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THE INCIDENCE AND DETECTABILITY OF PHLEBITIS BY HEALTHCARE PROFESSIONALS IN A 1,200 BED TEACHING HOSPITAL WITH NO VASCULAR ACCESS TEAM

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ABSTRACT: *Infusion phlebitis can be caused by a multitude of factors including the chemical nature of the infusion, the catheter type, insertion and care technique, and factors leading to catheter or site contamination. A cross-sectional study of 100 randomly selected charts of patients were reviewed for the occurrence of phlebitis and IV-related adverse event. In addition, an 8-item questionnaire that assessed 51 physicians' and nurses' knowledge of phlebitis and aspects of prevention and care was administered. 95 of the 100 patients were included in the study. Overall phlebitis incidence was 36.8%. Three cases of infiltration and one of extravasation were also documented. The median interquartile range (IQR) score was 62.5 (50-75). This study reports a moderately high incidence of phlebitis and other IV complications. It suggests the need for a better system of documenting phlebitis, and the need to be consistent in compliance with CDC guidelines for line longevity.*

KEYWORDS: Phlebitis, Intravenous Access, Knowledge, Nursing, Incidence

INTRODUCTION

Infusion phlebitis is most common with peripherally inserted short catheters. It is an inflammatory process that affects the three layers of the vein. This almost preventable adverse event is characterized by pain and erythema in its early stages, and may progress to forming palpable cord and purulence in the advanced stages when the early signs are not detected or prevented [1]. Infusion phlebitis may be caused by a multitude of reasons including the chemical nature of the infused drug such as the osmolarity and pH of the infusion[2]; its irritant nature [3]; the bacterial contamination at the dressing site of the catheter [4]; the type of catheter dressing performed and its technique [5]; the nature of the inserted catheter [6] and its dwell time [7]; or the inappropriate technique used in catheter insertion [8] . Controlling some or all of these causative factors will likely lessen the development of this complication [9].

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LITERATURE/THEORETICAL UNDERPINNING

The rate of this complication varies from one institution to another and can be as high as 50% of hospitalized patients[10,11]. The difference in the reported rate is due to the fact that phlebitis can be triggered by one or more of the reasons listed earlier, but a tamed phlebitis rate could be due to controlling one or more of the factors influencing its development. Nevertheless, this may not eliminate the development of this complication entirely but may reduce significantly it to the desired 5% occurrence per Intravenous Nurses Society guidelines[1]. The Centers for Disease Control and Prevention (CDC) issued evidence-based guidelines for short catheter longevity limited to 96 hours after which catheters should be changed with or without the development of phlebitis[12].

The significance of estimating the rate of phlebitis in a hospital helps in its assessment on how serious this complication is within its own walls, and has the advantage of directing the healthcare provider to implementing appropriate measures to reduce it to the lowest possible level through various interventional plans. From a patient perspective, an improvement in the quality of life and comfort are prime outcome, but a significant reduction in workload and expense is attained from averting the cost of treating this complication. Plans to reduce this untoward adverse event include targeting healthcare staff with education and training; introducing standardized catheter insertion and care procedures, and selecting appropriate catheters based on types of medications to be infused. The establishment of a vascular access team of credentialed professionals who start and manage IV lines for all patients from admission to discharge has also proven its benefits[13].

METHODOLOGY

This cohort study was conducted on patients admitted to King Abdulaziz Medical City in Riyadh (KAMC), National Guard Health Affairs (NGHA) from 2015-2016. Its major intention was to document the incidence of phlebitis in this hospital and to evaluate the accuracy and the comprehensiveness of documentation in the patient record. It was followed by a cross sectional study utilizing a questionnaire that was administered to a convenient samples of healthcare professionals to assess their knowledge of this adverse event, their ability to detect it or prevent it. The main purpose was to rule out an under estimation of phlebitis occurence by the investigators based on the healthcare professionals documentation. Charts of 100 adult patients were randomly selected with IV lines admitted to patient care units in Internal Medicine, Nephrology, Cardiology, Surgical and other ICUs were reviewed for any indication of phlebitis development during their entire stay in the hospital. Patients were included if they were aged $\geq$18 years and hospitalized for not less than 4 days and no more than 30 days. The review included patient data that were collected from patients' charts as well as the computerized physician order entry QuadraMed® program. Any indication of the occurrence of phlebitis, whether recorded or not, was documented along with the date of occurrence and its grade as defined by the Intravenous Nurses Society (INS) (Table-1)[14]. Demographic and clinical data were also gathered including age, gender, body mass index (BMI), admission date, IV and oral medications.

