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Amiodarone Induced Phlebitis

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AMIODARONE INDUCED PHLEBITIS

by

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Abstract

Amiodarone is a commonly used antiarrhythmic medication. When administered through a peripheral intravenous catheter, Amiodarone is associated with a high risk of phlebitis. Phlebitis is characterized by inflammation, swelling, redness, and pain at the vascular point of access and along the vascular route of administration. Phlebitis can cause a delay of treatment, infection, and prolonged hospital stays. A central line is the preferred IV administration route for Amiodarone due to its potential effects of vein irritation. Often times Amiodarone is administered in an emergent setting where attaining a central line is not feasible. Therefore, peripheral IV administration is routinely used placing the patient at a high risk of developing phlebitis.

A review of phlebitis; providing definitions, risk factors, and use of phlebitis scales was conducted. Next, the correlation between Amiodarone and phlebitis was examined; noting intrinsic factors, dose concentration, infusion duration, and nursing interventions. Conclusions were drawn addressing the severity of the correlation of Amiodarone and phlebitis. Amiodarone induced phlebitis incidence and educational needs at a local hospital were assessed. Through collaboration of experts, a patient educational tool and an implementation process were developed to aid in decreasing the Amiodarone induced phlebitis severity at the local hospital. The educational tool included definitions and signs and symptoms of phlebitis. The role of the IV team at the hospital and the role of the patient in IV surveillance were also included in the educational tool. Through education, patients can gain an understanding of phlebitis and the importance of participation in their healthcare. Patient involvement in IV surveillance is expected to result in earlier phlebitis detection; leading to a decrease in phlebitis severity.

Amiodarone Induced Phlebitis

Introduction

Amiodarone is one of the most widely used antiarrhythmic medications and is available in an oral pill form and as an intravenous (IV) injection or infusion. Amiodarone is used to prevent or treat serious cardiac arrhythmias by blocking certain cardiac electrical signals (Amiodarone hydrochloride, 2014). Its intravenous use in the treatment of atrial fibrillation has been on a rise (Siddoway, 2003). Amiodarone is an adrenergic blocker and considered a Class III medication of the Vaughan-Williams classification of antiarrhythmic medications (Amiodarone hydrochloride, 2014). Adrenergic blockers are medications which inhibit specific receptor sites from sympathetic stimulation and causes vasodilation (Elmhurst College, n.d.). Class III antiarrhythmic medications are potassium-channel blockers which slows heart conduction (CV Pharmacology, 2011). Amiodarone may cause serious or fatal side effects including: lung damage, liver damage, heart conduction problems, and thyroid problems (Rx List, 2014). A central line is the preferred IV administration route for Amiodarone due to its potential effects of vein irritation. Often times Amiodarone is administered via a peripheral IV catheter in an emergent setting to treat life-threatening cardiac arrhythmias in the hospital when attaining a central line is not feasible.

IV administered Amiodarone has been linked to a high risk of developing phlebitis. Phlebitis is the inflammatory process of the endothelial wall of a vein (dos Reis, Silveira, Vasques, & de Carvalho, 2009). Phlebitis is characterized by localized pain, erythema, edema, warmth, streak formation, and/or a palpable cord (Alexander, et al., 2010). Phlebitis is a painful condition which may progress to infection and in severe cases may spread to deep veins. Phlebitis may cause a delay in treatment as well as prolonged hospital stays. The four categories of phlebitis relate to the causative factors: chemical, mechanical, bacterial, and post infusion (Alexander, et al., 2010). This project examines chemical phlebitis in relation to the IV medication Amiodarone. Chemical phlebitis occurs when medications or IV solutions irritate the endothelial vein wall, causing an inflammatory response. Medications and IV solutions with a pH of <5 or >9, osmolality of >600 mOsm/L, precipitate formation, or particulate matter can contribute to vein irritation (Alexander, et al., 2010).

A hospital in a suburb of Minneapolis, which specializes in cardiovascular care, commonly uses IV Amiodarone for the treatment of serious cardiac arrhythmias. Registered nurses are responsible for administrating the medication and for monitoring its effects. IV Amiodarone is administered on three departments within the hospital: the Telemetry Unit, the Advanced Cardiovascular Unit, and the Medical/Surgical Intensive Care Unit. Data collected from June to October in 2013 revealed 34% of patients on the Telemetry floor who had received peripheral IV Amiodarone developed phlebitis. The nursing staff were noted to follow a hospital issued protocol outlining the administrations steps and monitoring requirement of IV Amiodarone. However, patients receiving the medication are not aware of the high incidence of phlebitis and what they can do to monitor and report signs and symptoms of the condition.

Purpose

The purpose of this independent project is to develop nursing interventions to decrease the incidence and the severity of Amiodarone induced phlebitis in the patient population at the local hospital. Educational needs of patients who received IV Amiodarone in the hospital have been assessed. The following review of literature of Amiodarone and its correlation to phlebitis served in the development of a patient educational tool (See Appendix A). The educational tool focuses on defining phlebitis, signs and symptoms of phlebitis, and the reporting of phlebitis signs and symptoms. Through education, patients and their family members will be empowered to take an active role in their healthcare by identifying and reporting the signs and symptoms of phlebitis. Ultimately through prompt identification, IV Amiodarone induced phlebitis may decrease in severity.

Significance

Phlebitis is the inflammatory process of the endothelial wall of a vein (dos Reis, Silveira, Vasques, & de Carvalho, 2009). Characteristics of phlebitis include: localized pain, erythema, edema, warmth, streak formation, and/or a palpable cord (Alexander, et al., 2010). This painful condition which may progress to infection and in severe cases may spread to deep veins. Phlebitis may cause a delay in treatment as well as prolonged hospital stays. Research studies of the contributing factors of phlebitis have resulted in inconclusive evidence. However, research studies have shown phlebitis to be correlated to diabetes mellitus, catheter placement in the lower extremities and antecubital fossa, and medication administration. Interventions shown to reduce incidence and severity rates of phlebitis are the utilization of specialized IV teams who

have the responsibility to insert IV catheters and the utilization of a standardized phlebitis scale for determining the presence of phlebitis.

The Intravenous Nurses Society states the acceptable rate of phlebitis is 5% or lower in all populations (Gallant & Schultz, 2006). Data collected from June to October in 2013 revealed 34% of patients on the Telemetry floor at the local hospital who received peripheral IV Amiodarone developed phlebitis. This data is in congruence with incidence rates reported in research studies of Amiodarone induced phlebitis. There is a clear correlation between peripheral IV Amiodarone and phlebitis. However, the studies of contributing factors of peripheral IV Amiodarone induced phlebitis have resulted in inconclusive evidence. A central line is the preferred IV administration route for Amiodarone due to its potential effects of vein irritation. Often times Amiodarone is administered via a peripheral IV catheter in an emergent setting to treat life-threatening cardiac arrhythmias in the hospital when attaining a central line is not feasible.

The purpose of this independent project is to develop nursing interventions to decrease the incidence and the severity of Amiodarone induced phlebitis in the patient population at the local hospital. By decreasing the incidence and severity of Amiodarone induced phlebitis, patient satisfaction and patient outcomes will improve. Evaluation of implemented nursing interventions will provide data of the effectiveness of the interventions. Therefore, institutions may consider implementing similar interventions based on their patients' and organizations' needs and desires.

Theoretical Framework

The Iowa Model for Evidence-based Practice guided this project. The model was created by Marita G. Titler, PhD, RN, FAAN. The algorithm for this model guides the user through the process of creating evidence-based solutions for an identified problem (See Appendix B). The use of three decision points leads the user through feedback circuits. The feedback circuits require analysis of the selected problem, adequate available research, and the appropriateness of the proposed changes.

This model was chosen due to the consideration of the current knowledge, patient population, organization, and the healthcare team. Evidence-based practice plays a vital role in healthcare as it connects what is known to what is practiced. Evidence-based practices are founded in current knowledge and aid in creating safe and effective healthcare practices. By identifying the specific population, organizational needs, available resources, and the healthcare teams' area of expertise, solutions can be created to fit the needs and desires of the patients and organization. This ensures the solution will fit the identified problem to the best of the organizations' ability. For purposes of this project, the model was implemented in six main steps.

