Phlebitis Uncovered: An Integrative Review of Contributing Factors

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Received:2025-09-08, Revised:2025-09-21, Accepted:2025-09-27, Published:2025-09-30

Abstract

Background: Phlebitis is a common complication of intravenous therapy, marked by inflammation of the vessel wall and surrounding tissues. Its incidence varies widely, from 6.2% to over 70%, and is influenced by multiple factors. This review aimed to identify factors contributing to phlebitis to improve prevention strategies and patient care in clinical settings.

Methods: We conducted an integrative review of relevant articles, including clinical studies, meta-analyses, and case reports published up to October 2024. A comprehensive search was performed across PubMed, Google Scholar, Embase, and Scopus. Twenty-one studies were selected for analysis and summary.

Results: Based on the reviewed studies, several factors influence phlebitis incidence: patient-related factors, including age (older adults over 40 are generally at increased risk), gender, with inconsistent impact, and comorbidities such as diabetes, hypertension, and obesity; medication-related factors (drug irritancy, pH, osmolality, and particulate matter); and procedure-related factors (catheter placement and clinical practices).

Conclusion: Phlebitis risk is shaped by patient-, product-, and process-related factors. Understanding how these elements interact is essential for effective prevention and management. Further research will help clinicians develop strategies to reduce complications and improve outcomes.

J Pharm Care 2025; 13(3): 197-216.

Keywords: Phlebitis; Intravenous Infusion; Thrombophlebitis; Intravenous Therapy; Peripheral Catheter

Introduction

Phlebitis is an inflammatory reaction affecting the vessel wall—particularly the intimal layer of the vein—and the surrounding tissues at the catheter insertion site. It is a common complication of intravenous (IV) drug administration (1). Reported incidence rates vary widely, ranging from 6.2% to over 70% (2, 3). In a prospective study by Göransson and Johansson, thrombophlebitis was observed in up to 54% of patients after peripheral venous catheter insertion (1). This high rate is concerning because phlebitis can cause patient discomfort, interrupt therapy, increase healthcare costs, prolong hospitalization, and complicate nursing care (4, 5). More than 80% of hospitalized patients requiring IV therapy receive it through peripheral IV catheters, the most common nursing intervention (6). Given these challenges, early diagnosis and appropriate management of phlebitis are essential to improve patient outcomes and overall quality of care (7).

Diagnosis is based on four main signs: redness at the IV infusion site; palpable swelling or a venous cord extending from the insertion site; pain at or near the site (with or without palpation); and increased skin temperature at the injection site (8–12). Phlebitis can manifest as pain, swelling, thrombosis, erythema, hyperemia, edema, localized warmth, tenderness, palpable venous cords, and an elevated risk of bloodstream infection. Signs may be localized to the injection site or spread along the vein, and can appear either at insertion or within 48 hours after removal of a peripheral IV catheter, complicating diagnosis and management (7, 13).

The exact mechanism of phlebitis remains incompletely understood. Proposed processes include local damage to the endothelial lining and surrounding tissues, histamine release, activation of C-nociceptors, and stimulation of the kallikrein–kinin system following bradykinin release (14, 15). Several contributing factors have been highlighted, including insertion site, frequency of catheter use, vessel trauma, and chemical properties of administered drugs—such as formulation, pH, osmolality, and inherent irritant characteristics (5, 16, 17). The interaction of these factors often obscures a single causative mechanism. A clear understanding of these influences is

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crucial for prevention and improved patient outcomes.

Although previous studies have explored various contributors to phlebitis, much of the data is poorly organized and lacks sufficient detail to provide clear guidance, producing inconsistent and incomplete recommendations. Earlier reviews have often overlooked the full range of contributing factors and rarely present them within a single, organized framework.

This integrative review addresses this gap by gathering and organizing contributing factors to highlight the multifaceted nature of phlebitis and the risk factors commonly overlooked in individual studies. The goal is to clarify prevention and clinical management strategies and thereby support improved patient care.

Method

This study was conducted as an integrative review. Relevant articles (including clinical studies, meta-analyses, systematic reviews, literature reviews, and case reports) published up to October 2024 were collected. The search combined keywords and MeSH terms such as "phlebitis," "intravenous injection," "IV therapy," "vasculitis," "thrombophlebitis," "injection-related complications," and "drug-induced phlebitis." Searches were performed across multiple databases: PubMed (54 articles), Google Scholar (93 articles), Embase (124 articles), and Scopus (87 articles). All retrieved references were imported into EndNote X9 (Clarivate Analytics) for management. Duplicate records were removed, and articles were selected based on relevance to phlebitis and inflammatory mechanisms in blood vessels. Studies involving animals (72 articles), in vitro experiments (53 articles), or lacking direct relevance (40 articles) were excluded. After full-text assessment, 51 additional articles were excluded due to ineligibility. Ultimately, 21 studies—11 clinical studies, five case reports, and five systematic reviews/meta-analyses—were included for full analysis (Figure 1). Key findings from clinical studies, case reports, and reviews are summarized in Tables 1–3.

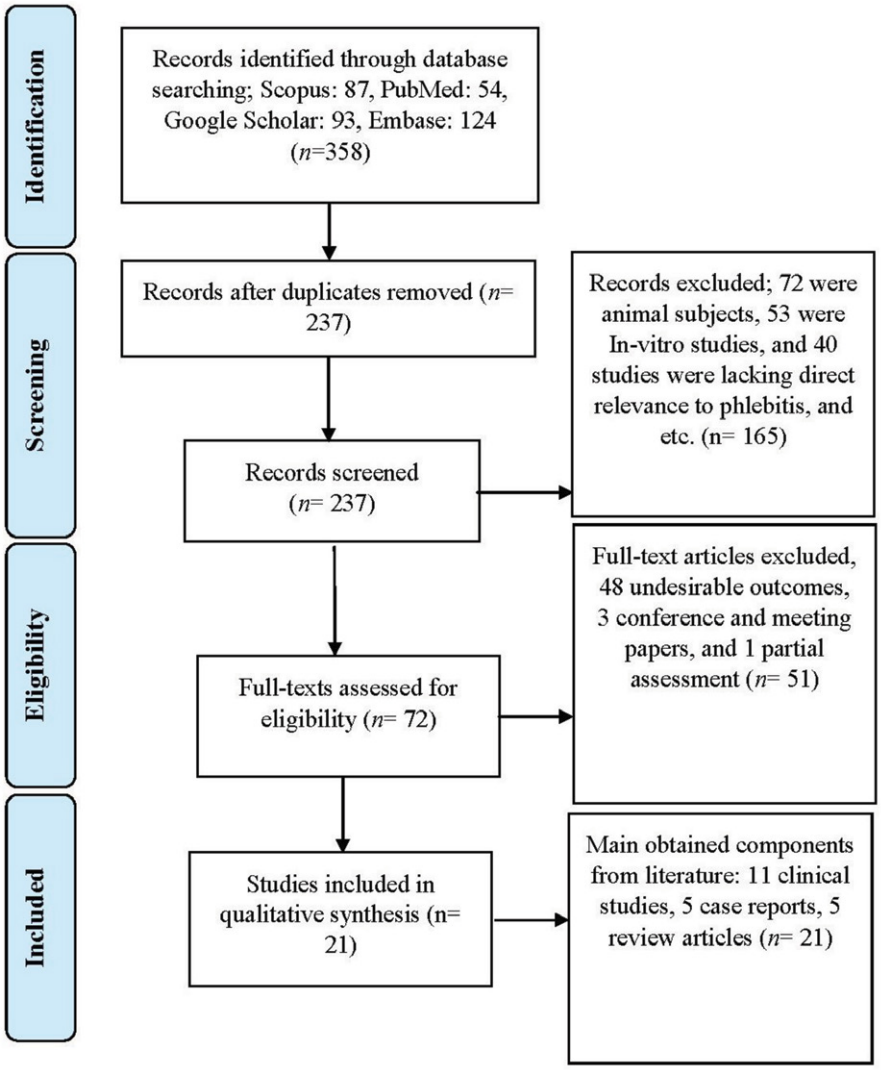

Figure 1. PRISMA flow diagram: process of the integrative review

Results

From the research performed through the mentioned databases, 358 articles were retrieved, of which 21 (5.86%) met the inclusion criteria. Eleven clinical studies are summarized in Table 1.

