Hong Kong Rehab Nursing Society Seminar: “Update Diabetes Nursing Practice” Medical treatment

Date : 12 June 2026

Time : 7:00 pm - 9:00 pm

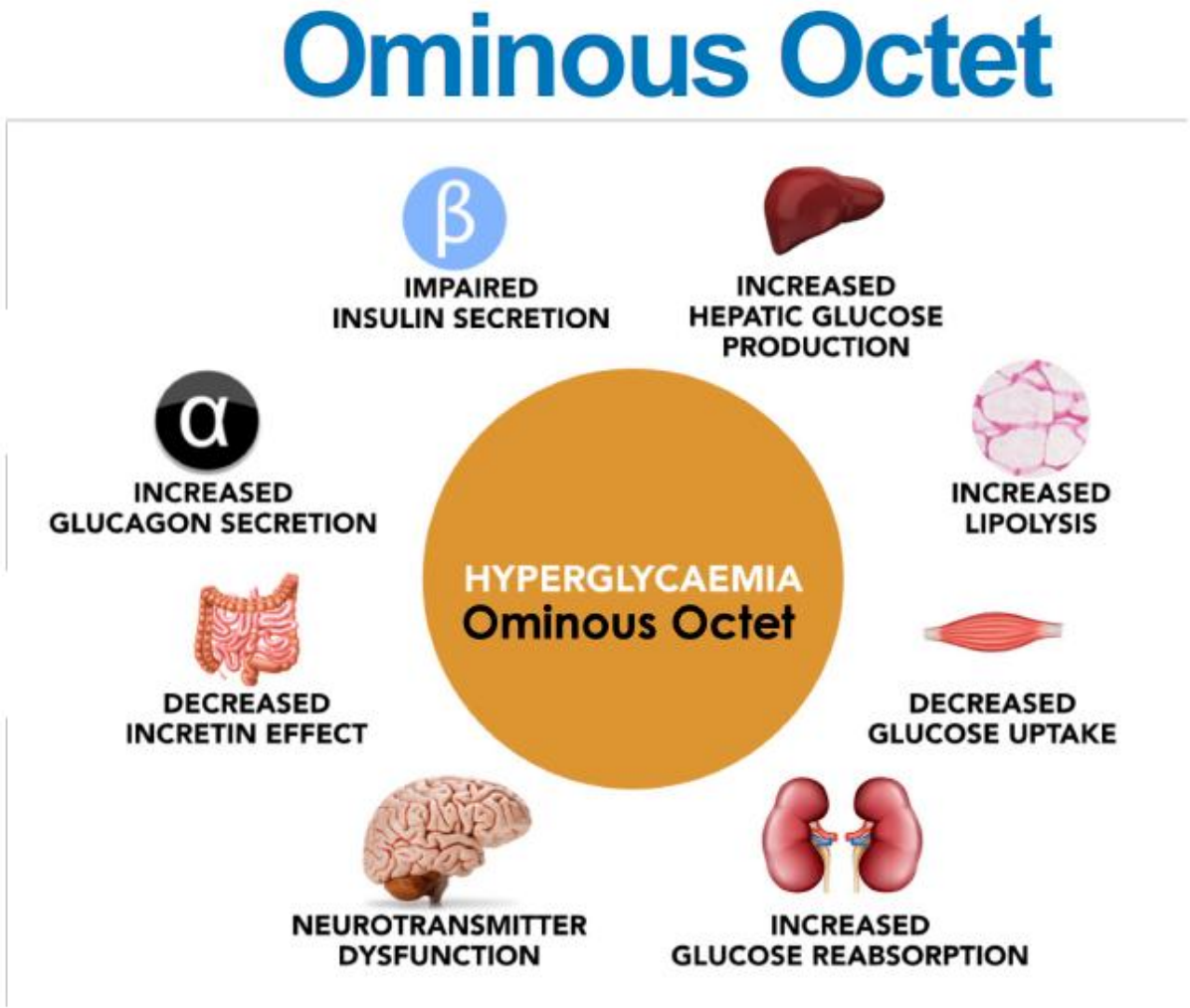
Medical treatment in Diabetes

A) Part one - Oral Antidiabetic drugs (OADs)

B) Part two - Injectables

Part one – Oral Antidiabetic drugs (OADs)

Characteristics of Type 2 DM



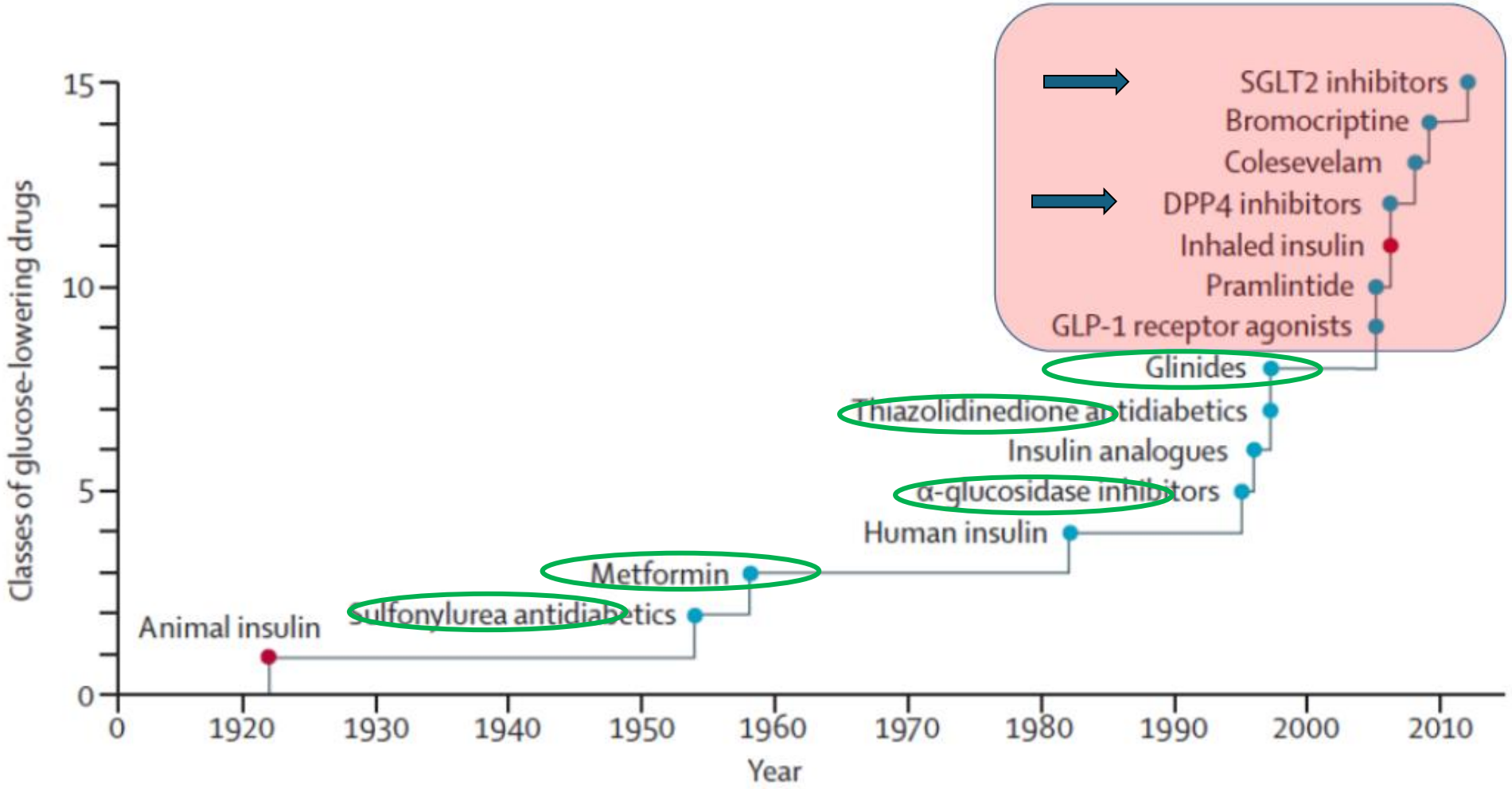
De Fronzo. Diabetes Care 2009

An Ideal Anti-Diabetic Drug

1. Good glucose lowering efficacy
2. No or little hypoglycaemic potential
3. Durability of efficacy
4. Additional pleiotropic effects
   - renal protection
   - CV protection
   - others
5. Free of adverse effects
6. Low cost

Such drug does not exist

Development of Glucose-Lowering Drugs (GLDs)



Kahn SE, et al. *Lancet* 2014;383(1022):1068-83

1. Metformin (MF)

- Time to take: with or after meals
- Optimal dose: 2-3g per day
- 1st line anti-diabetic drug in HA
- Action: ↑Insulin sensitivity, suppress hepatic glucose production
- Adverse effect: GI intolerance eg diarrhea, anorexia
- Should be started with a lower dose then titrate up to optimal dose as tolerated
- Reduce dose or off if ↓ renal function
- Beware of blood glucose ↑↑ once MF being off

Metformin - Summary

- 1st line anti-diabetic drug in HA
- Optimal dose 1,000 mg bd with potent glucose-lowering effect esp. FBS

Merits	Adverse Effects / Cautions
no hypoglycaemia with monotherapy	GI upset (extended-release preparation as alternative)
weight neutral	anorexia
generic: very cheap	vitamin B12 deficiency (long-term use)
potential reduction in CV events (UKPDS)	lactic acidosis (rare)
prevent progression of pre-diabetes to diabetes	contraindicated if poor renal function (eGFR <30 ml/min)
↓ cancer risk (liver, pancreas)	
potential anti-inflammatory, anti-oxidant, anticancer, anti-aging & neuroprotective effects	

Prevent Lactic Acidosis

- Avoid MF use during acute kidney injury or at hypoxia state
- Aware of those new combined drugs with MF e.g. JanuMet
- “Safe Use of MF in Adults with T2 DM and CKD: lower dosages and sick day education are essential”

Canadian Journal of Diabetes. 43 (2019) 76-80

Guideline for DM patients taking metformin who require contrast imaging study

Department of Medicine

September 2017

Background:

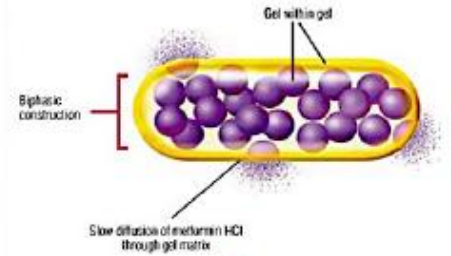
1. IV contrast may cause significant acute kidney injury (in patients with pre-existing renal impairment) which increases the risk of lactic acidosis in patients taking metformin
2. The above risk is minimum in patients with eGFR > 60 ml/min
3. According to FDA guideline (2016), metformin should be discontinued at the time of or before an iodinated **intravenous** contrast imaging procedure **only** in patients with an eGFR below 60 ml/min, and all patients who will be administered **intra-arterial** iodinated contrast.

Workflow:

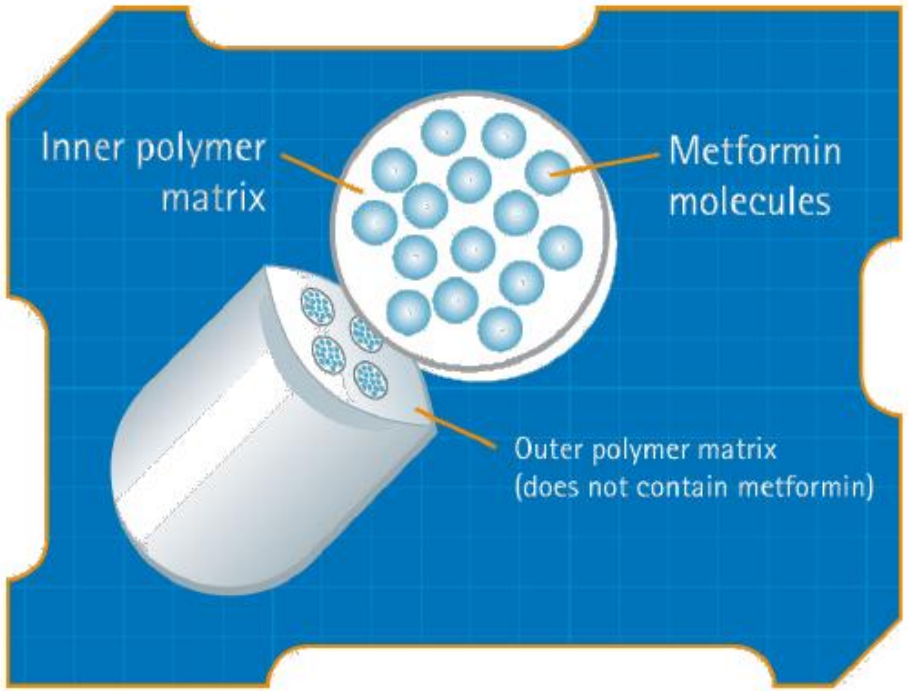
1. For all DM patients who are taking metformin before contrast imaging procedure, book B8 medical dayward as usual. Patients will receive two dayward appointments: Visit A. 2 to 3 days before procedure and Visit B. 2 to 3 days after procedure.
2. Visit A: Check renal function before 9:00am, assessed by dayward MO after result available. For intravenous contrast imaging, *metformin will be stopped if eGFR < 60 ml/min*, otherwise patients can continue to take metformin. For intra-arterial contrast imaging, metformin will be stopped in all patients.
3. Visit B: Re-check renal function again and assessed by dayward MO for resuming metformin (if stopped before procedure) or making medication adjustment.