Step 1: Identification of Problem

The clinical problem of Amiodarone induced phlebitis was identified. Data collected from June to October in 2013 revealed 34% of patients on the Telemetry floor at the local hospital who received peripheral IV Amiodarone developed phlebitis. The Intravenous Nurses Society states the acceptable rate of phlebitis is 5% or lower in all populations (Gallant &

Schultz, 2006). This baseline data provided evidence for this problem to be a priority for the organization.

Step 2: Formation of a Team

A team was formed; consisting of the researcher/developer and identified experts. Experts were selected upon their experience, knowledge, and availability. The team focused on collaboration with the common goal of improving nursing practice and patient outcomes.

Step 3: Literature Search, Critique, and Synthesize

Research was gathered, critiqued, and synthesized to assemble a literature review. Databases were chosen based upon the problem identified. Individual studies were evaluated on the strength of the research and methodologies. The whole body of evidence was evaluated for appropriateness of utilization in this project.

Step 4: Development of Recommendation

A decrease in phlebitis severity of patients receiving peripheral IV Amiodarone was the outcome selected based on the literature review and collected baseline hospital data. Recommendations were based on patient risk, patient benefit, nursing scope of practice, feasibility, and organizational cost. The recommendation was reviewed by experts and deemed appropriate for adoption into nursing practice.

Step 5: Implementation of Recommendation

An implementation plan was developed. Standard practice guidelines were constructed and education provided to staff. Education entailed purpose of recommendation, timeline of implementation, and resources available.

Step 6: Evaluation of Recommendation

An evaluation of the recommendation was developed using measurable outcomes and feedback. The incidence and severity of phlebitis is to be measured and compared to pre-implementation data. Stakeholder feedback will be sought to identify perceptions of impact and barriers.

Definitions

Definitions are provided to clarify terms for use in this project.

- Cardiac arrhythmia is an abnormal heart rate or rhythm (UCLA Health, n.d.).
- Atrial fibrillation is the most common type of cardiac arrhythmias which occurs when atria chambers fibrillate due to rapid, disorganized cardiac electrical signals (National Heart, Lung, and Blood Institution, 2014).
- Amiodarone is a class III antiarrhythmic drug used to treat and prevent cardiac arrhythmias, including atrial fibrillation (O'Donovan, 2012).
- Phlebitis is an inflammatory process of the vascular endothelial wall and is characterized by local swelling, redness, warmth, and a fibrous cord formation along the venous passageway (dos Reis, Silveira, Vasques, & de Carvalho, 2009).

Process

The PubMed and CINAHL databases were used to gather current literature. The PubMed database was chosen due the nature of the topic, which involved a medication and a medical condition. The PubMed database provides access to millions of citations including MEDLINE, online books, and journals (U.S. National Library of Medicine, n.d.). The use of the

medical subject heading (MeSH) term phlebitis was used. This resulted in 24,395 articles. The publication date was limited to ten years, searches limited to free full text articles, and species limited to human. This narrowed results to 213 articles. Articles were then reviewed and selected based on the relevance to phlebitis risk factors and Amiodarone induced phlebitis, which resulted in two useful articles. PubMed was also searched with the text words "intravenous catheter phlebitis," resulting in 375 articles. The publication date was limited to ten years, searches limited to free full text articles, and species limited to human. This narrowed results to eight articles. Articles were then reviewed and selected based on the relevance to phlebitis risk factors and Amiodarone induced phlebitis, which lead to one useful article.

The Cumulative Index of Nursing and Allied Health Literature (CINAHL) database was chosen due its access to nursing and allied health professional journals (EBSCO Industries, 2014). The CINAHL database was searched with the title keywords of Amiodarone AND phlebitis. This resulted in three articles, all appropriate for use in this project. The title keyword of phlebitis resulted in 157 articles. The publication date was limited to ten years and the language to English which narrowed results to 54 articles. Articles were then reviewed and selected based on the relevance to phlebitis risk factors and Amiodarone induced phlebitis, which lead to seven useful articles. The title keywords of "intravenous catheters" resulted in 99 articles. The publication date was limited to ten years and the language to English which narrowed results to 60 articles. Articles were then reviewed and selected based on the relevance to phlebitis risk factors and Amiodarone induced phlebitis, which lead to three useful articles. Three additional articles were found through the survey of references of useful research publications.

Expert suggestions were taken into consideration. Current literature was necessary to ensure inclusion of the latest information. The literature authors were also considered. Possible biases were addresses. An additional resource was found on IV-therapy.net. This web-based publication resource was found to be relevant and was included in the literature review. The website IV-therapy.net provides IV infusion forums, resources, and links and does not recommend or endorse any services, processes, or commercial products. Another valuable resource included to aid in analysis of the literature was an evidence-based textbook by the Infusion Nurses Society (INS). INS is a national nonprofit organization which provides infusion therapy education, resources, scholarships, and meetings for their members. The INS textbook provided current IV therapy practice recommendations.

It is through the understanding of current evidence and current practice that evidence-based improvements can be generated. In order to effectively develop and implement the patient educational pamphlet, expert reviews were completed. The experts included a Clinical Nurse Specialist (CNS) at the local hospital. The CNS provided insight into the needs of the hospital, staff, and patients as well as the hospital's process of implementing recommendations. The expert opinion of a nursing professor at the University of North Dakota was sought. The professors' experience of nursing research and education provided valuable critique of the quality of research and recommendations of this project. A graduate prepared nurse educator provided feedback on the educational patient brochure. The nurse educator gave expert critique of the educational brochure with focus on learner needs. The Unit Bases Quality Team (UBQT) at the hospital was also consulted. The UBQT focuses on the quality of nursing practice at the hospital with the goal of improving patient outcomes. The UBQT provided feedback on the recommendations and implementation process with regards to the nursing role and responsibilities.

Review of Literature

Possible Risk Factors of Phlebitis

Hospital department of IV insertion.

The hospital department location of where IV insertion took placed was examined in multiple studies resulting in conflicting evidence. The Emergency Department (ER) was reported to have an increased risk of phlebitis when compared to the operating department (Uslusoy & Mete, 2008). Uslusoy and Mete conducted a descriptive comparative study to determine predisposing factors in peripheral IV phlebitis development. A sample size of 568 IV sites was examined with 53 IV catheters placed in the Emergency clinic. Phlebitis developed in 38 (71.7%) of the catheters placed in the Emergency clinic which resulted in a statistically significant p value of 0.000. Furtado (2011) used a quantitative approach to determine peripheral IV phlebitis incidence and predisposing factors in a general surgery department. The sample included 171 patients and 286 peripheral cannulae. Furtado reported 67 (77%) of the 87 IV insertions in the ER developed phlebitis. Factors which may affect the quality of IV insertion in the ER may include patient vein condition and nurse stress in emergency settings.

Salgueiro-Oliveira and Parreira (2012) found no difference in the incidence of phlebitis when comparing rates for patients who received any type of IV therapy on a general ward as compared to those patients treated in the emergency room. The researchers conducted a prospective observational study to determine the phlebitis incidence and risk factors in peripheral IV catheters. The sample consisted of 1,244 catheters, of which 317 catheters were inserted/removed catheters. The number of IV catheters inserted in the ER was 79 and the number inserted on the general ward was 235. Although the incidence rate of phlebitis or p

values in these departments were not reported, the authors stated "*no statistically significant differences were found*" between the departments using the chi-square test and the t-test analysis.

Similarly, no statistically significance of phlebitis incidence was reported in patients on medical versus surgical departments (Malach et al., 2006). Malach et al. (2006) conducted nine point prevalence studies to identify peripheral IV phlebitis rates, determine predictors of phlebitis, and to isolate pathogenic bacteria from phlebitis catheter tips. The study examined 578 IV lines. The medical department included 322 patients with 16 phlebitis reports (5%) while the surgical department included 256 patients with 11 phlebitis reports (4.3%). The catheter insertion techniques were not reported in these studies. It is unknown if techniques differed between departments and whether it was a significant factor in phlebitis incidence.