Table 1. Summary of clinical studies

Type of Study (Reference)	Study participants	Phlebitis rate	Identified risk factors
Observational, Cohort (18)	1582 patients, 2495 PIVCs	27%	Duration of catheterization
Clinical Trial (19)	255 patients	36.8%	Catheter material, Gender, Duration of catheterization
Observational, Comparative (20)	355 patients, 568 IV sites	54.5%	Insertion site, Frequency of catheterization
Retrospective, Cohort (21)	300 patients	19.3%	Irritant drug concentration
Observational, Prospective (3)	384 patients	70%	Duration of catheterization
Observational, Prospective (22)	317 patients, 532 PICs	31.8%	Chronic disease, Duration of catheterization, Type of intravenous fluid
Observational, Prospective (23)	224 patients	52.2%	Duration of catheterization, Ongoing infection
Observational, Cohort (24)	80 patients	15%	Osmolarity
Multicenter, Observational (2)	35 patients	6.2%	Plastic cannulas, Type of intravenous fluid (dextrose-containing solutions), Insertion site, Concomitant antimicrobial
Multicenter, Observational (25)	1498 patients	15.4%	Insertion site, Duration of catheterization
Post-Hoc Analysis (26)	1357 patients, 3425 PIVCs	9.1%	Patients' BMI, ICU characteristics, Peripheral intravenous catheter characteristics, Characteristics of the drugs

PIVCs: Peripheral Intravenous Catheters, IV: Intravenous, BMI: Body Mass Index, ICU: Intensive Care Unit

The key points from the five recent case reports, five review articles, and a comprehensive meta-analysis are summarized in Tables 2 and 3, respectively.

Table 2. Summary of case reports

Presented Case (Reference)	Comorbidities	Suspected Active Substance and Related Factors	Clinical Manifestations	Interventions	Recommendations
A 29-year-old Nigerian male (8)	Malaria with acute gastroenteritis	IV promethazine, a medication with vesicant properties	Intense burning and erythema after 25 mg of promethazine was injected via a size 22G IV cannula (inserted the previous day on the anteromedial aspect of his right forearm and maintained with continuous intravenous crystalloid infusion)	- Immediate removal of the cannula and insertion of another cannula on the contralateral arm - Replacement of promethazine with ondansetron - Treatment with a topical anti-inflammatory agent	The preferred parenteral route of administration for promethazine is deep intramuscular injection, rather than intravenous. Recommendations to prevent promethazine-induced thrombophlebitis include: - Using large and patent veins for administration - Using lower doses of promethazine - Diluting the drug and administering it slowly - Considering alternative therapies instead of promethazine - Educating the patient
A 29-year-old male (9)	ESRD, IgA nephropathy, candidate for kidney transplantation, no known allergies	IV diphenhydramine, drug dilution, infusion rate	Transient burning pain and erythema in the volar and dorsal forearm tributaries of the cannulated vein, immediately after IV injection of 1 mL of undiluted 50 mg diphenhydramine via 18G IV cannula placed in the lateral dorsal side of the patient's left-hand cephalic vein. No Itching, Hemodynamic changes, and Signs of a systemic allergic reaction. Phlebitis was confirmed (Infusion Nurses Society phlebitis scale).	- Patient's vein was flushed with a normal saline infusion. - The erythema resolved after 30 minutes. - Anesthesia was induced and maintained through the same intravenous cannula without any issues.	- Appropriate drug dilution - Slow infusion
A 48-year-old male (10)	Poorly controlled type 2 diabetes, lower limb cellulitis	Ciprofloxacin concentrate solution was infused directly into a peripheral line without dilution, medication error	Phlebitis had been noticed with clinical manifestations including swelling of the vein, localized redness, and pain a day after the first ciprofloxacin dose (antibiotic treatment regimen included ciprofloxacin 200 mg IV infusion twice per day plus clindamycin 600 mg IV infusion three times per day) via a peripheral line on the patient's right arm.	- The injection line was changed to the patient's left hand, but phlebitis appeared in that hand as well. - The ciprofloxacin treatment was stopped. - Topical non-steroidal anti-inflammatory drugs were used for symptom management of the phlebitis.	- Correct dilution of the concentrated medication - Slowing the rate of infusion - Using larger veins through a central line for IV injection - Educating healthcare professionals.
A 54-year-old Hispanic female (11)	Controlled hypertension, persistent, uncomplicated sigmoid diverticulitis failing oral antibiotic therapy	Vancomycin-associated cutaneous drug reaction	Empiric IV antibiotic therapy with vancomycin and piperacillin-tazobactam was initiated by the emergency department. Within 30 minutes of starting a vancomycin infusion, the patient developed: - A vermiform appearing rash - The rash ascended along the venous distributions of the left arm - The rash was exclusively localized to the areas proximal to the vancomycin IV infusion site.	- Vancomycin infusion was stopped. - Worm-like rash resolved 15 minutes after vancomycin infusion was stopped. - Patient was treated with intravenous piperacillin-tazobactam only which was tolerated well.	- Consider vancomycin-associated cutaneous drug reactions, although they are rare.

Presented Case (Reference)	Comorbidities	Suspected Active Substance and Related Factors	Clinical Manifestations	Interventions	Recommendations
a 59-year-old male (12)	Myelodysplastic syndrome complicated with fungal infection	Peripheral intravenous infusion of liposomal amphotericin	Redness and swelling, measuring 3 x 4 cm, at the previous puncture sites on both hands, pain, tenderness and increased skin temperature at the affected sites following 18 days of treatment with 500 mL of 5% glucose injection and 100 mg of liposomal amphotericin B complex infused at a constant rate of 60 mL/h. - To prevent infusion blockage, the catheter was flushed with 20 mL of 5% glucose injection every 2 hours, and the indwelling needle was regularly replaced. - Secondary phlebitis (Nursing Treatment Practice Standards)	- The patient was administered 50 mg of intramuscular tramadol hydrochloride injection for pain relief, as per the physician's instructions - Mupirocin ointment, Lidocaine cream, and Magnesium sulfate wet compress - The infrared therapy was used for 30 minutes each time, twice a day and continued for 6 consecutive days when phlebitis was cured.	- Specific electromagnetic wave therapy can help quickly heal phlebitis caused by amphotericin B treatment. - Timely and effective intervention for phlebitis is crucial for patient recovery and health. - Closely monitor the patient's condition - Understand the mechanism of phlebitis - Identify and diagnose early phlebitis - Ensure effective and rapid treatment