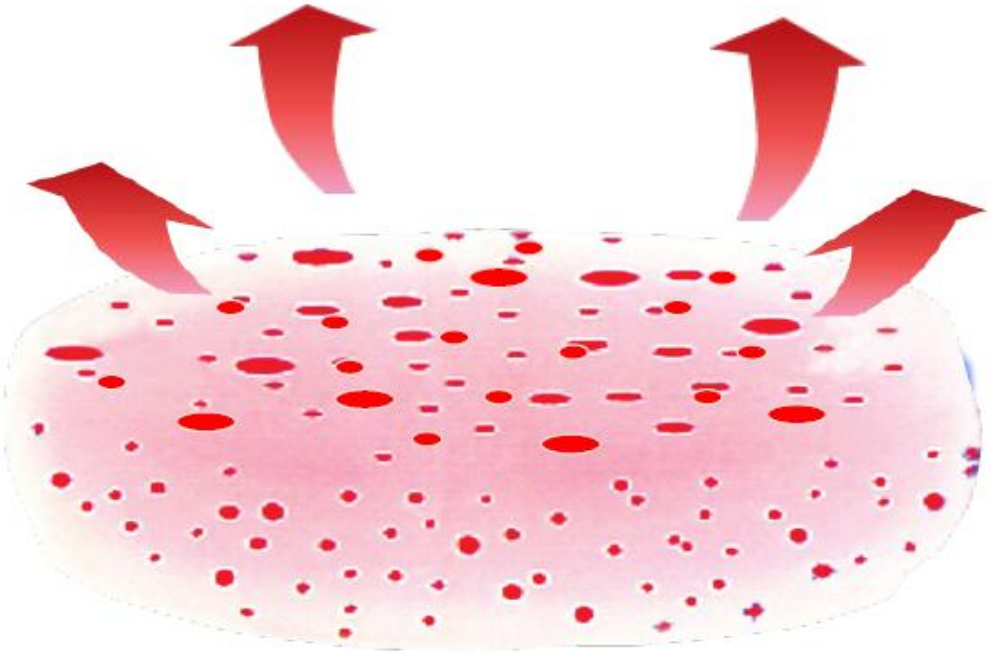
Reference: https://www.fda.gov/Drugs/DrugSafety/ucm493244.htm

Biguanides

Metformin	
Formulation	Immediate release tablet (Glucophage®)    Prolonged release tablet (Glucophage XR®)    'GelShield' diffusion system

The GelShield® Diffusion System Provides Prolonged Metformin Release in Branded Glucophage XR®





- Tablet swells and stays longer in the stomach duodenum
- Metformin is released slowly and continuously from the increased gel mass

Timmins P. Clin *Pharmacokinet* 2005;44:721-9

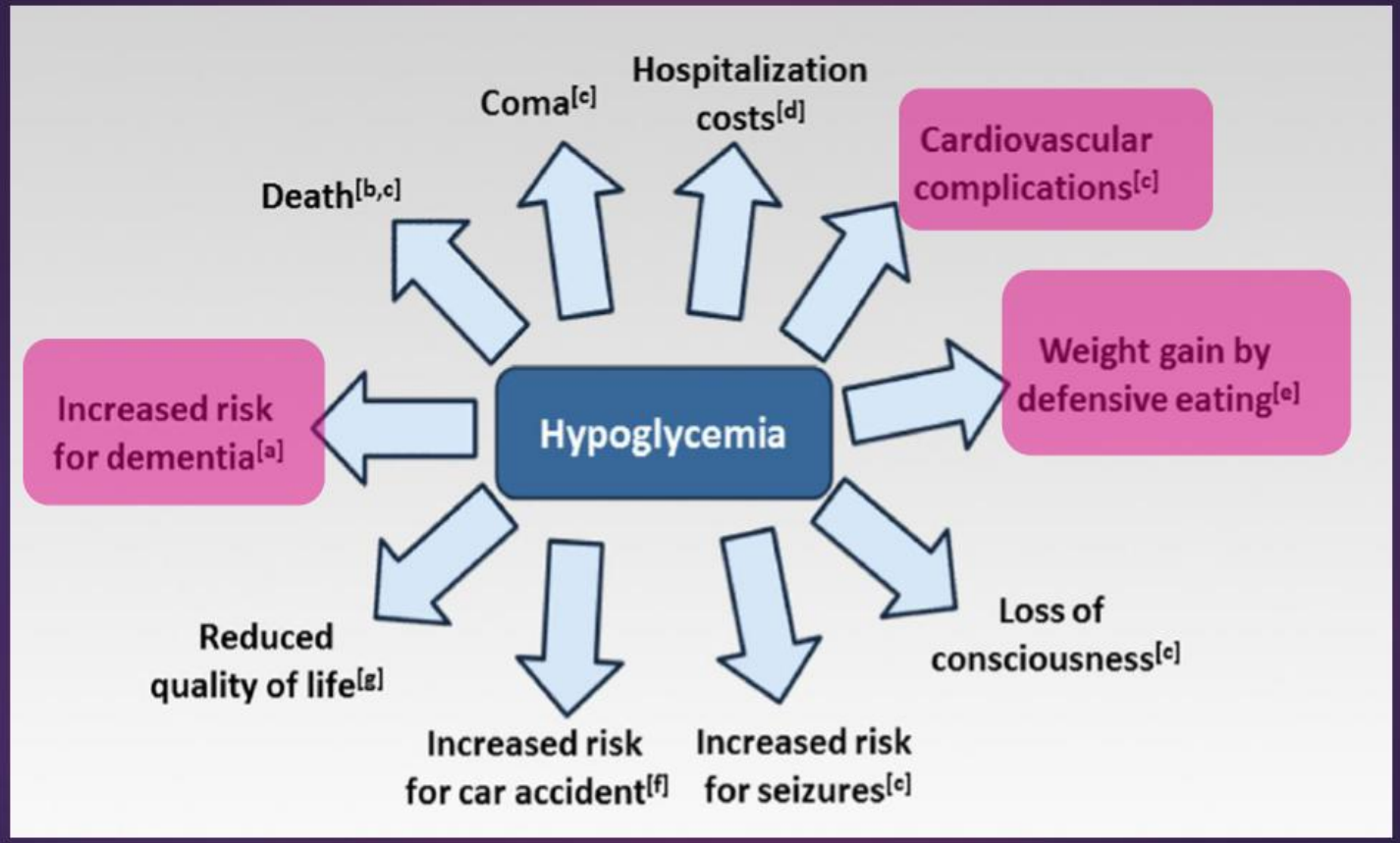
2. Sulphonylurea (SU)

- Stimulate β-cells to secrete insulin irrespective of ambient blood sugar levels
- Always taken before meals
- Potent immediate and extended glucose-lowering especially in patients with CKD

Merits	Adverse effects / Cautions
high glucose-lowering potency	very high risk of hypoglycaemia
cheap	defensive eating, weight gain
	poor durability
	potential ↑ CV mortality

SU should be avoided in
- elderly patients
- advanced CKD
- high CV risk

Consequences of Hypoglycaemia



Nursing Care

- Time to take – 30 min before main meals **BUT**
- Always alert hypoglycemia especially the following patients:
  - Elderly
  - Have dementia or cognitive problems
  - Prone to hypoglycemia / brittle DM
  - Drop in renal function, reduce dose or stop if ↓ RFT or ↑ LFT
  - Always remind to follow by carb intake (be caution when patient is NPO except med)
  - Higher risk in patients with irregular meal time and carb portion
  - Alert dental problems and sick days that affect patients' oral intake

Sulphonylurea

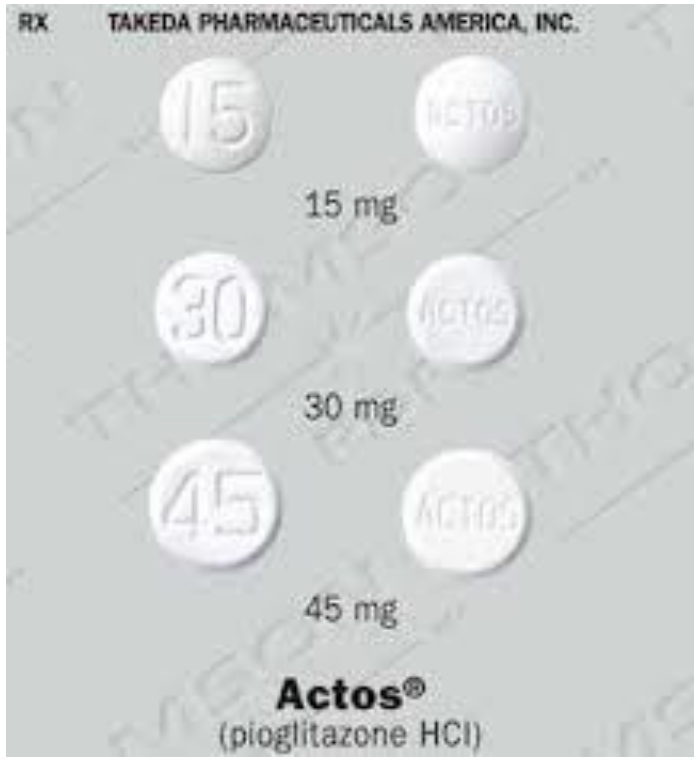
Diamicron 80mg (Gliclazide)

Amaryl (Glimepiride)

Minidiab 5mg (Glipizide)

Diamicron MR 30mg

3. Thiazolidnediones (TZD):
Pioglitazone (Actos)



Thiazolidnediones (TZD):
Pioglitazone (Actos)

- Mechanism of action: very potent insulin sensitizer at both liver + peripheral tissues (muscle & fat cells)
- Suppresses lipolysis
- Re-distribute visceral fat to subcutaneous region

Clinical parameters that may predict clinical efficacy of pioglitazone

- ✓Central obesity
- ✓Low HDL levels
- ✓Presence of fatty liver

Side Effects

- Edema and weight gain
- Sore throat, muscle pain
- Bone fracture (0.5/100 pt yr)

Precautions:

- Hepatic impairment (99% metabolized by liver)
- Class III/IV heart failure
- Existing fluid retention
- DKA

Nursing advice:

