al*.[55] LoE†: II Australia/2021	Randomized clinical trial	To compare PAC‡‡ dressing and fixation methods to prevent device failure in adult Intensive Care Unit.	Skin antisepsis, sterile gloves, lidocaine use.
Rickard *et al*.[56] LoE†: II Australia/2021	Randomized clinical trial	To compare the effectiveness and costs of 7-day versus 4-day infusion set replacement to prevent catheter-related primary bloodstream infections.	Skin antisepsis, sterile field and sterile glove use.

*ID: article identification; †LoE: level of evidence; **PVC: peripheral venous catheter; §CVC: central venous catheter; ‡‡ PAC: peripheral arterial catheter.

Chart 2 – Characteristics of studies included in the “Maintenance” category. Uberaba, MG, Brazil, 2022.

ID* LoE†	Design	Objective	Main results/approach
Covey *et al*.[57] LoE†: VI USA/1988	Descriptive	To examine the effects of three catheter-related healthcare-associated infection prevention protocols.	Change of sterile circuit, saline solution and transducer.
Hospital Infection Control Practices Advisory Committee[58] LoE†: V USA/1996	Review	To develop guidelines to reduce infectious complications associated with intravascular device use.	Change of dressing, sterile circuit, saline solution and transducer.
O’Grady *et al*.[17] LoE†: VII USA/2002	Review, guideline	To create a guideline for preventing infections related to intravascular catheters.	PAC‡‡ change time, change of sterile circuit, saline solution and transducer every 96 hours.
Maki *et al*.[59] LoE†: VI USA/2006	Review	To identify the absolute and relative risks of bloodstream infection associated with various types of intravascular devices.	Catheter handling.
Koh *et al*.[20] LoE†: VI Australia/ 2008	Descriptive, quantitative, observational	To measure colonization and rates of catheter-related bloodstream infection in arterial catheters.	Change of sterile circuit, saline solution and transducer.
Martins *et al*.[21] LoE†: VI Brazil/2008	Descriptive, observational	To check nursing professionals’ adherence to asepsis recommendations when installing and handling the PVC**.	Connection antisepsis.
López *et al*.[24] LoE†: II Spain/2009	Randomized clinical trial	To investigate the clinical performance of a closed infusion system compared to an open system in PVC**.	Dressing.
Koh *et al*.[26] LoE†: IV Australia/2012	Descriptive, quantitative, prospective and observational	To determine colonization rates in CVC§, PAC‖, non-tunneled CVC§ and PICC†† segments after removal.	Change of sterile circuit, saline solution and transducer.
López *et al*.[24] LoE†: II Spain/2014	Controlled clinical trial	To compare closed system PVC** with open system PVC**.	Dressing, disinfection of connectors.
Gunther *et al*.[60] LoE†: II France/2016	Randomized clinical trial	To describe post-insertion complications of intravascular access.	Dressing.
Loveday *et al*.[61] LoE†: V England/2016	Review	To survey the evidence regarding dressings impregnated with 2% chlorhexidine gluconate.	Dressing.

Chart 2 – Cont.

ID* LoE†	Design	Objective	Main results/approach
Marsh *et al*.[35] LoE†: II Australia/2018a	Randomized clinical trial	To compare two coverage methods for PVC**.	Dressing.
Marsh *et al*. [62] LoE†: II Australia/2018b	Quantitative, experimental, randomized, controlled	To compare the insertion of a PVC** by a general practitioner and nurse and specialists.	Dressing.
Rickard *et al*.[36] LoE†: II Australia/2018	Randomized clinical trial	To compare the effectiveness and costs of polyurethane dressings to PVC**.	Dressing and stabilization device.
Timsit *et al*.[37] LoE†: V France/2018	Review	To provide updated information on the available knowledge on epidemiology and diagnosis of CVC§ and arterial complications in the Intensive Care Unit.	Catheter change time.
Lanza *et al*.[40] LoE†: VI Brazil/2019	Quantitative, cross-sectional	To analyze nursing professionals' adherence to preventive measures for PVC** infection.	Connection antisepsis.
Etafa *et al*.[63] LoE†: VI Ethiopia /2020	Descriptive	To assess undergraduate nursing students' knowledge about evidence-based guidelines on PVC** management.	Hand hygiene, polyurethane dressing and gauze.
Liu *et al*.[48] LoE†: VI China/2020	Descriptive	To identify the incidence, risk factors, and medical costs of PVC-induced complications.	Sterile transparent film use.
Schults *et al*.[50] LoE†: VI Australia/2020	Descriptive, quantitative, observational	To describe PAC‡‡ insertion and management practices and associated complications.	Coverage and stabilization for PAC‡‡.
Larsen *et al*.[55] LoE†: II Australia/2021	Randomized clinical trial	To establish the feasibility of a randomized controlled trial comparing methods of dressing and securing arterial catheters to prevent device failure.	Complications when using PAC‡‡ with dressing.
Rickard *et al*.[56] LoE†: II Australia/2021	Randomized clinical trial	To compare the effectiveness and costs of 7-day versus 4-day infusion set replacement to prevent bloodstream infection related to CVC§, tunneled CVC§, PICC††, and PAC‡‡.	Change of sterile circuit, saline solution and transducer, antisepsis of dressings connectors.
Silva *et al*.[64] LoE†: VI Brazil/2021	Descriptive	To identify PVC‖ bloodstream infection control.	Dressing.

