Journal of Nursing
Revista de Enfermagem
UFPE On Line
ISSN: 1981-8963

ORIGINAL ARTICLE

DIFFERENCE OF VOLUMES IN SOLUTIONS FOR MAINTENANCE OF TOTALLY IMPLANTED CENTRAL VENOUS CATHETER

DIFERENÇA DOS VOLUMES NAS SOLUÇÕES PARA MANUTENÇÃO DO CATETER VENOSO CENTRAL TOTALMENTE IMPLANTADO

DIFERENCIA DE LOS VOLUMENES EN LAS SOLUCIONES PARA MANTENIMIENTO DEL CATÉTER VENOSO CENTRAL TOTALMENTE IMPLANTADO

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ABSTRACT

Objective: to verify the difference in the volume of solution that is used and that should be used in maintenance of the totally implanted central venous catheter and the factors associated with this difference. ***Method:*** this is an observational cross-sectional study with a quantitative approach conducted with 69 cases. The research project was approved by the Research Ethics Committee, under the protocol 181 086. ***Results:*** males represented 51% of cases, the predominant age group was over 18 years old (72%), the largest number of placements occurred in the right subclavian vein (59%), and the 9.6 French catheter was the most used (80%). The difference between the amount inserted in milliliters and that it should be inserted was 0.7416 mL. ***Conclusion:*** the information generated cater for institutions that use such devices to plan and perform actions involving the placement and nursing care related to them, as well as prevention of complications in cases of unnecessary exposure of the user of these catheters to the drugs used in its maintenance. ***Descriptors:*** Indwelling Catheter; Oncology Nursing; Health Profile.

RESUMO

Objetivo: verificar a diferença do volume da solução que se usa e o que deveria ser usado na manutenção do cateter venoso central totalmente implantado e os fatores associados a essa diferença. ***Método:*** estudo observacional de corte transversal, com abordagem quantitativa, conduzido com 69 casos. O projeto de pesquisa foi aprovado pelo Comitê de Ética em Pesquisa, sob o Protocolo 181.086. ***Resultados:*** o sexo masculino representou 51% dos casos, a faixa etária predominante foi a partir dos 18 anos (72%), o maior número de implantações ocorreu na veia subclávia direita (59%), e o cateter de 9,6 *french* foi o mais utilizado (80%). A diferença entre a quantidade em mililitros inserida e aquela que deveria ser foi de 0,7416 mL. ***Conclusão:*** as informações geradas servem para as instituições - que utilizam tais dispositivos - planejarem e executarem ações envolvendo a implantação e os cuidados de enfermagem relacionados a eles, além da prevenção de intercorrências em casos de exposições desnecessárias do usuário desses cateteres às drogas utilizadas em sua manutenção. ***Descritores:*** Cateteres de Demora; Enfermagem Oncológica; Perfil de Saúde.

RESUMEN

Objetivo: verificar la diferencia del volumen de la solución que se usa y lo que debería ser usado en el mantenimiento del catéter venoso central totalmente implantado y los factores asociados a esa diferencia. ***Método:*** estudio observacional de cohorte transversal, con enfoque cuantitativo, conducido con 69 casos. El proyecto de investigación fue aprobado por el Comité de Ética en Investigación, sobre el Protocolo 181.086. ***Resultados:*** el sexo masculino representó 51% de los casos, la edad predominante fue a partir de los 18 años (72%), el mayor número de implantaciones ocurrió en la vena subclavia derecha (59%), y el catéter de 9,6 *french* fue el más utilizado (80%). La diferencia entre la cantidad en mililitros inserida y aquella que debería ser, fue de 0,7416 mL. ***Conclusión:*** las informaciones generadas sirven para las instituciones - que utilizan tales dispositivos – planear y ejecutar acciones envolviendo la implantación y los cuidados de enfermería relacionados a ellos, además de la prevención de complicaciones en casos de exposiciones desnecesarias del usuario de esos catéteres a las drogas utilizadas en su mantenimiento. ***Palabras clave:*** Catéteres de Demora; Enfermería Oncológica; Perfil de Salud.

