

INFUSION RELATED PHLEBITIS IN TIKRIT TEACHING HOSPITAL, IRAQ: A POINT PREVALENCE STUDY

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HOSPITAL, IRAQ: A POINT PREVALENCE STUDY**

BY

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The Department of Nursing**

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ETHICS STATEMENT

The thesis entitled “Infusion Related Phlebitis In Tikrit Teaching Hospital, Iraq: A Point Prevalence Study,” which was prepared and presented as a thesis was written by myself and in accordance with the scientific, academic rules, and ethical conduct. The idea/hypothesis of my thesis solely belongs to my supervisor and me. I conducted the research pertaining to the thesis; therefore, all of the sentences and interpretations within the work belong to me.

I declare the aforementioned issues to be correct.

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ABSTRACT

INFUSION RELATED PHLEBITIS IN TIKRIT TEACHING HOSPITAL, IRAQ: A POINT PREVALENCE STUDY

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Master of Science in Nursing

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Infusion-related flebitis is a common complication that occurs with inflammation of the venin tunica intima layer due to infusion of liquids, medicines or other substances. This study is a point prevalence study to determine the prevalence of infusion-related flebitis in patients administered a peripheral intravenous catheter. Prior to the start of the study, authorization from the institution, ethics board authorization and written approval from the patients were obtained. The data collection includes forms related to patient characteristics, peripheral intravenous catheters, and flebit scale. The data in this study was analyzed using the SPSS 22 software package. In addition to frequency analyses, dependencies between variables were studied using the Ki-Kare dependency test. The prevalence of flebitis in the study was 64.5%. The rates of developing flebitis have varied, with the most common one being the first degree flebit. The study found that the first day the catheter was placed, more flebit was developed. Antibiotic therapy was administered to 59.3% of the catheters applied to the developing region of Flebit. The study found that the development of flebitis was more common in patients with heart failure and in catheters used in emergency services. The prevalence of flebit found in our study has exceeded the rate accepted by the Infusion Nurses Unit. Based on these findings, further research is recommended for the development and implementation of evidence-based standard protocols aimed at preventing phlebitis, identifying effective interventions and improving clinical outcomes.

2024, 55 pages

Keywords: Flebit, Peripheral intravenous catheter, Point prevalence

ÖZET

IRAK, TIKRİT EĞİTİM HASTANESİNDE İNFÜZYONLA İLİŞKİLİ FLEBİT: BİR NOKTA PREVALANS ÇALIŞMASI

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İnfüzyonla ilişkili flebit, sıvıların, ilaçların veya diğer maddelerin infüzyonu nedeniyle venin tunica intima tabakasının inflamasyonu ile ortaya çıkan yaygın bir komplikasyondur. Bu çalışma, periferik intravenöz kateter uygulanan hastalarda infüzyon ilişkili flebit prevalansını belirlemek amacıyla yapılan bir nokta prevalans çalışmasıdır. Çalışmaya başlamadan önce kurum izni, etik kurul izni ve hastalardan yazılı onam alınmıştır. Veri toplama, hasta özelliklerine, periferik intravenöz kateterlere ve flebit ölçeğine ilişkin formları içermektedir. Bu çalışmada veriler SPSS 22 yazılım paketi kullanılarak analiz edilmiştir. Frekans analizlerinin yanı sıra değişkenler arasındaki bağımlılık Ki-Kare bağımlılık testi kullanılarak incelenmiştir. Çalışmada flebit prevalansı %64.5 olarak belirlenmiştir. Gelişen flebitlerin dereceleri değişkenlik göstermiş olup, en yaygın 1. derece flebit görülmüştür. Çalışmada, kateterin yerleştirildiği ilk gün daha fazla flebit geliştiği saptanmıştır. Flebit gelişen bölgeye uygulanan kateterlerin %59.3'ünden antibiyotik tedavisi uygulanmıştır. Çalışmada, flebit gelişiminin kalp yetmezliği olan hastalarda ve acil serviste uygulanan kateterlerde daha yaygın görüldüğü saptanmıştır. Çalışmamızda saptanan flebit prevalansı, infüzyon hemşireleri birliğinin kabul ettiği oranı geçmiştir. Bu bulgulara dayanarak, flebiti önlemeyi, etkili müdahaleleri belirlemeyi ve klinik sonuçları iyileştirmeyi amaçlayan kanıta dayalı standart protokollerin geliştirilip uygulanması için daha fazla araştırma yapılması önerilmektedir.

2024, 55 sayfa

Anahtar Kelimeler: Flebit, Periferik intravenöz kateter, Nokta prevalans

GENİŞLETİLMİŞ TÜRKÇE ÖZET

IRAK, TIKRİT EĞİTİM HASTANESİNDE İNFÜZYONLA İLİŞKİLİ FLEBİT: BİR NOKTA PREVALANS ÇALIŞMASI

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İnfüzyon, çeşitli terapötik, tanısal ve destekleyici amaçlarla uygulanan sıvıların doğrudan kan dolaşımına veya vücut boşluğuna kontrollü olarak verilmesi işlemidir. Bununla birlikte, infüzyon flebit gibi bazı komplikasyonları da beraberinde getirir. Flebit, periferik intravenöz kateterlerin uygulama bölgesinde görülen en yaygın komplikasyonlardan biridir. İnfüzyonla ilişkili flebit, sıvıların, ilaçların veya diğer maddelerin infüzyonu nedeniyle venin tunica intima tabakasının inflamasyonu ile ortaya çıkan yaygın bir komplikasyondur. Flebit, gelecekteki venöz erişimi olumsuz etkilemekle birlikte bakteriyel flebit ve kan dolaşımı enfeksiyonuna yol açabilir. Flebit, hastaneler, klinikler veya evde bakım ortamları gibi intravenöz tedavi alan hastalarda yaygın olarak görülür. Bu çalışma, Irak'taki Tikrit Eğitim Hastanesi'nde periferik intravenöz kateter uygulanan hastalarda infüzyon ilişkili flebit prevalansını belirlemek amacıyla yapılan bir nokta prevalans çalışmasıdır. Veriler Irak Tikrit Eğitim Hastanesinde yatan hastalardan toplanmıştır. Çalışmanın yürütüldüğü hastanede 250 klinik ve 80 yoğun bakım ünitesi yatağı bulunmakla birlikte toplam 330 yatağa sahiptir. Çalışmada 335 kateter değerlendirilmiştir. Çalışmanın dahil edilme kriterleri, hastanede yatan, 18 yaş üstü intravenöz tedavi gören ve çalışmaya katılmayı kabul eden hastalarken dışlama kriterleri ise intravenöz tedavi almamış, psikolojik ve ruhsal sorunları olan, 18 yaş altı ve çalışmaya katılmayı kabul etmeyen hastalardır. Çalışmaya başlamadan önce Salahuddin Sağlık Hizmeti Eğitim ve İnsani Gelişim Merkezi'nden kurum izni, Çankırı Karatekin Üniversitesi'nden Etik kurul izni ve hastalardan yazılı onam alınmıştır. Çalışmanın uygulaması dokuz aşamada yapılmıştır. Birinci aşamada; çalışmanın geçerliliği için hastalarla bir günde görüşülmüş, güvenilirlik için tüm ekibe aynı anda eğitim verilmiş, objektiflik için iki ekip aynı anda çalışmış, doğruluk için hastalar gözlemlenmiş ve

dosyaları incelenmiştir. İkinci aşamada; belirlenen hastanede her 30 yatak için biri gözlemci olmak üzere iki hemşire görevlendirilmiştir. Üçüncü aşamada; veri toplama işlemine başlamadan önce her klinik için belirlenen hemşirelere "İV kateterizasyon komplikasyonları, flebit oluşum süreci, flebitin değerlendirilmesi ve sınıflandırılması" konularını içeren yarım günlük bir eğitim verilmiştir. Dördüncü aşamada; verilerin toplanması için araştırmanın yapılacağı kuruma uygun olan tek bir gün belirlenmiştir. Beşinci aşamada; verilerin toplanacağı kliniklerde yatan hastalardan yazılı onam alınmıştır. Veriler hastalarla yüz yüze görüşülerek, hastaların cilt değerlendirmeleri yapılarak ve tıbbi takipleri/kayıtları incelenerek toplanmıştır. Altıncı aşamada; veri toplamada kullanılacak formlar, araştırmacı tarafından ölçümü yapacak hemşirelere dağıtılıp, toplanmıştır. Yedinci aşamada; çalışmanın yapıldığı hastanenin yatak sayısına göre belirlenen hemşireler, araştırmanın yapıldığı günün sabahı aynı anda tek noktadan hareket ederek veri toplamaya başlanmıştır. Sekizinci aşamada; veriler bütün kliniklerde belirlenen iki hemşire tarafından toplandı. Dokuzuncu aşamada; Veri toplama formlarını dolduran ekipler formları, formların dağıtımını ve toplanmasından sorumlu araştırmacıya teslim etmiştir. Bu çalışmada veriler SPSS 22 yazılım paketi kullanılarak analiz edilmiştir. Frekans analizlerinin yanı sıra değişkenler arasındaki bağımlılık Ki-Kare bağımlılık testi kullanılarak incelenmiştir. Çalışma sonuçlarına göre, kateter yerleştirilen hastalarda infüzyon hemşireler birliği tarafından kabul edilen flebit oranından daha fazla flebit geliştiği saptanmıştır. En çok 1. derece flebit gözlenmiş olup gelişen flebitlerin çoğunun kateter yerleştirildikten sonraki ilk günde geliştiği, kalp yetmezliği olan bireylerde ve acil serviste uygulanan kateterlerde daha fazla flebit geliştiği saptanmıştır. Bu sonuçlar doğrultusunda, flebit oranlarını azaltmaya yönelik etkili müdahaleleri belirlemek için daha fazla araştırma yapılması, kalp yetmezliği gibi kronik hastalığı bulunan hastalar için flebit gelişimini önleyici tedbirlerin alınması ve kliniklerde hasta sonuçlarını iyileştirmeyi hedefleyen, kateter uygulama ve bakımı için kanıta dayalı standart protokollerin geliştirilmesi ve uygulamaya aktarılması önerilmektedir.

