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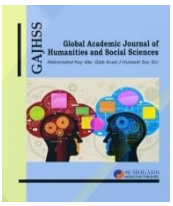

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Original Research Article

Reduction of Peripheral Intravenous Catheter Complication among Cardiac Patients: A Quality Improvement Project

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Abstract: Peripheral intravenous catheter complications accounted nearly fifty percent of its prevalence among hospitalized patients that lead to increase health care cost and safety dilemma. This occurrence is far more fatal among cardiac patients. ***Aim***: This project was initiated aiming to address the increasing complications brought by peripheral intravenous catheters such as phlebitis, extravasation, infiltration, infection and thrombosis through early detection and timely intervention. ***Methods***: The structured data driven effort-FOCUS-PDCA cycle (Plan-Do-Act-Check) was utilized initially in Critical Care unit and had been fully implemented in the entire Prince Sultan Cardiac Center Qassim health care facility. More so, VIP (Visual Inspection Phlebitis) score was used as an improvement project tool which was revised and adapted accordingly. ***Results and Discussion***: The results revealed that from six months (June to December) of project implementation, 246 cardiac admissions in CCU were re-assessed using VIP form. Only 47 (19.10%) got intravenous complications, of which 39 (15.85%) got phlebitis mostly diabetic patients about 89 (36.17 %). Additionally, older patients of 50 years and above and male in gender had a higher tendency of having phlebitis. Stage 1 revealed 74.35% while chemical type revealed 53.19 %. Cardiac medications causing more occurrences were Amiodarone, Potassium Chloride, Esmolol and Actylase. Overall, it significantly addressed the problem in peripheral intravenous complication reducing from 28.26% to 2.43% recognizing the root cause. ***Conclusion***: The findings generated concluded that utilizing VIP form to reduce the alarming peripheral intravenous complications was effective. Not only the early signs were staged and identified but as well treated promptly. The cardiac staff's training, attitude and medication protocol must be given attention.

Keywords: Cardiac Patients, FOCUS-PDCA, PIVC Complication, VIP Form.

INTRODUCTION

Peripheral intravenous cannulation is the most frequent and non-invasive but crucial procedure in Critical Care Unit aside from central venous catheters and arterial lines. The PIVC (Peripheral Intravenous Catheter) related complications includes bacterial infection of about 1.5% from health care associated infection while failure before the treatment completion of about 6% that could be attributed from phlebitis, dislodgement, occlusion and extravasation [1]. Phlebitis defined as the inflammation of the tunica intima of the superficial vein presents higher incidence rate in critical area caused by trauma, medications with extreme pH and osmolarity, irritants, bacterial contamination and patient acuity [2, 3]. Furthermore,

poor identification of phlebitis or poor reporting and documentation protocols increased its prevalence [4].

Nowadays, monitoring bundles and health care training dedicated to PIVC are well established. However, its complexity, intrinsic and extrinsic factors kept mortality high resulting to prolong hospitalization and increased health care cost. Author Andrew Jackson the first to develop an assessment tool was followed by Paulette Gallant and Alyce Schultz modified work known as the Visual Inspection Phlebitis (VIP) score. Studies proved its significance and reliability in addressing the problem through standardized evaluation tool intended for prevention and reduction to a minimum rate of less than 5 % [5, 6].

MATERIALS AND METHOD

The quality improvement project was conceptualized recognizing the high incident rate of phlebitis in Coronary Care Unit. The project started from June and ended in November. Utilizing the FOCUS-PDCA cycle its' objectives were to identify the root cause of the problem that is PIVC complication, correct the existing problem, find appropriate solutions and develop an effective monitoring tool for early identification, staging and reporting. PDCA which stands for Planning, Do, Check and Act is an iterative evidence-based improvement cycle proposing a change to address the gap, improve the quality and creating innovative solutions [7].

Ethical consideration and verbal consent were observed throughout the process which starts from insertion of IV canula and during the daily inspection.

Local and Participants

The quality improvement project was conducted in Prince Sultan Cardiac Qassim, Coronary Care Unit department. Including all admissions with indwelling peripheral cannula to monitor every second hourly by staff nurses for any signs of complication.

Instrument

The VIP score was adapted and later on modified according to the need of the center where it became user-friendly and easy to use. Although it was publicly available, author's permission was sought and consented to use via electronic communication. The form was composed of criteria (definitive sign), score (stage) and management.

