SCT Proceedings in Interdisciplinary Insights and Innovations. 2025; 3:382
doi: 10.56294/piii2025382

Category: Applied Research in Health and Medicine

ORIGINAL

Knowledge possessed and procedures applied by nursing personnel in relation to the care and handling of central venous catheters

Conocimientos que posee y procedimientos que aplica el personal de Enfermería en relación con el cuidado y manipulación de los Catéteres Venosos Centrales

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Cite as: Zerrizuela MF, Lara WA. Knowledge possessed and procedures applied by nursing personnel in relation to the care and handling of central venous catheters. SCT Proceedings in Interdisciplinary Insights and Innovations. 2025;3:382. DOI: https://doi.org/10.56294/piii2025382

Submitted: 12-09-2025 **Reviewed:** 27-11-2024 **Accepted:** 03-01-2025 **Published:** 05-01-2025

Editor: Emanuel Maldonado

ABSTRACT

Introduction: It was estimated that 8% of hospitalized patients will require a Central Venous Catheter (CVC), which implies risks of mechanical and infectious complications if not properly used. This study aimed to describe the knowledge and procedures of nursing staff in the management of patients with CVC. The research was developed in a public hospital in Rosario between August and September 2022.
Methods: A quantitative methodological approach was used, with a non-experimental, descriptive and cross-sectional design. The population studied included nurses from a public hospital, and the sample consisted of 21 Nursing Technicians and one Bachelor working in intermediate care. The majority were women (77.27%), with an average age of 37 years. Data collection consisted of surveys to assess knowledge and direct observation of CVC management and healing procedures.
Results: The nurses' knowledge of biosafety and CVC maintenance was assessed as average, while that related to alarm patterns, risks and complications was lower. In the procedures observed, post-cure activities showed a high performance, highlighting the correct disposal of waste, hand washing and records. The pre-healing steps obtained acceptable results, but weaknesses were identified in the manipulation of lumens and connections. Actions during healing showed the lowest performance, although in general, the procedures exceeded the levels of knowledge evaluated.
Conclusions: The study evidenced limited nursing staff knowledge in critical areas related to CVCs, which could increase the risk of complications. However, the procedures observed were acceptable, with strengths in the post-healing stages. Areas for improvement were identified, especially in actions during healing and device manipulation, suggesting the need for specific trainings to optimize the care of CVC patients.

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Keywords: nursing; central venous catheters; knowledge; care; manipulation.

RESUMEN

Introducción: Se estimó que el 8% de los pacientes hospitalizados requerirán un Catéter Venoso Central (CVC), lo que implica riesgos de complicaciones mecánicas e infecciosas si no se utiliza adecuadamente. Este estudio se propuso describir los conocimientos y procedimientos del personal de enfermería en el manejo de pacientes con CVC. La investigación se desarrolló en un hospital público de Rosario entre agosto y septiembre de 2022.
Métodos: Se utilizó un enfoque metodológico cuantitativo, con diseño no experimental, descriptivo y de corte transversal. La población estudiada incluyó enfermeros de un hospital público, y la muestra estuvo conformada por 21 Técnicos en Enfermería y un Licenciado que trabajaban en cuidados intermedios. La mayoría eran mujeres (77,27%), con una edad promedio de 37 años. La recolección de datos consistió en encuestas para evaluar conocimientos y observación directa de los procedimientos de manejo y curación de los CVC.
Resultados: Los conocimientos del personal enfermero sobre bioseguridad y mantenimiento del CVC fueron evaluados como medios, mientras que los relacionados con pautas de alarma, riesgos y complicaciones fueron inferiores. En los procedimientos observados, las actividades posteriores a la curación mostraron un desempeño elevado, destacándose la correcta eliminación de desechos, lavado de manos y registros. Las etapas previas a la curación obtuvieron resultados aceptables, pero se identificaron debilidades en la manipulación de lúmenes y conexiones. Las acciones durante la curación mostraron el menor rendimiento, aunque en general, los procedimientos superaron los niveles de conocimiento evaluados.
Conclusiones: El estudio evidenció un conocimiento limitado del personal de enfermería en áreas críticas relacionadas con los CVC, lo que podría aumentar el riesgo de complicaciones. Sin embargo, los procedimientos observados fueron aceptables, con fortalezas en las etapas posteriores a la curación. Se identificaron áreas de mejora, especialmente en las acciones durante la curación y la manipulación del dispositivo, lo que sugiere la necesidad de capacitaciones específicas para optimizar el cuidado de pacientes con CVC.

