

AVALIAÇÃO DAS CONDUTAS DE PUNÇÃO E MANUTENÇÃO DO CATETER INTRAVENOSO PERIFÉRICO

EVALUATION OF PERIPHERAL INTRAVENOUS CATHETER PUNCTURE AND MAINTENANCE PROCEDURES

EVALUACIÓN DE LAS CONDUCTAS DE PUNCIÓN Y MANTENIMIENTO DEL CATETER INTRAVENOSO PERIFÉRICO

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RESUMO

Objetivo: avaliar a equipe de enfermagem quanto às condutas de punção e manutenção do cateter intravenoso periférico. **Método:** estudo transversal, realizado entre os meses de setembro e dezembro de 2017, em uma instituição filantrópica no interior de Minas Gerais, nas clínicas cirúrgica, pediátrica e maternidade. Utilizou-se o índice de concordância de Kappa, não ponderado, com intervalo de confiança de 95% e nível de significância $p < 0.05$. **Resultados:** a concordância entre os especialistas e a equipe de enfermagem, segundo o índice de Kappa, foi moderada (0,41-0,60) ($p < 0,05$). Sete pacientes (1,8%) apresentaram eritema, com dor e/ou edema no local de inserção do cateter e foram classificados como grau 2. Observou-se que onze cateteres (2,8%) estavam com o dispositivo destampado no momento da visita, 138 (35,5%) com o curativo molhado, 206 (53%) apresentavam sujidades no curativo e no extensor (dupla via), 117 (30,1%) estavam sem data, 123 (31,6%) sem a assinatura do profissional que realizou a punção. **Conclusão:** Apesar de ser um desafio para a prática clínica, seguir diretrizes baseadas em evidências científicas, este estudo contribui para evidenciar que, sem medidas de vigilância e treinamento da equipe multiprofissional, as medidas de controle de infecção, associadas ao cateter venoso periférico, podem não ser adotadas e refletir risco para o paciente.

Descritores: Flebite; Observação; Infecção; Enfermagem.

ABSTRACT

Objective: to evaluate the nursing team regarding peripheral intravenous catheter puncture and maintenance. **Method:** a cross-sectional study was carried out between September and December of 2017 in a philanthropic institution in the country-side of Minas Gerais, at the surgical, pediatric and maternity clinics. The unweighted Kappa agreement index with 95% confidence interval and a significance level $p < 0.05$ were adopted. **Results:** the agreement between the specialists and the nursing team according to the Kappa index was moderate (0.41-0.60) ($p < 0.05$). Seven patients (1.8%) presented erythema with pain and/or edema at the insertion site and were classified as grade 2. It was observed that 11 catheters (2.8%) had uncovered devices at the time of the visit, 138 (35.5%) presented wet dressings, 206 (53%) presented dirt in the dressing and in the extensor (double route), 117 (30.1%) were undated, and 123 (31.6%) had no signature of the professional who performed the puncture. **Conclusion:** although it is a challenge for clinical practice to follow guidelines based on scientific evidence, this study contributes to show that without surveillance measures and training of the multiprofessional team, control measures of infections associated with peripheral venous catheters may not be adopted and translate into risk to patients.

Descriptors: Phlebitis; Observation; Infection; Nursing.

RESUMEN

Objetivo: evaluar el equipo de enfermería en cuanto a las conductas de punción y mantenimiento del catéter intravenoso periférico. **Método:** estudio transversal, realizado entre los meses de septiembre y diciembre de 2017, en una institución filantrópica en el interior de Minas Gerais, en las clínicas quirúrgica, pediátrica y maternidad. Se utilizó el índice de concordancia de Kappa no ponderado con intervalo de confianza del 95% y nivel de significancia $p < 0.05$. **Resultados:** la concordancia entre los especialistas y el equipo de enfermería, según el índice de Kappa, fue moderada (0,41-0,60) ($p < 0,05$). Siete pacientes (1,8%) presentaron eritema, con dolor y/o edema en el lugar de inserción del catéter y se clasificaron como grado 2. Se observó que 11 (2,8%) catéteres estaban con el dispositivo de estampado en el momento de la visita, 138 (35,5%) con el vendaje mojado, 206 (53%) presentaban suciedad en el vendaje y en el extensor (doble vía), 117 (30,1%) estaban sin fecha, 123 (31,6%) sin la firma del profesional que realizó la punción. **Conclusión:** A pesar de ser un desafío para la práctica clínica seguir directrices basadas en evidencias científicas, este estudio contribuye a evidenciar que, sin medidas de vigilancia y entrenamiento del equipo multiprofesional, las medidas de control de infección, asociadas al catéter venoso periférico, pueden no ser adoptadas y reflejar el riesgo para el paciente.