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Anahtar Kelimeler: Flebit, Periferik intravenöz kateter, Nokta prevalans

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1. INTRODUCTION

In the medical field, infusion involves precisely introducing substances directly into the bloodstream or body cavity, serving various therapeutic, diagnostic, and supportive purposes. This crucial medical procedure is commonly utilized for swiftly administering medications, maintaining fluid balance, providing nutritional support via Total Parenteral Nutrition (TPN), transfusing blood products, and aiding diagnostic procedures with contrast agents or tracers. Nonetheless, alongside its benefits, infusion carries potential complications. Infections may result from insufficient sterilization practices, while phlebitis, marked by vein inflammation, thrombosis, and clot formation, poses risks such as irritation and hindered blood flow. Allergic reactions to infused substances, ranging from mild to severe, and fluid overload leading to pulmonary edema, present additional challenges underscoring the need for vigilant monitoring and adherence to safety protocols in infusion therapy (Teshome *et al.* 2023). Phlebitis stands as a prevalent complication of peripheral intravenous catheters (PICs), significantly affecting future venous access, with bacterial phlebitis potentially progressing to bloodstream infection (Diwakar *et al.* 2022). Infusion-associated phlebitis, a frequently encountered complication, arises when the vein lining becomes inflamed following the infusion of fluids, medications, or other substances. This condition is predominantly observed in patients undergoing intravenous therapy within hospital, clinic, or home care environments (Mandal and Raghu 2019). Phlebitis can arise from various causes, including the irritant properties of certain medications, infusion speed or volume, catheter size or placement, and individual patient characteristics (Guanche-Sicilia *et al.* 2021). A common trigger is intravenous catheters, which are tubes inserted into veins for the direct administration of fluids, medications, or nutrients into the bloodstream. The presence of these catheters can irritate the vein's inner lining, leading to inflammation (Goulart *et al.* 2020). Risk factors for phlebitis include age, sex, venipuncture site, large venous catheters, failed attempts, hypertonic fluids, and antibiotics (Heras *et al.* 2022). If left untreated, infusion-associated phlebitis can escalate to more severe complications like blood clot formation or infections. Thus, prompt recognition and management of this condition are crucial to minimize its impact on patient well-being and treatment outcomes (Ortel *et al.* 2020). Clinical presentations encompass edema, hyperemia, pain, localized

warmth, and the formation of a fibrous cord along the vessel path. In instances of infection, drainage of purulent exudate may occur at the site of peripheral intravenous catheter (PIC) insertion. Severity can be classified, with the adoption of scales being recommended. The Infusion Nursing Society (INS) Phlebitis Scale is commonly utilized in Brazil, ranging from 0 to 4, where zero denotes the absence of complications and progresses in accordance with inflammation symptoms and signs, indicating increasing severity of phlebitis, culminating in grade 4, which encompasses indicators of infection presence (Simões *et al.* 2022). Healthcare providers meticulously monitor patients for signs and symptoms of phlebitis during infusion therapy. Employing proper insertion techniques, utilizing suitable catheters, and conducting regular site assessments aid in preventing its occurrence. Should phlebitis arise, treatment often involves removing the irritant, applying warm compresses, elevating the affected extremity, and addressing pain or other symptoms (Guanche-Sicilia *et al.* 2021).

Infections also play a significant role in phlebitis. Bacteria may enter the bloodstream through the catheter site or other pathways, leading to vein infection. This infection can elicit an immune response, subsequently causing inflammation (Sengupta 2019). Phlebitis can also be induced by vein trauma resulting from injury, surgical procedures, or repeated injections. Damage to the vein's inner lining due to trauma can trigger an inflammatory response. Certain medical conditions may predispose individuals to phlebitis. Conditions affecting blood clotting, such as thrombophilia or coagulopathies, heighten the risk of developing blood clots within veins, leading to inflammation. Conditions like vasculitis, characterized by blood vessel inflammation, can also precipitate phlebitis. Additionally, lifestyle factors such as obesity, smoking, and physical inactivity can elevate the risk of phlebitis. Hormonal changes, observed in pregnancy or with hormonal birth control usage, may also influence vein inflammation (Salma *et al.* 2019). The specific causes of phlebitis vary depending on an individual's medical history, underlying health conditions, and environmental factors. Diagnosis typically entails a physical examination, review of medical history, and imaging studies such as ultrasound to evaluate inflammation extent and potential blood clot presence (Jinna and Khoury 2019).

Treatment for phlebitis often involves addressing the underlying cause, managing pain and inflammation, and preventing complications such as deep vein thrombosis (DVT). This can include medications to relieve pain and inflammation, antibiotics for infections, and strategies to promote blood circulation and prevent clot formation (Indriani and Mediani 2021). According to the Infusion Nurses Society (INS) standards, the accepted phlebitis rate is 5% or less. However, research findings suggest a significant discrepancy in reported incidence. Thus, Webster cites that the phlebitis rate ranges from 2.3% - 67% (Webster *et al.* 2019). The worldwide prevalence of phlebitis was in Australia at 12% (Marsh *et al.* 2021), Portugal at 11.5% (Luyu and Jiaquin, 2020), Germany at 7.6% (Seven *et al.* 2019), Spain at 5.6% (Arias *et al.* 2017), Portugal 36.7% (Pires and Silva 2018). There was no information or database on the prevalence of phlebitis in Iraq.

1.1 Problem statement

Infusion therapy, an essential aspect of modern medical care, is pivotal in delivering patients fluids, medications, and nutrients. However, this practice has its challenges. One of the significant complications that can arise from infusion therapy is infusion-associated phlebitis (IAP), characterized by inflammation of the vein lining due to various causes, including chemical irritation, mechanical trauma, and microbial colonization. IAP hinders the therapeutic efficacy of infusions and poses risks of systemic infections, prolonged hospital stays, and increased healthcare costs (Gorski *et al.* 2021).

While studies on IAP have been conducted globally, the prevalence and factors contributing to IAP may vary significantly based on geographical, cultural, and institutional factors. Tikrit Teaching Hospital, situated in Iraq, is a representative healthcare facility in a region where prevailing healthcare practices and patient demographics might impact the occurrence of IAP. Despite its potential implications for patient safety and healthcare resource utilization, more data must be provided on the prevalence and determinants of IAP within the Tikrit Teaching Hospital context.

This point prevalence study seeks to address this knowledge gap by investigating the prevalence of IAP among patients undergoing infusion therapy at Tikrit Teaching Hospital. By identifying the factors associated with IAP occurrence, this study aims to contribute to the enhancement of patient care practices, the optimization of infusion therapy protocols, the reduction of preventable complications within this healthcare setting, and the extent of the prevalence of phlebitis. The insights gained from this research hold the potential to inform evidence-based interventions that enhance patient outcomes and overall healthcare quality.

In Iraq, more than a mere medical challenge, infusion-associated phlebitis (IAP) has emerged as a substantial concern affecting patient care and safety within healthcare facilities. The geopolitical landscape, unique healthcare infrastructure, and prevailing clinical practices in Iraq can contribute to a distinctive set of factors influencing the occurrence and impact of IAP. The scarcity of comprehensive data specific to this context underscores the pressing need for localized research efforts to comprehend the extent of the issue, its underlying causes, and potential avenues for mitigation.

Against this backdrop, the present study delves into the prevalence of infusion-associated phlebitis among patients undergoing infusion therapy at Tikrit Teaching Hospital. This research provides a glimpse into the magnitude of IAP within this vital healthcare institution by capturing a point prevalence snapshot. The outcomes of this investigation could yield invaluable insights into the prevalence of IAP in the Iraqi healthcare landscape, potentially paving the way for tailored interventions and best practices that enhance patient well-being, streamline medical processes, and align with the region's unique requirements.

Through the lens of Tikrit Teaching Hospital, this study endeavors to contribute to the scientific understanding of IAP and the enhancement of patient care delivery in Iraq. The findings may prove instrumental in shaping evidence-based protocols, bolstering infection control measures, and fostering a culture of patient safety that is adaptive to the challenges and opportunities that define the Iraqi healthcare landscape.

As such, this point prevalence study aspires to be a foundational step towards a safer, more efficient, and patient-centric healthcare environment within Tikrit Teaching Hospital and, by extension, across healthcare facilities in Iraq. By addressing the specific nuances of IAP prevalence in this context, the study aims to empower healthcare providers with actionable knowledge to drive meaningful improvements in patient outcomes and quality of care.

1.2 Objectives

- Assessment of the prevalence of Phlebitis-Associated Infusion.
- Find out the relationship between Infusion-related phlebitis and demographics data on patient's age, gender, etc.

1.3 Study question

- What is the prevalence of infusion-related phlebitis?
- Do characteristics affect the development of infusion-related phlebitis?

2. LITERATURE REVIEW

2.1 Overview

Phlebitis, the inflammation of a vein, presents with a constellation of symptoms pain, redness, swelling, and warmth stemming from irritation or damage to the inner lining of the affected vein (Ambardekar 2022).

