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Diabetes mellitus is one of the major causes of premature morbidity and mortality. Studies show that intensive glycaemic control could significantly reduce the risk of diabetic complications. With the increasing number of diabetic patients under primary care indicated for insulin, family physicians will play a pivotal role in prescribing it in their setting. The initiation and titration of any insulin regimen is not difficult in most patients. With support from diabetes nurses and training on insulin use, family physicians can provide insulin therapy to diabetic patients in the community and reduce the number of referrals to secondary care. This article reviews the most updated clinical guidelines on insulin use to better equip family physicians on the initiation and titration of insulin in primary care.

Introduction

Diabetes mellitus is one of the major causes of premature morbidity and mortality. Glycaemic control is of utmost importance in its management. Controlled clinical trials such as the Diabetes Control and Complications Trial,¹ the UK Prospective Diabetes Study (UKPDS),² the Veterans Affairs Diabetes Trial,³ the Action in Diabetes and Vascular Disease: Preterax and Diamicron Modified Release Controlled Evaluation trial,⁴ and a study on Japanese patients⁵ demonstrated that intensive glycaemic control could significantly reduce the risk of microvascular complications. Studies also support the role of glycated haemoglobin (HbA1c) reduction in decreasing cardiovascular disease risk.^{6,7} The general goal of an HbA1c level of below 7% has been recommended by many authorities. In the UKPDS, 50% of patients were taking insulin therapy to maintain HbA1c levels of below 7% within 6 years of the diagnosis of type 2 diabetes.²

Traditionally, the use of insulin to improve glycaemic control was provided by medical specialists. With the increasing number of patients under primary care for whom insulin is indicated, prescribing it in the same setting appears much more convenient for the end users. Often however, insulin is not started in time, due to psychological resistance from both doctors and patients. This review aims to provide updated information on insulin use so that primary care doctors may be better equipped for insulin initiation and titration.

Patient's barriers to insulin therapy

Patients are commonly reluctant to start insulin injections. Studies show that more than one quarter of type 2 diabetics may refuse insulin when it is prescribed.⁸ Some patients refuse insulin therapy outright, citing a variety of reasons, while others bargain with their doctors to delay its initiation. Common concerns they express about insulin therapy include perceived adverse effects such as hypoglycaemia, weight gain, perceived loss of control of their diabetes, and anxiety over injections.^{9,10}

Identifying the precise barriers and addressing such concerns are the keys to successful insulin initiation. Most of these barriers can be overcome by detailed explanation, education, counselling, and adequate support.

Indications for insulin

A consensus statement from the American Diabetes Association and the European Association for the Study of Diabetes was updated in 2012, and emphasised a patient-centred approach and individualised HbA1c treatment targets for the management of hyperglycaemia in type 2 diabetes. It recommended that insulin could be considered as one of the options for dual combination therapy, if an individualised HbA1c level target was not reached after metformin therapy. This choice could be based on patient and drug characteristics, with an over-riding goal of improving glycaemic control while minimising side-effects. When three-drug combinations are considered, insulin is likely to be more effective than most other agents (eg sulfonylurea, thiazolidinedione, dipeptidyl peptidase

Key words

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4 inhibitor, glucagon-like peptide-1 receptor agonist), especially when the HbA1c level is very high ($\geq 9.0\%$).¹¹

In the primary care setting, the most common indication for initiating insulin is failure to achieve glycaemic control after lifestyle interventions and oral anti-diabetic medications. Patients with severe renal impairment (a contra-indication to using metformin) may also be candidates for insulin therapy. Patients with diabetic ketoacidosis, hyperosmolar hyperglycaemic states, and severely uncontrolled diabetes should be admitted to hospital for insulin therapy.