Descriptores: Flebitis; Observación; Infección; Enfermería.

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INTRODUCTION

The insertion of Peripheral Intravenous Catheters (PIC) is one of the most widely used methods for infusion therapy in hospitalized patients⁽¹⁻²⁾. Complications such as infiltration, occlusion, malfunction and phlebitis, however, may increase morbidity, mortality, and the length and cost of hospitalization⁽²⁾.

Brazilian studies have shown an incidence of 22.9% of post-infusion phlebitis and 72.6% of chemical phlebitis⁽³⁻⁴⁾. In the United States, England and Iran, the prevalence of post-infusion phlebitis is 20 to 80%⁽⁵⁾. According to data from the Intravenous Nurses Society, the acceptable rate of phlebitis in a given patient population is 5% or less⁽⁵⁾.

Venous access through PIC is an invasive procedure in which a sterile device is inserted into a vein for intravenous therapy. Therefore, it can be considered a critical and invasive procedure because the catheter breaks the skin that gives natural protection and penetrates into the vein. If the requirements of infection control and skill suitability are not met during the procedure, this technique, can lead to inflammation in the vein walls⁽⁶⁾.

In this sense, the inflammation of endothelial cells of the venous wall, which is known as phlebitis, resulting from the use of PIC, is considered one of the most frequent adverse events in the daily practice of hospital institutions. The prevention of this problem is still a gap in scientific knowledge, since it may involve mechanical and chemical factors^(2,7-8).

Catheters of smaller gauge may cause less mechanical phlebitis to the vein wall through the cannula and less obstruction of blood flow inside the vein when compared to those of greater gauge⁽⁷⁻¹⁰⁾. On the other hand, care is required, especially in the administration of drugs, which must be slow to allow adequate blood flow into the vein so that it does not irritate the vein wall leading to possible chemical phlebitis.

The manifestations of phlebitis are characterized by pain, edema, hyperemia at the insertion site, and hardening⁽⁹⁻¹⁰⁾. In cases of worsening, a palpable fibrous cord may become evident, with or without purulent secretion at the insertion site⁽⁸⁻⁹⁾. Post-infusion phlebitis may occur after cessation of infusion and catheter withdrawal, usually identified within 48 hours after removal of the PIC⁽⁹⁻¹²⁾. The maintenance of PIC requires evaluation every four hours or within smaller intervals depending on the criticality of

the patient, seeking to identify clinical signs suggestive of phlebitis⁽¹³⁾.

According to the National Health Surveillance Agency (2017), actions such as hand hygiene, choice of veins of larger caliber, choice of the smallest device indicated for the infusion, adequate fixation to prevent mechanical irritation, punctures performed by technically qualified professionals and who have sufficient knowledge to carry out this task, will be sufficient to reduce PIC-related complications⁽¹³⁾. Alternating the access site every 96 hours is indicated. However, in the case of pediatric patients or patients with difficult access, this recommendation should be reconsidered⁽¹³⁾.

In procedures of puncture and maintenance of the insertion site such as occlusion and fixation of the dressing, a clean and dry aspect should be monitored at daily basis by the nursing team, because the inadequate preservation of the insertion site may lead to adverse events in patients. An intervention study showed that inadequate fixation of PIC led to an incidence of phlebitis of 71%⁽²⁾. These device must be attached with sterile and transparent material in order to favor the inspection of the insertion site⁽¹³⁾.

