

# Difficulty in visibility and palpation of the peripheral venous system in adults and older adults

*Dificuldade na visibilidade e palpação da rede venosa periférica em adultos e idosos*

*Dificultad de visibilidad y palpación de la red venosa periférica en adultos y ancianos*

## Abstract

**Objective:** To evaluate the difficulty in visibility and palpation of the peripheral venous network in adults and older adults admitted to a hemodynamic intervention unit.

**Method:** An observational prospective study was conducted with 105 adults and older adults admitted to a hemodynamic intervention unit, in a public general teaching hospital. Data were collected by means of a structured instrument consisting of demographic and clinical variables, with observation of peripheral intravenous puncture from October to December 2022. Descriptive analysis was performed, calculating proportions. **Results:** Results show a difficulty during palpation and visualization of the vein of 11.4% and 16.2%, respectively. Among those who had difficulty visualizing the vein, 60% were unsuccessful in the first puncture attempt. **Conclusion:** Peripheral puncture in veins with greater visibility and palpation difficulty contribute to failure in the first attempt.

**Descriptors:** Catheterization, Peripheral; Nursing; Palpation; Hemodynamics; Adult.

## Resumo

**Objetivo:** Avaliar a dificuldade na visibilidade e palpação da rede venosa periférica em adultos e idosos admitidos em uma unidade de intervenção hemodinâmica. **Método:** Trata-se de um estudo observacional e prospectivo com abordagem quantitativa. Realizado com 105 participantes, dentre adultos e idosos, admitidos em unidade de intervenção hemodinâmica, em um hospital geral público e de ensino. Os dados foram coletados por meio de instrumento estruturado contendo variáveis demográficas e clínicas, com observação da punção intravenosa periférica. Realizou-se a análise descritiva, calculando as proporções. **Resultados:** A dificuldade durante a palpação e a visualização da veia foram de 11,4% e 16,2%, respectivamente. Entre os participantes que apresentaram dificuldade para visualização da veia, 60% tiveram insucesso na primeira tentativa de punção. **Conclusão:** A punção periférica em veias que possuem maior dificuldade para visibilidade e palpação contribuem para o insucesso na primeira tentativa.


**Descritores:** Cateterismo Periférico; Enfermagem; Palpação; Hemodinâmica; Adulto.

## Resumen


**Objetivo:** Evaluar la dificultad de visibilidad y de palpación de la red venosa periférica en adultos y ancianos ingresados en una unidad de intervención hemodinámica. **Método:** Se trata de un estudio observacional y prospectivo con enfoque cuantitativo. Participaron 105 adultos y ancianos ingresados en una unidad de intervención hemodinámica, en un hospital general público y universitario. Los datos se recolectaron mediante un instrumento estructurado, que contiene variables demográficas y clínicas, con observación de punción intravenosa periférica, durante los meses de octubre a diciembre de 2022. Se realizó un análisis descriptivo en el cual se calculó las proporciones. **Resultados:** La dificultad reportada durante la palpación y la visualización de la vena fue del 11,4% y el 16,2%, respectivamente. Entre los participantes que tuvieron dificultades en la visualización de la vena, el 60% falló en el primer intento de punción. **Conclusión:** La punción de venas periféricas que presentan mayores dificultades en la visibilidad y la palpación tiene tendencia a fallar en el primer intento.

**Descritores:** Cateterismo Periférico; Enfermería; Palpación; Hemodinámica; Adulto.


Guilherme Nascimento  
De Azevedo<sup>1</sup>

 0000-0003-4012-8263


Damiana Aparecida Trindade  
Monteiro<sup>1</sup>

 0000-0002-6740-7687


Lúbia Alves dos Santos<sup>1</sup>

 0000-0003-0467-876X


Lúcia Aparecida Ferreira<sup>1</sup>

 0000-0001-6469-5444

Cíntia Machado Dutra<sup>1</sup>

 0000-0001-5120-6111

Silmara Elaine Malaguti Toffano<sup>1</sup>

 0000-0002-9080-9123

<sup>1</sup>Federal University of Triângulo Mineiro (UFTM), Uberaba – MG, Brazil

Corresponding author:

Guilherme Nascimento de Azevedo  
E-mail: guilhermenascimentoazevedo@hotmail.com

## INTRODUCTION

Peripheral intravenous catheterization (PIVC) is a procedure often performed in hospitals and is an important therapeutic resource in clinical practice<sup>(1)</sup>. Although routine, the performance of PIVC is a clinical problem due to the difficulty in being inserted in a single puncture<sup>(2)</sup>.

