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Intravenous Site Complications for Patients Receiving Chemotherapy: An Observational Study

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Abstract

Objective: This article explores the factors contributing to intravenous (IV) site related complications in patients receiving chemotherapy related to different variables such as different sizes of cannula, types of chemotherapy, duration of infusing the chemo and locations of the insertion of cannula in a large teaching hospital over an eight-month period.

Methods: A cross-sectional observational study which involved examining peripheral IV site complications conducted at a teaching hospital among sixty-one oncology patients receiving chemotherapy related to different variables such as different sizes of cannula, types of chemotherapy, duration of infusing the chemo and locations of the insertion of cannula was conducted. Patients were chosen according to the inclusion criteria and chemotherapy was given as prescribed.

The signs and symptoms of IV site irritation due to phlebitis and extravasations were observed. Any complaints of pain were assessed on the puncture site and the patient was referred for treatment if necessary. The patients were monitored for a minimum of six cycles at different steps of administration (pre, during and after IV chemotherapy administration).

Results: A total of 61 patients with a total of 366 cycles receiving chemotherapy were observed during their first six cycles of chemotherapy. Majority of the cycles 132 (36.1%) are given in patients with breast cancer, 230(62.8%) of patients received non-vesicant chemotherapy. A total of 23 patients (12.8%) developed pain complaint and/or irritation when the chemotherapy contained vesicant chemotherapy (P = 0.028); 261(71.3%) patients with cancer received chemotherapy with duration varying from 1 to 72 hours. Fifteen (5.7%) of those patients developed pain complaint and/or irritation (P = 0.003).

The majority of cycles were given in the hand 351(95.9 %). Twenty patients (5.6%) developed pain complaint and/or irritation and 3(20%) developed problems when chemotherapy was given in the arm (ante-cubital) (P = 0.025).A total of 213(58.2 %) patients used small gauge size 24 to 26 cannula. The size of the cannula did not show significant correlations for pain complaint and/or irritation (P= 0.055).

Conclusion: In our center, we found that certain factors in the intravenous chemotherapy administration led to complications and patient's dissatisfaction. There is the need to investigate each of those factors in a randomized control trial.

Keywords: Chemotherapy; Extravasation; Infiltration; Intravenous complication; Phlebitis

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Introduction

Peripheral intravenous (IV) cannulation is one of the common clinical procedures in hospitals. More than 80% of patients admitted to the hospital will require IV cannulation [1,2]. One of the indications for IV insertion is chemotherapy administration. The drugs used in cancer treatment vary in their chemical structure, biological side effects, and toxicities. Peripheral intravenous is preferred because it is inexpensive and simple, although it is not without any risk [3].

IV chemotherapy should not be painful, therefore when pain is reported; it should not be

Table 1: Number of cycles given in various types of cancer.

Variables		Count	Percentage (%)
Total		366	100.00%
Diagnosis	Breast Cancer	132	36.10%
	Ovarian Cancer	108	29.50%
	Colon Cancer	36	9.80%
	Endometrial Cancer	12	3.30%
	Uterine Cancer	6	1.60%
	Cervical Cancer	6	1.60%
	Pancreatic Cancer	18	4.90%
	Trophoblastic Gestational Disease/ Choriocarcinoma	12	3.30%
	Non-Hodgkin's Lymphoma	12	3.30%
	Hodgkin's Lymphoma	12	3.30%
	Prostate Cancer	6	1.60%
	Rhabdomyosarcoma	6	1.60%

ignored, as this might be an indication of IV occlusion, phlebitis or extravasation [4,5].

Chemotherapy administration could be given in the general oncology ward or as a daycare unit, depending on the hospital setting. Various complications related to intravenous chemotherapy administration have been encountered in our center. We observed that there were different practices regarding the size and location of the IV cannula. In general wards, the patient's chemotherapy was administered using a big gauge cannula size 20 and 22, and patients experienced complications of phlebitis and extravasations compared to the daycare unit, where a small bore cannula size 24 and 26 was used without any complications. Therefore, this study explored the factors contributing to IV site complications. Specifically, this study will examine the relation between the size and location of cannula, and in addition, the duration and types of chemotherapy agents.

