

Comparison of complete blood count of blood samples taken through venipuncture and through the peripheral venous infusion line after the administration of fluids

Mohammad Reza Yazdankhahfard¹, Mahboobeh Taghizadeganzadeh^{1*}, Farzaneh², Mohammad Reza, Kamran Mirzaei³

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1. Dept. of Nursing, Faculty of Nursing and Midwifery, Bushehr University of Medical Sciences, Bushehr, Iran
 2. Dept. of Pathology, Bushehr University of Medical Sciences, Bushehr, Iran
 3. Dept. of Community Medicine, Bushehr University of Medical Sciences, Bushehr, Iran

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Abstract

Introduction:

A number of factors can affect hematological measurements among which the effect of blood sample collection procedures by nurses in hematology test results is of great importance. Therefore, this study was carried out with the aim of determining and comparing the experimental values of complete blood cell count through taking blood samples from peripheral vein infusion of intravenous fluids and routine blood sampling procedure while receiving continuous IV fluids.

Methods & Materials:

This quasi-experimental intervention study was done on 60 patients hospitalized in the internal medicine ward who were selected for blood sampling. Two samples were taken from each patient through a peripheral intravenous line after throwing the first 5 cc of IV away and collecting the remaining 5 cc and through the routine blood sampling procedure for the case and control group, respectively. Then all the samples were analyzed in terms of the number of white blood cells, red blood cells, platelets, hemoglobin and Hematocrit using SPSS software¹⁹, paired t-test and Pearson correlation.

Results:

The mean values of white blood cells, red blood cells, platelets, hemoglobin and Hematocrit in the case group were 9694 mm³, 4433000 mm³, 240166 mm³, 12.52 gr/dl, 38.90% and 9587 mm³, 4588000 mm³, 244800 mm³, 12.68 gr/dl, 38.96% in the control group, respectively. A significant difference was only observed in hemoglobin values between the case and control groups.

Conclusion:

In order to measure the amount of white blood cells, red blood cells, platelets and Hematocrit, blood samples taken from peripheral vein infusion can be used after throwing away 5 cc at the beginning of the sampling.

Keywords: Complete blood count, catheter, Venous Blood

Introduction

It is more than three decades that researchers discuss sampling through venous catheters and many relevant

unanswered questions. This question is still raised whether intravenous lines can be used for sampling. The reports of medical diagnostic laboratories are an

* Corresponding author, Address: Bushehr, Bushehr University of Medical Sciences, Faculty of Nursing and Midwifery

Tel: 09178900849

Email: mahboob.6691@yahoo.com

important part of the information based on which physicians diagnose the diseases and treat patients (1). To obtain accurate laboratory data for hematology samples, it is necessary that blood sample collection be done properly by nurses. Several factors can affect hematology measurement, one of which is the standard method of sampling by nurses before any analysis to reduce unwanted changes (2). Reviews show that errors before laboratory results on blood samples will cause 60-70% of incorrect laboratory diagnoses which include error in sampling process, transportation of samples to the laboratory and preparation of samples (3). Veins are the first sites for blood collection. Venipuncture is usually done through a superficial vein and the antecubital fossa is the area that is used most (4).

Most patients in the hospital need intravenous catheters for administration of fluids or medications (5). In a study by Sarani et al. in Yazd, it was found that 50% of patients were treated intravenously. Also in a study by Razavi et al. in Tehran, 55% of patients were treated intravenously; these figures show the wide range of intravenous treatment in Iran (6). Despite these peripheral catheters for blood collection, typically, nurses and laboratory staff use venipuncture (5) because it is believed that the injection of medication and fluid changes the results (7). Venipuncture is an invasive and painful procedure that can cause bruising, hematoma, infection, vasovagal reactions and in rare cases damage to the peripheral nerves (8), also it is a nursing skill for access to the venous system in many situations, especially when the patient has few suitable vessels or requires frequent blood tests (9). Nevertheless, fewer studies have been conducted on the comparison of hematologic parameters in blood samples obtained by venipuncture and peripheral catheter for patients with intravenous fluid intake (10) and relevant studies have emphasized performing more research in this field and on more cases. Given that on

the one hand, blood collection is still done through venipuncture in some hospital departments and on the other hand, no research has been done in this regard in Iran, this study was conducted to determine and compare laboratory values of blood collection through the peripheral venous infusion line and through venipuncture in patients admitted to the internal medicine department in Shohadaye Khalije Fars Hospital, Bushehr, in 2014.

