

Insulin injection practices

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ABSTRACT

The purpose of this study was to investigate the practices of insulin injection and the grounds on which diabetic patients make decisions in relation to insulin therapy. The data for this study were collected by a structured questionnaire with a few open-ended questions. The study group of 100 patients with type 1 diabetes was collected from two sources. The first half of them (50) came from the Central Hospital of North Karelia and the second half from the Diabetes Education Centre of the Finnish Diabetes Association. The study group consisted of 56 women and 44 men. The range of age was 17–64 (mean 32 years) and the duration of diabetes 1–40 years (mean 11 years). Injection site problems were reported by 65% of the patients. Patients utilising a small skin area for injections (the size of a stamp), or patients who had poor metabolic control ($HbA_{1c} > 8.6\%$), reported more problems than other patients. 30% of the patients occasionally injected through clothing during unusual situations (e.g. parties, busy work etc). Occasional skipping of injections was reported by 31% of the patients for reasons such as oblivion or on purpose (e.g. low blood glucose). The most general basis for their injection routines was reported to be a habit and the other basis was patient education. The study suggests problems in insulin injection practices. Systematic checking of the injection sites and technique and the improvement of patient education are recommended. Copyright © 2000 John Wiley & Sons, Ltd.

Practical Diabetes Int 2000; 17(8); 252–254

KEY WORDS

injecting insulin; insulin treatment; lipohypertrophy; diabetes care; diabetes mellitus

Introduction

Treatment of diabetes requires permanent lifestyle changes. The maintenance of good metabolic control requires on a daily basis follow-up of diet, exercise and implementation of drug therapy.¹ Diabetic patients make a number of choices regarding their daily therapy and are responsible for maintaining a state of good metabolic control by adjusting the different elements of therapy. Adaptation to the requirements of diabetes and commitment to the therapy is a demanding, lifelong process.²

The Diabetes Control and Compli-

cations Trial³ demonstrated that tight metabolic control significantly reduces the risk of diabetes related complications. It is not easy to achieve a good, lifelong, metabolic control in everyday life. Many factors are related to this. Intensive diabetes therapy includes, in addition to intensive insulin treatment, blood glucose home monitoring and intensive patient education.³ Multiple injection therapy has made the treatment of diabetes more flexible, but also imposes greater demands in relation to self-care of diabetes.⁴ New devices developed for injecting insulin, such as the insulin pen and a variety of needles, require new skills.⁵ In studies relating to self-care of diabetes, insulin therapy has been found to be the best realised area.⁶ Insulin injection site problems are less well known. It has been found that diabetic patients inject insulin into fairly limited areas, which can result in lipodystrophy.⁷ In addition, some injections reach the muscle,^{8–10} resulting in different insulin absorption rate than from the subcutaneous tissue.⁸

In the past few years, changes in the methods of diabetes therapy have made it necessary to improve diabetes

education. Education is a cornerstone of successful treatment, in addition to diet, exercise and drug therapy.^{4,5,11} The aim of the education related to insulin therapy is to learn the injection technique, to know how to pick injection sites appropriately and to become familiar with care of injection sites. A further aim is to overcome the fear of injection. Advice is also given about the storage of insulin and appropriate use, disposal and maintenance of injection equipment.

Several studies have been performed on insulin dosing and regimen.^{3,8–10} Little attention has been focused on how patients inject insulin in everyday life.¹² The purpose of this study was to evaluate implementation of insulin therapy in practice. Additional aim was to study the grounds on which diabetic patients make decisions in relation to insulin therapy.

Patients and methods

The study group of type 1 diabetic patients was collected from two sources. The first group came from the Diabetes Education Centre of the Finnish Diabetes Association and the other from a secondary care hospital

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Submitted: 4 January 1999

Accepted: 8 September 1999

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(North Karelia Central Hospital, Joensuu, Finland), 50 patients from each. During October–November 1997 all type 1 diabetic patients aged 17–65 with duration of diabetes >6 months and no insulin pump in use were selected for the study. Altogether there were 56 women and 44 men. The detailed clinical characteristics are given in Table 1. 26% of the patients had good metabolic control ($HbA_{1c} < 7.5\%$, reference range 4.5–6.5%), 38% acceptable (HbA_{1c} 7.5–8.5%) and 36% of the patients poor metabolic control (HbA_{1c} 8.6–10.0%). The data for this study were collected by a structured questionnaire with a few open-ended questions. After finishing questionnaire patients' injection sites were checked (visually and palpated) by a diabetes specialist nurse. HbA_{1c} (reference range 4.5–6.5%) was determined by high-performance liquid chromatography (Mono-S, Pharmacia, Uppsala, Sweden).

The data were analysed by SPSS software (version 5.0, Chicago, IL, USA). Frequencies were calculated and the connections between the variables were studied by cross-tabulation. Open-ended questions were analysed by using content analysis. The ethics committee of North Karelia Central Hospital approved the study protocol.

Results

Injection devices

Eighty-five per cent of the patients used an insulin pen. These patients used solely insulin pens. Insulin syringes only were used by 12% of the patients. Some patients used both insulin pens and syringes. A single needle was used five times or more often by 60% of the patients. Only

one patient disposed of the needle after a single use. Several patients used single needle until it hurt or was blunt. The most common length of the needle was 12.7 mm. Only a few patients used shorter needles. Several patients did not know the length of their own needle.