Palabras clave: enfermería; catéteres venosos centrales; conocimiento; cuidado; manipulación.

INTRODUCTION

According to Moreno Rivas (2021), peripheral venous catheters are generally used for administering fluids and electrolytes, antibiotic treatment, parenteral nutrition, and extracting blood samples. However, unlike the former, Central Venous Catheters (CVC) allow for hemodynamic monitoring, oncological treatment, and blood transfusion due to the possibility of direct access to the bloodstream at a central level. They also offer the possibility of perfusing high-molarity solutions that remain in place for extended periods during prolonged treatments. It is estimated that 8% of patients admitted to a hospital will need a device of this kind placed in the subclavian, jugular, or femoral vein. CVCs can be inserted using a non-tunneled technique (transient CVC or peripheral insertion) when the need for application is short-term, or a tunneled technique (permanent CVC) can be used for patients who require them for more than 30 days.

Although these types of catheters are very beneficial for the treatment of patients, there are mechanical and infectious complications related to their use. From the perspective of Moreno Rivas

(2021), infectious complications have a more significant impact on users' health because the associated mortality rates vary between 20% and 35%, and the average hospitalization is 7 days. The colonization of these devices frequently occurs from the skin to the connection. It depends on factors such as the material from which it is made, the insertion site, the number of lumens, the length of time it has been in place, the fluid being administered, the patient's state of health, and the type of handling by healthcare personnel. Local infections associated with CVCs can develop into systemic infections with more serious complications such as bacteremia, endocarditis, osteomyelitis, or septic shock.

In the hospital where the research was carried out, an increase was observed in the rate of CVC-related infections with complications for the patient's health, an increase in hospital stay, and the loss of venous access necessary for the treatment, monitoring, or feeding of the care recipient. At this point, nursing's role becomes fundamental in prevention due to its competence in disciplinary knowledge and the execution of procedures related to the care of this type of venous access.

What knowledge does the nursing staff have, and what procedures do they apply to care for and handling Central Venous Catheters (CVC) in a public hospital in Rosario between August and September 2022?

Objective

To determine the knowledge of nursing staff about the care and handling of Central Venous Catheters (CVC) in a public hospital in the city of Rosario in August and September 2022 and what procedures they apply.

METHODS

Design

A study was carried out with a quantitative methodological perspective, a non-experimental descriptive design, and a cross-sectional approach based on fieldwork to determine the knowledge of nursing staff about the care and handling of central venous catheters (CVC) surveyed in a public hospital in the city of Rosario in August and September 2022 and what procedures they apply.

Area of Study

The research was carried out in a public hospital providing secondary care in the city of Rosario. It has an adult and pediatric on-call service, maternity, an adult intensive care unit, an adult coronary care unit, two adult intermediate care units, a pediatric intermediate care unit, neonatology, an operating theater, diagnostic imaging, a day hospital for cancer patients, and outpatient care in various specialties such as dentistry, medical clinic, ophthalmology, and psychology, among others.

Specifically, one of the adult intermediate care wards was chosen; it has a Head Nurse and a Deputy Head Nurse who carry out management tasks and a staff of 26 professional nurses, three of whom have a degree in Nursing. The age range of the workers was between 22 and 55 years old, and they were distributed in three rotating shifts (morning, afternoon, and night), with four to five nurses per shift. The working day is six or eight hours depending on the type of contract each employee has, and all the staff carry out the same activities regardless of the level of training each employee has.

