

Practical issues in insulin therapy

Samsonly Chan

UCH APN(DM)

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Practical issues in insulin therapy

- Indication for insulin therapy
- Type of insulin
- Common insulin regimens
- Insulin injection technique
- Storage of insulin
- Injection site Problems
- Practical tips to reduce pain for insulin injection
- Case discussion
- Q & A
- Injection devices demonstration

Indication for insulin therapy

Short Term Use

- Intercurrent illnesses

Illness → physical stress ↑ Blood glucose level

e.g. severe infection, acute myocardial infarction, stroke, before and during operative period.

- Plan pregnancy and during pregnancy.
- Lactating women.



Indication for insulin therapy

LongTerm Use

- Type 1 DM
- Secondary oral anti-diabetic drugs (OAD) failure

  Poor diabetic control despite maximum dose of OADs
- Type 2 DM with impaired renal/liver function



Type of insulin

Human Insulin

- Synthetic insulin with a chemical structure identical to insulin in human

- Regular human insulin e.g. Actrapid & Humulin R





- Protaphane, Mixtard30HM, Humulin N, Humulin 70/30 are human insulin added with different amount of protamine suspension to make different insulin action profiles









Types of Insulin

Insulin Analogue

- Synthesized through genetic engineering, undergoing ‘recombinant DNA’ technology to change the sequence of some amino acids.
- The process allows the insulin to be used by the body either more rapidly or more uniformly.

- e.g. Humalog (Lispro), Novorapid (Aspart), Lantus (Glargine)







Insulin Action Chart

Product Description	Brand Name	Presentation	Action Profile
Short Acting Insulin Inject 30 mins before meals or specified	Actrapid		Onset: 0.5 hour Peak: 1.5 to 3.5 hours Duration: 7 to 8 hours
	Humulin R		Onset: 0.5 hour Peak: 2 to 4 hours Duration: 6 to 8 hours
Intermediate-Acting Insulin Inject 30 mins before meals or specified	Protaphane		Onset: 1.5 hour Peak: 4 to 12 hours Duration: 24 hours
	Humulin N		Onset: 1 hour Peak: 4 to 10 hours Duration: 16 to 18 hours
Pre-Mixed Insulin Inject 30 mins before meals or specified	Mixtard 30	 30% Actrapid & 70% Protaphane	Onset: 0.5 hour Peak: 2 to 8 hours Duration: 24 hours
	Humulin 70/30	 30% Humulin R & 70% Humulin N	Onset: 0.5 hour Peak: 2 to 12 hours Duration: 16 to 18 hours

Source: NTEC PWH i-M&T Diabetes and Endocrine Centre June 2015

Insulin Action Chart

DMEC Sept 2014

Product Description	Brand Name	Presentation	Action Profile
Ultra Rapid Acting Insulin Analogue	NovoRapid (Aspart) FlexPen		Onset: 10 to 20 mins Peak: 1 to 3 hours Duration: 3 to 5 hours
Inject within 10 mins before meals	Humalog (Lispro) KwikPen		Onset: within 15 mins Peak: 1 hour Duration: 3.5 to 4.5 hours
	Apidra (Glulisine) SoloStar		Onset: 10 to 20 mins Peak: 1 to 2 hours Duration: 4 hours
PreMixed Insulin with Ultra Rapid Acting Insulin Analogue	NovoMix30 FlexPen	 30% NovoRapid + 70% protaminated insulin aspart	Onset: 10 to 20 mins Peak: 1 to 4 hours Duration: 24 hours
Inject within 10 mins before meals	Humalog(Lispro) Mix 25 KwikPen	 25% Lispro + 75% insulin Lispro protamine suspension	Onset: within 15 mins Peak: 1 hour Duration: 16 to 18 hours
	Humalog(Lispro) Mix 50 KwikPen	 50% Lispro +50% insulin Lispro protamine suspension	Onset: within 15 mins Peak: 1 hour Duration: 16 to 18 hours
Long Acting Insulin Analogue	Levemir (Detemir) FlexPen		Peak: 3 to 14 hours Duration: 24hours
OM or Nocte or specified	Lantus (Glargine) SoloStar/Vial		Onset: 1 to 2 hours Peak: no pronounced peak Duration: 24 hours