Despite the importance of this issue, studies about dressings and their fixation are still insufficient and receive little attention in the scientific community⁽²⁾. Dirty and wet dressings can favor the creation of a biofilm and bacterial proliferation at the insertion site and even within the catheter lumen^(2,7-8). Connectors or lids may also be cross-contaminated by bacteria when asepsis measures are not properly adopted. It should be noted here that although connectors are recommended to have a single use, the high cost to exchange for new connectors means that most institutions do not discard them and follow standard recommendations for alcoholic friction after handling^(2,13).

Punctures for PIC insertion should be minimized when considering the same patient, avoiding scheduled replacement of catheter, which does not reduce the risks of phlebitis and other complications related to this device, but rather causes increased discomfort in patients and greater workload to nurses⁽⁵⁻⁸⁾.

Studies indicate that in order to avoid complications associated with PIC, such as phlebitis, continuing education on skills and insertion techniques contribute to reduce the difficulties of insertion and maintenance of these

devices^(2,5,7-9). For the nursing team, however, it is still a challenge to apply adequate techniques in practical and clinical activities in hospital institutions. In view of the above, the objective of the study is to evaluate the nursing team regarding the puncture for insertion of peripheral intravenous catheters and their maintenance.

METHOD

Cross-sectional study, carried out with the nursing team of a philanthropic institution in the country-side of Minas Gerais. The study period was September through December 2017. The institution has a team of 44 professionals comprising the nursing team, distributed among the surgical, maternity and pediatric clinics, including a total of 36 nursing technicians and 8 nurses. The study sample included 32 professionals from the nursing team. There was a 27.3% loss due to 3 professionals who were on vacation, 1 who was removed from the team and re-assigned, and 8 who refused to participate in the study.

A validated questionnaire containing 12 questions with the following variables was applied for data collection⁽¹⁴⁾: gender, age, indication of the PIC, mode of preparation of the medicine and adverse events associated with it, selection of venipuncture material, insertion and removal technique, and skin antisepsis. Each question had five alternatives as answers.

The technique of direct observation of the CPI of patients admitted to the surgical, pediatric and maternity clinics for a period of 4 months was also adopted. Data were collected in daily visits by the researchers, who had been previously trained, using standardized actions. A total of 389 observations were made.

The same patient could be observed more than once for the following variables, which were categorized as "yes" or "no": the device is capped, dry, clean, dated and signed. It was also observed if the connector of the PIC was stored in a suitable place or not. In this study, appropriate storage corresponded to the case when the connector was stored by patient in a covered and dry container, since the institution has not yet adopted the Anvisa recommendations on discarding the caps after each use⁽¹³⁾.

The insertion site of the PIC was evaluated for phlogistic signs of phlebitis using the

classification scale proposed by the Infusion Nursing Society (INS)^(1,3).

The categories evaluated were: Grade 0, when there were no clinical signs of phlebitis; Grade 1, when erythema is present, with or without local pain; Grade 2, when erythema is present, with local pain and/or edema; Grade 3, erythema is present as well as local pain and/or edema, with hardening and a palpable fibrous cord; Grade 4, when there is presence of pain with erythema and/or edema, with hardness and a palpable fibrous cord extending more than 2.5 cm in length and with purulent drainage^(1,3).

The survey was approved under number 2,253,693 by the Research Ethics Committee of the Federal University of the Jequitinhonha and Mucuri Valleys - UFVJM in the year 2017.

The Statistical Package for the Social Sciences For Windows (SPSS, Inc., Chicago, IL, USA), version 20.0, was used to analyze the data for descriptive analysis (Mean (M) \pm standard deviation (SD)) and reliability of the questionnaire.

The reliability of the answers was tested by means of analyses between the answers of three specialists (gold standard) confronted with the results presented by the observed subjects of the nursing team. Unweighted kappa values were used to measure the inter-evaluator agreement with a 95% confidence interval. The significance level was set at $p < 0.05$. Kappa was considered adequate when > 0.70 . Kappa values range from -1 (total absence of agreement) to 1 (total agreement).

The conventional interpretation of Kappa values is: 0.00-0.20 = poor agreement; 0.21-0.40 = reasonable agreement; 0.41-0.60 = moderate agreement; 0.61-0.80 = good agreement; 0.81 - 1.00 = very good agreement.

RESULTS AND DISCUSSION

Of the 32 nursing professionals who participated in this research, 7 (21.9%) were nurses and 25 (78.1%) nursing technicians; 87% were female; the mean age was 32 ± 7.61 years, being the minimum age 20 years and the maximum 54 years.