The capacity is for 29 patients divided into two wards. Each room can accommodate three patients, except for two, where there is only room for one patient who requires isolation due to a particular pathology. All rooms have an oxygen and compressed air panel, bathroom, bedside, dining tables, wardrobe, television, air conditioning, and heating.

Participants

Population

The study population consisted of the entire nursing staff (26 nurses) working in the intermediate care ward of the health center in the city of Rosario from August to September 2022.

Sample

From August to September 2022, 22 nurses worked in the intermediate care ward of the health center in the city of Rosario.

Inclusion criteria: nursing staff who perform care tasks in the intermediate care service.

Exclusion criteria: management personnel who perform management tasks and those nurses who were on leave for personal reasons during data collection.

Data collection techniques and instruments

A self-constructed survey was used to measure knowledge about CVC care (see Appendix A) using the information obtained from the theoretical framework. It included 21 multiple-choice questions with only one correct option, which was divided into three sections to reveal knowledge about biosafety measures (5 questions), catheter maintenance (11 questions), and alarm, risk, and complication guidelines (5 questions). The surveys were designed using the Google Forms application and were made available to each professional by emailing them the corresponding link. A pilot test of the instrument was previously carried out with 20 student nurses, and some questions were identified that needed to be reformulated.

For the variable Procedures Applied by Nursing Staff at the Time of Healing (before, during, and after) and CVC Handling, an observation of the activities of the nursing staff was carried out, and a checklist was completed for this purpose, based on the information compiled in the theoretical framework (see Annex B). This checklist included four sections to reveal the procedures carried out by nurses before (18 items), during (9 items), after healing (6 items), and during the handling of the CVC device (11 items).

The responses obtained and the procedures surveyed were coded as correct and incorrect, assigning them numerical values of one and zero, respectively. With the data obtained, the corresponding data matrix was constructed for each variable, which allowed for the analysis and subsequent description of these.

Ethical considerations

The express consent of all study participants was requested and obtained in writing (Informed Consent - See model in Appendix C). When invited to participate in the research study entitled “Knowledge Possessed and Procedures Applied by nursing staff about the Care and Handling of Central Venous Catheters,” they were provided with information about the purpose, duration, methodology, and criteria for ending their participation, emphasizing the right to withdraw at any time if they so wished.

A clear commitment was made to maintain confidentiality regarding the personal data of the project participants, both in obtaining, processing, and storing the data and in the subsequent publication of the results. To this end, all data that could identify the participants was coded to protect personal data, safeguard their identity, and ensure anonymity.

Authorization was also requested, and the necessary information about the research was provided to the Nursing Department with a note addressed to the head of the sector (see signed authorization in Appendix D).

