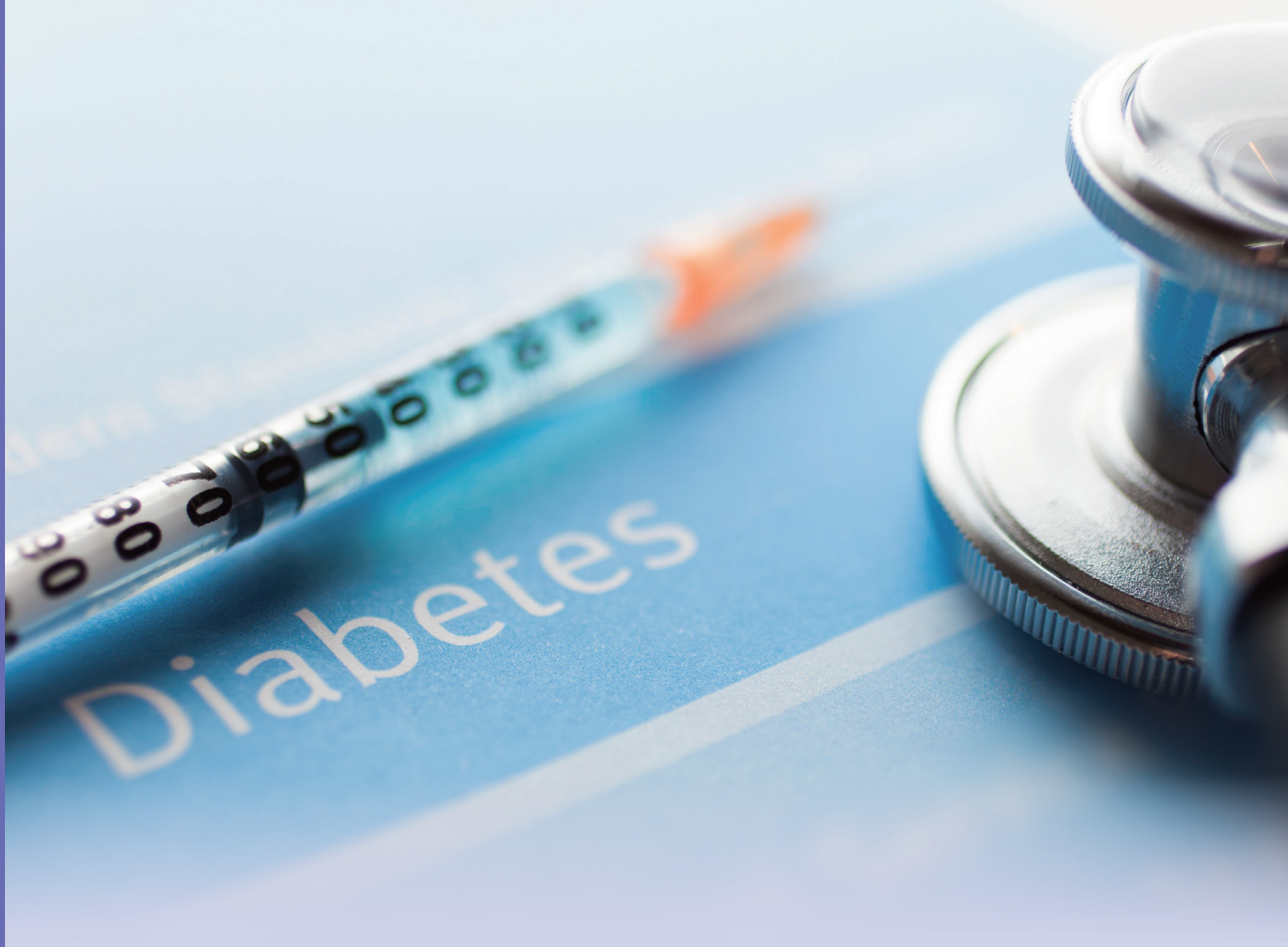


Evidence-based Clinical Guideline

Subcutaneous insulin injection
for people with diabetes mellitus

2021/10

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Scope and Purpose

The purpose of this guideline is to support nurses in Hong Kong in the care of people with diabetes who require subcutaneous insulin therapy. We put forward this set of evidence-based recommendations to guide nurses in the administration of subcutaneous insulin in all clinical settings. Moreover, we hope this guideline can be used by clinicians or other health care workers who are not specialized in the care of diabetes, to safely administer insulin.