This condition's origins are diverse and encompass intravenous catheters, infections, physical trauma, blood clotting disorders, and chemical irritation arising from certain medications. The two main categories of phlebitis are superficial phlebitis and deep vein thrombophlebitis. The former affects veins near the skin's surface, often resulting in milder symptoms and less severe complications. In contrast, deep vein thrombophlebitis involves deeper veins and carries a heightened risk of blood clot formation, which can lead to more severe consequences, such as pulmonary embolism (Myhre *et al.* 2022).

Diagnosis involves a combination of physical examination and imaging techniques, like ultrasound, to pinpoint the location and severity of the inflammation. The treatment strategy varies depending on the underlying cause and extent of the condition, with interventions ranging from removing intravenous catheters and pain management to administering antibiotics and blood thinners. It is crucial to promptly seek medical attention when phlebitis is suspected, as early intervention aids in proper management, reduces the risk of complications, and promotes a smoother recovery process (Biggers 2021).

2.2 History

The history of phlebitis dates back centuries, with references to vein inflammation found in ancient medical texts. Hippocrates, often referred to as the "Father of Medicine," documented cases of what is believed to be phlebitis in his writings around 400 BCE. He

described the symptoms of swollen and painful veins, suggesting an understanding of vein-related conditions.

Throughout history, observations and treatments for vein inflammation evolved. In the 1st century CE, the Roman physician Aulus Cornelius Celsus mentioned inflamed veins in his medical writings. The term "phlebitis" itself comes from the Greek word "phleps," which means vein, and "itis," denoting inflammation (Galanaud *et al.* 2013). Limited advancements in medical understanding occurred during the Middle Ages and Renaissance. However, by the 19th century, medical knowledge began to expand, and significant progress was made in recognizing the causes and effects of phlebitis. Dr. Armand Trousseau, a French physician, contributed to understanding phlebitis and its link to blood clot formation (Davies 2020). In the 20th century, medical advancements, such as imaging techniques like ultrasound, allowed for better diagnosis and visualization of inflamed veins. This period also saw the refinement of treatments and preventive measures, especially in post-operative care and intravenous catheter usage.

Today, health professionals have a much clearer understanding of the causes, risk factors, and treatment options for phlebitis. Advanced diagnostic tools, effective medications, and surgical techniques have significantly improved patient outcomes. The field of vascular medicine continues to evolve, focusing on early detection, prevention, and minimally invasive interventions for vein-related conditions (Okazaki 2019). The historical progression of knowledge about phlebitis highlights the continuous efforts of medical practitioners and researchers to understand better and manage this condition, ultimately improving patient care and quality of life (Torné-Ruiz *et al.* 2023).

2.3 Etiology and pathology

The etiology and pathology of phlebitis involve a complex interplay of factors contributing to the inflammation of veins. Phlebitis, characterized by pain, redness, swelling, and warmth along the affected vein, can arise from various causes and mechanisms (Khalidi *et al.* 2019).

2.3.1 Etiology (causes)

1. Intravenous Catheters: The insertion and presence of intravenous catheters can mechanically irritate the vein's inner lining, triggering an inflammatory response (Marsh *et al.* 2020).
2. Infections: Bacteria entering the bloodstream through the catheter site or spreading from other sources can lead to infection-induced phlebitis (Nickel 2020).
3. Trauma: Physical injury or trauma to a vein, often from medical procedures, injections, or external impact, can initiate inflammation (Salgueiro-Oliveira *et al.* 2019).
4. Blood Clotting Disorders: Conditions affecting the body's ability to regulate blood clotting can result in clot formation within veins, prompting an immune response (Papadopoulou *et al.* 2021).
5. Chemical Irritation: Certain medications or solutions administered through IV can irritate vein walls, leading to chemical-induced inflammation (Siagian 2019).
6. Underlying Medical Conditions: Conditions like vasculitis, thrombophilia, and coagulopathies can increase the susceptibility to phlebitis (Gales *et al.* 2023).

2.3.2 Pathology (mechanisms)

Phlebitis primarily involves an inflammatory response triggered by the vein's endothelial cells, the cells lining the inner surface of blood vessels. The inflammation process includes several key steps:

1. Injury or Irritation: Mechanical irritation, chemical exposure, or infections damage the endothelial cells, exposing the underlying tissue (Silva *et al.* 2021).
2. Dilation and Increased Permeability: In response to the damage, the blood vessel dilates, allowing immune cells and proteins to reach the affected area more quickly. Increased permeability leads to fluid and immune cells escaping the surrounding tissue (Raffetto and Khalil 2021).

3. **Immune Response:** Immune cells, such as white blood cells, infiltrate the inflamed tissue to combat potential infection. This contributes to the characteristic redness, warmth, and swelling (Gomez-Lopez *et al.* 2021).
4. **Clot Formation:** In some cases, the body's response to injury can lead to the formation of blood clots within the inflamed vein, especially if clotting disorders are present (Bibi *et al.* 2022).
5. **Tissue Repair and Resolution:** As the underlying cause is addressed and inflammation subsides, the body works to repair the damaged tissue and restore normal blood flow (Zou *et al.* 2022).

Understanding the etiology and pathology of phlebitis helps guide diagnosis, treatment, and prevention strategies. Early recognition and appropriate management are essential to mitigate complications, particularly in deep vein thrombophlebitis cases where blood clotting can lead to more severe consequences (Wong *et al.* 2023).

2.4 Signs and symptoms

The signs and symptoms commonly associated with infusion-related phlebitis (Mihaela *et al.* 2018)

1. **Localized Pain or Discomfort:** Patients often report pain, tenderness, or discomfort around the area where the intravenous (IV) catheter has been inserted. The pain might be described as aching, throbbing, or soreness.
2. **Redness and Swelling:** The skin around the catheter insertion site can become red, inflamed, and swollen. The redness might extend outward from the catheter entry point.
3. **Warmth:** The affected area can feel warm to the touch due to the inflammatory response in the vein.
4. **Palpable Cord:** In some cases, the inflamed vein might feel harder or thicker than usual, creating a palpable cord-like structure under the skin.

5. **Slowed Flow Rate:** If the inflammation is obstructing blood flow through the vein, there could be a reduction in the rate at which fluids or medications are being infused.
6. **Visible Red Streaks:** Red streaks might extend along the vein's path in severe cases, indicating the inflammation's progression.
7. **Fever and Chills:** If the inflammation has resulted in an infection, systemic symptoms such as fever, chills, and malaise might be present.
8. **Limited Range of Motion:** If the affected vein is near a joint, movement might be restricted due to pain and swelling.

It is essential to note that while these symptoms are characteristic of infusion-related phlebitis, they can also overlap with other conditions. If you suspect you have phlebitis or experience any of these symptoms after undergoing IV therapy, it is advisable to seek medical attention. Healthcare professionals can evaluate the situation, determine the cause, and provide appropriate treatment to alleviate symptoms and prevent complications (Brørs *et al.* 2023, Hernández *et al.* 2023) (Figure 2.1).

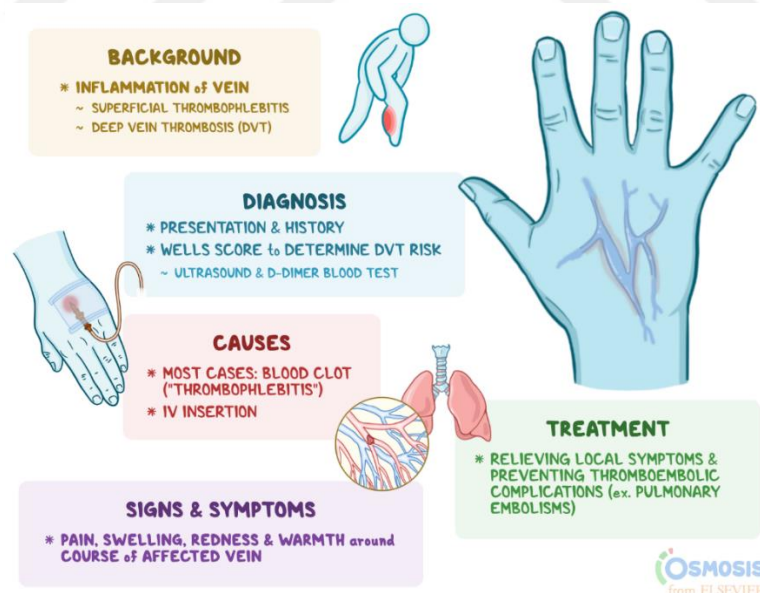


Figure 2.1 Overview of phlebitis (Hernández *et al.* 2023)

2.5 Prevalence

The prevalence of infusion-related phlebitis, which is inflammation of a vein caused by intravenous (IV) therapy, can vary based on multiple factors, including patient population, healthcare setting, and the type of IV catheters used. While specific prevalence rates may differ between studies, here is an overview of the prevalence of infusion-related phlebitis:

Healthcare Settings: Phlebitis is a common complication of IV therapy in hospitals and communities. Its prevalence can be higher in hospital settings, especially in areas like intensive care units, where patients often require prolonged IV therapy due to the severity of their conditions (Indriani and Mediani 2021).

Patient Populations: The prevalence can vary among different patient populations. Individuals who need frequent or prolonged IV therapy, such as those receiving chemotherapy, antibiotics, or parenteral nutrition, might be more likely to experience infusion-related phlebitis (Cottrill 2022).

Types of Catheters: The type of catheter used for IV therapy can influence the prevalence of phlebitis. For instance, peripheral catheters inserted in smaller veins might carry a slightly higher risk due to the potential for irritation and limited blood flow (Yasuda *et al.* 2021).