In addition to the chart review, an 8-item questionnaire that assesses knowledge about phlebitis was administered to a convenient sample of healthcare professionals (HCPs) with care responsibilities to the designated patients. The 8 items covered knowledge about phlebitis in

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terms of its definition, diagnosis, general and medication-related causes, signs and symptoms and strategies to reduce its risk. A total score reflecting knowledge about phlebitis was obtained for each respondent by computing the percentage of correctly answered questions (out of 8) and multiplying the result by a 100. The resultant score range from 0-100 with higher scores indicating better knowledge.

Statistical Analysis: Descriptive statistical analyses were performed for the study sample. Continuous variables were summarized using mean and standard deviation (SD) and median (interquartile range: IQR) and proportions were used for categorical variables. The occurrence of phlebitis was evaluated and compared by patient demographic and clinical characteristics. Categorical data were analyzed using Chi-square or Fisher's exact tests. The distribution of all continuous data was examined. For continuous variables whose distributions approximate normality, a t-test was used for comparisons. When normality assumptions are not satisfied, the non-parametric Mann-Whitney U test was utilized. The knowledge score was compared by HCPs' educational level, occupation and number of years of practice using the t-test/one-way ANOVA or the Mann-Whitney U test/Kruskal-Wallis test. Statistical significance was considered at $p<0.05$. All statistical analyses were performed using SPSS 21.0 [Release 21.0.0.0, SPSS Inc., USA].

RESULTS/FINDINGS

Table 2 includes descriptive statistics, overall and comparison by phlebitis status. Of the 100 randomly selected patients, 95 had available file/IV data (95%). Average age was 62.5 years (SD = 20.1), with 53% males. Patients were treated with several IV medications (not listed in detail) including, but not limited to, Acetaminophen (32%), Pipracillin/tazobactam (20%), Ceftriaxone (7%), Vancomycin (4%) and Clindamycin (4%). Patients were also treated with a variety of oral medications including corticosteroids (6%); with 2% using Prednisone and 4% Prednisolone.

Thirty five of the 95 patients had phlebitis (36.8%) which was graded by the investigators using the Intravenous Nurses Society (INS) based on the written descriptive terms in the chart (grade 1 = 33 cases, and grade 2 = 2 cases). In addition, three cases of infiltration (3.2%) and one case of extravasation (1.1%) were documented in the chart on 4 patients making the combined occurrence of these adverse events (4.2%). Results from comparing the incidence of phlebitis by patient demographics revealed that none of the variables listed in Table 2 were significantly associated with phlebitis ($p>0.05$).

Results from the survey assessing knowledge about phlebitis among HCPs are summarized in (Table 3). A total of 51 HCPs completed the questionnaire; 20 physicians (39%), and 31 nurses (61%). Twenty percent of respondents had an education level of Masters or above and about 71% of them had 6 or more years of practice. Overall, the score reflecting knowledge about phlebitis ranged from 12.5-100; mean ± SD was 62.7±15.3, median (IQR) = 62.5 (50-75). The knowledge score was significantly or marginally different by respondents' practice-related characteristics. Significantly higher knowledge level was observed among respondents with 6 or more years of practice compared to those with fewer practice years [median (IQR): 62.5 (62.5-75) for those with 6 or more practice years, 62.5 (37.5-62.5) for 1-5 years; $p = 0.025$]. Marginally significant differences were observed by education level [62.5 (50-75) for those holding Bachelor's degree or below vs. 68.8 (62.5-75) for Master's or above; $p = 0.055$].

