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Screening of Lipohypertrophy (LH) in type 1 and type 2 diabetes patients and factors influencing this condition

Abstract

Introduction: Lipohypertrophy (LH) is a chronic complication of diabetes mellitus that is caused by frequent subcutaneous injections of insulin. This study examines the prevalence of insulin-induced LH at injection sites in diabetes individual (Type 1 and Type 2), as well as the factors that have been affecting this condition.

Method: The research sampling consisted of 50, OPD diabetes patients, who had been using insulin for at least 6 months. Observation and palpation techniques were used in assessing LH in diabetics' subjects. LH was assessed as present or not resent. The presence of noticeable or palpable lump at the injection site indicated that LH was present. A questionnaire was developed using relevant literature and FIT guidelines. Data were analyzed using SPSS version 16, percentages, χ^2, and logistic regression analysis, chi-square analysis

Result: LH was identified in 13 of 50 study participant (26%). The factors which influence development of LH are like duration of insulin therapy, needle length, frequency of insulin injection/day, insulin type. There was a strong relationship between the presence of LH with non –rotation of sites and needle reuse.

Conclusion: LH was prevalent in our patients and could be because of lack of knowledge, faulty insulin injection technique. Therefore, intensive diabetes education and counselling play important role in reducing the occurrence of LH in insulin-treated patients.

Keywords: Lipohypertrophy, needle length, insulin, type 2 diabetes, site-rotation, re-use

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Introduction

Insulin is an essential anabolic hormone important for normal metabolism of carbohydrate, protein, and fat. Patients with Type 1 diabetes did not produce enough insulin to sustain life, hence are dependent upon exogenous insulin for survival. On the other hand, all type 2 diabetes patients are not on insulin but they need treatment with exogenous insulin at some point in life because of failure of oral hypoglycemic medication, or during the time of stress, surgery and illness.[1] 38 % of types 2 diabetes patients need insulin within 10 years of diagnosis (UKPDS).[2] Skin problem like lipohypertrophy (LH), lipoatrophy, allergy, edema and is very common in patients who all are on insulin therapy. Among these Lipohypertrophy (LH) is a chronic complication of diabetes mellitus that which is caused by frequent subcutaneous insulin injection at the same site and repeated use of the same needle. LH is a hard or soft lump under the skin caused by the accumulation of extra fat at the injection site after repeated use of same site. It may be slightly painful, and may change the timing or absorption of insulin action. LH may be the result of a local anabolic action of insulin on adipocytes, promoting fat and protein synthesis.[3] LH has in turn been associated with the significantly increased level of glycaemic variability, hypoglycemia and increase insulin dose.[4,5]

There are many factors influencing the development of LH were reported as follows; gender, body mass index (BMI) , duration of insulin therapy, the number of injections per day, daily insulin dose, injection site, not rotating the injection site, using a pen or syringe, needle length and the frequency of needle exchange, insulin type 3, 4, 5.

Objective

The main objective of this study was,

a. To assess the prevalence of LH in diabetes patients who all are on insulin therapy.
b. Identify factors associated with LH.

Method

The research sampling consisted of 50 OPD diabetes patients. Inclusion criteria were having Type 1 and Type 2 diabetes and who had been on insulin therapy for at least 6 months. Patients excluded were gestational diabetes (GDM), those not using insulin and/or whose insulin treatment was only temporary.

Insulin treatment was only temporary. A questionnaire was developed using a relevant literature search and FIT Indian guidelines. Physical and personal characteristic of patient's likes, age, gender, types of diabetes, duration of diabetes was taken into consideration. Insulin treatment and injection technique were assessed. It comprised MCQs, like the needle length, duration, and frequency of insulin injection, needle reuse and site rotation, injection site. Observation and Palpation techniques were used in assessing LH. The presence of palpable or noticeable lump at injection site indicated the presence of LH. Informed consent form obtained from all patients who agreed to participate in the study.

Data were analyzed using SPSS version 22, Chi-squared test percentages, χ^2, and logistic regression analysis.