Specialized IV teams.

The use of specialized IV teams who are responsible for insertion of peripheral catheters have been shown to reduce the incidence of phlebitis. Insertion techniques were reported and analyzed in two studies (Jacobson & Winslow, 2005; Lee et al., 2009). Jacobson and Winslow (2005) recommend the utilization of IV teams in institutions. Jacobson and Winslow (2005) conducted a descriptive study with a sample size of 34 nurses who provided self-reports of approximately ten IV insertions each. The small sample size was a limitation to this study as well as the self-report method. The accuracy and comprehensive of the self-reports are unknown (Jacobson & Winslow, 2005). Lee et al. (2009) conducted a prospective study with a large sample size of 3,165 adult patients with a total of 6,538 peripheral IV catheters. The aim of the study was to determine the risk factors of IV catheter infection in catheters replaced 72 to 96 hour intervals compared to those replaced in 48 to 72 hour intervals. Lee et al. (2009) found

extending the catheter replacement interval was not a risk factor of catheter infection, rather catheter insertion by non IV therapists showed a statistically significant correlation to local catheter infections.

IV insertion site.

The IV insertion site may be a factor in phlebitis incidence. Insertion in the antecubital fossa, for example, has been associated with an increased risk of phlebitis (Uslusoy & Mete, 2008; Furtado, 2011). One possible reason for this correlation may be the movement of the catheter through bending of the arm. Uslusoy and Mete (2008) conducted a descriptive comparative study to determine predisposing factors in peripheral IV phlebitis development. A large sample size of 568 IV sites was examined with 125 IV catheters placed in the antecubital fossa. Phlebitis was reported in 79 (63.2%) of these catheters with a p value of 0.049. Furtado (2011) used a quantitative approach in their study of 286 peripheral cannulae with 72 cannulae in the antecubital fossa. A reported p value of 0.001 suggested a relationship between the antecubital fossa location and phlebitis incidence.

Hand, forearm, and wrist sites did not show a statistical significance in phlebitis incidence (Salgueiro-Oliveira & Parreira, 2012). The prospective observational study by Salgueiro-Oliveira and Parreira (2012) had a large sample size of 1,244 catheters including a total of 317 inserted/removed catheters. Upper extremity IV catheters accounted for 93.9% of the sample. Phlebitis was reported in 42.2% of patients with an upper extremity IV catheter and no statistically significant difference between the anatomic locations of hand, forearm, and wrist in phlebitis incidence was noted. Specific phlebitis incidence rates for each anatomic location were not reported.

Lower extremity IV catheters are seldom used and have been associated with an increased risk of phlebitis (Nassaji-Zavareh & Ghorbani, 2007; Salgueiro-Oliveira & Parreira, 2012). Nassaji-Zavareh and Ghorbani (2007) conducted a prospective study with a sample size of 300 patients with the purpose of examining phlebitis incidence and risk factors. No data was reported on IV medications or infusions. Of the 300 patient sample, only 13 patients had lower extremity catheters. Yet a significant incidence of 76.9% of phlebitis was found with an odds ratio (OR) of 3.25 and a 95% confidence interval (CI) of 2.26 to 4.67.

Salgueiro-Oliveira and Parreira (2012) had a sample size of 1,244 catheters which included a total of 317 inserted/removed catheters. IV catheters in the lower extremities accounted for 19 patients in the sample of which 13 developed phlebitis. Salgueiro-Oliveira and Parreira (2012) reported patients with IV catheters in an upper extremity had a <72% chance of phlebitis development than those with a lower extremity IV catheter; OR of 0.281 and a 95% CI of 0.097-0.807.

IV medication and number of drug administrations.

IV medications have shown to be a significant factor in phlebitis development. Uslusoy and Mete (2008) conducted a descriptive comparative study to determine predisposing factors in peripheral IV phlebitis development. A sample size of 568 IV sites was examined. Specific drugs were not reported; instead categories were used. These categories included: antibiotics, antibiotics and other drugs, drugs other than antibiotics, and no drugs. A significant difference was found between patients who received any type of IV drug therapy and patients who did not receive any medication ($p = 0.002$). Phlebitis developed in 60.8% of those who received IV drugs; resulting in a statistically significant correlation between drug treatment and phlebitis

(Uslusoy & Mete, 2008). No statistically significance was found between the different IV medication categories and the phlebitis rate.

Antibiotics were linked to a higher incidence of phlebitis in studies (Furtado, 2011; Salgueiro-Oliveira & Parreira, 2012). Furtado (2011) used a quantitative approach to determine peripheral IV phlebitis incidence and predisposing factors in a general surgery department. The sample included 171 patients and 286 peripheral cannulae. Furtado (2011) categorized medications as: antibiotics only, antibiotics and other, and medications other than antibiotics. Of the 88 patients who received only antibiotics through a peripheral IV catheter, 61 (69.3%) developed phlebitis. An IV catheter used solely for administration of antibiotics resulted in a higher incidence rate of phlebitis ($p < 0.05$). Salgueiro-Oliveira and Parreira (2012) had a sample size of 1,244 catheters which included a total of 317 inserted/removed catheters. They reported antibiotics administered more than 15 times: Meropenem, Amoxicillin-clavulanate, Azithromycin, Levofloxacin, Cefuroxime, and Pipercillin/tazobactam. The study made comparisons of these antibiotics as well as of those who received any type of antibiotic to those who did not receive antibiotics. Salgueiro-Oliveira and Parreira reported the chance of developing phlebitis increased 1.92 times with IV antibiotic administration with an OR of 1.916 and a 95% CI of 1.184-3.100. The odds increased 2.3 times with Levofloxacin administration (OR: 2.264; CI: 1.031-4.968) and 2.5 times with Azithromycin administration (OR: 2.468; CI: 1.168-5.213).

The frequency of IV drug administrations may be a factor in the incidence of phlebitis. A 50% increase in risk was reported when drugs were administrations four times per day as compared to one to three daily administrations (Uslusoy & Mete, 2008). This descriptive comparative study was conducted to determine predisposing factors in peripheral IV phlebitis

development. A sample size of 568 IV sites was examined. The medication administration frequencies investigated included: one to three time daily, four to six times daily, seven to nine times daily, and ten or more times daily. Phlebitis incidence increased when medication administration frequency was four or more times per day ($p = 0.003$).

Drug administrations of more than seven times per day resulted in a higher phlebitis incidence rate (Furtado, 2011). This quantitative study was conducted to determine peripheral IV phlebitis incidence and predisposing factors in a general surgery department. The sample included 171 patients and 286 peripheral cannulae. The medication administration frequencies in this study included: three or less administrations per day, four to six administrations per day, and seven or more administrations per day. Patients who received seven or more medication administration per day had a phlebitis incidence rate of 73.1% ($p = 0.012$). The number of patients who received seven or more administrations per day was 209, while the number of patients who received three or less daily medication administrations and four to six daily administrations was 34 and 43 respectively.

However, Salgueiro-Oliveira and Parreira (2012) found no significant differences between the number of drug administrations and phlebitis. Salgueiro-Oliveira and Parreira (2012) conducted a prospective observational study to determine the phlebitis incidence and risk factors in peripheral IV catheters. The sample consisted of 1,244 catheters including a total of 317 inserted/removed catheters. The study examined the number of IV antibiotic administrations and reported the mean number of 23.89, standard deviation of 21.41, and median number of 18; p value not reported.

Types of infusion fluids.