- Aware of fluid retention – edema, SOB, HF

Pioglitazone (Actos®): Summary

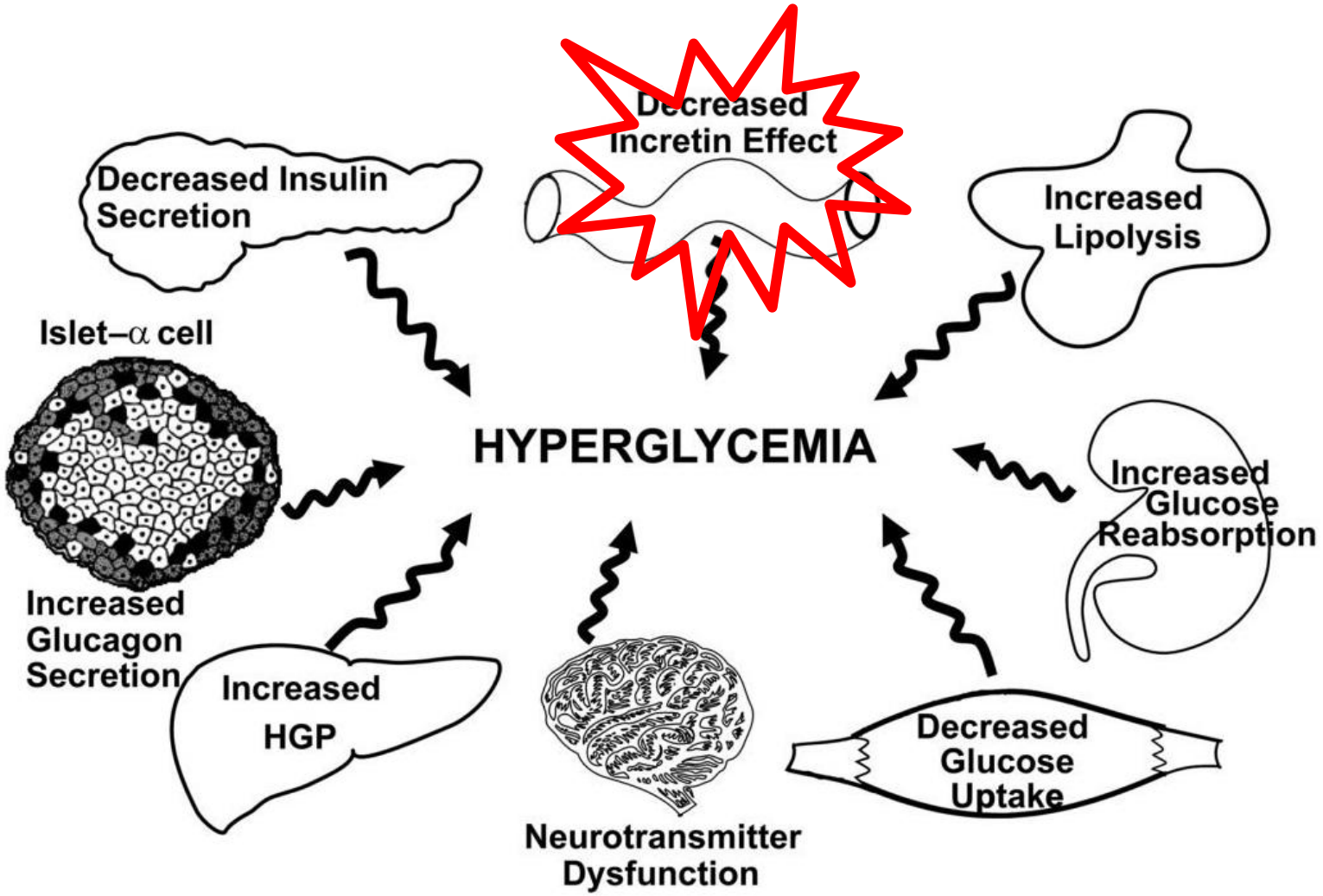
- Potent insulin sensitizer with marked glucose-lowering effect

Merits	Adverse Effects / Cautions
no hypoglycaemia with monotherapy	weight gain
good durability (preserve β-cells)	fluid retention
improvement of lipid profile (↓TG, ↑HDL)	contraindicated in NYHA Class 3 & 4 heart failure
prevent progression of pre-diabetes to diabetes	risk of peripheral fractures in female (excess risk 5 case/1000 pt-yr)
generic: cheap	? ↑risk of CA bladder (NOT substantiated in long-term study)
reduction in CV events (PROACTIVE, IRIS)	
improvement of fatty liver	
can be used in patients with ESRD / RRT	

Practical Hints in the Clinical Use of Pioglitazone

1. A very potent glucose-lowering drug esp. in patients with insulin resistance
2. Starting dose 15 mg stepping up to optimal dose 30 mg daily if tolerated
3. Lower the starting dose (7.5 mg) in patients with advanced CKD (eGFR <30 ml/min)
4. If add-on to SU or insulin, please reduce dose of SU/insulin
5. A preferred OAD in patients with MASLD and history of ischaemic stroke
6. Ensure adequate vitamin D/Ca intake to optimise bone health especially in elderly
7. Avoid use of PIO in patients with history of CA bladder

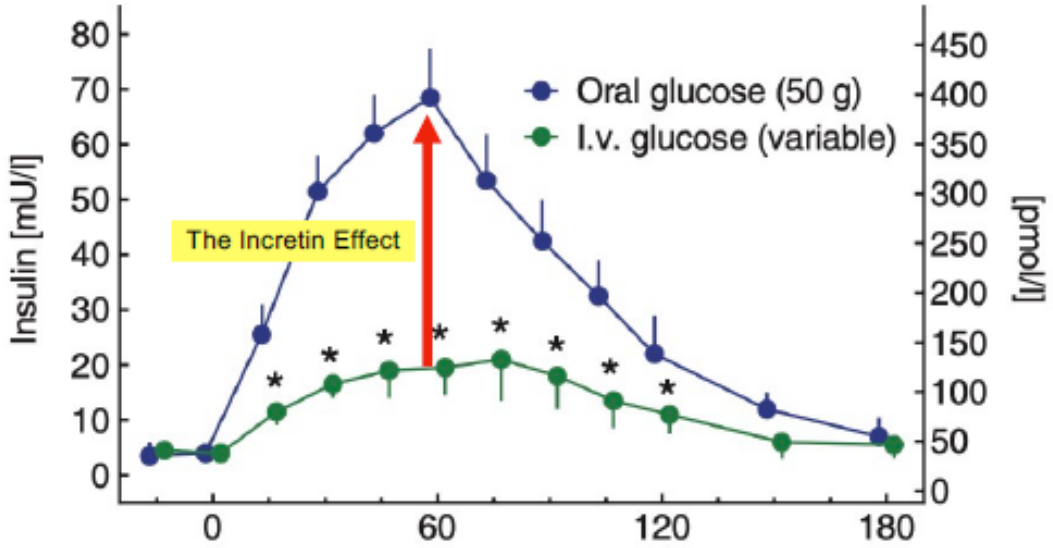
Pathophysiologies of T2DM – the Ominous Octet



The Incretin Effect

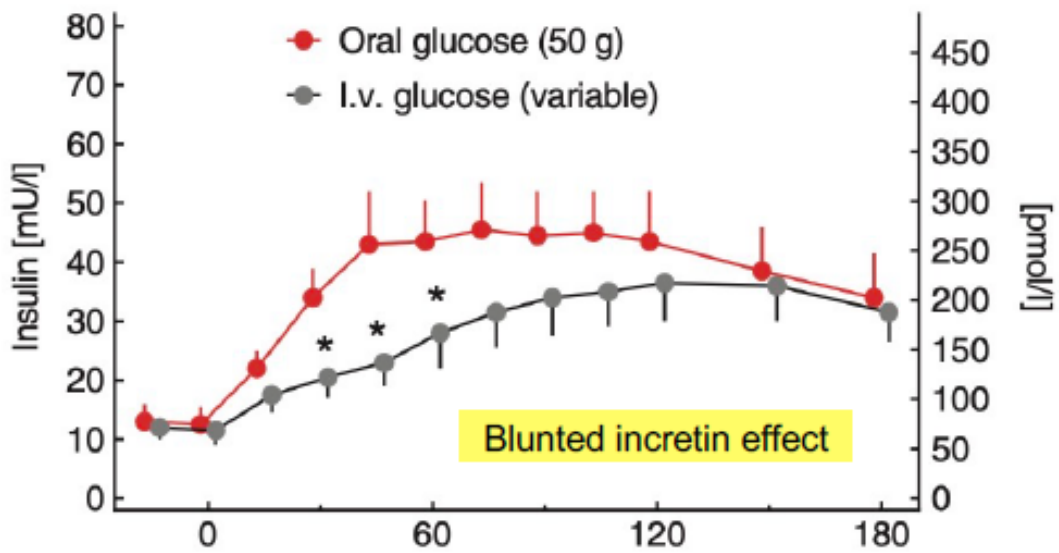
"INtestine seCRETion INsulin"

In metabolically healthy individuals



- Greater stimulation of insulin secretion with oral glucose than intravenous glucose, even when the same amount is administered, or when the glycemic excursions are similar (i.e. isoglycaemic)

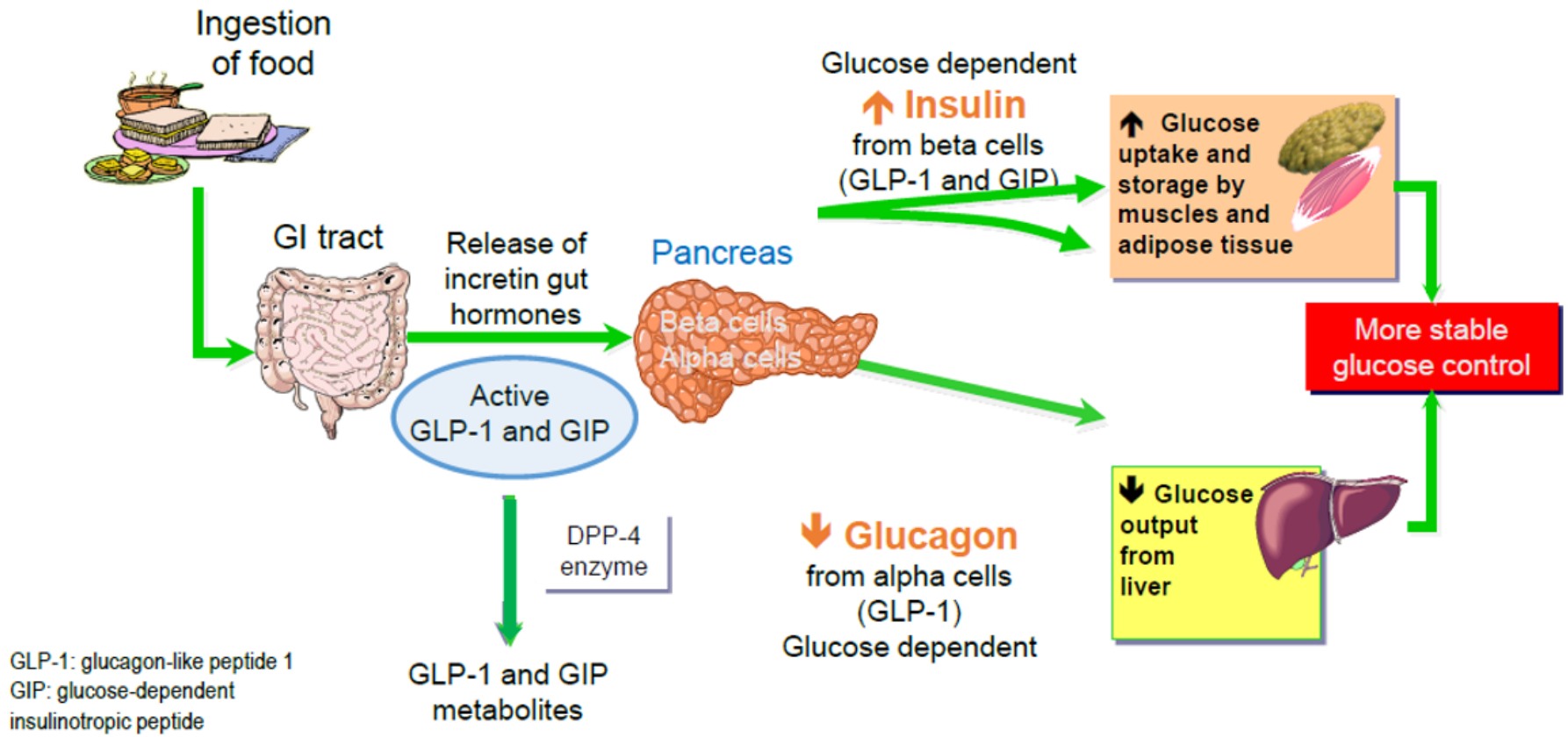
In patients with type 2 diabetes



- Insulin secretory responses show slow rise to a peak after oral glucose ingestion
- Response only marginally higher than that to isoglycaemic intravenous glucose