https://doi.org/10.56294/piii2025382

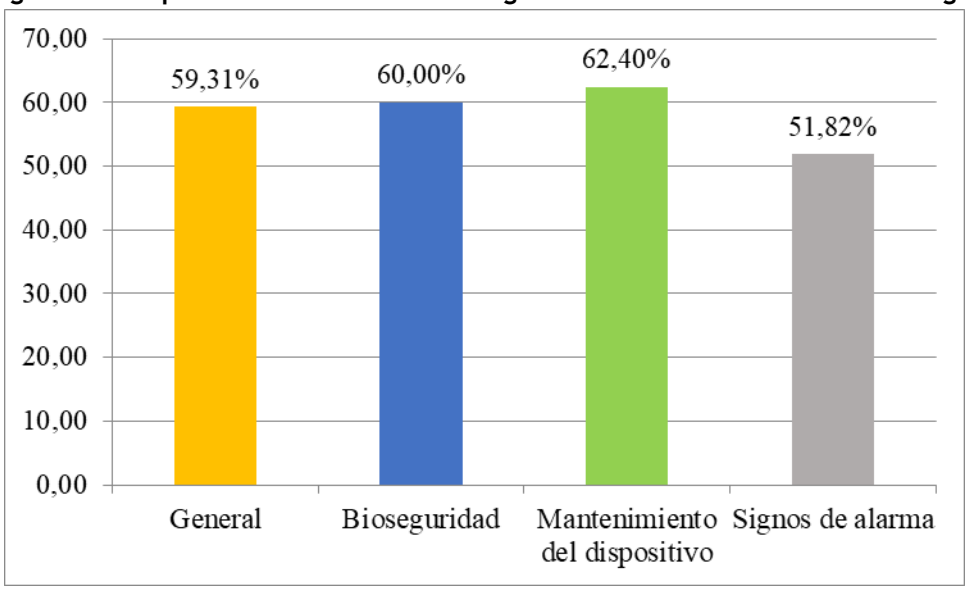
RESULTS

The study population consisted of 22 nurses, with a higher representation of women (77.27%) and an average age of just over 37 years; only one nurse had a university degree. The distribution by work shift resulted in 9 nurses on the morning shift (3 from 6:00 to 12:00 and six from 6:00 to 14:00), eight on the afternoon shift (3 from 12:00 to 18:00 and five from 14:00 to 22:00), and five nurses on the night shift (6:00 p.m. to midnight).

Regarding the first specific objective of investigating the level of knowledge of nursing staff in three areas (biosafety measures, maintenance, alarm guidelines, potential risks and complications about CVCs), out of 21 multiple-choice questions (P) (from letter a to f) and 22 surveys with completed questionnaires (462 total responses), 274 correct responses were obtained (59,31%).

The biosafety area had 66 correct answers out of a possible 110, the device maintenance area 151 out of 242, maintaining a percentage only slightly higher than the overall result, while the area referring to alarm, risk, and complication guidelines had 57 correct answers out of 110, representing the area of knowledge with the worst result.

Figure 1. Comparison of Overall Percentages of Correct Answers on Knowledge.



Source: compiled by the authors based on the results of the surveys carried out.

Analysis of each of the answers revealed that the strengths of knowledge in biosafety were in the ability of nurses to conceptualize it (Q1), to express the biosafety measures necessary for CVC use (Q2), and the actions necessary when a patient undergoes an infectious process (Q3);. At the same time, there was a lack of knowledge about the color of the bag that should be used to discard the waste from the healing procedure healing (P4). Half of the nurses selected the recommended (clinical) type of hand washing before catheter manipulation (P5).

Table 1. Nurses' Knowledge According to Correct Answers About CVC Biosafety, Warning Signs, Risks and Complications.

	Biosecurity		Warning Signs, Risks and Complications	
Question Nº	Total Corrects	Percentage	Total Correct	Percentage
P1	17	77,27	19	86,36
P2	16	72,73	8	36,36
P3	16	72,73	18	81,82
P4	6	27,27	12	54,55
P5	11	50	0	0,00

Source: Data obtained from the analysis of the survey carried out on the population studied with regard to knowledge about biosafety, warning signs, risks and complications related to CVC.

The strengths of knowledge about warning signs, risks, and complications were in the warning guidelines (P3) and the measures to be taken in case of bleeding after CVC placement (P1). However, there was a lack of knowledge about the dressing material when bleeding from the insertion point (P4). There were no correct answers about the complications associated with the presence of the catheter (P5). One in three nurses selected the appropriate material for covering the insertion point during the bleeding post-healing period (P2).

Regarding the maintenance of the CVC device, the nurses showed a high level of knowledge about the time to replace the infusion system (P10), the assessment of the evolution of healing (P1), the site where healing should begin (P6), and the general care of the catheter according to its lumen (P8). They demonstrated an acceptable level of knowledge about the procedure for disinfecting ports and connections (P9) and an average level about washing the catheter with saline solution (P11).