Methodology

This is an observational study examining Peripheral Intravenous (PIV) site complications for patients receiving chemotherapy related to different variables such as different sizes of cannula, types of chemotherapy, duration of infusing the chemo, and locations of the insertion of cannula. Patients are chosen according to inclusion criteria and chemo therapy is given as prescribed.

The criteria selected for participants are the patients using PIV cannula for chemotherapy, with sizes of cannula including 20, 22, 24, 26 and patient receiving first cycle of chemo therapy only with pre-assessment of the cannulation site shows no pre-complication. Those who are receiving any type (vesicants / non-vesicants drug) were included. Our study includes adult male and female with any type of cancer.

All patients using central line catheter, peripherally inserted central catheter, and patients who have already started chemotherapy, were excluded. Age below 18 years was also not included. In addition, all patients receiving inotropes/antibiotics or any other IV drugs on the same iv peripheral line were excluded. Any patient during the initial assessment that showed any complication in the PIV site was not included. The patients were monitored for a minimum of six cycles at different steps of administration (pre, during and after).

The signs and symptoms of IV site irritation due to phlebitis and extravasations were observed. Any complaint of pain was assessed on the puncture site and the patient was referred for treatment if necessary.

Approval was obtained from King Abdulaziz University Hospital and the Research Ethical Committee prior to data collection. Informed consent was also obtained from the participants involved in this study. All the cultural and religious practices were kept and respected. Permission was obtained from the Nursing Department of the Hospital and Research Ethical Committee. All the ward managers were informed for their due cooperation and support. The patient was given a brief explanation regarding the purpose of the study. The study was carried out anonymously and on a voluntary basis, with confidentiality being assured.

Statistical methodology

This study was analyzed using IBM SPSS Statistics for Windows, Version 22 (IBM Corp., Armonk, NY USA). A simple descriptive statistic was used to define the characteristics of the study variables through a form of counts and percentages for the categorical variables. To establish a relationship between categorical variables in this study, the Chi-Square test was used. The tests were done with the

Table 2: Correlation between different variables and pain complaints and/or irritation at the intravenous site.

All Cycles				Pain complaint and/or irritation				
Variables		Number	%	No	%	Yes	%	p-value
Total		366	100					
Regimen	Non Vesicant	66	18	66	100	0	0	0.028
	Vesicant	70	19.1	67	96	3	4.2	
	Combined	230	62.8	210	91.3	20	8.6	
Duration	IV push-rapid 3-5 min	5	1.4	5	100	0	0	0.003
	IV Infusion 10min - 60min	75	20.5	73	97.3	2	2.6	
	Short Chemotherapy >1hr - 72hrs	261	71.3	246	94.2	15	5.7	
	Very Long (4-8 days)Chemotherapy	25	6.8	19	76	6	24	
Location	Hand	351	95.9	331	94.5	20	5.6	0.025
	Arm	15	4.1	12	80	3	20	
Size	Small G-24/26	213	58.2	204	95.7	9	4.2	0.055
	Big G- 20/22	153	41.8	139	90.8	14	9.1	

assumption of normal distribution. Lastly, a conventional p-value < 0.05 was the criteria for rejection of the null hypothesis.

Results

Sixty-one patients with a total of 366 cycles receiving chemotherapy were observed during their first six cycles of chemotherapy. The subjects observed had different types of cancer, with the majority of cycle 132 (36.1%) are given in patients being diagnosed with breast cancer, followed by ovarian cancer 108 (29.5%), while 36(9.8%) was diagnosed with colon cancer (Table 1).

