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Comparison of the Results of Blood Sugar between Direct Blood Sampling and Peripheral Catheter in Hospitalized Patients

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Abstract

Background: providing comfort for hospitalized patients is one of the important roles of nurses. The usual method of blood sampling causes pain and increases the likelihood of damage to peripheral veins. Blood sampling of peripheral venous catheter may reduce these complications, but the results of various studies in this regard are contradictory .The aim of this study was to compare the blood sugar of blood samples collected by venipuncture and peripheral catheter. Methods: This cross-sectional, analytical study was conducted on 78 patients admitted to the Poursina Rasht Medical Education Center. Patients were divided into 3 groups. Group 1 received normal saline serum, group 2 received dextrose saline, and group 3 received no infusion. From each patient, two blood samples were taken: One through peripheral venous catheter and one by venipuncture. The blood sugar were examined. Data was analyzed by paired t-test, ANOVA, and Bland–Altman plot. Results: Most of the patients were male (64.1%) and the average age was 51 ± 19 years. There were significant differences in the blood sugar between two methods of venipuncture and blood sampling from catheter in the normal saline group (P=0.0001) ،dextrose saline group (P=0.021) and no infusion group (P=0.017). Conclusion: The result of this study shows that Blood sampling from catheter cannot be used to measure blood sugar level. However, further studies are needed on blood sugar.

Keywords: Nursing Care, Peripheral Venous Catheter, Blood Sugar.

Introduction

Inpatients undergo various invasive procedures during hospitalization. one of the most common of these procedures is direct perforation of the vein to collect blood samples to monitor and control disease (Ortells-Abuye and et al., 2004). Blood sample is taken at least once a day from approximately all inpatients, and 25% of the inpatients undergo blood sampling for at least three times (Cadacio & Nachamkin, 2017).

The usual method of blood sampling not only takes much time of the nurse but also causes pain, discomfort, anxiety, and irritability for the patient and increases the likelihood of damage to peripheral veins, phlebitis, venous thrombosis, hematoma, bleeding, and infection Yazdankhahfard and et al., 2015; Aliasgharpour and et al., 2016). Needle phobia or needle fear is offered in 10-20% of the general people (Braniff and et al., 2014). Children and adults who experience frequent direct blood sampling are reported to suffer from high levels of pain and anxiety (Kennedy and et al., 2008).The hole in the vein also puts nurses at the risk of needlestick injuries (Hambleton and et al., 2014). Nurses tend to take blood through peripheral venous catheters to decrease venipuncture complications and increase the comfort of patients (Mofrad and et al., 2016).

Peripheral venous catheters are used to treat millions of patients around the world (Cicolini, and et al., 2014). Hospitalized patients often undergo peripheral venous catheter (Baker and et al., 2013). These catheters obviate the need for needle and facilitate venous blood

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sampling. It also reduces the time needed to collect blood samples and reduces complications of bleeding and possible infection (Mofrad and et al., 2016). It seems that using a peripheral venous catheter to obtain a blood sample is safe, convenient, and fast as well as effective for patients with limited veins (Hambleton and et al., 2014).

For about four decades, sampling for diagnostic tests through arterial and venous catheters has been debated. Some studies have shown that blood samples needed for diagnostic tests can be collected by peripheral venous catheter without the need for recurrent invasive techniques (Himberger & Himberger, 2001; Aliasgharpour and et al., 2016; Ortells-Abuye and et al., 2014). Numerous studies have addressed the appropriateness of blood sampling using the venous catheter. These studies have reported contradictory results regarding the studied blood sugar in two methods of blood sampling, and have emphasized the necessity of duplicating such studies in different patients (Ortells-Abuye and et al., 2014; Mofrad and et al., 2016; Watson and et al., 1983). On the other hand, a review of the studies showed that although most articles did not report statistically significant differences, different intravenous serum samples led to different observations (Aliasgharpour and et al., 2016; Watson and et al., 1983; Herr and et al., 1990).. Therefore, with regard to the available evidence and the necessity of further studies, this Research was performed to compare the results of blood sugar in venous blood samples taken by direct blood sampling and peripheral venous catheter in hospitalized patients.

