Evidence-based Clinical Guideline

Subcutaneous insulin injection for people with diabetes mellitus
The purpose of this guideline is to support Hong Kong nurses to care for people with diabetes who require subcutaneous insulin therapy. We put forward a set of evidence-based recommendations to guide nurses to administer 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 diabetes care to safely administer insulin.

**SCOPE AND PURPOSE**

The work on the evidence based clinical guideline started in 2011 with formation of a guideline development committee of five members and an advisor. The aim is to outline the research questions and guide subsequent literature review and discussion.

A comprehensive literature review 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 organizations between 1980 to 2012 were included. Many studies before 1980 were performed with injection tools no longer in use in Hong Kong and were excluded from the result, with one exception (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 consensus in a first draft guideline by 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.

The content of the guideline was confirmed by the Committee by February 2013, and together with supporting literature, was presented for review to a panel of fifteen local diabetes nurses experts; all of whom are experienced clinicians 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 hearing meetings were then held in March and April 2013, for an iterative process of discussion, debate and validation. Each recommendation was modified if necessary. Recommendations were considered legitimate based on ≥80% panel consensus. The level of evidence and its strength were assessed by all panel members together to ensure reproducibility. The guideline was finalized after consensus approval reached by the board of experts.

The evidence-based clinical guideline put forth in this document is the result of the process. Evidence was graded according to a grading method (see next section). The grade for each of the guideline statements is indicated at the end of each statement together with respective citations.

**Description of the guideline**

Evidence was graded according to the grading method proposed by Frid et al (2010)\(^7\). The method includes a ‘I II III’ scale for scientific support and a ‘ABC’ scale for the strength of recommendations.

**Scientific support scale:**

1. At least one randomized controlled trials (RCTs)
2. At least one non-randomized (or non-controlled or epidemiologic) study
3. 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. IIA). The number indicates the degree of rigor of scientific evidence in the literature as support by the expert panel, and the letter indicates the weight of significance of the recommendation to be applied to 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 preparations, insulin pens and pre-drawn syringes be stored?
6. How should lipohypertrophy and lipoatrophy be managed?

Definition of Terms

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

Injection area: Refer 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 unto.

How should insulin injections be prepared?

Skin preparation

1. Cleanliness of the skin must be ensured prior to subcutaneous insulin injection in all settings.22 (III A)
2. Disinfection of the skin is not necessary prior to subcutaneous insulin injection in the home environment.21,24,38,47,54,73 (I B)
3. If skin swabbing is performed, the skin must be allowed to dry properly before injection.55,81 (III A)

Insulin vial and penfill membrane preparation

1. Cleanliness of membrane must be ensured prior to needle puncture. (III B)
2. It is not necessary to disinfect the membrane of the pen filling or vial membrane to reduce the risk of infection in the home environment.39,54 (III A)
3. If skin swabbing is performed, the skin must be allowed to dry properly before injection.55,81 (III A)

Insulin pen administration system

Insulin administration systems and penfills must be kept strictly for individual use.4 (II A)

Mixing of cloudy insulin

1. Cloudy insulin (e.g. NPH and pre-mixed insulin) must be well mixed before injection.4,14,45,57 (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.42 (I A)

Drawing of insulin by syringe

1. When drawing up insulin, air equivalent to the dose should be drawn up first and injected into the vial to facilitate insulin withdrawal.22 (III B)
2. Air bubbles should be expelled from the syringe before injection.22,55 (III A)
3. Soluble insulin (e.g. rapid or short acting) must be drawn into the syringe before intermediate acting (e.g. NPH) insulin.61 (III A)
4. Only compatible insulins can be drawn into one syringe.4 (III A)

Priming of insulin pens

1. Air generated in the insulin pen should be removed (if any) before injection.16,29 (II B)
2. Pen devices must be primed before each injection.4,22 (III B)
3. Priming, when conducted, must be ensured by observing at least a drop at the needle tip.25 (IIIA)

Maximum dose of insulin for each administration

Single insulin doses greater than 50 units should be considered to be given in 2 separate injections.8,18,31,52 (III B)
Which sites should be used for insulin injection?