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INTRODUCTION

The incidence of cancer in the world population has growing with increasingly alarming numbers. Every year, about 12.7 million cases are diagnosed worldwide, and if there is no improvement in control of it, this number may reach 21.3 million in 2030 and of these, it is estimated that about 13.1 million patients will die of this disease.[1] Malignant neoplasms, or cancer, have been an important cause of death in Brazil, and growth and population aging can contribute greatly to the impact of this disease in this country and worldwide.[2]

Brazil recorded 141,000 cancer deaths in 2004, of which the most common in males are lung, prostate and stomach cancers; whereas in women, breast, lung and bowel cancers are the most prevalent, excluding non-melanoma skin cancer.[3]

In 2014, estimates in Brazil pointed to the occurrence of 576,580 new cancer cases, including non-melanoma skin cancers, which shows the magnitude of the cancer problem in this country. The most incident types are non-melanoma skin, prostate, lung, colon and rectum, and stomach cancers for males; and non-melanoma skin, breast, colon and rectum, cervix, lung and thyroid cancers for females.[4] In childhood, the most frequent malignant neoplasms are leukemias, central nervous system tumors and lymphomas.[5]

Parallel to the increased incidence of cancer in our country, oncology has had great progress, both in diagnostic as in the therapeutic techniques, which has enabled improved survival and quality of life of patients with this disease. It is nursing responsibility to follow the development of this specialty from scientific researches, which are among the key features for updating the knowledge, so that one can pay a better care and with more quality to cancer patients.

In this context, the nurse has the competence to assist cancer patients in diagnostic evaluation, treatment, rehabilitation, to care for family members, and to develop educational activities integrated with other professionals, to support legislative measures and to identify occupational risk factors in the practice of care to cancer patients and their families.[3]

A prolonged treatment with chemotherapeutic drugs administered in peripheral veins can lead to endothelial irritabilities, besides the risk of tissue necrosis, which can also occur in case of leakage into the subcutaneous region for some of them, becoming increasingly common the implantation of central venous catheters (CVC) for this purpose.

In addition to chemotherapy, this device may have other indications such as blood products management, antibiotics, parenteral nutrition, pain killers and frequent need for blood sample collection.[6]

Such devices can be inserted into peripheral veins, such as the Peripherally Inserted Central Catheter (PICC), or inserted into deep veins, such as the Semi-Implanted Central Venous Catheter (SI-CVC) and Totally Implanted Central Venous Catheter (TI-CVC).[3]

Among these, the TI-CVC has gained more supporters as it offers the following advantages: the system is entirely subcutaneous, reducing the risk of infection; it minimizes the risk of thrombosis, it is easy to puncture, allows outpatient treatment; it is radiopaque, does not interfere in the daily activities of the patient, it is aesthetic and preserves the peripheral venous system.[7] The insertion of these devices is carried out through a puncture or dissection of deep vein such as the subclavian or internal jugular veins, for example. For some patients, the device is an essential part of cancer treatment, as it is often the only access system of chemotherapy medication to the body.[8]

Although this type of catheter has multiple indications, such as the infusion of blood and blood products and the collection of material for laboratory analysis, the chemotherapy administration started from the 70s.[9] Even with the risks, the benefits they provide have made them become increasingly popular in the 80s, with the introduction of TI-CVC in 1983 for cancer patients who would make use of antineoplastic agents.[10]

Such catheters tend to stay until the end of treatment, if there is no infection, obstruction or other complication. Importantly, these devices require monthly maintenance when not being used for infusions.[11]

It is observed that, in the daily practice of specialized institutions in cancer treatment, there is a discrepancy in relation to the volume of liquid to be introduced into the indwelling catheters, i.e., in relation to the volumetric capacity of the catheter. This situation should be a concern for nurses, who is the professional that handles this device.

In research on the published data on this topic and articles that addressed the volume of the solutions used in the maintenance of these catheters, we observed a volumetric

discrepancy ranging from two to ten milliliters on the volume of solution used.[11]

The Infusion Nurses Society (INS), which is an American company with credibility in publications involving various issues related to infusion therapy, notes that the volume used for catheter maintenance should be at least twice the volumetric capacity of the device used,[12] thus preventing an incomplete filling that would consequently increase the risk of obstruction. Therefore, we notice the importance of concern with the safety of the subject in whom the catheter will be implanted, with the use of the solutions used in this device, with the characteristics of the material and with individualized practice for maintenance of its permeability. Therefore, the establishment of the solution volume to maintain these catheters unobstructed must consider both the aspects of the catheter as those from the user.

The Oncology Hospital in Rio de Janeiro/RJ, the research field that subsided this study, is part of an institution that is reference in oncology in the country. It has in its form of nursing procedure to CVC handling the recommendation of the administration of 2ml of heparin solution for its maintenance, making no distinction between adults and children, for example,[13] where there may be variations in the features of one another.