Source: NTEC PWH i-M&T Diabetes and Endocrine Centre June 2015

Common insulin regimen

- Basal Insulin combination with Anti-Diabetic Drugs

e.g 1. Protaphane 8 units at bed time, Diamicrom 80mg BD, Metformin 1 gm BD

e.g 2. Protaphane 8 units OM, Diamicron 80mg pm , Metformin 1 gm BD

e.g 3. Lantus 8 units at bed time, Diamicron 160mg OM ,Metformin 1gm BD, Januvia 100mg daily



Common insulin regimen

- Intermediate-acting Insulin Twice a Day (BD injections)

(-/+ combination with Anti-Diabetic Drugs)

e.g. 1. Protaphane 20 units OM, 10 units pm

e.g. 2. Protaphane 20 units OM and 10 units at bed time

e.g. 3. Humulin N 20 units OM, 10 units pm



Common insulin regimen

- Premixed Insulin Twice a Day (BD injections)
  (−/+ combination with Anti-Diabetic Drugs)

  e.g. 1. Mixtard30HM 20 units before breakfast ,10 units before dinner

  e.g.2. Humulin 70/30 20units before breakfast, 10 units before dinner

  e.g. 3. Novomix30 20 units before breakfast, 10 units before dinner

  e.g. 4. Humalogmix25 20 units before breakfast, 10 units before dinner



Common insulin regimen

- Basal-Bolus Insulin (4 shots/day)

e.g. 1. Protaphane 8 units at bed time, Actrapid 6 units ac breakfast, 8 units ac lunch and 8 units ac dinner

e.g. 2. Humulin N 8 units om, Humulin R 6 units ac breakfast, 8 units ac lunch and 8 units ac dinner

e.g. 3. Lantus 8 units at bed time, Novorapid 6 units with breakfast, 8 units with lunch and 8 units with dinner

e.g. 4. Lantus 8 units OM, Humalog 6 units with breakfast, 8 units with lunch and 8 units with dinner



Insulin Injection Technique



How should we prepare insulin injection ?

Insulin Injection Device:

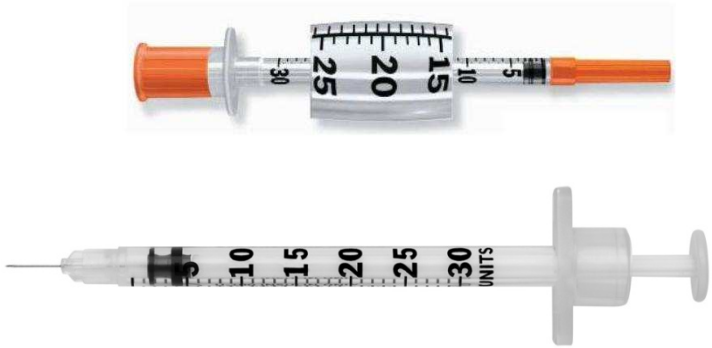
Insulin syringe



8mm 1cc (100 units)



8 mm 0.5cc (50 units)



8mm 0.3 cc (30 units)

How should we prepare insulin injection ?

Insulin Injection Device:

Insulin pens/ preloaded insulin pens

Flex pen



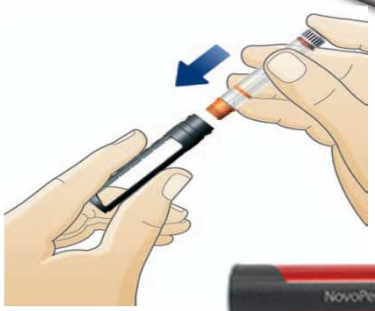
Huma Pen





Kwik pen





Solostar



Novo pen Echo



How should we prepare insulin injection ?