Data Collection and Management: The following sequel was carried out to meet the project's projected outcome:

F-Find an Opportunity

The opportunity represented the problem or the gap we need to address such an alarming rise of phlebitis in an advanced stage where 4 cases with stage 4 to 5 happened in a week equivalent to 20%. According to the standards of the Infusion Nurses Society (INS), the acceptable phlebitis rate is 5% or less as a general guideline [8]. The impact of this included but not limited to patient safety risk, delayed discharged, pain and discomfort, increased cost related hospitalization, compromise venous access, interruption to prescribed therapy and associated increased equipment cost and staff time. Additionally, the risk and likelihood were assessed revealing likelihood score of 5 (almost certain) with greater than 50 % chance of risk to occur and impact score of 3 (moderate) requiring professional intervention; overall risk rating of 8 (high risk) suggested to improve existing control [9].

O-Organize the Team

The team who undertook the primary and secondary responsibilities was composed of Nursing Director and Deputy Nursing Director (top managers); Head Nurse and Clinical Instructor (initiator and facilitator); Quality link and Charge Nurse (monitoring and evaluation) and lastly, Coronary Care Unit staff and medical team (members)

Clarify the Process

The process began with identifying the goal, objectives and desired outcome which was to reduce peripherally intravenous cannula (PIVC) related phlebitis by 90 percent. To add clarification the flow was schematically presented in the figure 1.

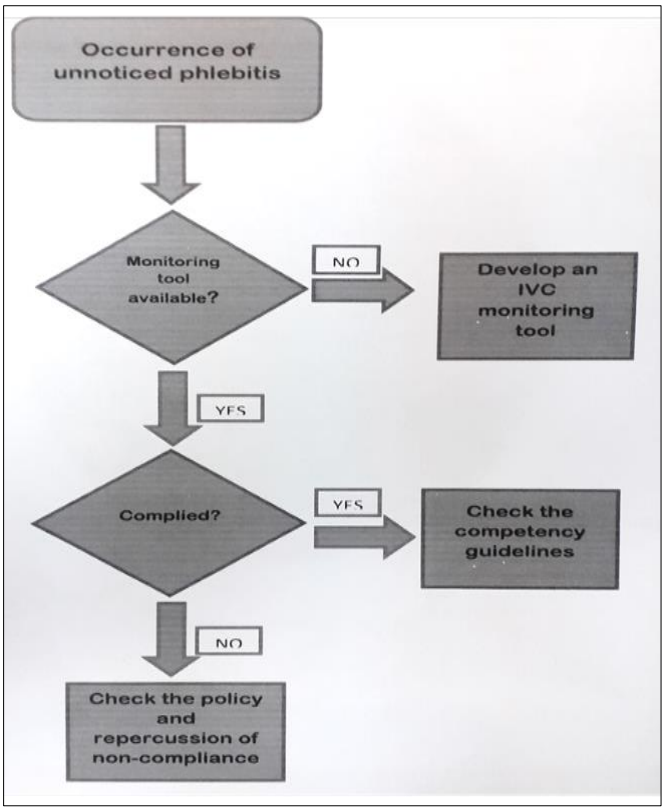

Figure 1: ***Pathway clarifying the process***

U-Understand the Problem

At this stage, the project owner utilized the fish bone approach in order to list all possible cause and contributory factors in occurrence of PIVC phlebitis. It was summarized and presented in figure 2 for thorough understanding.

