ORIGINAL ARTICLE

Knowledge of nurses about peripherally inserted central catheter

Conocimiento de los enfermeros sobre el catéter central de inserción periférica

Conhecimento dos enfermeiros sobre cateter central de inserção periférica

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Abstract

The aim was to evaluate the knowledge of nurses working in clinical and surgical inpatient units and intensive care units about indication, maintenance and complications related to the Peripherally Inserted Central Catheter. Cross-sectional, descriptive, prospective and quantitative study, with nurses from clinical and surgical inpatient units and intensive care units, based on an instrument developed by the authors. Analysis and treatment of quantitative and categorical dimensions through the Jamovi software, in absolute frequencies, percentages, mean, median, mode, standard deviation and Fisher's Exact Test. A total of 46 nurses participated in the study. The overall results were satisfactory, with the exception of the question that addressed bleeding through the ostium after device insertion. Professionals from the intensive care unit and those who performed the role of on-call staff stood out positively. The study made it possible to identify that nurses have satisfactory knowledge regarding the indication, maintenance and complications of the Peripherally Inserted Central Catheter. Participants emphasized the need for training on the subject to acquire knowledge and develop skills.

Descriptors: Catheterization, Central Venous; Nursing Care; Nurses; Health Education; Drug Administration Routes.

Resumén

El objetivo fue evaluar el conocimiento de los enfermeros que actúan en las unidades de hospitalización clínica y quirúrgica y en las unidades de cuidados intensivos sobre la indicación, el mantenimiento y las complicaciones relacionadas con el Catéter Central de Inserción Periférica. Estudio transversal, descriptivo, prospectivo y cuantitativo, con enfermeros de unidades de hospitalización clínica y quirúrgica y unidades de cuidados intensivos, a partir de un instrumento desarrollado por los autores. Análisis y tratamiento de dimensiones cuantitativas y categóricas a través del software Jamovi, en frecuencias absolutas, porcentajes, media, mediana, moda, desviación estándar y Test Exacto de Fisher. Participaron del estudio un total de 46 enfermeros. Los resultados generales fueron satisfactorios, con la excepción de la pregunta que abordaba el sangrado a través del ostium después de la inserción del dispositivo. Se destacaron positivamente los profesionales de la unidad de cuidados intensivos y los que desempeñaban el papel de enfermeros de guardia. El estudio permitió identificar que los enfermeros tienen conocimientos satisfactorios sobre la indicación, mantenimiento y complicaciones del Catéter Central de Inserción Periférica. Los participantes enfatizaron la necesidad de capacitarse en el tema para adquirir conocimientos y desarrollar habilidades.

Descriptores: Cateterismo Venoso Central; Atención de Enfermería; Enfermeras y Enfermeros; Educación en Salud; Vías de Administración de Medicamentos.

Resumo

Objetivou-se avaliar o conhecimento de enfermeiros que trabalham em unidades de internação clínica, cirúrgica e centro de terapia intensiva sobre indicação, manutenção e complicações relacionadas ao Cateter Central de Inserção Periférica. Estudo transversal, descritivo, prospectivo e quantitativo, com enfermeiros de unidades de internação clínica e cirúrgica e centro de terapia intensiva, a partir de instrumento elaborado pelos autores. Análise e tratamento das dimensões quantitativas e categóricas através do software Jamovi, em frequências absolutas, percentuais, média, mediana, moda, desvio padrão e Teste Exato de Fisher. Participaram do estudo 46 enfermeiros. Os resultados gerais foram satisfatórios, com exceção da questão que abordava o sangramento pelo óstio após a inserção do dispositivo. Destacaram-se positivamente os profissionais do centro de terapia intensiva e os que desempenhavam a função de plantonista. O estudo permitiu identificar que os enfermeiros possuem conhecimento satisfatório quanto à indicação, manutenção e complicações do Cateter Central de Inserção Periférica. Os participantes enfatizaram a necessidade de treinamento sobre a temática para aquisição de conhecimentos e desenvolvimento de habilidades.

