



# Incidence of Peripheral Phlebitis and its Predictive Characteristics in Female Inpatients Hospitalized at a Public Hospital in Thailand: A Prospective Cohort Study

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## Abstract :

**Objective:** To determine incidence of peripheral phlebitis and its predictive characteristics in female inpatients hospitalized at a public hospital in Thailand.

**Methods:** A prospective cohort study analyzed data of 373 female inpatients at medical, surgical and orthopedic departments in Ratchaphiphat hospital, Bangkok, Thailand during November 1, 2016 to February 28, 2017. All patients were admitted and received intravenous fluids therapy, clinical outcomes were monitored by floor nurse, using standard protocol for intravenous therapy (The Visual Infusion Phlebitis scale).

**Results:** The incidence of peripheral phlebitis was 13.94%, and predictive factors of peripheral phlebitis were Cancer (RR=6.94, 95% CI=3.66-13.16, p<0.001), Smoking status (RR=3.06; 95% CI=1.14-8.17, p=0.026), Nicardipine (RR=3.82; 95% CI=1.06-13.74, p=0.040), 50% glucose (RR=6.11; 95% CI= 2.85-13.12, p<0.001), Amikacin (RR=5.56; 95% CI=2.26-13.67, p<0.001), Vancomycin (RR=6.11; 95% CI=2.53-14.74, p<0.001) and Clindamycin (RR=5.09; 95% CI= 2.04-12.73, p<0.001).

**Conclusions:** Incidence of phlebitis in this study was comparative to those of other studies. Its predictive characteristics included having cancer, smoking status, glucose use, and medications—including Nicardipine, Amikacin, Vancomycin, and Clindamycin.

**Key words:** phlebitis, risk factor, nursing, cohort study, epidemiology

## I. INTRODUCTION

Intravenous therapy is a common procedure performed on hospitalized patients in clinical practice [1-3]. Although intravenous therapy—including intravenous infusion and medications—are importantly required procedure for replacement of fluids loss, maintain electrolyte and administration of medications, its

complications; such as infiltration, leaking, occlusion, phlebitis, extravasations, and others; are still of great concern [4,5].

Peripheral phlebitis is the most common complication and its consequences are significant. The consequences of phlebitis include discomfort [2], suffering from pain, early removal and replacement of intravenous catheter [1,6], increased risk of infection [5,7], septicemia [5], longer admission [3], additional healthcare expenditure [3], morbidity [3] and mortality [7]. Prevalence of phlebitis in Thailand was estimated to be around 20%. In Ratchaphiphat hospital, Bangkok, Thailand; mortality rate from phlebitis was previously estimated as 20 per 1000 person-day.

From previous literature, factors associated with phlebitis were female [2,5,7,8], children and elders [5,9], obesity [10,11], chronic diseases—such as diabetes mellitus, hypertension, cancer, blood disease, being immunocompromised, and others [5,8]; smoking status (current and former smoker) [12], infectious diseases [3,8], department or ward (e.g., medical department) [7], catheter with large diameter [5,13-18], anatomical regions (e.g., dorsum of hand, cubital fossa) [6,7,8,17,19-22], using tape and gauze for cannula dressing [7,13], catheterized times more than 72 hours [5,6,7,21,23], type of infusate—especially the hypertonic [6,7,24], some antibiotics [5,7,18,25], frequency of drug administration (>3 times/day) [6] and drug administration by intravenous pushing [6], etc. However, information about this issue in Thailand is still lacking. This study was thus conducted to determine the incidence of phlebitis and its predictive characteristics among female inpatients at Ratchaphiphat hospital, Bangkok Thailand.

## Methods

This study was a prospective cohort study analyzing data of 373 female patients admitted to medical, surgical and orthopedic departments at Ratchaphiphat hospital,

Bangkok, Thailand; during November 1, 2016 and February 28, 2017. Patients requiring peripheral intravenous catheterization for at least 72 hours were eligible. They received peripheral intravenous fluids and/or medications by doctor's orders. Patients receiving blood transfusion or total parenteral nutrition (TPN) with high osmolality were excluded. This study followed up signs of peripheral phlebitis since insertion of intravenous catheter and every 8 hours thereafter until catheter was removed by nurse using standard protocol for intravenous therapy.