Elrick H et al. J Clin Endocrinol Metab 1964
Nauck MA et al. Diabetologia 1986
Nauck MA and Meier JJ Diabetes Obes Metab 2018

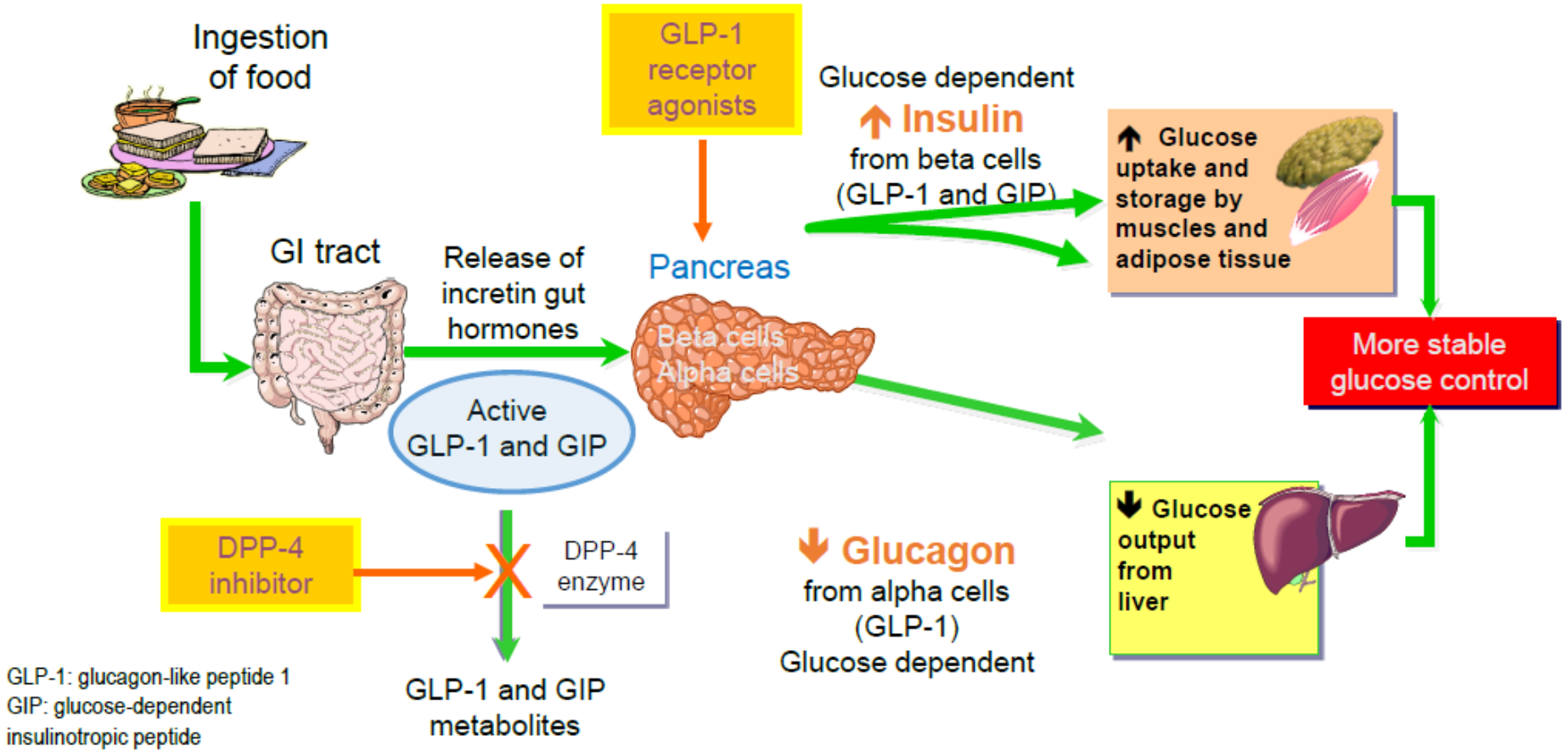
Action of Glucagon Like Peptide 1 (GLP-1) and Glucose-dependent Insulintrophic Peptide (GIP)



GLP-1: glucagon-like peptide 1
GIP: glucose-dependent insulinotropic peptide

Incretin axis is abnormal in T2DM : reduced release of GLP-1
reduced response to GIP

Action of Glucagon Like Peptide 1 (GLP-1) and Glucose-dependent Insulintrophic Peptide (GIP)



Incretin axis is abnormal in T2DM : reduced release of GLP-1
reduced response to GIP

4. DPP-4 Inhibitors

Januvia (sitagliptin) 100mg

Alogliptin (Nesina) 25mg

Galvus (vildagliptin) 50mg

Onglyza (saxagliptin) 5mg

Trajenta (Linagliptin) 5mg

Nursing Advice

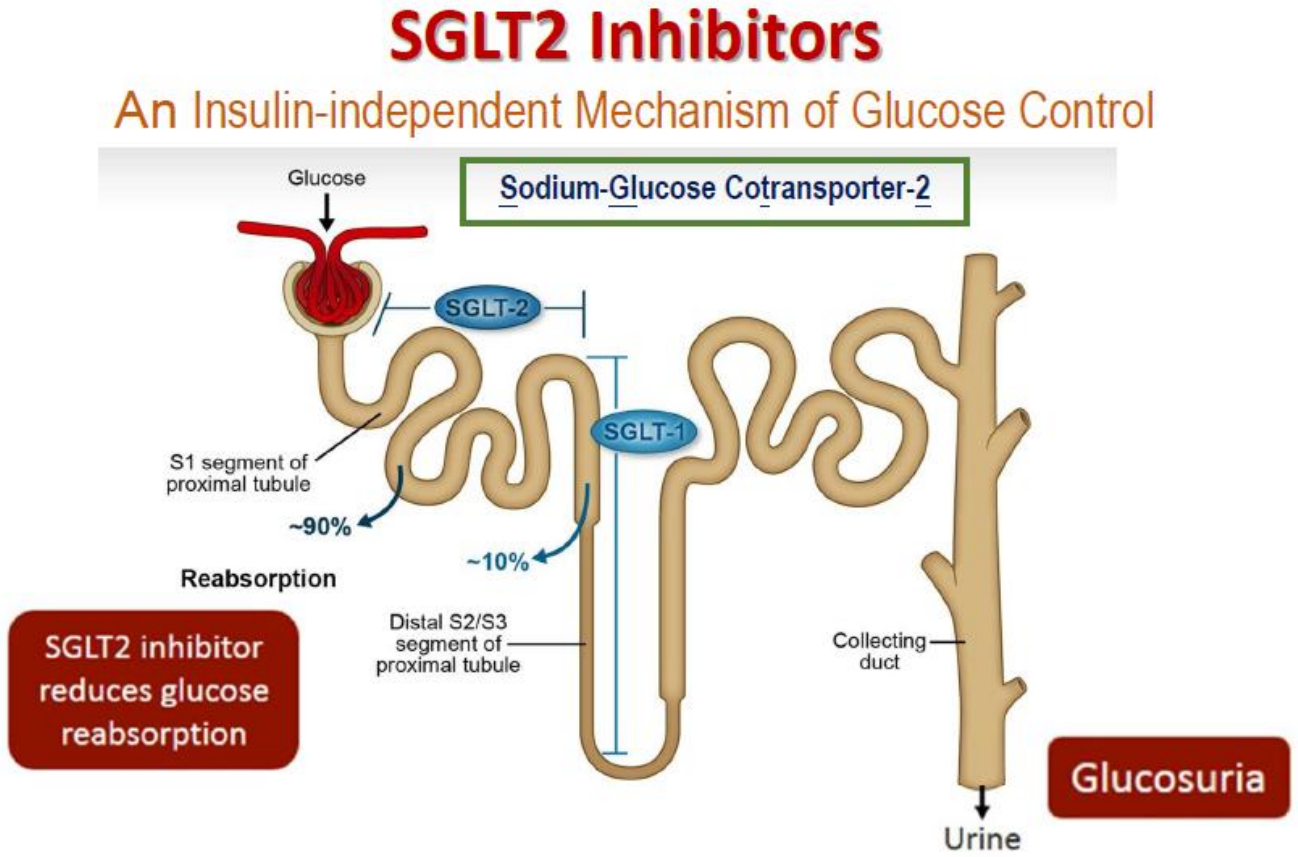
- **Administration:**
  - ❖With or without food, same time each day
- **Side effects:**
  - ❖URTI, headache, nasopharyngitis
  - ❖Acute Pancreatitis - so not for patients with history of pancreatitis
  - ❖Stop and seek medical advice if acute abdominal pain
- ↓ dose in patients with ↓ RFT (80% metabolized by kidney) except Trajenta (80% by Liver)
- Lower hypoglycemic risk as compared with SU / Insulin
- Be caution when patient is NPO except med

DPP4 inhibitor - summary

- Incretin-enhancer: enhance circulating levels of GLP-1 & GIP (still within physiological levels)
- Modest HbA1c lowering by 0.4-0.8%

Merits	Adverse Effects / Cautions
no hypoglycaemia with monotherapy	nasopharyngitis
weight neutral	? pancreatitis / pancreas cancer (NOT substantiated) Avoid in patients with Hx of pancreatic diseases
well tolerated	biliary tract disease
CV safety neutral	pemphigoid
Safe to use in the elderly	severe arthralgia (FDA alert)
	↑hospitalisation for heart failure (SAX)

5. Sodium Glucose Co-Transporter 2 (SGLT2) Inhibitor



Nauck MA. *Drug Des Devel Ther* 2014;8:1335-80

* Dapagliflozin

* Empagliflozin

* Canagliflozin

Sodium Glucose Co-Transporter 2 (SGLT2) Inhibitor

- Dapagliflozin (Forxiga) / Empagliflozin (Jardiance)
- Administration: before the first meal
- Action: inhibit SGLT2 in the kidneys → ↑urinary glucose excretion → lower BSL
- SE: Low risk of hypoglycemia, urinary tract infection, Euglycemia DKA
- Precaution: reduce dose with renal impairment

SGLT-2 Inhibitors: Summary

- Insulin-independent mechanism with moderate glucose-lowering effect

Merits	Adverse Effects / Cautions
no hypoglycaemia with monotherapy	genito-urinary infection
weight loss (~2kg)	polyuria, dehydration
BP improvement (~3-4/1-2 mmHg)	hypotension
can be combined with all types of regimen	Fournier gangrene (of the perineum)
can be used at any stage of T2DM	beware of acute kidney injury
reduce hospitalisation for heart failure	euglycaemic ketoacidosis*
retard CKD progression	fracture, ↓BMD (CANA-FDA Alert)

*SGLT2i should be stopped during acute medical illnesses or perioperative period

Nursing Advice

Watch out for side effect:

- Hypotension – HBPM
- Dehydration – ↑↑ fluid intake
- Urinary tract infection, genital infection – hygiene, stop and seek medical advice if dysuria or signs of infection
- Hyperkalaemia (caution if with ACEI/ARB)
- ↑ bladder cancer (Dapagliflozin) – inform pt possible S/E
- Bone fracture & ↑ 2x risk of leg/foot amputation (FDA – Canagliflozin) – inform pt possible S/E

Precaution:

- reduce dose for patients with renal impairment
- Stop if prolonged fasting, acute illness/stress, undergo planned operation (at least 3 days before), DKA
- Avoid simultaneous initiation of SGLT2i and GLP1-RA
- Caution for dehydration in the elderly especially in patients on pre-existing diuretic therapy

FDA Warning:

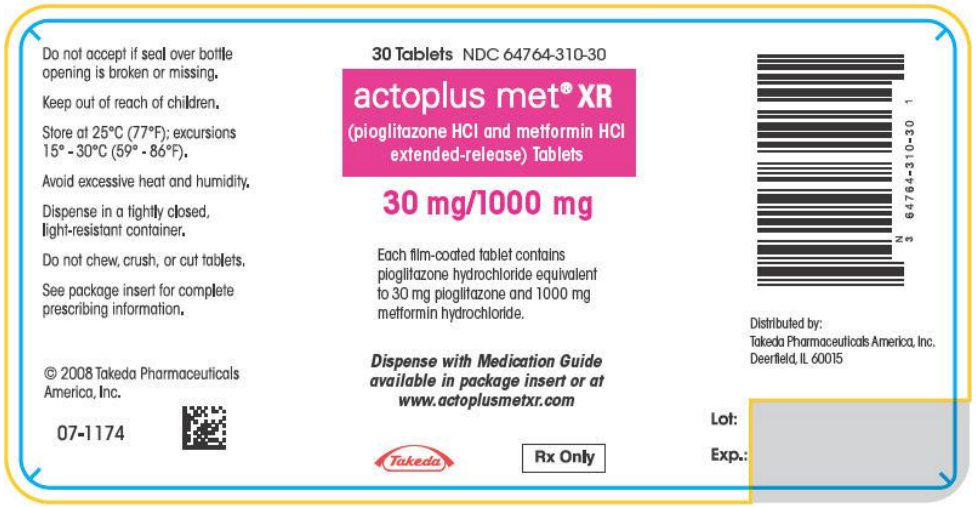
- Euglycemia DKA – difficult to aware (not for T1 usually)