IV: Intravenous, G: Gauge, ESRD: End Stage Renal Disease, IgA: Immunoglobulin A

Table 3. Summary of meta-analysis and review studies

Authors, Year (Reference)	Patient's age and gender	Predisposing Risk Factors	Management
Lv L et al, 2020 (13)	15791 patients; Mean of 57 years old; 53.9% male	**1. Patient-Related Factors** - Gender: Females have a significantly higher risk of developing phlebitis (Odds Ratio = 1.42). - Age: Older age is inversely associated with the incidence of phlebitis. - Comorbidities: Presence of infectious diseases and diabetes mellitus are noted as risk factors. **2. Catheter-Related Factors** - Type of Catheter: Teflon catheters are associated with a higher incidence of phlebitis (33%) compared to Vialon catheters (27%). - Insertion Site: Catheters inserted in the forearm are linked to a higher risk of phlebitis. **3. Infusion-Related Factors** - Infusion Duration: Longer dwelling time of the catheter increases the risk of phlebitis. - Type of Infusion: Infusion of antibiotics is associated with a higher incidence of phlebitis. **4. Intervention-Related Factors** - Intervention Status: Non-intervened groups show a higher incidence of phlebitis (30%) compared to intervened groups (21%). **5. Other Factors** -Visual Infusion Phlebitis (VIP) Scale: The use of the VIP scale for monitoring is associated with a lower incidence of phlebitis (25.9%) compared to other scales (37.8%).	**1. Prevention Strategies:** Proper Insertion Technique, Selection of Catheter Type, Site Selection **2. Monitoring and Assessment:** Regular Monitoring, Documentation **3. Intervention Strategies:** Removal of Catheter, Site Change **4. Symptomatic Treatment:** - Local Care: Apply warm compresses to the affected area to alleviate discomfort and promote healing. - Medications: Administer analgesics to manage pain associated with phlebitis. - Antibiotics: If there is evidence of infection, appropriate antibiotic therapy should be initiated. **5. Education and Training:** - Staff Training - Patient Education
Garcia-Expósito J et al, 2023 (7)	726 patients; Not available	**1. Mechanical Factors** - Catheter Insertion Technique: Improper insertion techniques can lead to trauma to the vein. - Catheter Size: Larger gauge catheters are associated with a higher risk of phlebitis. - Duration of Catheterization: Prolonged use of PVCs increases the risk of phlebitis. **2. Chemical Factors** - Type of Infusion Solutions: Certain solutions, especially those that are hypertonic or irritating, can cause inflammation of the vein. - Medications Administered: The use of specific medications, such as vasopressors (e.g., noradrenaline), can increase the risk of phlebitis. **3. Biological Factors** - Infection: Bacterial contamination at the catheter site can lead to phlebitis. - Patient's Immune Response: Individual variations in immune response can affect susceptibility to phlebitis. **4. Patient-Related Factors** - Age: Older patients may have more fragile veins, increasing the risk. - Comorbidities: Conditions such as diabetes, obesity, and vascular diseases can predispose patients to phlebitis. - Gender: Some studies suggest that females may be at a higher risk. **5. Environmental Factors** - Nursing Practices: Inadequate care and monitoring of the catheter site can lead to complications. - Hospital Protocols: Variations in hospital protocols for catheter maintenance and replacement can influence phlebitis rates.	**Treatment:** - Ichthammol glycerin and heparinoids were effective in decreasing the degree of phlebitis. - Sesame oil achieved the most significant reduction in the degree of pain - Heparinoids and ichthammol glycerin were the only products that demonstrated a statistically significant reduction in the degree of infiltration.

Authors, Year (Reference)	Patient's age and gender	Predisposing Risk Factors	Management
Zhu LL et al, 2023 (14)	Not Available	1. **Patient Characteristics:** - Age: Higher incidence in older patients, particularly those aged 85 and above. - Gender: Women may have a higher proportion of complications. - Comorbidities: Conditions such as diabetes mellitus can affect circulatory system changes, increasing risk. 2. **Catheter-Related Factors:** - Catheter Size: Larger caliber catheters are associated with increased risk due to greater attraction to the vessel wall. - Catheter Length: Longer catheters may increase the risk of phlebitis. - Type of Catheter: The choice of catheter type based on expected duration and known complications can influence risk. 3. **Insertion Site:** - Location: Insertion into areas such as the wrist, antecubital fossa, and joints is linked to higher rates of mechanical phlebitis due to movement. - Vein Quality: Choosing straight, palpable, and well-filled veins can reduce risk. 4. **Infusion Factors:** - Type of Infusion: The pH, osmolarity, and irritant nature of the infused substances can contribute to phlebitis. - Duration of Catheter Use: Prolonged use of a catheter increases the risk of phlebitis. 5. **Nursing Practices:** - Aseptic Technique: Inadequate aseptic technique during insertion and maintenance can lead to infection and phlebitis. - Monitoring: Lack of regular assessment and monitoring of the catheter site can delay the detection of phlebitis. 6. **Environmental Factors:** Emergency Situations: High incidence of phlebitis has been noted in emergency areas where aseptic techniques may not be strictly followed.	**1. Prevention Strategies:** Aseptic Technique: - Use alcoholic chlorhexidine solution (>0.5%) or 2% aqueous chlorhexidine for skin preparation. - Perform hygienic hand washing and use clean gloves when handling catheters and connections. Catheter Selection: - Choose the smallest caliber and shortest length catheter appropriate for the treatment to minimize trauma. - Avoid inserting catheters in high-mobility areas (e.g., joints, wrist). Monitoring and Maintenance: - Regularly assess the catheter insertion site for signs of phlebitis (warmth, tenderness, erythema). - Maintain accurate records of catheter insertion, medication administration, and dressing changes. - Replace administration systems and accessories every 4 to 7 days or when visibly soiled. **2. Nursing Assessment:** - Involve patients in the choice of catheter and insertion site. - Analyze patient characteristics and prescribed medications to identify risk factors for phlebitis. - Keep the catheter insertion site visible for continuous monitoring. **3. Interventions for Treatment:** Topical Treatments: - Apply alternating hot and cold compresses to reduce erythema, edema, and pain. - Use topical agents such as sesame oil, chamomile extract, or marigold ointment for their anti-inflammatory properties. - Consider using Burow's solution for its astringent effects on the affected area. Medication Administration: - Administer anti-inflammatory medications as needed. -Use topical diclofenac or heparin gel for symptomatic relief. Catheter Removal: - Remove the catheter if signs of phlebitis develop (e.g., warmth, tenderness, erythema). - Ensure proper documentation of the condition and any interventions taken. **4. Patient Education:** - Educate patients and their families about the signs and symptoms of phlebitis. - Guide proper care of the catheter and the importance of reporting any discomfort or changes at the insertion site. **5. Follow-Up Care:** - Monitor patients post-discharge for any signs of phlebitis after catheter removal. - Reinforce education on recognizing symptoms and when to seek medical attention.