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Similar scores, however, were observed among physicians and nurses (IQR): 62.5 (53.1-75) and 62.5 (50-75) for physicians and nurses, respectively. Results from detailed analyses including number and percent of respondents who answered individual survey questions correctly, overall and by respondents' characteristics are displayed in Tables-4a and -4b.

DISCUSSION

The calculated phlebitis incidence in this institution was 37%, a rate that appears to be high considering the INS guidelines that allows up to 5%[1]. The INS standard, however, may be difficult to attain due to the diverse contributing factors to phlebitis. Irritating drugs alone cannot be implicated as the sole cause for phlebitis as most clinicians speculate when they render their daily care. Factors such as mechanical insertion techniques, line manipulation, line dressing change, and patient's disease along with other reasons could also be contributing to the development of phlebitis as well. Three infiltrations occurred in three patients who each had grade 1 phlebitis based on descriptive documentation in the patients' records. These infiltrations may have been the result of not responding to the development of phlebitis early enough. One of the three patients had both an infiltration, and ten days later had an extravasation. It is worth noting that nurses never specified the grade of phlebitis or even named this adverse event in patients' charts as expected by universal Nursing Standards of Practice and by published world grading guidelines for phlebitis. This is a hindrance to understanding the status and or the progression of this adverse event. Nurses were able, however, to clearly identify infiltrations and extravasation by name. It is worth noting that our institution has detailed policies and procedures describing the detection, prevention and treatment of phlebitis, infiltrations, and extravasations and addresses the need for alternate IV line site change every 96 hours. Despite these policies and procedures nurses failed to document periodic line changes if it ever occurred. Thus, there was no assurance whether the evidence-based CDC guidelines of alternating lines every 96 hours were enforced[12]. Incidentally, a previous 2014 publication on phlebitis in this institution recommended not to follow the periodic establishment of IV lines in alternate sites and recommended such IV site changes be directed by clinical judgment [15]

Aside from computing the rate of phlebitis, our data indicated that none of the patient demographic and clinical characteristics had an impact on the risk of phlebitis or other occurring IV complications.

The investigators wanted to insure that the observed phlebitis incidence is accurate and is not underestimated. Hence was the administration of the 8-item questionnaire to 51 physicians and nurses. The questionnaire focused on assessing the ability of such practitioners in recognizing this adverse event, in knowing how to document it, treat it, and in evaluating how they prevent its recurrence by recognizing some of its causes (Table 4-a). Participating nurses and physicians were able to identify phlebitis (98%), and were able to list its causes and identify strategies to reduce its risk (84%). Only 55% were able to correctly list 3 medications that may cause it. Most respondents, and surprisingly physicians, did not have sufficient knowledge of phlebitis grading used in classifying the severity of this inflammatory reaction (60%). Moreover, when they were asked about signs and symptoms of grade 2, the overall response of the HCP groups was low (37%). The significance of this question lies in the fact that when grade 2 phlebitis occurs, nurses must report it to the physician for the latter to take a remedial action. However, nurses did twice as good in their response than physicians (45% vs. 25%) especially those healthcare providers with more professional practice (Table 4-b). It was noted that healthcare providers who had a higher graduate degree were more able to identify the proper grading of phlebitis than those with a bachelor degree or lower ($p<0.05$). This has an

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important healthcare consequence when realizing that the largest population of our nurses is bachelor prepared or less. This was consistent with the observation of a similar study that measured the nurses' perceptions about risk factors for phlebitis in Serbia. The study reported that the level of education and years of practice affected their knowledge; where nurses with lower education level or less work experience were not able to identify correctly the risk factors for phlebitis[16]. Nurses in our study did not use grading nomenclature in describing the observed phlebitis regardless of their experience, and investigators ended up grading these cases based on the descriptive terms provided in the chart. Our grading level of phlebitis may have been underestimated if the nurses did not use appropriate descriptive terms to of this inflammatory process in the chart. Aside from phlebitis, the vast majority of physicians and nurses in our study were not able to differentiate between "extravasation" and "infiltration" (94%) which are two distinct adverse events of intravenous infusion with different outcomes to the patient. Perhaps, the rarity of these adverse events in intravenous administration and the lack of exposure of the healthcare providers to these adverse events may have been a reason for this observation. Incidentally, our institution has clear Administrative Policies and Procedures (APP) delineating the definition and treatment of these adverse events. On the other hand, nurses in our investigation were able to name the infiltrations and extravasation appropriately but not phlebitis.