Descritores: Cateterismo Venoso Central; Cuidados de Enfermagem; Enfermeiras e Enfermeiros; Educação em Saúde; Vias de Administração de Medicamentos.

Introduction

Intravenous therapy for drug administration is one of the most performed procedures in hospitals worldwide[1]. Depending on the prescribed treatment, clinical condition and vascular network of the patient, peripheral or central intravascular devices are used, each with its specific characteristics, indication and length of stay[2].

One of the options is the Peripherally Inserted Central Venous Catheter (PICC), which consists of a vascular device inserted through an introducer needle, preferably guided by ultrasound, through puncture in the basilic, cephalic veins. , brachial, median cubital, and as a last alternative, the external jugular vein. In neonatal or pediatric patients, the axillary, temporal, posterior auricular, saphenous and popliteal veins can also be considered[2-4]. The ultimate goal is to reach large vessels such as the superior and inferior vena cava for the administration of long-term therapies, drug infusions, hyperosmolar solutions, vesicants and/or irritants[1].

Described in 1929 by the German physician Werner Theodor Otto Forssmann after performing the procedure on his own body[5], in Brazil, the PICC was incorporated into the care practice in 1990, and with regard to Nursing, Resolution No. 258 of 2001 and the Federal Counselor's Opinion No. that regulate the nurse as a qualified professional, with technical and legal competence to insert and manipulate the PICC[6,7].

Initially used in neonatology and pediatrics, its use was introduced in the care of adult patients, considering that the advantages of this technology are equivalent to different age groups, among them: venous network preserved with less discomfort and pain for the patient, avoiding multiple venous punctures; lower risk of infection compared to other central vascular devices; possibility of being inserted at the bedside; route for administration of chemotherapy, total parenteral nutrition and antibiotic therapy; employment in home therapy and good value for money[8-11].

Good results are also mentioned in the care of prone patients with Acute Respiratory Distress Syndrome associated with COVID-19[12]. When evaluating the reason for the indication of 656 PICCs, a Canadian study pointed to the administration of antibiotics (341/52%), chemotherapy (229/35%) and parenteral nutrition (37/6%) as the main reasons of choice[13].

Undoubtedly, it is a technology that adds benefits to patients and the continuity of health care. However, it requires trained and qualified professionals for the insertion and strict monitoring of its maintenance and prevention of complications to patients.

The development of this study is anchored in the interest in analyzing the nurses' knowledge about the aspects concerning the PICC, guiding the planning of educational actions, risk-free nursing care, maintenance of the catheter until the therapeutic discharge and reduction of hospital costs for improper handling/maintenance.

Thus, the objective was to evaluate the knowledge of nurses working in clinical and surgical inpatient units and intensive care centers on indication, maintenance and complications related to PICC.

Methodology

Ethical aspects: the study followed the principles of Resolution No. 466/2012 of the National Health Council, being approved by the Research Ethics Committee (CEP) of Hospital Federal Cardoso Fontes under opinion number 5,157,991. Participants' identities were kept confidential, using the letter E for nurses followed by a sequential alphanumeric code in the collected instruments.

Study type: cross-sectional, descriptive, prospective and quantitative study.

Unit of analysis: nurses working in the Clinical and Surgical Inpatient Units and Intensive Care Center (ICU).

Study scenario: Clinical and Surgical Inpatient Units and ICU of a medium-sized public hospital located in the city of Rio de Janeiro. The choice of sectors was based on the higher prevalence of PICC use in hospitalized patients, based on the deductive knowledge of the authors of the study.

Inclusion criteria: being a nurse and working in the Clinical and Surgical Inpatient Units or ICU. Exclusion criteria: leave for vacation or licensing.

Sample: the choice of institution was made for the convenience of the researchers and the population was represented by all nurses who worked in the Clinical and Surgical Inpatient Units and ICU (n=66), excluding, according to pre-established criteria, those who were away for leave or vacation (n=5), adding up those who were not located (n=2) and those who reported refusal to participate (n=13). The final sample consisted of 46 participants.

