

Lipohypertrophy in insulin-treated diabetes: Prevalence and associated risk factors

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Article points

1. The American Diabetes Association recommends the early addition of insulin therapy in people with diabetes who do not meet target goals. This guidance has led to an increase in the number of people with type 2 diabetes requiring insulin therapy. However, this rise in the use of insulin can lead to problems such as lipohypertrophy.
2. This study aimed to assess the prevalence of lipohypertrophy in a group of 55 people who were taking insulin. The study found that 51% of the study sample had lipohypertrophy.
3. Rotation of injection sites, frequency of insulin injections, and the duration of insulin use are all associated with lipohypertrophy.

Key words

- Insulin usage
- Lipohypertrophy
- Site rotation

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The American Diabetes Association recommends the early addition of insulin therapy in people with diabetes who do not meet target goals. This guidance has led to an increase in the number of people with type 2 diabetes requiring insulin therapy. However, this rise in the use of insulin has led to an increase in complications, such as lipohypertrophy. Lipohypertrophy is defined as an accumulation of subcutaneous fat tissue at a site where insulin has been injected continuously. This Irish study evaluated the prevalence of lipohypertrophy among 55 people treated with insulin. Furthermore, the authors aimed to determine the factors related to insulin use that may impact on lipohypertrophy. To do this each study participant was asked to answer six questions about their insulin usage, including duration and frequency of insulin use.

The prevalence of diabetes is increasing and the International Diabetes Federation estimates that there are 191 380 people with diabetes in Ireland, with a prevalence of 6.1% of the population. By 2030, it is thought that there will be approximately 278 850 people with the condition, with a prevalence of 7.5% in the population (International Diabetes Federation, 2012).

The American Diabetes Association (ADA, 2012) recommends the early addition of insulin therapy in people with diabetes who do not meet target goals. This guidance has led to an increase in the number of people with type 2 diabetes requiring insulin therapy. However, this rise in the use of insulin can lead to problems, such as more frequent episodes of hypoglycaemia, and lipohypertrophy, which will be the focus of this article.

Lipohypertrophy is defined as an accumulation of subcutaneous fat tissue at a site where insulin has been injected continuously (Vardar and Kizilci, 2007). It is a well-known complication

of insulin therapy and is characterised by the occurrence of soft fatty swellings at the site of repeated insulin injections (Hambridge, 2007). Insulin absorption diminishes in the areas of lipohypertrophy. Not only is there a danger of hyperglycaemia but conversely, when the same dose of insulin is injected into an area without lipohypertrophy, there is an increased risk of hypoglycaemia (Vardar and Kizilci, 2007). This leads to erratic diabetes control, which puts the individual at risk of developing chronic complications. It is vital that doctors and nurses recognise this condition by inspecting insulin sites regularly and encouraging site rotation.

The principle aim of this study was to estimate the prevalence of lipohypertrophy and to evaluate associated risk factors.

Method

This was a prospective study of 55 people with diabetes. The population consisted of 41 people with type 1 diabetes (T1D) and 14 people with type 2 diabetes (T2D). The sample was selected

from four outpatient clinics in St Michael's Hospital, Dublin. Two of these clinics were for people with T2D and two were clinics for people with T1D.

Each insulin-treated person involved in the study was examined for lipohypertrophy using observation and palpation techniques. Lipohypertrophy was assessed as "present" or "not present". The presence of a noticeable or palpable lump at the injection site indicated that lipohypertrophy was present.

Questionnaire

A questionnaire was developed using a relevant literature search and incorporating the recent Irish guidelines for insulin injection technique (Forum for Injection Technique [FIT] Ireland, 2012). It comprised six multiple-choice questions that aimed to assess the duration and frequency of insulin injection, needle length and site rotation. There were four or five answers to choose from for each question. They were asked to fill out the form in the waiting area and to return to a box located at the reception area of the outpatients' clinic. The questionnaire can be seen in *Box 1*. Questionnaire data was complete for all questions, except needle change ($n=52$) and site rotation ($n=53$).

Descriptive statistics are presented as mean and standard deviation (SD) or as a number and percentage. Differences between scale variables were determined using *t*-tests for unpaired data, and between categorical variables using chi-squared tests.

The association between lipohypertrophy and all potential predictors was tested using multiple logistic regression analysis; results are presented as odds ratios (OR) and 95% confidence intervals (CI). Results were considered significant if $P<0.05$. Statistics were performed using IBM SPSS version 20 (IBM Corp, 2011).

Results

Lipohypertrophy was identified in 28 of 55 study participants (51%). Descriptive statistics are shown in *Table 1*. Only 23% of people with lipohypertrophy moved to a different

Box 1. Lipohypertrophy questionnaire.

1. How long have you been injecting insulin

- 0–5 years
- 6–10 years
- 11–15 years
- 16–20 years

2. How many times a day do you inject?

- Once daily
- Twice daily
- Three times daily
- Four times a day or more

3. How much insulin do you inject on average?

- Less than 30 units per day
- Between 30 and 60 units per day
- Between 60 and 100 units per day
- Greater than 100 units per day

4. How often do you change the needle on the insulin pen?

- At every injection
- Every 2–3 injections
- Every 4–5 injections
- When cartridge/pen is finished

5. What size needle do you use?

- 4 mm
- 5 mm
- 6 mm
- 8 mm
- Greater than 8 mm

6. Do you move to a different area each time you inject?

- Yes, I move to a different site at every injection
- I move to a different site every week
- I move around sites occasionally, when I remember
- No, I only use one site

Page points

- This study involved 55 insulin-treated people with diabetes and assessed the prevalence of lipohypertrophy and associated risk factors.
- Study participants were asked to complete a questionnaire that assessed the duration and frequency of insulin injection, as well as needle length and site rotation.
- Lipohypertrophy was identified in 28 of 55 study participants (51%). Only 23% of people with lipohypertrophy moved to a different area each time they injected, compared to 85% of people without lipohypertrophy.