Our finding on the incidence of phlebitis in our institution of 37% seems to be reasonably reflective of the true incidence though the findings of the administered questionnaire may suggest otherwise. What is notable though is that the nursing staff never documented adverse events in the chart by name or by grade when they detected this inflammatory process. However, they took the appropriate measures to treat it. Moreover, neither drugs, nor any other phlebitis causing factors were identified by the healthcare providers in the patients' record. No alteration in drug regimen as a result of the described symptoms was clearly detected, but occasionally a change in the catheter site was documented. Our list of suspected phlebitis causing medications was based on the frequency of their use when phlebitis was suspected.

The documented 37% incidence of phlebitis in our retrospective study corroborates with the findings of another prospective study conducted in our institution in 2014 in which phlebitis incidence was 29% [15,17]. However, that study made the troubling recommendation not to follow the evidence-based guidelines by CDC for changing short peripheral catheters every 72-96 hours but instead to rotate the catheter site once clinically indicated or predicted. We feel that that their findings and recommendations in this paper may have adversely altered some of the nursing practices in our institution.

Our finding is consistent with the Swedish Nurses Phlebitis perception study [18] and the Serbian Nurses Phlebitis perception study[16] where antibiotics were ranked the most common agents to induce phlebitis.

The biggest limitation of our study is the small sample size which only reflects about 10% of overall hospitalized patients at our institution. Moreover, patients were screened in internal medicine wards that also included transitional care units which with long term care patients that may not necessarily represent the care of other hospitalized patients. While our study excluded patients admitted for over one month, the nursing care of other patients in these units may have also been modeled based on the overall treatment setting.

Another limitation of our study is the lack of consistent documentation of phlebitis in patient charts. Despite the fact that both the paper and the electronic medical chart were screened for

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phlebitis, we were not able to find a consistent process for such documentation. It is possible that some cases may have not been documented in either chart or were documented under terms that were not recognized through our screening process.

CONCLUSION

This study suggests the need for a better system of documenting phlebitis, and for a complete compliance with the current institutional policies and procedures which clearly calls for observing the CDC guidelines of catheter longevity and with clear documentation. Moreover, it may be necessary to consider reducing the incidence of phlebitis by using midline catheters for example with phlebitis causing drugs, and or to improve catheter care techniques through personnel training and standard catheter care protocols. The creation of a professionally trained vascular access Nursing team has also been proven to be effective in reducing IV related complications and improving the quality of care [19].

Future Research

The prevalence and incidence of phlebitis shall be measured after the implementation of the suggested recommendations and be compared to the current phlebitis incidence rate to assess the efficacy and value of these recommendations.

REFERENCES

Intravenous Nurses Society. Revised Intravenous Nursing Standards of Practice. *J Intraven Nurs.* 1998;21:S34-S36.

Kuwahara T, Asanami S, Tamura T, Kaneda S. Effects of pH and osmolality on phlebitic potential of infusion solutions for peripheral parenteral nutrition. *The Journal of toxicological sciences.* Feb 1998;23(1):77-85.

Morrill GB, Katz MD. The use of lidocaine to reduce the pain induced by potassium chloride infusion. *J Intraven Nurs.* Mar-Apr 1988;11(2):105-108.

Ena J, Cercenado E, Martinez D, Bouza E. Cross-sectional epidemiology of phlebitis and catheter-related infections. *Infection control and hospital epidemiology.* Jan 1992;13(1):15-20.

Tripepi-Bova KA, Woods KD, Loach MC. A comparison of transparent polyurethane and dry gauze dressings for peripheral i.v. catheter sites: rates of phlebitis, infiltration, and dislodgment by patients. *American journal of critical care : an official publication, American Association of Critical-Care Nurses.* Sep 1997;6(5):377-381.