Some clinical factors may interfere with the difficulty during the insertion of the PIVC, such as: comorbidities, capillary fragility, loss of water in body composition, malnutrition, decreased subcutaneous tissue or confusional conditions. In addition, changes in the immune system, skin and decreased fat and muscle mass increase exposure to lesions and infections at the insertion site<sup>(3)</sup>.

During the analysis of the peripheral vein, aiming for success in the first attempt, the professionals must consider the visibility, palpation, path and mobility of the vein, in addition to the insertion site, device material and indication of access<sup>(4)</sup>.

The traditional and still routinely used approach for PIVC involves a visual inspection and palpation of the extremity to locate a vein, followed by puncture with the needle and insertion of the cannula, which requires knowledge of the vascular anatomy to estimate the location of the vessel, which is directly influenced by certain conditions, such as decreased peripheral perfusion, leading to scarcity or absence of apparent and palpable veins<sup>(5-6)</sup>.

Multiple attempts at PIVC can lead to a stressful experience for both the patient and the professional. Recognizing factors that involve difficulty in venipuncture, such as visibility and palpability, contributes to clinical decision-making and may guide the conduct of bedside nursing professionals before performing the procedure, thus ensuring a safer PIVC<sup>(7-8)</sup>.

New technologies such as the use of ultrasound aid in the execution of PIVC, reducing the number of unsuccessful puncture attempts and reducing complications associated with the procedure, contributing to the quality of

care provided safely and reducing damage to patients<sup>(7)</sup>.

Given the above, the following questions emerge: Is the difficulty in visualizing and/or palpating the vein frequent? And such difficulties impact the failure of the PIVC?. Therefore, the objective of the present study is to evaluate the failure of PIVC and the difficulty in the visibility and palpation of the peripheral venous system in adults and the older adults admitted to a hemodynamic intervention unit.

## METHOD

This is an observational and prospective study, with a quantitative approach, carried out in a general public and teaching hospital in Minas Gerais. Data collection was carried out by the researchers during the months of October to December 2022, during the service hours of the care unit.

The population consisted of 105 people, including adults and older adults, aged 18 years or older, admitted to a hemodynamic intervention unit and who required a PIVC for their treatment or diagnosis. According to the hospital flowchart, the patients admitted to the hemodynamics unit could come from the admission and discharge service of the urgency and emergency unit, or from other inpatient or diagnostic units, such as wards. Readmitted patients with PIVC previously observed in the study were excluded. Study participants were selected by convenience sampling, in the period established for data collection.

Patients were invited to participate in the research before the PIVC, proceeding with the reading of the informed consent form with information regarding the study. After acceptance, the signature of the term was requested, one copy for the research participant and the other for the researcher.

For data collection, a structured instrument was used containing demographic variables: sex (female and male); hospitalization specialty (hemodynamics, cardiology, vascular, pacemaker, others); self-declared skin color (white, brown,

yellow, black); age by age group in complete years ( $\leq 20$ , 21-30, 31-40, 41-50, 51-60 or  $\geq 61$ ); comorbidities (diabetes mellitus, neoplasia, thrombosis, coagulopathy, systemic arterial hypertension; history of difficult peripheral venipuncture) (yes or no); history of multiple venipunctures in the last 90 days (yes or no). The variables related to the observation of the procedure were topography (back of the hand, forearm, antecubital fossa, arm and jugular); presence of edema at the puncture site/limb (yes or no); PIVC model (retractable device or with needle protection device); catheter cannula material (polyurethane or polytetrafluorethylene); caliber (14G, 16G, 18G, 20G, 22G or 24G); PIVC time, date and number of attempts. We also recorded, through direct observation, the presence of difficulty in identifying the selected peripheral vein through palpation (yes or no) and difficulty in visualizing the selected vein (yes or no). The instrument used was previously validated for form and content in previous studies of the research group<sup>(9)</sup>.

Before the PIVP (peripheral intravenous puncture), the researcher filled out the instrument and observed the participant's venous system. Then he monitored the performance of the procedure by the professional in the sector (nurse or nursing technician), recording it in an instrument for observation. The filled instruments were stored in envelopes and sealed until the time of data analysis, and subsequently archived for five years.