Authors, Year (Reference)	Patient's age and gender	Predisposing Risk Factors	Management
Garcia-Expósito J et al, 2022 (4)	2042 patients; 17-70 years old; 55.1% female	1. **Mechanical Factors:** - Insertion technique of the peripheral venous catheter (PVC). - Duration of catheterization. 2. **Chemical Factors:** - Type of intravenous solution being infused. - Irritating properties of certain medications. 3. **Bacterial Factors:** - Contamination during catheter insertion or maintenance. - Presence of bacteria at the insertion site. 4. **Patient-Related Factors:** - Age of the patient (older adults may be at higher risk). - Gender (some studies suggest a higher incidence in females). - Underlying health conditions (e.g., diabetes, obesity). - Immune status (immunocompromised patients may be more susceptible). 5. **Environmental Factors:** - Hospital setting and practices related to catheter care. - Use of non-sterile techniques during catheter handling. 6. **Catheter-Related Factors:** - Gauge of the catheter (larger gauge may increase risk). - Location of catheter insertion (certain sites may be more prone to phlebitis).	**1. Immediate Actions:** Remove the Peripheral Venous Catheter (PVC): The first step in managing phlebitis is to immediately stop the infusion and remove the catheter to prevent further irritation and complications. **2. Topical Treatments:** Physical Measures: - Application of cold or warm compresses to the affected area to alleviate symptoms. - Heat application has been noted for its vasodilating effects, which may help reduce inflammation. Phytotherapeutic Treatments: - Use of herbal products such as calendula, chamomile, and aloe vera, which have shown potential benefits in reducing symptoms of phlebitis. - Other phytotherapeutic agents like quercetin and ichthammol glycerine have also been explored for their effectiveness. Pharmacological Treatments: - Magnesium Sulphate: Identified as one of the most effective treatments, often used in combination with glycerine. - Heparinoids: Used as anti-inflammatory agents, although their efficacy is generally lower compared to magnesium sulfate. - Glycerine: Sometimes used alone or in combination with other agents. **3. Administration Techniques:** Application Method: Treatments can be applied through massage or with compresses, and the use of bandages may enhance absorption. Frequency of Application: Most treatments are applied 2 to 3 times daily for a duration ranging from 2 to 7 days, depending on the specific product and clinical guidelines. **4. Monitoring and Follow-Up:** Regular assessment of the affected area for signs of improvement or worsening of symptoms. Documentation of the patient's response to treatment and any adverse effects. **5. Education and Prevention:** - Educating healthcare staff on proper catheter insertion and maintenance techniques to minimize the risk of phlebitis. - Implementing protocols for the timely assessment and management of phlebitis in patients receiving intravenous therapy.

Authors, Year (Reference)	Patient's age and gender	Predisposing Risk Factors	Management
Furlan MDS et al, 2024 (5)	Not Available	**1. Patient-Related Factors:** - Length of Stay: Longer hospitalization increases the risk. - Infection and Comorbidities: Presence of infections and chronic diseases heightens the risk. - Age: Certain age groups (e.g., older patients) are more susceptible. • - Skin Quality and Elasticity: Poor skin elasticity and vein quality contribute to risk. • - Mobility: Reduced patient mobility is a risk factor. • - Pain at Catheter Insertion Site: Presence of pain can indicate higher risk. **2. Intravenous Therapy Related Factors:** • - Peripheral Intravenous Catheter (PIC) Dwell Time: Longer dwell time (e.g., greater than 72 hours) is associated with increased risk. • - Type of Medications Administered: Use of certain medications (e.g., antibiotics, irritants) can lead to phlebitis. • - Infusion Method: Continuous versus intermittent infusion methods may affect risk. **3. Procedural Factors:** • - Nursing Care: Receiving less nursing care is a predictor of phlebitis. • - Catheter Insertion Attempts: Multiple insertions at the same site increase risk. • - Insertion Technique: Unsuccessful insertion attempts and improper catheter placement angle can contribute to phlebitis. **4. Catheter-Related Factors:** • - Catheter Material: Use of Teflon® catheters is noted as a risk factor. • - Gauge of Catheter: Larger gauge catheters (e.g., 18-gauge) are associated with higher risk.	**1. Prevention Strategies:** - Standardized Protocols: Implementing standardized protocols for the insertion and maintenance of peripheral intravenous catheters (PIC) to minimize complications. - Nursing Care: Ensuring adequate nursing care and regular assessment of the catheter insertion site to detect early signs of phlebitis. - Patient Education: Educating patients about the signs and symptoms of phlebitis to encourage prompt reporting. **2. Monitoring and Assessment:** - Regular Monitoring: Frequent monitoring of the catheter site for signs of inflammation, pain, or other complications. - Use of Assessment Tools: Employing validated scales and tools for the assessment of phlebitis to ensure consistent measurement and reporting. **3. Catheter Management:** - Appropriate Catheter Selection: Choosing the right type and size of catheter based on the patient›s condition and vein quality. - Dwell Time Management: Limiting the dwell time of PICs to reduce the risk of phlebitis, with recommendations for timely replacement based on clinical indications rather than routine schedules. **4. Treatment of Phlebitis:** - Removal of Catheter: If phlebitis is diagnosed, the affected catheter should be removed immediately to prevent further complications. - Symptomatic Treatment: Providing symptomatic relief for patients, which may include the application of warm compresses to the affected area and the use of analgesics for pain management. - Antibiotic Therapy: In cases where infection is suspected or confirmed, appropriate antibiotic therapy should be initiated. **5. Staff Training and Education:** - Training Programs: Implementing training programs for healthcare staff on best practices for IV therapy and phlebitis management. - Skill Development: Encouraging skill development in catheter insertion techniques to minimize unsuccessful attempts and associated risks.

For clinical studies, the main indicators were phlebitis rate and identified risk factors among participants. Case reports provided details on comorbidities, clinical manifestations, interventions, and recommendations. To evaluate the selected systematic review articles and meta-analysis, the focus was on the findings of predisposing risk factors and management strategies resulting from these studies.

Studies conducted from 1995 to 2024 included data from over 6,500 patients, with approximately 51% female and 49% male participants aged 17–70 years. Incidence rates varied widely but generally showed a slightly higher frequency in females (around 25–33%), while males had rates near 17–30%. The factors influencing phlebitis can be categorized into three main groups: patient-related, product-related, and process-related factors. Each main category includes several subcategories (Figure 2).

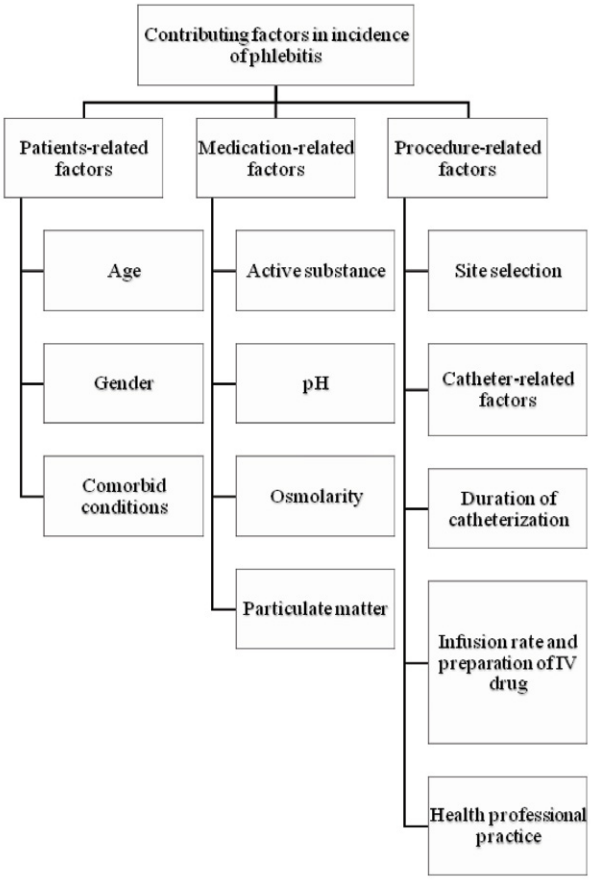

Figure 2. Classification of contributing factors in the incidence of IV therapy-induced phlebitis

