

## Assessment of Insulin Injection Practices in Patients With Diabetes Presenting to a Tertiary Care Hospital

Muneeb-ur-Rehman, Bilal Ahmed\*, Khurshid Muhammad Ultra\*\*

Department of Medicine, Pak Emirates Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, \*Department of Endocrinology, Pak Emirates Military Hospital/ National University of Medical Sciences (NUMS) Rawalpindi Pakistan, \*\*Department of Rehab Medicine, Armed Forces Institute of Rehabilitation Medicine/ National University of Medical Sciences (NUMS) Rawalpindi Pakistan

### ABSTRACT

**Objective:** To assess insulin insertion practices, including storage, injection techniques and sharps waste disposal in patients with diabetes using insulin syringes and pen-filled insulin.

**Study Design:** Cross-section study

**Place and Duration of Study:** Department of Endocrinology, Pak-Emirates Military Hospital Rawalpindi, Pakistan from March to May 2020.

**Methodology:** All insulin-dependent patients with diabetes were interviewed according to a questionnaire and their insulin insertion techniques and practices assessed. Questionnaire was based on the American Diabetes Association guidelines for insulin insertion. Those who had incorrect practices were later counselled about the correct practices.

**Results:** 84(70%) participants used insulin syringe for insulin insertion, while 36(30%) used pen-filled insulin. Three-quarters of the patients reported that they were never taught by any healthcare professional regarding correct insulin insertion techniques. 69(57.5%) of those using insulin syringe cleaned the insertion site before injecting insulin, while only 51(22.2%) of those using pen-filled insulin did so. 25(20.6%) of the participants did not wash their hands with soap prior to insulin injection. 68(56.7%) of the participants did not maintain cold chain. Most of the patients 92(77%) disposed off their insulin sharps in household garbage.

**Conclusion:** There was a significant gap between insulin insertion guidelines and current insulin injection practices. Education and proper counseling should be provided to the patients using insulin by healthcare professionals and their practices should be checked on every out-patient encounter.

**Keywords:** Diabetes Mellitus; Insulin; Injection Techniques.

**How to Cite This Article:** Rehman MU, Ahmed B, Ultra KM. Assessment of Insulin Injection Practices in Patients With Diabetes Presenting to A Tertiary Care Hospital. Pak Armed Forces Med J 2025; 75(SUPPL-I): S20-S23. DOI: <https://doi.org/10.51253/pafmj.v75iSUPPL-I.6189>

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## INTRODUCTION

Diabetes mellitus (DM) is one of the most prevalent non-communicable chronic disease in Pakistan. 1 According to International Diabetes Federation, around 19 million people were suffering from diabetes in 2019, and its prevalence is rising.<sup>1,2</sup> Occurrence of newly established cases of diabetes mellitus is 15.1% in males and 6.8% in females of urban areas, while it is 5% in males and 4.8% in females in rural areas of Pakistan.<sup>3</sup> Apart from oral hypoglycemic agents, insulin is a major treatment modality for diabetes mellitus. Insulin can be injected subcutaneously either via insulin syringe, or via pen-filled preparation.<sup>4</sup> The proportion of people using insulin for treatment of diabetes mellitus varies from country to country<sup>1</sup>. Unfortunately, there is no statistic available in Pakistan which depicts the percentage of

people using insulin for diabetes. Correct insulin insertion technique is very important for good glycemic control. Poor storage conditions can also adversely affect the potency of insulin<sup>5</sup>. Moreover, improper disposal of sharps generated after injecting insulin may be associated with spread of blood-borne diseases<sup>6</sup>.

Faulty insulin insertion techniques not only result in higher insulin consumption, but also result in glycemic variability and increased adverse effects, including hypoglycemia, lipodystrophy and allergies.<sup>7</sup> Although a lot of effort is generally made in adjusting ideal insulin regimen to achieve good glycemic control, little attention is paid towards the appropriate insertion technique.<sup>3,5</sup> Poor insulin injection technique is one of the most important and modifiable factor for poor glycemic control<sup>4,5</sup>. Various studies from around the world have highlighted discrepancy between guidelines and on-ground practices.<sup>8,9</sup> However, literature in this regard is scarce in Pakistan. Therefore, this study was conducted with an objective

**Correspondence:** Dr Muneeb-ur-Rehman, Department of Medicine, Pak Emirates Military Hospital Rawalpindi Pakistan

Received: 25 Jan 2021; revision received: 24 Apr 2021; accepted: 06 May 2021

to assess the practice of storage, injection technique and disposal of sharps waste.