Maki DG, Ringer M. Risk factors for infusion-related phlebitis with small peripheral venous catheters. A randomized controlled trial. *Annals of internal medicine.* May 15 1991;114(10):845-854.

Oishi LA. The necessity of routinely replacing peripheral intravenous catheters in hospitalized children. A review of the literature. *J Intraven Nurs.* May-Jun 2001;24(3):174-179.

Lundgren A, Jorfeldt L, Ek AC. The care and handling of peripheral intravenous cannulae on 60 surgery and internal medicine patients: an observation study. *Journal of advanced nursing.* Jun 1993;18(6):963-971.

Print ISSN: ISSN 2397-0758, Online ISSN: 2397-0766

Nelson RR, Tebbs SE, Richards N, Elliott TS. An audit of peripheral catheter care in a teaching hospital. *The Journal of hospital infection.* Jan 1996;32(1):65-69.

Singh R, Bhandary S, Pun KD. Peripheral intravenous catheter related phlebitis and its contributing factors among adult population at KU Teaching Hospital. *Kathmandu Univ Med J (KUMJ).* Oct-Dec 2008;6(24):443-447.

White SA. Peripheral intravenous therapy-related phlebitis rates in an adult population. *J Intraven Nurs.* Jan-Feb 2001;24(1):19-24.

Centers for Disease Control and Prevention. 2011 guidelines for the prevention of intravascular catheter-related infections. http://www.cdc.gov/hicpac/BSI/references-BSI-guidelines-2011.html. Accessed March 28, 2017.

Palefski SS, Stoddard GJ. The infusion nurse and patient complication rates of peripheral-short catheters. A prospective evaluation. *J Intraven Nurs.* Mar-Apr 2001;24(2):113-123.

Infusion Nurses Society. Infusion nursing standards of practice. *Journal of Infusion Nursing.* 2011;34(1S):S1-S110.

Abolfotouh MA, Salam M, Bani-Mustafa A, White D, Balkhy HH. Prospective study of incidence and predictors of peripheral intravenous catheter-induced complications. *Therapeutics and clinical risk management.* 2014;10:993-1001.

Milutinovic D, Simin D, Zec D. Risk factor for phlebitis: a questionnaire study of nurses' perception. *Revista latino-americana de enfermagem.* Jul-Aug 2015;23(4):677-684.

Ray-Barruel G, Polit DF, Murfield JE, Rickard CM. Infusion phlebitis assessment measures: a systematic review. *Journal of Evaluation in Clinical Practice.* 2014;20(2):191-202.

Lanbeck P, Odenholt I, Paulsen O. Perception of risk factors for infusion phlebitis among Swedish nurses: a questionnaire study. *Journal of infusion nursing : the official publication of the Infusion Nurses Society.* Jan-Feb 2004;27(1):25-30.

Robinson MK, Mogensen Km Fau - Grudinskas GF, Grudinskas Gf Fau - Kohler S, Kohler S Fau - Jacobs DO, Jacobs DO. Improved care and reduced costs for patients requiring peripherally inserted central catheters: the role of bedside ultrasound and a dedicated team. 20050818 DCOM- 20060227 (0148-6071 (Print)).

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APENDIX

Table 1: Intravenous Nurses Society Phlebitis Scale

Grade	Symptom
0	No symptoms
1	Erythema at access site with or without pain
2	Pain at access site with erythema and/or edema
3	Pain at access site with erythema Streak formation Palpable venous cord
4	Pain at access site with erythema Streak formation Palpable venous cord 1 inch in length Purulent drainage

Table 2: Descriptive Statistics for Demographic Data by Phlebitis Status. Total Number of Subjects with Available Data = 95.