The role of gender is debated, as some studies observed no significant difference, while others suggest physiological differences (such as smaller vein caliber in females) may increase risk. Patient-related factors such as age (higher risk generally above 40), obesity, diabetes, and other comorbidities were also associated with increased phlebitis likelihood. Medication-related factors, including drug pH, osmolarity, and particulate matter, especially with certain antibiotics and vasoactive drugs, significantly affect phlebitis rates. Procedure-related factors like catheter site, catheter material and size, duration of catheter use, and infusion rate also impact incidence, with larger-gauge catheters and longer durations associated with higher risk. Overall, the interaction of patient, drug, and procedural factors determines phlebitis occurrence; gender appears contributory but not definitive.

Discussion

Based on the analysis of the 21 articles included in this integrative review, it appears that despite the clinical significance of phlebitis as a quality-of-care indicator, the number of comprehensive studies in this area is still limited. Reported incidence rates of phlebitis varied considerably across studies, with some reporting rates as low as around 6% while others indicated much higher frequencies (up to 70%) (2, 3). Such variation may reflect differences in study design, patient populations, definitions of phlebitis, and clinical settings.

Below, we examine the main contributing factors identified in the literature that influence the occurrence and progression of phlebitis.

Patient-related factors

Several patient characteristics affect the likelihood of

phlebitis. Factors such as age, sex, underlying health conditions like diabetes, high body mass index or obesity, malnutrition, immunosuppression, neutropenia, and venous insufficiency have all been associated with increased risk (27). A history of chronic illnesses or thromboembolic events can also play a role. It is important to note, however, that most of these risk factors are inherent to the patient and not easily modified by nursing staff (28).

a) Age

In a descriptive cross-sectional study, Erdogan et al. examined factors influencing phlebitis and infiltration in patients with peripheral IV catheters in a neurosurgery clinic. The study included 325 adults who received IV medication, with catheter sites assessed every 24 hours for signs of complications. Results showed that age and gender were not significant predictors of phlebitis, although infiltration occurred most often in patients aged 50–59 years (29). Similar findings were reported by Uslusoy et al., who also found no link between phlebitis incidence and demographic factors (20).

However, evidence on age remains inconsistent. Daud et al. observed a higher risk of phlebitis in patients over 40, possibly due to fragile skin and reduced vascular integrity in older adults (30). Wallis et al. likewise reported the highest incidence at a mean age of 51.6 years (31). These findings suggest that while some studies show no clear relationship, others highlight age as a meaningful risk factor for phlebitis.

b) Gender

Erdogan et al. reported no significant association with phlebitis incidence (29). Other studies, however, have shown mixed results. Karadag found a higher frequency in women (19), while Daud et al. and Lundgren et al. observed greater prevalence in men (30, 32). These inconsistencies suggest that gender may be a contributing factor in some contexts, but not a consistent or universal predictor.

Variability likely reflects differences in populations, research methods, and clinical settings. Some authors have proposed physiological explanations, such as variations in skin thickness or hormonal influences, that could affect susceptibility. Nonetheless, most evidence indicates that factors like catheter insertion technique, vein condition, and catheter dwell time often have a larger impact than gender alone. Still, gender remains a variable of interest and warrants further study to clarify its role and underlying mechanisms (7–9).

c) Comorbid conditions

Erdogan et al. reported that comorbid conditions significantly influence infiltration and phlebitis risk in patients with peripheral IV catheters. In their study, infiltration was more common in patients with spinal diseases, while phlebitis was seen more frequently in those with cranial conditions (29). Similarly, Saji et al. found higher rates of phlebitis in patients with diabetes and hypertension, conditions known to predispose individuals to vascular complications (33). Enes et al. also confirmed that patients with chronic diseases face a substantially greater risk of phlebitis, underscoring the need for close monitoring in this population (34).

BMI has also been identified as a risk factor. It shows a U-shaped relationship, with both underweight and overweight patients showing higher susceptibility. In these groups, avoiding large-gauge PIVCs may help reduce the risk (26). Similarly, a descriptive survey of 46 adult inpatients found phlebitis in all participants, most frequently at stage 4. The main risk factors included male sex (91.7%), immunosuppression (63% HIV, 100% diabetes, and 100% immunosuppressive therapy), and multiple catheter insertions (90.9%) (35).

Danski et al. further suggested that shorter hospital stays may reduce phlebitis incidence, particularly among patients without comorbidities (36). Overall, while existing studies highlight several patient-related risks, further research is needed to clarify the relationship between comorbidities and phlebitis. A deeper understanding could help clinicians better identify high-risk groups and tailor preventive strategies accordingly.

Medication-related factors

Chemical phlebitis is directly linked to administration of drugs with inherent irritant properties, extreme pH, high osmolality, or particulate matter.

a) Active substances

Understanding the physicochemical properties of IV drugs—such as formulation, pH, osmolarity, and the characteristics of the active substances—is crucial for identifying medications that may damage the endothelium. Some drugs are known to irritate blood vessels, resulting in higher rates of phlebitis. Transient phlebitis has been reported after IV administration of drugs including morphine, pethidine, meperidine, propofol, diphenhydramine, and certain antibiotics (10). Antibiotics are particularly associated with infusion-related phlebitis (10, 37). IV antibiotics, especially vancomycin, amphotericin B, and many beta-lactams, are strongly associated with infusion-related phlebitis, potentially due to microparticles in their formulations (37). Lanbeck et al., in a prospective observational study, identified dicloxacillin and erythromycin as antibiotics with the highest tendency to irritate vessels (37). Awareness of these associations helps clinicians reduce complications during IV therapy.

Amiodarone-induced thrombophlebitis has also been reported in many case studies (38, 39). IV amiodarone, widely used for rhythm-related tachyarrhythmias, is

recognized as a vascular irritant. Thrombophlebitis is its most common adverse effect, mainly due to mechanical and chemical effects of particulate matter introduced during injection (38, 39). This particulate matter may result from drug instability, poor quality control, or substandard compounding practices. Additionally, amiodarone can crystallize if its solubility limits are exceeded during dilution and mixing in the bloodstream (38, 39).

Nicardipine, recommended as the first-line treatment for hypertensive emergencies in acute stroke, also carries a notable risk of phlebitis (21, 40). Patient characteristics can influence this risk, but effective prevention strategies are not well established. Higher concentrations of IV nicardipine are associated with greater incidence and severity of phlebitis (21, 40). A retrospective, non-blinded cohort study of 300 acute stroke patients treated with IV nicardipine between July 2014 and June 2016 found that diluting nicardipine to below 130 µg/mL significantly reduced both phlebitis incidence and severity. Proper administration techniques to limit peak concentration can therefore decrease the risk (21).