Following variables were collected and analyzed in this study:

A. Patient related to characteristics: age, body mass index, underlying diseases (e.g., diabetes mellitus, dyslipidemia), smoking, admission diagnosis, admission site or department in hospital (medical, surgical and orthopedic)

B. Peripheral intravenous catheterization characteristics: medication (e.g., antibiotics), frequency of drug administration (1-3 times/day, >3 times/day), method of drug administration (infusion, push and infusion, push), anatomical region (forearm, antecubital fossa, dorsum of the hand), type of cannula dressing (transparent polyurethane patch, gauze and tape), type of fluids (isotonic, hypotonic, hypertonic)

C. Outcome: phlebitis assessed by visual inspection and scaled using standard protocol for

intravenous therapy with follow-up by floor nurse. Peripheral phlebitis was recorded as either yes (phlebitis occurred) or no. Outcome occurrence was observed from first catheterization until removal or replacement. Reasons for catheter removal or replacement were also recorded for analysis.

### Statistical analysis

Descriptive statistics were applied to describe patients' characteristics. Predictive characteristics of phlebitis were determined using generalized linear model for risk ratio regression with stepwise method to obtain parsimonious model.

### Ethical consideration

This study protocol was reviewed and approved by Ethical Review Committee for Human Research, Faculty of Public Health, Mahidol University and the IRB committee of Bangkok Metropolitan Administration, Bangkok, Thailand.

### Results

Cumulative incidence of phlebitis was 13.94% among all patients. Clinical characteristics which were significantly different between those with and without phlebitis were underlying diseases, medication administration, type of infusate, type of medication, and type of cannula dressing (Table 1).

**Table 1. Clinical characteristics of 373 female inpatients at Ratchaphiphat hospital, Bangkok, Thailand**

Characteristics	Phlebitis n (%)	No phlebitis n (%)	p-value
<b>Patient (Total: 373)</b>	52 (13.94)	321 (86.06)	
<b>Age</b> (n = 373 patients), Overall Mean $\pm$ SD = 64.39( $\pm$ 17.09)			
Mean $\pm$ SD	68.96 ( $\pm$ 13.17)	63.66( $\pm$ 17.55)	0.257 <sup>‡</sup>
Min. – Max.	18-85	18-96	
$\leq$ 59 years	12(10.43)	103(89.57)	
$\geq$ 60 years	40(15.50)	218(84.50)	
<b>Body mass index (BMI)</b> (n = 373 patients), Overall Mean $\pm$ SD =23.24 ( $\pm$ 5.63)			
Mean $\pm$ SD	(22.12 $\pm$ 4.82)	(23.43 $\pm$ 5.74)	0.1594 <sup>‡</sup>
Min. – Max.	12.90- 37.47	13.5-54.9	
Normal (20 – 24.99 kg/m <sup>2</sup> )	24(12.70)	165(87.30)	
Overweight (25 – 29.99 kg/m <sup>2</sup> )	5(11.90)	37(88.10)	
Obesity ( $\geq$ 30 kg/m <sup>2</sup> )	3(13.98)	40(93.02)	
Underweight (<20 kg/m <sup>2</sup> )	20(20.42)	78(79.59)	
<b>Underlying diseases</b>			
No	0	28(100)	0.021*
Yes	52(15.07)	23(84.93)	
<b>Diabetes</b>			
No	25(11.90)	185(88.10)	0.229*
Yes	27(16.56)	136(83.44)	
<b>Hypertension</b>			
No	15(10.42)	129(89.58)	0.127*