There is publication recommending heparinization of CVC with 3 ml of heparin solution for adults and 1 ml of the same solution in cases of children,[14] not taking into account variations of users' characteristics in individual assessment of cases, whether in children or in adults. Thus, it is observed that there is no specific criterion for heparinization that takes into account the specificities and particularities of each user.

One must consider that when an institution has its pre-established protocols, incorporated by professionals, the procedures are usually performed without the need for a professional to make prescriptions. In the case of volume for maintenance TI-CVC, when the institution has a predetermined amount for the volume generally there is no prescription, neither from the physician, nor from the nurse, and professionals perform what is determined by the protocol, by handbooks or by a standard operating procedure, among others.

Another factor observed throughout this study is that during surgery for implantation of the catheter, the surgeon may need to sever part of the device to adjust it in the patient's profile. Thus, the size of a catheter inserted into a child may not be the same as the one entered into an adult. Moreover, even among adults and among children there is difference in size depending on the distance from the catheter insertion area until the location designated for placement of its distal portion. Generally, this part is positioned in the superior vena cava, in the inferior vena cava or in the brachiocephalic veins, in relation to the reservoir. Another variation is regarding its setting place, which may be in the chest, in upper or lower limbs.[13] It is clear, then, that the length of the catheter will be different and hence the volume of solution inserted therein should also be different, i.e., proportional to the size of the catheter inserted in the user, after discounting the discarded part in surgery.

By performing an activity without taking into account the specificities presented above, namely: the user's biotype, the volumetric capacity of the chosen catheter and the possible cut of the catheter by the surgeon to place it properly, the nurse responsible for handling this catheter will risk performing the maintenance incorrectly.

OBJECTIVE

♦ To verify the difference between the volume of solution that is used and what should be used for the maintenance of TI-CVC according to the INS, and which factors are associated with this difference.

METHOD

Article drawn from the dissertation << ***Diferença do volume presente e requerido de solução para manutenção do cateter venoso central totalmente implantado e fatores associados (Difference between the present and the required solution volume for the manteinance of the totally implanted central venous catheter and associated factors)*** >>, presented to the Professional Master's Program in Nursing/MPEA, Nursing Schoool Aurora de Afonso Costa/EEAAC, Universidade Federal Fluminense/UFF, in Niterói, RJ, Brazil, in 2013.

This is an observational study of cross-sectional quantitative approach, with a survey of the types of catheters used in a reference institution: the volume to fully fill these catheters individually and non-participant observation of the implantation of 69 catheters in the respective users, applying a questionnaire for surgeons responsible for the implantation of these devices, in order to know the catheter election criteria to be used and the section performed to get the proper size for each patient. The research was conducted in a surgical center of a public

hospital specialized in oncology in Rio de Janeiro.

We carried out the sample calculation to identify the number of implantations to be monitored to obtain significance of the research, based on the proportion of surgeries performed at the hospital every month, adopting 0.10 as percentage error for this analysis, established as standard for this analysis, with 0.05 significance, or 95% confidence level. The minimum sample was defined as seven cases for pediatric patients and 42 for adult patients. The collected sample was 69 cases from March to May 2013, thus meeting the statistical calculation.

We used a form prepared by the researchers with questions regarding the indication of catheter implantation, the body region where it was implanted, the blood vessel chosen for the procedure, among others; and a pre-test was carried out with the head surgeon of the Pediatric Surgery Department of the institution investigated. After review and discussion of responses, adjustments were drafted in the questionnaire so that the questions could contemplate the research objectives, as well as data from the medical record such as age, sex, among others. These data, collected through the forms, were crossed with the data collected in the operating room during non-participant observation.

The inclusion criteria were: all TI-CVC inserted in the operating room of the hospital during the research period.

After successive readings of scientific papers related to the implantation, maintenance and care of the TI-CVC, a framework was developed with the possible variables that could influence the volume of solution that the catheters would require, according to their respective volumetric capacities after the inserting in each patient. Thus, after identification, these variables were statistically tested using the tests described below, to verify the degree of the influence and significance of each of them with respect to the determination of volumetric capacity of each catheter, and we also testes which variables were correlated.