Previous studies have recommended using central venous catheters to minimize PIVC-related complications from high-risk drugs such as nicardipine and noradrenaline, although concerns about bloodstream infection and bleeding persist (41). Selecting an appropriate device based on individual patient characteristics is therefore essential. Experimental research evaluating the venous irritation potential of 62 IV drugs found that glucose solutions, 1M sodium bicarbonate, and 10% mannitol significantly irritated veins. Drugs such as vancomycin, ciprofloxacin, amiodarone, haloperidol, and labetalol were also irritative due to their low pH (42). Other agents, including dexketoprofen, diazepam, digoxin, etomidate, phenytoin, levetiracetam, and metamizole, exhibited high osmolarity in both reconstituted and undiluted forms, with diazepam, digoxin, and phenytoin remaining highly osmotic even after dilution in 100 mL of saline. The effects of pH and osmolarity are discussed in greater detail below (42). Although drug-induced phlebitis is largely attributed to the intrinsic properties of the drug, other contributing factors should not be overlooked.

b) pH

The pH of IV formulations plays a significant role in the incidence of phlebitis. Normal blood pH ranges from 7.35 to 7.45, and drugs with an acidic pH (<7, particularly <4.1) or an alkaline pH (>7, especially >9) can damage the tunica intima, the innermost layer of the vein (28, 43–45). Such damage may lead to phlebitis, thrombosis, sclerosis, or infiltration. To prevent pH-related phlebitis, several strategies are recommended. Diluting acidic or alkaline drugs with appropriate IV fluids can minimize complications, with hemodilution being the most effective method (28, 43–45). Selecting a larger vein with good blood flow or using a central line when necessary also promotes adequate hemodilution during infusion. In some cases, a midline or peripherally inserted central catheter may be more appropriate than a standard peripheral IV (28, 43–45). Extending the infusion time to allow for gradual drug administration further reduces the risk, whereas rapid infusion increases the likelihood of phlebitis by exposing the vein to more concentrated solutions and greater vascular irritation (28, 43–45).

c) Osmolality

Considering tonicity is essential for preventing phlebitis. Injectable drugs, whether administered alone or diluted with IV solutions, may be hypertonic, isotonic, or hypotonic. Normal serum osmolarity ranges from 275 to 295 mOsm/L, corresponding to the tonicity of 0.9% sodium chloride (normal saline), which serves as the standard reference for isotonic solutions (20). Isotonic solutions are generally well tolerated and less likely to cause vascular irritation or phlebitis (44, 46, 47).

Hypotonic solutions, such as 0.45% sodium chloride or sterile water for injection, have a lower osmolality than blood. These solutions can cause water to move into endothelial cells, leading to cellular swelling and an increased risk of vessel irritation and phlebitis (46, 47). In contrast, hypertonic solutions—or drugs with an osmolality greater than 312 mOsm/L—draw water out of endothelial cells, causing cell shrinkage and a higher likelihood of vessel wall damage (10, 20). Because of their strong association with chemical phlebitis, vascular irritation, and thrombosis, hypertonic solutions are generally not recommended as diluents for peripheral infusions.

Notably, certain drugs, including diazepam, digoxin, and phenytoin, maintain high osmolarity even after dilution in 100 mL of saline (24). There is a direct relationship between drug tonicity and phlebitis incidence. Studies have shown that hypertonic drugs with tonicity above 600 mOsm/L can cause phlebitis in peripheral veins within 24 hours (24). Research by Jamal et al. (2019), Jacinto et al. (2014), and Gomes et al. (2011) consistently demonstrated a significant association between high-osmolality IV fluids and phlebitis occurrence (24, 48–50). A study by Nito et al. examined the relationship between IV fluid osmolarity and phlebitis risk in 80 pediatric patients at hospitals in Banjarmasin, Indonesia (24). The researchers found that phlebitis developed in 2.7% of

patients receiving isotonic IV fluids, compared with 25% of those receiving hypertonic fluids. Peripheral veins generally tolerate osmolarity levels between 250 and 350 mOsm/L; osmolarity below 250 mOsm/L can lead to cell rupture, while levels above 600 mOsm/L are strongly associated with phlebitis (24).

Thus, both hypertonic and hypotonic drugs and solutions can damage the endothelial lining, leading to inflammation from chemical trauma. To reduce the risk of phlebitis, it is crucial to use isotonic IV solutions and drugs that are compatible with the patient's vascular system (24).

d) Particulate matter

According to the European, Japanese, and U.S. Pharmacopeias, particulate matter in injectable products is defined as "extraneous, mobile, undissolved particles—excluding gas bubbles—that are unintentionally present in solutions for injection and parenteral infusions."

Particulate matter can be divided into three main subtypes (51):

1. Extrinsic particles: Foreign and unexpected entities that are not part of the formulation, packaging, or assembly process (52, 53).
2. Intrinsic particles: Originating from the formulation, packaging, or assembly process itself (51, 54).
3. Inherent particles: Materials expected within the drug formulation and considered an accepted characteristic of the product.

Particulate matter can also be categorized by its source:

1. Particles from glass containers: These may result from interactions between formulation ingredients and the packaging or from glass fragments introduced during handling of ampoules or vials (55).
2. Particles from plastic containers: Sharp instruments, such as needles, can detach small plastic fragments when inserted through vial septa or stoppers (56, 57).
3. Particles from infusion sets: Tubing and catheters may introduce particulate matter if manufacturers' particle content limits are not followed (53, 57). Regulatory limits are set by organizations such as the FDA, USP 788, and ISO 8536-4.
4. Drug incompatibilities: Physicochemical incompatibility between drugs and carrier fluids, especially when multiple drugs are infused through the same catheter, can create particulate matter (58, 59).
5. Undissolved solids in drug solutions: Improper reconstitution or inconsistent stirring of powdered drugs can leave undissolved particles.

Preventing particulate contamination and drug incompatibilities is crucial for safe injectable administration, particularly in patients receiving multiple medications. Pharmaceutical manufacturers must, therefore, apply strict quality control to minimize particulate matter, ensuring both patient safety and treatment efficacy.

In-line filters can help reduce the risk of infusion-related phlebitis (60, 61), although evidence does not support their effectiveness in preventing infections from intravascular catheters and infusion systems. Supporters of filters cite several advantages:

1. Reducing infection risk from contaminated infusates or proximal areas.
2. Lowering phlebitis risk in patients requiring high medication doses or those with prior phlebitis.
3. Removing particulates that could contaminate IV fluids (62).
4. Filtering endotoxins from gram-negative bacteria in contaminated infusates (63).

However, bloodstream infections from infusates are rare, and pharmacy-based filtration may be a more effective and economical way to remove particulates. Additionally, in-line filters can clog with certain solutions, such as dextran, lipids, and mannitol, which may require more frequent line manipulations and potentially reduce drug delivery. Therefore, routine use of in-line filters to prevent central line–associated bloodstream infections is not strongly recommended (55).

Particulate matter in injectable medications can pose serious risks, including phlebitis and other complications. IV infusion of particulates may cause phlebitis through direct mechanical trauma to the vein, chemical damage from undissolved particles, or infection if the particles are nonsterile (55, 60–63).

