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Original Research Article

Impact of interventions on the incidence of thrombophlebitis in peripheral venous cannulation in a tertiary care teaching hospital

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ABSTRACT

Background: In hospitalized patients the use of intravenous devices like cannula are indispensable. Nearly about 80% of hospitalized patients require peripheral venous cannulation, as a part of therapy. Thrombophlebitis is one of the prevalent complications of peripheral venous cannulation.
Method: The present study was aimed to find the incidence of thrombophlebitis after peripheral venous cannulations in the patients admitted in a tertiary care teaching hospital. Impact of regular trainings and interventions on the incidence and grades of thrombophlebitis was also studied. The study was conducted for period of 1 year.
Result: The total of 28850 cannulations carried out on 11686 patients was observed. Phlebitis was diagnosed in 1821 peripheral venous cannulations, giving the incidence of 6.3%. As per Visual Infusion Phlebitis (VIP) score, 1527 (83.86%) were grade 1 phlebitis, 274 (15.04%) were with grade 2 phlebitis and 20 (1.10 %) were grade 3 phlebitis. Regular surveillance, training and timely interventions were carried out during this period and the effect of these interventions was noted in the monthly phlebitis rate. Phlebitis rate reduced from 9.89% in January to 3.99% in the month of December. There was also reduction in grade 2 thrombophlebitis (from 21.05% in January to 6.09% in December). In the last 4 months of study period grade 3 phlebitis was not reported.
Conclusions: A significant reduction in the incidence of phlebitis associated with peripheral intravenous cannulations may be achieved by regular surveillance, training and timely interventions.

Keywords: Cannulation, Thrombophlebitis, Visual infusion phlebitis score

INTRODUCTION

Intravenous devices are indispensable and commonly used among hospitalized patients. In the modern practice of medicine around 80% of the hospitalized patients receive intravenous (IV) therapy at some time during their admission.[1] The peripheral venous cannulation (PVC) is a commonly used invasive procedure to administer medications, fluids and bio products. The most common complication associated with it is thrombophlebitis with incidence varying according to different settings. [2]

Thrombophlebitis is the inflammation of the vessel wall due to the formation of blood clot. There have been many theories on the pathophysiology of peripheral vein infusion thrombophlebitis. The currently accepted concept suggests that catheterization of the vein leads to inflammation and thrombus formation.[3]

If the condition does not get resolved, this may lead to other complications like pulmonary embolism, deep vein thrombosis, septicemia, formation of nodule and cellulitis. Due to this a need of insertion of new cannula at the site other than previous is required. These complications of PVCs, followed by its therapy can have catastrophic effect on the health as well as quality of life of patients and on the other side increasing financial burden with longer stay in hospital and treatment. [4]

The present observational study was carried out to find the incidence of thrombophlebitis in peripheral venous cannulations. Regular surveillance, training and timely interventions were carried out and impact of these interventions on the incidence and grade of thrombophlebitis over a period of one year was studied.

METHODS

The present prospective observational study was carried out in a tertiary care teaching hospital, for a period of 1 year from January 2019 to December 2019. Study was approved by Institutional Ethics Committee.

Patients admitted in the medical, surgical, obstetrics and gynecology, pediatric wards and critical care unit with peripheral venous cannulations were included in the study. Universal sampling was employed for the duration from January 2019 to December 2019. Patients with PVC done outside our hospital were excluded from the study. Posters of VIP score were displayed at all the prominent places in the ward. Training on PVC was conducted on regular basis for nurses and resident.

From January 2019 record of all peripheral venous cannulations was maintained in a register in individual wards. The demographic details of the patients along with the date and time of insertion and removal of peripheral venous cannula, number of attempts, and gauge of the needle used were recorded. Record was also maintained in nurse's care plan.