Materials and Methods:

The study protocol was confirmed by the Ethics Committee of Guilan University of Medical Sciences. This cross-sectional, analytical study was performed on 78 patients hospitalized in surgical, orthopedic, emergency, neurosurgical, and internal nerve surgery departments in a hospital in Iran from September, 2017 to December, 2017. Inclusion criteria were the physician's blood sampling order for blood sugar (BS), peripheral venous catheter gauge 20, 18 years and older , available veins, lack of anemia, lack of arterial and venous fistula, taking normal saline or dextrose saline serum or not receiving serum. Exclusion criteria included lack of proper functioning of the peripheral vein catheter, hemolysis of the blood sample, and over 20 seconds taken to collect sample from the peripheral venous catheter. All of the patients who were eligible were invited to participate in the study and, if they agreed, written consent was obtained from them. A researcher-prepared checklist including demographic characteristics and biochemical information was used to collect data. The sample size was determined to be 78, divided into three groups of 26 each, with 95% accuracy, 90% confidence interval, and the mean deviation of glucose 28 (Table 1) according to the study of Watson with a significance difference of at least 25% (Watson and et al., 1983).

Group 1 included patients receiving normal saline serum, group 2 received dextrose saline, and group 3 did not receive any infusion. Two separate venous blood samples were taken from each patient. A blood sample of a peripheral venous catheter was taken from one of the hands and another sample was taken by direct blood sampling from the vein of another hand. In groups 1 and 2, the infusion was stopped for 15 seconds (Ortells-Abuye and et al., 2014). Then, in all three groups, the standard tourniquet was placed 5 cm above the peripheral venous catheter position (Brunner, L. S. (2009) and was closed for 30 seconds (Yazdankhahfard and et al., 2015). A 1 ml blood sample was taken from peripheral venous catheter prior to blood sampling by using a 2 ml syringe and discarded (Mofrad and et al., 2014). Then, immediately 3 ml of blood taken from the same path was tested. In group 3 who did not receive any infusion, the catheter was first aspirated to remove blood. If the initial aspiration of the blood was not removed, the catheter route was washed with 2 ml of normal saline and the entire 2 ml blood was re-aspirated and removed. Then, 1 ml of blood was removed from the catheter and discarded, and blood samples were collected from the catheter using 5 ml syringes to perform the tests. Immediately after blood sampling via catheter, a 3 ml venous blood sample was collected from the other hand by venipuncture using a 5 ml syringe and needle 21. The test tubes were simply numbered and sent to a laboratory at the same time, without labelling blood sampling method on them.

Biochemical analyses were carried out to determine the serum concentrations glucose. BS was determining by using Glucose Oxidase (GOD) and Peroxidase (POD) method and reading in 505nm (Bionik- Iran).. The data were analyzed using the SPSS version 18. Paired t-test, ANOVA, and bland-Altman plot were other tests used in this study.

Results:

The majority of the patients were male (64.1%) and the mean age of the patients was 51 ± 19 years. BS was not significantly different between the three groups (P = 0.445) but in each group, it was significantly different (Table1).

Table 1. Analysis of venipuncture and peripheral venous catheter sample

Laboratory Test	Group	Venipuncture (mean ±SD)	Peripheral venous catheter (mean± SD)	Mean difference mean± SD	P* value
BS	Normal saline	63.52±145.62	59.92±116.54	-29.08±24.41	**0/000**
	Dextrose saline	48.17±142.58	119.38±191.85	49/27±101/83	**0/021**
	Without serum	38.18±102.54	39.07±100.12	-2/42±4/83	**0/017**
	Total	54.10±130.24	88.91±136.17	5/92±68/11	**0/445**

P* value: Pair t-test

The Bland-Altman plot was used to investigate the agreement between two parameters. BS were significantly different between the two methods in the three groups (Figures 1 ، 2 and 3). BS were not statistically significantly different between the two methods in the three groups as well (Table 2 and Figuer 4).