The type of infusion fluids may influence the risk of phlebitis. Hypertonic fluids and isotonic fluids with potassium chloride (KCL) were found to have a correlation to phlebitis when compared to isotonic fluids (Uslusoy & Mete, 2008). This descriptive comparative study was conducted to determine predisposing factors in peripheral IV phlebitis development. A sample size of 568 IV sites was examined. Categories in this study included: isotonic, isotonic with KCL, hypertonic, and no IV fluids. A significant difference between rate of phlebitis and IV fluids were reported ($p = 0.000$). The lowest rate of phlebitis (44.7%) was found with isotonic IV fluids. The rate of phlebitis with hypertonic IV fluids was 72.4% and 63.6% with isotonic fluids with KCL. However, Salgueiro-Oliveira and Parreira (2012) found no significant difference between serum infusions and phlebitis development. This prospective observational study was conducted to determine the phlebitis incidence and risk factors in peripheral IV catheters. The sample consisted of 1,244 catheters including a total of 317 inserted/removed catheters. The sample study included only one hypotonic serum infusion, three hypertonic serum infusions, and 226 isotonic serum infusions. Alexander, et al., (2010) stated vein damage may occur with hyperosmolar solutions. Solutions may become hyperosmolar when electrolytes, antibiotics, and certain medications are mixed with isotonic solutions (Alexander, et al., 2010). The mixing of medications in fluids may result in an increased risk of phlebitis when solutions become hyperosmolar.

IV dwell time.

The Center for Disease Control (2002) recommended rotating IV sites every 72-96 hours to reduce the risk of infection and phlebitis. This recommendation appears to be controversial.

Uslusoy and Mete (2008) reported catheters in place for >24 hours were 1.6 times more likely to develop phlebitis than catheters in place for zero to 24 hours ($p = 0.000$). This descriptive study examined 568 IV sites with the purpose of identifying predisposing factors of peripheral IV phlebitis. The technique of catheter insertion was not reported. Staff nurses collected 9% of the data which raises issues of reliability.

Another study found catheters in place for 25-48 hours to have reduced rates of phlebitis when compared to catheters in place for >72 hours (Furtado, 2011). This quantitative study was conducted to determine peripheral IV phlebitis incidence and predisposing factors in a general surgery department. The sample included 171 patients and 286 peripheral cannulae. Catheters in place for 48 hours or longer had an increased phlebitis incidence rate of 76.9% ($p= 0.000$). The IV catheter insertions in this quantitative study were done by ward nurses without standard guidelines or practice recommendations. Registered nurses working in the hospital surgical department collected data for this study which leads to a risk of reliability.

On the contrary, other studies found no correlation between catheter dwell times of 72 hours and phlebitis and recommend leaving IV catheters in place until no longer clinically indicated (Salgueiro-Oliveira & Parreira, 2012; Webster et al, 2008). Salgueiro-Oliveira and Parreira conducted a prospective observational study to determine the phlebitis incidence and risk factors in peripheral IV catheters. The sample consisted of 1,244 catheters including a total of 317 inserted/removed catheters. Although the incidence rate of phlebitis or p values were not reported for the dwell time of catheters, the authors stated no statistically significant differences were found between using the chi-square test and the t-test analysis. Different nursing team members contributed to the collection of data in this study which presents a risk to reliability.

Webster et al. (2008) conducted a randomized controlled trial with a sample size of 755 patients to compare routine replacement of IV sites with replacement of IV sites only when clinically indicated. The control group (routine replacement of IV site every 72 hours) had a phlebitis incidence rate of 33% and the intervention group (replacement of IV site only when clinically indicated) had a phlebitis incidence rate of 38%. The difference was found to be not significant (relative risk 1.15, 95% CI 0.95 to 1.40). A limitation to this study is the lack of a standardized approach for outcome monitoring; medical records were the main source.

Intrinsic and extrinsic factors.

The intrinsic factors of gender and age were examined in multiple studies of phlebitis. No statistically significance was found by Salgueiro-Oliveira and Parreira (2012), Furtado (2011), and Uslusoy and Mete (2008). Salgueiro-Oliveira and Parreira conducted a prospective observational study to determine the phlebitis incidence and risk factors in peripheral IV catheters. The sample consisted of 1,244 catheters including a total of 317 inserted/removed catheters. The mean age of the sample was 75.92 with a standard deviation of 14.52 and 50.6% were male. Gender and age were not found to be significant factors in phlebitis incidence. Although the incidence rate of phlebitis or p values were not reported for the age or gender factors, the authors stated use the chi-square test and the t-test analysis to determine significance.

Furtado (2011) also examined intrinsic factors. This quantitative study was conducted to determine peripheral IV phlebitis incidence and predisposing factors in a general surgery department. The sample included 171 patients with 286 peripheral cannulae. Age and gender were not found to be significant factors in phlebitis incidence ($p > 0.05$). The phlebitis incidence rate was 76.8% in those with diabetes mellitus and found significant ($p = 0.03$). To note, the sample consisted of 217 patients without diabetes mellitus and 69 patients with the condition.

Uslusoy and Mete (2008) conducted a descriptive study which examined 568 IV sites to identify predisposing factors of peripheral IV phlebitis. Age was not found to be a significant factor in the rate of phlebitis (p= 0.505). This study categorized age in 10 year intervals, starting at age 18 and ending with a category of 70 years of age and older. The sample varied in age groups; 41 patients were18 to 29 years old, while 128 patients were 70 years or older. Gender was not found to be a significant factor in the rate of phlebitis (p= 0.080).

Malach et al. (2006) conducted nine point prevalence studies to identify peripheral IV phlebitis rates, determine predictors of phlebitis, and to isolate pathogenic bacteria from phlebitis catheter tips. The study examined 578 IV sites. Age groups were divided into two categories: 18 to 65 years of age and 65 years of age and older. No statistical significance was found. Limitations included subjectivity in phlebitis diagnosis criteria and investigators' influence on survey results with the point prevalence study method (Malach et al., 2006).

Nassaji-Zavareh and Ghorbani (2007) also reported a correlation between diabetes mellitus and phlebitis and also found an increase incidence of phlebitis in patients < 60 years old when compared to patients 60 years and older. This prospective study had a sample size of 300 patients and was conducted to examine phlebitis incidence and risk factors. Phlebitis was 7.8 times more common in those with diabetes mellitus than those without diabetes mellitus (OR 7.78, 95% CI 4.59 to 13.21). Patients 60 years and older had a lower incidence of phlebitis than patients younger than 60 years of age (OR 1.18, 95% CI 0.79-1.74). The female gender was found to be a significant factor in phlebitis incidence (OR 1.50, 95% CI 1.01-2.22).

Wallis et al. (2004) conducted a secondary data analysis from a randomized controlled trial with the aim to determine risk factors for peripheral IV catheter failure. The sample size included 3,283 patients with 5,907 catheters. The majority of the sample was male (64.3%).

The female gender was found to have a significant association with the development of phlebitis (p= 0.001). Limitations included lack of data regarding IV medication use, patient characteristics, IV dressings, IV securement, and IV flushing (Wallis et al., 2004).

Catheter size.

Multiple studies analyzed whether a relationship between IV catheter size and phlebitis exists. A gauge size of 18 was found to be associated with phlebitis (Furtado, 2011; Wallis et al., 2014). Furtado (2011) conducted a quantitative study to determine peripheral IV phlebitis incidence and predisposing factors in a general surgery department. The sample included 171 patients with 286 peripheral cannulae. This study reported 18 gauge cannulae to be associated with an increased risk of phlebitis; phlebitis incidence rate of 72.5% (p= 0.031). Wallis et al. (2004) conducted a secondary data analysis from a randomized controlled trial with the aim to determine risk factors for peripheral IV catheter failure. The sample size included 3,283 patients with 5,907 catheters. Wallis et al. reported an increase in phlebitis rate with 18 gauge or larger catheters (p= 0.14).

No correlation between IV catheter size and phlebitis was found in other studies (Salgueiro-Oliveira & Parreira, 2012; Nassaji-Zavareh & Ghorbani, 2007; Uslusoy & Mete, 2008). Salgueiro-Oliveira and Parreira conducted a prospective observational study to determine the phlebitis incidence and risk factors in peripheral IV catheters. The sample consisted of 1,244 catheters including a total of 317 inserted/removed catheters. The sample included four patients with 18 gauge catheters, 154 patients with 20 gauge catheters, and 108 patients with 22 gauge catheters. No difference between catheter gauge size and phlebitis incidence was reported. The authors stated use of the chi-square test and the t-test analysis to determine significance (specific statistics not reported). Nassaji-Zavareh and Ghorbani conducted a prospective study with a

sample size of 300 patients to examine phlebitis incidence and risk factors. The gauge sizes in this study were 18 and 20. No significant relationship was found between gauge sizes and phlebitis rates (OR 1.11, 95% CI 0.75 to 1.65). Uslusoy and Mete conducted a descriptive study which examined 568 IV sites to identify predisposing factors of peripheral IV phlebitis. Uslusoy and Mete reported catheter gauge sizes of 16, 18, 20, and 22. The number of patients varied within the categories of catheter gauge sizes. Four patients were included in statistical analysis of catheter gauge size of 22 while 174 patients were included with a catheter gauge size of 20. No significant difference was found between phlebitis incidence and catheter size (p= 0.337). IV catheter size and phlebitis may be dependent upon the vein size. Alexander, et al., (2010) have noted phlebitis to be associated with large-gauge catheters placed in a small veins which causes vein inflammation and irritation.