On the other hand, patients whose compliance to medications and/or self-monitoring of blood glucose (SMBG) is poor, or they (or their caregivers)

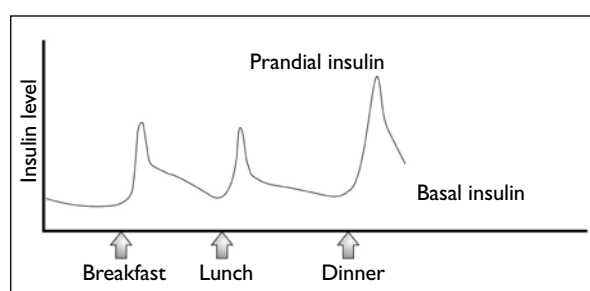


FIG 1. Physiological profile of insulin

在基層醫療的層面上給予胰島素治療

糖尿病是提早發病和死亡的主要病因之一。研究顯示，嚴格的血糖控制可以顯著降低糖尿病併發症的風險。隨著越來越多在基層醫療的層面上接受診斷治療的糖尿病患者需要接受胰島素治療，家庭醫生在處方胰島素時扮演重要角色。在大多數患者中，開始胰島素治療以及其滴定並不困難。在糖尿專科護士的協助下以及接受胰島素治療的培訓，家庭醫生可以在社區內為糖尿病患者提供胰島素治療，從而減少轉介至第二層醫療的個案。本文回顧有關胰島素治療的最新臨床指南，讓家庭醫生更好裝備在基層醫療的層面上提供胰島素治療和滴定。

are unable to perform insulin injection or SMBG, should not be started on insulin treatment. Patients with type 1 diabetes, pregnancy, large fluctuation noted in test-strip glucose levels, and those suspected of secondary causes of hyperglycaemia, should be referred to endocrinologists for further assessment and management. Moreover, as drugs commonly used to treat diabetes and its complications may be contra-indicated or not recommended in pregnancy, diabetic women contemplating pregnancy should also be referred to endocrinologists for specialist care.¹²

TABLE 1. Types of insulins and suggested action profile according to the manufacturers

Insulin class	Insulin registered in Hong Kong	Pharmacodynamics ^{13,14}			Comments
		Onset	Peak	Duration	
Rapid-acting insulin analogues	<ul style="list-style-type: none"> • Apidra (glulisine)^{††} • Humalog (Lispro)[‡] • NovoRapid (Aspart)[§] 	5 mins <15 mins 10-20 mins	30-60 mins 30-90 mins 1-3 hrs	2-4 hrs 3-5 hrs 3-5 hrs	<ul style="list-style-type: none"> • Inject immediately before meal • Closely reproduce physiological prandial peak • Better postprandial hyperglycaemia control and less hypoglycaemia before next meal
Short-acting (regular soluble) insulins	<ul style="list-style-type: none"> • Humulin R[‡] • Actrapid[§] • SciLin N^{††} 	30-60 mins	2-4 hrs	5-8 hrs	<ul style="list-style-type: none"> • Inject 30 minutes before meal • Delayed peak can lead to postprandial hyperglycaemia and delayed hypoglycaemia
Intermediate (NPH*) insulin	<ul style="list-style-type: none"> • Humulin N[‡] • Protaphane[§] • SciLin N^{††} 	1-2 hrs	4-10 hrs	10-16 hrs	<ul style="list-style-type: none"> • When used as basal insulin, the peak can lead to nocturnal hypoglycaemia • High intra-patient variation in absorption, day-to-day peak and duration
Long-acting insulin analogues	• Levemir (detemir) [§]	3-4 hrs	6-8 hrs (relatively flat)	20-24 hrs	<ul style="list-style-type: none"> • May need twice daily injection • Less weight gain compared with other insulins including glargine
	• Lantus (glargine) [†]	90 mins	Flat	24 hrs	<ul style="list-style-type: none"> • Almost peakless with decreased hypoglycaemia • Good for basal insulin supply with once daily injection
Premixed human insulins	<ul style="list-style-type: none"> • Humulin 70/30[‡] • Mixtard 30 HM[§] • SciLin M30 (30/70)^{††} 	30-60 mins	Dual	10-16 hrs	<ul style="list-style-type: none"> • Component: regular insulin + NPH insulin • Produce 2 peaks (biphasic) to cover 2 meals • Convenient but inflexible (fixed basal and prandial insulin)
Biphasic analogue insulins	• NovoMix 30 [§]	5-10 mins	Dual	10-16 hrs	<ul style="list-style-type: none"> • Component: rapid acting insulin + analogue protamine insulin • Fasting peak for prandial cover • Less variability than premixed human insulins
	• Humalog Mix 25 [‡]	<15 mins	Dual	10-16 hrs	
	• Humalog Mix 50 [‡]	5-10 mins	Dual	10-16 hrs	

* NPH denotes neutral protamine Hagedorn

[†] Insulin registered but not yet available in the market of Hong Kong

[‡] Eli Lilly and Company, Indianapolis, US

[§] Novo Nordisk, Bagsvaerd, Denmark

[†] Sanofi SA, Paris, France

^{††} SciGen Ltd, Singapore

Patient education and support

A structured insulin programme (supported by a diabetes nurse) should be employed whenever insulin is initiated. Education on SMBG and insulin injection technique, diet, drug compliance, management of hypoglycaemic attacks, travel, sick days, and management after missing a dose should also be provided. Telephone support should also be available.