Regarding the degree of agreement between specialists and the nursing team, Table 1 shows the Kappa values of agreement.

Table 1 - Distribution of the degree of agreement between specialists and the nursing team according to the Kappa index. Brazil, Diamantina, MG, 2017.

| Question | Correct answer | Kappa Index Standard Error | 95% CI p-value |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------|
| 1 | Introduction of large amount of liquid = venoclysis. | 0.53 (0.021) | -0.23-1.00 p*=0.001 |
| 2 | Intravenous drug administration = Do not apply the drug and therapy prescribed in case of error or illegible identification. | 0.48 (0.023) | -0.32-1.00 p*=0.013 |
| 3 | Selection of materials for peripheral venipuncture = kidney-shaped pan, gloves for medical procedures, syringe, needle to aspirate medicines, medicine to be aspirated, peripheral catheter, tourniquet, adhesive plaster, cotton and 70% alcohol. | 0.52 (0.023) | -0.12-1.00 p*=0.012 |
| 4 | Skin antisepsis = in the direction of the venous return, changing the faces of the cotton. | 0.41 (0.038) | -0.26-1.00 p* =0.001 |
| 5 | In peripheral venous puncture = Select the needle gauge according to the vein to be punctured. | 0.61 (0.021) | -0.09-1.00 p*=0.002 |
| 6 | Angle of perforation of the venipuncture= 5 ⁰ at 30 ⁰ depending on the depth of the vessel. | 0.48 (0.023) | -0.32-1.00 p*=0.001 |
| 7 | Needle bevel in peripheral venipuncture = facing upwards. | 0.75(0.024) | 0.43-1.00 p*=0.002 |
| 8 | In peripheral venipuncture with needle catheter = insert part of the catheter, wait for the blood to appear and slide the remainder of the catheter into the vein. | 0.43 (0.024) | -0.21-1.00 p*=0.001 |
| 9 | In peripheral venipuncture with needle catheter, the tourniquet = should be maintained during the puncture in the vein. | 0.77 (0.022) | 0.45-1.00 p*=0.011 |
| 10 | Fixing the catheter: according to the device to be used. | 0.75(0.021) | 0.43-1.00 p*=0.001 |
| 11 | Intravenous drug administration = do it slowly. | 0.55 (0.021) | -0.14-1.00 p*=0.001 |
| 12 | When withdrawing the needle catheter = press the puncture site in order to contain possible bleeding and formation of hematoma. | 0.61(0.023) | -0.09-1.00 p*=0.001 |

Source: prepared by the authors.

*p < 0.05

The present study measured the level of knowledge of nursing professionals evaluated through Kappa values. Although the majority of questions presented values < 0.70, all variables were significant ($p < 0.05$). This fact demonstrates the insecurity of the nursing team, especially with respect to adequate knowledge of the technique of insertion of needle PIC, such as the appropriate angle of puncture or direction of antisepsis on the patient's skin. As seen in Table 1, the agreement in this question was "moderate".

Professionals with adequate knowledge of techniques of insertion and maintenance of PIC are able to put into practice their clinical competence to apply measures to prevent adverse events such as infiltration, extravasation or phlebitis in the pre-puncture, puncture and post-puncture phases^(7-9,12).

Regarding the procedures of puncture and maintenance of the dressing of the PIC, Table 2 presents the descriptive analysis of the variables analyzed in the direct observations.

Table 2 - Distribution of variables related to procedures of puncture and maintenance of the dressing at the insertion site, whether it was dry, capped, clean, dated and signed during the phase of direct observations. Brazil, Diamantina, MG, 2017 (n = 389).

| Puncture and maintenance of the dressing of the PIC (n = 389) | Yes | | No | |
|---------------------------------------------------------------|-----|------|-----|------|
| | f | % | f | % |
| Occluded | 378 | 97.2 | 11 | 2.8 |
| Dry | 251 | 64.5 | 138 | 35.5 |
| Clean | 183 | 47 | 206 | 53 |
| Dated | 272 | 69.9 | 117 | 30.1 |
| Signed | 266 | 68.4 | 123 | 31.6 |
| Connector in inappropriate place | 119 | 30.6 | 270 | 69.4 |

Source: prepared by the authors.