**METHODOLOGY**

This observational cross-sectional study was conducted at department of endocrinology, Pak-Emirates Military hospital Rawalpindi from March to May 2020. Ethical approval of this study was obtained from the institutional review committee (certificate number A/28/EC/216/2020).

**Inclusion Criteria:** All patients with diabetes mellitus aged 20 to 80 years who visited the general medical or endocrinology out-patient department of Pak Emirates Military hospital and had been injecting insulin, both via insulin-syringe or pen-filled, for a minimum of 4 consecutive weeks were included.

**Exclusion Criteria:** Non-insulin dependent diabetes patients were excluded.

These patients underwent a survey by a questionnaire which focused on key insulin insertion parameters. The questions were based on the recommendations of American Diabetes Association for insulin administration.<sup>10</sup> Those who had incorrect practices were later counselled and educated about the correct procedure. Through non-probability sampling technique, a total of 120 patients were included during the study period.

Data was entered into, and analyzed by IBM-SPSS 20.0 software. The categorical variables were presented as frequency and their respective percentage.

**RESULTS**

Out of 120 patients who were included in the study, 74(62%) were males and 46(38%) females. 38(32%) were illiterate, 66(55%) passed matriculation while 16(13%) had cleared intermediate exams. Most of our patients i.e. 114(95%) had type-II diabetes while only 6(5%) had type-I diabetes. 95(79%) of the patients said that they injected insulin themselves while 25(21%) were dependent upon someone else to inject insulin.

84(70%) of the participants used insulin syringe for insulin insertion, while rest of them 36(30%) used pen-filled insulin. The results of various aspects of insulin insertion techniques are given in Table.

Out of the 120 patients included in our study, 28(23.3%) reported that they injected insulin immediately before meals while 60 patients (50%) injected it less than 15 minutes before meals. 32(26.7%) injected it more than 15 minutes before meals. 20

patients (16.7%) used a single insulin syringe only once, while 64(53.3%) used it twice and 36(30%) used an insulin syringe more than twice.

**Table : Various aspects of Insulin insertion techniques and their responses in our patients**

	Type of Insulin	Yes n(%)	No n(%)
Do you make a skin fold?	Insulin syringe	64(76.2)	20(23.8)
	Pen-filled	20(55.6)	16(44.4)
Do you wash hands prior to injecting insulin?	Insulin syringe	68(81)	16(19)
	Pen-filled	28(77.8)	8(22.2)
Do you clean the skin at insertion site prior to insulin injection?	Insulin syringe	48(57.1)	36(42.9)
	Pen-filled	8(22.2)	28(77.8)
Do you clean the rubber on insulin vial with a swab before use?	Insulin syringe	56(66.7)	28(33.3)
	Pen-filled	-	-
Do you inspect the insulin vial for any frothing, precipitation or change of color or consistency before use?	Insulin syringe	60(71.4)	24(28.6)
	Pen-filled	24(66.7)	12(33.3)
Do you change the site of insertion frequently?	Insulin syringe	48(57.1)	36(42.9)
	Pen-filled	28(77.8)	8(22.2)
Do you shake insulin vial between your palms prior to injection?	Insulin syringe	56(66.7)	28(33.3)
	Pen-filled	-	-
Do you remove air bubbles prior to injection?	Insulin syringe	56(66.7)	28(33.3)
	Pen-filled	12(33.3)	24(66.7)
In the past, has any healthcare professional educated you about proper insulin insertion technique?	Insulin syringe	66(71.4)	24(28.6)
	Pen-filled	28(77.8)	8(22.2)

51(42.5%) patients reported taking the insulin syringe out immediately after insertion.<sup>21</sup> patients (17.5%) took the syringe out in less than 5 seconds while 36(30%) kept the needle inside the skin for 5-10 seconds after fulling pressing the thumb bottom.

Only 52 patients (43.3%) transported insulin from pharmacy to their home with ice i.e. maintaining cold chain. Rest of the 68 patients (56.7%) did not maintain cold chain. 28 patients (23.3%) stored insulin inside a freezer, 7(63.3%) inside a refrigerator, while 16 patients (13.3%) kept the insulin at room temperature.

An important aspect of insulin insertion is the disposal of sharps or insulin syringes after their use. Figure shows how our patients discarded their insulin syringes after use.