Procedure-related factors

Ensuring the safe preparation and administration of injectable medications is essential for patient well-being, especially given the risks associated with IV catheters. Phlebitis, a common complication of IV therapy, can result from multiple factors, including catheter site selection, device characteristics, and the length of time the catheter remains in place. A clear understanding of these factors, along with adherence to proper clinical practices, is key to minimizing phlebitis and promoting effective patient care. This discussion will focus on best practices and recommendations designed to reduce the occurrence of phlebitis and enhance overall patient safety during IV therapy.

a) Site selection

Previous studies have shown that smaller veins, such as those on the dorsum of the hand, are more prone to phlebitis. While larger veins are generally preferred for IV access, it is equally important to consider patient comfort and individual anatomical differences when choosing an insertion site. Striking a balance between effective access and the patient's specific condition can help reduce phlebitis risk and improve overall care.

According to CDC recommendations, upper extremity sites should be used for peripheral and midline catheter insertion in adults, and lower extremity catheters should be switched to upper extremity sites as soon as feasible (64). For pediatric patients, veins in the upper or lower extremities, or the scalp in neonates and young infants, are appropriate. Daily evaluation of the insertion site is essential, and catheters should be removed if phlebitis, infection, or malfunction are suspected (64).

In a multicenter study by Danchaivijitr et al., the rate of phlebitis and contributing factors were investigated across 6,256 infusion sites (2). The forearm was the most commonly used site, followed by the hand and arm (2). The study found that phlebitis incidence was higher when infusion was administered at sites other than the forearm. Proper insertion technique, attentive nursing care, and careful site selection are therefore key strategies to reduce infusion-related phlebitis (2).

b) Catheter-related factors

Catheter-related factors, including catheter size, material, and the risk of catheter-related infections, play an important role in the incidence of phlebitis. The choice of catheter material can influence complication rates (64). For example, polytetrafluoroethylene (Teflon®) and polyurethane catheters are associated with fewer complications compared to polyvinyl chloride or polyethylene catheters. According to CDC recommendations, catheter selection should consider intended use, duration, potential complications, and the experience of the operator. Steel needles should be avoided due to the risk of tissue necrosis. Their use can result in infiltration of IV fluids into subcutaneous tissues, which is particularly concerning if the infused fluid is a vesicant. Both long and short peripheral IV catheters have been linked to peripheral vein infusion–related thrombophlebitis (64).

A study in Ankara, Turkey, examined the effect of two different short catheter materials on phlebitis incidence (19). A total of 255 patients were followed for six days, with 130 receiving Teflon catheters and 125 receiving Vialon catheters. Results showed that 49.2% of patients in the Teflon group developed phlebitis, compared to 24.0% in the Vialon group (19). The overall phlebitis rate was 36.8%, indicating that Vialon catheters were associated with a significantly lower risk (19). These findings are consistent with another study showing that Vialon catheters are less likely to cause phlebitis than Teflon catheters (65). In that study, PIVCs were removed due to phlebitis in 16.3% of the Vialon group and 53.8% of the Teflon group (65).

Large-gauge catheters carry a higher risk compared to smaller-gauge ones, likely due to the mechanical trauma inflicted during insertion into relatively short and narrow veins. Research suggests that catheter choice affects the risk of infiltration. For adults, Naomi et al. recommend 22-gauge peripheral IV catheters, while Erdogan et al. advocate for smaller catheters such as 20- and 22-gauge. Advantages of smaller-gauge catheters include better facilitation of blood flow around the insertion site, reducing the risk of vein damage (64). Another study demonstrated that phlebitis incidence was lower in patients with a 20-gauge cannula compared to those with an 18-gauge cannula (66).

Catheters can also become colonized by skin organisms during insertion or removal. Colonized catheters increase the risk of peripheral venous infusion–related thrombophlebitis by up to six times (67). The pathogenesis of catheter-related infections may involve migration of skin flora through the percutaneous insertion site (67).

In summary, careful consideration of catheter material, size, and the potential for colonization by skin flora is essential to reducing the incidence of phlebitis and related complications.

c) Duration of catheterization

The duration of catheterization is one of the most important risk factors for developing phlebitis. Scheduled replacement of intravascular catheters is recommended as an effective strategy to reduce complications, including phlebitis and catheter-related infections. Research shows that the risk of thrombophlebitis and bacterial colonization increases when short peripheral venous catheters are left in place for more than 72 hours (64). However, studies have not found a significant difference in phlebitis rates between catheters left for 72 hours versus those left for 96 hours. To minimize the risk of infection and discomfort from phlebitis, short peripheral catheters are usually replaced every 72–96 hours (28).

Midline catheters, in contrast, have lower rates of phlebitis compared to short peripheral catheters, and they also carry a lower risk of infection compared to central venous catheters. In a prospective study of 140 midline catheters, the bloodstream infection rate was only 0.8 per 1,000 catheter days, with no significant risk factors identified, including duration of catheterization. The median use of midline catheters was seven days, with some remaining in place for up to 49 days. No randomized controlled trials have yet confirmed the benefits of routine replacement

to prevent catheter-related infections in midline catheters. CDC guidelines recommend that peripheral catheters should not be replaced more frequently than every 72 to 96 hours to reduce infection and phlebitis risk in adults (64).

A study by Lulie et al. examined factors associated with peripheral vein phlebitis—including age, gender, residence, religion, education, admission diagnosis, hospital stay duration, catheterization duration, IV drug use, infusates, and comorbidities such as HIV/AIDS and hypertension—among 384 hospitalized patients (3). The study found that catheter dwell time was the most significant factor for phlebitis, with a notable increase in incidence among patients with catheterization exceeding 96 hours compared to those under 72 hours (3). The authors recommend daily assessment of the cannula, with removal if it has been in place for longer than 96 hours (3).

These results align with a study by Osei-Tutu et al., which followed 224 patients over three months at Cape Coast Teaching Hospital to identify risk factors for phlebitis following peripheral IV cannulation (23). Using the Visual Infusion Phlebitis Score, they found that phlebitis incidence was higher among patients with cannulas in place for more than four days (66.3%) compared to those with cannulas in place for up to four days (44.4%). Overall, phlebitis rates increased significantly after four days, especially in patients with ongoing infections. Therefore, routine replacement of cannulas by the fourth day is recommended (23).

Prolonged catheterization increases the risk of continuous trauma from the catheter, prolonged exposure to irritant medications and infusates, and a higher likelihood of bacterial colonization and infection (64). Regular monitoring and timely replacement of catheters are essential to preventing complications and ensuring patient safety (64).

d) Infusion rate and preparation of intravenous drug

The incidence of phlebitis can be affected by several factors related to drug administration, including the rate of infusion and the preparation of IV solutions (68). Higher infusion rates can create turbulent blood flow, which irritates the vein's endothelial lining and promotes inflammation (44). Multiple studies have shown that a slow and controlled infusion rate reduces mechanical stress on the vein walls, thereby lowering the incidence of phlebitis (69, 70).

As mentioned earlier, the physical and chemical properties of IV solutions, such as osmolarity and pH, also play a significant role in phlebitis risk. Additionally, proper preparation of IV drugs and solutions is critical in preventing phlebitis (71). This includes ensuring drug compatibility with carrier fluids, using aseptic techniques, and maintaining appropriate storage conditions (20, 58). Each drug should be prepared according to its inherent characteristics and compatibility guidelines (24, 71).