A normality test was made to see if the variables follow a normal distribution (Gaussian), where the data in histogram form an ascending or descending continuous imaginary line. We also used the Shapiro-Wilk test, which is based on W statistic, where the lowest values are evidence that the data are normal. As all variables do not follow the normality, we applied the Spearman's correlation test, used when there are bivariate quantitative variables.[15]

As for the statistical test for the quantitative analysis, the non-parametric Mann-Whitney test, also known as "U test", was applied, which can be used for independent samples, where the values of sample A are generally lower than in B.[15]

In the analysis, we used descriptive statistics to characterize the variables evaluated. A database was created in a spreadsheet in Excel™ program in which occurred the distribution of variables related to the implantation of the TI-CVC. Data were analyzed with SAS software, version 9.1.3, and presented as simple and percentage frequency.

Data collection was started after approval of the research project by the Research Ethics Committee of the Instituto Nacional de Câncer, under the protocol number 181,086.

RESULTS

After identifying the types of variables, they were classified in dependent or independent, and in quantitative or qualitative.

The variables found in the research during its development were: body surface, catheter size in centimeters (cm) before implantation, catheter size that was implanted, how many milliliters (mL) of solution were inserted, how many milliliters (mL) should be inserted according to INS, the difference between the inserted mLs and what should be inserted according to the INS, sex, catheter brand, chosen vein, feature of the chosen port, surgeon's experience time and whether adult or pediatric surgeon.

We accompanied 69 implantations of TI CVC from March to May 2013, both in adults as in children, during 23 days, with length of stay in the operating room of 6 hours per day, totaling 138 hours of non-participant observation.

As for the volumes that the various catheter sizes include, in centimeters, the saline solution was inserted until the total filling of the catheter and the "rule of three" was applied for the identification of other possible centimeters, according to the sizes of catheters found in data collection, as shown in Table 1.

Table 1. Volume in milliliters for maintenance of 9.6 French TI-CVC (OD).

Catheter size in centimeter (cm)	Volumetric capacity of the catheter in mL	Total volume in mL end of the port + catheter
39 cm	0.65 mL	1.00 mL
38 cm	0.63 mL	0.98 mL
37 cm	0.62 mL	0.97 mL
36 cm	0.60 mL	0.95 mL
35 cm	0.58 mL	0.93 mL
34 cm	0.57 mL	0.92 mL
33 cm	0.55 mL	0.90 mL
32 cm	0.53 mL	0.88 mL
31 cm	0.52 mL	0.87 mL
30 cm	0.50 mL	0.85 mL
29 cm	0.48 mL	0.83 mL
28 cm	0.47 mL	0.82 mL
27 cm	0.45 mL	0.80 mL
26 cm	0.43 mL	0.78 mL
25 cm	0.42 mL	0.77 mL
24 cm	0.40 mL	0.75 mL
23 cm	0.38 mL	0.73 mL
22 cm	0.37 mL	0.72 mL
21 cm	0.35 mL	0.70 mL
20 cm	0.33 mL	0.68 mL
19 cm	0.32 mL	0.67 mL
18 cm	0.30 mL	0.65 mL
17 cm	0.28 mL	0.63 mL
16 cm	0.27 mL	0.62 mL

Note: The volumetric capacity of the port concerning this catheter is 0.35 mL and is invariable.

Table 1 shows the respective volumes comprising the port and the catheter according to the possible sizes were determined after its implantation. It is observed variation of 16 to 39 centimeters. The values required for filling it out ranged from 0.62 to 1.00 milliliters. Following the recommendations of the INS, these recommended amounts range from 1.24 to 2.00 milliliters, considering the volume of the port, which has a capacity of 0.35 milliliters and is invariable. It is noteworthy that this was the largest catheter available in the institution at the time of the research. Thus, it is seen that the volume needed to fill all catheters available in the institution will be a maximum of 2.00 milliliters, considering the sample.

Through Mann-Whitney test (Table 2), with 0.05 of significance, it was analyzed if the sex of the patients interferes in the results of the variables, given the anatomical differences between the sexes, which may cause differences in the results. This test was performed separately for adults and children.

Table 2. Mann-Whitney test regarding sex for adults.

Variable	Test statistic	P value
Body surface	442.5	0.0026
Size of implanted catheter	564	0.3335
Mililiters	611	0.1604
Ideal milliliters	568	0.3628
Difference (mL) between what is done and what should be done	639	0.1553

It is observed that only the variable body surface was statistically significant, that is, sex does not affect the results of other variables, only this variable.

The Mann-Whitney test regarding sex for children demonstrated that this item did not influence the results of the variables; this may be due to the sample size was small.