Physiology of insulins

The ideal insulin regimen aims to mimic the physiological profile of insulin secretion as closely as possible. There are two major components in the insulin profile: a continuous basal secretion and prandial surge after meals (Fig 1). The basal secretion controls overnight and fasting glucose while the prandial surges control postprandial hyperglycaemia.

Based on the time of onset and duration of their actions, injectable formulations can be broadly divided into basal (intermediate insulin and long-acting analogues) and prandial (regular insulin and rapid-acting analogues) insulins (Table 1^{13,14}). Premixed insulin formulations incorporate both basal and prandial insulin components.

Insulin regimen

The choice of insulin regimen should depend on the goal of treatment with regard to age, co-morbidities, existing diabetic complications, functional status, and compliance. A less stringent HbA1c goal may be appropriate for patients with a history of severe hypoglycaemia, limited life expectancy, advanced microvascular or macrovascular complications, and extensive co-morbidity.¹² The number of injections, frequency of SMBG acceptable to the patient, and baseline glycaemic control also affect the choice of insulin regimen. Because of progressive pancreatic β -cell dysfunction, most patients require progression to more complex regimens in order to maintain and/or reach target.^{15,16} Common insulin regimens are illustrated in Figure 2 and can be listed as follows:

- (1) Once daily regimen at bedtime¹⁷
- (2) Premixed biphasic regimen¹⁸
- (3) Basal bolus therapy¹⁹
- (4) Prandial premixed therapy²⁰

A single dose of neutral protamine Hagedorn (NPH)/premixed insulin at breakfast is less commonly used if there is only daytime hyperglycaemia.²¹