- Skin preparation

1. Cleanliness of the skin must be ensured before subcutaneous insulin injection.

2. Disinfection of the skin is not necessary before subcutaneous insulin injection in the home environment .

3. If skin swabbing is performed, the skin must be allowed to dry properly before injection.



How should we prepare insulin injection ?

- Insulin vial and penfill membrane preparation

1. Insulin administration systems and penfill must be kept strictly for individual use.

2. The insulin vial and penfill membrane must be clean and dry prior to puncture.

3. It is not necessary to disinfect the membrane in home environment.



How should we prepare insulin injection ?

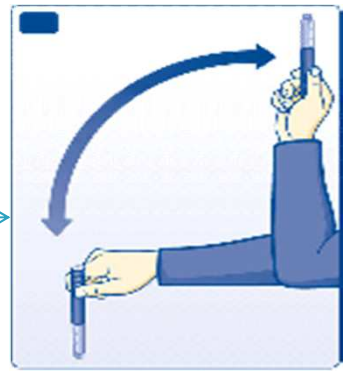
- Mixing of cloudy insulin

1. Cloudy insulin (e.g. NPH and pre-mixed insulin) must be well mixed before injection.



2. Tipping the insulin pen (to 180°) for at least 20 cycles must be done to ensure complete re-suspension of cloudy insulin before injection.

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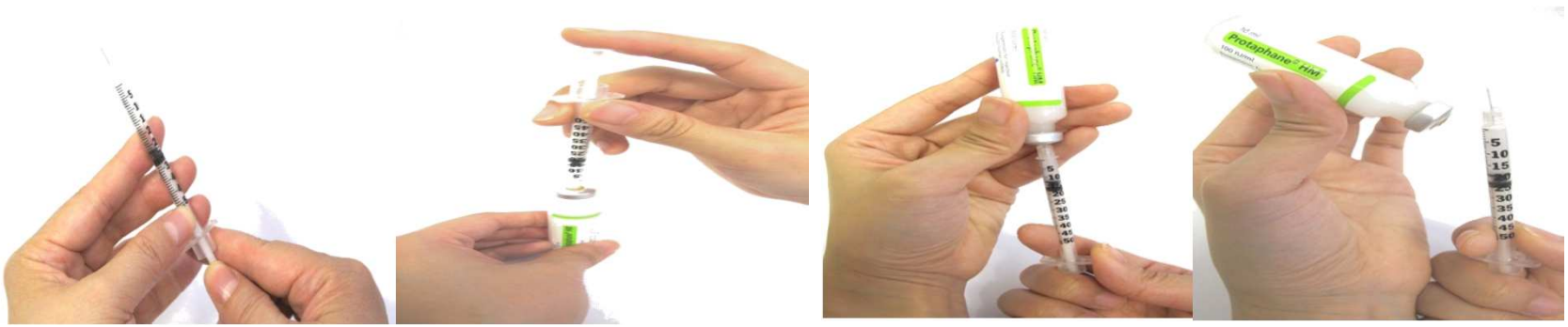


How should we prepare insulin injection ?

- Drawing of insulin by syringe

1. When drawing up insulin, the air equivalent to the dose should be drawn up first and injected into the vial to facilitate insulin withdraw.

