

## Impact of peripheral intravenous catheter status and monitoring on catheter removal outcome among patients at Viet Tiep General Hospital in 2025

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### ABSTRACT

Peripheral intravenous catheterization is a common and essential technique that plays a crucial role in internal medicine and emergency treatment. Many studies have shown that catheter removal is often due to causes such as thrombophlebitis, catheter slippage, embolism, and needle displacement from the vein. However, the studies on factors related to removing the peripheral intravenous needle are limited. Therefore, we conducted this study to examine the impact of peripheral intravenous catheter status and monitoring on catheter removal outcomes among patients at Viet Tiep General Hospital. A descriptive cross-sectional survey was conducted among 271 inpatients with intravenous catheters. The study results showed that the rate of unplanned needle removal was 33.9%. The status of unplanned peripheral intravenous needle removal was highest with the feeling of discomfort among patients (35.4%), followed by pain (32.8%), and needle slippage due to water into the tape (18.8%). Backward stepwise logistic regression analysis revealed two statistically significant factors influencing peripheral intravenous line removal: site swelling (OR = 0.485; 95% CI: 0.244–0.964;  $p = 0.039$ ) and nurse monitoring (OR = 2.352; 95% CI: 1.400–3.952;  $p = 0.001$ ). The study results further support the evidence that the nurse monitoring schedule may reduce the risk of unplanned peripheral intravenous line removal.

**Keywords:** Remove catheter, catheter, peripheral intravenous infusion

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### INTRODUCTION

In nursing practice, the use of peripheral intravenous lines is a common and important technique, playing an essential role in internal medicine as well as emergency treatment. Most hospitalized patients need to have an IV line established to inject drugs, infuse fluids, transfuse blood or maintain venous access to meet treatment needs. Even Alexandrou's research (2015) showed that more than one billion peripheral intravenous catheters are placed in hospitalized patients worldwide each year [1]. In hospitals, Evan

Alexandrou estimated that 59% of patients had received at least one peripheral intravenous line. However, one of the major challenges in intravenous line care is that unplanned removal of the IV needle, meaning the needle is removed earlier than expected, without medical orders. This is an essential issue because of its negative effects on the treatment process, patient satisfaction as well as hospital quality.

In the worldwide, some studies have recorded the rate of unplanned catheter removal ranging from 10% to more than 30%, depending on the country, type of

hospital and patient population. According to a study in China (2023), the rate of unplanned catheter removal was 10.04% [2]. In Japan, the rate of catheter removal due to catheter failure was 18.8% [3]. An observational study in Spain among 711 intravenous lines showed that the failure rate (leading to premature removal) was 41.8% [4]. These results have prompted many international medical institutions to develop improved guidelines and interventions to reduce this rate.

In Vietnam, there are some studies investigated the complications of thrombophlebitis during using intravenous needles. A cross-sectional study was conducted on 900 inpatients at Hanoi Medical University Hospital with 1,519 peripheral intravenous needles. The result showed that the rate of phlebitis was 30.4%, of which grade 1 accounted for 21.3%, grade 2 was 8.5%, and grade 3 was 0.6% [5]. However, research focusing on removing peripheral intravenous needles is limited. The lack of data showed this issue. Therefore, this is the urgency and practical significance for further studies and some factors related to removing peripheral intravenous needles in patients.

The Viet Tiep General Hospital is a large hospital. There are numerous patients with a variety of specialties. The intravenous infusion is widely used in care and treatment. However, there are currently no studies specifically assessing the impact of catheter removal status and monitoring on removing peripheral intravenous catheter outcomes among patients. The study question was whether factors regarding peripheral intravenous catheter status and monitoring influencing the removal of peripheral intravenous outcomes. Therefore, we conducted the topic "Impact of peripheral

intravenous catheter status and monitoring on catheter removal outcomes among patients at Viet Tiep General Hospital in 2025" to examine the impact of peripheral intravenous catheter status and monitoring on catheter removal outcomes among patients at Viet Tiep General Hospital.