Adjustment of oral anti-diabetic drugs

Synergistic effects of oral anti-diabetic drugs with

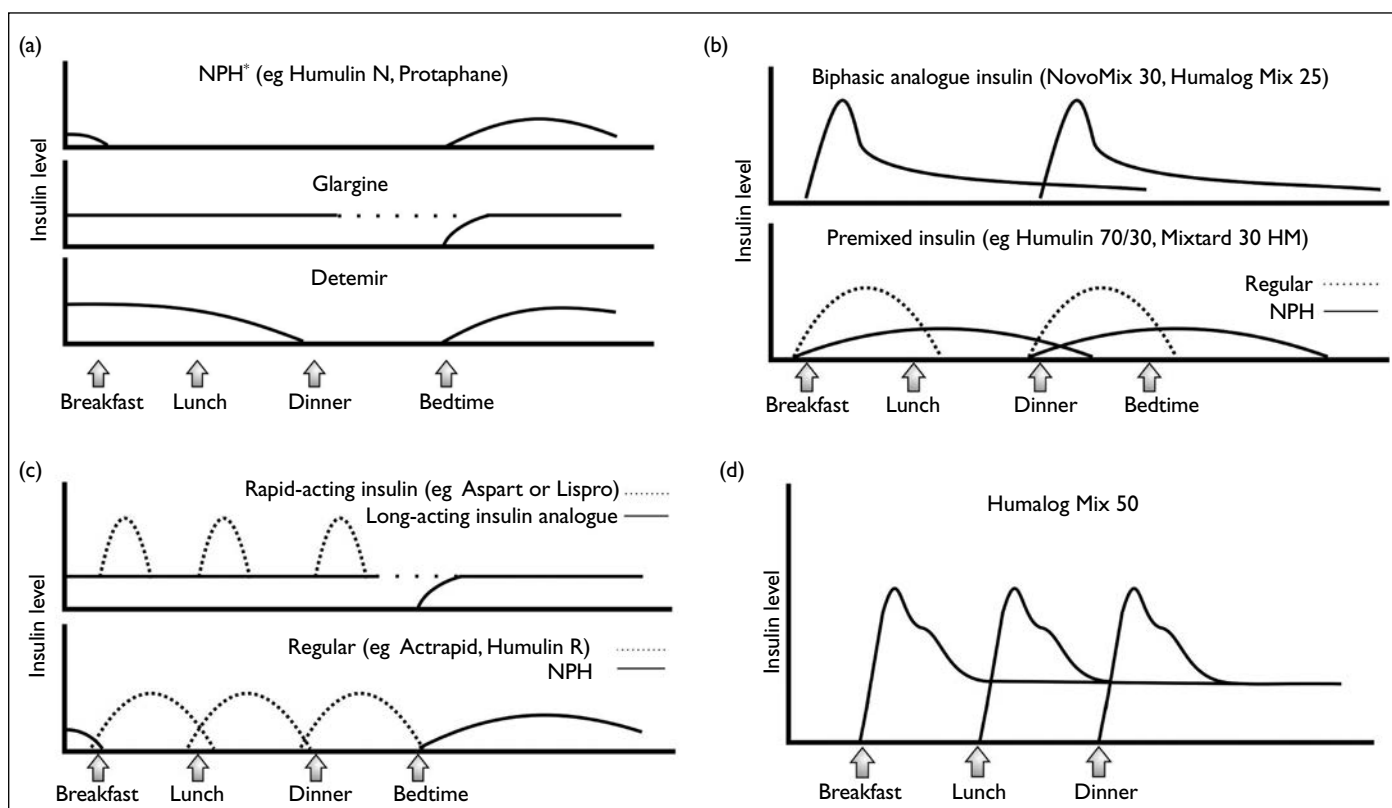


FIG 2. Common insulin regimens

(a) Once daily basal insulin at bedtime, (b) twice daily premixed biphasic insulin regimen, (c) basal bolus therapy, and (d) prandial premixed therapy

* NPH denotes neutral protamine Hagedorn

insulin may allow the latter's dose to be reduced by up to 50%.²² When starting insulin therapy in patients on oral anti-diabetic drugs, metformin and sulphonylurea (and acarbose, if used) can be continued. If the patient is taking supra-maximal doses of any of the oral drugs, such doses should be reduced in line with product information recommendations. For example, the maximum recommended daily dosage of metformin is 2 g. Long-acting sulphonylureas (eg glibenclamide) should be avoided and their use should be reviewed if hypoglycaemia supervenes. To avoid hypoglycaemia in patients receiving high doses of insulin, sulphonylurea dosing may need to be reduced or cease. Pioglitazone (but not rosiglitazone) can be combined with insulin in patients who previously endured marked glucose lowering in response to thiazolidinedione therapy.^{23,24}

Initiation of insulin therapy

When initiating insulin, one should consider whether the patient is prone to fasting and/or postprandial hyperglycaemia. Optimal fasting blood glucose control should be the first target to achieve with a bedtime basal insulin. When the fasting blood glucose is under control, one should address daytime preprandial and postprandial hyperglycaemia. A morning dose of basal insulin can help to control pre-dinner hyperglycaemia. To control postprandial hyperglycaemia, regular/rapid-acting or premixed insulin should be used before meals.

Most patients have high fasting blood glucose levels. Starting with a single dose of bedtime basal insulin in combination with an oral anti-diabetic drugs is generally well accepted, is simple to implement, and effective in achieving rapid glycaemic control.²⁵

Neutral protamine Hagedorn insulin

For fasting hyperglycaemia, it is common practice to start with an injection of NPH insulin at bed-time. The initial dose is usually 10 units per day (but may start at a lower dose of 0.2 units per kg per day for lean patients with body weight of <50 kg); thereafter the dose is titrated according to the fasting capillary blood glucose level obtained every 3 days or so.

Long-acting insulin analogues

Use of long-acting insulin analogues (glargine or detemir) are considered if the patient (1) suffers from significant nocturnal hypoglycaemia while on NPH insulin; (2) has an irregular lifestyle, eg shift work; or (3) prefers and can afford a long-acting insulin analogue.²³

Glargine is given as a daily dose at bedtime, with dinner or in the morning. Detemir can be given as daily or twice daily doses. If given daily dose,

detemir should be used at bedtime or with dinner. The initial dose of a long-acting insulin analogue is 10 units or 0.15 units per kg per day.