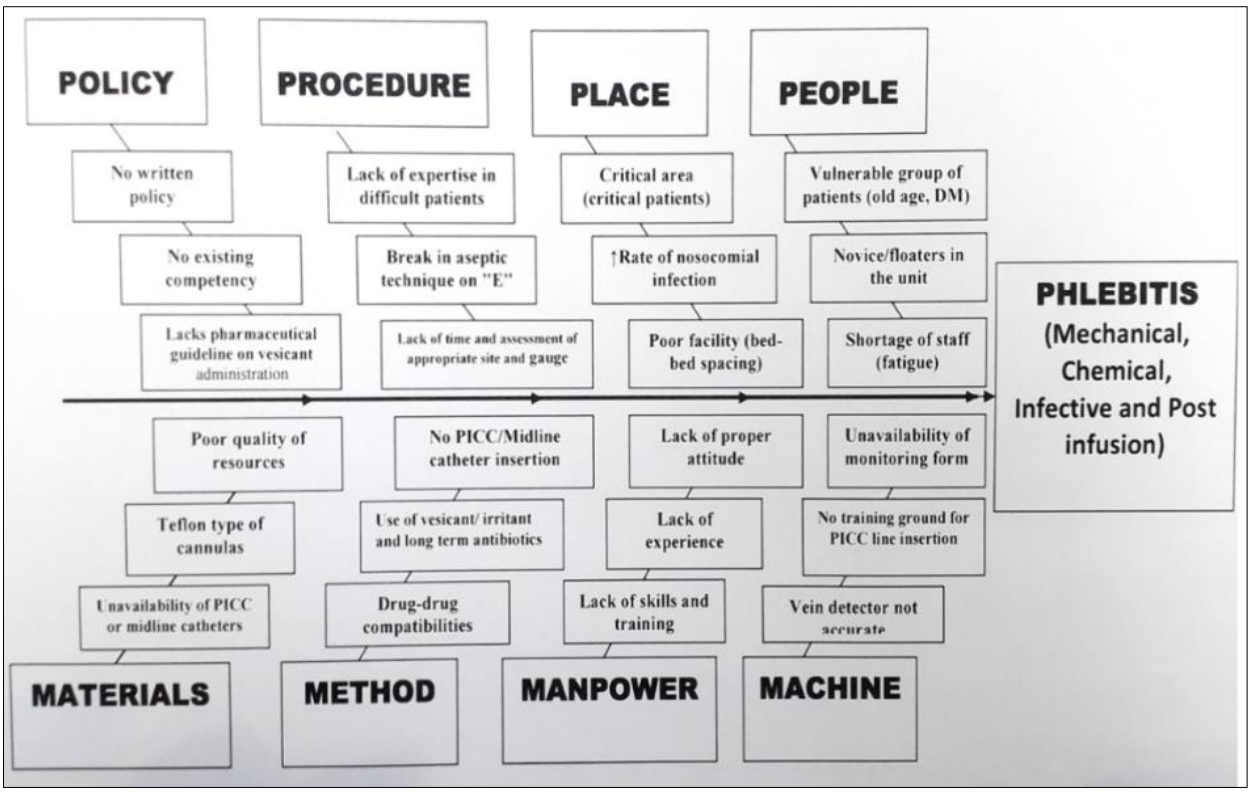

Figure 2: ***Fish bone approach***

S-Select Strategy for Improvement

This stage included the selection of the best intervention deemed suitable. Among the identified solutions, adaptation and modification of phlebitis monitoring tool and start of intensive training program were the most feasible, cost-effective and impactful strategies as shown in Figure 3.