2. Air bubbles should be expelled from the syringe before injection

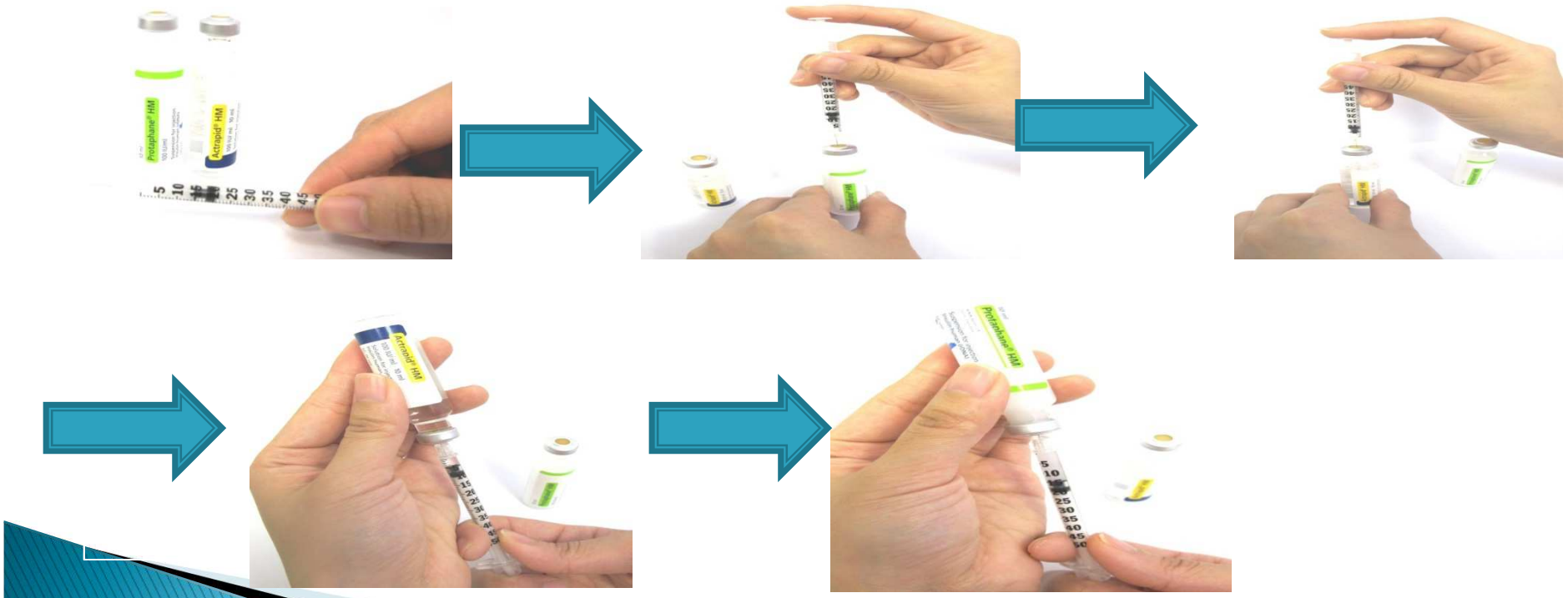


How should we prepare insulin injection ?

- Drawing of insulin by syringe

3. Only compatible insulins can be drawn into one syringe.
4. Rapid acting or short acting insulin must be drawn into the syringe before intermediate acting insulin.

Drawing short and intermediate insulin in one insulin syringe

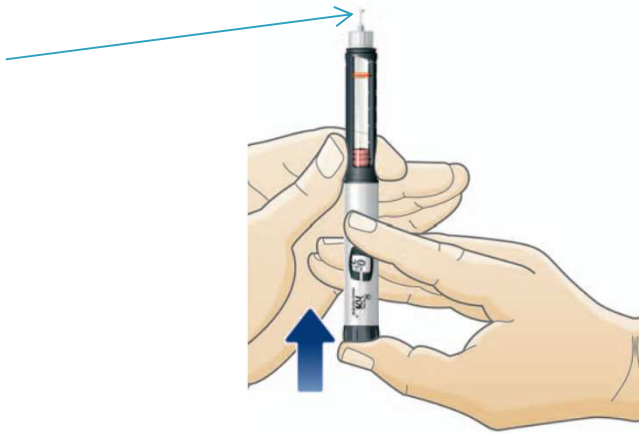


How should we prepare insulin injection ?

- Priming of insulin pens
  1. Air generated in the insulin pen should be removed (if any) before injection.