Premixed human insulin

To manage day-time or postprandial hyperglycaemia (particularly if the HbA1c $\geq 9\%$), premixed human insulin of 5-10 units twice per day (before breakfast and before dinner) can be considered.²³ Premixed human insulin should be given 30 minutes before a meal.

A once-daily premixed human insulin regimen before dinner may be an option, mainly for those with fasting and post-dinner hyperglycaemia.

Biphasic analogue insulin

A biphasic analogue insulin (containing 25 or 30% as rapid-acting insulin) is considered if a patient prefers injecting insulin immediately before a meal, hypoglycaemia is a problem, or blood glucose levels increase markedly after meals.²³

Biphasic analogue insulins should be given immediately before meals. For NovoMix 30 (Novo Nordisk, Bagsværd, Denmark), the recommended starting dose is 12 units as a single dose predinner,²¹ or 6 units prebreakfast and 6 units predinner.¹⁸ For Humalog Mix 25 (Eli Lilly and Company, Indianapolis, US), the recommended starting doses are 10 units predinner or 10 units prebreakfast and predinner, depending on the capillary blood glucose profile.²⁶

Insulin titration

Clinic or patient-driven algorithms for titrating basal insulin therapy have been shown to be effective²⁷⁻²⁹; the choice depends on the complexity of the insulin regimen contemplated, the risk of hypoglycaemia, the patient's self-management competency, and the resources available. How the titration is implemented generally depends on the average of about three of the latest capillary blood glucose levels obtained at specific times according to the timing and type of insulin used (Table 2).

Hypoglycaemic values should be carefully interpreted and their cause(s) identified, bearing in mind that morning hyperglycaemia may be caused not only by poor glycaemic control but also by the so-called 'Dawn' phenomenon or the Somogyi effect.³⁰

An example of a simple and safe scale for titration is shown in Table 3. The frequency of titration is usually every 1 to 2 weeks, depending on resources available. The optimal targets for insulin titration include fasting and pre-meal capillary blood glucose levels of less than 6 mmol/L, post-meal capillary blood glucose levels of less than 8 mmol/L, and a

TABLE 2. Types of insulin injection with respective capillary blood glucose monitoring for insulin titration

Regimen	Capillary blood glucose monitoring						
	Fasting	Post-breakfast	Pre-lunch	Post-lunch	Pre-dinner	Post-dinner	Bedtime
Bedtime NPH* insulin or long-acting insulin analogue	✓						
Morning NPH insulin or premixed human insulin or biphasic insulin analogue		✓	✓	✓	✓		
Pre-dinner premixed human insulin or biphasic insulin analogue	✓					✓	✓
Pre-breakfast regular insulin or rapid-acting insulin		✓	✓				
Pre-lunch regular insulin or rapid-acting insulin				✓	✓		
Pre-dinner regular insulin or rapid-acting insulin						✓	✓

* NPH denotes neutral protamine Hagedorn

TABLE 3. Scales for insulin titration

Capillary blood glucose (mmol/L)*	Insulin dosage (units)
<4.0	-2
4.0-7.0	+0
7.1-10.0	+2
>10.0	+4

* Latest average of ≥ 3 capillary blood glucose readings taken at specific times according to the time and types of insulin injection

HbA1c level of less than 7%. The insulin dose should be decreased if hypoglycaemia is encountered. The HbA1c level should be checked every 3 months until less than 7% and then at least every 6 months.

Stepwise change of insulin regimens

While the patient is on bedtime NPH insulin, a second dose at breakfast (starting with 4 units) could be considered if the fasting blood glucose level is on target but the pre-dinner level is out of range.

If basal insulin (including twice-daily NPH insulin or a once-daily long-acting insulin analogue) fails to achieve glycaemic control, addition of prandial insulin either in the form of a premixed preparation or basal-bolus therapy should be considered. Twice daily premixed human insulins (mixtures of regular and NPH insulin) warrant fewer daily injections than basal-bolus regimens, but with the limitation that relatively fixed mealtimes should be maintained every day. Moreover, the prandial surge of blood glucose during lunch is also not covered.