Data collection: an instrument developed by the authors was used, containing data for the qualification of the participants (age, training time, work sector, working time in the institution, training, function, working period and previous course on PICC), eight questions closed on the subject and a space for recording comments, suggestions and/or other information of interest. The closed questions were related to the indication, maintenance and complications of PICC. All had three response options, one of which was “I don’t know how to answer”, as described in Chart 1.

Data were collected from November to December 2021, in the Clinical and Surgical Inpatient Units and ICU. The nurses were approached in the work sectors, and after the presentation of the study, ICF, research instrument and guidance on the possibility of not answering any item, as desired, the researchers remained away waiting for the completion of the fillings. In some moments, interference in the work routine was noticed. In this situation, the researchers scheduled the collection of instruments on a date and time scheduled with the participants.

Chart 1. Closed questions contained in the research instrument. Rio de Janeiro, RJ, Brazil, 2021

1. The PICC is a peripherally inserted, centrally located vascular device, usually indicated:
⍰ To obtain and maintain prolonged deep venous access and administer hyperosmolar solutions.
⍰ Difficult peripheral venous access due to repeated punctures with hematoma and thrombus formation.

I do not know how to answer.
2. It is possible that bleeding in the ostium is persistent in the first 24 hours after puncture. In this case, how should we proceed?
The first conduct should be to perform a cold compress.
Perform as many dressing changes as necessary, adding a bandage with light compression, until adequate clotting.
I do not know how to answer.
3. An advantage of using the device is the reduction of staff stress from repetitive punctures. It is a nursing care during the manipulation of the valved PICC:
Do not use needle on catheter valve or non-needle connector. The fitting is for the syringe only.
If the PICC is pulled and pulled out during handling, it must be reintroduced at the same time.
I do not know how to answer.
4. The flush consists of washing the catheter to avoid obstruction. Considering the use of the PICC, it must be performed:
Swirl flush, with brief pauses at each ml, and use of a 10 or 20 ml syringe, avoiding the risk of catheter rupture due to high pressure.
Laminar flush, slow and constant, preferably with a 5 mL syringe, avoiding the risk of rupture of the catheter due to high pressure.
I do not know how to answer.
5. The nurse is responsible for changing the access dressing. What is the dressing change period in the case of sterile clear film:
7 days or according to saturation.
5 days or according to saturation.
I do not know how to answer.
6. The PICC is a device with a central access feature, so it needs to have a good external fixation to avoid changing its positioning. About catheter fixation:
It is fixed by surgical stitches, so observation of the skin is necessary to prevent infections.
Its fixation and stabilization are carried out using cling films and/or specific devices, so extreme care must be taken when handling.
I do not know how to answer.
7. Thrombosis is one of the risks of using the PICC, so it is necessary to:
Measure the distance of 5 cm from the catheter insertion ostium, measure the circumference of the limb at this location and record the measurement on a specific form.
Measure only the circumference of the opposite limb where the PICC is inserted and record the measurement on a specific form.
I do not know how to answer.
8. These are complications that indicate catheter removal:
Bleeding from the ostium, hyperthermia, and poor general condition.
Pain, heat, redness, swelling, and discharge at the insertion site or along the course of the vein.
I do not know how to answer.

Data analysis and treatment procedure: for data analysis, the quantitative and categorical dimensions were organized in Jamovi software spreadsheets, objectified in absolute frequencies, percentages, mean, median, mode and standard deviation according to the variables. Fisher's exact test was used to compare independent samples. The records contained in the space referring to comments, suggestions and/or other information of interest were organized and analyzed in four stages: familiarization with the data; initial encoding; identification of themes; and naming of the overarching themes[14].