Phlebitis Scales

The phlebitis scales used in the studies examined varied. Therefore, diagnosis and severity of phlebitis may be difficult to compare. The use of IV scales in documenting phlebitis has shown to be valuable. The Infusion Nurses Society (INS) phlebitis scale was found to be valid and reliable and recommended to be used in both the acute care and community settings (Groll, Davis, Mac Donald, Nelson, & Virani, 2010). Groll et al. (2010) conducted an observational study to evaluate the psychometric properties of the INS measurement scales of phlebitis severity and infiltration in peripheral vascular access devices. This study included 182 patients. Interrater reliability for the Phlebitis scale was found to be statistically significant with a kappa value of 0.450 and p <0 .001. In terms of validity, a significant agreement between identified chart cases of phlebitis and observed cases with the Spearman p = 0.39, $p < 0.01$. Groll et al. (2010) reported an increase in phlebitis identification by nurses when the INS scales

were implemented which may be due to a heightened awareness through use of the tool. Limitations of this study included a lack of cases with phlebitis and infiltration ratings of 4 (very severe) and few cases of a rating of 3 (severe) (Groll et al., 2010).

The use of a phlebitis scale aided in a 50% decrease of Amiodarone related phlebitis (Spiering, 2013). This study compared the severity of phlebitis before and after the implementation of a guideline using a phlebitis scale. The use of the tool required visual inspection of IV sites and patient report of pain. There is compelling evidence of a statistically significant reduction of the severity of phlebitis through the use of a phlebitis scale, although full details of study are unknown. This study is unpublished; abstract currently available.

Pain in Detecting Phlebitis

Pain has been associated with phlebitis development and reported to be a significant phlebitis indicator. Malach et al. (2006) conducted nine point prevalence studies to identify peripheral IV phlebitis rates, determine predictors of phlebitis, and to isolate pathogenic bacteria from phlebitis catheter tips. The study examined 578 IV lines. Pain was reported as a statistically significant predictor of phlebitis with a p value of < 0.001. Norton et al. (2013) conducted a retrospective chart review to determine the incidence and contributing factors of Amiodarone-induced phlebitis. The sample size consisted of 105 patients. A phlebitis incidence rate of 40% was reported as well as a phlebitis recurrence rate of 50%. Pain was found to be the most common reported indication of phlebitis with 45 patients reporting pain at the IV insertion site. The Center for Disease Control (2002) states pain to be a sign of phlebitis and recommends the removal of peripheral IVs when patients develop tenderness or other signs of phlebitis (Center for Disease Control, 2002).

Patient Empowerment

Empowering patients to take an active role in their healthcare may aid in lessening the severity of phlebitis. This is due to the subjectivity of pain, which is an indicator of phlebitis. Wåhlin, Ek, and Idvall (2006) conducted open-ended interviews of 11 patients in two intensive care units with the purpose to describe patient empowerment in an intensive care situation. Findings suggest in order to empower patients, staff need to allow patients to participate in their care to their own desired degree of participation. Communication is vital in the nurse patient relationship and will aid in determining patients' expectations and desires. McGuckin and Govednik (2013) reviewed current literature on the willingness of patients to be empowered, empowerment barriers, and hand hygiene programs which include patient empowerment and hand hygiene improvement. A total of 22 full papers on patient empowerment and hand hygiene was reviewed. Researchers concluded patients possess a willingness to be empowered and there is a need for health care workers to help their patients become empowered by providing explicit permission.

Correlation of Phlebitis and Intravenous Peripheral Amiodarone

A statistically significant correlation between peripheral IV Amiodarone and phlebitis in hospitalized patients requiring the medication to treat or prevent cardiac arrhythmias has been reported (Boyce & Yee, 2012; de Fatima Suardi Martinho & Rodrigues, 2008; Mowry & Hartman, 2011; Norton et al., 2013; Slim, Roth, Duffy, Boyd, & Rubal, 2007). These studies have been retrospective chart reviews and/or observational studies as well as case report.

Boyce and Yee (2012) conducted an observational retrospective chart review to determine the incidence and severity of phlebitis in patients who received peripheral IV Amiodarone. A small sample size of 12 patients was included in this study. Eight patients

developed phlebitis (67%). This high incidence of phlebitis prompted the study to stop in order to bring awareness and educate healthcare members. de Fatima Suardi Martinho and Rodrigues (2008) conducted a descriptive exploratory cross-sectional quantitative study. The purpose of this study was to examine phlebitis occurrence in patients who received peripheral IV Amiodarone and to describe nursing interventions for those who developed phlebitis. A small sample size of 40 patients was examined. Phlebitis was reported in 55% of the sample. Mowry and Hartman (2011) conducted an observational and retrospective chart review study to determine phlebitis incidence rates in cardiothoracic surgical patients who received peripheral IV Amiodarone and/or Vancomycin and to examine the effects of the concentration of Amiodarone on the development of phlebitis. The sample included 2,423 patient records. Thrombophlebitis was found in 10.6% of the sample who received only Amiodarone. Norton et al. (2013) conducted a retrospective chart review to determine the incidence and contributing factors of Amiodarone-induced phlebitis. The sample size consisted of 105 patients. A phlebitis incidence rate of 40% was reported as well as a phlebitis recurrence rate of 50%. Slim et al. (2007) conducted a retrospective chart review study to determine the association of peripheral intravenous Amiodarone infusion at current dose recommendation and the risk of phlebitis. The sample consisted of 273 coronary artery bypass or valve surgical patients. The incidence of phlebitis in patients receiving peripheral IV Amiodarone was 13.9%. A statistically significant association between phlebitis development and peripheral IV Amiodarone was found (p= 0.006, OR 12.1, 95% CI 1.9 to 78.0). Many factors have been examined within these studies including: intrinsic factors, dose concentration, infusion duration, and nursing interventions.

Intrinsic factors.

Researchers have examined the effects of intrinsic factors on phlebitis development in those who received peripheral IV Amiodarone. Age and gender were the main factors studied and resulted in inconsistent findings. de Fatima Suardi Martinho and Rodrigues (2008), reported the age of 65 years or greater to be the most significant intrinsic factor in patients receiving peripheral IV Amiodarone. de Fatima Suardi Martinho and Rodrigues conducted a descriptive exploratory cross-sectional quantitative study. The purpose of this study was to examine phlebitis occurrence in patients who received peripheral IV Amiodarone and to describe nursing interventions for those who developed phlebitis. A small sample size of 40 patients was examined. Two intrinsic factors were reported: age over 65 years and poor vein condition. Those who developed phlebitis and were 65 years of age or older consisted of 14.9% of the sample. Poor vein condition was present in 3.5% of the sample who developed phlebitis. Statistical analysis not reported. A semi-structured script was used to collect data which may have included subjectivity by data collector(s).