Table 3 shows the Mann-Whitney test regarding the groups, because it is necessary to know whether there are differences of these variables in relation to children and adults.

Table 3. Mann-Whitney test, regarding the groups.

Variable	Test statistic	P value
Body surface	Test statistic	0.0001
Size of implanted catheter	760	0.0001
Mililiters	495	0.5
Ideal milliliters	553.5	0.183
Difference (mL) between what is done and what should be done	438.5	0.1914

It can be seen that there is difference between children and adults only on body surface and the size of the implanted catheter, with no differences for the other parameters, that is, for quantity inserted in mLs and ideal quantity in mLs, and the difference between them has not suffered statistical difference when comparing adults and children, as shown by the means of these variables.

In Tables 4 and 5, it was held the Spearman's correlation test to verify whether the quantitative variables are correlated or not, first for adults and then for children.

Table 4. Correlation test for adults, according to Spearman's correlation coefficient (p value).

	Body surface	Size of implanted catheter	Mililiters	Ideal milliliters	Difference (mL) between what is done and what should be done
Body surface	100.000	0.01492	-0.06307	0.27150	-0.30203
		(0.9181)	(0.6635)	(0.0565)	(0.0330)
Size of implanted catheter	0.01492	100.000	0.04148	0.73338	-0.58273
	(0.9181)		(0.7749)	(<0.0001)	(<0.0001)
Mililiters	-0.06307	0.04148	100.000	0.21559	0.47134
	(0.6635)	(0.7749)		(0.1327)	0.0006
Ideal milliliters	0.27150	0.73338	0.21559	100.000	-0.73976
	(0.0565)	(<0.0001)	(0.1327)		(<0.0001)
Difference (mL) between what is done and what should be done	-0.30203	-0.58273	0.47134	-0.73976	100.000
	(0.0330)	(<0.0001)	(0.0006)	(<0.0001)	

Table 4 shows that the variable 'size of the implanted catheter' is correlated with the variables 'ideal quantity in milliliters that should be inserted according to INS' and the 'difference between the quantity in milliliters that is administered and what should be administered according to INS'. The variable 'ideal quantity in milliliters according to INS' is also correlated with 'size of the implanted catheter' and with the 'difference between quantity in milliliters that is administered and what should be administered according to INS'.

Table 5. Correlation test for children, according to Spearman's correlation coefficient (p value).

	Body surface	Size of implanted catheter	Ideal milliliters	Difference (mL) between what is done and what should be done
Body surface	100.000	0.66813	0.93591	-0.93591
		(0.0018)	(<0.0001)	(<0.0001)
Size of implanted catheter	0.66813	100.000	0.71754	-0.71754
	(0.0018)		(0.0005)	(0.0005)
Ideal milliliters	0.93591	0.71754	100.000	-100.000
	(<0.0001)	(0.0005)		(<0.0001)
Difference (mL) between what is done and what should be done	-0.93591	-0.71754	-100.000	100.000
	(<0.0001)	(0.0005)	(<0.0001)	

Table 5 is shows that the variable 'body surface' is correlated with the variables 'ideal quantity in milliliters that should be inserted according to INS' and the 'difference between the quantity in milliliters that is administered and what should be administered according to INS'. The variable 'ideal quantity in milliliters that should be inserted according to INS' is also correlated with the 'difference between the quantity in milliliters that is administered and what should be administered according to INS'.

It is observed that, in Table 5, the variable 'milliliters' was removed because as the two variables obtained the same values, the first in adults and the second in children, it is not possible to calculate the correlation coefficient.

DISCUSSION

Of the 576,580 new cases of cancer estimated for 2014, excluding non-melanoma skin cancer, there will be a total of 394,450 cases and, of these, 203,930 will be in male patients (52%) whereas 190,520 cases in female patients (48%).[4] This percentage has similarity with those found in this study, in which 51% of male patients, compared to 49% of female patients who implanted catheter made it for administration of chemotherapeutic drugs.