It was observed that 11 catheters (2.8%) had the device uncovered at the moment of the visit, 138 (35.5%) had wet dressings, 206 (53%) presented dirt in the dressing and in the extensor such as blood and medicines, 117 (30.1%) were undated, and 123 (31.6%) had no signature of the professional who performed peripheral venipuncture (Table 2).

It was found that 119 (30.6%) of the patients had the connectors in inappropriate places, such as: attached to the saline infusion set, to the bedside table of the patient, inside a container together with connectors of different patients, and attached to the pocket of the apron of the professional. The other 270 (68.4%) had the device, but were not receiving intravenous solution at the moment of observation (Table 2).

Regarding the puncture and maintenance procedures observed in the insertion site of the PIC, it was verified that 35.5% of the dressings were not dry and this reality is constant in the institution researched (Table 2). This fact is explained by the frequent humidity in the fixation site, which may be associated with the number of infusions or drugs administered per day, infiltrations, and intraluminal washes of the infusion equipment, besides the handling of the attachments and catheters^(9, 15-17).

A prospective intervention study conducted in Australia showed that half of the dressings in PIC were not dated or signed at the studied institution⁽¹⁸⁾. However, after an educational intervention, dates and signatures in dressings increased significantly from 36.4% to 50.0% ($p < 0.05$)⁽¹⁸⁾. In the present study, it was

found that dressings without dates and signatures were also a problem. It is important to highlight that any technique involving the patient should be well documented for future reports of adverse events associated with PIC. In order to raise the awareness of the nursing team, educational measures such as active monitoring can contribute to improving the knowledge about PIC insertion and maintenance techniques^(15-16,18). Studies have shown a reduction in the rates of PIC-associated complications with clustered approaches, including use of online education modules, and implementation of evidence-based practices about insertion and maintenance of these devices, besides direct and monitored observation of professionals so as to obtain a feedback of the team^(7-9,15-16).

A prospective study in Israel showed that there was a decrease in morbidity and frequency and length of hospitalization of patients when comparing situations of presence and absence of PIC connectors⁽¹⁹⁾. A multivariate analysis was used in this prospective study, including variables such as age, gender, type of dressing, and connectors. It was found that the variable "connector" alone was responsible for the reduction of the of phlebitis rate ($p < 0.01$) in the institution⁽¹⁹⁾. Such a rate could be ameliorated with friction using appropriate antiseptic substances such as 70% alcohol to prevent infections associated with connectors at the moment of handling them⁽¹²⁻¹³⁾.

Table 3 shows the advance level of phlebitis according to observations in the puncture site and proximal area of the PIC.

Table 3 - Progress of phlebitis according to observations of the puncture site and proximal area of the PIC according to the Infusion Nursing Society. Brazil, Diamantina, MG, 2017.

| Classification | F | % |
|----------------|-----|------|
| Grade I | 369 | 93.4 |
| Grade II | 12 | 3 |
| Grade III | 7 | 1.8 |
| Grade IV | 1 | 0.3 |
| Grade V | 0 | 0 |

Source: prepared by the authors.

It was observed that 12 (3%) of the patients presented clinical signs such as presence of erythema, with or without local pain, being classified as grade 1; seven (1.8%) presented erythema with pain and/or edema at the insertion site of the catheter and were classified as grade 2; and only 1 (0.3%) was classified as grade 3, presenting erythema, local pain and/or edema with hardening and a palpable fibrous cord.

Knowing the possible adverse events that the patient may suffer contributes to a successful insertion of PIC^(2,10-12). During venipuncture, for example, several numbers of attempts of insertion in the upper limbs may trigger mechanical phlebitis, often difficult to report^(2,15). Furthermore, mechanical phlebitis may develop as the result of inadequate movement of the upper limbs that leads the catheter to cause shear stress in the intima vessel layer, i.e. a tangential force in the vein wall.

A prospective cohort study in Australia found that mechanical phlebitis was associated with the dominant side of the patients (1.39; 95% CI, 1.09-1.77), that is, the side they move more frequently⁽¹⁶⁾.