Some warnings regarding SGLT2i

1. Caution for dehydration in the elderly especially in patients on pre-existing diuretic therapy and poor oral intake
2. Caution in patients with poor perineal hygiene eg on napkins
3. Caution in patients with peripheral arterial disease
4. Caution for DKA in patients with normal or low BMI, which may indicate underlying insulin deficiency ⇒ potential risk of DKA

New Combined Drugs

Actosmet: Actos + Metformin



ActoPlus MetXR: Actos + Metformin XR

New Combined Drugs:

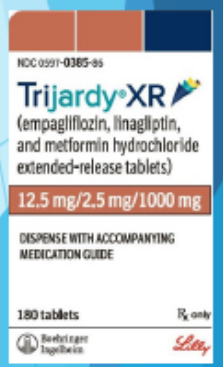
- Oseni: alogliptin + pioglitazone

- Nesina Met: alogliptin + Metformin

- GalvusMet: Vildagliptin + Metformin

Oral Combination Products

Brand name	Generic drug
Actoplus Met / Actoplus Met XR	Metformin + Pioglitazone
Galvus Met	Metformin + Vildagliptin
Janumet / Janumet XR	Metformin + Sitagliptin
Jardiance Duo	Metformin + Empagliflozin
Tranjenta Duo	Metformin + Linagliptin
Xigduo XR	Metformin + Dapagliflozin
Oseni	Alogliptin + Pioglitazone
Glyxambi	Empagliflozin + Linagliptin
Trijardy XR	Metformin + Empagliflozin + Linagliptin

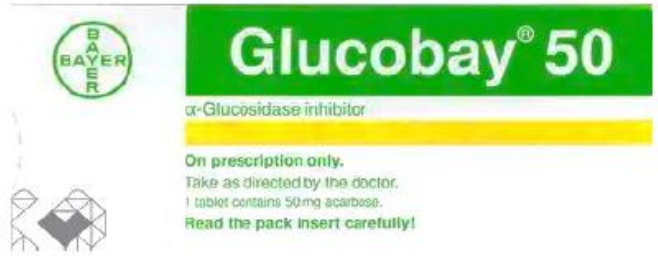


6. Others - Glinides

- Repaglinide (Novonorm®)
- prandial β-cell stimulator: augment glucose-induced insulin secretion in T2DM
- taken at the beginning of each meal

Merits	Adverse Effects / Cautions
↓ postprandial hyperglycaemia	limited clinical efficacy
	frequent dosing
	adverse effects: hypoglycaemia, weight gain
	expensive

6. Others - Alpha-glucosidase inhibitors

Acarbose (Glucobay®)	
Formulation	
Clinical considerations	✓ No hypoglycemia ✓ Weight neutral ✓ Target post-prandial hyperglycemia • Efficacy: weak

Alpha-glucosidase inhibitors

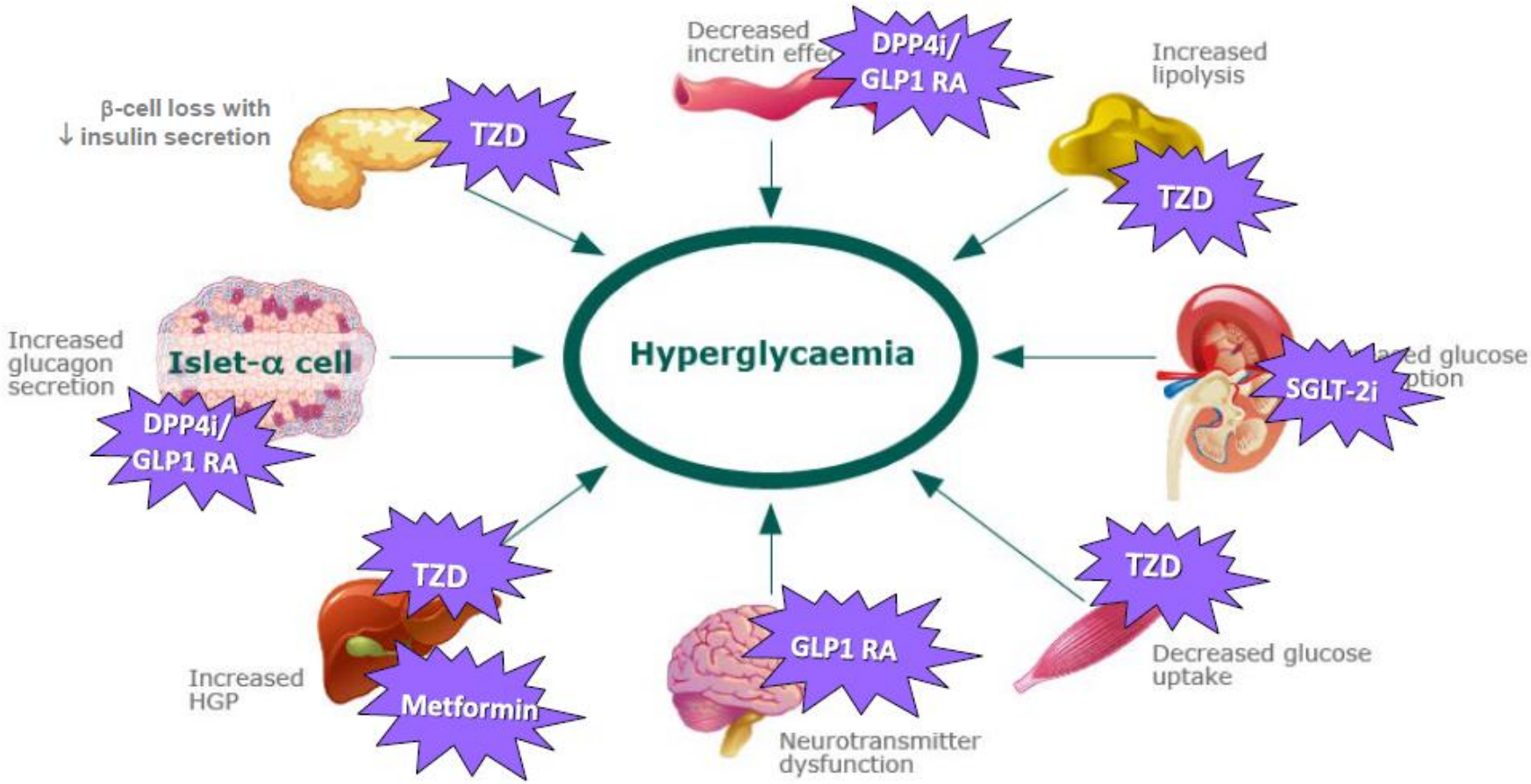
Acarbose	

Side effects	• GI side effects common
	  • flatulence, loose stools / diarrhea
	  (↑ with higher load of sucrose/carbs)

Clinical considerations	• Contraindications:
	  1. Inflammatory bowel disease
	  2. At risk of intestinal obstruction
	  3. Chronic intestinal disorders
	• Hypoglycemia treatment
	  • MUST use simple glucose or lactose
	  • NOT sucrose

Pathophysiologies of T2DM

The Ominous Octet



Modified from Defronzo RA. *Diabetes* 2009;58;773-95

The rationale for combination therapy

- Two (or more) anti-diabetic agents that have different mechanisms of action
- Two agents each at less than maximum dose rather than increase in initial medicine to maximum dosage
- Fewer side effects than monotherapy at higher doses

Expected effect of anti-diabetic agents

Class of Medicine	Expected Decrease In A1c In Mono-Therapy
Alpha-glucosidase inhibitor	0.5-0.8%
Biguanide	1.0-2.0%
Insulin sensitizers (Thiazolidinediones)	0.5-1.4%
Insulin secretagogues (eg Sulphonylurea)	1.0-2.0%
SGLT2 inhibitor	0.4-1.5%
GLP-1 agonist	0.5-1.0%
DPP-4 inhibitor	0.5-0.8%

Summary

- There are a number of therapies, including lifestyle modification, available to people with type 2 diabetes- therapy needs to be tailored to person's needs
- Usually begin with lifestyle changes and metformin
- If glucose is outside of target range→ change therapy
- Add a different class of medication; reassess lifestyle
- Do not delay starting insulin if insulin is needed

Treatment strategies

ADA standard care 2026(update every year)

Diabetes Care (vol 49, suppl 1), Jan 2026

Table 6.3—Summary of glycemic goals for many nonpregnant adults with diabetes

A1C	<7.0% (<53 mmol/mol)*†
Preprandial capillary plasma glucose	80–130 mg/dL* (4.4–7.2 mmol/L)
Peak postprandial capillary plasma glucose‡	<180 mg/dL* (<10.0 mmol/L)

*More or less stringent glycemic goals may be appropriate for certain individuals. †CGM may be used to assess glycemic status as noted in Recommendations 6.3b and 6.3c. Goals should be individualized based on duration of diabetes, age and life expectancy, comorbid conditions, known cardiovascular disease or advanced microvascular complications, impaired awareness of hypoglycemia, and individual considerations (per **Fig. 6.1**). ‡Postprandial glucose may warrant special attention if A1C goals are not met despite reaching preprandial glucose goals. Postprandial glucose measurements should be made 1–2 h after the beginning of the meal, which is generally the timing for peak levels in people with diabetes.

Treatment Target Values of Non-pregnant Adult Type 2 Individuals – HACPG 2026

Table 1. Treatment Target Values of Non-pregnant Adult with Type 2 Diabetes[7, 8, 9, 10, 11].

	Treatment targets
Fasting plasma glucose (mmol/L)	4.4–7.2
Postprandial plasma glucose (mmol/L)	≤ 10.0
HbA1c	< 7.0%[a]
Body mass index (kg/m²) for Asians	< 23.0
Waist circumference for Asian male	< 90 cm (< 36 inches)
Waist circumference for Asian female	< 80 cm (< 32 inches)
Systolic BP (mmHg)	< 130[b]
Diastolic BP (mmHg)	< 80[b]
Low-density lipoprotein cholesterol (LDL-C) (mmol/L)	• High risk: < 1.8[c] • Very high risk: < 1.4[c] • (Extreme risk: < 1.0[c]) AND, if possible, ≥ 50% reduction from baseline
HDL-C for male (mmol/L)	> 1.0
HDL-C for female (mmol/L)	> 1.3
Non-HDL-C (mmol/L)	0.8 mmol/L higher than LDL-C goal
Triglyceride (mmol/L)	< 1.7

Goals should be individualised:

a. For most adults, the recommended HbA1c target is < 7.0%, provided that it can be safely achieved without hypoglycaemia. Targets may be adjusted under specific conditions (see *Section 5.1.2*):
   - < 6.0–6.5% for younger patients/women planning or during pregnancy;
   - < 7.0–7.5% for elderly without frailty or multimorbidity;
   - < 7.5–8.0% for patients at risk of hypoglycaemia including insulin users or with significant CVD; and
   - < 8.0–8.5% for elderly with frailty or multimorbidity.

b. A higher BP target of < 140/90 mmHg may be considered for certain populations, such as elderly or frail individuals with poor health, or those experiencing adverse effects from intensive therapy, provided that it can be safely achieved.