Result

In our study, LH was identified in 13 out of 50 (26%) of study participants. Socio-demographic characteristics of patients revealed that mean age was 51.06±15.30. 54% of patients were female and 46% were males. In our study, the prevalence of LH was more in females compared to males (33.3%). Mean duration of diabetes was 10.9±9.84 years. 46.6 % of patients with diabetes duration > 10 years had LH. Prevalence of LH was high in type 1 diabetes patients compared to type 2 diabetes (Table 1).

There is a significant relationship between the duration of insulin therapy and development of LH. 58.3% of patients with duration of insulin treatment >5 years had LH compare to less than 5 years (P=0.012). Type of insulin used had an influence on the development of LH. In all total 52% of patients were using analogue insulin, 40% were using human insulin and 8 %were using mixture of both. 16 % of patients had developed LH with human insulin compared to that was using analogue (6%) (p= 0.048) (Table 1).

There was no significant change in age (p=0.23), gender (p=0.3), type of diabetes (p=0.273), and Duration of diabetes (p-0.31) (Table 1).

In our study, we saw another factor affecting LH was an insulin delivery device. In total 80% of patients were taking insulin with a pen, and 20% were taking with a syringe. 50% of patients developed LH as compare to the pen (20%, p=0.042) (Table 2).

Analysis of the needle length in patients with LH present revealed that thirty-three (68 %) patients were using 6mm or 8 mm size needle. Twelve (36.6%) patients developed LH were using 6 or 8mm needle as compare to 4 mm needle (6.25%, P= 0.005) (Table 2).

Only 6 % of patients were doing the practice of single-use needle. In total 74 % of patients were reusing needle more than three times. LH was greatest when a needle was reused more than five times (55.5%) as compared to single use(33.3%, p = 0.007) (Table 2).

There was a strong association between the presence of LH and non-rotation of an injection site. Considering the insulin injection technique, LH was found to be more prevalent in patients who failed to rotate their injection site (57.8%), compared to who regularly rotate(6.45%, p=0.001)The prevalence of LH was statistically significantly higher in patients who had taken multiple injection /day. (p=0.001). (Table 2) (Figure 1) .

Table 1 Clinical and personal characteristic

Variable	Category	Total	Lipo Present	Lipo Absent	P value
Age (years)		51.06 15.3	49.2 (15.06)	51.7 (15.6)	0.23 (NS) t Test
Gender	Male	23(46%)	4 (17.3%)	19 (82.6%)	0.3 (NS) Chi Square
	Female	27 (54 %)	9 (33.3%)	18 (66.6 %)	
Duration of DM (years)	<5	10 (20%)	3 (30 %)	7 (70 %)	0.31 (NS) Chi Square
	10-Jun	20 (40 %)	4 (20 %)	16 (80 %)	
	15-Nov	15 (30%)	4 (26.6%)	11 (73.3%)	
	>15	5 (10%)	1 (20 %)	4 (80%)	
Duration of insulin (Years)	<5	38 (76%)	6 (15.7%)	32 (84.2%)	0.012 (S) t Test
	10-Jun	8 (16%)	5 (62.5%)	3 (37.5%)	
	>10	4 (8%)	2 (50%)	2 (50%)	
Type of DM	Type 1	7 (14 %)	2 (28.5%)	4 (71.4%)	0.273 (NS) Chi Square
	Type 2	43 (86%)	11 (25.5%)	33 (76.7%)	
Insulin Type	Human insulin	20 (40%)	8 (40 %)	12 (60 %)	0.048 (S) Chi Square
	Analogue	26 (52%)	3 (11.5%)	23 (88.4%)	
	Both	4 (8%)	1 (25%)	3 (75 %)	

Table 2 Insulin treatment and Injection technique

Variable	Category	Total	Lipo present	Lipo absent	P value
Insulin inj Type	Pen	40 (80%)	8 (20%)	32 (80%)	0.042 (S) Chi Square
	Syringe	10 (20%)	5 (50%)	5 (50%)	
Needle length	4mm	16(32%)	1 (6.25%)	15 (93.7%)	0.005 (S) Chi-Square
	6mm	31 (62%)	9 (29%)	22 (70.9%)	
	8mm	3(6%)	3 (100%)	0 (0%)	