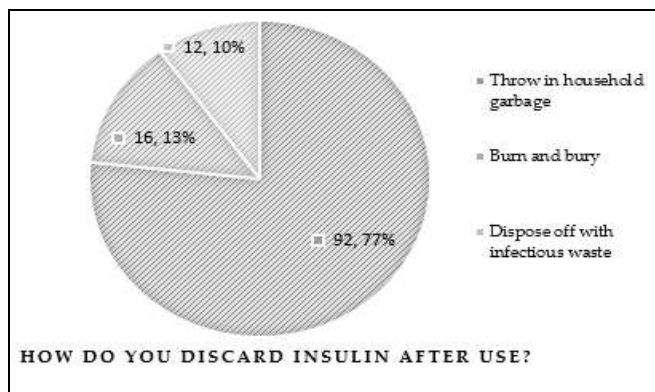


Figure: Disposal of insulin syringes after use

**DISCUSSION**

Correct insulin insertion technique is essential for good glycemic control.<sup>11</sup> However our study showed significant variation of insulin insertion techniques from the recommendations of American diabetes association guidelines of insulin administration.<sup>10</sup>

A study conducted in Nepal on insulin insertion techniques showed that 69% of the patients did not wash hands before insulin insertion,<sup>12</sup> while our results were the opposite: 70% of our patients claimed washing their hands before insulin insertion. A higher proportion (i.e.81%) of those using insulin syringe claimed washing hands prior to injection, as compared to those using pen-filled insulin (78%). About 50% of our patients injected insulin less than 15 minutes before meals, although guidelines suggest injecting insulin 30 minutes before meals in the abdomen, and 45 minutes before meals if injecting it elsewhere in the body.<sup>13</sup> There are however, studies which show no change in HbA1c levels with variation in meal-to-injection time.<sup>14,15</sup>

43% of our respondents said that they take the insulin injection out of the skin immediately after injection. These results are worse than those reported in a similar study conducted in Nepal.<sup>12</sup> Guidelines recommend waiting for at least<sup>5-10</sup> seconds before taking the syringe out of the skin, so that the complete dose of insulin is administered through the narrow needles of insulin syringes. Higher doses of insulin may need more transit time.<sup>13-18</sup>

Our study reports that about a quarter of our patients had never been taught about proper insulin insertion technique by a healthcare professional, as was reported by a study conducted in Islamabad last year.<sup>19</sup>

63% of our patients kept insulin vials inside a refrigerator and only 43% were maintaining cold chain. A possible reason for this discrepancy is that our pharmacies do not provide ice packs for transportation of insulin. During summers, temperatures in Rawalpindi and surrounding regions rises up to 40 degrees Celsius and patients from far-flung areas might have to travel for 3-4 hours in scorching heat to reach their homes. Guidelines recommend storing insulin in a refrigerator or an earthenware pot filled with water and to take out the insulin to room temperature at least 30 minutes before injection. Studies report 14-18% reduction in potency of insulin if it is stored at temperatures exceeding 30 degrees Celsius.<sup>20</sup>

Disposal of insulin syringes and sharps is very important as far as spread of communicable diseases and public health is concerned. If sharps are not properly disposed of, they can act as a means for transmission of blood-borne diseases such as HIV and Hepatitis B and C from patients to general public. Children can accidentally get pricked by these syringes if they play with them.<sup>18</sup> Sharps waste disposal is mostly ignored not only by our patients, but also by our health care professionals. 16 Our study showed more than three quarters of our patients disposed of the syringes in household garbage, which can be a source of infection; while only 10% of the patients claimed to dispose of the syringes separately in infectious waste. This result is higher than results of a similar study conducted in UK, which showed that 65% of the people disposed of their syringes in household garbage<sup>21</sup>; while lower than an Indian study, which showed 84% of their population of throw sharps in household garbage.<sup>18</sup> An Ethiopian study showed 63% of their respondents to throw sharps in household garbage.<sup>16</sup>

Our study reports that only 17% of the patients used a single insulin syringe only once, while the rest of them used twice or even more than twice. As per guidelines, a single insulin syringe should be used only once.<sup>10</sup> However, patients in most of the poor countries like ours use insulin syringes more than once.<sup>12,21</sup> Low income and affordability issues are the main factors behind this malpractice, which can lead to high infection rate and lipodystrophy of the skin.<sup>16,17</sup> Government should help in making insulin syringes available at subsidized rates.

Physicians and nurses should demonstrate, educate and reinforce insulin-dependent diabetics

about proper insulin insertion techniques whenever insulin is prescribed. This will help in effective use of insulin and achieving good glycemic control.

**CONCLUSION**

There was a significant gap between insulin insertion guidelines and current insulin injection practices. Education and proper counseling should be provided to the patients using insulin by healthcare professionals. Their practices should be checked on every out-patient encounter so that maximum benefit is reaped out of the insulin injections.

**Conflict of Interest:** None.

**Funding Source:** None.

**Authors' Contribution**

Following authors have made substantial contributions to the manuscript as under:

MUR & BA: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

KMU: Data acquisition, data analysis, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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