The variables under study were coded and cataloged. The data were double typed and validated in a Microsoft Office® Excel® spreadsheet so that possible typos could be identified. Subsequently, the data were exported and analyzed in the IBM® Statistical Package for the Social Sciences® software, version 24. For all analyses, a significance of 0.05 was adopted. Analyses of categorical variables were performed using absolute and percentage frequency distributions.

This study was approved by the Research Ethics Committee, respecting resolution

466 of 2012 of the National Health Council, for Scientific Research in Human Beings in Brazil, including secrecy and anonymity (Opinion: 4,743,840 of 2021).

## RESULTS

The study sample consisted of 105 participants, most of whom were male (63.8%). As for the color self-declared by the participants, most were brown (49.5%). The predominant age group in the study was 61 years or older (58.1%). The comorbidities most reported by the participants were systemic arterial hypertension (79%) and diabetes mellitus (40%) (Table 1).

**Table 1** – Demographic profile of patients according to categories sex, self-declared color, age group and comorbidities. Uberaba, MG, Brazil, 2022 (n=105)

Variable	N	%
<b>Sex</b>		
Male	60	57.1
Female	45	42.9
<b>Self-declared color</b>		
White	40	38.1
Brown	52	49.5
Yellow	01	1.0
Black	12	11.4
<b>Age group</b>		
31-40	03	2.9
41-50	06	5.7
51-60	29	27.6
$\geq 61$	67	63.8
<b>Comorbidities</b>		
Diabetes	42	40.0
Neoplasias	04	3.8
Thrombosis	03	2.9
Coagulopathies	01	1.0
Systemic arterial hypertension	83	79.0
Renal failure	02	1.9

Source: Study data (2022)

As for the variable related to specialties, the most present in the study was cardiology (41.9%) and hemodynamics (41%). The most prevalent procedure/reason for hospitalization was cinecoronary angiography/coronary angiography (80%) (Table 2).

**Table 2** – Profile of patients according to specialty and reason for hospitalization. Uberaba, MG, Brazil, 2022 (n=105)

Variable	N	%
<b>Specialty</b>		
Hemodynamics	43	41.0
Cardiology	44	41.9
Blood vessel	14	13.3
Pacemaker	01	1.0
Others	03	2.9
<b>Reason for hospitalization</b>		
Cinecoronary/ Coronary angiography	84	80.0
Other	21	20.0

Source: Study data (2022)

Regarding the history of difficult peripheral venipuncture, 26 (24.8%) participants reported presenting it, and 19 (18.1%) reported having a history of multiple punctures. Regarding the site of choice of puncture, the most prevalent was the left forearm (52.4%). The presence of edema at the puncture site was identified in 2 patients (1.9%) (Table 3).

**Table 3** – Regarding peripheral venipuncture: history of difficult peripheral venipuncture, history of multiple punctures, topography, and edema, type of peripheral venous catheter, material and gauge. Uberaba, MG, Brazil, 2022 (n=105)

Variable	N	%
<b>History of difficult peripheral venipuncture</b>		
Yes	26	24.8
No	79	75.2
<b>History of multiple punctures</b>		
Yes	19	18.1
No	86	81.9

(Continua)

Variable	N	%
<b>Topography</b>		
Back of Right Hand	01	1.0
Back of Left hand	19	18.1
Left Upper Arm	55	52.4
Left Antecubital Trench	10	9.5
Right arm	03	2.9
Left Arm	17	16.2
<b>Presence of edema</b>		
Yes	02	1.9
No	100	95.2
Not Informed	03	2.9
<b>Peripheral venous catheter type</b>		
With needle protection device	105	100.0
<b>Material</b>		
Polyurethane	22	21.0
Polytetrafluorethylene	83	79.0
<b>Gauge</b>		
18 G	02	1.9
20 G	55	52.4
22 G	47	44.8
24 G	01	1.0

Source: Study data (2022).

As for the number of attempts, 17 (16.2%) failed the first puncture attempt. Difficulty during vein identification by palpation was found in 12 (11.4%) punctures, and difficulty in visualizing the vein was observed in 17 (16.2%).

**Table 4** – Regarding the number of attempts, difficulty in palpation and visualization of the vein. Uberaba, MG, Brazil, 2022 (n=105)

Variable	N	%
<b>Number of puncture attempts</b>		
01	88	83.8
02	10	9.5
03	04	3.8
04	03	2.9
<b>Difficulty in palpating the vein</b>		
Yes	12	11.4
No	93	88.6
<b>Difficulty in visualizing the vein</b>		
Yes	17	16.2
No	88	83.8

Source: Study data (2022).