## METHODS

### Subjects

*Inclusion criteria:* Inpatients with an intravenous infusion catheter, agreeing to participate in the study, and having the ability to answer the interview questions

*Exclusion criteria:* Patients who had cognitive problems

### Location and time

- This study was conducted at Viet Tiep General Hospital

- The time of study was from February 2025 to May 2025

**Research design:** Cross-sectional descriptive  
**Sample size and variables**

The sample size for cross-sectional descriptive research is calculated according to the following formula:

$$N = \frac{Z_{1-\frac{\alpha}{2}}^2 p(1-p)}{d^2}$$

- N is the sample size

-  $\alpha = 0.05$ , the value of  $Z_{1-\frac{\alpha}{2}}$  is 1.96

- p: estimated rate of unplanned needle removal  $p=0.16$  according to previous research results [3]

- d: allowable error = 0.05

Therefore, the sample size for this study is at least 246 patients who meet the selection criteria.

In fact, we conducted the study on 271 patients who met the selection criteria

*Sampling method:* convenience sampling

*Research variables*

- General information about the research subjects: Age, gender, education level, comorbidities, family economy, marital status
- Information on planned and unplanned removal of the peripheral intravenous catheter
- Information related to catheter removal status: Swelling at the infusion site, itching, pain, discomfort, ineffective adhesive tape due to water, removing the catheter due to daily activities, needle blockage, blown vein.
- Information on nursing care monitoring: yes/no

**Collection of data**

The data collection tool is a designed questionnaire including questions about demographics, medical information, and patient line information. The patients were chosen from the medical and surgical departments. Patients will be interviewed directly and answer according to the appropriate answers. The researchers, who selected the data, were trained before collecting data.

**Analysis**

Data was analyzed using SPSS 22.0 software. Descriptive statistics were used to describe demographic statistics, information on the status of removing intravenous catheter, information on catheter removal status, and information on nurses monitoring the infusion line. Logistic regression analysis with the backward stepwise method was used to find factors related to the status of removing the peripheral intravenous catheter, OR (CI 95%) were used to measure the associations with statistical significance  $p < 0.05$ .

**Research ethics**

The study was approved IRB (Institutional Review Board) at Hai Phong University of Medicine and Pharmacy and approved by the leadership of Viet Tiep Hospital. Before collecting data, patients were clearly informed about the purpose and content of the questionnaire, and voluntarily agreed to participate in the study. Patients could stop participating in the study at any time when they want.

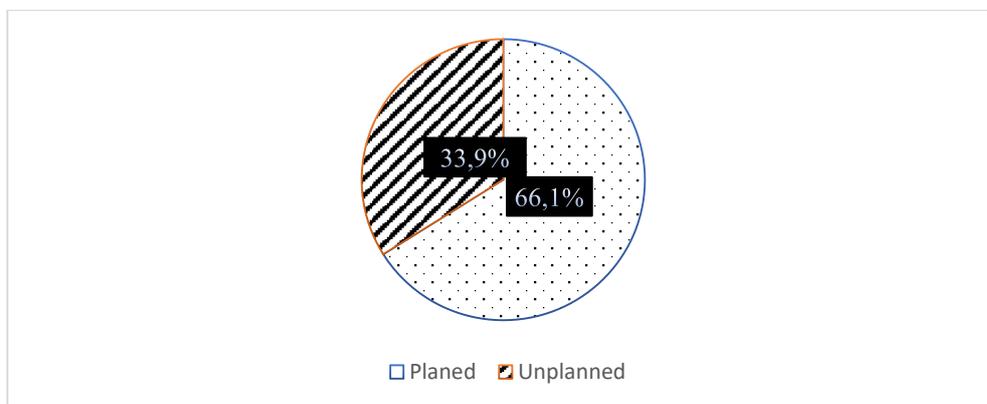
**RESULTS**

*Table 1. Characteristics of subjects (n=271)*

Variable	N	%	
<b>Age</b>	< 60	106	39.1
	≥ 60	165	60.9
<b>Gender</b>	Male	148	54.6
	Female	123	45.4
<b>Education</b>	No education	3	1.1
	Primary	91	33.6
	Secondary school	92	33.9
	High school	56	20.7
	University	28	10.3
	Glad -Undergraduate	1	0.4
<b>Married status</b>	Single	18	6.6
	Maried	207	76.4
	Widow/divorce	46	17.0