No correlation of age or gender to phlebitis incidence or severity was found in other studies (Boyce & Yee, 2012; Norton et al., 2013; Slim et al., 2007). Boyce and Yee (2012) conducted an observational retrospective chart review to determine the incidence and severity of phlebitis in patients who received peripheral IV Amiodarone. A small sample size of 12 patients was included in this study. Age ranged from 50 to 87 years of age in the sample population. Statistical analysis not provided. Accurate assessment of the criteria of pain in diagnosing phlebitis was unknown as well as timeliness of IV discontinuation when indicated were limitations to this study. Norton et al. (2013) conducted a retrospective chart review to determine the incidence and contributing factors of Amiodarone-induced phlebitis. The sample

size consisted of 105 patients with 75 male and 30 female. The male gender was not found statistically significant (OR 1.49, 95% CI 0.57-4.06). This study had a limitation relating to a lack of nurse documentation on reasons for IV discontinuation which lead to the exclusion of patients. Slim et al., (2007) conducted a retrospective chart review study to determine the association of peripheral intravenous Amiodarone infusion at current dose recommendation and the risk of phlebitis. The sample consisted of 273 coronary artery bypass or valve surgical patients. Gender was not found to be a significant factor in phlebitis incidence with or without peripheral IV Amiodarone administration ($p > 0.48$). Age was not found to be a significant factor in phlebitis incidence with or without peripheral IV Amiodarone administration ($p > 0.51$).

Dosage concentration.

Inconsistent data were found regarding whether a lower dose concentration correlates to a lower risk of phlebitis development in patients receiving peripheral IV Amiodarone. The United States Food and Drug Administration recommendation of IV Amiodarone dose concentration ranges from 0.5 mg/ml for maintenance infusions to 1.8 mg/ml for slow loading dose infusions (U.S. Department of Health, 2011). The dose concentration of < 2 mg/ml has been found to have a similar correlation of phlebitis as higher dose concentrations. Slim et al., (2007) compared the Amiodarone dose concentration of < 2 mg/ml (exact dose not reported) to previous studies using > 3 mg/ml and found the dose concentration not be a statistical significant factor in phlebitis incidence. This retrospective chart review study was conducted to determine the association of peripheral intravenous Amiodarone infusion at current dose recommendation and the risk of phlebitis. The sample consisted of 273 coronary artery bypass or valve surgical patients. Phlebitis incidence in those who received peripheral IV Amiodarone was 13.9% (p= 0.001, 95% CI 2.6 to 25.2%). This study used the original Amiodarone preparation as well as several

generic forms. Researchers noted the study was unable to examine interaction among other risk factors of phlebitis.

A case report involving a 2mg/ml peripheral IV Amiodarone infusion resulted in septic thrombophlebitis (Aljitawi, Shabaneh, & Whitaker, 2005). The case report described a patient who received peripheral IV Amiodarone on two occasions during the hospital stay; using a peripheral IV site in each arm. The patient developed a severe case of bilateral superficial thrombophlebitis. Although case reports are considered to have low level evidence, this report provides compelling evidence of the potential severity of phlebitis.

A lower dose concentration of 1.8 mg/ml was noted to be associated with the development of phlebitis (Norton et al., 2013). Norton et al. (2013) conducted a retrospective chart review to determine the incidence and contributing factors of Amiodarone-induced phlebitis. The sample size consisted of 105 patients. Peripheral IV Amiodarone was administered with a concentration of 1.8 mg/ml and phlebitis incidence among those who received the medication was 40%.

It may be debatable whether the dose concentration of 1.2 mg/ml or lower reduces the risk of phlebitis. Mowry and Hartman (2011) reported the dose concentration of 1.2 mg/ml to have a statistical significant lower risk for phlebitis when compared to the dose concentration of 1.8 mg/ml. This observational and retrospective chart review study was conducted to determine phlebitis incidence rates in cardiothoracic surgical patients who received peripheral IV amiodarone and/or vancomycin and to examine the effects of the concentration of Amiodarone on the development of phlebitis. The sample included 2,423 patient records. The comparison groups ranged in the number of records from 339 to 1,675. Binary logistic regression showed the odds for thrombophlebitis occurrence with 1.8 mg/ml Amiodarone concentration to be 3.64

times the odds for thrombophlebitis occurrence with 1.2 mg/ml Amiodarone concentration (p </= 0.005). The data collector was not blinded to the administration of vancomycin and/or Amiodarone in the sample. Bedside nurses were responsible for reporting peripheral thrombophlebitis to the data collector; accuracy in reporting may questionable.

de Fatima Suardi Martinho and Rodrigues (2008) found a statistical significant incidence of phlebitis (55%) in a sample population of patients receiving peripheral IV Amiodarone of a low concentration dose of 0.5 mg/ml. Statistical analysis not reported. Although the study had a small sample study of 40 and there was no comparison group of those who did not receive the medication, the study provided compelling evidence of a high incidence of phlebitis.

Infusion duration.

The length of Amiodarone infusion was examined. It remains uncertain whether infusion duration is associated with phlebitis development. Norton et al., (2013) reported the longer the length of infusion, the greater the risk of phlebitis. Norton et al. conducted a retrospective chart review to determine the incidence and contributing factors of Amiodarone-induced phlebitis. The sample size consisted of 105 patients. The infusion duration was highly correlated the total Amiodarone dosage and total dose received via peripheral IV catheter ($p < 0.001$). Boyce and Yee (2012) found no correlation between phlebitis incidence and length of Amiodarone infusion. Boyce and Yee conducted an observational retrospective chart review to determine the incidence and severity of phlebitis in patients who received peripheral IV Amiodarone. A small sample size of 12 patients was included in this study. Statistical analysis not provided. This study followed subjects for 24 hours after discontinuation of Amiodarone and noted phlebitis can occurs up to 48 hours after IV catheter removal. This may have affected results.

Nursing interventions.

Nurses are primary caregivers and have the responsibility of reporting phlebitis and providing appropriate treatments according to their institution protocols. Norton et al. (2013) found the first 24 hours of an Amiodarone infusion to be the most critical time for monitoring the IV site for phlebitis. This is due the high incidence rate of phlebitis associated with the dose of 3 mg, which is commonly given within the first 24 hours of loading. Norton et al. (2013) found a lack of reliable and valid monitoring method of IV catheters in their study which likely contributed to exclusion of patients and underdiagnoses of phlebitis.

Another study found a significant lack of nursing documentation of the nursing interventions used for detecting phlebitis and the interventions used to treat phlebitis (de Fatima Suardi Martinho & Rodrigues, 2008). Only 37.5% of the review charts included documentation of following the institutional protocol for phlebitis treatment (de Fatima Suardi Martinho & Rodrigues, 2008). This study was conducted on an adult cardiology intensive care unit at a designated hospital and may not be appropriate for generalization.

Summary

A variety of case control and cohort studies as well as a limited number of randomized control studies composed the phlebitis literature review. Comparisons of studies were difficult to assess due to small sample sizes, lack of documentation, use of different phlebitis scales, different categorizations used, and use of different protocols. Many studies took place at a single designated institution; making generalization challenging. Additional studies providing high grade evidence will add to the current evidence available and aid in identifying risk factors.

It is difficult to make comparison in studies regarding phlebitis incidence relating to insertion department. This is due to inability to compare insertion techniques, nurse skill, and environmental factors among the different settings. Perhaps this is reason for inconsistent results. Further studies addressing these issues expanding to a variety of institutions will provide deeper understanding. Multiple studies indicated a relation of IV medication type to phlebitis development; specifically antibiotics. It may be difficult to distinguish whether the number of IV medication administrations and/or type of IV medication relate directly to phlebitis development as numerous medications and interactions may take place. Multiple studies have indicated an increased risk of phlebitis with IV catheter placement in the antecubital fossa. It is also reported with lower extremity IV catheters, but the sample size in those studies was very small which affects reliability. Hypertonic IV fluids and potassium chloride have shown to increase the risk of phlebitis in multiple studies. Although one study did not find a correlation, the sample consisted of only three hypertonic infusions. The use of INS phlebitis scale has shown validity and reliability and can provide a measureable method for documentation of phlebitis as reported by one study. Additional studies on phlebitis scale may strengthen this point. IV site pain has been associated with phlebitis. Recommendations include removing the IV catheters when pain develops to decrease the severity of phlebitis. Encouragement of patient involvement in their healthcare will increase patient empowerment and their comfort in reporting signs and symptoms of phlebitis. This will aid in quicker detection of phlebitis.

There has been limited research conducted on phlebitis development in peripheral IV Amiodarone administration. The studies available provide low grade evidence and inconsistent findings on possible risk factors. However, all studies have shown a correlation of peripheral IV

Amiodarone and phlebitis development. Further research with larger sample size and high grade evidence is needed to determine possible associated factors.