The patients in whom it was possible to identify the difficulty in palpating the veins had 58.3% failure on the first attempt of PIVC, and those who had difficulty in visualizing the vein 53.3%, both with  $p \leq 0.001$ .

## DISCUSSION

As for the results, the male population is shown to be in greater quantity in the hemodynamic intervention unit, as well as the brown population and aged 61 years or older, which corroborates the literature when evaluating venous catheters<sup>(10-12)</sup>.

It is observed that culturally women attend the health system more frequently, both for consultation and hospitalization because they are more aware of signs and symptoms of chronic diseases. In addition, they seek the service to perform prenatal care, prevention and other diseases in their acute form<sup>(13)</sup>.

Regarding comorbidities, most interviewees had diabetes mellitus and/or systemic arterial hypertension, which represents a change in current disease patterns<sup>(13)</sup>.

Research shows that the rise of chronic diseases is happening due to the aging of the population, significantly increasing the demand for health services<sup>(14)</sup>. The presence of comorbidities and other clinical variables accelerate the need in the hospitalization process, which requires the preparation of health networks in view of the scenario of population aging.

The specialties responsible for hospitalization in the hemodynamic intervention unit were mainly cardiology and hemodynamics, in order to perform coronary angiography. It is understood that the hemodynamics service is recent and performs diagnostic and therapeutic tests, being necessary for the area of interventional medical cardiology, and, as shown in the results, the search for the test is a way to diagnose causing changes in treatment that can lead to better results<sup>(15-16)</sup>.

To carry out invasive procedures, prior intravenous access is essential and meets

the needs of established infusion therapy<sup>(17)</sup>. The visibility and palpability of the vein are considered crucial in the success of PIVC so that it does not compromise the vascular system and does not cause complications such as hematoma, extravasation, among others. The history of difficulty with venipuncture must be taken into consideration when the patients undergo a new procedure, guiding the decision-making process on how to perform the procedure assertively.

Another study points out that the success rate in single puncture was 73%, with 15% requiring a second attempt. The successful insertion on the first attempt was related to patient factors, such as age and palpation of the target vein, and to clinical factors, such as professionals with greater confidence and insertion experience<sup>(18)</sup>.

When analyzing the catheter caliber, it was observed that most used the 20G caliber (52.4%), which is associated with the literature, which states that 56.8% used this same caliber<sup>(19)</sup>. In another study, its percentage of use was significantly higher: 91.5% of the cases showed that the required cannula caliber was 20G, and in the remaining cases an 18G or 16G cannula was used on the right arm<sup>(20)</sup>.

A study indicates that females, history of difficult access, non-visible or palpable veins, use of chemotherapy and nursing staff with little professional experience are related to failure in the first puncture attempt<sup>(21)</sup>.

Most patients who had difficulty visualizing and palpating the venous system also had difficulty being punctured. In the absence of a visible and palpable vein, it is important to recognize these factors and establish management and support strategies as an institutional protocol, either with the use of technologies or with reference professionals/teams to perform the procedure. Turkish researchers allocated patients with difficult puncture, including those with non-palpable veins, comparing the use of technologies with the traditional technique and observed greater success with the aid of ultrasound<sup>(21)</sup>.

Thus, we highlight the need to proactively assess the difficulty of venous access, associated with physical examination and analysis of the patient's history in relation to vascular access, and consider a wide range of variables<sup>(22)</sup>.

The study presented a limitation regarding the specificity of the population, and it is necessary to understand the profile of patients in other contexts and care units.

## CONCLUSION

Based on the results obtained in this study, it can be concluded that the factors associated with PIVC failure in adult patients may be related to clinical variables, especially characteristics of the venous system. The puncture in veins that have visibility and palpation contributes to the assertiveness of the procedure.

Technologies associated with assistance such as the use of ultrasound, care protocols and professionals with expertise in the area can effectively contribute to the success of the first attempt at PIVC, avoiding multiple punctures, which can lead to irreversible damage.

As implications for nursing, the study of technologies and innovations in this field enables the sensitization of professionals and researchers to the critical look of the venous system and preservation of multiple puncture vessels. It also provides evidence, tools, guidelines and institutional protocols regarding PIVC and infusion therapy.

We identified few studies in the literature that addressed the evaluation of the venous system in adults. Thus, it is important to carry out research on this theme to identify more effective intervention and prevention strategies in the control and management of possible complications related to the venous system, seeking to improve the patient's quality of life and improve the care provided.

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