Guideline Development Process

The work on the evidence-based clinical guideline started in 2011 with the formation of a guideline development committee consisting of five members and an advisor. The aim was to address the research questions guided by subsequent literature review and discussion.

A comprehensive literature review on this topic was undertaken. Related research studies, journal articles, guidelines, and other documents relating to subcutaneous insulin injection and best practice guidelines in insulin injection published by professional organization between 1980 to 2012 were reviewed. Many studies before 1980 were performed with injection tools no longer in use in Hong Kong and were excluded from the review, with the exception of a paper (Koivisto & Felig 1978) that had studied skin bacteria (as alcohol swab is still in use). The reviewed publications are listed in the reference section.

Each guideline development committee member was held responsible for examining one to two research question(s), studying relevant literature to develop recommendations. The members as a whole reviewed the recommendations, discussed gaps, available evidence, and came to a consensus in a first draft guideline in 2012.

The draft was then discussed and refined in 8 meetings where the research questions, recommendations and their substantiating evidence were considered and modified based on consensus by all members. The content of the guideline was confirmed by the Committee in February 2013, and together with the supporting literature, was presented for review to a panel of fifteen local diabetes nurse experts; all of whom were experienced nursing experts from various hospitals/ clinics. The panel was asked to review the recommendations and the literature provided within one month. A worksheet was also designed to facilitate discussion. A series of three meetings were then held in March and April in 2013, for an iterative process of discussion, debate and validation. Each recommendation was modified as required. Recommendations were considered legitimate based on ≥ 80% panel consensus.

The level of evidence and its strength were assessed collectively by all panel members to ensure reproducibility. Evidence was graded according to a grading method (see next section). The grade for each of the guideline statements was indicated at the end of each statement together with respective citations. The guideline was published in January 2014 and subsequently updated in December 2020. The literature review was mainly focused on the period between 2014 to 2019.

Description of the guideline

Evidence was graded according to the grading method proposed by Frid et al., (2010)[27]. The method included a 'I, II, III' scale for scientific support and a 'A, B, C' scale for the strength of recommendations.

Scientific support scale:

I At least one randomized controlled trials (RCTs)

II At least one non-randomized (or non-controlled or epidemiologic) study

III Consensus expert opinion (including e.g. case reports, case series) based on extensive patient experience

Strength of recommendation scale:

A. Strongly recommended

B. Recommended

C. Unresolved issue

Thus, each guideline statement is followed by both a number and a letter (e.g. II A). The number indicates the degree of rigor of the scientific evidence in the literature as supported by the expert panel, and the letter indicates the strength of the recommendation to be applied in local practice.

Research Questions

As a basis for developing the recommendations set forth in the guideline, the guideline development committee addressed six questions relevant to the clinical practice:

1. How should insulin injections be prepared?

2. Which sites should be used for insulin injection?

3. What should be the appropriate needle length?

4. How should insulin injection be performed?

5. How should insulin and insulin pens be stored?

6. How should lipohypertrophy and lipoatrophy be managed?

1. How should insulin injections be prepared?

Skin preparation

1. Cleanliness of the skin must be ensured prior to subcutaneous insulin injection in all settings.[38] (III A)

2. Disinfection of the skin is not necessary prior to subcutaneous insulin injection in the home environment.[26,49,57,78] (I B)

3. If skin swabbing is performed, the skin must be allowed to dry properly before injection.[58,85] (III A)

Insulin vial and penfill membrane preparation

Cleanliness of penfill and vial membrane must be ensured, it is not necessary to disinfect the membrane in the home environment.[43,57] (III A)