Materials and methods

This research is a quasi-experimental study with a control group conducted on patients admitted to the internal medicine department in Shohadaye Khalije Fars Hospital, Bushehr. The sample size was determined as 60 considering confidence interval of 95%, study power of 90% and the standard difference 0.8 using Altman normogram. Blood samples were taken after providing necessary information about the objectives and methods of the study and obtaining written informed consent of qualified patients (patients requiring fluid therapy, patients receiving at least 100 cc of fluid, patients without peripheral venous infusion line, patients over 18 years of age, patients capable of giving written consent). Two samples of blood were drawn from each patient, one through the peripheral venous infusion line with fluid intake and another from patient's hand through venipuncture with 10 cc syringe and needle gauge 20. To do so, at first, both areas were disinfected with betadine by a skilled nurse and then were washed with alcohol to ensure that betadine did not remain on the area. Then, the peripheral venous infusion line was disconnected for 30 seconds and a tourniquet was fastened above and near it and another tourniquet was also fastened in venipuncture area in another arm. Thirty seconds after fastening the tourniquet on the arm with peripheral venous infusion line, the infusion set was replaced with a 10-cc syringe, 5 cc of the blood was taken

and discarded, and then another 10-cc syringe was used to draw 5 cc blood. The peripheral vein infusion fluid was discontinued for one minute until sampling was done. For venipuncture, after 30 seconds of fastening the tourniquet, 5 cc of the blood sample was drawn with a 10-cc syringe and needle gauge 20. Both samples were poured into two separate containers for performing the tests. The container with samples obtained from the peripheral venous infusion line was labeled "A" and the container with samples obtained from venipuncture was labeled "B". In order not to determine how the samples were prepared, the samples were sent to the laboratory with false names to be analyzed, where the complete blood count test was done by sysmex Xs800i. Demographic information of participants including age, gender, type of disease and also the type and amount of intravenous fluids and the laboratory results of blood samples were analyzed by descriptive statistics method (frequency and mean) and inferential statistics (paired t-test and Pearson's correlation coefficient) using SPSS software 19. Significance level was considered 0.05.

Results

Sixty percent of participants were male and the rest were female and they aged between 19 and 91 years (46.95 ± 20.73). The most common cause of admission to hospital for patients participating in the study was cellulitis (10%). 58.3% of participants received 3.3, 1.2 serum and 41.70% of them received 0.9% normal saline through the peripheral venous infusion line. The lowest amount of fluid received until taking blood sample was 2000 liters and the maximum was 9000 liters (5008.33 ± 1923.65).

Comparison of the hematology test results in two blood samples obtained from the peripheral venous infusion line and venipuncture (Table 1) using paired t-test showed that there was only a statistically significant difference between the value of hemoglobin in the samples (p-value = 0.00).

Also, the correlation between laboratory values of complete blood count samples through the peripheral venous infusion line and venipuncture (Table 2) using the Pearson's correlation coefficient indicated statistically significant positive and direct correlation (p-value = 0.00).

Table 1: Mean and standard deviation of complete blood count samples through the peripheral venous infusion line and venipuncture

Variable Blood sampling method	Placket (mm ³)	Hematocrit (mm ³)	Hemoglobin (%)	Red blood cell (gram percentage)	White blood cell (mm ³)
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Infusion line	240166±91260	38.90±8.46	12.52±2.45	4433000±0.868	9694±3829
Venipuncture	244800±89634	38.96±7.30	12.68±2.41	4588000±123058	9587±3829
Paired t-value	-1.07	-0.15	-3.01	-1.14	-1.60
Patients-value	0.29	0.88	0.00	0.26	0.12

Table 2: The correlation between the values of complete blood count samples through the peripheral venous infusion line and venipuncture

Variable	Significance level	correlation coefficient
WBC	0.991	0.000
RBC	0.537	0.000
Hct	0.934	0.000
PIt	0.932	0.000
Hb	0.986	0.000

Discussion and conclusion

Blood is the most common fluid used for medical tests to evaluate different and disorders. Currently, venipuncture is the most common method for taking blood (4), but this method is associated with pain and discomfort, damage to peripheral veins, phlebitis and bleeding, which may hinder using blood vessels in future (11). It is nearly four decades that researchers discuss sampling through arterial and venous catheters for diagnostic tests (12). Although other studies have been conducted in similar fields such as hemolysis of blood samples obtained by different blood sampling methods or on the estimation of the amount of discarded blood before sampling (13-17), this question is still raised whether intravenous infusion lines can be used for sampling (1). The results showed that, except for hemoglobin value, there were no statistically significant differences between the test values of white blood cells, red blood cells, hematocrit and platelets in blood samples taken through intravenous infusion line and venipuncture.