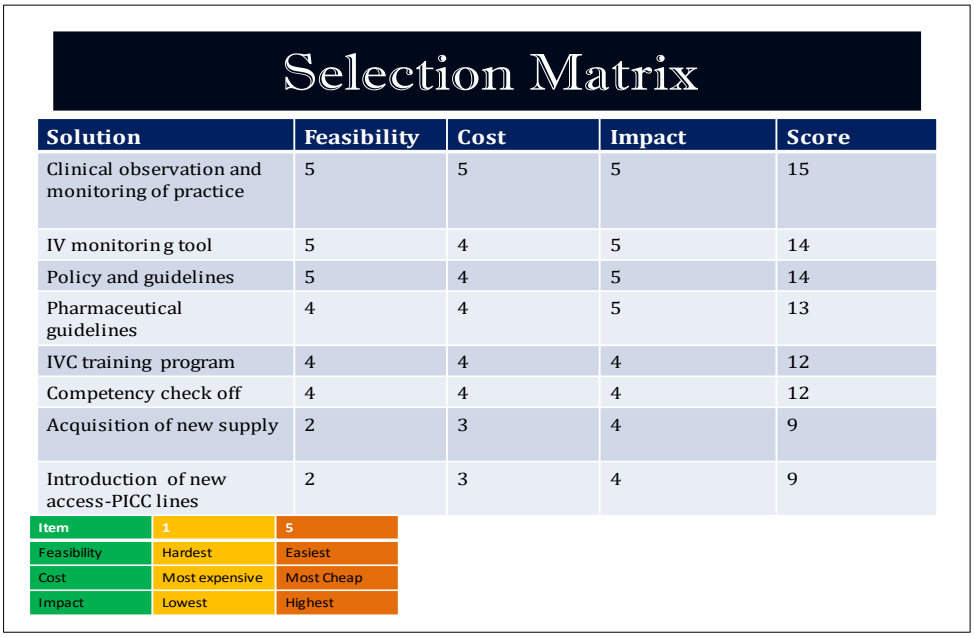

Figure 3: ***Strategy selection matrix***

After completion, planning subsequently proceed which determined strategies related to areas of improvement, time frame and assigned staff. The do part commenced from holding an internal meeting then external conference with higher rank managers. Other activities included the development of PIVC monitoring tool, conducting in service education lectures, competency check-off and revisiting the existing policy. Check part ensured that the VIP form was utilized properly. Problems arising were examined and re-evaluated for further improvement while the act part proceeded with center wide adaptation of the project upon realizing its valuable outcome.

Data Analysis

The data gathered were analyzed using descriptive statistics such as frequency distribution and percentage count. This parameter helped interpret the variables into measurable outputs.

RESULTS AND DISCUSSION: Using the PDCA cycle the following data was gathered, analyzed and interpreted.

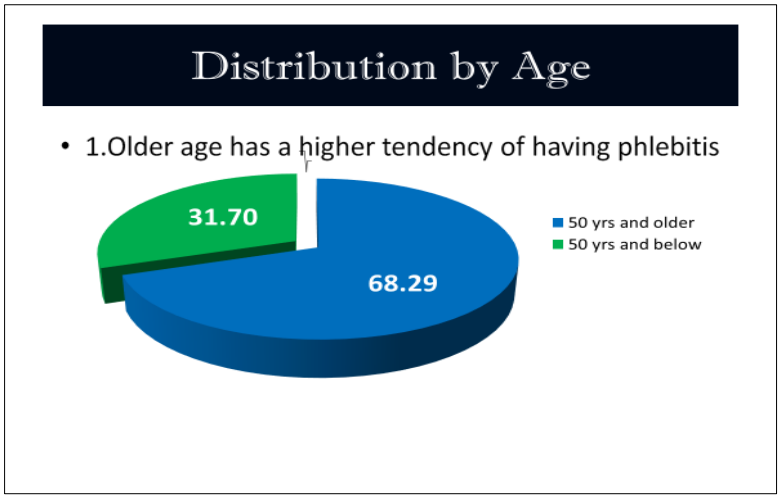

Figure 4: ***Distribution by age***

The total CCU admission from June to November with indwelling intravenous catheter was 246. Out of that 168 (68.29%) were aged 50 years and above while 78 (31.70%) belonged to age group 50 years and younger. Studies showed that age was one of the major determinants of phlebitis. Among older patient, the anatomical and physiological changes coupled with intravenous therapy made them susceptible to PIVC complications. Aging was also associated with venous thromboembolism with hypercoagulability, venous statis and dysfunctional endothelium [10].

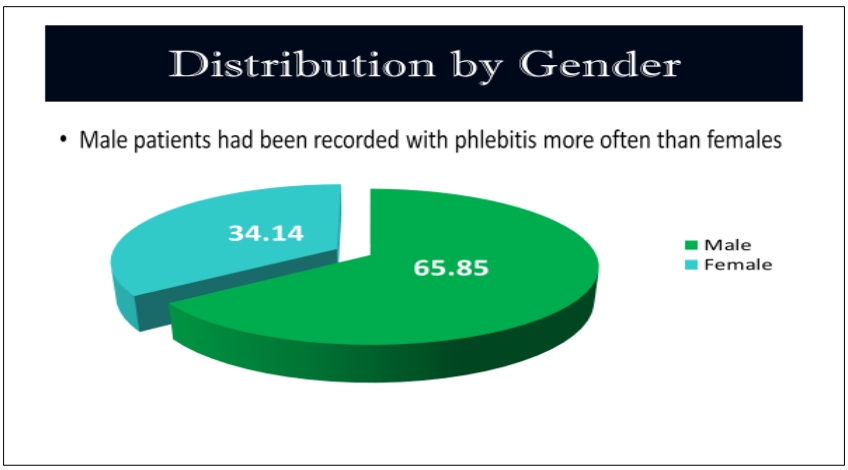

Figure 5: ***Distribution by Gender***

Out of 246, 162 (65.85%) were male while 84 (34.14 %) were female. In showed that male cardiac patients were noted to have higher phlebitis incidence than females. Some studies supported this claim due to their familial history, underlying disease and lifestyle such as increased rate of smoking resulting to damaged intravascular vessels and slower blood blow [11].