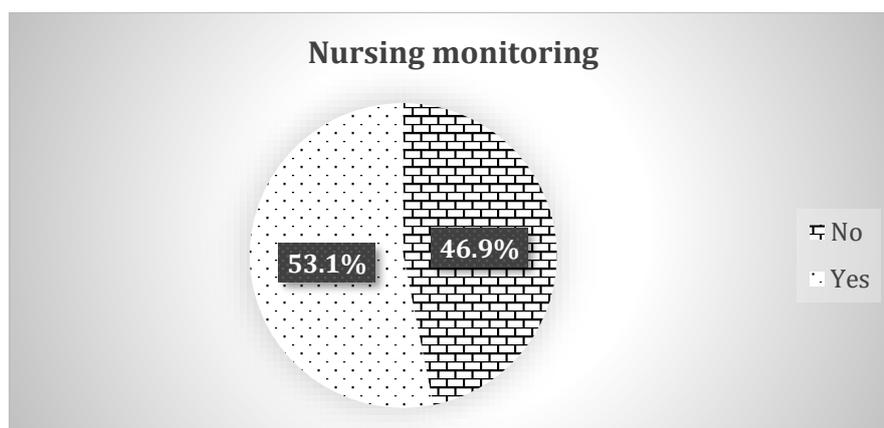
<b>Economic</b>	More than enough	35	12.9
	Enough	190	70.1
	Not enough	46	17.0
<b>Other diseases</b>	Yes	138	50.9
	No	133	49.1

The proportion of patients under 60 years old accounted for 39.1%, and from 60 years old and older accounted for 60.9%. Male patients accounted for 54.6%, female patients accounted for 45.4%, mainly primary and secondary school, accounting for 33.6% and 33.9% respectively, and the people with postgraduate degrees accounted for 0.4%. Most of the patients are married, accounting for 76.4%, divorced or widowed, accounting for 17%, and the proportion of single status accounting for 6.6%. Most of the patients have enough economic conditions with 70.1%, 12.9% patients with more than enough status, and 17% belong to the group facing not enough. The proportion of patients with other diseases was 50.9%, and those without other diseases was 49.1%.



**Figure 1.** Rate of removal of the Intravenous catheter

Among the 271 patients in the study, there were 92 cases of unplanned removal of an intravenous catheter (33.9%) and 179 cases of planned removal of an intravenous catheter (66.1%).



**Figure 2.** The rate of nursing monitoring of the intravenous infusion

A total of 271 patients, 144 (53.1%) cases reported being monitored by nurses during the infusion process, while 127 (46.9%) cases reported not having nurses monitoring during the infusion process.

**Table 2.** Characteristics of the peripheral intravenous catheter status (n=271)

Variable		n	%
Swelling at the infusion site	No	230	84.9
	Yes	41	15.1
Itching	No	245	90.4
	Yes	26	9.6
Pain	No	182	67.2
	Yes	89	32.8
Discomfort	No	175	64.6
	Yes	96	35.4
Ineffective adhesive tape due to water	No	220	81.2
	Yes	51	18.8
Removing the catheter due to daily activities	No	238	87.8
	Yes	33	12.2
Needle blockage	No	233	86.0
	Yes	38	14.0
Blown vein	No	244	90.0
	Yes	27	10.0

The study results showed that the highest rate of unplanned removal of peripheral intravenous catheter was with patient discomfort (35.4%), followed by pain (32.8%), ineffective tape due to water (18.8%), and the smallest percentage was itching status (9.6%).

**Table 3.** Analysis of factors affecting the removal of intravenous infusion catheter (n=271)

Variables	B	OR =Exp(B)	95% C.I.for EXP(B)		p
Step 1 Swelling at the infusion site	-0.643	0.525	0.245	1.127	0.098
Itching	-0.367	0.693	0.281	1.710	0.426
Pain	-0.250	0.779	0.418	1.450	0.430
Discomfort	0.116	1.123	0.614	2.056	0.706
Ineffective tape due to water	-0.001	0.999	0.469	2.129	0.999
Removing the catheter due to daily activities	-0.787	0.455	0.195	1.066	0.070
Blown vein	-0.253	0.777	0.303	1.992	0.599
Needle blockage	0.589	1.801	0.715	4.538	0.212
Nursing monitoring	0.851	2.341	1.349	4.063	0.003
Step 2 Swelling at the infusion site	-0.643	0.526	0.248	1.112	0.093
Itching	-0.367	0.692	0.281	1.705	0.424
Pain	-0.250	0.779	0.419	1.448	0.429
Discomfort	0.116	1.123	0.616	2.047	0.704