Few studies have been performed on blood collection through the peripheral catheters used for injecting intravenous fluids (18,19). The study conducted by Robert Hare et al. on complete blood count was nearly similar to this study which indicated significant differences in hemoglobin values and hematocrit and there were no differences in the values of white blood cells, red blood cells and platelets in blood samples taken through angiocatheter and venipuncture (10). The findings of this study on the values of white blood cells, red blood cells, hemoglobin and platelets are consistent with the current study, but on the hematocrit are not consistent with

the conclusions. However, in the studies conducted by Zlotowski et al. in 1999, Berger-Achituv et al. in 2004 and also Himberger et al. in 2001 to count blood cells, it was found that there were no statistically significant differences between the values of white blood cells, red blood cells, hemoglobin, hematocrit and platelets in two blood samples taken through the peripheral catheter and venipuncture (5,16,20). The findings are consistent with the present study for all values except hemoglobin. The slight difference in the results may be due to different numbers of participants, receiving different amounts of infusion fluid and the difference in the duration of discontinuation of infusion fluid before drawing blood sample through angiocatheter in the mentioned studies which shows the need for further research in this regard. According to the results, blood collection through the peripheral venous infusion line with fluid intake can be considered as a reliable method in complete blood count tests (except hemoglobin) in patients admitted to hospitals and thus it can be hoped that complications of frequent blood collection through venipuncture be decreased in patients.

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References:

1. Malki A, Kaviani S, Mansoorie K. Quality control in hematology laboratory. Tehran: Andishe Rafie; 2009:11-13.(persian)

2. Razavi M, Falah Abadi H, Sorosh J, et al. Easy interpret CBC. Tehran: Boshra; 2011: 9-43(persian)

3. Simundic A-M, Lippi G. Preanalytical phase—a continuous challenge for laboratory professionals. *Biochem Med* 2012;22(2):145-149.
4. Jafarei Ashteiani M, Molah N, sabaghi F. mosb's manual of diagnostic and laboratory test. Pagana K, pagana T. Tehran: Jame Negar; 2012:16-35.(persian)
5. Zlotowski SJ, Kupas DF, Wood GC. Comparison of laboratory values obtained by means of routine venipuncture versus peripheral intravenous catheter after a normal saline solution bolus. *Ann Emerg Med* 2001;38(5):497-504.
6. Borzo R, Salavati M, Zandieh M, et al. The effect of sterile gauze bandage on preventing of phlebitis and local infections due to using intravenous catheter. *J Gorgan Univ of Med Sci* 2003;5(12):71-76.(persian)
7. Ohnishi H. Side effects of phlebotomy: pathophysiology, diagnosis, treatment and prophylaxis. *Rinsho byori* 2005;53(10):904-910.
8. Asheghan M, Khatibi A, Holisaz M. Paresthesia and forearm pain after phlebotomy due to medial antebrachial cutaneous nerve injury. *J Brachial plex peripher nerve Inj* 2011;6(1):5.
9. Nicravan Mofrad M. Emergency nursing. Tehran: nordanesh; 2001: 69 .(persian)
10. Herr RD, Bossart PJ, Blaylock RC, et al. Intravenous catheter aspiration for obtaining basic analytes during intravenous infusion. *Ann Emergency Med* 1990;19(7):789-792.
11. Timby BK. Fundamental nursing skills and concepts 9 th ed. philadelphia: Lippincott williams& wilkins; 2009: 329.
12. Zand S, Rezaie K, Koohestani H. Effect of blood sampling via saline lock on the validity of coagulation tests results. *J Birjand Unive Med Sci* 2010;17(1):19-25. (persian)
13. Baker RB, Summer SS, Lawrence M, et al. Determining Optimal Waste Volume From an Intravenous Catheter. *J Infus Nurs* 2013;36(2):92-96.
14. Bowen RA, Hortin GL, Csako G, et al. Impact of blood collection devices on clinical chemistry assays. *Clin Biochem* 2010;43(1):4-25.
15. Heiligers-Duckers C, Peters NALR. Low vacuum and discard tubes reduce hemolysis in samples drawn from intravenous catheters. *Clin Biochem* 2013;46(12):1142-1144.
16. Himberger JR, Himberger LC. Accuracy of drawing blood through infusing intravenous lines. *Heart & Lung: J Acute Crit Care* 2001;30(1):66-73.
17. Lippi G, Cervellin G, Mattiuzzi C. Critical review and meta-analysis of spurious hemolysis in blood samples collected from intravenous catheters. *Biochem Med* 2013;23(2):193-200.
18. Lindley C, Sawyer W, Haddon T, et al. Comparison of PT, aPTT, and factor VII values obtained by concurrent sample collection by direct venipuncture and peripheral venous catheters. *Pharmacotherapy: J Human Pharmacol Drug Ther* 1994;14(2):224-228.
19. Watson KR, O'Kell R, Joyce JT. Data regarding blood drawing sites in patients receiving intravenous fluids. *Am J Clin Pathol* 1983;79(1):119-121.
20. Berger-Achituv S, Budde-Schwartzman B, Ellis MH, et al. Blood sampling Through Peripheral Venous Catheters is Reliable for selected Basic Analytes in Children. *Pediatr* 2010;126(1):179-186.