Insulin pen administration system

Insulin administration systems and penfills must be kept strictly for individual use.[37,45,73] (II A)

Mixing of cloudy insulin

1. Cloudy insulin (e.g. NPH and pre-mixed insulin) must be well mixed before injection.[2,15,16,61] (III A)

2. Tipping the insulin pen (to 180°) for at least 20 cycles must be done to ensure complete re-suspension of the NPH insulin before injection.[46] (I A)

Drawing of insulin by syringe

1. When drawing up insulin, the volume of air equivalent to the volume of insulin to be administered should be drawn up first and injected into the vial to facilitate insulin withdrawal.[38] (III B)

2. Air bubbles should be expelled from the syringe before injection.[38,58] (III A)

3. Soluble insulin (e.g rapid or short acting) must be drawn into the syringe before intermediate acting (e.g. NPH) insulin.[66] (III A)

4. Only compatible insulins can be drawn into one syringe.[2] (III A)

Priming of insulin pen

1. Air generated in the insulin pen should be removed (if any) before injection.[19,33] (II B)

2. Pens devices must be primed before each injection.[2,38] (III B)

3. Priming, when conducted must be ensured by observing at least a drop at the needle tip.[38] (III A)

Maximum dose of insulin for each administration

Single insulin doses greater than 50 units should be considered to be given as 2 separate injections.[5,20,35,54] (III B)

2. Which sites should be used for insulin injection?

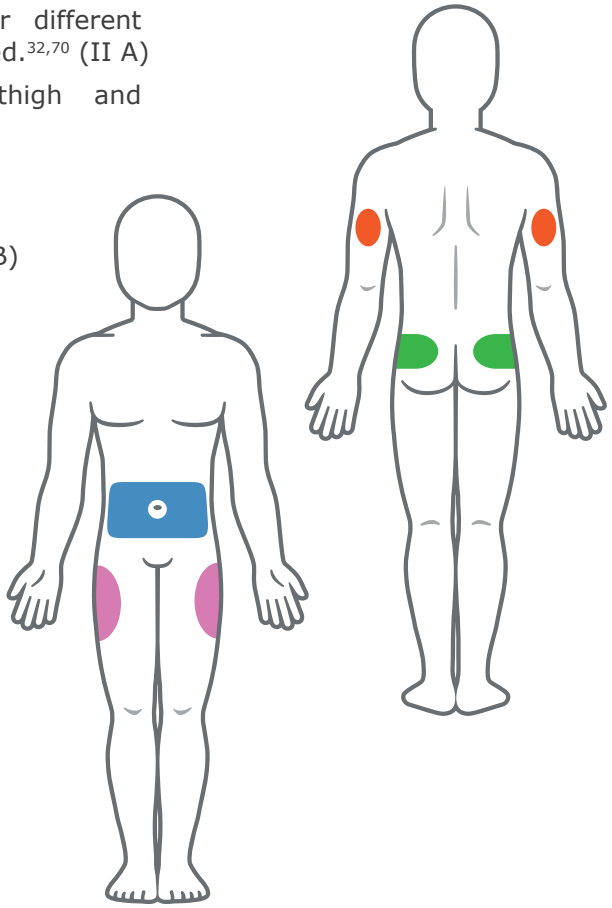
Areas for injection

1. The appropriate injection areas are different for different individuals, and professional advice should be provided.[32,70] (II A)

2. Usual areas include abdomen, upper arm, thigh and buttock.[2,16,22,35,38,48,58,76] (II A)

3. These recommended areas should include:

- Abdomen, avoiding umbilicus[2,16,35,38,58] (III B)
- Thigh, upper lateral and anterior aspect[32,36,48,70] (II B)
- Buttock, upper lateral quadrant[32,35,70,76] (II B)
- Arm, upper lateral and posterior aspect[32,48,70] (II B)