	<b>Variables</b>	<b>B</b>	<b>OR =Exp(B)</b>	<b>95% C.I.for EXP(B)</b>		<b>P</b>
	Removing the catheter due to daily activities	-0.787	0.455	0.199	1.044	0.063
	Blown vein	-0.253	0.777	0.303	1.988	0.598
	Needle blockage	0.589	1.801	0.723	4.489	0.206
	Nursing monitoring	0.850	2.341	1.354	4.045	0.002
Step 3	Swelling at the infusion site	-0.680	0.507	0.245	1.046	0.066
	Itching	-0.374	0.688	0.280	1.693	0.416
	Pain	-0.215	0.807	0.446	1.459	0.478
	Removing the catheter due to daily activities	-0.786	0.456	0.199	1.043	0.063
	Blown vein	-0.232	0.793	0.312	2.016	0.626
	Needle blockage	0.599	1.820	0.731	4.531	0.198
	Nursing monitoring	0.837	2.310	1.343	3.972	0.002
Step 4	Swelling at the infusion site	-0.704	0.495	0.241	1.015	0.055
	Itching	-0.361	0.697	0.284	1.713	0.432
	Pain	-0.223	0.801	0.443	1.447	0.461
	Removing the catheter due to daily activities	-0.784	0.457	0.199	1.046	0.064
	Needle blockage	0.519	1.681	0.718	3.936	0.231
	Nursing monitoring	0.837	2.308	1.342	3.970	0.002
Step 5	Swelling at the infusion site	-0.699	0.497	0.243	1.019	0.056
	Itching	-0.440	0.644	0.268	1.544	0.324
	Removing the catheter due to daily activities	-0.774	0.461	0.201	1.056	0.067
	Needle blockage	0.451	1.570	0.686	3.595	0.286
	Nursing monitoring	0.794	2.211	1.304	3.750	0.003
Step 6	Swelling at the infusion site	-0.775	0.461	0.229	0.927	0.030
	Removing the catheter due to daily activities	-0.740	0.477	0.208	1.094	0.081
	Needle blockage	0.495	1.641	0.720	3.741	0.239
	Nursing monitoring	0.829	2.290	1.358	3.864	0.002
Step 7	Swelling at the infusion site	-0.748	0.473	0.236	0.948	0.035
	Removing the catheter due to daily activities	-0.570	0.566	0.263	1.216	0.145
	Nursing monitoring	0.847	2.333	1.386	3.928	0.001
Step 8	Swelling at the infusion site	-0.724	0.485	0.244	0.964	0.039
	Nursing monitoring	0.855	2.352	1.400	3.952	0.001

The results of logistic regression analysis with the backward stepwise method after entering the independent variables into the model. Most of the variables were not statistically significant and were gradually eliminated from the model. In the final model (Step 8), 2 factors remained

statistically significant, including the nurse monitoring the infusion (OR = 2.352; CI 95%: 1.400–3.952;  $p = 0.001$ ) and swelling at the intravenous infusion site (OR = 0.485; CI 95% (0.244–0.964);  $p = 0.039$ ). Other factors, such as pain, itching, and removal of the catheter due to daily activities, needle blockage, and blown vein, were not recorded as statistically significant in the final model.

## DISCUSSION

According to the research results, the proportion of male patients was 54.6% and female patients was 45.4%. In terms of education level, the majority of patients have an education level from primary to secondary school, accounting for more than 67%. The proportion of patients with university, college, and postgraduate degrees was only 10.7%. The marital status of the patients showed 76.4% married and 17% widowed or divorced. According to Le Thanh Toan's study (2024), most patients were at primary and secondary education levels were 47.4%, 37.1% respectively; the high school level accounted for 9.3%, and college, university degrees accounted for 6.2%. The marital status indicated 78.4% married, 14.4% widowed, and 7.2% divorced [6]. In terms of economic status, most patients reported they had an "enough" standard of living (70.1%), while up to 17% belonged to the "not enough" status. Finally, the proportion of patients with other diseases accounted for 50.9% and 48.1% of patients without other diseases.