Results

Fifty-nine research instruments were distributed with a return of 46 (77.97%) completed. Thus, 46 nurses from the Clinical Inpatient Unit, Surgical Inpatient Unit and ICU participated in the study, most of them with postgraduate degrees, exercising the role of on-duty, with working time in the institution for less than 1 year and without carrying out training and /or PICC training, as shown in Table 1.

Regarding the age and time of training of the participants, a variation of 31 to 60 years and 2 to 35 years, respectively, was found, as described below: age (mean=40.49; median=41.00; standard deviation= 7.21; minimum=30.00; and maximum=61.00) and training time (average=13.25; median=10.50; standard deviation=7.38; minimum=2.00 and maximum=35 .00).

Regarding the results obtained from the answers of the 46 participants to the 8 questions contained in the research instrument, 305 correct answers and 51 errors were identified, with a negative emphasis on the answers obtained in question 2 (Table 2).

Table 1. Characterization of the research participants regarding the work sector, training, working time in the institution, function, working period and previous course on PICC. Rio de Janeiro, RJ, Brazil, 2021 (n=46)

Work sector	**n**	**%**
ICU	19	41,30%
Surgical Inpatient Unit	14	30,43%
Clinical Inpatient Unit	12	26,09%
Did not answer	1	2,17%
	46	100%
Education	**n**	**%**
Graduation	5	10,87%
Postgraduation	34	73,91%

Residence	5	10,87%
Master's degree	2	4,35%
	46	100%
Working time at this institution	**n**	**%**
Less than 1 year	18	39,13%
From 1 to 5 years	12	26,09%
More than 5 years	16	34,78%
	46	100%
Occupation	**n**	**%**
On duty	36	78,26%
Routine	7	15,22%
Coordinator	2	4,35%
Did not answer	1	2,17%
	46	100%
Work time	**n**	**%**
Morning	6	13,04%
Morning and afternoon	26	56,52%
Afternoon	1	2,17%
Night	13	28,26%
	46	100%
Prior course on PICC	**n**	**%**
I don't have	27	58,70%
Professional training	11	23,91%
Training	6	13,04%
Did not answer	2	4,35%
	46	100%

Table 2. Characterization of participants' responses to the research instrument's questions. Rio de Janeiro, RJ, Brazil, 2021 (n=46)

Questions	Right		Wrong		Did not know how to answer		Did not answer		Total	
	n	%	n	%	n	%	n	%	n	%
1	38	82,61%	8	17,39%	0	0,00%	0	0,00%	46	100,00%
2	27	58,70%	14	30,43%	3	6,52%	2	4,35%	46	100,00%
3	43	93,48%	2	4,35%	1	2,17%	0	0,00%	46	100,00%
4	37	80,43%	7	15,22%	2	4,35%	0	0,00%	46	100,00%
5	40	86,96%	6	13,04%	0	0,00%	0	0,00%	46	100,00%
6	38	82,61%	7	15,22%	0	0,00%	1	2,17%	46	100,00%
7	40	86,96%	4	8,70%	0	0,00%	2	4,35%	46	100,00%
8	42	91,30%	3	6,52%	1	2,17%	0	0,00%	46	100,00%

Still on question 2, a statistical association was identified between the period of work and the results, highlighting positively the participants who work as on-duty workers (morning and afternoon and evening), as shown in Table 3. A statistical association was found between the getting all the questions right and the work sector, highlighting positively the participants crowded in the CTI (Table 4).

Table 3. Result of the answers to question 2 of the research instrument by work shift. Rio de Janeiro, RJ, Brazil, 2021 (n=46)

Work time	Question 2				Fisher's Exact Test
	Right	Wrong	Don't know	Total	p-value

Morning	Observed	1	4	1	6	
	Expected	3,68	1,91	0,41	6,00	
	% relative to lines	16,70 %	66,70 %	16,70 %	100,00 %	
Afternoon	Observed	0	1	0	1	
	Expected	0,61	0,32	0,07	1,00	
	% relative to lines	0 %	100,00 %	0 %	100,00 %	
Morning and afternoon	Observed	17	7	0	24	
	Expected	14,72	7,64	1,64	24,00	0,016*
	% relative to lines	70,80 %	29,20 %	0 %	100,00 %	
Night	Observed	9	2	2	13	
	Expected	7,98	4,17	0,89	13,00	
	% relative to lines	69,20 %	15,40 %	15,40 %	100,00 %	
Total	Observed	27	14	3	44*	
	Expected	27,00	14,00	3,00	44,00	
	% relative to lines	61,40 %	31,80 %	6,80 %	100,00 %	

Note: *p value: significance level p < 0.05. **Two participants did not answer question 2.