*ID: article identification; †LoE level of evidence; ‡‡PAC: peripheral arterial catheter; **PVC: peripheral venous catheter; §CVC: central venous catheter; ††PICC: peripherally inserted central venous catheter.

Chart 3 describes the characteristics of the studies included in the "Removal" category according to article identification (ID), design, objective, approach and level of evidence.

Chart 3 – Characteristics of studies included in the "Removal" category. Uberaba, MG, Brazil, 2022.

ID* LoE†	Design	Objective	Main results/approach
Hospital Infection Control Practices Advisory Committee[58]LoE†: V USA/1996	Review	To develop guidelines to reduce infectious complications associated with intravascular device use.	Cateter use time.
Timsit et al.[37] LoE†: V France/2018	Review	To provide up-to-date information on the epidemiology and diagnosis of central venous catheter and peripheral arterial catheter complications.	Catheter use time and complications, ultrasound use, antisepsis.
Lye et al.[65] LoE†: V Australia/2019	Review	To assess the current literature related to removal versus retention of central venous catheters and intra-arterial lines with suspected infection in the adult intensive care population.	Cateter use time.

*ID: article identification; †LoE level of evidence.

DISCUSSION

PAC insertion care varied between studies, such as hand hygiene and skin antisepsis with different antiseptics.

Studies with level I evidence in relation to hand hygiene were identified as follows: conventional soap and water or application of alcohol gel[66]; water and liquid soap; 60 to 80% alcohol without the presence of dirt[1]; solution based on 60% alcohol, ethanol or 70% isopropyl alcohol without the presence of dirt; non-antimicrobial or antimicrobial soap with water[67]. The study found in the literature highlighted the importance of hand hygiene and the use of gloves when handling the catheter[38].

Regarding the recommendations for skin antisepsis before PAC insertion, this review has identified variations[18,22,23,29–31,35,39,41–43,45,46,52–54] among them: chlorhexidine >0.5%[1] with alcohol[39,43] and as an alternative iodine tincture, iodophor or 70% alcohol[30,41,42,46,53,66],10% alcohol[43], alcohol-based chlorhexidine[29], chlorhexidine[18,41], aqueous chlorhexidine[29,67] and 2% chlorhexidine gluconate in alcohol[22,31,35,45,46,52,54], 75% alcohol[23], 10% povidone-iodine[23,52,68], investigations being[1,66,67,68] level of evidence I. No studies were found in this review that used the "no touch" technique for PAC insertion. However, do not touch the area after antisepsis of the insertion site has been carried out[66], except if palpation is carried out with a sterile glove if necessary, it is recommended PVC insertion care, due to the non-use of a sterile glove in the procedure[1,69–70]. As for the protection barrier, studies described sterile cap[25], glove[25,26,32,44,47,55,56], sterile field[25,26,32,56], mask and gown use[25,32,44], i.e., maximum protection barriers[1,25,26,32,66,71]. The evidence from the studies ranged from level I to IV.

Research found in the literature identified using a sterile and disposable transducer kit together with the pressure bag[47]. It is recommended to use a disposable transducer[1] or sterilize a reusable transducer, solution, tubing and pressure bag[66], level of evidence I. It is important to highlight that, when choosing the radial artery as the puncture site, it is necessary to perform the Allen test[27] due to collateral circulation[19], considering age, the presence of comorbidity, skin conditions, patients' mental state, in addition to the choice of the non-dominant limb[1] with strong scientific evidence. These aspects are important for PVC use, and can be applied to PAC use, including choosing the artery to

be punctured[69]. Professionals should opt for a catheter with a smaller caliber to avoid complications, such as mechanical phlebitis and flow obstruction[1]. Level of evidence I.

No evidence was identified in this study on the number of insertion attempts specific to the PAC, however, two puncture attempts per professional and a maximum of four attempts in total are recommended for peripheral puncture[1] and PVC[67]. Level of evidence I.

Furthermore, an experienced professional must be called in case of failures[1,67]. Studies with level of evidence II and VI recommendations identified that ultrasound (US)[27,32,33,37,51] use contributes to the success of insertion and the minimization of complications, helping to reduce multiple attempts, improve vessel accuracy and reduce patient stress[69]. Level of evidence I.

