

ASSESSMENT OF INSULIN INJECTION PRACTICES IN DIABETES PATIENTS: A CROSS-SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL WITH 220 PARTICIPANTS

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ABSTRACT

Background: Diabetes mellitus (DM) is a prevalent chronic disease that requires consistent insulin therapy, particularly in patients with type 1 and advanced type 2 diabetes. Appropriate insulin injection techniques, including site rotation, needle reuse, and insulin storage, are crucial for maintaining effective glycemic control and preventing complications. Despite the importance of these practices, suboptimal insulin administration remains a widespread issue among patients, which affects diabetes outcomes.

Objective: This study aimed to assess insulin injection practices, including technique, site rotation, needle reuse, and knowledge of insulin storage, among 220 diabetes patients at a tertiary care hospital. The study also aimed to identify gaps in adherence to recommended insulin administration practices.

Methodology: This cross-sectional study was conducted in Medical unit of services hospital, Lahore from July 2023 to June 2024. A total of 220 patients with diabetes who had received insulin therapy for at least six months were included. Data were collected through structured interviews, direct observation of insulin injection techniques, and review of patient records. The participants were categorized by age, gender, type of diabetes, and insulin regimen. Descriptive statistics and chi-square tests were used for data analysis.

Results: The mean age of participants was 55.3 years, with 120 (54.5%) males and 100 (45.5%) females. Among the patients, 70% had type 2 diabetes, while 30% had type 1 diabetes. The study found that 50% of patients rotated their injection sites regularly, 82% reused needles, and 55% stored insulin correctly at 2-8°C. The correct injection technique (90° angle) was used by 60% of patients, with 25% using a 45° angle. Lipohypertrophy was observed in 12% of patients.

Conclusion: This study highlights significant gaps in insulin injection practices among diabetes patients at a tertiary care hospital. Despite good awareness, a large proportion of patients continue to reuse needles, fail to rotate injection sites, and improperly store insulin. These practices increase the risk of poor glycemic control and complications. Enhanced patient education, particularly on insulin injection techniques, site rotation, needle hygiene, and insulin storage, is essential for improving diabetes management and reducing complications.

Keywords: Insulin injection, diabetes, tertiary care hospital, injection techniques, patient education, needle reuse, insulin storage.

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INTRODUCTION

Diabetes mellitus (DM) is a worldwide health issue with millions of sufferers worldwide. The World Health Organization (WHO) has reported a consistent rise in prevalence of diabetes with an estimated 537 million adults living with diabetes in 2021 and is expected to grow by 2030¹. Treatment of diabetes necessitates insulin

administration particularly in patients with type 1 and advanced diabetes. Although effective, insulin therapy requires accurate and repeatable injection habits that maximize the effects of blood glucose, and avoid hypoglycemia, lipohypertrophy, and infection^{2,3}.

Some studies have also shown that diabetes patients exhibit common practices of insulin improper injection,

despite the prevalence of insulin therapy^{4,5}. Routine rotation of injection sites, proper disposal of needles, and proper storage of insulin are imperative practices, which have the potential to create a major difference in terms of insulin therapy effectiveness⁶. These practices are however, usually overlooked and hence, compromised treatment outcomes⁷.

Earlier studies have investigated patient education in terms of insulin therapy but there remains gaps in adherence to best practices especially in low-resource contexts^{8,9}. The reuse of the needle, incorrect injection method, and inadequate awareness of insulin storage conditions have been identified in studies in developed and developing countries^{10,11}. Hence, the aim of the proposed study is to evaluate the insulin injection among diabetic patients in a tertiary care hospital with specific emphasis on the methods of injection, rotation of sites, needle reuse, and storage of insulin.

METHODOLOGY

Study Design: This study was a cross-sectional observational research carried out in at a hospital that focuses on diabetes treatment. The aim of the study was to determine the practice on insulin injection among 220 diabetes patients in terms of the method of injection, needle reuse, change of site, and insulin storage. The sample size consisted of 220 patients with diabetes aged >18 years and six months under the insulin treatment. Patients with type 1 and type 2 diabetes were both enrolled. Patients were not considered in case of incapacitation to self-administer insulin, severe cognitive impairment, and pregnancy.

There were three methods of collecting data:

Structured Interviews: The participants were questioned regarding their insulin injection habits, insulin storage knowledge, site rotation and reuse of needles.