2.6 Risk factors

Several risk factors can contribute to developing phlebitis, such as vein inflammation. These factors increase the likelihood of irritation or damage to the vein's inner lining, triggering an inflammatory response. Here are some common risk factors of phlebitis (Ying *et al.* 2020, Guanche-Sicilia *et al.* 2021, Suliman *et al.*, 2020, Kotake *et al.* 2023):

1. Intravenous Catheters: The insertion and presence of intravenous (IV) catheters can mechanically irritate the vein, making it more susceptible to inflammation.
2. Duration of Catheterization: Prolonged use of IV catheters increases the risk of phlebitis as more prolonged exposure to the catheter can cause ongoing irritation.
3. Catheter Size and Material: Larger catheters or those made of certain materials might cause more friction against the vein walls, increasing the risk of irritation.
4. Catheter Insertion Site: Catheters inserted into veins with more movement, such as those near joints, can be more prone to irritation and inflammation. Catheters inserted in areas where veins are more delicate or prone to movement, such as the hands or feet, might be at a higher risk.
5. Patient Age: Older individuals might have more fragile veins and be prone to irritation.
6. Multiple Catheter Insertions: Repeated catheter insertions into the same vein can increase the risk of phlebitis due to cumulative damage.
7. Chemical Irritation: Certain medications or solutions administered through IV can irritate the vein's inner lining, leading to chemical-induced inflammation.
8. Infection: Bacteria entering the bloodstream through the catheter site or other sources can cause infection-induced phlebitis.
9. Blood Clotting Disorders: Conditions that affect blood clotting increase the risk of clot formation within veins, which can trigger inflammation.
10. Medical Conditions: Conditions like cancer, heart disease, obesity, and autoimmune disorders can increase the risk of developing phlebitis.
11. Poor Catheter Care: Inadequate hygiene or improper catheter insertion and maintenance can contribute to the development of phlebitis.
12. Smoking and Obesity: Lifestyle factors such as smoking and obesity can impact blood flow and increase the risk of vascular inflammation.
13. Previous History: Individuals who have previously experienced phlebitis are more likely to develop it again, mainly if the same veins are being used for IV therapy.
14. Dehydration: Dehydrated individuals might have thicker blood that flows more slowly, increasing the risk of clot formation and subsequent inflammation.

15. Hormonal Factors: Hormonal changes, such as those occurring during pregnancy or while taking hormonal birth control, can affect blood clotting and increase the risk of phlebitis.
16. Immobilization: Prolonged periods of immobility, such as bed rest or wheelchair use, can slow blood flow and contribute to vein inflammation.
17. Malnutrition: Malnutrition can weaken blood vessels and compromise the immune system's ability to respond to inflammation, increasing the risk of phlebitis.
18. Poor Circulation: Conditions that affect blood circulation, such as peripheral vascular disease or diabetes, can contribute to the development of phlebitis.
19. Chemotherapy: Cancer patients undergoing chemotherapy might have a higher risk of phlebitis due to the impact of chemotherapy drugs on blood vessels.
20. Peripheral Arterial Disease: Individuals with peripheral arterial disease might have compromised blood flow in their extremities, increasing the risk of vein inflammation.
21. Excessive Alcohol Consumption: Heavy alcohol consumption can lead to changes in blood clotting and vessel function, contributing to phlebitis.
22. Immunosuppression: Conditions or medications that suppress the immune system, such as certain autoimmune diseases or organ transplants, can increase susceptibility to infections that lead to phlebitis.
23. Occupational Factors: Certain occupations that require repetitive movements or prolonged standing might increase the risk of phlebitis due to strain on the veins.
24. Genetic Predisposition: Some individuals might have a genetic predisposition that makes them more susceptible to developing phlebitis.

It is important to note that the presence of one or more risk factors does not guarantee the development of phlebitis. However, individuals with multiple risk factors might have a higher likelihood of experiencing this condition. Healthcare professionals consider these risk factors when assessing patients and implementing preventive measures to minimize the occurrence of phlebitis and its potential complications (Ying *et al.* 2020, Igarashi *et al.* 2021, Kotake *et al.* 2023, Kimmel Institute 2019, Milutinović *et al.* 2015).

2.7 Complications

Infusion-related phlebitis, which involves inflammation of a vein due to intravenous (IV) therapy, can lead to various complications. These complications can range in severity and require proper management to prevent further health issues. Here are some potential complications of infusion-related phlebitis (Biggers 2021, Nagarsheth *et al.* 2023, Yasuda *et al.* 2021, Lulie *et al.* 2021):

1. **Infection:** One of the most significant complications is infection at the catheter site or within the bloodstream (septicemia). Bacteria can enter the body through the catheter insertion site, leading to localized or more widespread systemic infection.
2. **Cellulitis:** Inflammation from phlebitis can spread to the surrounding skin and tissues, causing cellulitis. This condition results in redness, swelling, pain, and warmth beyond the immediate catheter site.
3. **Abscess Formation:** In severe cases, infection can lead to an abscess, a pocket of pus that develops in the tissues around the catheter.
4. **Thrombophlebitis:** In some instances, the inflammation can trigger the formation of blood clots within the affected vein. This condition is known as thrombophlebitis and can lead to further complications, including embolism, if the clot dislodges and travels to other parts of the body.
5. **Septic Thrombophilia** is a severe condition in which a blood clot forms in an infected vein. It can result in severe illness and requires immediate medical attention.
6. **Catheter Dysfunction:** The inflammation can impede the proper functioning of the catheter, leading to reduced or disrupted delivery of fluids, medications, or nutrients.
7. **Pain and Discomfort:** Phlebitis can cause significant pain, tenderness, and discomfort at the catheter insertion site, impacting a patient's overall well-being.
8. **Delayed Treatment:** If phlebitis is not recognized and treated promptly, it can lead to delays in administering necessary medications or fluids, negatively affecting patient outcomes.
9. **Catheter Removal:** In severe cases of phlebitis, the catheter might need to be removed prematurely, requiring a new insertion site and potentially causing inconvenience to patients and healthcare providers.

10. Systemic Complications: If an infection spreads through the bloodstream, it can lead to more serious systemic complications, including sepsis, a life-threatening condition.
11. Scarring: Severe cases of phlebitis can result in scarring at the catheter insertion site, potentially affecting future IV placements.
12. Long-Term Vein Damage: Repeated occurrences of phlebitis can lead to long-term damage to veins, making future IV access more challenging.
13. It is important to promptly address any signs or symptoms of phlebitis to prevent these complications (Biggers 2021, Nagarsheth *et al.* 2023, Yasuda *et al.* 2021, Lulie *et al.* 2021).

2.8 Diagnosis

The diagnosis of infusion-related phlebitis, which involves vein inflammation due to intravenous (IV) therapy, typically consists of a combination of clinical assessment and, in some cases, imaging studies. Healthcare providers aim to identify the signs and symptoms of phlebitis, determine its severity, and rule out other potential causes. Here is an overview of the diagnostic process:

1. Clinical Assessment: Healthcare providers will begin by evaluating the patient's medical history and conducting a physical examination. They will focus on the following aspects:
 - a. Symptoms: Inquiring about pain, redness, swelling, warmth, and tenderness at or around the catheter insertion site.
 - b. Onset and Progression: Determining when the symptoms started and how they have progressed over time.
 - c. Previous Catheter Use: Inquiring about any recent or previous IV catheter insertions and whether the patient has a history of phlebitis (Lodzinska *et al.* 2019).

2. Visual Inspection: Healthcare providers will inspect the catheter insertion site and the surrounding area for signs of inflammation, such as redness, swelling, and warmth (Guanche-Sicilia *et al.* 2021).
3. Assessment of Catheter: The catheter will be examined for any signs of clotting, visible damage, or improper placement (Hontoria-Alcoceba *et al.* 2023).
4. Ultrasound: In cases where the diagnosis is uncertain, or there is concern about deep vein thrombophlebitis (clot formation in deeper veins), ultrasound imaging may be performed. Ultrasound can visualize the blood flow and identify the presence of clots (Dang *et al.* 2023).
5. Blood Tests: If there are signs of infection, blood tests might be conducted to assess markers of inflammation (such as elevated white blood cell count) and identify bacterial infection (Kittaka 2020).
6. Patient History: Gathering information about the patient's medical conditions, medications, and previous history of vascular issues can help make an accurate diagnosis (Daud and Mohamad 2021).
7. Rule Out Other Conditions: The healthcare provider will also consider other potential causes of the symptoms, such as cellulitis (skin infection), allergic reactions, or thrombosis (Koh *et al.* 2021).
8. Communication: Open communication between the patient and healthcare provider is crucial. Patients should provide detailed information about their symptoms, medical history, and recent procedures or interventions (Murayama 2021).

The diagnosis of infusion-related phlebitis is primarily clinical, relying on the assessment of symptoms and visual inspection. If there are concerns about more severe complications or deep vein involvement, imaging studies like ultrasound may be employed. Early diagnosis and appropriate management are essential to prevent complications and ensure a favorable outcome (Filippone 2005).

2.9 Medical management

The medical management of infusion-related phlebitis, which involves vein inflammation due to intravenous (IV) therapy, aims to alleviate symptoms, prevent complications, and promote healing. The approach to management can vary based on the severity of the condition and the presence of complications. Here are some common medical management strategies (Park *et al.* 2019, Davidson *et al.* 2019, El-Sayad *et al.* 2023, Ge *et al.* 2019):

1. Catheter Removal and Replacement: If the catheter is identified as the cause of phlebitis, it is often removed and replaced with a new catheter in a different vein. This helps to eliminate the source of irritation and inflammation.
2. Warm Compresses: Applying warm, moist compresses to the affected area can help alleviate discomfort and promote blood flow, which may reduce inflammation.
3. Pain Management: Over-the-counter pain relievers, such as ibuprofen or acetaminophen, can manage pain and discomfort associated with phlebitis.
4. Anti-Inflammatory Medications: Nonsteroidal anti-inflammatory drugs (NSAIDs) can help reduce inflammation and relieve symptoms. However, their use should be based on a healthcare provider's recommendation, considering individual patient factors.
5. Elevating the Affected Limb: Elevating the limb with phlebitis can help reduce swelling and improve blood circulation.
6. Topical Creams: Topical creams containing anti-inflammatory agents can be applied to the affected area to help reduce pain and inflammation.
7. Antibiotics: If there are signs of infection, such as increased redness, warmth, or fever, antibiotics might be prescribed to treat the underlying bacterial infection.
8. Hydration: Proper hydration can help maintain healthy blood flow and reduce the risk of clot formation.
9. Vein Assessment: Healthcare providers might assess the condition of the vein and the patient's overall vascular health to determine the most appropriate course of action.