Page points

1. Lipohypertrophy was more common in people who were injecting four or more times per day ($P=0.009$) and the duration of insulin therapy was longer in those with lipohypertrophy, compared to those without lipohypertrophy.
2. In the logistic regression analysis, lower frequency of site rotation, lower frequency of injection and longer duration of diabetes were significantly associated with presence of lipohypertrophy.
3. There was no significant difference in the prevalence of lipohypertrophy when it came to the dose of insulin the study participants were injecting.

Table 1. Presence of lipohypertrophy and associated variables.

Variables	Lipohypertrophy absent (n=27)	Lipohypertrophy present (n=28)	P values
Age (years)	50.8 (16.5)	59.5 (15.9)	0.053
Gender (male: female; %)	33:67	54:46	0.130
Duration of time using insulin (years)	10.6 (10)	19.2 (13.6)	0.011
Insulin dose (units)	44.9 (18.4)	54.3 (33.1)	0.197
Frequency of injections per day (<4 or ≥4; %)	56:44	21:79	0.009
Needle size (≤6 mm or >6 mm; %)	56:44	36:64	0.140
Needle change at each injection or not at each injection (%)	81:19	88:12	0.442
Site frequency: rotate site every time or not every time (%)	85:15	23:77	<0.001

Results are presented as mean (SD) for interval variables and as percentage for categorical variables. P-values are based on unpaired *t*-tests for interval variables and on chi-squared tests for categorical variables

area each time they injected, whilst 85% of people without lipohypertrophy moved to a different area each time they injected ($P<0.001$). Lipohypertrophy was more common in people who were injecting four or more times per day ($P=0.009$) and the duration of insulin therapy was longer in those with lipohypertrophy, compared to those without lipohypertrophy ($P=0.011$). There were no significant differences in age ($P=0.053$); gender ($P=0.130$); needle length ($P=0.140$); total insulin dose ($P=0.197$) and whether the needle was changed at time of each injection ($P=0.442$).

In the logistic regression analysis, the following variables were significantly associated with presence of lipohypertrophy: lower frequency of site rotation (OR=0.011; 95% CI 0.000–0.166, $P=0.003$); lower frequency of injection (OR=0.040; 95% CI 0.003–0.624,

$P=0.022$); and longer duration of diabetes (OR=1.117; 95% CI 1.007–1.239, $P=0.037$).

Discussion

A total of 51% of people with diabetes in our sample had lipohypertrophy. Our study shows that the factors associated with lipohypertrophy were the lack of rotation of injection sites, high frequency of injections and the longer duration of insulin use (Table 1). However, the multivariable model unmasked a negative relationship between injection frequency and presence of lipohypertrophy, highlighting even more the importance of site rotation. Other reports have noted that not rotating injection sites is one of the main reasons for lipohypertrophy (Chowdhury and Escudier, 2003). The longer a person has been administering insulin, the more likely

they are to develop lipohypertrophy. This is best explained by a direct lipogenic effect of insulin at the site of injection (Vardar and Kizilci, 2007). It is interesting to note that there was no significant difference in the prevalence of lipohypertrophy when it came to the dose of insulin the study participants were injecting. We did not find any association between length of needle and lipohypertrophy. In fact the majority of people were prescribed a 6 mm needle or less. This adheres to the recommended guidelines (FIT Ireland, 2012).

By making healthcare professionals and people with diabetes aware of lipohypertrophy, we hope to keep the complications associated with it to a minimum. It is vital that the condition is recognised so that the treatment is appropriate. Lipohypertrophy is found to be the most common cutaneous complication of insulin therapy (Richardson and Kerr, 2003). By auditing the factors that have an influence on lipohypertrophy, the DSN can focus on key areas in education that will help to prevent this

Forum for Injection Technique (FIT)

FIT was conceived in the UK and now has Boards in Ireland, Canada, Switzerland, India and South Africa. FIT is an autonomous organisation comprising specialist diabetes nurses and its mission is to support people with diabetes using injectable therapies by educating and supporting healthcare workers.

The *First UK Injection Technique Recommendations* (2nd edition) have been published to raise awareness of existing and emerging research relating to injection technique and the impact this may have on health outcomes for people with diabetes that require subcutaneous injection therapy.

FIT is committed to supporting the implementation of the recommendations by all those involved in diabetes care and to developing the recommendations further.

The latest edition of the recommendations can be accessed via the FIT website: www.fit4diabetes.com.

condition from occurring or re-occurring.

Rotation of injection sites is paramount when trying to avoid lipohypertrophy. In addition, the duration of insulin use and the frequency of insulin injections have been found to be important factors that influence the development of lipohypertrophy.

Conclusion

The prevalence of lipohypertrophy is so great that it cannot be ignored. Nurses must strive to examine every person who uses insulin for lipohypertrophy at their annual clinic review. Nurses should pay particular attention to those who have been injecting insulin for a long period of time and who are on multiple injections. When educating a person who is starting insulin, it is important to emphasise site rotation, as well as the importance of correct needle length and changing the needle frequently. We intend to develop an information leaflet on lipohypertrophy that is clear and concise. We also aim to run education sessions for staff to increase awareness of lipohypertrophy. ■

“By making healthcare professionals and people with diabetes aware of lipohypertrophy, we hope to keep the complications associated with it to a minimum.”

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