Factor	All (N = 95, 100%)	No Phlebitis (N = 60, 63.2%)	Phlebitis/Adverse Events (N = 35, 36.8%)	p-value*
Age (years) Mean ± SD**	62.5 ± 20.1	61.3 ± 22.4	65.1 ± 15.2	0.38
Median (IQR)	68 (51.5-77.3)	69.5 (42-78)	68 (57-77)	
Gender n (%)				
Female	45 (47.4%)	27 (60.0%)	18 (40.0%)	0.55
Male	50 (52.6%)	33 (66.0%)	17 (34.0%)	
BMI (kg/m^2) Mean ± SD**	27.5 ± 7.0	27.2 ± 6.5	28.0 ± 7.9	0.62
Median (IQR)	26.0 (22.8-30.9)	26.0 (22.7-30.7)	23.0 (22.4-31.2)	
BMI Category n (%)				0.94
Underweight (<18.5 kg/m^2)	4 (4.2%)	2 (50.0%)	2 (50.0%)	
Normal (18.5-24.9 kg/m^2)	35 (36.8%)	23 (65.7%)	12 (34.3%)	
Overweight (25-29.9 kg/m^2)	30 (31.6%)	19 (63.3%)	11 (36.7%)	
Obese (>30 kg/m^2)	26 (27.4%)	16 (61.5%)	10 (38.5%)	

*Based on the t-test/Mann Whitney U test. **Data not available for all subjects. IQR: interquartile range

Table 3. Descriptive Statistics for Total Score Reflecting Knowledge about Phlebitis, Overall and by Characteristics of Healthcare Professionals at the Hospital

		N (%)	Mean ± SD	Median (IQR)	p-value
All participants		**51 (100%)**	**62.7±15.3**	**62.5 (50-75)**	
Education level					0.055
	Bachelor or below	41 (80.4%)	60.7±15.5	62.5 (50-75)	
	Masters or above	10 (19.6%)	71.3±11.9	68.8 (62.5-75)	

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Profession					0.76
	Physician	20 (39.2%)	61.3±18.1	62.5 (53.1-75)	
	Nurse	31 (60.8%)	63.7±13.4	62.5 (50-75)	
Practice years					0.025
	5 or less	15 (29.4%)	55.0±19.4	62.5 (37.5-62.5)	
	6 or more	36 (70.6%)	66.0±12.2	62.5 (62.5-75)	

Total score reflecting knowledge about phlebitis ranged from 13-100. IQR: interquartile range

Table 4a: Number and Percent of Respondents who Answered Individual Survey Questions Correctly.

Item/Question	N	N Correct	% Correct
Understanding of "Phlebitis	51	50	98.0%
Difference: "Extravasation" & "Infiltration"	51	3	5.9%
Grading the severity of phlebitis	51	20	39.2%
Signs/symptoms of "Stage 2 Phlebitis	51	19	37.3%
What causes phlebitis in your practice	51	43	84.3%
Three medications that may cause phlebitis	51	28	54.9%
Actions to identify a phlebitis case	51	50	98.0%
Important strategies to reduce phlebitis	51	43	84.3%

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Table 4b: Number and Percent of Respondents who Answered Individual Survey Questions Correctly, by Respondents' Characteristics.

	Education level		Profession		Practice years	
Item/Question	**Bachelor / below**	**Masters/ above**	**Physician**	**Nurse**	**≤5**	**6+**
Understanding of "Phlebitis	97.6%	100.0%	95.5%	100.0 %	93.3%	100.0%
Difference: "Extravasation" & "Infiltration"	4.9%	10.0%	5.0%	6.5%	6.7%	5.6%
Grading the severity of phlebitis	31.7%	70.0%	40.0%	38.7%	26.7%	44.4%
Signs/symptoms of "Stage 2 Phlebitis	41.5%	20.0%	25.0%	45.2%	26.7%	41.7%
What causes phlebitis in your practice	80.5%	100.0%	90.0%	80.6%	80.0%	86.1%
Three medications that may cause phlebitis	48.8%	80.0%	60.0%	51.6%	40.0%	61.1%
Actions to identify a phlebitis case	97.6%	100.0%	95.0%	100.0 %	93.3%	100.0%
Important strategies to reduce phlebitis	82.9%	90.0%	80.0%	87.1%	73.3%	88.9%

*Based on the chi-square test.

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