5 Mottos of T2DM Management

Early

Aggressive

Comprehensive

Avoidance of Therapeutic Inertia

Treat-To-Targets

Part Two - Injectables

Insulins and GLP1-ra

Content

- Learn more about Insulin
- How to give insulin safely
- Insulin injection skill
- Adverse effect of insulin therapy
- Other DM Injectable (incretins) - Glucagon-like Peptide 1 Receptor Agonist

Content

- Learn more about Insulin
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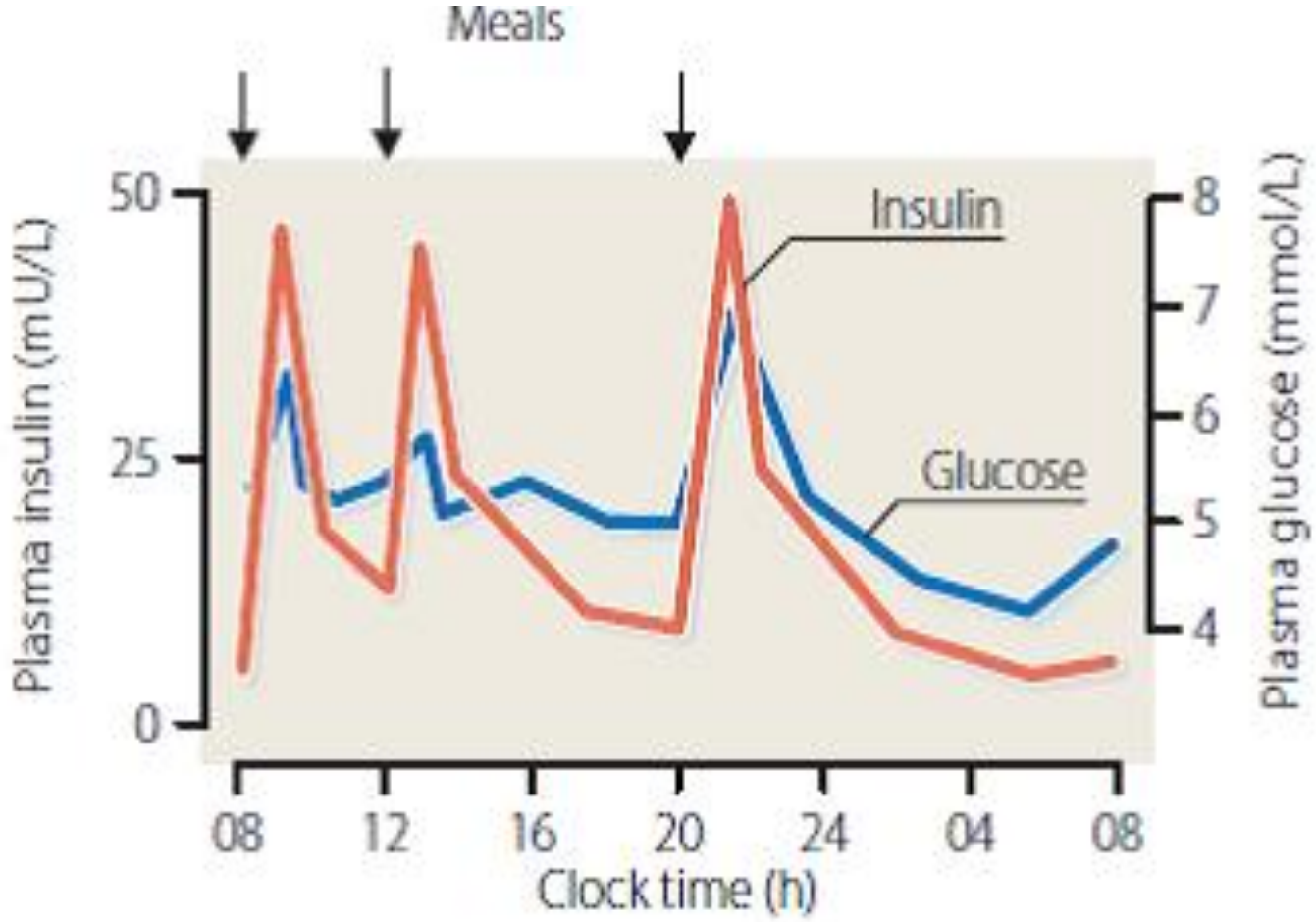
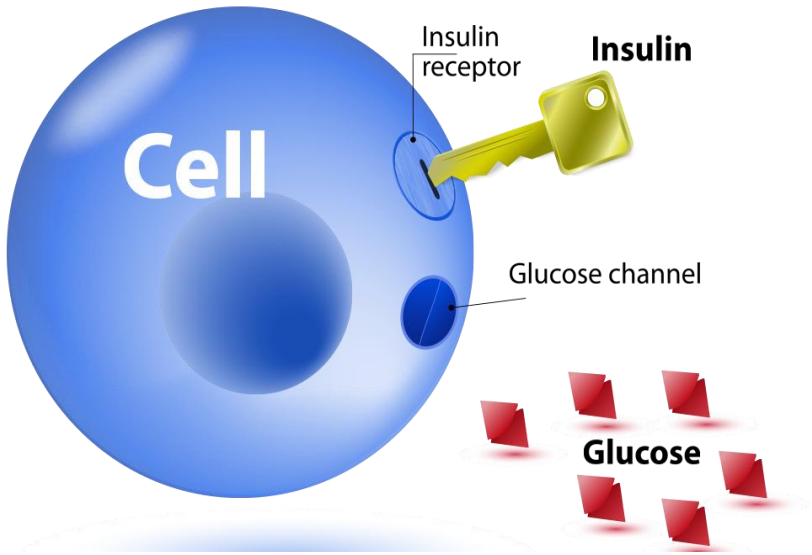
Learn more about insulin - what is insulin

- Insulin is a hormone secreted by the beta cells of pancreas
- It secretes in response to glucose or other stimuli, such as amino acids
- There is always some insulin in circulation, with surges of insulin triggered by a rise in blood glucose



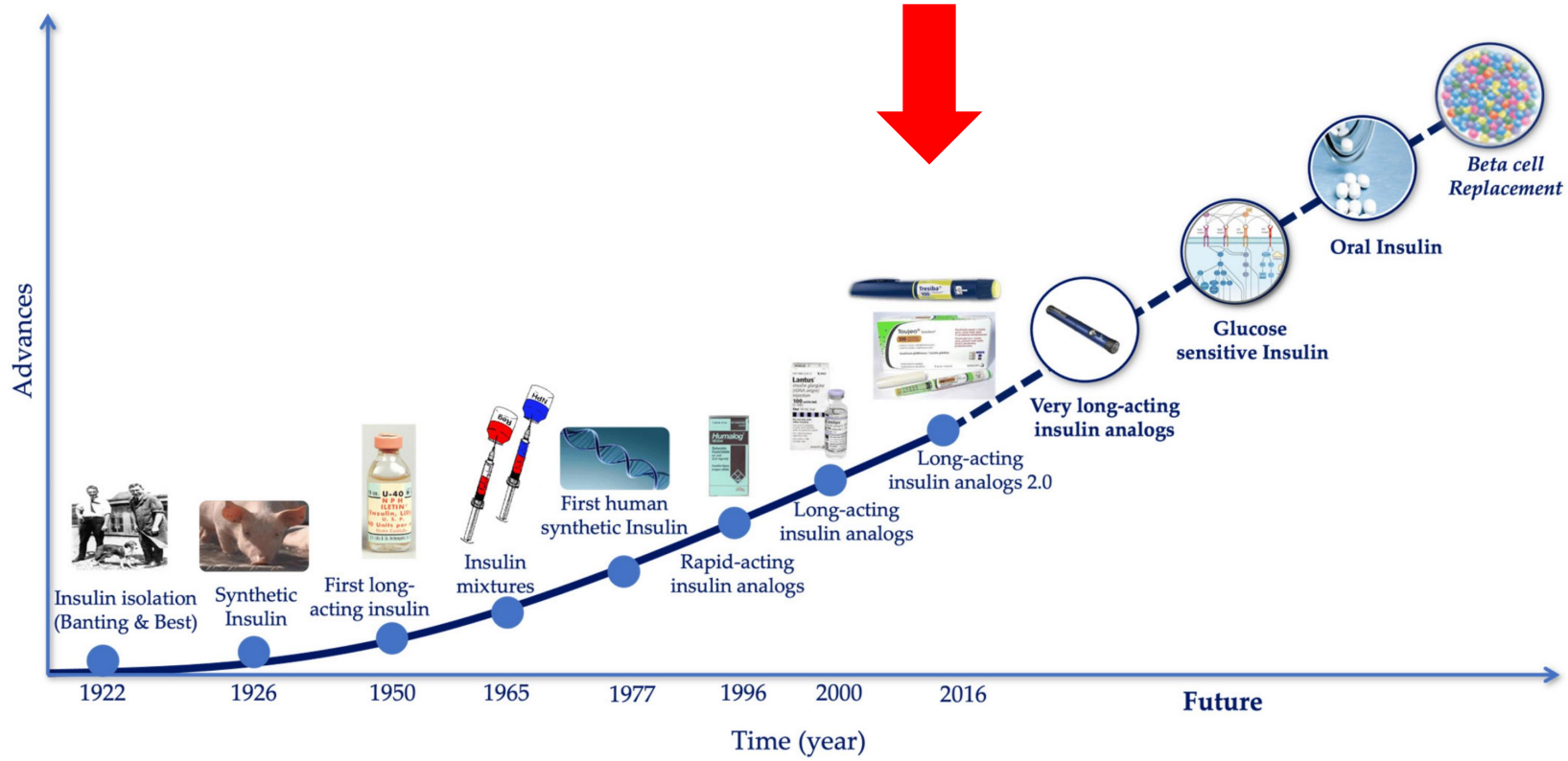
Retrieved from https://www.diabetesincontrol.com/handbook-of-diabetes-4th-edition-excerpt-4-normal-physiology-of-insulin-secretion-and-action/

Learn more about insulin - Who require insulin therapy?



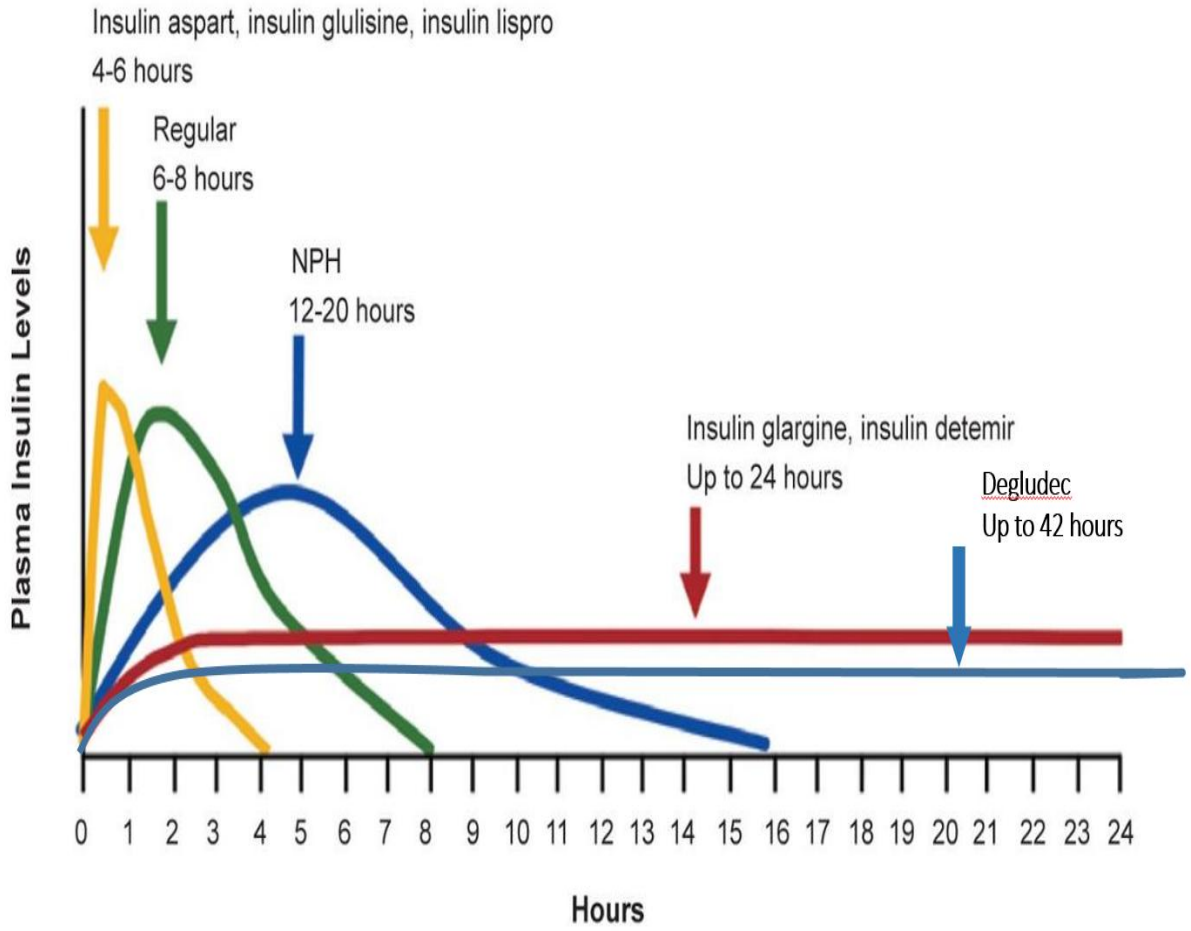
Long Term	Short Term
• Type 1 DM • Latent Autoimmune Diabetes in Adults (LADA)	• Type 2 DM for pre-conception planning, during pregnancy & lactating period • Gestational diabetes
Type 2 DM with • Failure in oral anti-diabetes drugs • Insufficient of insulin • Impaired renal or liver function	Severe metabolic decompensation • Diabetic ketoacidosis (DKA) • Hyperglycaemic Hyperosmolar State (HHS) • Lactic acidosis
• After total pancreatectomy	• Acute glucose control (infections, MI, major surgery, major trauma, steroid therapy…

