Endocrinology & Diabetes Research

Research Article

A SCITECHNOL JOURNAL

Insulin Usage Errors and Effectiveness of Health-care Providers' Intervention Regarding Self-Insulin Administration among Diabetic Patients Presenting in Services Hospital, Lahore

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Received date: December 30, 2019; **Accepted date:** January 22, 2020; **Published date:** January 29, 2020

Abstract

Correct technique of insulin administration is critical for optimal glycemic control in diabetic patients. It is proposed that appropriate type, dose and technique have a crucial role in the successful use of insulin. No study has been conducted in Pakistan, to access insulin usage errors. The aim of this study is to determine insulin usage errors and the effectiveness of health-care providers' intervention regarding self-insulin administration among diabetic patients. This prospective study was conducted at Services Hospital Lahore. Systematic Non-probability consecutive sampling technique was used. A total of 140 patients were selected. Adult diabetic patients using insulin presenting in OPD of Services Hospital Lahore, were included in this study. Patients dependent on others for insulin administration were excluded from this study. Statistical Package for Social Sciences (SPSS) software version 22 was used for data entry and analysis. A total of 140 participants were recruited in this study, the response rate of 114 (81.43%). Most of the participants 109 (95.6%) used abdomen for injection of insulin, 5 (4.4%) injected at thigh. No participant has injected in the arm or buttock area. Before the intervention, only 15 (13.1%) had appropriate technique while after intervention 52 (72%) participants had the appropriate technique of insulin administration. Age of the participants was the only statistically significant factor for appropriate insulin injection technique. A significant gap is present between the insulin administration guidelines and current practices of insulin injection. Counseling about proper insulin injection techniques significantly reduced the errors of insulin administration.

Keywords: Insulin; Injection; Diabetes; Health problems

Introduction

Diabetes is one of the major health problems. Worldwide an estimated 347 million people have diabetes. In 2015; the prevalence of diabetes in adults was found to be 8.8%. Insulin discovery is a miracle of medical history and it is a key factor in diabetic care which helps to achieve optimal glycemic control. Insulin is very effective in reducing blood glucose level [1-3].

Use of insulin for the treatment of diabetes mellitus is often limited due to its narrow therapeutic index. Insulin is mostly injected via syringes and Insulin pens studies suggest that the use of insulin pen is associated with improved compliance [4,5].

Correct technique of insulin administration is critical for optimal glycemic control in diabetic patients. It is proposed that appropriate type, dose and technique have a crucial role in the successful use of insulin [6].

Insulin absorption is impaired by choosing the wrong site of injection, delivery devices, and the faulty technique, leading to poor glycemic control thus, and compromising long-term outcomes [7].

The Institute for Safe Medication Practices categorized insulin as a high-alert medication [8]. ASHP Foundation expert consensus panel suggested that proper patient education and regular assessment, ensures appropriate insulin use thus avoiding any unlikely effects [9].

No study has been conducted in Pakistan, to access insulin usage errors. The aim of this study is to determine insulin usage errors and the effectiveness of health-care providers' intervention regarding self-insulin administration among diabetic patients. Hypothesis made is that health care providers' intervention will reduce errors of self-insulin administration among diabetic patients.

Materials and Methods

This prospective study was conducted at Services Hospital Lahore. Systematic Non-probability consecutive sampling technique was used. A total of 140 patients were selected. The study was initiated after approval from the research ethics committee. Informed consent was taken from the subjects before the start of the study. Adult diabetic patients using insulin presenting in OPD of Services Hospital Lahore, were included in this study. Patients dependent on others for insulin administration were excluded from this study.

The patient name, age, gender, education, marital status, and contact details were noted by the researcher.

The participants were then asked to demonstrate insulin administration using injection pillow. This pre-intervention demonstration was observed according to the checklist. An observational checklist was developed according to the guidelines for administration of insulin for nursing staff by NHS Lanarkshire [10].

This was followed by individualized educational session consisting of practice through demonstration and re-demonstration of the procedure. Patients were given an appointment after two weeks to reassess the technique of insulin administration. Reminders were delivered through call to ensure more turnovers for follow up visit.

Statistical Package for Social Sciences (SPSS) software version 22 was used for data entry and analysis.

Demographic details of patients including age, gender, and education were analyzed by descriptive statistics for frequency and percentage. The site of insulin injection was also analyzed by

descriptive statistics. Those participants who performed eight or more steps properly, their technique was considered as appropriate.

In order to identify the association between categorical data chi-square test was used. Association between the dependent variable and continuous data was analyzed using student's t-test and Mann Whitney test.

Determinants for proper injection technique were identified using Multivariate logistic regression. p value ≤ 0.05 was considered as statistically significant.

Results

A total of 140 participants were recruited for this study. Twenty-six participants did not come for follow up visit of the reassessment of the technique of insulin injection post-intervention. Thus, 114 was the number of participants with the response rate of 81.43%.

Mean age of the participants was 56 years with a standard deviation of 10 years.

Among the participants 68 (59.6%) were female and 46(40.4%). Among the study population, 06 (5%) were uneducated, 35 (30.7%) had primary, 66 (57.9%) had secondary and 7 (06%) had tertiary level education. 05 (4%) were single, 92 (80.7%) were married, 2 (1.8%) were divorced and 15 (13.2%) were widowed.

Most of the participants 109 (95.6%) used abdomen for injection of insulin, 5 (4.4%) injected at thigh. No participant has injected in the arm or buttock area.