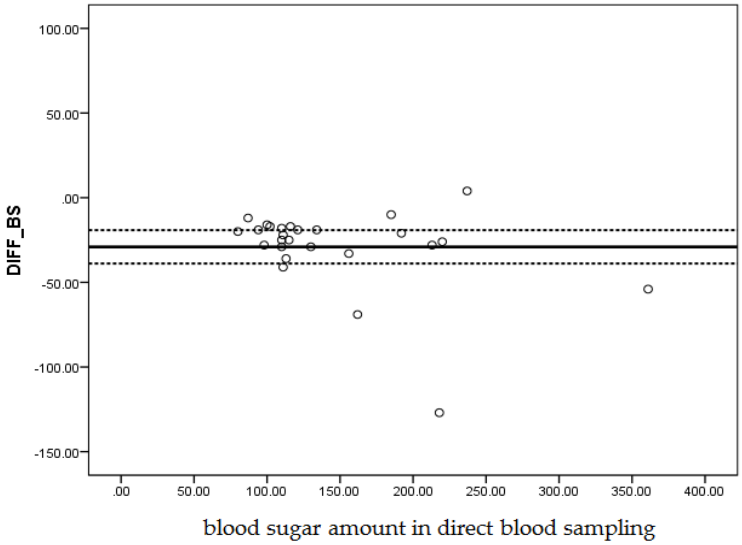

Fig 1. Agreement analysis of blood sugar in normal saline group

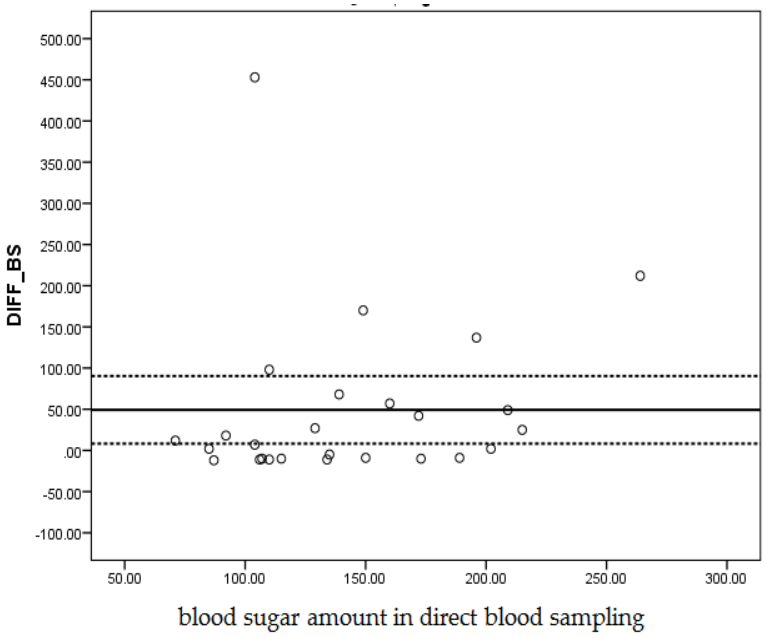

Fig 2. Agreement analysis of blood sugar in dextrose saline group

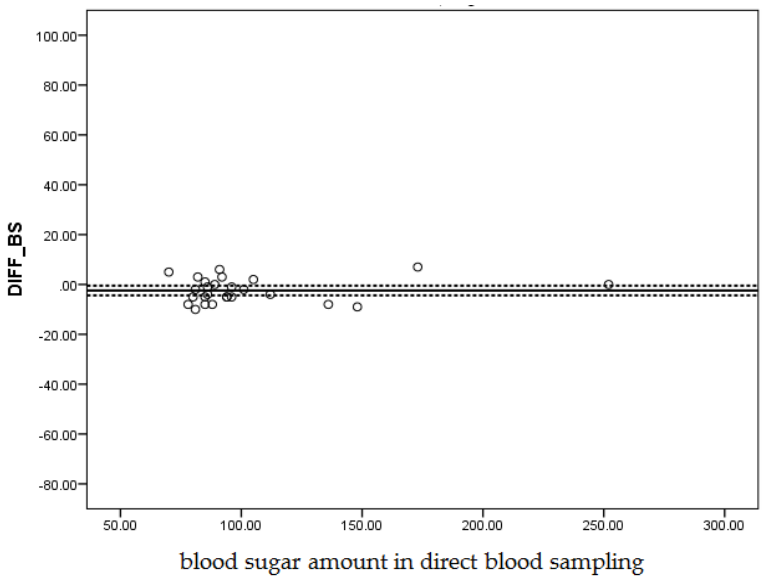

Fig 3. Agreement analysis of blood sugar in without serum group

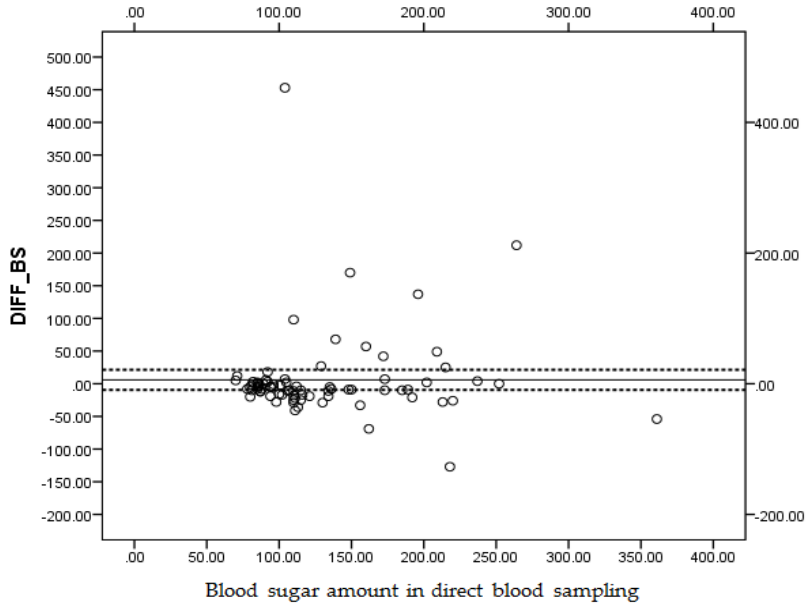

Fig 4. Agreement analysis of blood sugar in three groups

Table 2. Bland-Altman Plot-used agreement analysis of blood sugar

Laboratory Test	Group	Mean	Confidence Interval of the 95% Difference	
			Upper	Lower
DIFF_ BS	Normal saline	-29.07692	-19.2190	-38.9349
	Dextrose saline	49.26923	90.3984	8.1400
	Without serum	-2.42308	-.4703	-4.3758
	Total	5.92	21.28	-9.43

The absolute difference between the direct blood sampling and peripheral catheter was evaluated by using the ANOVA test. The highest mean absolute value of BS difference was observed in the dextrose saline group. The absolute difference between direct blood collection and peripheral catheter was statistically significant for BS (P = 0.007).

Table 3. Absolute difference of Laboratory Test

Laboratory Test	Group	Mean	P* value
absulote_diff_ Glucose	Normal saline	29/38	**0/007**
	Dextrose saline	56/81	
	Without serum	4/50	
	Total	30/23	

P* value: Anova

Discussion:

BS was significantly different between the two methods in three groups but there were no differences in each of the groups. In most studies, patients received a variety of sera that were generally examined and the effect of each individual serum was not investigated (Ortells-Abuye and et al., 2014; Yazdankhahfard and et al., 2015; Aliasgharpour and et al., 2016; Corbo and et al., 2007). BS were not significantly different between the two methods in the three groups, which is in agreement with the studies of Gholipour, Yazdankhahfard, Hambleton, Ortells, Heimberger and Rezaei. (Ortells-Abuye and et al., 2014; Yazdankhahfard and et al., 2015; Gholipour; Himberger & Himberger, 2001; Gholipour and et al., 2016; REZAEI and et al., 2009).