Daily PVC site was monitored for the development of the signs and symptoms of thrombophlebitis in 3 shifts by infection control nurse and staff nurse till the cannula was removed. Thrombophlebitis was graded using visual infusion phlebitis (VIP) score.[5] Peripheral venous cannulation insertion and maintenance bundles were formulated. Insertion bundles included, use of intracath tray, hand hygiene, selection of vein, skin preparation with 2% chlorhexidine, aseptic non touch technique and correct sharp disposal. Maintenance bundle included daily PVC site assessment, dressing integrity checks, port disinfection, port capping, saline flushes, daily evaluation for the continuation of cannula and hand hygiene before handling cannula.

Training

Training of staff nurses and junior doctors was conducted by Microbiologist, infection control nurses and link nurses. Bed side training was conducted on daily basis. This included PVC insertion and maintenance bundles, diagnosis and grading of phlebitis (VIP score). PowerPoint presentations, videos and hands on training was used as training module.

Interventions

Monthly changes in the incidence and grades of thrombophlebitis over a period of one year were recorded. The effect of training and various interventions was noted on the incidence and grades of thrombophlebitis. Department wise presentation of phlebitis was made in the monthly HICC meetings. Weekly audits of insertion and Maintenance bundles were carried out and monthly feedback was shared with concerned department. Feedback was given to individual departments with names of the defaulters. Training was intensified for the HCWs from the department showing increase in phlebitis rate. Staff nurses and doctors who did cannulations for more than second attempt were retrained. In the month of March use of 10 cm venous extension (Ven-o-line, Romsons Disposable Medical Devices, India) PVCs was implemeted all over hospital.

Statistical analysis

Data was entered in excel sheet and analysed using SPSS version 25. Categorical variables have been expressed as frequencies and percentages.

RESULTS

The study was carried out to observe the development of phlebitis among the patients undergoing PVCs, admitted in a tertiary care hospital over the period of 1 year, from 1st January 2019 to 31st December 2019. Total 28850 PVCs carried out on 11686 patients, were monitored till the cannula was removed. When the patients were divided on the basis of age there were 5142 (44%) patients below the age of 45 years and 6544 (56%) were above the age of 45 years. Out of all patients observed number of females was (52%, n=6077), which was significantly higher than males (48%, n=5609). Among the total 28850 PVCs observed, phlebitis was developed in 1821, giving the incidence of 6.3%. While no phlebitis was seen in 27033 (93.70%) PVCs. When classified according to the grades of phlebitis as per VIP score, 1527 (83.86%) were grade 1 phlebitis, 274 (15.04%) were with grade 2 phlebitis and 20 (1.10%) were grade 3 phlebitis. Grade 1 was significantly more among the phlebitis developed. The results are shown in Table 1.

The month wise distribution of the total PVCs and the phlebitis developed were calculated giving the month wise incidence of its development. The highest incidence (9.92%) was observed in the month of February, followed by in January 9.89%, the least cases of phlebitis were noted in August (3.84%) and December (3.99). The incidence of grade I phlebitis was found to be higher

compared to grade II and III. The distribution of all PVCs according to month and respective number of development of phlebitis and its grades with incidences are shown in Table 2 and presented graphically in Figure 1.

There was gradual reduction in grade II and grade III phlebitis. In last 4 months of the study grade III phlebitis was not seen (Table 2).

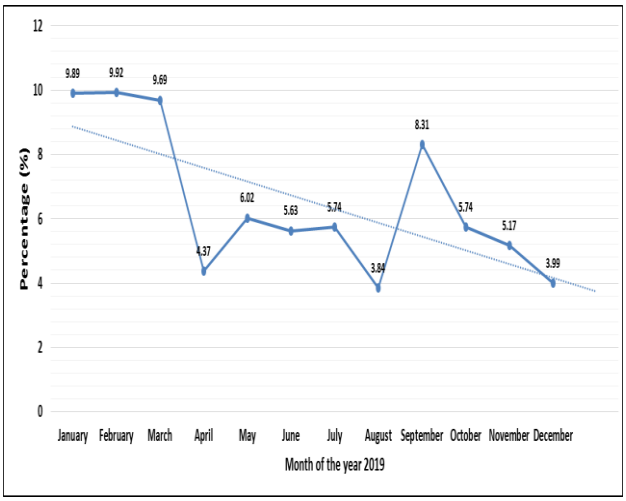

Figure 1: Graphical presentation of month wise incidence of phlebitis in patients underwent PVC in the year 2019.