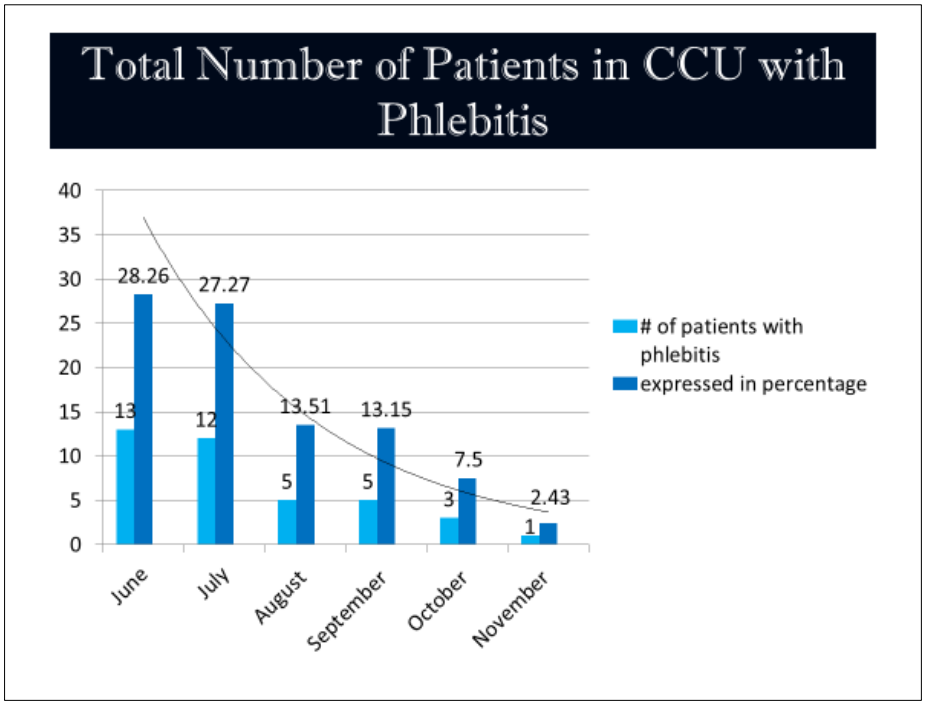

Figure 6: ***Total number of patients with phlebitis***

Each month revealed a descending slope of phlebitis incidence started from June and ended in November. 13 (28.26%) cardiac patients obtained phlebitis on June followed by 12 (27.27%) on July, 5 (13.15) for both August and September, 3 (7.5%) on October and 1 (2.43%) on November. The downward trend signified a crucial reduction of phlebitis after implementation of the VIP form.