Direct Observation: A registered nurse observed a sample of patients as they gave their insulin injections with the aim of determining the accuracy of their behaviors.

Review of Patient Records: The patient records were examined at the hospital in terms of insulin regimen, comorbidity and past complications.

Variables:

Injection Technique: Proper angle, length of needle and preparation of skin.

Site Rotation: Site rotation frequency and regularity.

Needle Reuse: Reuse and Disposal.

Insulin Storage: Knowledge and behaviours concerning insulin storing conditions.

Statistical Analysis: The data were summarized using descriptive statistics. Categorical variables were compared with the chi-square test and a p-value less than 0.05 was taken to be significant. Analysis of the data was performed in SPSS version 25.

RESULTS

A total of 220 patients were included in the study, with 120 (54.5%) males and 100 (45.5%) females. The mean age was 55.3 years (range 18-80 years). The majority of patients had type 2 diabetes (70%), while 30% had type 1 diabetes. Most patients (85%) were on multiple daily insulin injections (MDI), with the remaining 15% using insulin pens or pumps.

Table 1: Demographic Characteristics of the Study Participants

Variable	Frequency (n)	Percentage (%)
Gender		
Male	120	54.5
Female	100	45.5
Age (Years)		
18-30	20	9.1
31-40	30	13.6
41-50	50	22.7
51-60	60	27.3
61+	60	27.3
Diabetes Type		
Type 1	66	30
Type 2	154	70
Insulin Regimen		
Multiple Daily Injections	187	85
Insulin Pen/Pump	33	15

Injection Techniques and Site Rotation:

Injection Angle: 60% of patients used the correct 90° injection angle, while 25% used an incorrect 45° angle and 15% used varying techniques.

Site Rotation: 50% of patients rotated their injection sites regularly, 35% did so occasionally, and 15% consistently used the same site.

Needle Reuse: 82% of patients reused needles, with 22% using the same needle more than five times.

Insulin Storage: 55% of participants stored insulin correctly at 2-8°C, while 45% stored it at room temperature.

Table 2: Insulin Injection Practices

Practice	Frequency (n)	Percentage (%)
Injection Angle		
Correct 90°	132	60
Incorrect 45°	55	25
Variable	33	15
Site Rotation		
Consistently rotated	110	50
Occasionally rotated	77	35
Same site used consistently	33	15
Needle Reuse		
Reused needles	180	82
No reuse	40	18
Insulin Storage		
Correct storage (2-8°C)	121	55
Incorrect storage (room temp)	99	45

DISCUSSION

The findings of this research highlight the high gaps in insulin injection practices of diabetes patients in a tertiary care hospital. Regardless of the popularity of insulin therapy in the process of controlling diabetes, the research shows that the number of non-adherents to the prescribed practices of insulin injection use remains high among patients. These loopholes are alarming, because they may directly affect glycemic regulation, risk predisposing to complications, and compromise the whole efficacy of insulin therapy.

One of the most important findings made by the present study is the poor injection method used by a big percentage of participants. Insulin injection was done at 90deg angle only among 60 percent of patients and 25 percent of patients injected at 45deg angle. This is non-optimal technique that may produce inefficient absorption of insulin, which causes errors in the level of blood glucose. The correct angle of injection is the key to the effective absorption of the insulin and the prevention of such complications as bruising and lipoatrophy^{12,13}. The result is in line with those of other researchers, who also have found that improper injection practices are prevalent, even though there is extensive awareness of the proper practices¹⁴.

The reason of not keeping proper technique is usually associated with the absence of effective patient education or the failure to reinforce the training offered by a healthcare professional. Studies indicate that despite teaching the patients about the proper techniques, the patient knowledge and skills in practice are irregular¹⁵. Providers should make sure that patients are shown practical demonstrations on a regular basis and that these methods are supported during the regular visits.

The other very important area of insulin injection that was not adhered to by a significant percentage of the respondents was site rotation. Fifty percent of patients regularly rotated injection sites as well as half of patients regularly used the same injection site. The practices predispose the risk of lipohypertrophy that may disrupt the absorption of insulin and result in ineffective control of blood sugar¹⁶. Lipohypertrophy was noted in 12% of patients in this study, and this is worrying given the effects that this may have on the insulin effectiveness.