To prevent movement of the catheter, the device must be stabilized. This means preserving the integrity of the access and preventing displacement or loss of access, following aseptic techniques^(2,16). It is important to note that non-sterile adhesive tapes and microporous tape should not be used to stabilize PIC or cover the catheter; stabilization should be done with adhesive material specifically designed for this, being transparent and sterile^(2,16). Signs of phlebitis were observed around the dressing, usually with regular tape or micropore tape.

In the institution where this study was conducted, the clinical practice does not yet include this procedures, which may be contributing to the high incidence of phlebitis. The non-application of sterile tapes or dressings

at the insertion site of PIC does not prevent the potential of bacterial colonization in this area. The development of phlebitis, however, depends on several factors such as the osmolarity and pH of the injected solution, the sex and age of the patient, the length of stay of the PIC, the technique used to insert this catheter, its fixation and location, and the material and the gauge of the chosen catheter^(2,9,16).

Another factor that may trigger phlebitis is the needle gauge at the time of venipuncture⁽¹⁵⁻¹⁷⁾. A meta-analysis conducted in Taiwan showed that the larger the needle, the greater is the tendency to develop phlebitis - 0.88 (95% CI, 0.67-1.17)⁽¹⁷⁾. It should be noted that the selection of the catheter to be inserted will depend on that site and the solution that will be infused⁽¹⁶⁻¹⁷⁾.

It is up to the nursing team to recognize signs and symptoms of phlebitis in order to notify and treat the patient as soon as possible. Phlebitis may narrow the lumen of the veins due to luminal hyperplasia, decrease blood flow, and trigger erythema and pain in the puncture site^(8,16-19). Such signs and symptoms should be readily identified to avoid the worsening of the phlebitis and to allow the adoption of protocols for technical improvement and continuing education of the team.

A prospective cohort study in Australia found a significant association (2.16; 95% CI, 1.26-3.71) between the presence of hematoma at the insertion site and phlebitis⁽¹⁸⁾. Knowledge of these initial signs of phlebitis will aid the team to increase control measures during insertion and maintenance of PIC, in order to avoid further damage to patients, as well as unnecessary removal of the devices, reducing costs with health and risks of infection, infiltration and inflammation of the insertion site⁽¹⁵⁻¹⁹⁾.

A limitation of the present study was the absence of an educational intervention with the nursing team and a pre- and post-intervention

comparison regarding with phlebitis incidence in the institution. The results of this study were presented to the research institution, pointing to the need to implement educational and active surveillance measures among the nursing team and the Hospital Infection Control Committee (HICC), with review and adaptation of the protocol for insertion and maintenance of CIP in the institution.

CONCLUSION

The results of this study indicated variable agreement (from “moderate” to “good”) in the knowledge of the nursing team about the insertion and maintenance of PIC. These results demonstrated a deficit in the technical-scientific knowledge in the daily practice of these professionals regarding the procedure of peripheral venipuncture and insertion of venous catheters.

Furthermore, the observation of inadequate actions in the puncture and maintenance of the dressing at the insertion site of the catheter, such as presence of moisture and non-occlusion of the fixation, indicates a limitation of the team in the care for prevention of infections and inflammation in the area of insertion of the catheter. This shows the need for the dissemination of institutional protocols and the importance of continuing education in order to avoid repetitive punctures, vascular damage, and consequent discomfort for the patient.

It is up to the nurse responsible for the sector to review the insertion and maintenance protocols of PIC, with special attention to the control of factors predisposing to infection, such as expiration date, fixation of dressings, protection of PIC during bathing, choice of smaller gauges for puncture, among other measures proposed by Anvisa.

It is still a challenge for clinical practice to follow guidelines based on scientific evidence, since changes in institutional protocols require the approval of managers, because it involves costs with equipment to improve the conformity of the interventions. However, the variables evaluated in this study, associated to insertion and maintenance techniques, are easy to implement when associated with institutional surveillance measures.

Therefore, this study contributes to the development of future intervention and experimental research to expand and disseminate knowledge about gaps and scientific evidence,

not only for the nursing team, but also for health institutions, with the involvement of the HICC and the purchasing sector, and standardization of processes.

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