10. Education and Prevention: Patients should be educated about the importance of reporting early signs of phlebitis and practicing proper catheter care to minimize the risk of recurrence.
11. Regular Monitoring: If the IV therapy needs to continue, healthcare providers may monitor the catheter insertion site for signs of improvement or worsening.
12. Consultation: In cases of severe or complicated phlebitis, a consultation with a vascular specialist might be necessary to determine the best management approach.

Patients must promptly communicate any changes or worsening symptoms to their healthcare providers. Early intervention can help prevent complications and promote a smoother recovery process. Additionally, healthcare providers should follow evidence-based guidelines for catheter insertion, maintenance, and care to minimize the risk of infusion-related phlebitis (Park *et al.* 2019, Davidson *et al.* 2019, El-Sayad *et al.* 2023, Ge *et al.* 2019).

2.10 Nursing management

Nursing management of infusion-related phlebitis is critical in preventing complications, providing patient comfort, and promoting optimal outcomes. Nurses are often at the forefront of patient care and are responsible for assessing, controlling, and managing phlebitis. Here is an overview of nursing management strategies (Collins 2022):

1. Prevention
 - a. Proper Catheter Insertion: Ensuring that catheters are inserted using aseptic techniques and inappropriate veins can minimize the risk of phlebitis.
 - b. Site Selection: Choosing a suitable vein that minimizes movement and friction can reduce the likelihood of irritation.
 - c. Rotation: Rotating catheter insertion sites and removing catheters as soon as they are no longer needed can help prevent prolonged irritation (Collins 2022).

2. Assessment

- a. Regular Monitoring: Nurses should frequently assess catheter insertion sites for early signs of phlebitis, such as redness, swelling, and pain.
- b. Documentation: Accurate and timely documentation of assessment findings is essential for tracking the progression of phlebitis and informing the healthcare team (Collins 2022).

3. Patient Education

- a. Educating Patients: Nurses should educate patients about the signs and symptoms of phlebitis, the importance of reporting any discomfort or changes, and the proper care of the catheter site.
- b. Hygiene and Care: Guidance on maintaining proper hygiene, avoiding unnecessary catheter movement, and not tampering with the site can help prevent complications (Torné-Ruiz *et al.* 2023).

4. Infection Control

- a. Hand Hygiene: Emphasizing the importance of proper hand hygiene before touching the catheter or insertion site helps prevent the introduction of bacteria.
- b. Aseptic Technique: Ensuring all catheter procedures follow strict aseptic techniques helps prevent infection-related phlebitis (Mathur 2011).

5. Pain Management

Pain Relief: Nurses can administer prescribed pain medications or provide non-pharmacological interventions, such as warm compresses, to alleviate discomfort (Boateng *et al.* 2019).

6. Communication

- a. Collaboration: Nurses should communicate effectively with the healthcare team, including physicians, to ensure proper management and timely interventions.
- b. Patient Communication: Listening to patients, addressing their concerns, and explaining the care plan can promote understanding and cooperation (Kwame and Petrucka 2021).

7. Documentation

Detailed Records: Thorough and accurate documentation of assessments, interventions, and patient responses is essential for continuity of care and legal documentation (Demsash *et al.* 2023).

8. Early Intervention

- a. Recognizing Complications: Nurses should be vigilant for signs of worsening phlebitis or other complications and take immediate action.
- b. Catheter Removal: If phlebitis is severe or infection is suspected, nurses may advocate for catheter removal and communicate with the healthcare team (Milutinović *et al.* 2015).

9. Patient Comfort

Easing Discomfort: Providing patients with information about pain management options and ensuring their physical comfort can improve the overall patient experience (Wensley *et al.* 2020).

10. Patient Advocacy

Ensuring Safety: Nurses advocate for patient safety by identifying and addressing concerns related to catheter care, management, or potential complications (Harding *et al.* 2020).

Effective nursing management of infusion-related phlebitis involves a combination of preventive measures, early recognition, proper patient education, and collaboration with the healthcare team. By prioritizing patient safety and well-being, nurses play a crucial role in reducing the incidence and impact of phlebitis (Harding *et al.* 2020, Collins 2022).



3. MATERIAL AND METHOD

3.1 Design of the study

This study is a point prevalence study aimed to determine the prevalence of infusion-related phlebitis in patients with peripheral intravenous catheters.

3.2 Ethical considerations

The researcher also obtained the resolution of research ethics (No. 7) At Cankiri Karatekin University (Data; 9/5/2023). (Appendix 1). The approval of the Training and Human Development Centre of the Salahuddin Health Service was obtained according to resolution (No. 1161), dated (11/4/2023) (Appendix 2). Approval was obtained from all patients before samples were collected.

3.3 Participants and setting of the study

The data was collected from patients at Tikrit Teaching Hospital/Iraq. The hospital where the study was conducted has 250 clinics and 80 intensive care unit beds. It had a total of 330 beds. The total size of the study sample, obtained within one day, was 330 patients. When testing the G- power for sample size according to the effect size, P, and the sample size were 3.0, 0.05, and 330. The G power was 0.99. In the study, 335 catheters were evaluated. (Figure 3.1) and (Figure 3.2).

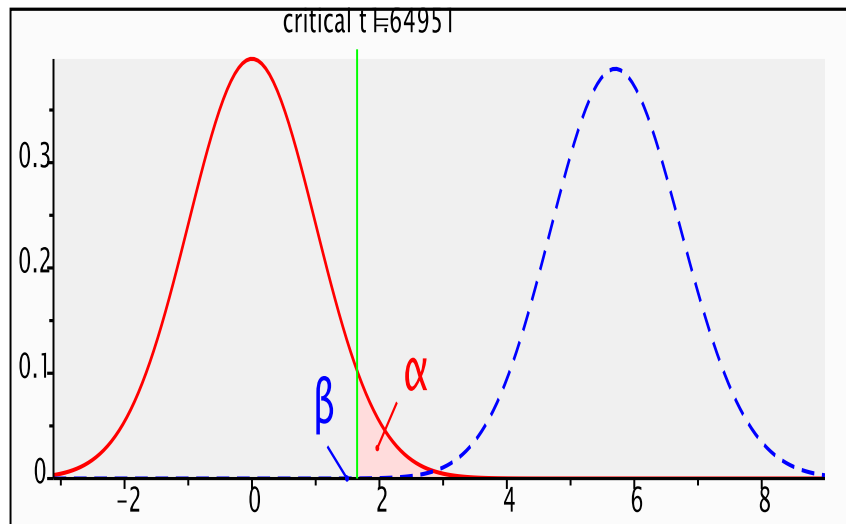


Figure 3.1 G- power analysis (critical t)

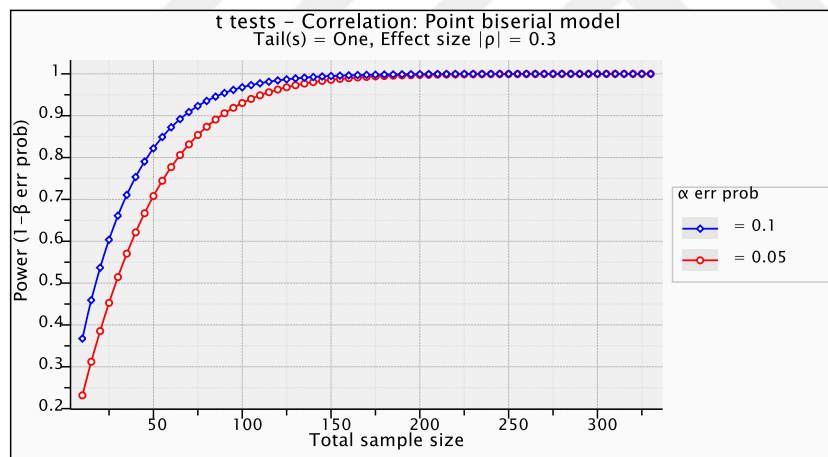


Figure 3.2 G- power analysis (Point biserial model)

3.3.1 Inclusion criteria

- Hospitalized patients of both genders (males and females) over the age of 18 who received intravenous treatment.

- Consent to participate in the study

3.3.2 Exclusion criteria

- Patients under the age of 18 who have not received intravenous treatment and who suffer from psychological and mental problems.
- Refusal to participate in the study.

3.4 Data collection

The steps of a point prevalence study are as follows:

- In the first stage, for the study's validity, patients were interviewed in a single day; for reliability, the entire team was trained simultaneously; for objectivity, two nurses (unit charge nurse and the most experienced nurse of the relevant clinic) worked simultaneously; for accuracy, the patients were observed, and their files were examined.
- In the second stage, in the designated hospital, two nurses, one of whom is an observer, were assigned to every 30 beds.
- In the third stage, before data collection began, half a day of training was given to the nurses determined for each clinic, including "complications of IV catheterizations, phlebitis formation process, evaluation and classification of phlebitis."
- In the fourth stage, data collection was planned for a single day, suitable for the institution where the research would be conducted.
- In the fifth stage, written informed consent was obtained from the patients hospitalized in the clinics where the data would be collected. Data were collected by meeting patients face to face, performing skin evaluations of the patients, and reviewing their medical follow-ups/records.
- In the sixth stage, on the day of the point prevalence, the researcher distributed and collected the forms for data collection to the nurses who would perform the measurement.