Biphasic insulin analogues (with 25 or 30% rapid-acting insulin) are injected immediately before meal and may therefore offer greater flexibility. Their rapid-acting insulin components more closely mimic physiological insulin secretion when compared to regular insulin. They offer more rapid onset and shorter durations of action, greater peak effects, and better control over postprandial blood glucose.³¹⁻³³

When switching from a basal insulin to a premixed insulin, the total daily insulin dose can be halved. Half the dose of the premixed preparation is then given before breakfast and the other half before dinner and titrated accordingly. If prandial cover for lunch is necessary or glycaemic control is not achieved while the patient is on twice-daily premixed insulin, one can consider either one of the following: (1) adding a third dose before lunch if the patient is on NovoMix 30; (2) adding a regular or rapid-acting insulin before lunch; (3) changing to basal bolus therapy; or (4) switching to three doses of a biphasic analogue insulin with 50% rapid-acting insulin (prandial premixed therapy). When switching to prandial premixed therapy, one third of the total daily insulin dose should be given before each of the three meals and titrated accordingly.

Basal bolus therapy allows greater flexibility in timing and dosing to suit individual needs and lifestyles, but at the expense of complexity and multiple injections. Stepwise addition of prandial insulin to basal insulin may be more practical and acceptable to patients than using multiple daily injections. In many instances, a single mealtime injection of a prandial insulin before the biggest meal might be sufficient to restore glycaemic control. A safe starting is 4 units of regular or rapid-acting insulin at meal time, whenever the pre-meal blood glucose level exceeds 7 mmol/L to be followed up by appropriate titration.

Self-monitoring of blood glucose

The American Diabetes Association recommends SMBG as a component of intensive glycaemic control in patients using insulin.¹² Studies have proved its effectiveness in improving glycaemic control in type 2 diabetes patients taking insulin. For patients using multiple insulin injections or an insulin pump, SMBG should be carried out three or more times daily. More frequent SMBG is necessary in case of illness, travel, or after any major change in diet or exercise level.

Complications of insulin injection

Hypoglycaemia

Hypoglycaemia is a major treatment-associated complication of diabetes. A population-based study showed the frequency of severe hypoglycaemia (defined as requiring treatment by emergency medical services) for type 1 and type 2 diabetes patients treated with insulin to be 11.5 and 11.8 events per 100 patient-years, respectively.³⁴ In this study,³⁴ older age, longer duration of diabetes, a higher HbA1c, and socio-economic deprivation were identified risk factors for severe hypoglycaemia.

Causes and prevention of hypoglycaemia

Causes of hypoglycaemia include excessive insulin/sulphonylurea, delayed or missed meals, increased drug absorption eg injection site problem and strenuous or unplanned exercise, decreased drug degradation as in renal failure, and drug interactions.

To prevent hypoglycaemia, regular SMBG should be performed especially for those on insulin injection, so that the correct dose can be determined. Meals should be regular and uniform. Additional carbohydrate of 10 to 20 g should be ingested before planned exercise if pre-exercise glucose levels are <5.6 mmol/L (100 mg/dL).¹² Insulin dose reduction may be necessary in patients with progressive renal functional impairment (estimated glomerular filtration rate of <60 mL/min)¹¹ even though it is not eliminated via the kidneys.

Diabetic patients and their relatives should be educated on the warning symptoms and management of hypoglycaemia. If a patient is prone to recurrent hypoglycaemia, he/she should also carry an identification card stating that he/she has diabetes and what others should do in case of severe hypoglycaemia causing unconsciousness. Diabetic patients on insulin should always carry some glucose with them.

Management of hypoglycaemia

Mild hypoglycaemia should be treated with 15 to 20 g glucose to raise the blood glucose quickly, eg 150 mL (half a 330 mL can) of non-diet fizzy drink, 200 mL of orange juice, 3 or 4 dextrose tablets, four large jelly babies, seven large jelly beans, or two tubes of glucose gel.³⁵ If feasible, the patient should undertake SMBG 15 minutes later; if hypoglycaemia continues, one of the above treatments should be repeated,¹² and followed up by intake of a longer-acting carbohydrate (a sandwich, banana, or next meal if due).³⁵ An ambulance should be called immediately and/or glucagon given if the patient has impaired consciousness.

The causes of the hypoglycaemia should be determined. If no obvious causes can be identified after reviewing the diet, physical activities and other possibilities, the dose of insulin or sulphonylurea should be reduced.