Patient Education Pamphlet

It is through the understanding of current evidence and current practice surrounding phlebitis and the administration of Amiodarone that evidence-based improvements can be generated. Evidence shows a significant correlation between peripheral IV Amiodarone and phlebitis incidence rates with inconsistent findings of possible contributing factors. The local hospital reports a significant phlebitis incidence rate among patients receiving peripheral IV Amiodarone. Literature indicates pain to be a significant indicator of phlebitis. Due to the subjectivity of pain, patient communication is vital.

Through discussion with the Clinical Nurse Specialist at the local hospital, a lack of patient education regarding phlebitis was identified. Patients were not aware of the importance of voicing discomfort or any sign or symptom of phlebitis. Patients often expressed their belief that some pain and discomfort with IV therapy should be expected and was considered normal. A phlebitis pamphlet designed for patients was determined to be a needed resource in improving patient care. Researchers reported that patients possess a willingness to be empowered and need to be encouraged to take active roles in their healthcare. Through education, patients can gain an understanding of phlebitis and the importance of participation in their healthcare.

A patient educational phlebitis pamphlet was developed and included definitions and signs and symptoms of phlebitis. The pamphlet also described the role of the IV team at the hospital as well as the patient role in IV surveillance. In the newly developed patient education material, patients are encouraged to participate in IV site surveillance by reporting any signs or

symptoms to the bedside or IV team nurse. Additionally, family members who are present are included in the education process per patient permission.

Assessment

In order to effectively develop and implement the patient educational pamphlet, expert reviews were completed. The experts included a Clinical Nurse Specialist (CNS) at the local hospital. The CNS provided insight into the needs of the hospital, staff, and patients as well as the hospital's process of implementing recommendations. The expert opinion of a nursing professor at the University of North Dakota was sought. The professors' experience of nursing research and education provided valuable critique of the quality of research and recommendations of this project. A graduate prepared nurse educator provided feedback on the educational patient brochure. The nurse educator gave expert critique of the educational brochure with focus on learner needs.

The Unit Bases Quality Team (UBQT) at the hospital was also consulted. The UBQT focuses on the quality of nursing practice at the hospital with the goal of improving patient outcomes. The UBQT provided feedback on the recommendation and implementation process with regards to the nursing role and responsibilities.

The patient population was assessed for the appropriateness of the educational material. The patient population encompasses a variety of educational levels and health care experiences. The educational material was developed with layman's terms in order to be useful to the general public in which the hospital services. The educational pamphlet was turned over to the local hospital for implementation.

Implementation

The process of implementation of the phlebitis education pamphlet was developed for the local hospital. Communication to nurses will take place in written and verbal forms. Details of the educational pamphlet will be included in the units' monthly email as well as in the units' quarterly meetings. The UBQT members and CNS will also be communicators and resources for the process. The patient education material was developed in a brochure format to keep in uniform with other patient educational materials. The brochure provides patients and family members with a written document which can be kept at the bedside and reviewed as often as desired. After approval from the organization, the material will be printed. The brochures will be stocked on the units in which use IV Amiodarone. The brochures will also be available to all IV team members in their designated resource center. The phlebitis pamphlet will be given to patients upon initiation of peripheral IV Amiodarone. Educational documentation will take place in the electronic patient chart.

Evaluation

In addition to the primary evaluation of the pamphlet by the CNS, nurse professor, and nurse educator, secondary evaluation will take place three months after its implementation. The secondary evaluation will examine the effectiveness of the patient educational brochure and will occur three months post implementation. Evaluation will include data collection of Amiodarone induced phlebitis and comparisons will be made with pre-implementation data. Data will include the incidence and severity rate of phlebitis which will be analyzed. Feedback from IV team members, bedside nurses, and patients/family members will be sought. Feedback will include effectiveness of education, patient comfort in participation, and identification of adjustment

needs or concerns. All data will be examined and appropriate action(s) will be developed if deemed necessary.

Discussion

The review of literature was conducted to identify the factors in phlebitis and Amiodarone induced phlebitis. Through examining current literature, nursing interventions may be created and/or adapted to best fit the patient populations' and organizations' needs and desires. Research has shown a high phlebitis incidence rate among those who received peripheral IV Amiodarone which is in congruence with the hospitals' findings. In order to reduce the Amiodarone associated phlebitis and its severity, current literature of phlebitis and Amiodarone induced phlebitis must be examined.

Conflicting evidence was reported by researchers on whether the department location of IV insertion influences the risk of developing phlebitis. Each study was conducted at a single designated institution and catheter insertion techniques were not reported. It is unknown if techniques differed between departments and its role in phlebitis incidence. It is also difficult to make study comparisons and generalizations due to unknown nurse and patient characteristics. Nurse experience, skill, stress level, adherence to use of established protocols, as well as patient cooperation, medical situation, and mental condition may affect the quality of IV insertion. Further research is needed to determine whether the department location of IV insertion is associated with an increased risk of phlebitis.

Specialized IV teams who are responsible for insertion of peripheral catheters were shown to reduce phlebitis incidence rates. Insertion techniques were reported and analyzed in two studies. Both studies recommended the utilization of IV teams in institutions. Skill and

experience of specialized IV team nurses proved to aid in IV insertion ability. The use of specialized IV teams has shown to reduce phlebitis rates. By utilizing these IV experts, patient outcomes and patient satisfaction will improve. For this project, the role and responsibilities of the IV team at the local hospital were examined. The IV team continues to be responsible for all IV insertions on the units and acts as resources for bedside nurses and clinicians.

The anatomic location of a peripheral IV was found to be associated with phlebitis incidence. The antecubital fossa was found to be correlated to an increased risk of phlebitis as reported by two studies. This may be related to the increased movement of the catheter through bending of the arm in which can cause vein irritation. The hand, forearm, and wrist IV insertion sites were investigated and no statistically significant difference between these sites and phlebitis incidence was noted. However, this is a single study and further studies are needed in order to make comparisons and generalizations. Lower extremity IV catheters have been associated with an increased risk of phlebitis. Two studies reported high phlebitis incidence rates in those with lower extremity IV catheters. Even though both studies had small sample sizes, statistical analysis provided compelling evidence that a relationship between lower extremity IV catheters and phlebitis development exists. Although avoidance of these sites may not be practical in all situations, having an awareness of the increased risk of phlebitis with IV catheters in these anatomic sites may serve to decrease phlebitis incidence and severity. As per protocol, the local hospital requires a clinicians' order for a lower extremity IV catheter insertion and use which is used as a last resort when multiple upper extremity IV attempts have been unsuccessful or upper extremities IV catheters are contraindicated. The IV team avoids the antecubital fossa site due to patient discomfort with arm mobility and increased risk of phlebitis.

IV medications have shown to be a significant factor in phlebitis development. The use of medication categories instead of describing the specific medication used caused difficulty in study comparisons. However, multiple studies have provided statistical significant evidence of a relationship between drug therapy and phlebitis incidence. It is debatable whether the number of medication administrations and/or the type of medication administered is correlated to phlebitis incidence. Further analysis of medication properties such as pH and osmolality are needed to identify the factors in which medications affect phlebitis incidence. The type of infusion fluids may influence the risk of phlebitis. Two studies reported conflicting results on the relationship between IV fluid infusions and phlebitis development. Additional studies are needed are need to determine the effect of IV infusion types on phlebitis rates.

Inconsistent evidence was found on whether rotating IV sites reduce the rate of phlebitis. Data collection in many of these studies involved multiple healthcare members which raises question of reliability. Phlebitis rates differed greatly among studies. For example, the phlebitis incidence rate of 76.9% was reported for catheters in place for 48 hours or longer by Furtado (2011) and Webster et al. (2008) reported an incidence rate of 33% for the control group (routine replacement of IV site every 72 hours) and the intervention group (replacement of IV site only when clinically indicated) had a reported phlebitis incidence rate of 38%. Each study was conducted at a designated institution creating difficulty in comparisons and generalizations. The Center for Disease Control (2002) recommends rotating IV sites every 72-96 hours to reduce the risk of infection and phlebitis. Until further reliable evidence is produced, following the CDC recommendations will provide best practice. Currently, the local hospital follows the CDC recommendation on the frequency of IV rotation.