Healthcare professionals' knowledge is essential for proper drug preparation, as discussed in detail below. Overall, optimizing both infusion rates and preparation methods is vital to minimizing the risk of phlebitis and improving patient outcomes during IV therapy.

e) Health professional practices

Healthcare professionals play a crucial role in preventing and managing phlebitis. Nurses, in particular, are responsible for essential tasks such as inserting and removing IV catheters, administering medications, and monitoring for phlebitis and other complications. To ensure patient safety and improve the quality of care, trained hospital staff—mainly nurses—must perform these tasks carefully and follow established precautions (28). The effectiveness of healthcare workers depends on several key factors, including site selection, adherence to aseptic techniques, catheter care, patient education, and careful monitoring.

Understanding phlebitis and its risk factors is important for healthcare professionals, as it can influence the incidence and severity of complications. In a study by Milutinović and Simin, some nurses recognized factors that may reduce the occurrence of phlebitis; however, more than half were unaware of these factors (72). Knowledge of phlebitis and early recognition of risk factors can help reduce further complications (73). Most nurses consider phlebitis a significant problem, and there are notable differences in perceptions regarding appropriate insertion site selection (72, 74). Nurses with six to ten years of work experience tend to have a better understanding and make more informed decisions about vein selection (72).

A cross-sectional study in a public hospital on Malaysia's East Coast involved 269 female nurses and assessed their perceptions of phlebitis risk factors (73). Regarding catheter materials, most nurses (85.5%) lacked knowledge about their impact on phlebitis. The majority (49.8%) correctly identified that a PIVC should be replaced after 72 hours to reduce risk. Interestingly, 58.7% believed that larger catheters reduce phlebitis risk, despite recommendations to use smaller sizes. Additionally, 60.6% recognized the hand as the optimal insertion site, while 37.2% considered the wrist higher risk. A large proportion (87%) acknowledged that high-concentration fluids and drugs increase phlebitis likelihood, and 45%

noted that dressing practices influence risk (73). These findings emphasize the need for further exploration into catheter characteristics, site selection, and dressing practices to improve patient outcomes (73). Overall, while nurses have some awareness of phlebitis risk factors, they often lack comprehensive knowledge, highlighting the need for ongoing training to enhance awareness and patient care (73).

According to CDC, adherence to guidelines on education, training, and staffing can significantly reduce thrombophlebitis and catheter-related infections (64). These guidelines include: 1) Comprehensive Education: Provide thorough training on catheter indications, insertion and maintenance procedures, and infection control. 2) Regular Knowledge Assessments: Continuously evaluate adherence to best practices among all personnel involved in catheter care. 3) Trained Personnel: Ensure only competent, trained staff perform insertion and maintenance of peripheral and central catheters. 4) Adequate Staffing: Maintain sufficient nursing staff in ICUs. Observational studies show that higher ratios of "pool nurses" or increased patient-to-nurse ratios correlate with more catheter-related bloodstream infections in ICUs (64).

Specialized "IV teams" have been shown to be highly effective in reducing phlebitis incidence, its complications, and associated costs (27, 35, 41, 73–75). Well-structured programs that provide healthcare providers with the necessary education to deliver, monitor, and evaluate care are essential for success (10). Prioritizing education, proper training, and adequate staffing allows healthcare professionals to enhance patient outcomes and minimize risks related to IV catheterization (27, 35, 41, 73–75).

A recent case study by Hosseini et al. highlighted phlebitis linked to ciprofloxacin in a 48-year-old male with poorly controlled type 2 diabetes (10). The patient developed phlebitis within 24 hours after receiving undiluted ciprofloxacin through a peripheral IV line, presenting with swelling and redness around the injection site. The medication had to be stopped. Investigation revealed that improper dilution and rapid infusion were major contributors. This case underscores the importance of following medication instructions for IV preparation and administration and reinforces the need for ongoing nurse education and adherence to protocols (10).

f) Prevention and management strategies

Many parenteral drugs can cause phlebitis due to mechanical, chemical, or infectious factors. Thrombophlebitis, a complication of IV therapy, can result in considerable pain, swelling, fever, and tissue damage. These complications may also increase hospital costs due to prolonged patient stays. The incidence of thrombophlebitis varies widely and is influenced by multiple factors, including the type, length, and size of the cannula, the skill of the healthcare professional performing the insertion, the infused materials, the frequency of dressing changes, and patient-specific characteristics such as age, sex, and underlying health conditions (13, 28).

Early identification of risk factors and prompt intervention at the first signs of infiltration or phlebitis are crucial to preventing serious adverse outcomes (6, 76). Without timely diagnostic and treatment measures, thrombophlebitis can lead to severe complications, including sepsis, which may further prolong hospitalization, increase healthcare costs, and add to patient stress. Healthcare professionals can adopt various strategies to reduce the risk of phlebitis. These include careful selection and placement of devices, rotating infusion sites, adjusting drug concentration or flow rate, modifying formulations, and using in-line filters to reduce contaminant particulates. Moreover, once infusion-associated phlebitis is diagnosed, pharmacological interventions such as local or systemic anti-inflammatory and analgesic agents can help lessen symptom severity and prevent further complications (6, 7, 76).

Several preventive strategies exist, with vigilant monitoring of the insertion site being the most critical. The Infusion Nurses Society has developed a Visual Infusion Phlebitis Scale, which ranges from 0 to 5 (77). A score of zero indicates the absence of complications, while higher scores correspond to increasing signs and symptoms of inflammation, with grade 5 representing indicators of advanced or late-stage thrombophlebitis (77–79). Accurate recognition of phlebitis symptoms and timely intervention based on severity are essential responsibilities of healthcare professionals. By applying these strategies and maintaining high vigilance, healthcare providers can significantly reduce the incidence of thrombophlebitis and improve patient outcomes (13).

Conclusion

Phlebitis is a common complication of IV therapy, influenced by factors that fall into three main groups: patient-related, medication-related, and procedure-related. Patient-related factors include age, gender, and comorbidities. Older adults, especially those over 40, are generally at higher risk, likely due to fragile skin and changes in vascular integrity, although studies show mixed results regarding age. Gender effects are inconsistent; some research reports higher rates in women, while other

studies find no significant difference. This suggests that the condition of the veins and proper catheter placement may be more important than gender alone. Comorbidities such as diabetes and hypertension consistently increase the risk, highlighting the need for tailored preventive strategies for these patients.

Medication-related factors also play a significant role. IV drugs with irritant properties, extreme pH levels, or variable osmolality can irritate blood vessels. Active substances such as morphine and certain antibiotics are particularly notable for this effect. Additionally, particulate matter—both intrinsic and extrinsic—adds to the risk of complications.

Overall, understanding these factors is essential for preventing and managing phlebitis effectively in clinical practice. Further research is needed to clarify how these factors interact and to develop more precise strategies for reducing phlebitis incidence and improving patient care.

Conflict of Interest

The authors declare that they have no competing interests.

Acknowledgments

Nothing to mention.

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PLEASE CITE THIS PAPER AS:

Hosseini S, Khajeamiri Y. Phlebitis Uncovered: An Integrative Review of Contributing Factors. J Pharm Care. 2025;13(3):197-216. DOI: 10.18502/jpc.v13i3.20323