Injection sites

Short-acting insulin was mainly injected into the abdomen and intermediate-acting insulin into the thighs or buttocks. Most patients had the opinion that they used injection areas wide enough. Checking the sites on all patients indicated that 23% of the patients used a very small injection area, the size of a stamp. Systematic site rotation was done by 30% of the patients and checking of the injection sites during each injection by 30% of the patients. Fifteen per cent of the patients reported that the injection sites were never checked by professionals.

Injection technique

The pinch-up of the skin fold at any injection site was not done by 15% of the patients. Injection angle was 90° with half of the patients. It was also 90° with those who did not pinch up or who used long needles. 30% of the patients occasionally injected through clothing. Reasons for this were different unusual situations or places when it was easiest to do so. Typical instances were during parties or in a hurry. Occasional skipping of injections was reported by 31% of the patients. Reasons such as on purpose with low blood glucose or being in a hurry were given.

Injection sites

Checking of injection sites indicated that 65% of the patients had injection

Table 2. Signs and symptoms related to insulin injection

	Patients
Swelling	46
Rash	8
Other	
Lipohypertrophy	29
Lipoatrophy	1

site complications (Table 2). There was lipohypertrophy of different shapes and sizes and swelling. Some patients had several complications. Most complications were seen in the abdomen. Cross-tabulation showed that patients with most findings were those with poor metabolic control ($HbA_{1c} > 8.6\%$) and small injection areas and those with the injection sites never checked.

Experience of injections

Several patients (78%) experienced always pain while injecting. Reasons for pain were injection site, blunt needles, reuse of needles and the technique of the injection. Other problems (fear of injections, loss of intimacy) in injections were mentioned by 14% of the patients.

Injection routines

A habit is the most common reason for behaviour. Some of the patients mentioned that it is a bad habit and they do not remember what they have done: whether they took insulin or not, in which site they injected last time etc. They are so scrutinised to do it in a certain way that they do not think it at all. A common reason for choosing an injection site was avoidance of pain. Those areas with less pain are more often chosen. Easiness was a common reason for using a small injection area, e.g. in the abdomen it is easy to inject through a buttonhole. The reason for rotating injection sites was the avoidance of lipodystrophy. Absorption of insulin was the reason for using different injection areas. The advice given by the educator was an important reason for this.

Table 1. Clinical characteristics of the patients

	Mean \pm SD	Range
Age	32 \pm 19	17–64
BMI (kg/m ²)	24 \pm 4	18–35
Duration of diabetes (years)	11 \pm 9	1–40
Number of injections/day	4 \pm 0.2	2–7

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Discussion

Several factors influence the metabolic control of diabetes.³ In everyday clinical work metabolic control, diet and insulin dose represent the major points of interest. Little attention is focused on insulin injection technique and injection site problems.⁹ Our study shows that most diabetic patients report problems with the injection sites or techniques. Objective evaluation of the injection areas showed alterations or technical problems in 65% of the patients.

Lipohypertrophy is the most common local complication among type 1 diabetic patients.^{9,12,13} Lipodystrophic changes (atrophy or hypertrophy) were common during the era of insulins from animal sources but the use of highly purified insulins and human insulin have not eradicated these changes.¹³ Prevalence rates of lipohypertrophy vary between 20 and 53%.^{7,14,15} The occurrence of this complication has been related to a possible growth factor effect of insulin on cellular elements of subcutaneous tissue.¹⁶ Repeated use of the same site for insulin injections, high body mass index and female sex favour lipohypertrophy.⁷ No data is available on the effect of repeated use of a single needle or on the trauma caused by blunt and deformed needle tips. Our findings support these previous observations with 29% of patients having lipohypertrophy and most of the patients using limited injection areas.

The limited rotation of different injection areas was unexpected. All these patients are advised during their continuous education to rotate injection areas regularly. Easy access to certain areas is a simple explanation. Other possible reasons for the selection are the sensation of pain. Our

data do not support the assumption that lipohypertrophic sites are less painful. Some recent observations support this finding.^{7,17} It is assumed that rooted habits may be the most important reason for selecting certain injection area. The previous observation that insulin absorption from lipohypertrophic areas may be delayed, thus affecting glycaemic profile, is of importance.¹⁴

Optimal injection technique is essential for good diabetes control. Frid and Linde⁸ reported a high prevalence of muscular insulin injections with the use of a standard 12.7 mm needle. This was more obvious with patients using a perpendicular injection technique without pinch-up. Muscular injection of insulin influences the absorption rate and ultimately the metabolic control.^{9,10} This might explain, at least partly, the relatively poor HbA_{1c} values among our patients.

In conclusion we found that a significant number of type 1 diabetic patients have problems with insulin injections or with insulin injection sites. Regular examination and organised rotation of injection areas are recommended. Also the possible metabolic consequences of injecting insulin in muscles or lipohypertrophic areas must be emphasised in patient education.

Acknowledgement

This study was supported by a grant from Becton Dickinson and we thank the personnel from the Diabetes Centre for their help.

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