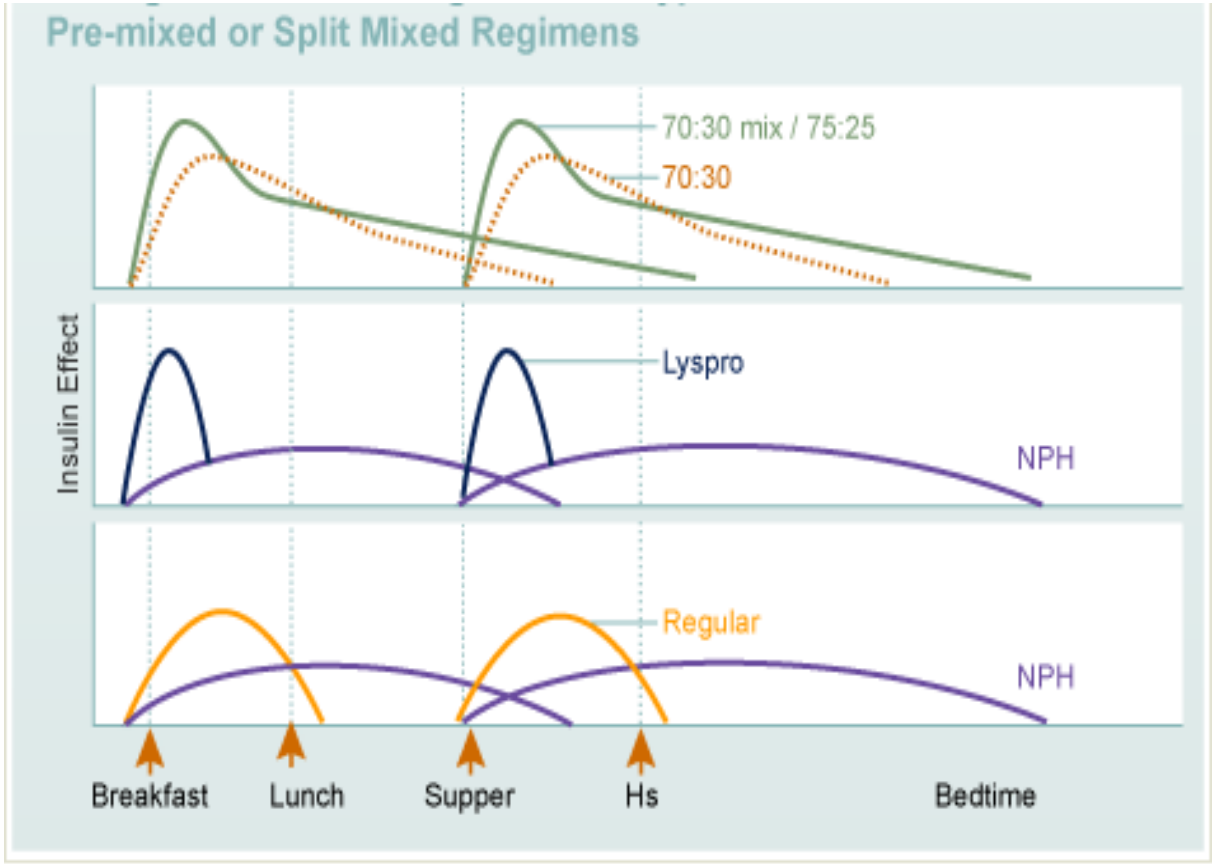
Learn more about insulin
- Evolution of Insulin



Learn more about insulin - Types of insulin

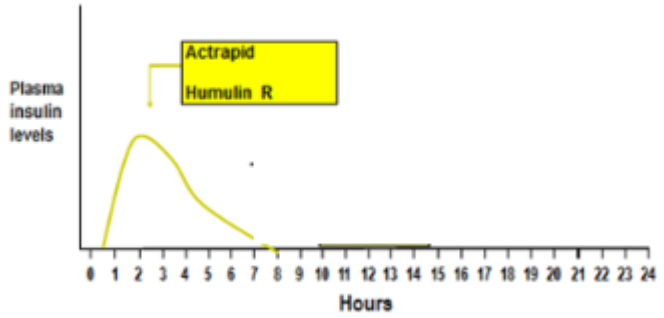
There are different types of insulin depending on **how quick** they work, when they **peak** and **how long** they last.





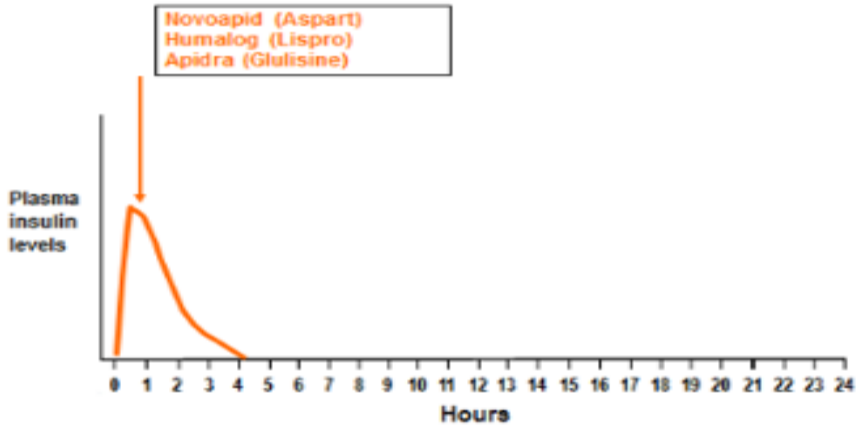
Short- Acting Insulin

Type of Insulin	Administration	Brand Name	Action Profile	Drug preparation	
				Vial	Penfill
Short-Acting Insulin	**30 minutes before meal or specified up to 3 times/day**	**Actrapid**	Onset: 30 mins Peak: 1.5 - 3.5 hours Duration: 7 - 8 hours		
		Humulin R	Onset: 30 mins Peak: 2 - 4 hours Duration: 6 - 8 hours		



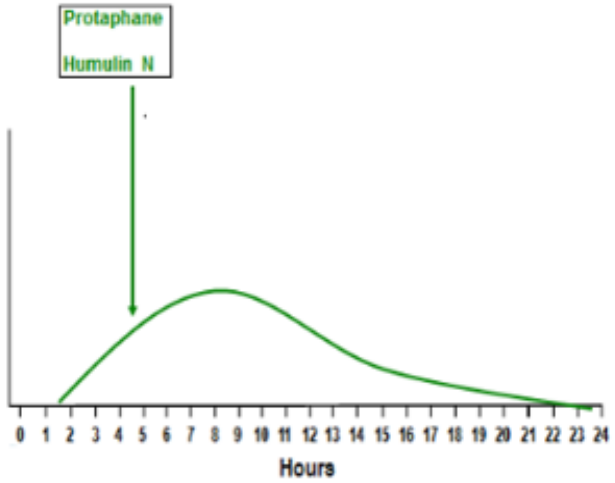
Rapid-Acting Insulin Analogue

Type of Insulin	Administration	Brand Name	Action Profile	Drug preparation		
				Vial	Disposable pen	Penfill
Rapid-Acting Insulin Analogue	0-15 mins before meal, up to 3 times/day	NovoRapid (Aspart)	Onset: 10 - 20 mins Peak: 1 - 3 hours Duration: 3 - 5 hours	NA		
		Humalog (Lispro)	Onset: less than 15 mins Peak: 30 -70 mins Duration 2.5 hours			
		Apidra (Glulisine)	Onset: 10 - 20 mins Peak: 1.6 – 2.8 hours Duration: 3-4 hours	NA		NA



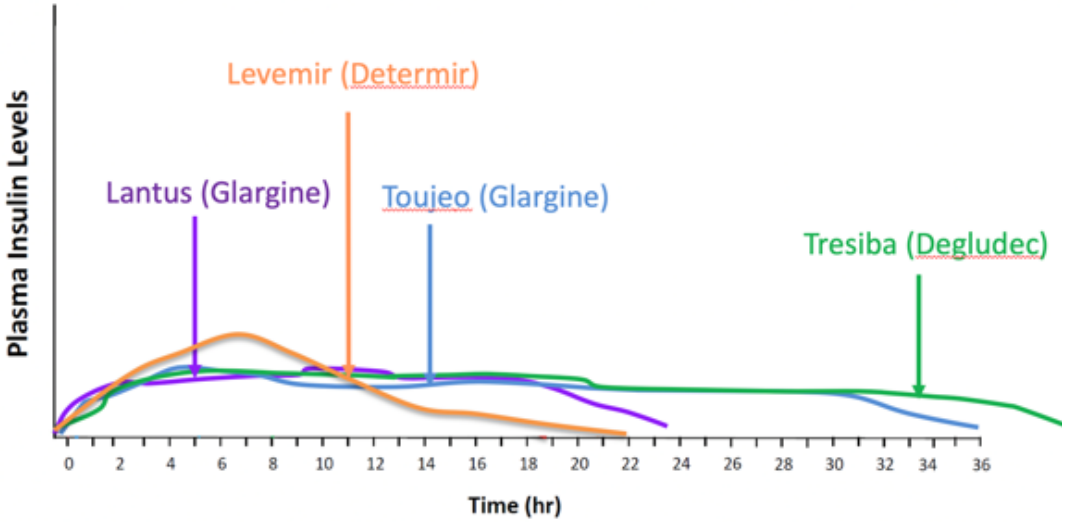
Intermediate-Acting Insulin

Type of Insulin	Administration	Brand Name	Action Profile	Drug preparation	
				Vial	Penfill
Intermediate-Acting Insulin	• 30 minutes before breakfast or specified up to 2 times/ day; • If used as basal insulin to control fasting h'stix -> give at ~ 11pm	Protaphane	Onset: 1.5 hour Peak: 4-12 hours Duration: 24 hours		
		Humulin N	Onset: 1 hour Peak: 4- 10 hours Duration: 14-24hours		