Our study results showed that there were 92 (33.9%) patients with unplanned catheter removal, and 179 (66.1%) patients with planned catheter removal. The rate of unplanned peripheral intravenous catheter removal was highest with the patient feeling discomfort 35.4%, followed by pain (32.8%), ineffective tape due to water (18.8%), and itching (3%). In addition, the study showed that 144 (53.1%) patients were monitored by nurses during the infusion process, while 127

(46.9%) cases did not have nurses monitoring during the process. The rate of unplanned catheter removal was higher than in several previous studies, and the catheter removal status showed a similar. Chen et al. (2021) in China reported that the rate of intravenous line failure ranged from 28–35%, mainly due to phlebitis and local pain [1]. A study in Spain (Jiménez-Martínez, 2024) showed that the rate of intravenous line failure was 31% with pain, needle dislodgement, and patient discomfort being the most common cause [4]. In Vietnam, there has been a limited study focusing on this issue. A survey at provincial hospitals recorded that the rate of intravenous line complications ranged from 25–40% with pain and discomfort being the leading causes of intravenous catheter removal [2].

The Logistic regression analysis using the backward stepwise method identified two statistically significant factors associated with unplanned removal of peripheral intravenous catheters. Swelling at the infusion site status was found to be a risk factor, increasing the likelihood of unplanned catheter removal (OR = 0.485; 95% CI: 0.244–0.964;  $p = 0.039$ ). The study results can be interpreted by the previous findings. The findings are consistent with recent evidence that showed local complications such as phlebitis and infiltration/extravasation (manifested by swelling, pain, and erythema) are the primary mechanisms leading to intravenous catheter failure and premature, unplanned intravenous catheter removal. A systematic review published between 2019 and 2024 has reported high failure rates of peripheral

intravenous catheters and highlighted infiltration/extravasation as a key driver of early catheter removal. Moreover, numerous observational studies have identified local clinical characteristics as critical predictors of catheter failure [7]. This provides a rationale for the clinical decision to remove catheters when swelling occurs to prevent complications. In contrast, active monitoring of the intravenous line by nurses emerged as a protective factor, reducing the risk of unplanned catheter removal (OR = 2.352; 95% CI: 1.400–3.952;  $p = 0.001$ ). Previous reports have shown that systematic nursing monitoring, including assessment of the insertion site and recording the complications, appropriate dressing and securement, and catheter daily evaluation that represents a fundamental strategy for early detection of abnormalities. Interventions such as controlling infusion rates, replacing catheters, or improving securement can effectively reduce the likelihood of unplanned intravenous catheter complications. Best practices recommend establishing routine surveillance and standardized control procedures for intravenous catheter care. Recent research has also indicated an association between nursing resources and failure rates of intravenous therapy, suggesting that enhanced nurse presence and monitoring may positively influence patient outcomes [8]. Our findings provide additional support for implementing vascular access care bundles to reduce unplanned catheter removal. The nursing care bundles should incorporate regular assessment of the infusion site (including pain, swelling, and erythema) during each nursing shift, adherence to recommended protocols for securement and dressing, and careful consideration of catheter removal or replacement based on

dwelling time and clinical necessity guided by standardized vascular access care documentation.

### CONCLUSION

The study conducted at Viet Tiep General Hospital in 2025 showed that the rate of unplanned removal of the peripheral intravenous catheter was 33.9%. The results showed that the highest rate of unplanned removal of peripheral intravenous needles was with the patient feeling uncomfortable (35.4%), followed by pain (32.8%), ineffective tape due to water (18.8%), and itching (3%). In addition, the study showed that 144 (53.1%) patients reported being monitored by nurses, and 127 (46.9%) patients did not receive nursing monitoring during the infusion process. Logistic regression analysis with the backward stepwise method showed two statistically significant factors influencing the removal of the peripheral intravenous catheter, including swelling at the site (OR = 0.485; 95% CI: 0.244–0.964;  $p = 0.039$ ) and nurse monitoring the line (OR = 2.352; 95% CI: 1.400–3.952;  $p = 0.001$ ).

### IMPLICATION FOR NURSING PRACTICE

This study result provides evidence that nurse monitoring during intravenous infusion therapy is essential to reduce the risk of unplanned removal of the peripheral intravenous. The nursing care bundles should consider the elements, including assessment of the infusion site (pain–swelling, erythema) on a shift, and appropriate catheter fixation, recommended dressing care, and consideration of needle removal/replacement if needed based on evidence-based practice and guidelines.

### LIMITATION

This study conducted the convenience sampling might reduce representativeness.

review and expert consensus. *Infect Prev Pract.* 5(2):100271.

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