- In the seventh stage, nurses, who were arranged according to the number of hospital beds, started collecting data by moving from a single point on the morning of the research.
- In the eighth stage, data were collected by a two-person team at each clinic.
- In the ninth stage, the teams that filled out the data collection forms delivered the forms to the researcher, who was responsible for distributing and collecting them.

3.5 Research instrument

In data collection, data collection forms for characteristics of patients, data collection forms for peripheral intravenous catheters, and phlebitis scale were used.

- ❖ The data collection form for patient characteristics collects data on patients' identifying characteristics (age, gender, day of hospitalization, catheter insertion clinic, diagnosis, chronic diseases, drugs used); this form was developed by the researcher (Groll *et al.* 2010, Gorski 2021) (Appendix 3).
- ❖ The data collection form for peripheral intravenous catheters is data on peripheral intravenous catheters (catheter number, the body in which the catheter is inserted section, the area where the catheter is inserted, the frequency of intervention of the area where the catheter is inserted) questions; This form was developed by the researcher (Gorski 2021) (Appendix 4).
- ❖ The Intravenous Nurses Association (INS 2006) developed the phlebitis scale and psychometric properties by Groll *et al.* (2010) evaluated and used by (Gorski *et al.* 2021). The recommended Phlebitis scale is included. This scale ranges from 0 to 4. Grade "0": No symptoms. Degree "1": Erythema at access site with or without pain; Grade "2": Pain at access site with erythema and edema; Grade "3": Pain at access site with erythema and/or edema, streak formation, palpable venous cord, Grade "4": Pain at access site with erythema and/or edema, streak formation, palpable venous cord greater than 1 in in length; purulent drainage (Appendix 5).

3.6 Data analysis

This study analyzed the data using the SPSS 22 software package. In addition to frequency analyses, the dependency between variables was examined using the Chi-Square dependency test. A significance level of 0.05 was used. It is noted in the data analysis that if $p > 0.05$, there is no significant dependency, whereas if $p < 0.05$, a considerable dependency is indicated.



4. RESULTS

The findings from the study investigating the prevalence of infusion-related phlebitis are detailed in this section. Analysis of the age distribution reveals participants ranging from 19 to 83 years old, with an average age of 43.76. Of the participants, 44.2% are female, and 55.8% are male. In terms of chronic illnesses, 57.9% have no chronic diseases, while 16.4% report chronic kidney failure, 10.1% have diabetes mellitus, and 7.8% exhibit hypertension and heart disease. Examining the clinics where PIVC was placed, 84.8% of patients were in the Emergency Service clinic, and 8.1% were in the Coronary Intensive Care Unit. Regarding PIVC sizes, 56.4% used 22G, and 43.6% used 20G. Placement of PIVCs reveals 36.1% on the right side and 63.9% on the left, with distribution across the back of the hand (35.2%), wrist (20.9%), forearm (25.7%), and inside of the elbow (18.2%). The frequency analysis indicates that 98.5% underwent repeated procedures. Drug administration details show that 69.3% received analgesics, 61.2% antibiotics, 34% steroids, and 39.1% proton pump inhibitors (Table 4.1).

Table 4.1 Distribution of patient characteristics undergoing PIVC (n=335)

Features	Mean ± Sd (Min-Max)	
Age	43.76±16.11 (Min:19-Max:83)	
	n	%
Gender		
Female	148	44.2
Male	187	55.8
Chronic Illness		
Diabetes Mellitus	34	10.1
Hypertension	26	7.8
Heart Disease	26	7.8
Chronic Kidney Failure	55	16.4
None	194	57.9
PIVC Insertion Clinic		
Coronary Intensive Care Unit	27	8.1
Emergency Department	284	84.8
General Intensive Care Unit	4	1.2
Dialysis Unit	11	3.3
Chest Intensive Care Unit	9	2.7
PIVC Size		
22G	189	56.4
20G	146	43.6

Table 4.1 Distribution of patient characteristics undergoing PIVC (n=335) (Continued)

Features	Mean ± Sd (Min-Max)	
Body Part for PIVC Placement		
Right	121	36.1
Left	214	63.9
PIVC Placement Site		
Back of the Hand	118	35.2
Wrist	70	20.9
Forearm	86	25.7
Inside of the Elbow	61	18.2
Frequency of Catheter Application to the Site		
First Time	5	1.5
Repeated	330	98.5
Drugs Administered via PIVC		
Antibiotic	205	61.2
Steroid	114	34
Antiepileptic	5	1.5
Analgesic	232	69.3
Proton Pump Inhibitor	131	39.1

Table 4.2 shows the distribution of phlebitis development in patients who underwent PIVC placement. The prevalence of phlebitis in the study is 64.5%, with 40.9% experiencing Grade 1 phlebitis, 18.8% Grade 2, 3.0% Grade 3, and 1.8% Grade 4 phlebitis.

Table 4.2 Development of phlebitis in patients undergoing PIVC placement

Phlebitis Complication	n	%
Phlebitis Prevalence	216	64.5
No Phlebitis	119	35.5
Phlebitis Grade		
Grade 1	137	40.9
Grade 2	63	18.8
Grade 3	10	3.0
Grade 4	6	1.8

Table 4.3 shows the distribution of nursing interventions in patients who developed phlebitis. When examining the clinics where PIVC was placed, the highest rate of 79.6%

is in the emergency service, and the lowest is in the general intensive care unit. It is also noted that the rate of antibiotic use via PIVC in patients who developed phlebitis is 59.3%.

Table 4.3 Nursing interventions in patients with developed phlebitis (n=216)

Nursing Interventions	n	%
Clinic Where PIVC Was Placed		
Coronary Intensive Care Unit	24	11.1
Emergency Service	172	79.6
General Intensive Care Unit	4	1.9
Dialysis Unit	10	4.6
Chest Intensive Care Unit	6	2.8
Use of Antibiotics via PIVC		
Yes	128	59.3
No	88	40.7

Table 4.4 shows the distribution of phlebitis development in peripheral IV catheter applications according to onset time. Upon examining the onset times, 82.9% of the patients developed phlebitis on Day 1, while 2.3% developed it on Day 5.

Table 4.4 Distribution of Phlebitis Development in Peripheral IV Catheter Applications According to the Time of Phlebitis Onset (n=216)

Phlebitis Onset Time	N	%
Day 1*	179	82.9
Day 2	11	5.1
Day 3	10	4.6
Day 4	11	5.1
Day 5	5	2.3
Total	216	100

*The day the catheter is placed is considered as Day 1.

Table 4.5 presents the distribution of phlebitis development according to the identifying characteristics of patients. It is observed that there is no statistically significant difference between the development of phlebitis and age groups ($p>0.05$). However, non-statistically substantial higher rates of phlebitis development are seen in the 60-69 (70.7%) and 70 and above (76.7%) age groups. There is no statistically significant

difference between the development of phlebitis and gender groups ($p>0.05$). Nevertheless, a non-statistically significant higher rate of phlebitis development is noted in males (65.2%). There is a statistically significant difference between the development of phlebitis and chronic illness groups ($p<0.05$). It is significantly more common for patients with heart failure (88.5%) to develop phlebitis compared to those with chronic illnesses like diabetes, hypertension, and chronic kidney failure.

Table 4.5 Distribution of phlebitis development according to the identifying characteristics of patients

Identifying Characteristics	Phlebitis				Total		χ^2/p
	Developed		Not Developed				
	N	%	n	%	n	%	
Age							
29 Years and Under	44	60.3	29	39.7	73	100	$\chi^2=4.420$ $p=0.491$
30-39 Years	57	66.3	29	33.7	86	100	
40-49 Years	35	58.3	25	41.7	60	100	
50-59 Years	28	62.2	17	37.8	45	100	
60-69 Years	29	70.7	12	29.3	41	100	
70 Years and Above	23	76.7	7	23.3	30	100	
Gender							
Female	94	63.5	54	36.5	148	100	$\chi^2=0.108$ $p=0.743$
Male	122	65.2	65	34.8	187	100	
Chronic Illness Status							
Present	92	65.2	49	34.8	141	100	$\chi^2=0.063$ $p=0.802$
Absent	124	63.9	70	36.1	194	100	
Chronic Illnesses							
Diabetes	20	58.8	14	41.2	34	100	$\chi^2=13.190$ $p=0.004$
Hypertension	11	42.3	15	57.7	26	100	
Heart Failure	23	88.5	3	11.5	26	100	
Chronic Kidney Failure	38	69.1	17	30.9	55	100	

Table 4.6 shows the distribution of phlebitis development according to the characteristics of peripheral IV catheter applications. There is a statistically significant difference between the occurrence of phlebitis and the units where the catheter was applied ($p<0.05$). The rate of patients developing phlebitis in the unit "Emergency Service" (60.6%) is statistically significantly higher compared to units such as the Coronary Care Unit, Dialysis Unit, and General Intensive Care/Chest Care Unit. No statistically significant

difference is observed between the occurrence of phlebitis and the sizes of the catheters used ($p>0.05$). There is also no statistically significant difference between the occurrence of phlebitis and the areas where the catheter was applied ($p>0.05$). Although not statistically significant, it is noted that catheters used in the inner elbow (77%) have a higher rate of phlebitis development. There is no statistically significant difference between the occurrence of phlebitis and the body parts where the catheter was applied ($p>0.05$).