To measure comfort, in addition to using 1% lidocaine[55], the anesthetic button on the PAC with surgical thread should be considered when necessary[10]. Level of evidence II and V.

The literature recommends observing the need for the device to remain in place[1], in addition to assessing it every four hours. In critically ill, sedated and cognitively impaired patients, assessment should be carried out every one/two hours and at least once during the shift[1] in hospitalized patients[69]. In the presence of phlogistic signs (erythema, edema, pain, sensitivity, induration, drainage or rupture of the skin and heat), the device should be removed[66], paying attention also to other changes, such as itching, hematoma and diaphoresis[55]. It is noteworthy that this review did not identify in the studies a specification of guidance on inspection. Level of evidence I.

Regarding change of sterile circuit, physiological solutions and transducer, there was divergence between studies, with results indicating every 96 hours[17,58], four to seven days[56], 24 to 48 hours[19,57] and 72 hours[20,26]. Concerning the level of evidence, the studies ranged from II to V. Current CDC, ANVISA and GORSKI recommendations point out that change should be done every 96 hours[1,66,67], with high levels of evidence I. A study showed that the change infusion for seven days is safe when compared to four days[56]. Level of evidence II.

There are no recommendations regarding using heparin together with saline solution to maintain the PAC[1] system circuit. Studies described connector antisepsis[40] with 70% isopropyl alcohol[56,68], 70% alcohol[21,28,49], with level II and VI recommendations, in addition to 70% ethyl alcohol[69]. Level of evidence I. Connectors must be changed after each disconnection or if dirt is present[1,69].

Sterile coverage (sterile, transparent, semipermeable gauze and adhesive tape with sterile polyurethane membrane and sponge dressing impregnated with 2% CHG) use prevents infection, reducing catheter displacement[1,24,28,48,50,56,60,61,67], and other studies pointed to chlorhexidine coverage use[44,69]. A study found in the literature showed a complication-free time of more than 11 hours when using a single-fixation dressing compared to polyurethane[35]. Level of evidence I to IV.

Regarding the management of CAP care, it is important to highlight the need to carry out training since their professional qualification, since the adoption of good practices involves constant updating[63].

Changing the dressing must be carried out if there is humidity, dirt, coverage detachment, loss of dressing, no need to use a device, traction, compromised skin integrity[66–67]. Level of evidence I. Diverging from the information above, the authors did not indicate a dressing change period[62]. Regarding stabilization, non-sterile adhesive tape and suture use was not recommended[36,50,55]. Level of evidence II and VI. Using barrier films for skin protection to reduce skin injuries was highlighted in a study[69]. Level of evidence I. Considering that catheter inspection contributes to infection control[64].

With regards to removal, using PAC after seven days of using the device increases the risk of infection, especially when used in the femoral artery instead of the radial artery[37], level of evidence V, although there is no evidence regarding the removal of the device with suspected infection[65]. Referring to complications and infection, insertion above the inguinal ligament can increase the risk of hemorrhage, air embolism, neurological injury, transient vascular occlusion, pseudoaneurysm and

infection. Regarding insertion in the D radial, transient vascular occlusion may occur[59,72]. Level of evidence I. Divergence in vessel caliber and diameter, multiple attempts, excessive manipulation[59] and patients' hemodynamic status contribute to the risk of complication of arterial vascular occlusion and catheter removal[72].

No studies were identified in this review on insertion site care after PAC removal. It was expected to find evidence about compressive occlusive dressing to avoid vascular complications, such as bleeding and hematoma, which was not identified. Transducer care in relation to reprocessing stood out[58,66]. Level of evidence V and I, respectively.

There were no studies that addressed specific care after removing the device and in relation to discomfort when using the device. The need for studies to fill these gaps is highlighted, to be applied in clinical nursing practice such as: training and training for PAC management; assessment of the presence of pain or discomfort; performing the sterile compression technique; and observation of signs of bleeding and hematoma in the first 12 hours after PAC removal.

Considering the risks of infection, an investigation showed similarity in CAP and CVC colonization in critically ill patients[34,59].

The limitation of this review considered the analysis of studies available in full through access intended for students, employees and professors of a federal public university, which may not include all studies published in the period selected for this investigation.

CONCLUSION

From the results of this review, it was possible to identify evidence about care related to PAC, highlighting hand hygiene, skin antisepsis, protection barrier, transducer use, technology use (US), the choice of cover, connectors and component disinfection.

Therefore, it is possible to emphasize that the importance of these practices favors the best application of PAC, minimizing complications regarding the use of devices related to patient pain, the performance of multiple punctures, among other events that should be avoided and questioned.

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NOTES

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