Yes	37(16.16)	192(83.84)	
<b>Dyslipidemia</b>			
No	45(16.13)	234(83.87)	0.039*
Yes	7(7.45)	87(92.55)	
<b>Heart disease</b>			
No	42(13.64)	266(86.36)	0.696*
Yes	10(15.38)	55(84.62)	
<b>Chronic kidney disease</b>			
No	43(12.99)	21.43(87.01)	0.155*
Yes	9(21.43)	33(78.57)	
<b>Cancer</b>			
No	42(11.97)	309(88.03)	< 0.001*
Yes	10(45.45)	12(54.55)	
<b>Blood disease</b>			
No	50(13.76)	314(86.26)	0.364*
Yes	2(22.22)	7(77.78)	
<b>HIV</b>			
No	52(14.40)	309(85.60)	0.386*
Yes	0	12(100.00)	
<b>Cerebrovascular disease</b>			
No	50(14.88)	286(85.12)	0.137*
Yes	2(5.41)	35(94.59)	
<b>Smoking status</b>			
Non-smoker	48(13.60)	305(86.40)	0.501*
Smoker	4(20.00)	16(80.00)	
<b>Admission diagnosis</b>			
Non-infectious	15(13.51)	96(86.49)	1.000*
Infectious	37(14.12)	225(85.88)	
<b>Ward in hospital</b>			
Surgical and orthopedic wards	3(6.12)	46(93.88)	0.120*
Medical wards	49(15.12)	275(84.88)	
<b>Type of fluids</b>			
No	18(11.04)	145(88.96)	0.014*
Isotonic and hypotonic fluids	22(12.94)	148(87.06)	
Hypertonic fluids	(30.00)	28(70.00)	
<b>Medication administration</b>			
No drug administration	0	36(100.00)	0.005*
Drug administration	52(15.43)	285(84.57)	
<b>Type of Medication</b>			
No drug administration	0	40(100.00)	0.003*
Other drug	14(18.18)	63(81.82)	
Antibiotics	31(17.71)	144(82.29)	
Antibiotics and other drugs	7(8.64)	74(91.36)	
<b>Medication administration:</b>			
<b>Amiodarone</b>			
No	47(12.95)	316(87.05)	0.006*
Yes	5 (50.00)	5(50.00)	
<b>Norepinephrine</b>			
<b>No</b>	48(13.19)	316(86.81)	0.025*
<b>Yes</b>	4(44.44)	5(55.56)	
<b>Dobutamine</b>			
No	52(14.02)	0	1.000*
Yes	0	319(85.98)	
<b>Ceftriaxone</b>			
No	31(13.30)	202(86.70)	0.646*
Yes	21(15.00)	119(85.00)	
<b>Amphotericin B</b>			
No	52(14.05)	318(85.95)	1.000*
Yes	0	3(100.00)	
<b>Ceftazidime</b>			

No	42(12.46)	295(87.54)	0.020*
Yes	10(27.78)	26(72.22)	
<b>Tazocin</b>			
No	48(13.91)	297(86.09)	1.000*
Yes	4(14.29)	24(85.71)	
<b>Clindamycin</b>			
No	48(13.30)	313(86.70)	0.071*
Yes	4(33.33)	8(66.67)	
<b>Augmentin</b>			
No	52(14.25)	319(85.98)	1.000*
Yes	0	6(100.00)	
<b>Cefazolin</b>			
No	52(14.25)	313(85.75)	0.606*
Yes	0	8(100.00)	
<b>Meropenam</b>			
No	50(14.53)	294(85.47)	0.401*
Yes	2(6.90)	27(93.10)	
<b>Vancomycin</b>			
No	48(13.22)	315(86.78)	0.037*
Yes	4(40.00)	6(60.00)	
<b>Amikacin</b>			
No	48(13.26)	314(86.74)	0.053*
Yes	4(36.36)	7(63.64)	
<b>Fosfomycin</b>			
No	50(13.66)	316(86.34)	0.253*
Yes	2(28.57)	5(71.43)	
<b>Cloxacillin</b>			
No	44(12.26)	315(87.74)	< 0.001*
Yes	8(57.14)	6(42.86)	
<b>Sulperazone</b>			
No	52(14.21)	314(85.79)	0.600*
Yes	0	7(100.00)	
<b>Levofloxacin</b>			
No	52(14.09)	317(85.91)	1.000*
Yes	0	4(100.00)	
<b>Metronidazole</b>			
No	50(13.55)	319(86.45)	0.095*
Yes	2(50.00)	2(50.00)	
<b>Dilantin</b>			
No	52(14.29)	312(85.71)	0.619*
Yes	0	9(100.00)	
<b>Nicardipine</b>			
No	50(13.70)	315(86.30)	0.309*
Yes	2(25.00)	6(75.00)	
<b>Hydrocortisone</b>			
No	50(13.55)	319(86.45)	0.095*
Yes	2(50.00)	2(50.00)	
<b>50%Glucose</b>			
No	46(12.85)	312(87.15)	0.010*
Yes	6(40.00)	9(60.00)	
<b>Omeprazole</b>			
No	48(14.63)	280(85.37)	0.365*
Yes	4(8.89)	41(91.11)	
<b>Metoclopramide</b>			
No	50(13.93)	309(86.07)	1.000 <sup>α</sup>
Yes	2(14.29)	12(85.71)	
<b>Dexamethasone</b>			
No	52(14.77)	300(85.23)	0.056 <sup>α</sup>
Yes	0	21(100.00)	
<b>Flurosemide</b>			