The pediatric cancer, also known as juvenile, is rare compared to cancer in adults, representing from 2 to 3% of all malignant tumors. Because of this, it should be studied separately from cancer in adults, since it presents differences in primary locations, different histological origins and different clinical behaviors.[16]

The patients in this study that were in the pediatric age accounted for 28% of cases, compared to 72% of the cases corresponding to adult age. The age group between 51 and 60 years old had the highest number of catheter implantations, with 16 implantations (32%), followed by the age group of those over 60 years of age, which totaled 14 implantations (28%). This is the age group with the highest incidence of new cases in the country, according to Ministry of Health data published in 2010.[17]

The blood vessel chosen for implantation of TI-CVC was the right subclavian vein, with 41 of 69 cases (59%). This is due to the ease of access of this blood vessel when compared to others.[3] Regarding recently published data with 61 cases of implantation of catheters in children and adolescents, in 42 of them (68.9%) the first insertion site chosen was also the right subclavian vein.[18]

Regarding the indication of catheter implantation, all 69 cases (100%) were indicated due to the need for chemotherapy. Although there are other purposes, such as blood transfusions and parenteral nutrition, for example, the catheter has still been very suitable for treatment with chemotherapy, as shown previously in a similar study, where 29 catheters of this type were inserted, of which 25 (86.3%) were indicated for treatment using anticancer drugs.[19] The vesicant characteristics that some chemotherapy drugs have, such as vincristine and doxorubicin, among others, is a factor that promotes the indication of these devices.[20]

The catheter with the highest frequency of choice for implantation was the one that has greater outer diameter or French available in the researched institution, that is, 9,6 French in 55 cases, equivalent to 80% of all inserted catheters during the study period. This choice favors both the infusion of chemotherapy as the blood collection and the blood transfusion, if necessary, because the

literature recommends that the latter two procedures cited are only made in catheters larger than 3.8 French, in order to prevent obstruction thereof.[21]

The authorities of the countries that make use of these devices, for example, the *Agência Nacional de Vigilância Sanitária* (ANVISA), in Brazil, must require that this information is described on the packaging of each catheter, according to their respective characteristics. Thus, we see the need for manufacturers of these devices to inform in the instruction manual the volumetric capacity of the catheters as well as their respective ports, as companies that manufacture these devices have technologies that inform these values much more accurately than the tests presented here.

Thus, as the volumetric capacity of the catheter being manipulated is known, the excessive insertion of substances into the bloodstream device is avoided and hence possible reactions, both bleeding, due to heparin,[14] as angioedema and even bronchoconstriction due to streptokinase,[22] as reported in the literature. Prior knowledge of the volumetric capacity of catheters also favors the standardization of nursing practice, preventing the discrepancy regarding the volume of solution used to maintain the device, as seen in the literature, which describes the use of volumes ranging from two to ten milliliters of solution for its maintenance.[11]

These findings also collaborate to patient's safety, reducing the risk of unnecessary harm associated with health care.[23] The importance of this issue is enhanced by the Brazilian government with the publication of the Decree No. 529 that establishes the *Programa Nacional de Segurança do Paciente* (National Program for Patient Safety-PNSP), which aims, among many goals, to promote and support the implementation of initiatives aimed at patient safety.[24]

Another important factor, arising from results of this research, is that the knowledge of the volumetric capacity of catheters that are manipulated prevents unnecessary spending with solution to its filling, whatever it may be. In addition, knowledge generated by this study will enable further studies to reduce costs, and will prevent empiricism observed in the maintenance of such catheters.

CONCLUSION

The variables used to describe the profile of patients who have totally implanted catheter in the institution are consistent with the literature found on the profile of patients with tumors in our country, saved the appropriate proportions relative to the size of the samples and research time. However, we can notice the indications for implantation of this catheter in the researched institution, which has proved 100% exclusive to treatments with chemotherapy, but it can be indicated for other purposes, as described above.

Thus, in addition to delineate the profile of users of catheters in that institution specialized in cancer treatment, this study demonstrates that the profile found reflects the profile found in the literature for the country, reinforcing the reference character in this modality of treatment that the research institution has in the Brazilian scene. However, it was found an average variation in the volume of solution used for maintenance of TI-CVC greater than 0.74 mL.

This information helps to collaborate with institutions that make use of these devices in the planning and execution of actions involving the implantation and nursing care related to their maintenance, so they can be used in the best possible way, preventing early withdrawal of them due to obstructions as consequence of inadequate filling. Moreover, it also serves for prophylaxis of possible complications in case of unnecessary exposure to the user of this device, as well as of drugs used in their maintenance.

FUNDING

This study was carried out with financial support from the *Conselho Regional de Enfermagem* (Regional Nursing Council) of Rio de Janeiro - RJ-COREN.

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Submission: 2015/03/01
Accepted: 2015/05/12
Publishing: 2015/05/15

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