  2. Insulin Pen must be primed before each injection.

  3. When conducting priming, must be ensured by observing at least a drop at the needle tip.



Maximum dose of insulin for each injection

- Single insulin doses greater than 50 units should be considered to given in 2 separated injections.

  e.g Protaphane 54 units OM ⟹ Protaphane 27/27 units OM

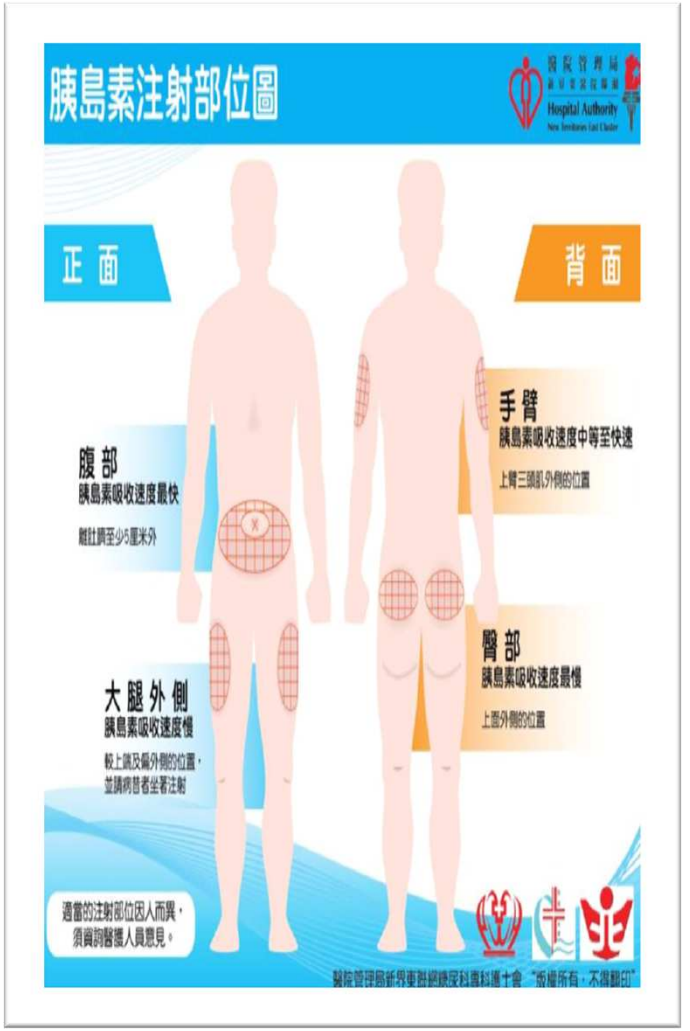
- This may enhance insulin absorption

Points to note:

- ?? patient 's capability.
- ?? Patient's willingness.

Area for injection

- **The recommended areas :**
  - Abdomen: avoiding umbilicus
  - Thigh: upper lateral and anterior aspect
  - Arm: upper, lateral and posterior aspect
  - Buttock: upper lateral quadrant



Area for injection

- the fastest absorption of insulin is:

Abdomen → upper arm → thigh → buttock

- The appropriate injection areas are different in individual.



Injection points rotation

- Rotate the injection points in the same anatomic region when using the same type of insulin.
- Rotate the injection points regularly.
- Educate patient a systematic injection site rotation scheme.
- Review of injection technique and injection site regularly



The appropriate needle length



- **Needle length of insulin syringe**

  Adults and children using 8 mm needle should lift a skin fold and inject a 45 to 90° angle to the skin surface

- **Needle length of Pen needles**

  The desired length of pen needle should be individually defined within the range of 4, 5 or 6mm needle.