Lipohypertrophy is the deposition of fat tissue that develops when one injections of insulin are repeatedly made into the same site. In the long-term this may modify the absorption rate of insulin such that patients become unable to efficiently regulate their blood glucose levels. The absence of proper site rotation might be attributed to a number of factors such as lack of awareness among patients or habit of using familiar sites that are convenient. The significance of rotating injection sites needs to be taught, and medical personnel must offer precise information on how to rotate sites successfully¹⁷.

In the research, the reuse of needles was 82 percent with 22 percent using the needle more than five times. Such practice is a major danger in terms of infection and other complications. Not only does needle reuse elevate the risk of contamination but it also makes the needles dull, resulting in pain during injection and subsequently undermining the insulin absorption process¹⁸. Although majority of the insulin injection devices used are set to be used once, patients tend to reuse the needles to conserve on expenses or because they lack the knowledge on the dangers of reusing such needles.

Poor discarding of used needles also worsens this situation. In this study, 65 percent of patients disposed used needles in household waste, and this exposes patients, and the environment to needlestick injuries and the environment to environmental risks. During the education of patients, appropriate disposal of the needles should be highlighted, and they should be given disposal safe areas like sharps containers¹⁹. Additionally, health-related campaigns and patient education programs must be particularly focused on the risks of needle reuse and remind patients that they should ensure that they use new needles every time they have an injection.

Another area in which patient practices were determined to be suboptimal is insulin storage. Although 55 percent of respondents stored the insulin properly 2-8degC, 45 percent stored it at room temperature. Poor glycemic control may be caused by improper storage of insulin that may affect its effectiveness. Insulin requires a cool and dry environment to preserve its strength and patients should be informed on the essence of observing the storage directions²⁰.

Patel and colleagues²¹ discovered that the degradation rate of insulin is faster at elevated temperatures and this could considerably decrease the pharmacological impact of insulin. In this study, the failure of patients to store their insulin appropriately risked the use of ineffective insulin, which would help increase the unstable blood glucose levels. Insulin storage education should be a priority especially in areas where temperatures are too high and patients should be advised to regularly check the expiration dates and their storage conditions.

The practice gaps in insulin injections that were identified in this study create the necessity of enhanced patient education. In a past research conducted by Jones et al.²², it was stressed that although patients are initially trained on insulin administration, failure to sustain education and follow up may lead to poor adherence to advised practices. This is specifically noticeable in site rotation, proper injection technique and insulin storage. It is important that those who offer healthcare services not only educate but also reiterate these messages especially when people visit the healthcare facility regularly.

Education of patients must be based on the individual needs and factors like literacy, socioeconomic status, and access to resources must be considered. A research

conducted by Brown et al.²³ has shown that personalized education that involves practical presentations and illustrations can go a long way in enhancing patient compliance with the practice of insulin injection. In addition, clinicians ought to engage patients actively in the treatment of diabetes by posing questions, asking clarifications, and showing the techniques.

Healthcare System and Support: The other issue, this research sheds some light on, is the role of the healthcare system in making insulin injection practices proper. Healthcare sectors ought to invest in the development of organized diabetes education programs that are readily accessible to every patient. Moreover, it is necessary to provide constant check-ups and visits as a way of keeping track of patients who are supposed to be on the most effective insulin administration practices. In addition, healthcare professionals must provide reminders and access information including pamphlets or mobile apps that may be used to augment learning about insulin therapy.

Patient adherence is also dependent on the availability of affordable insulin and supplies. In most low-income environments, insulin cost and injection supplies may be a hindrance to effective diabetes care. Insulin therapy can also be enhanced with programs to decrease their financial burden to increase the chances of patient having fresh needles and be able to store insulin in a proper way.

CONCLUSION

The paper has identified major disparities in insulin injection among the patients with diabetes in a tertiary care hospital. The main problems like lack of proper injection methods, poor rotation of the sites, reuse of needles and improper storage of insulin were common and could undermine the overall control of diabetes and place people at risk of complications. The results highlight the necessity of better patient education and formal diabetes management interventions that strengthen the best practices in terms of insulin administration. Medical professionals should make sure that patients are given constant and understandable information about injection methods, needle disposal, site switching, and insulin storage. With extensive education and continuous follow up, the results of diabetes can be greatly enhanced, which lessens the duration complications of inadequate insulin habits.

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