Table 4.6 Distribution of phlebitis development according to peripheral IV catheter application characteristics

Peripheral IV catheter Application Characteristics	Phlebitis				Total		χ^2/p
	Developed		Not Developed				
	N	%	n	%	n	%	
PIVC Placement Clinic							
Coronary Intensive Care Unit	24	88.9	3	11.1	27	100	$\chi^2=*$ p=0.004
Emergency Service	172	60.6	112	39.4	284	100	
Dialysis Unit	10	90.9	1	9.1	11	100	
General Intensive Care / Chest Intensive Care Unit	10	76.9	3	23.1	13	100	
Catheter Number							
Catheter No. 20	88	60.3	58	39.7	146	100	$\chi^2=1.997$ p=0.158
Catheter No. 22	128	67.7	61	32.3	189	100	
PIVC Placement Site							
Back of the Hand	76	64.4	42	35.6	118	100	$\chi^2=6.663$ p=0.083
Wrist	39	55.7	31	44.3	70	100	
Forearm	54	62.8	32	37.2	86	100	
Inside of the Elbow	47	77	14	23	61	100	
Body Part for PIVC Placement							
Right	77	63.6	44	36.4	121	100	$\chi^2=0.059$ p=0.809
Left	139	65	75	35	214	100	
Frequency of Catheter Application to the Site							
First time	0	0	0	0	0	0	-
Repeated	213	64.5	117	35.5	330	100	

*Due to insufficient numbers of subjects in some categories, the Monte Carlo simulation technique was used.

5. DISCUSSIONS

The findings of this study, which was conducted to determine the prevalence of infusion-related phlebitis in patients with peripheral intravenous catheters, are discussed in this section.

5.1 Distribution of patient characteristics undergoing PIVC

Recognizing the multifactorial etiology of phlebitis, numerous studies, including the one by (Lv and Zhang 2020), have explored its characteristics to identify risk factors, guiding the development of effective management strategies and guidelines. Given the variability in results across studies, the current research, led by (Indriani and Mediani 2021), aims to assess phlebitis incidence and evaluate associated risk factors.

Examining the age distribution of participants in the current study, the age range of 19 to 83 years, with an average age of 43.76, is noted. A similar recent study by (Mandal and Raghu 2019) found a higher risk of phlebitis in individuals under 60 years, aligning with studies conducted by (Singh *et al.* 2008, Singh *et al.* 2018). In contrast, (Carballo *et al.* 2004) reported a higher incidence in individuals over 60 years, attributing it to impaired inflammatory response in the elderly. These conflicting results highlight the need for further research to confirm these observations.

Gender distribution in the current study reveals 44.2% females and 55.8% males. Consistent with (Singh *et al.* 2018, Salma *et al.* 2019), the incidence was higher in male patients, while (Mandal and Raghu 2019) suggested a higher risk in females. (Comely *et al.* 2002) found no gender-related risk. The variations may be attributed to differences in study populations, demographics, and methodologies.

A substantial portion (57.9%) of participants without chronic illness aligns with findings from (Singh *et al.* 2008, Salma *et al.* 2019), indicating that individuals experiencing

infusion-related phlebitis may not have pre-existing chronic conditions. However, the presence of chronic kidney failure (16.4%), diabetes mellitus (10.1%), and hypertension and heart disease (7.8%) among those with phlebitis emphasizes the impact of underlying health conditions, consistent with research by (Webster *et al.* 2019).

The distribution of PIVC placements across different clinics, notably 84.8% in the Emergency Service clinic, aligns with (Robinson *et al.* 2005) findings, emphasizing the frequent use of PIVCs in emergency care settings. The lower proportion in the Coronary Intensive Care Unit (8.1%) resonates with (Govindan *et al.* 2021) study, indicating varying PIVC utilization in critical care units.

The detailed analysis of PIVC sizes, placement sites, procedural frequency, and administered drugs provides valuable insights. The prevalence of 22G PIVC usage by 56.4% aligns with (Magerotel *et al.* 2011) recommendations for smaller gauge catheters. The distribution of PIVC placements predominantly on the left side (63.9%) and various anatomical regions corresponds with (Singh *et al.* 2008) observations, highlighting the versatility of PIVC placement. The high frequency of repeated procedures (98.5%) aligns with (Singh *et al.* 2008) findings, reflecting the nature of PIVC lines used for prolonged treatments. Drug administration patterns mirror the diverse therapeutic uses of PIVCs, consistent with (Berman *et al.* 2020) insights.

5.2 Development of phlebitis in patients undergoing PIVC placement

In this study, the prevalence of phlebitis was 64.5%. Among those with phlebitis, 40.9% had Grade 1, 18.8% had Grade 2, 3.0% had Grade 3, and 1.8% had Grade 4 phlebitis (Table 4.2). The high rate of phlebitis in this study, broken down by grade, gives valuable information that can be put into context and compared with results from other studies in the same field. The overall rate of 64.5 percent is in line with the fact that phlebitis is a common problem that can happen after an intravenous catheterization (Salma *et al.* 2019). Despite the INS's recommendation that a phlebitis rate of 5% or below is acceptable, it is difficult to compare studies due to variations in definition and assessment procedures,

study design (incidence versus prevalence), casemix, and rate calculation methods (Infusion Nurses Society 2006).

Nonetheless, 18.09% of patients in a study developed phlebitis (Johansson *et al.* 2008). Indriani and Mediani (2021) determined that the occurrence of phlebitis varies greatly across various studies and areas, with documented rates of occurrence ranging from 1.3% to 61.2%. According to Agustiani and Santosa (2020), Phlebitis is a common illness among patients at Banyumas Regional Hospital who have peripheral intravenous catheters, with a prevalence rate of 18.3%, which exceeds the hospital's benchmark of 5%. A multicenter research conducted between 2017 and 2021 revealed an incidence density of 1.82 instances per 100 catheter-days, along with a total incidence of 10.68% (Cernuda Martínez *et al.* 2023). Yasuda *et al.* (2021) sought to provide a comprehensive account of the occurrence and consequences of peripheral intravascular catheter (PIVC)-related phlebitis in critically sick patients across 23 intensive care units in Japan. The research included a total of 2741 patients and 7118 peripherally inserted central venous catheters PIVCs, with 48.2% of the PIVCs being implanted in the intensive care unit. Phlebitis associated to PIVC was seen in 7.5% of the catheters and 12.9% of the patients during their stay in the intensive care unit. Phlebitis of grade 1 had the highest prevalence at 72.6%, whilst grade 4 had the lowest prevalence at 1.5%. Lv and Zhang (2020) conducted random effects meta-analyses to determine the overall and subgroup incidence rates of phlebitis, as well as the odds ratio between men and females. The findings indicated that the prevalence of phlebitis was 30.7 cases per 100 catheters, and severe phlebitis was seen in 3.6% of patients. Liu *et al.* (2020) conducted a prospective observational research on 1069 patients over a period of 5 months. The majority of problems in phlebitis (88.4%) and infiltration (93.7%) were classified as Grade 1. It is worth noting that 84.4% of patients in the control group had second-grade phlebitis, while 52.2% of patients in the intervention group had first-grade phlebitis (Okyay and Basak 2024). The research revealed that 40.9% of the cases were classified as first-degree phlebitis, while 18.8% were classified as second-degree phlebitis.

In this study, we determined that 40.9% of cases were first-degree phlebitis and 18.8% were second-degree phlebitis. In a study, while 84.4% of patients in the control group got second-grade phlebitis, 52.2% of patients in the intervention group had first-grade phlebitis (Okay and Basak 2024). Putting things into groups based on grade makes it easier to understand the severity spectrum. (Bitencourt *et al.* 2018) conducted a study and found that 26% of participants experienced phlebitis, a rate higher than what is suggested by the literature. However, it was shown that 82.6 percent of the reported cases of phlebitis were Grade 1, which does not mean the cases were more serious. In a prospective study of 80 children, Grade 1 phlebitis was found to be the most common type (46.25 percent, or 37 children), but Grade 2 phlebitis was also very common (23.7 percent) (Nagpal *et al.* 2015). Bitencourt *et al.* (2018) also used a graded system to determine lousy phlebitis. The fact that Grade 1 phlebitis is more common supports the idea that mild forms of phlebitis are more common and may not be as likely to worsen. It emphasizes the importance of always being alert and following the PIVD to spot the early signs and symptoms of phlebitis and keep the patient as safe as possible.

A frequent problem with PIVCs is phlebitis, which requires the removal of the catheter and insertion of a new one at a different location. Recurring episodes can lead to complications with venous access and the need for more invasive operations (Intravenous Nurses Society 1998). According to the Infusion Nurses Society (INS), the rate of phlebitis should not exceed 5%, and if the grade is greater than 2, intervention is necessary. Our estimations are significantly higher than what INS recommends, and we even observed that about 4% of patients get severe phlebitis (Infusion Nurses Society, 2006). This prevalence rate underscores the importance of vigilant monitoring and proper care to minimize the risk of phlebitis in clinical settings. Overall, this distribution of phlebitis severity highlights the spectrum of complications associated with PIVC placement and underscores the importance of proactive measures to minimize risks and optimize patient outcomes.