Variables		N (%)
Age (Years)	>45	5142 (44)
	<45	6544 (56)
Gender	Males	5609 (48)
	Females	6077 (52)
Attempt of cannulation	First	17310 (60)
	Second	10102 (35.02)
	Third	1438 (4.98)
Gauge of cannula used	Gauge 20	22587 (78.29)
	Gauge 22	4378 (15.18)
	Gauge 24	1885 (6.83)
Location of PVC	Hand	19906 (69%)
	Forearm	8655 (30%)
	Lower limb	289 (1%)
Duration of cannula (Hours)	<72	18207 (63.11)
	>72	10643 (36.89)
Location (ward/unit)	Medical	9304 (32.25)
	Critical	6973 (24.17)
	Surgical	6124 (21.23)
	Gynecology and obstetrics	3595 (12.45)
	Pediatric	2854 (9.9)
Phlebitis development	Developed	1821 (6.30)
	Not developed	27029 (93.70)
Grade of phlebitis	Grade 1	1527 (83.86)
	Grade 2	274 (15.04)
	Grade 3	20 (1.10)

Table 1: Characteristics of the participants.

Table 2: Month wise distribution of total PVC done, number of phlebitis occurred and its incidence.

Month	Total PVC (n)	Total phlebitis, n (%)	Grade I	Grade II	Grade III
Jan	2306	228 (9.89)	176 (77.19)	48 (21.05)	4 (1.75)
Feb	2319	230 (9.92)	180 (78.26)	46 (20)	4 (1.74)
March	2250	218 (9.69)	175 (80.27)	40 (18.35)	3 (1.38)
April	3090	135 (4.37)	110 (81.48)	23 (17.04)	2 (1.48)
May	2093	126 (6.02)	112 (88.89)	12 (9.52)	2 (1.59)
June	2858	161 (5.63	131 (81.37)	28 (17.39)	2 (1.24)
July	1918	110 (5.74)	96 (87.27)	12 (10.91)	2 (1.82)
Aug	3231	124 (3.84)	104 (83.87)	19 (15.32)	1 (0.81)
Sept	1816	151 (8.31)	132 (87.42)	19 (12.58)	0 (0)
Oct	2038	117 (5.74)	105 (89.74)	12 (10.26)	0 (0)
Nov	2050	106 (5.17)	98 (92.45)	8 (7.54)	0 (0)
Dec	2881	115 (3.99)	108 (93.91)	7 (6.09)	0 (0)
Total	28850	1821 (6.30)	1527 (83.86)	274 (15.04)	20 (1.10)

DISCUSSION

Peripheral venous cannulation is commonly used in the practice of medicine, and has revolutionized the practice of drug administration, allowing infusion of medications, hydration fluids, blood products and nutritional supplements.[6] IV administration has almost become a necessity in the indoor patient departments today.[1]Anything which has benefits will also come at the cost of some adverse effects like complications in this case, which might be simple pain, or may develop into severe thrombophlebitis and infections related to catheter infections.[6]

The present study was undertaken in a tertiary care teaching hospital over a period of one year to find out the incidence and grades of thrombophlebitis in peripheral venous cannulations. Various interventions were carried out during this period and impact of these interventions

on monthly incidence and grades of phlebitis were observed. 28850 peripheral venous cannulations were carried out on 11686 patients. Slightly higher but significant patients were below the age of 45 years, and more than half of them were females. Majority of the cannulations were achieved in the 1st attempt, followed by 2nd attempt and very few required 3rd attempts. The commonest cannula gauge used was gauge 20, with the commonest location including hand, forearm and very few in lower limbs. As a routine practice in our hospital cannula was removed if not required after 72 hours, so the duration of cannula<72 hours was significantly more in the 63.11 % patients compared to 36.89% with>72 hours.