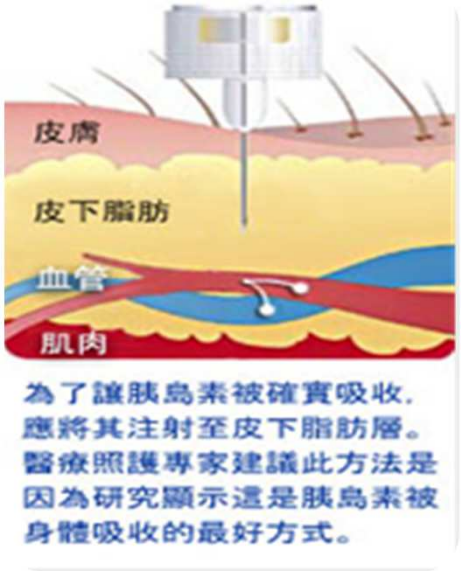






Special issues on Insulin injection

- Adults can use 4-6 mm pen needles and give vertically.
- When using needle length >/= 8 mm, should use the thumb and index or middle finger to pinch up subcutaneous fat for injection.





Special issues on Insulin injection

- Children and slender patients should use 4 or 5 mm needles and may need to pinch up the subcutaneous fat.
- Insulin Syringe should be removed immediately after completion of injection.
- The pen needle should be held within the injection site for at least 10 seconds after the plunger is fully depressed.
-
- Insulin syringe and pen needles should be avoided reuse and disposed properly

Special issues on Insulin injection

- Insulin should not be injected into abnormal skin. (e.g. damaged skin, lipohypertrophy, lipoatrophy, scars, rash, lumps, mole..).
- Injection point should not be massaged after injection
- Pregnant women with diabetes who continues to inject into the abdomen should pinch up subcutaneous fat for injection

Storage of insulin

- Storage of Insulin should be according to the manufacturers' instructions.

- Insulin should not be use after expiration.
- Unopened insulin vials/cartridges/prefilled disposable pen should be refrigerated (2 ◦ to 8 ◦C)

- Opened insulin vials/cartridges/prefilled disposable pen should be kept at room temperature.

- Insulin should not be exposed to direct heat or sun light.

Storage of insulin



- Pre-filled insulin syringe of single formulation (except Lantus) should be refrigerated at 2 to 8 ◦C at most 28 days.



- Lantus should be injected immediately after withdrawal.
- Lantus should not be mixed with other forms of insulin.

- The needle of pre-filled insulin syringes (cloudy insulin, e.g. Protaphane) should point upwards

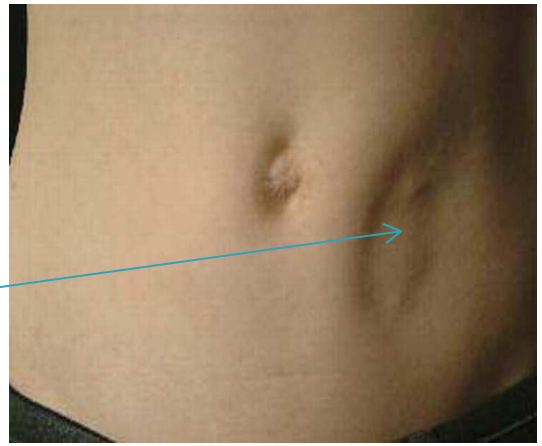


Injection site Problems

Lipoatrophy (萎縮)

Causes:

- is probably caused by an immune reaction. Human insulin is not common with Lipoatrophy.
  - Reuse of pen needle
  - Inappropriate site of rotation



- Avoid to inject the atrophic areas.

Injection site Problems

Lipohypertrophy（肥厚)

- Repeated insulin injection in the same site, fat and scar accumulate to form hard , fatty lumps which will slow insulin absorption.

- Causes:
  - Reuse of pen needle
  - Inappropriate site of rotation



Injection site Problems

Points to note:

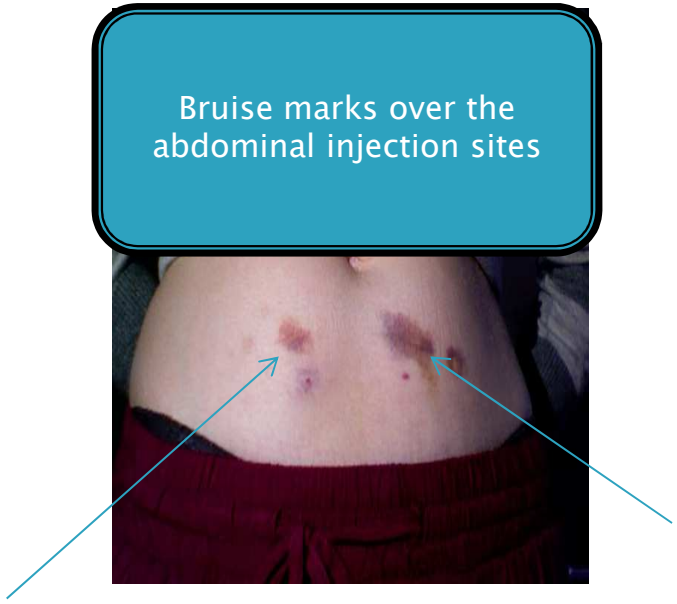
- Avoid to inject into hypertrophic areas and watch out any hypoglycemia when switching injection site from hypertrophic areas to normal tissue.
- Ensure visual inspection and palpation of injection area before injection.

Injection site Problems

Bruising

Causes:

- Wrong injection skills
- Massage injection site after injection
- Drugs related e.g. warfarin
- Thrombocytopenia



Injection site Problems

Itchy, redness, nodules after insulin injection (?? every shot/occasional)

- ?? Local allergic reaction to insulin or intradermal injection.

- Local allergic reaction: rare.
- May consider to change other insulin preparations.

Allergic reaction



Practical tips to my diabetic patients with insulin therapy

通常胰島素注射不會造成疼痛, 以下tips 可減少疼痛的幾會:

1. 如用酒精清潔皮膚,讓酒精全部揮發才注射
2. 打開針盍時，勿彎曲針頭
3. 注射室温的胰島素
4. 切勿重用針頭
5. 注射時要輕快穿刺肌膚
6. 正確捏起脂肪來注射

Case discussion

1. Mr Chan, currently on Protaphane 26 units ac breakfast and 10 units at bed time. Claimed that already kept on tight diet control. Noted high side h'Stix after breakfast and after dinner?

   Switched to BD Mixtard30HM 28 units ac breakfast and 12 units ac dinner.

- What advice should be given to Mr. Chan about his new insulin regimen ?

Case discussion



2. Mrs Wong , 82 years old, lives alone, son lives apart.
   on insulin therapy with insulin regimen:
   Mixtard30HM 16 units ac breakfast and 10 units ac dinner.

   Son visits Mrs. Wong weekly and preloads the insulin into the insulin syringe , Mrs Wong gives insulin injection by herself.

   Mrs Wong admitted for hypoglycaemia before lunch.
   Insulin regimen was changed to Lantus 18 units OM.

- What is the problem related to Mrs Wong's new insulin regimen ?

Case discussion

3. Mr. Lee was on combination therapy and FU in private,

Dm regimen: Metformin 1 gm BD, Mixtard30HM 28 units ac breakfast and 14 units ac dinner.

He admitted for chest infection, upon discharge, put on Metformin 1gm BD and Humulin70/30 22 units ac breakfast and 12 units ac dinner. Mr. Lee preferred long term FU in public hospital for financial reasons.

What injection device was used for administration of this new insulin preparation?



Huma Pen



Novo pen 5



Insulin syringe

Case discussion

4. Ming , 12 years old boy, Type 1 Diabetes since age 10, currently on Lantus 10 units om, Novorapid 2 units with breakfast, 4 units with lunch and 4 units with dinner. Admitted for fracture right middle finger. Insulin injections were administrated by ward nurse.

- Can nurse give the 10 units Lantus and 2 units Novorapid with one insulin syringe with breakfast for Ming ?


Q & A

References:

- Evidence-based clinical guideline (subcutaneous insulin injection for people with diabetes mellitus) 2014. Association of Hong Kong Diabetes Nurses.

- NTEC PWH i-M&T Diabetes and Endocrine Centre June 2015.



Thank You