Table 4. Correct answers in all questions by sector according to the responses of the participants to the research instrument. Rio de Janeiro, RJ, Brazil, 2021 (n=46)

Sector		Right on all questions			Fisher's Exact Test
		No	Yes	Total	p-value
ICU	Observed	9	10	19	
	Expected	12,67	6,33	19,00	
	% relative to lines	47,40 %	52,60 %	100,00 %	
Surgical Inpatient Unit	Observed	13	1	14	
	Expected	9,33	4,67	14,00	
	% relative to lines	92,90 %	7,10 %	100,00 %	0,024*
Clinical Inpatient Unit	Observed	8	4	12	
	Expected	8,00	4,00	12,00	
	% relative to lines	66,70 %	33,30 %	100,00 %	
Total	Observed	30	15	45*	
	Expected	30,00	15,00	45,00	
	% relative to lines	66,70 %	33,30 %	100,00 %	

Note: *p value: significance level p < 0.05. **One participant did not inform the sector of work.

In reference to the space for comments, suggestions and/or other information of interest, 12 records were made. All related to the request for training/training on PICC for the institution's nurses by the Continuing Education Service.

Discussion

It emerged quantitatively from the data that most nurses have an average age of 40 years, postgraduate, with little time working in the institution and without training or qualification on PICC. A Brazilian study showed a similar result regarding the level of professional training of nurses, but with a lower average age[1]. As for previous qualification or training, a Chinese study corroborates the findings, highlighting that less than half of the nurses had undergone training on the subject[15]. Unlike the result described by a Brazilian study, with 78% of nursing professionals trained by the work institution[16].

Regarding the indication of the catheter, 17.39% of the participants indicated the incorrect answer, disregarding the use of the device to obtain and maintain deep access for a long time and administration of hyperosmolar solutions. A study showed a low level of accuracy by nurses regarding the indication of PICC for the administration of vasoactive drugs, venous hydration, parenteral nutrition and prolonged antibiotic therapy, and in critically ill patients[1].

With regard to complications, the overall results were satisfactory, with the exception of the issue that addressed bleeding through the ostium after device insertion. According to the protocol used at the institution where the research was carried out, if there is persistent bleeding in the first 24 hours, a bandage with gauze, sterile transparent film and a slightly compressive bandage is recommended. The other dressings should preferably be performed with a sterile semipermeable transparent cover, changed every seven days or at any time in case of dirt, humidity or low adhesion. In case of unavailability, use sterile gauze and tape, changing every 48 hours or earlier, according to the situations already described[3].

There was a high percentage of assertiveness regarding the screening of the risk of thrombosis through the measurement and evaluation of the circumference of the punctured limb, 5 cm from the ostium of insertion of the PICC. Several studies cite thrombosis as one of the main complications of catheter use[17-20]. Preventive strategies are described as handling the catheter by a trained nursing team, prior evaluation of the vessels with ultrasound before insertion, use of smaller diameter catheters and confirmation of the proper positioning of the post-puncture device by radiography, continuous control of processes of quality and institution of care and maintenance[13,18].

Still on the complications, it is noteworthy that more than 90% of the participants identified phlebitis as a complication indicative of catheter removal. The occurrence of phlebitis is an adverse event that cannot be neglected in the care of patients with vascular access. Care packages or bundles are options applied in care practice to minimize

clinical complications, prolonged hospitalizations and hospital costs[21].