No	47(13.54)	300(86.46)	0.385*
Yes	5(19.23)	21(80.77)	
<b>Other non-antibiotics</b>			
No	50(14.53)	294(85.47)	0.401 <sup>‡</sup>
Yes	2(6.90)	27(93.10)	
<b>Frequency of drug administration</b>			
1-3 times/day	29(12.78)	198(87.22)	0.077*
>3 times/day	23(20.54)	89(79.46)	
<b>Method of drug administration</b>			
Infusion	39(19.02)	166(80.98)	0.083*
Pushed and infusion	7(9.72)	65(90.28)	
Pushed	6(10.00)	54(90.00)	
<b>Catheter size</b>			
Small size (G22-24)	50(14.16)	303(85.84)	1.000*
Large size (G16-20)	2(10.00)	18(90.00)	
<b>Anatomical region</b>			
Forearm	16(13.68)	101(86.32)	0.060*
Antecubital fossa	0	27(100.00)	
Dorsum of the hand	36(15.72)	193(84.28)	
<b>Type of cannula dressing</b>			
Transparent polyurethane patch	5(6.41)	73(93.59)	0.028*
Gauze and tape	47(15.93)	248(84.07)	

<sup>‡</sup>Independent sample t-test, \*Exact probability test

Predictive characteristics of phlebitis among female patients included cancer, smoking status, nicardipine, 50% glucose, amikacin, vancomycin and clindamycin (Table 2).

**Table 2. Predictive characteristics of phlebitis among female patients**

Factors	Risk ratio*	95%CI	p-value
Cancer			< 0.001
No	1	Reference	
Yes	6.94	3.66, 13.16	
Nicardipine			0.040
No	1	Reference	
Yes	3.82	1.06, 13.74	
Smoking status			0.026
Non-smoker	1	Reference	
Smoker	3.06	1.14, 8.17	
50% glucose			< 0.001
No	1	Reference	
Yes	6.11	2.85, 13.12	
Amikacin			< 0.001
No	1	Reference	
Yes	5.56	2.26, 13.67	
Vancomycin			< 0.001
No	1	Reference	
Yes	6.11	2.53, 14.74	
Clindamycin			< 0.001
No	1	Reference	
Yes	5.09	2.037, 12.73	

\* Estimated by generalized linear model for risk ratio regression with forward stepwise method

## II. DISCUSSION

Cumulative incidence of phlebitis among 373 female inpatients in this study was 13.94% which suggested that phlebitis was relatively common in this clinical setting.

This finding was consistent with the cumulative incidence determined in several studies. [2,6]

This study also showed significant predictors of phlebitis which were consistent with previous studies. These predictors included underlying disease (cancer), smoking status [25], and medications (nicardipine,

50% glucose, amikacin, vancomycin, and clindamycin). Antibiotics showed strong predictive effect on phlebitis outcome because antibiotics was theoretically high in osmolarity[5,7,18,25].

### III. CONCLUSIONS

Incidence of phlebitis in this study was comparative to those of other studies. Its predictive characteristics included having cancer, smoking status, glucose use, and medications—including Nicardipine, Amikacin, Vancomycin, and Clindamycin.

#### Conflict of interest

Nil

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