Weight gain

It is well known that insulin causes weight gain. Since many diabetic patients are already overweight or obese, further weight gain after insulin injections reduces their efficacy and increases cardiovascular risks. The underlying causes of insulin-associated weight gain include: conservation of glucose calories that previously were renally excreted, a general anabolic effect of insulin, and perhaps increased carbohydrate and calorie intake to compensate or defend against hypoglycaemia.³⁶

Management of insulin-related weight gain includes limiting the insulin dose by increasing insulin sensitivity through diet, exercise, and insulin-sensitising drugs (such as metformin).³⁶ The use of the new insulin analogue detemir has also been proved to achieve less weight gain and hypoglycaemia as compared to taking a conventional basal insulin.³⁷

Skin-related complications of insulin therapy

Cutaneous side-effects related to insulin therapy are common,³⁸ although most are temporary and mild. Some patients, however, have serious skin complications, including bleeding and bruising, allergy, lipoatrophy and lipohypertrophy. The latter not only cause discomfort and disfigurement, but may also affect glycaemic control.

Bruising and bleeding

Bruises and bleeding are the most common skin complications of insulin therapy. Prevention entails applying pressure over the injection site with a piece of clean gauze or tissue after the needle is removed. Changing to a smaller gauge or shorter needle may also help if the problem persists.

Lipoatrophy

Lipoatrophy is localised loss of subcutaneous fat at the injection site. Lipoatrophy has become less frequent since the introduction of recombinant human insulin. It is nevertheless an important complication as the absorption of insulin from the affected areas is unpredictable, and results in fluctuating blood glucose levels.³⁹

The risk of developing this complication can be reduced by regular rotation of injection sites. Treatment includes repeated injections of highly

purified human insulin into the area, to stimulate regeneration of fat cells.⁴⁰ Adding a small amount of dexamethasone (4 µg/unit) to the insulin was also reported to be effective treatment.⁴¹

Lipohypertrophy

Lipohypertrophy is the most common cutaneous complication of insulin therapy. A prevalence of around 20 to 30% has been reported in patients with type 1 diabetes and around 4% in those with type 2 disease.⁴² Low educational status, reuse of needles, failure to rotate injection sites, and long duration of insulin use are suggested risk factors.⁴³ Evidence shows that insulin absorption at lipohypertrophic areas can be significantly delayed, leading to erratic glycaemic control and unpredictable hypoglycaemia.⁴⁴ Moreover, as the lipohypertrophic areas are relatively anaesthetic, patients tend to continue injecting into the same areas, thus exacerbating the problem.³⁸

Management includes avoiding injections into lipohypertrophic areas, and regular rotation of injection sites. Changing to insulin lispro (a rapid-acting insulin analogue) has also been reported to result in resolution of lipohypertrophy.⁴⁵ If regression does not occur, the affected site may improve after liposuction.⁴⁶

Allergy

The clinical presentations of insulin allergy can range from minor localised skin reactions to severe generalised reactions with urticaria, generalised rash or angioedema, although they are rare. Local skin reactions to subcutaneous injections may give rise to localised pruritus, erythematous patches, and occasionally induration over the injection sites that may be immunoglobulin E or G mediated.⁴⁷ The allergy could be against the insulin molecule itself, non-insulin protein contaminants, or additives (such as zinc or protamine) that are commonly added to longer-acting formulations.⁴⁸

The local skin reactions are usually self-limiting and resolve spontaneously within a few weeks, despite continuation of insulin injections.⁴⁸ Antihistamine can be prescribed to mitigate the allergic response and for symptom control. However, if the skin reactions persist, changing to a newer, less allergenic insulin analogue may be useful.⁴⁹ If allergy persists after changing insulins, consider referral to an endocrinologist for other methods like dividing the dose and varying the delivery site, or the addition of dexamethasone to insulin injections (one microgram for each unit of insulin), or insulin desensitisation.⁴⁸ There are also reports that continuous insulin infusion (pump) therapy may help resolve such allergy.⁵⁰

Referral

There is no widely accepted guideline for referring type 2 diabetes patients with insulin-related issues to specialist physicians or endocrinologists. We suggest that referral should be made whenever a family physician feels that management is beyond his/her capability in terms of knowledge, experience, nursing, or other support.

Conclusion

In primary care, for most patients the initiation and titration of an insulin regimen is not difficult. With support from diabetes nurses and training on insulin use, family physicians can provide insulin therapy to diabetic patients in the community and reduce the number of referrals to secondary care.

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Declaration

No conflicts of interest were declared by the authors.

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