A retrospective cohort study identified the variables age, puncture site (below the elbow) and catheter type as risk factors for the occurrence of phlebitis in patients using PICC[22]. Brazilian research highlighted as nursing care for phlebitis, catheter removal, application of cold and warm compresses, compress with chamomile tea, observation of limb circumference and application of Hirudoid according to medical prescription[23].

About washing the device, ignorance was identified by 19.57% of the participants, adding the wrong answers and those who reported not knowing the correct option. A result similar to that presented by another Brazilian study[16]. Research carried out in Norway showed PICC occlusion due to lack of washing and the need for patients to remind nurses that catheter washing should be performed[24].

It is recommended to wash the PICC using a swirled or pulsatile flush, with brief pauses, to remove precipitated drug deposits or fibrin adhered to the catheter lumen, before and after drug administration, after parenteral nutrition administration, collection of blood and blood products infusion, with syringes of larger volumes (10 or 20 mL) to ensure low intraluminal pressure and minimize the risk of device rupture[3,16].

Regarding the setting of the PICC, good results were found in the responses of the participants. However, 15.22% incorrectly stated that sutures should be used to stabilize the catheter. This practice is contraindicated due to the risk of needlestick accidents, biofilm formation and association with primary bloodstream infection (IPCS)[3]. An American study compared two fixation devices for the PICC, associating them with the IPCS. One not yet widespread in Brazil, the Subcutaneous Engineered Securement Device (SESD), which is a stabilizer attached to the subcutaneous tissue by a small rod, and the device for fixation by adhesiveness to the skin. It was concluded that the use of the first had a significant impact on reducing the risk of IPCS and increasing safety for patients[25].

A statistically significant difference was identified between the ICU professionals, when compared to the other sectors of the study, in the correctness of all the instrument's questions. It is deduced that these professionals have greater opportunities to manipulate the device because it is a critical care environment, with critically ill patients who are often eligible for the use of the PICC. Refers to the use of the PICC in patients who need intensive care care since 1996[19]. A study corroborates the findings by finding that nurses who work in places with a greater number of patients using PICCs have greater knowledge on the subject, acquiring increased experience and proficiency[15].

Discussion that extends to nurses on day or night shift, who, because they remain in a continuous workload longer than nurses in routine and coordinator roles, and because they work in direct care, maintain contact with patients potentially eligible for the insertion of the PICC, favoring the acquisition of knowledge and skills. A Portuguese study highlights that limited contact with patients with this device restricts the development of specific skills[26].

The results showed that more than 58% of the participants had no training or qualification on PICC. The literature reinforces the importance of trained nursing professionals for the safe handling and maintenance of intravenous devices to reduce adverse events, increase patient satisfaction, reduce unscheduled withdrawals, control institutional expenses and discontinue therapy[1,15,26].

All discursive records were related to the request for training on PICC, substantiating that the participants understand the importance of professional qualification for the construction of theoretical knowledge, technical skills and good health practices. The relevance of protocols, care and management indicators, checklists and systematization of nursing care are also mentioned as methods to guide and support clinical practice for safe insertion, maintenance and removal of the catheter[1,20,23].

It should be noted that patient care safety using the PICC is not restricted to training for the indication and insertion of the device, but also to professionals trained in the use, maintenance, detection of complications and critical thinking for decision making[1].

Conclusion

The study made it possible to identify that nurses have satisfactory knowledge regarding aspects related to the indication, maintenance and complications of the PICC, with the exception of the conduct recommended by the institution in case of bleeding through the ostium after insertion of the device. Professionals who provide care as on-duty workers and those who work with critically ill patients stood out positively.

Participants emphasized the need for training on the subject to acquire knowledge and develop skills. The results described here are relevant to support the planning of health education actions, reinforce institutional guidelines and equip professionals to provide safe and quality care. It is suggested that future studies may explore the effectiveness of training on PICC on clinical outcomes and the incidence of complications related to omission of health care.

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