Sixty-six (18%), 70(19%) and 230(62.8%) patients received non-vesicant, vesicant, and combined chemotherapy, respectively. Twenty patients (8.6%) developed pain complaint and/or irritation when the chemotherapy contained combined chemotherapy while 3(4.2%) patients developed the same complaint when using vesicant chemotherapy alone. None had problem with non-vesicant chemotherapy (P= 0.028).

261(71.3%) patients with cancer received chemotherapy with duration varying from 1 to 72 hours. Fifteen (5.7%) of those patients developed pain complaint and/or irritation. Six (24) patients had this problem with the longer duration chemotherapy (4-8 days), while no patient had that problem with rapid IV push (3-5 mints) chemotherapy (P = 0.003).

The majority of cycles were given in the hand 351(95.9 %).Twenty (5.6%) patients developed pain complaint and/or irritation and 3(20%) developed problem when chemotherapy was given in the arm (antecubital) (P =0.025).One hundred and fifty-three (41.8%) patients used size 20-22 gauge cannula and 213(58.2 %) used small gauge size 24-26 cannula. The size of the cannula did not show significant correlations for pain complaint and/or irritation (P= 0.055) (Table 2).

Discussion

Peripheral intravenous cannula complications may be related to mechanical or physical factors. Among the mechanical factors, the insertion techniques, the anatomy of the site, the size and type of device, number of insertions, catheter in situ for more than 72 hrs, the severity of the disease, and pre-existing infections should be considered [6-9]. On the other hand, chemical factors including the infusion of irritant drugs such as IV amiodarone, antibiotics with low PH, and vesicant infusion, may play a major role [5,10,11]. Vesicant infusions (agents that cause vein damage) can result in extravasation and serious complications, permanent damage or injury which can cause pain and irritation [5,12,13]. Our study showed similar findings, that vesicant chemotherapy caused significant pain and discomfort complains compared to non-vesicant chemotherapy.

It has been suggested that the duration of the chemotherapy with the catheter in place affects the incidence of sepsis while increasing the infection rate [14,15]. In this study, the two cases with infection had catheters in place for as long as 46 days. Prolong infusion of chemotherapy like taxaneand anthracycline was associated with 52% infusion-related phlebitis [16]. Our observations were similar with previous observations in which patients that received chemotherapy for over 72 hours experienced more pain than those who had short infusion or IV bolus and this correlation was statistically significant.

The choice of which vein to puncture and size of the cannula should be based on the duration of the IV therapy, characteristics of the drugs, and state of the patient's peripheral venous network [9]. The dorsum of the hand and anti cubical fossa is the commonly preferred sites for routine venous cannulation. Goudra et al. [17] conducted randomized control trial for the effect of site selection on pain with IV insertion and found that in the absence of any contraindications, the arm (antecubital) should be the cannulation site of choice. However, considerations like increased chance of kinking and obstruction might preclude such practice [17]. Cocolini et al. [18] demonstrated that using antecubital vein rather than the hand and forearm vein should be encouraged to reduce the risk of thrombophlebitis [18]. This supports our findings where patients who received chemotherapy in the arm (antecubital) experienced less pain and/or irritation during IV chemotherapy.

With regard to the size of cannula used, size22 gauge cannula is recommended to be the standard practice, while for fragile vein that has received previous multiple cannulation a 24 gauge cannula is suitable for chemotherapy administration [19,20].

Smaller cannula minimized the trauma to the vein and allowed increased blood flow that leads to increase in dilution of the chemotherapy agents and minimized the risk of mechanical phlebitis [2,9,21]Administration of chemotherapy in large gauge cannula is associated with increased risk of thrombophlebitis [22]. Our study result did not support this finding; we found no difference in terms of pain and/or irritation for patients who used big or small gauge cannula. However, this finding needs to be confirmed in a larger study. In conclusion, we found in our center that certain factors in intravenous chemotherapy administration led to complications and patient's dissatisfaction, and there is need to investigate each of these factors in a randomized control trial.

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