Table 2. Nurses' knowledge according to correct answers about CVC device maintenance

Maintenance of the CVC Device		
Question Nº	Total Correct	Percentage
P1	21	95,45
P2	4	18,18
P3	9	40,91
P4	8	36,36
P5	9	40,91
P6	21	95,45
P7	8	36,36
P8	19	86,36
P9	16	72,73
P10	22	100,00
P11	14	63,64

Source: Data obtained from the analysis of the survey carried out on the population studied with regard to the maintenance of CVCs.

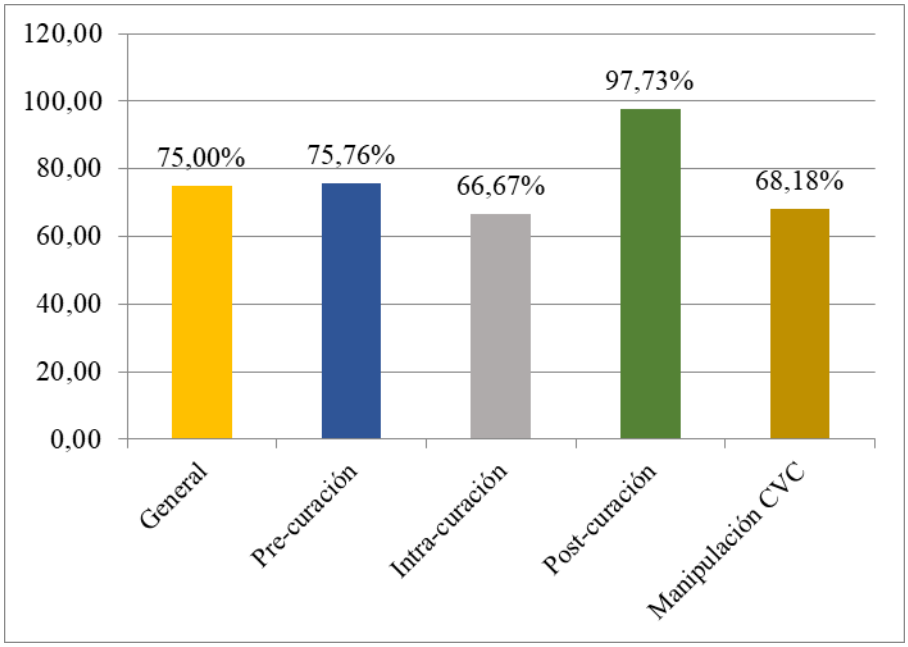
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The most important knowledge deficits were in the time that should elapse before the first healing (P2), the frequency with which they should be performed (P3), what decision to make when exudates appear (P7), the frequency of maintenance of unused lumens (P4) and the antiseptic for alternative use when the protocolized one is not available (P5).

Regarding the second specific objective of verifying the procedures used by nursing staff before, during, and after the healing of the CVC insertion site and the third objective of verifying the procedures used during the handling of the device, the application of the checklist made it possible to determine that, out of 968 procedures observed, 726 (75%) were performed correctly. Among these, those prior to healing with a frequency of 300 out of 396 observed, during healing 132 out of 198, after healing 132 out of 198, and those involving handling of the CVC device 165 out of 242 (Figure 2).

In this way, the post-healing procedures presented a very high standard, and the pre-healing procedures were similar to the general average of procedures executed correctly. On the other hand, the CVC device manipulation and intra-healing procedures were below the general average (Figure 2).

Figure 2. Comparison of Overall Percentages and of Procedures Correctly Performed



Source: compiled by the authors based on observation of the participating nursing staff.