**Areas for injection**
1. The appropriate injection areas are different in individuals and professional advice should be provided. (II A)
2. Usual areas should include abdomen, upper arm, thigh and buttock. (II A)
3. These recommended areas should include:
   - Abdomen, avoiding umbilicus (II B)
   - Thigh, upper lateral and anterior aspect (II B)
   - Buttock, upper lateral quadrant (II B)
   - Arm, upper lateral and posterior aspect (II B)

**Injection points rotation**
1. Injection points should be rotated in the same area when using the same type of insulin (II B)
2. Injection points should be rotated regularly. (II A)
3. Patients should be taught a systematic rotation scheme. (II A)
4. Regular review of injection technique and injection sites should be undertaken and documented. (II B)

**Special consideration**
1. Injection points should not be massaged after injection. (II B)
2. Pregnant patients who continue to inject into the abdomen should give all injections with a raised skin fold. (II B)

What should be the appropriate needle length?*

**Needle length of syringe**
Adults and children using an 8 mm needle should lift a skin fold and inject at a 45 to 90 degree angle to the skin surface. (II A)

**Needle length of pen needle**
The desired length of a pen needle should be individually defined within the range of 4, 5 or 6 mm. (II A)

*In addition to the recommendation, clinical decision should also be based on individual assessment.*
How should insulin injection be performed?

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

1. Advice should be given with regard to lifting of a skin fold and the angle of injection.12,25,28,55,68 (II A)
2. Adults should use 4-6 mm needles and inject vertically.27,28,31,34,35,37,50,51,67,69,79 (II B)
3. When using a needle of ≥ 8mm, patients should lift a skin fold using the thumb and index or middle finger that lifts subcutaneous tissue away from the muscle layer.31,46,60,66,68,77 (II A)
4. Children and slender patients should use 4 or 5 mm needles and may require a skin fold lift.13,36,37 (II B)

**Reuse of needle & syringe**

Reuse of needles and syringes should be avoided.4,17,20,46,56,58,63,70,72,78 (II A)

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

**Length of time and the needle remains in the tissue**

1. Syringe should be removed following the completion of injecting.6,27 (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.4,6,8,22,27,29,70 (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.4,16,29,41,46 (II A)
2. Under no circumstance should pen device needles and syringes be directly disposed into public rubbish.4,22,27 (III A)
3. Patients should be taught to dispose of pen needles and syringes properly.9,22,46,70,75 (II B)

How should insulin preparations, insulin pens and pre-drawn syringes be stored?

**Storage of insulin**

Insulin should be stored according to the manufacturers’ instructions.4,30 (III A)

**Insulin pen/ pre-filled syringe**

1. Pre-filled syringes of single formulation (except Lantus) should be stored in a refrigerator at 2 to 8°C for at most 28 days.4,30,81,74 (II B)
2. Insulin glargine should not be mixed with other forms of insulin.4,30,81 (III B)

**Pre-loaded (or filled) syringes: positioning**

The needle of pre-loaded insulin syringes (containing isophane insulin) should point upwards.4,61 (III B)

How should lipohypertrophy and lipoatrophy be managed?

**Lipodystrophy**

1. Injection into the hypertrophic and atrophic areas should be avoided.1,19,43,49 (II A)
2. Visual inspection and palpation of injection area by the health care professionals (HCP) should be performed routinely and documented.22,21,46,78 (III B)
3. Patients should be taught to examine their injection sites and not to inject into hypertrophic and atrophic areas.22,32,40 (III A)
4. A decrease of insulin dose may be required when switching injection from areas of lipohypertrophy to normal tissue and should be guided by blood glucose measurement.19 (II B)
References


51. Lauritzen, L. "Mixing insulin: shake, rattle or roll?" Nursing Standard 13(39), 47-53; quiz 54.


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Acknowledgement

We thank the authors of Association for Diabetescare Professionals (EADV) for permission to adopt part of the excerpts from the EADV guideline.

Particular thanks go to Ms Maggie Siu and BD Company for the assistance of literature search.

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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Contents

• Scope and purpose
• Guideline development process
• Description of the guideline
• Updating and publication
• Research questions
• Definition of terms
• How should insulin injections be prepared?
• Which sites should be used for insulin injection?
• What should be the appropriate needle length?
• How should insulin injection be performed?
• How should insulin preparations, insulin pens and pre-drawn syringes be stored?
• How should lipohypertrophy and lipoatrophy be managed?
• References