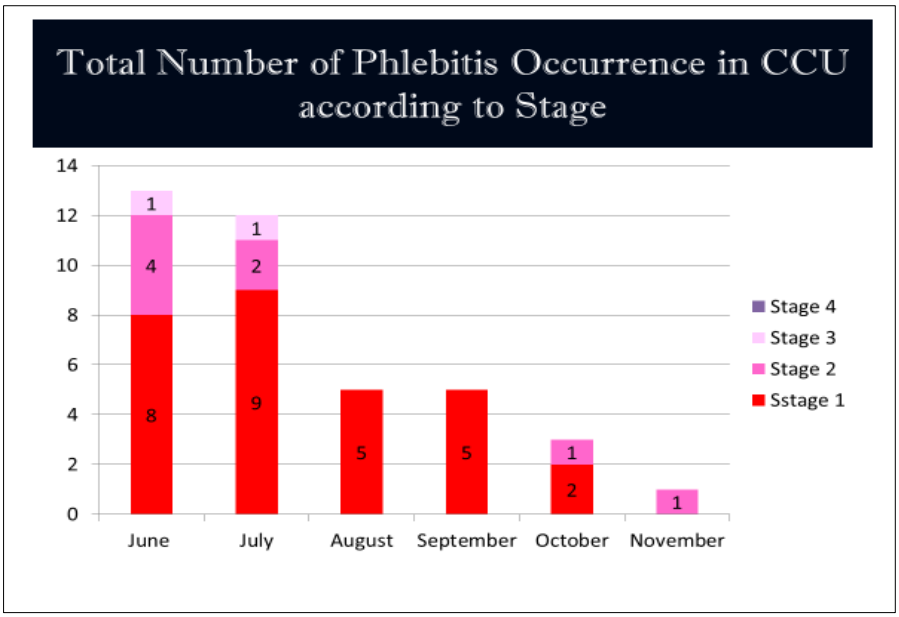

Figure 7: ***Phlebitis stage***

Stage 1 phlebitis dominantly occurred with total quantity of 8, 9, 5, 5,2 and 1 for the month of June, July, August, September, October and November respectively. Stage 2 did not manifest significantly in August and September while stage 3 and 4 did not manifest from August to November. This proved that utilizing the VIP form enable the nurses to assess and monitor the condition of the inserted peripheral cannula from the first onset of signs and symptoms. At stage 1, appropriate intervention was carried out therefore preventing to its severe form.

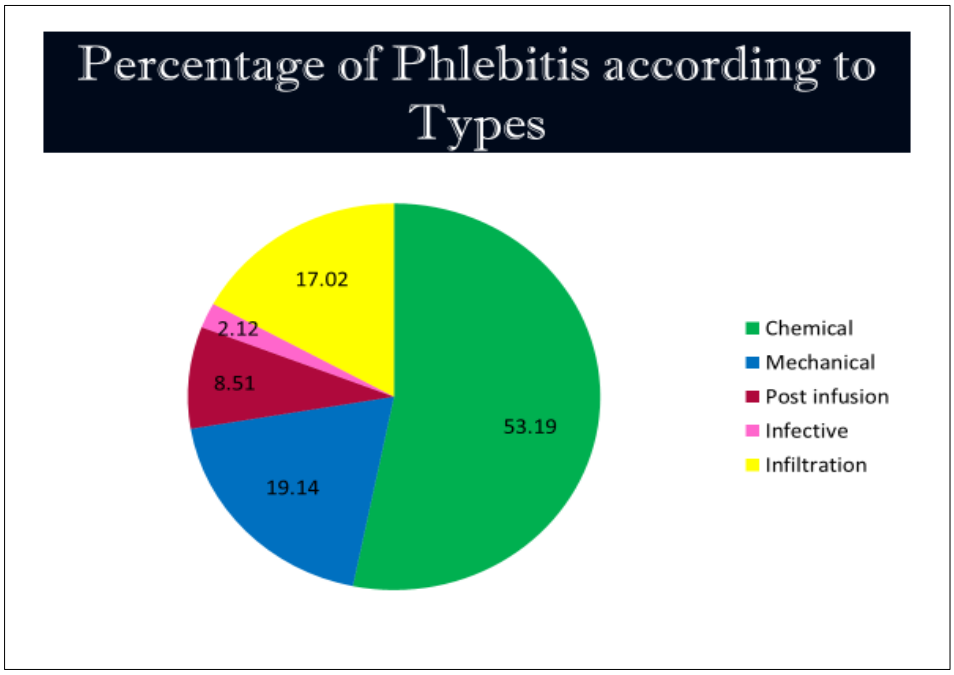

Figure 8: ***Types of phlebitis***

Phlebitis types typically comprised of chemical, mechanical, post infusion, infective and infiltration. Among these, chemical phlebitis occurred largely at 53.19% followed by mechanical at 19.14% and infiltration at 17.02%. Meanwhile, post infusion and infective accounted for 8.51% and 2.12% respectively. Critical area procedures frequently relied on IV therapy and the use of highly potent antibiotics, dopaminergic and inotropic supports. Thus, pH (acid/base) and osmolarity contents could potentiate chemical irritation and inflammation of the veins [12].