Steps of insulin injection technique Pre-intervention and Post-intervention are mentioned in Table 1.

Check list	Pre-education(n=114)		Post-education(n=114)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Check the expiry date of insulin				
Done	7	6.1	62	54.4
Not done	107	93.9	52	45.6
Gently mix or roll insulin 10 times before use(cloudy insulin only)				
Done	58	50.9	104	91.2
Not done	56	49.1	10	8.8
Aspirate with syringe amount of air equal to insulin				
Done	32	28.1	87	76.3
Not done	82	71.9	27	23.7
Make sure that air bubbles are out				
Done	66	57.9	105	92.1
Not done	48	42.1	9	7.9
Clean the site of injection				
Done	114	100	114	100
Not done	0	0	0	0
Inject insulin subcutaneously at 90° angle				
Done	52	45.6	98	86
Not done	62	54.4	16	14
Wait for 10sec before removal of the needle				
Done	112	98.2	114	100
Not done	2	1.8	0	0
Avoid massage at injection side				
Done	71	62.3	107	93.9
Not done	43	37.7	7	6.1
Proper disposal of the needle				
Done	50	43.9	97	85.1
Not done	64	56.1	17	14.9

Table 1: Steps of insulin injection technique Pre-intervention and Post-intervention.

The number of participants who performed each step appropriately after intervention increased. The total number of participants who had appropriate technique before intervention was 15(13.1%) while 82(72%) had appropriate technique after the intervention.

Participants with an appropriate technique before and after the intervention are shown in Table 2.

	Pre-education(n=114)		Post-education(n=114)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Appropriate	15	13.2	82	71.9
Inappropriate	99	86.8	32	28.1

Table 2: Participants with the appropriate technique before and after intervention.

There was no significant statistical association between the appropriate technique of insulin injection post intervention and gender, level of education and marital status. This is shown in Table 3.

Variable	Appropriate N (%)	Inappropriate N (%)	X2 (df)	p value*
Gender				
Male	33 (71.7)	13 (28.3)	0.001(1)	0.97

Female	49 (72.1)	19 (27.9)		
Education Level				
None	4 (66.7)	2 (33.3)		
Primary	23 (65.7)	12 (34.3)	1.58 (3)	0.66
Secondary	49(74.2)	17(25.8)		
Tertiary	6(85.7)	1(14.3)		
Marital status				
Single	4 (80.0)	1 (20.0)		
Married	69 (75.0)	23 (25.0)	3.63(3)	0.304
Divorced	1 (50.0)	1 (50.0)		
Widowed	8 (53.3)	7 (46.7)		

Table 3: The appropriate technique of insulin injection post intervention and gender, level of education and marital status.

Age was found to be a statistically significant factor. Mean age among participant with proper insulin technique was more as compared to the respondents with inappropriate insulin technique. Multivariate analysis was used to control any confounding factors in order to identify independent factors that contribute to proper insulin injection technique after intervention (Table 4).

Variable	Wald	Adjusted OR (95% CI)	p value
Age	0.944	0.944 (0.903, 0.988)	0.013

Table 4: Predictors for appropriate insulin injection technique post intervention.

Using bivariate analysis factors with p value less than ≤ 0.25 were considered as covariates for further analysis. Age was an independent factor associated with proper insulin injection technique with p=0.013.

Discussion

This study assessed the impact of education on appropriate insulin injection technique.

In this study 109 (95.6%) of the respondents used abdomen and only 5 (4.4%) used thigh, 5(4.4%) used for injection of insulin. In a study it was found that 7565 (57%) of the patients commonly inject insulin in abdominal skin, 5425 (40.8%) used thigh, 2566 (19.3%) used buttock and 4204 (31.6%) used arm for injection of insulin. Literature suggests that insulin should ideally be injected over the abdomen or thigh [7,11,12]. In another study thigh was the most common site of insulin injection.

This study suggests a high prevalence of insulin injection errors among diabetic patients. Similar results were found in past studies [13].

After proper education participants with adequate insulin administration technique increased from 15 (13.1%) to 52 (72%). A similar study conducted in Iran shows similar results [14].

In this study education, gender, and marital status were not significant factors in determining the correct technique of insulin administration. While in another study level of education was found to be a significant factor.

In the current study, the only determinant for appropriate insulin injection technique is the age of the respondents.

The most common errors in injection technique were found to be not checking the expiry date of insulin 107 (93.4%), not proper mixing or rolling 56 (49.1%). 64 (56.1%) did not dispose of the needle properly. In this study 62 (54.4%) did not use 90° angle for insulin injection. These results are similar to other studies [14-16]

The possible reason may be that the participants in the current study are not exposed to proper insulin administration technique in previous consultations. Periodic reinforcement of technique is needed.

Age of the participants was the only statistically significant factor for appropriate insulin injection technique.

The possible reason can be that Patients with increased age have a better potential to benefit from individualized coaching on insulin technique coaching.

However, to the best of our knowledge, no study has assessed the relationship between age and appropriateness technique of insulin injection.

Limitations of the current study need to be considered, as it is unable to assess the long term sustainability of educational program regarding insulin administration technique. Direct comparison with other researches is difficult due to variability in study setting.

Conclusion

A significant gap is present between the insulin administration guidelines and current practices of insulin injection. Counseling about proper insulin injection techniques significantly reduced the errors of insulin administration.

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