Age was not found to be a significant factor in phlebitis incidence by four research studies. This contradicts the common belief of the elderly predisposition to phlebitis development due to deteriorated vein condition with age. Other factors associated with age which may influence phlebitis development included pain perception, mobility, and mental status. The relationship between gender and phlebitis incidence is controversial. The female gender may be associated with an increase in phlebitis as reported by two studies. Researchers suggest the difference may be related to the hormonal difference among males and females, yet no clear answers were reported. However, no significance was found by three research studies. A correlation between diabetes mellitus and phlebitis was a statistical significant finding in two studies. This report suggests the need for further examination of medical conditions and their relationship to phlebitis.

Inconsistent findings were reported on the relationship between IV catheter size and phlebitis. Statistical analysis was reportedly used in all studies. IV catheter size and phlebitis may be dependent upon the vein size. A large-gauge catheter placed in a small vein may cause vein inflammation and irritation, leading to phlebitis development. Further investigation on catheter gauge size and phlebitis incidence is needed.

The use of IV scales in documenting phlebitis has shown to be valuable. The Infusion Nurses Society (INS) phlebitis scale was found to be valid and reliable and recommended to be used in both the acute care and community settings. The use of a standardized scale provides staff with a diagnostic tool in which guides accurate phlebitis diagnosis. It is through consistent and accurate diagnosis in which phlebitis can be identified, prompting appropriate treatment and resulting in a reduction of phlebitis severity.

Pain has been associated with phlebitis development and reported to be a significant phlebitis indicator. Pain was found to be the most common reported indication of phlebitis. This emphasizes the importance of including pain in the assessments of IV sites. IV sites need to be replaced when pain is reported as it is an indicator of phlebitis. This may aid in an earlier detection of phlebitis and therefore, lessen the severity of phlebitis. Due to the subjectivity of pain, patients need to be educated on phlebitis and empowered to communicate any discomfort.

Researchers suggest patients possess a willingness to be empowered and need to be encouraged to take an active role in their healthcare. Empowering patients to take an active role in their healthcare may aid in lessening the severity of phlebitis. Through education and encouragement, patients will become more comfortable in voicing signs and/or symptoms of phlebitis. The subjectivity of discomfort or pain relates to the need of patient communication. Pain is an indicator of phlebitis; therefore quicker phlebitis detection will occur when patients express IV site discomfort.

The examined Amiodarone induced phlebitis research study designs have been retrospective chart reviews, observational studies, and case report. These designs are of low ranking and there is a clear lack of high grade studies conducted on this topic. However, the evidence is compelling. Evidence shows a significant correlation between peripheral IV Amiodarone and phlebitis with incidence rates ranging from 10.6% to 67% in the studies described.

The research shows inconclusive evidence of contributing factors of the development of Amiodarone induced phlebitis. Age and gender were the main intrinsic factors studied and resulted in inconsistent findings. The majority of studies did not find age or gender to be correlated to Amiodarone induced phlebitis. As previous discussed, other factors associated with

age which may influence phlebitis development included pain perception, mobility, and mental status. If age or gender were identified as significant phlebitis risk factors, additional interventions may be developed to create a deeper awareness and closer monitoring for those at risk.

Amiodarone dose concentration of 0.5 mg/ml and higher were investigated in research studies. Although it may be debatable whether a lower dose concentration results in a lower phlebitis incidence, a significant phlebitis incidence was found with each dose concentration examined. This signifies presence of a high correlation of peripheral IV Amiodarone and phlebitis development. It may be beneficial to study the dose concentrations < 0.5 mg/ml to determine its risk of phlebitis. If dose concentrations < 0.5 mg/ml are associated with a statistically significant lower risk of phlebitis incidence, the appropriateness of usage may be evaluated.

Studies reported inconsistent findings on whether the length of Amiodarone IV infusion correlates to an increase risk of phlebitis. Given the low level of study designs, lack of provided statistical analysis for each study, and small sample sizes, it is difficult to make judgment on whether a correlation exists. However, a heightened awareness of phlebitis development for all patients receiving peripheral IV Amiodarone is warranted.

Studies which investigated nursing interventions found lack of reliable and valid monitoring methods of IV catheters and lack of nursing documentation of interventions used to detect and treat phlebitis. These studies were conducted at a single designated institution and may not be appropriate to make generalizations of other institutions. The evidence signifies the need for institutions to self-examine their nursing interventions to ensure appropriate use and documentation of phlebitis interventions.

Nursing Implications

Practice

Evidence suggests the need for consistent, accurate nursing documentation of phlebitis. Nurses are primary caregivers and have the responsibility of reporting phlebitis and providing appropriate treatments according to their institution protocols. Consistent, accurate nursing documentation of phlebitis will allow for tracking of phlebitis incidence and severity. This also provides a paper trial of the IV condition; requiring nurses to take responsibility for their assessment and performed interventions. The use of a standardized phlebitis scale may aid nurses in consistent documentation, accurate phlebitis identification, and prompting of appropriate phlebitis treatment. The use of the antecubital fossa and lower extremities has been reported to have a correlation to an increased phlebitis incidence. Although avoidance of these sites may not be practical in all situations, having an awareness of the increased risk of phlebitis with IV catheters in these anatomic sites may serve to decrease phlebitis incidence and severity.

Research

Further high grade research is needed to clarify the reported inconsistencies of the contributing factors of phlebitis. Further investigation is needed of the contributing factors of phlebitis including: department of IV insertion, IV medication, IV infusions, intrinsic factors IV catheter size, and frequency of IV site rotation. Additional research of phlebitis scales are needed to identify barriers and the effects of implementation. The multiple variations in phlebitis scales used in research studies calls for further investigation comparing phlebitis scales to identify effectiveness. There is a clear lack of high grade research designs conducted on Amiodarone induced phlebitis. Although, the evidence available provides compelling evidence

of an existing relationship between peripheral IV Amiodarone and phlebitis development, contributing factors have not been clearly identified. Further research is indicated.

Education

Bedside nurses must be educated on the signs and symptoms of phlebitis and the risk factors of phlebitis; specifically Amiodarone induced phlebitis. An increased awareness will guide nurses to quicker detection of phlebitis and an earlier initiation of phlebitis treatment. Patients and families must be educated on phlebitis and encouraged to communicate signs and/or symptoms of phlebitis. Education of nurses, patients, and families will aid in prompt detection and treatment of phlebitis.

Policy

The adoption of the INS phlebitis scale into a policy for practice will provide a reliable and valid tool for phlebitis assessment and documentation. By accurately assessing and documenting phlebitis, an institution may track phlebitis cases, make comparisons, and further address the findings. Use of a standardized tool will aid in decreasing the progression of phlebitis by guiding nurses in determining phlebitis. Specialized IV teams who are responsible for the insertion of IV catheters have shown to reduce phlebitis incidence rates. By utilizing these specialized teams, their expert skills and knowledge will decrease catheter placement failures, increase patient satisfaction, and decrease phlebitis incidence rates.

Conclusion

The purpose of the independent study is to develop nursing interventions to decrease the incidence and severity of Amiodarone induced phlebitis in the patient population at the local

hospital. The Iowa Model for Evidence-based Practice was chosen as a guide for this project due to the consideration of current knowledge, patient population, organization, and the healthcare team. Current literature was retrieved through the PubMed and CINAHL databases. A review of literature revealed many inconsistencies among studies as well as limited published research on Amiodarone induced phlebitis. Strong evidence was found regarding pain as an indicator of phlebitis and the positive effects of patient empowerment on patient participation. An analysis of the literature review aided in the construction of nursing implications involving practice, research, education, and policy. Through collaboration with identified experts, a need for patient education was determined at the local hospital. A phlebitis brochure was developed as well as an implementation and evaluation process. It is through patient education and participation that phlebitis may be detected earlier which will lead to a decrease in phlebitis severity.

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