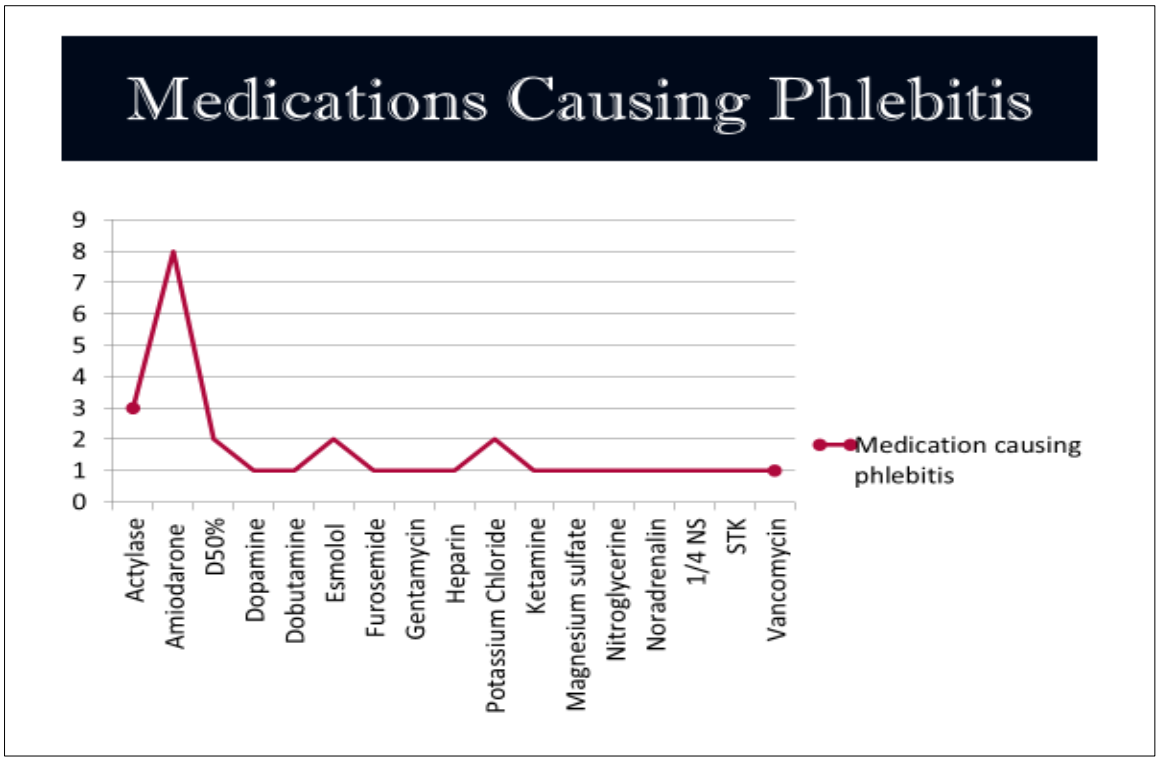

Figure 9: ***Medication causing phlebitis***

Among the cardiac patients who incurred phlebitis were those who were provided with Actylase, Amiodaorone, Dextrose 50%, Dopamine, Dobutamine, Esmolol, Furosemide, Gentamycin, Heparin, Potassium Chloride, Ketamine, Magnesium Sulfae, Nitroglycerine, Noradrenalin, ¼ Normal saline, Streptokinase and Vancomycin. From the list, Amiodarone obtained the highest causative factor with total of 8 patients followed by Actylase with 3 patients. According to studies peripheral amiodarone infusion was associated with direct irritation of vessel walls and phlebitis rates of 8% to 55% [13]. Cardiac medications with a pH of <5 or >9, an osmolarity > 600 mOsm/L had high incidence of phlebitis reported in the literature [14].

CONCLUSION

The finding suggested that phlebitis as a common culprit of intravenous therapy remained to be a preventable complication through a timely identification, monitoring, staging and intervention. The use of VIP form together with the collaborative efforts of the whole team successfully reduced the phlebitis incidence rate in Coronary Care Unit to acceptable level. Additionally, further improvement opportunities were determined: 1) The idea of starting PICC lines in CCU can be considered as an adjunct solution for long term therapy and hypertonic and irritant medications. 2) Revisit the dedicated medication protocols for hypertonic, irritant and vesicant medications. 3)The correlation of selected site, gauge, size of the vein and the type of material used in development of phlebitis must be studied. 4) Administrative support and continued education and training must be strengthened.

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