From the analysis of each procedure carried out by the nursing staff (see the tables corresponding to the data matrix in Appendix E), in the period prior to healing (pre-healing), three procedures were found to have a high degree of incorrect execution: hand washing according to WHO recommendations (item 12, 77.27%), removal of the transparent dressing (item 16, 72.73 %) and the prior verification of materials and supplies necessary to carry out the procedure (item 1, 68.18%). Providing two packs of sterile gauze with the antiseptic routinely used in the service (item 5, 50.00%) and removing adornments from the professional's hands (item 13, 59.09%) revealed a medium level of incorrect practices.

During the healing process, six procedures were executed incorrectly, with approximately half of the executions: the aseptic gloving of the first glove and the antisepsis of the insertion site (items 3 and 6, 50.00%); the aseptic opening of the sterile glove packaging and the place of taking the second glove (items 2 and 4, 4 5.45%); and the antisepsis and drying of the site of fixation in the same way (items 7 and 8, 45.45%).

Regarding the handling of the CVC device, procedural errors included disinfecting ports and connections before handling them (item 8, 86.36%), replacing solutions and perfusion equipment according to the standard, and protecting the junction between the catheter and the equipment to be removed (items 4 and 5, 68.18%). Checking catheter patency and assessing the condition of the venous access also had a significant percentage of incorrect procedures (item 2, 59.09%).

The general objective is to determine the knowledge of nursing staff about the care and handling of central venous catheters (CVC) in a public hospital in the city of Rosario in August and September 2022 and what procedures they apply. The following comparative table (Table 3) can be constructed.

Table 3. Expressed Knowledge and Observed Procedures of the Participating Nursing Staff

	Knowledge	Procedures
Issues addressed	21 multiple-choice questions.	44 procedures from a checklist.
Overall performance	59.09% correct	75.00% correct
Strengths	62.40% CVC maintenance	97.73% post-cure
Biosafety deficit	Hand washing according to WHO recommendations.	Hand washing according to WHO recommendation.
Cure deficit	Wound healing: antisepsis, technique, timing, materials, complications.	Aseptic gloves. Removal of the transparent dressing. Prior verification of necessary materials and supplies.
Device handling deficit, risk and complications	Device disinfection, lumen maintenance and patency assessment.	Disinfection of stations and connections. Replacement of perfusion solutions and equipment; protection of the junction between the catheter and the equipment to be removed. Verification of catheter patency and assessment of venous access conditions were.

Source: own elaboration based on the analysis of surveys and observation of nursing staff.

By analyzing Table 3, it can be said that there is a relationship between some gaps in theoretical training and subsequent actions. The training needs of nurses are clear, both in terms of knowledge and procedures, which need to be reviewed, clarified and corrected.

CONCLUSIONS

Regarding the care of CVCs, the nurses showed an average knowledge of biosafety concepts and catheter maintenance and an even lower performance on alarm, risk, and complication guidelines.

On the other hand, the procedures observed achieved an acceptable overall result with very high performance in post-healing activities: discarding contaminated gauze and gloves in a red bag, preparing the patient, washing hands at the end of the procedure, making the corresponding record of the activity and reporting any eventualities. Those prior to healing were also acceptable, and lower-than-average performance was recorded in handling the CVC device. Those performed during healing were even lower.

https://doi.org/10.56294/piii2025382

However, the four procedural instances observed had higher results than those obtained in the three areas of knowledge investigated.

In both the field of knowledge and procedure, deficits were identified regarding hand washing and techniques for disinfection, asepsis, care of the insertion site, maintenance of the CVC device, and complications resulting from the presence of the catheter.

Two pieces of data have attracted attention: nurses who showed a knowledge score of 27.27% regarding the classification of waste according to the color of the bag achieved a 100.00% assessment of the procedure when they were observed to correctly dispose of the material at the end of the healing process; on the other hand, the high performance of the workers in the sequence of technical procedure after healing contrasts with the deficient performance in activities prior to healing, during healing and when handling the device.

The findings suggest developing educational interventions to supplement and update deficient knowledge and clarify procedural rules and protocols to correct the difficulties encountered.

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FINANCING

None.

CONFLICT OF INTEREST

None.