Hambleton (2014) studied the direct blood sampling from the vein compared to the peripheral catheter and changes in the laboratory results following intravenous injection. In the study of Hamleton, there were no differences in BS between the two methods. which is in agreement with our study in the three groups .in Hambleton study, the duration of stopping serum (2 minutes) and the amount of discarded blood volume (2 cc) were higher.

Ortells compared the two methods of collecting blood samples, direct perforation of the vein and the peritoneal vein catheter. In the study of Ortells, different types of serum were used, and the effect of each serum on the laboratory parameters was not investigated separately. BS were not different in the study of Ortells, which is in agreement with our study in the three groups. The reason for the agreement is that in the study of Ortells, 4 cc blood volume was discarded.

Mofrad compared the effect of blood sampling from peripheral venous catheter and venipuncture on the results of blood biochemical tests of patients hospitalized in the cardiac care unit. In the study of Mofrad, BS were not different between direct blood sampling and peripheral catheter pathway, and agreement with our study in the three groups (Mofrad and et al., 2014). In the study of Mofrad, peripheral venous catheter was washed with 1 cc normal saline every 8 hours. The drug was stopped for 5 minutes and tourniquet was tide longer (1 minute) compared to our research (Mofrad and et al., 2014).

Aliasgharpur and et-al compared the results of blood samples collected through intravenous catheter and routine blood sampling. He showed that, BS was different between the two methods, which is not in agreement with our research results. The sample size In their study (n: 61) was less than that of our study, and the duration of serum stopping (30 seconds) was longer than that in our research (Aliasgharpour and et al., 2016).

In general, the differences in BS between our study and other studies were the amount of discarded blood volume, duration of tourniquet closure, duration of serum discontinuation, number of participants, and type of serum (Table 4).

Conclusion:

This study shows that for conducting BS test into 3 groups(normal saline, dextrose saline serum and without serum), peripheral venous catheter cannot be used Instead of venipuncture. More studies are needed on blood sugar.

Limitation: During the study, 2 hemolytic blood samples were discarded from the test results and the blood sample was replaced by another person's. In addition, the effect Intravenous drugs on the results of laboratory parameters could not be controlled for.

Table 4: Comparison of blood sampling method and peripheral venous catheter in different studies

Study	year	n	Infusion	Duration stoped Infusion	duration Tourniquet was applied	Discarded blood volume	Result	
Hambleton	2014	259	Normal saline	20 min	Not mentioned	2 ml	Laboratory Test	**ICC**
							Glucose	**0.99**
Ortells	2014	272	Saline 5%Glucose Glucosaline Isoplasmal Ringer	15 second	Not mentioned	4 ml	Laboratory Test	**rc**
							Glucose	**0.957**

Mofrad	2016	80	one ml of sodium chloride 0.9% was injected into the catheter (every 8 hours)	5 min (medication infusion)	1min	1 ml	Laboratory Test Glucose	**P value** **0.428**
Aliasgharpour	2016	61	1/3 2/3 serum Normal saline Half saline Ringer Lactated ringer	30second	30second	2 ml	Laboratory Test Glucose	**P value** **0.01**
Gholipour (Persian)	2016	96	Serum type not mentioned. Washed with 2 cc normal saline	5 min	30 second	0.5 ml	Laboratory Test Glucose	**P value** **0.074**
Corbo	2007	81	Serum type not mentioned	2 min	Not mentioned	5 ml	Laboratory Test Glucose	**P value** **0.36**
Rezaey)Persian(	2009	63	After injection of the drug or intravenous fluids, the catheter was washed with 2 cc normal saline	5 min	Not mentioned	0.5 ml	Laboratory Test Glucose	**P value** **0.22**
Himberger	2001	64	Dextrose water 5% Lactated ringer normal saline	30second	30second	5 ml	Laboratory Test Glucose	**P value** **0.197**
Zlotowski	2001	33	Normal saline	2 min	Not mentioned	Not mentioned	Laboratory Test Glucose	**99% agreement interval** **Not the same**

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