A study from Chitwan medical college by Thapa et al reported highest incidence of phlebitis among the patients with durations of cannula ranging between 48-72 hours.[7] According to Rai et al an average time of IV cannulation was 5 days, with use of 20-gauge cannula for all patients.[8]

The present study reported phlebitis incidence of 6.3% among 28850 PVCs observed. In the initial months (January, February and March) the incidence of phlebitis was high (9.89%,9.92% and 9.69 respectively). Due to increased awareness created through training sessions the reporting was increased. In March venous extension of 10 cm was used in all PVCs. This minimized chances of mechanical irritation and infection by taking the administration site away from insertion site. Due to this intervention the phlebitis rate reduced in the month of April and in subsequent months. Emphasis was given on aseptic technique during insertion. Use of intracath tray was made compulsory. Hand hygiene and use of gloves during insertion was monitored. Aseptic handling of the ports was implemented. Also, regular surveillance, training and sharing of phlebitis data of individual wards in the monthly meetings contributed towards achieving reduction in the phlebitis at the end of the study period. Purushothaman et al analyzed the data of thrombophlebitis before and after the training of the nursing staff over the period of 4 years.[9] They also reported significant reduction in numbers of thrombophlebitis in the post training period.

Similar reduction in phlebitis rate was noted by Sriupaya et al in 2014.[10] They observed reduction in phlebitis from 0.6% to 0.02%. They could achieve this with implementation of hand hygiene and dressing integrity checks, while Yagnik et al in 2017 achieved reduction from 3.7% phlebitis in pre intervention to 0% in post intervention phase.[11] They stressed on documentation during insertion and aseptic non-touch technique during insertion. Duncan et al in 2018 could achieve reduction in phlebitis rate from 8% to 2%.[12] Few of their bundle components were-PIVC site assessment, alcohol caps and minimization of tubing disconnect.

In our study as per the VIP score 1527 (83.86%) were with grade I phlebitis, 274 (15.04%) with grade II phlebitis and 20 (1.10 %) with grade III phlebitis.[5] Due to regular surveillance and increased awareness created through intense training, phlebitis was diagnosed at earlier grades, so incidence of grade III phlebitis was very less. During the study period there was gradual reduction in grade II phlebitis (21.05% in Jan to 6.9% in December). Also, in the last 4 months of the study period grade III phlebitis was not reported. This was achieved due to continuous monitoring of cannulation site. Cannula was removed and resited as per VIP score guidelines. With decrease in the incidence of phlebitis the significant decrease in the number of grades I, grade II and grade III phlebitis noted from the month January to December. Similar result of incidence of thrombophlebitis was reported by Rai et al, they also noted predominantly grade I phlebitis, followed by grade II and very few grades III.[8] In a study by Saji et al out of total 82 patients recruited 50% incidence of thrombophlebitis was reported.[6] 61% of them were with grade 1 thrombophlebitis and remaining grade 2 was in 39% of patients without any incidence of grade 3 thrombophlebitis, with no association of thrombophlebitis incidence and risk factors considered. Thapa et al reported the overall incidence of phlebitis to be 33.44% and early-stage phlebitis was 88.26%.[7]

Performing peripheral venous cannulation is an invasive procedure and requires an experienced clinician or nurse, local aseptic methods and knowledge of common precautions that need to be taken while giving the therapy. Due to lack of knowledge, reasonable care and skill, thrombophlebitis has emerged as a very common complication in hospitalized patients. The reason why more lighter needs to be shed on this subject is that it increases the nursing cost and time, along with putting the patient's safety at risk.[4]

Limitations

We could not compare all the risk factors between phlebitis and non-phlebitis group. Further study is needed in this regard to highlight risk factors.

CONCLUSION

Regular surveillance of phlebitis helps in planning interventions to reduce phlebitis due to peripheral venous cannulation. Knowledge about the anatomy of venous structure, diagnosis as per visual Infusion Phlebitis score and early diagnosis of phlebitis is crucial to reduce its incidence in patients undergoing peripheral venous cannulations.

Regular training of the staff and doctors involved in peripheral cannulation should be an integral part of infection control activities.

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