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Variable	Category	Total	Lipo present	Lipo absent	P value
Frequency of Injection (per/day)	1	11 (22%)	0 (%)	11 (100%)	0.001 (S) Chi Square
	2	24 (48%)	5 (20.8%)	19(79.1%)	
	>3	15 (30%)	8 (53.3%)	7(46.6%)	
Rotating Site	Yes	31 (62%)	2 (6.45%)	29 (93.5%)	0.001 (S) Chi-Square
	No	19(38%)	11 (57.8%)	8 (42.1%)	
Needle Change	Single use	3 (6%)	1(33.3%)	2 (66.6 %)	0.007 (S) Chi-Square
	2-Jan	10(20%)	1 (10%)	9 (90%)	
	3 to 5	19 (38%)	1 (2%)	18 (36%)	
	> 5	18(36%)	10 (55.5%)	8 (44.4%)	

Figure 1 some of the picture of Lipohypertrophy (LH).

Discussion

The study aimed to assess the prevalence of LH, one of the most common complications of insulin therapy, and factors influencing in the development of LH.

In our study, the prevalence of LH was found to be 26 %. The prevalence was quite less as compared to the rate reported by Blanco M, in his recent study.[5,6] This may be because of increase in awareness, proper education and availability of shorter needle length and standard of care they received. Our study showed that the prevalence of LH was high in type 1 diabetes patients. Though difference was not significant (p=0.273). The prevalence in this study is similar to a study by Al Hayek et al.[16] However other studies found a prevalence of LH was high in type 2 diabetes patients.[7,8]

Prevalence of LH was more in females compared to males. In our study, there was no significant difference in patients having a duration of diabetes ≥10 years than those with a duration of fewer than 10 years (p=0.31).

In our study, needle reuse and needle length were found to be strongly associated with LH. The frequency of LH was higher in patients who reused needle three times or more (35.1%). Several studies have similar findings. A study done my Ayman et al, found that 46 % of patients had were developed LH reusing needles more than three times.[5,9,10]

15.7% of patients developed LH, within less than five years of insulin therapy. This may be because of non-rotation of an injection site, and needle reuse, hence proper education and counselling are very important to prevent LH. In our study, LH was more in patients who administer insulin injection 3 times per day (p=0.001). Prevalence of LH is more in patients who take multiple doses of injection, three to four times per day. A study conducted by Blanco M, all have emphasized, that development of LH increases with increase in no. of injection per day. It was seen that needle length is an important factor in the development of LH. In our study, LH was more frequent in patients using 6mm and 8mm needle. It was reported in a form of injection technique 2015 (FIT) guidelines, that 4 mm needle is effective and safe compared to 6 & 8 mm.[11,12] Many studies reported a strong association between non-rotation of insulin site and development of LH. In our study only 6.45 % of patients who rotate correctly developed LH. The similar finding was shown in his study by Vardar B et al.[13,14] The prevalence of LH was statically significant in patients who failed to rotate their injection site.[15,17]

Conclusion

From this study, it is concluded that the prevalence of LH was high in insulin-treated diabetes patients. Multiple insulin doses, duration of insulin therapy, needle length, site rotation, needle reuse were determined as the risk factors affecting the development of LH. Our study also showed that not rotating injection site and needle re-use was one of the important factors in the development of for LH.

It showed that healthcare professional or diabetes educator or

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should screen for LH, and teach them how to prevent LH in their daily management of diabetes mellitus.

Key message

1. Health care provider or diabetes educator should screen for LH regularly in their patients, who are on insulin therapy. More education and counseling are needed for who have been taking insulin for a long period of time and multiple injection doses.
2. By auditing the factors that have an influence on LH, the diabetes educator can focus on key areas in education that will help to prevent this condition from occurring.

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Conflict of interest

The author declares no conflict of interest.

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