Additionally, this highlights the need of doing more research and implementing techniques to decrease the occurrence of phlebitis in clinical settings. In comparison to

previous studies, this particular investigation discovered a greater rate. Phlebitis is a widespread health problem in Iraq, primarily caused by factors such as restricted availability of advanced medical equipment, insufficient sterilization and infection control measures, inadequate training and education of healthcare personnel, excessive workload, environmental and socioeconomic factors, overall poor health, chronic diseases, absence of standardized protocols, and cultural and educational influences. Inadequate training and instruction are essential in order to minimize problems like as phlebitis, whereas high patient-to-nurse ratios might result in hurried operations and incorrect insertion methods. Financial limitations may restrict the allocation of resources to healthcare, so affecting the quality of medical equipment and the education of proficient healthcare professionals. Individuals with suboptimal overall physical well-being, especially due to inadequate nutrition and limited availability of preventative medical services, may have an elevated vulnerability to problems such as phlebitis. The absence of established methods for the insertion, maintenance, and replacement of peripheral intravenous catheters (PIVCs) might result in the underreporting of incidents and hinder data-driven advancements. To tackle these problems, a comprehensive strategy is needed, which involves allocating resources to healthcare infrastructure, expanding training and education initiatives, establishing standardized care procedures, and strengthening infection control methods.

5.3 Nursing interventions in patients with developed phlebitis

The current study shows that the highest rate of 79.6% is in the emergency service, and the lowest is in the general intensive care unit. It is also noted that the rate of antibiotic use via PIVC in patients who developed phlebitis is 59.3% (Table 4.3). The finding that 79.6% of PIVC placements in emergency services are linked to phlebitis is in line with studies by (Zochios *et al.* 2014, Mattox 2017), which highlight how common phlebitis is in these types of care settings. The higher rate of phlebitis in this clinical setting is likely because the emergency service often deals with very sick patients who need quick access to a vein. The study by (Shimizu *et al.* 2020) found that the lowest rate of PIVC placement associated with phlebitis was in the general intensive care unit. This suggests that although PIVCs are common in intensive care, the phlebitis rate may differ depending on

the hospital unit. This difference may be due to different patient groups, underlying health conditions, and procedures.

Also, the high rate of antibiotic use through PIVC in patients who got phlebitis (59.3%) shows how complicated intravenous therapy is and how it can increase the risk of phlebitis. This finding fits with what (Silva *et al.* 2020) found, which shows how certain types of drugs might affect the development of phlebitis. Also, the fact that antibiotics are given through PIVC (59.3% of cases) makes us consider whether antibiotic interventions are appropriate and effective.

5.4 Distribution of phlebitis development in peripheral IV catheter applications according to the time of phlebitis onset

The current study reveals that 82.9% of the patients experienced phlebitis on Day 1, whereas only 2.3% developed it on Day 5 (Table 4.4). A study by (Cicolini *et al.* 2014) found that the phlebitis rate increased after the second day. Other studies have found that the rate of phlebitis went up after the first 24 hours (Yasuda *et al.* 2021, Webster *et al.* 2019, Lv and Zhang 2020).

According to a study by Vendramim *et al.* (2020), phlebitis did not happen with catheters in the vein for less than 12 hours. The rate of phlebitis rose between 24 and 48 hours, and it reached 90 to 100 percent up to 96 hours. Abadi *et al.* (2013) did another study that found that phlebitis was most common in the first 40 to 49 hours. Because of several interconnected factors, Phlebitis is more likely to happen at this early stage. For starters, putting in the catheter can damage the vein wall, which can cause an inflammatory response Lv and Zhang (2020). Your vein may react more strongly to the catheter in the first few hours while your immune system adjusts to having the intravenous device there. Phlebitis can be made worse by microbes that enter the bloodstream when the catheter is put in or handled in the early stages. Additionally, changes in the blood vessels caused by the catheter and patient-specific factors such as vein health and immune response may

all play a part in the higher incidence of phlebitis during this period (Yasuda *et al.* 2021, Webster *et al.* 2019, Lv and Zhang 2020).

5.5 Distribution of phlebitis development according to the identifying characteristics of patients

The study indicates no significant age-related difference in phlebitis development. However, a noteworthy difference emerges in the association between phlebitis and chronic illnesses. Heart failure patients (88.5%) are more prone to phlebitis compared to those with conditions like diabetes, hypertension, and chronic kidney failure (Table 4.5). Our results are similar to those of (Daud and Mohamad 2021), who found that phlebitis was common in people aged 60 and up. They also said that men were more likely than women to have phlebitis. Also, almost half of the people who got phlebitis had never had it before, which shows how unpredictable it is. Being aware that many phlebitis cases happened in people who were admitted to orthopedic wards helps us figure out where this problem is most common. Finally, the study found that people with a history of chronic disease had the highest rate of phlebitis. The statistically significant difference in our study between the groups that got phlebitis and those who had a chronic illness, especially the higher rates in people with heart failure, was in line with what (Bayeh *et al.* 2023) found. This supports the idea that people with heart failure have higher rates of phlebitis. Some long-term illnesses, like heart failure, make people more likely to get phlebitis.

5.6 Distribution of phlebitis development according to peripheral IV catheter application characteristics

The study revealed a notable disparity in the incidence of phlebitis based on the units and catheter application. The Emergency Service unit exhibited a higher prevalence of phlebitis (60.6%) than the other units. The study found no notable disparity in catheter sizes or application sites. However, catheters inserted in the inner elbow region (77%) exhibited a higher incidence of phlebitis formation. No statistically significant difference

was observed in the occurrence of phlebitis based on the body parts where the catheter was applied (Table 4.6).

A recent study by Silva *et al.* (2023) on the characteristics of how the Peripheral IV Catheter (PIVC) is used and the incidence of phlebitis also found that environmental factors play a significant role in affecting complications related to catheter use. The strong link between putting in a PIVC in a clinic and getting phlebitis is in line with what other research has found, which stresses how important it is to watch patients and take precautions in outpatient settings closely (Li *et al.* 2023). A recent study by (Singh *et al.* 2021) also found that the need for emergency care may make it more likely for problems to happen during catheter placement. This is in line with the higher rate of phlebitis in emergency services. A recent study by (Gunasundram *et al.* 2021) found that phlebitis happened more often in the Emergency Service than in units like the Coronary Care Unit, the Dialysis Unit, and the General Intensive Care/Chest Care Unit. The study provides much information about specific clinical situations, but there were no significant associations in some areas, such as catheter size and application site. This shows how complicated the factors that affect the development of phlebitis are and the need for more research in this area (Fazal *et al.* 2023).

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

- An overall rate of 64.5 percent among patients undergoing PIVC placement is a high rate of infusion-related phlebitis, according to the study.
- The most common type of phlebitis is Grade 1, followed by Grades 2, 3, and 4. This shows that the cases were of a range of severity levels.
- Antibiotics were given through a PIVC to 59.3% of patients who got phlebitis.
- Most cases of phlebitis occur on the first day after the catheter is placed, which shows how important it is to start monitoring and treating right away.
- Age and gender do not seem to make a statistically significant difference in the development of phlebitis.
- People with heart failure are much more likely to get it, which suggests that they may be at risk.
- Phlebitis occurrence is significantly influenced by the catheter used in the emergency service unit compared to the coronary care unit, dialysis unit, and general intensive care/chest care unit. The Emergency Service has the highest rate of cases compared to the other units.

6.2 Recommendations

- Further research is warranted to explore specific interventions to reduce phlebitis rates, considering factors such as catheter securement techniques and skin preparation.
- Investigate the impact of catheter-related factors, such as size and insertion site, on developing phlebitis to enhance understanding and inform best practices.
- Consider implementing preventative measures, particularly in high-risk patient groups, such as those with chronic illnesses like heart failure, to minimize the occurrence of phlebitis.

- Conduct prospective studies to assess the long-term effects of nursing interventions, antibiotic use, and other clinical practices on the development and recurrence of phlebitis.
- Collaborate with multidisciplinary teams to develop standardized protocols and guidelines for catheter placement and maintenance across various clinical units to improve consistency and patient outcomes.



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APPENDICES

APPENDIX 1. Ethics committee permission

APPENDIX 2. Institutional permit received from Iraq in Arabic and English

APPENDIX 3. Data collection form for characteristics of patients

APPENDIX 4. Data collection form for peripheral intravenous catheters

APPENDIX 5. Phlebitis scale



APPENDIX 1. Ethics committee permission



APPENDIX 2. Institutional permit received from Iraq in Arabic and English

**APPENDIX 2. Institutional permit received from Iraq in Arabic and English
(Continued)**



APPENDIX 3. Data collection form for characteristics of patients

Data collection form for characteristics of patients
1. Age:..... 2. Gender: 1. Female 2. Male 3. Admission Day:..... 4. The clinic where the patient was admitted: 5. Diagnosis:..... 6. Chronic Disease: 1. Diabetes 2. Hypertension 3. Heart Failure 4. Other..... 7. Clinic Where Peripheral Intravenous Catheter Is Inserted:

APPENDIX 4. Data collection form for peripheral intravenous catheters

Data collection form for peripheral intravenous catheters				
Catheter Number Used	1. 22G 2. 20G 3. 18G 4. 16G			
Body Part for PIVC Placement	1. Right 2. Left			
PIVC Placement Site	1. Upper hand 2. Wrist 3. Forearm 4. Inside the elbow 5. Other.....			
Frequency of PIVC Application to the Site	1. First time using 2. Used repeatedly			
IV Drugs Received by the Patient	1. Antibiotic 2. Steroids 3. Antiepileptic 4. Analgesic 5. Proton pump inhibitor 6. Other.....			
The day the catheter was inserted	1. day	2. day	3. day	4. day
Phlebitis Grading				

APPENDIX 5. Phlebitis scale

Phlebitis scale
Grade 0: No symptoms
Grade 1: Erythema at access site with or without pain
Grade 2: Pain at access site with erythema and/or edema
Grade 3: Pain at access site with erythema and/or edema, streak formation, palpable venous cord
Grade 4: Pain at access site with erythema and/or edema, streak formation, palpable venous cord greater than one inch in length, and purulent drainage

CURRICULUM VITAE

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