Rotation of injection points

1. Injection points should be rotated within the same area when using the same type of insulin[8,11,48,50,70] (II B)

2. Injection points should be rotated regularly.[9,44,63,75] (II A)

3. Patients should be taught a systematic rotation scheme.[6,29,38,44,58,75,84] (II A)

4. Regular review of injection technique and injection site should be undertaken and documented.[4,21] (II B)

Special consideration

1. Injection points should not be massaged after injection.[6,25,55,67] (II B)

2. Pregnant patients who continue to inject into the abdomen during the second and third trimester should administer all injections with a raised skinfold.[6,28,38,60] (III B)

3. What should be the appropriate needle length?*

Needle length of insulin syringe

The desired needle length of insulin syringe should be the shortest available needle 6mm.[6,7,10,28,38,39] (II A)

Needle length of pen needle

The desired length of pen needle should be individually defined within the range of 4 or 5 mm.[6,7,10,27,28,32,38,39,41,48,53,56,68,74,76] (II A)

4. How should insulin injection be performed?

Way of insertion: with/ without skin pinch up, insertion angle*

1. Advice should be given with regards to the lifting of a skin fold and the angle of injection.[12,32,39] (II A)

2. Adults should use 4-5 mm needles and inject vertically.[13,28,32,39,40,41,50,74,82] (II B)

3. When using a needle of ≥ 6 mm, patients should inject at 45-degree angle and/or lifting a skinfold using the thumb and index or middle finger that lifts subcutaneous tissue away from the muscle layer.[35,39,42,64,72,77,80,82] (II A)

4. Children and slender patients should use 4 mm needles and may require a skin fold lift.[13,39,56] (II B)

Reuse of needle & syringe

Reuse of needles and syringes should be avoided.[2,14,48,59,75,81,86] (II A)

Length of time the needle remains in the tissue after injection

1. Syringe should be removed following the completion of the insulin injection.[3,28] (III B)

2. The pen needle should be maintained and held within the injection site for at least 10 seconds after the plunger is fully depressed.[3,27,33,83] (II A)

Disposal of needle & syringe

1. When using a pen device, the pen needle should be removed from the device immediately after administering the insulin.[3,33,45] (II A)

2. Under no circumstances should pen device needles and syringes be directly disposed into public rubbish bins.[23,28] (III A)

3. Patients should be taught to dispose of pen needles and syringes properly.[75,79] (II B)

* In addition to the recommendation, clinical decision should also be based on individual assessment

5. How should insulin preparations and insulin pens be stored?

Storage of insulin

Insulin should be stored according to the manufacturers' instructions.[2,34] (III A)

Insulin pen/ pre-filled syringe

1. The practice of pre-loading insulin in the syringe is not recommended.[65,66] (III B)

2. Insulin glargine and detemir should not be mixed with other forms of insulin in the same syringe.[2,18,24,34] (II B)

3. Insulin should not be extracted from pen devices or penfill.[62] (III B)

6. How should lipohypertrophy and lipoatrophy be managed?

Lipodystrophy

1. Injection into the hypertrophic and atrophic areas should be avoided.[1,21,47,51] (II A)

2. Training of Health Care Professionals is required to identify lipohypertrophic lesions.[30,31] (II A)

3. Visual inspection and palpation of injection sites by health care professionals should be performed routinely and documented.[35,38,48,81] (III B)

4. Intensive patient training on injection technique, systematic rotation and frequent inspection is effective in improving and in preventing lipohypertrophy.[17,71] (I A)

5. A decrease in insulin dose may be required when switching insulin injection from areas of lipohypertrophy to normal tissue and should be guided by blood glucose measurements.[21] (II B)

Definition of Terms

Injection site: Refers to an (one) anatomical area such as upper arm, thigh, abdomen.

Injection area: Refers to a designated space for injection within a site, such as upper lateral aspect of the thigh, or upper right quadrant of the abdomen, or lateral posterior aspect of right arm.

Injection point: Refer to the specific spot where the needle punctures through the skin.

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Updating and publication

The Association of Hong Kong Diabetes Nurses (AHKDN) is responsible for updating the clinical guidelines every 4 years.

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