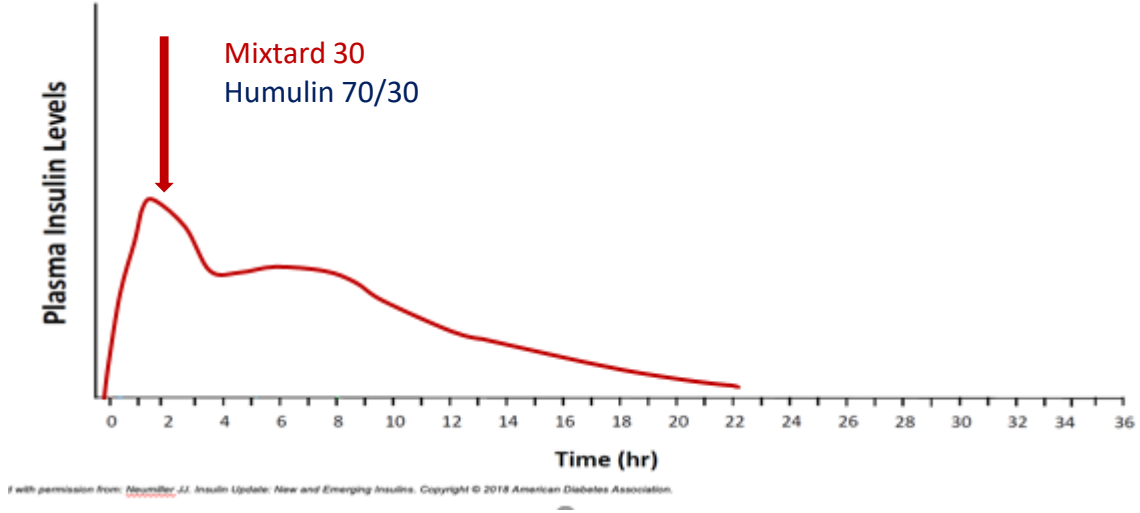
Long-Acting Insulin Analogue

Type of Insulin	Administration	Brand Name	Action Profile	Drug preparation	
				Vial	Disposable pen
Long-Acting Insulin Analogue	OM or Nocte or specified once daily	**Levemir (Detemir)**	Onset: 3-4 hours Peak: 3-9 hours Duration: 6-23 hours	NA	
		Lantus (Glargine)	Onset: 3-4 hours Peak: no pronounced peak Duration: 24 hours		
		Tresiba (Degludec)	Onset: ~ 1 hour Peak: 9 hours Duration: 42 hours	NA	
		Toujeo SoloStar (300U/ml) Concentrated Insulin	Onset: 6 hours Peak: no peak Duration: 24-36 hours	NA	



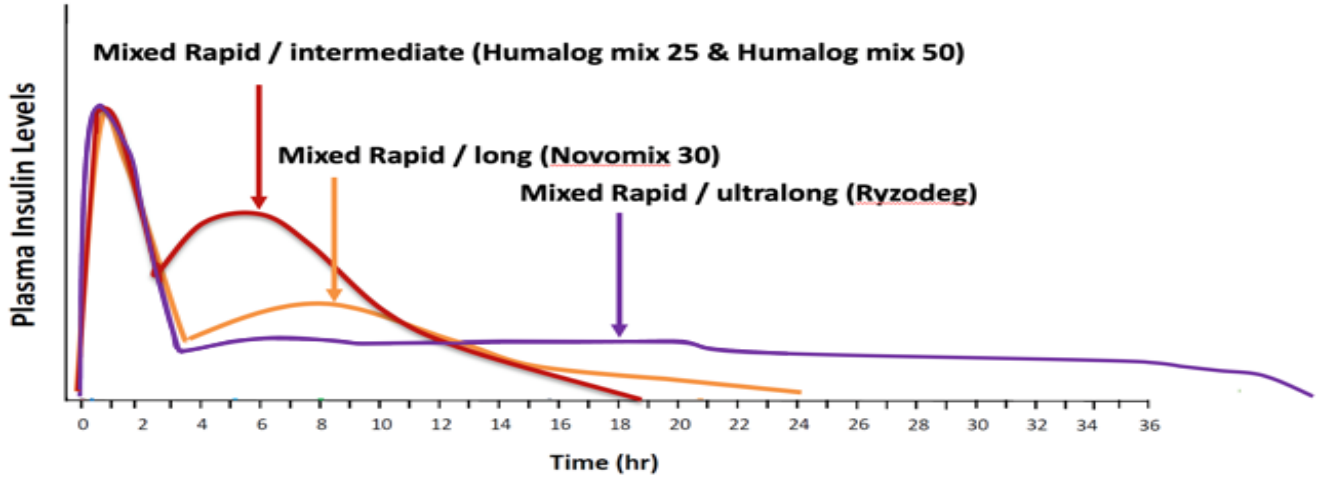
Pre-mixed Insulin

Type of Insulin	Administration	Brand Name	Action Profile	Drug preparation	
				Vial	Pen fill
Pre-Mixed Insulin	30 minutes before meal or specified Up to 2 times/ day	Mixtard 30 (30% Actrapid & 70% Protaphane)	Onset: 30 mins Peak: 2 to 8 hours Duration: 24 hours		
		Humulin 70/30 (30% Humulin R & 70% Humulin N)	Onset: 30 mins Peak: 2 to 12 hours Duration: 16 to 18 hours		



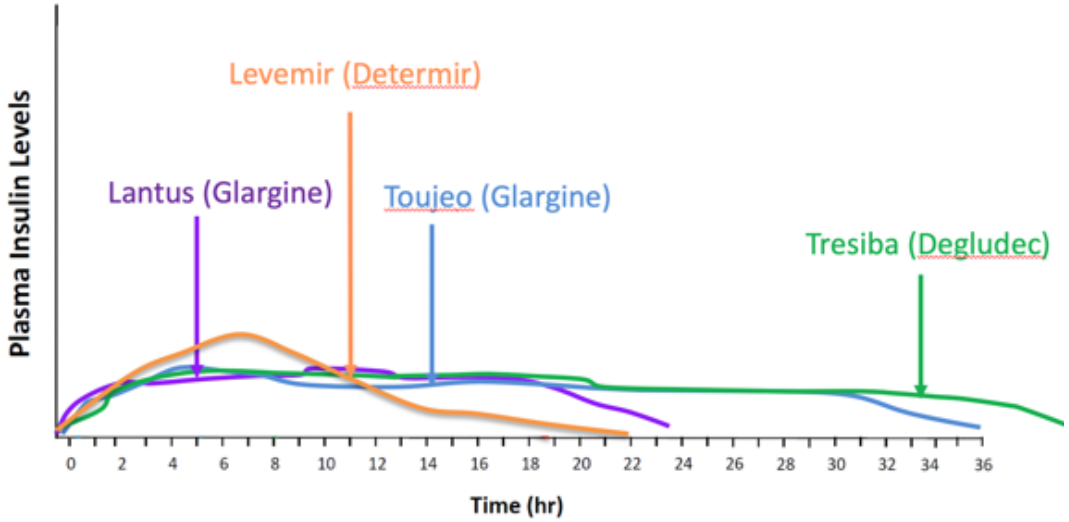
Pre-mixed insulin analogue

Type of Insulin	Administration	Brand Name	Action Profile	Drug preparation	
				Vial	Disposable pen
Pre-mixed insulin analogue	• 0-15 mins before meal • Up to 3 times/ day	NovoMix30 FlexPen (30% Aspart & 70% Protaminated Aspart)	Onset: 10 to 20 mins Peak: 1 to 4 hours Duration: 24 hours	NA	
	• 0-15 mins before meal • Up to 2 times/ day	Humalog Mix 25 (25% Lispro & 75% Lispro Protamine)	Onset: less than 15 mins Peak: 1 hour Duration: 16 to 18 hours	NA	
		Humalog Mix 50 (50% Lispro & 50% Lispro Protamine)	Onset: within 15 mins Peak: 1 hour Duration: 16 to 18 hours	NA	
	• 0-15 mins before meal	Ryzodeg (Aspart 30% & Degludec 70%)	Onset: 14 mins Peak: 72 mins Duration: 24 hours	NA	



Long-Acting Insulin Analogue

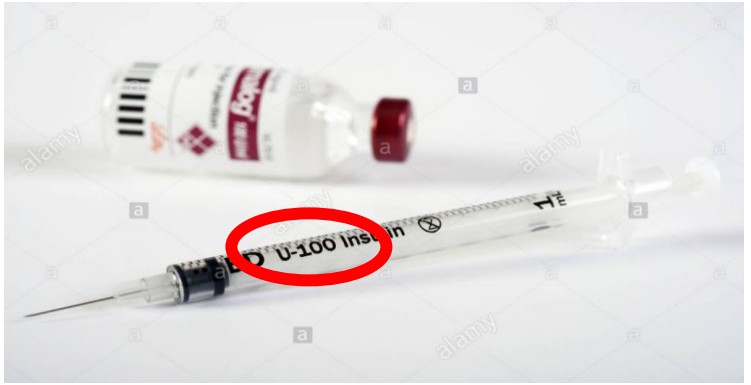
Type of Insulin	Administration	Brand Name	Action Profile	Drug preparation	
				Vial	Disposable pen
Long-Acting Insulin Analogue	OM or Nocte or specified once daily	**Levemir (Detemir)**	Onset: 3-4 hours Peak: 3-9 hours Duration: 6-23 hours	NA	
		Lantus (Glargine)	Onset: 3-4 hours Peak: no pronounced peak Duration: 24 hours		
		Tresiba (Degludec)	Onset: ~ 1 hour Peak: 9 hours Duration: 42 hours	NA	
		Toujeo SoloStar (300U/ml) Concentrated Insulin	Onset: 6 hours Peak: no peak Duration: 24-36 hours	NA	



Learn more about insulin
- Do you know the ‘unit’ of insulin?

- The unit of weight is “kilogram, kg” or “pound, lb”, whereas
- The unit of measurement used in insulin therapy is “international units, IU” (In pharmacology, the **international unit** (**IU**) is a unit of measurement for the effect or biological activity of a substance, for the purpose of easier comparison across similar *forms* of substances.)

Learn more about insulin - Insulin concentration



Insulin is available in different strengths; the most common is U-100

- U-100 = 100 units of insulin in 1 ml
- U-300 = 300 units of insulin in 1 ml
- U-40 = 40 units of insulin in 1 ml

Be certain to match your insulin strength with the correct size syringe

HA warehouse supplying insulin syringe is "U-100"

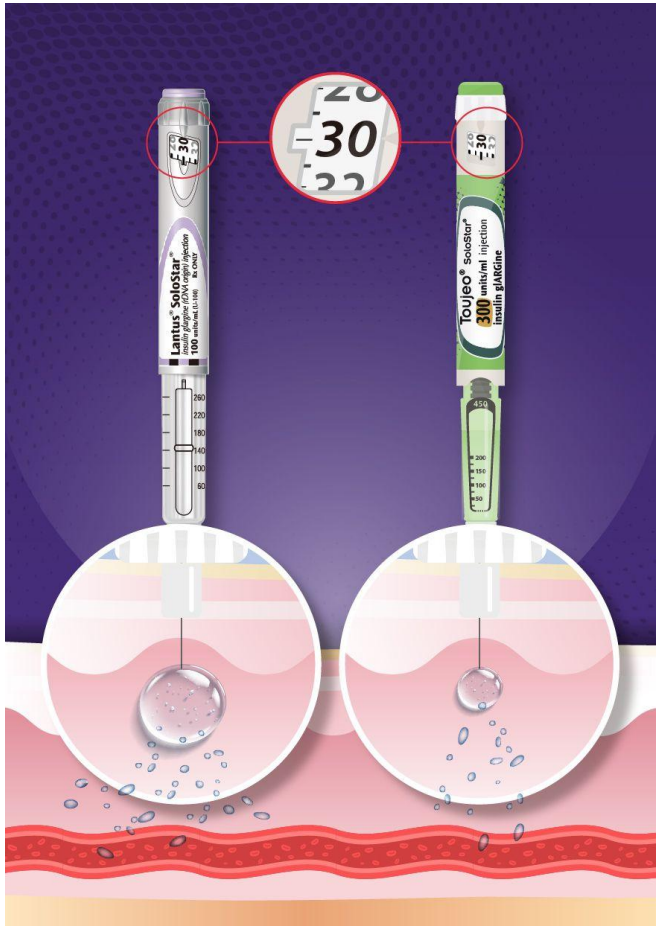
HA drug formulary in the past years, only got U-100 insulin

➢Be alert! Insulin U-300 (Toujeo) is available now!

Learn more about insulin - Concentrated Insulin

CPO introduced concentrated insulin **Toujeo** (insulin glargine) **300 units/ml** SoloStar **injection pen** to HADF in Mar 2024

Insulin Glargine (Toujeo) 300 units in 1mL



<u>Clinical benefit for concentrated insulin:</u>

- ↓ volume
- ↓ painful
- ↓ risk of lipohypertrophy

Content

- Learn more about Insulin
- How to give insulin safely
- Insulin Injection skill
- Adverse effect of insulin therapy
- Other DM Injectable (incretins) - Glucagon-like Peptide 1 Receptor Agonist

Rights of Insulin Administration

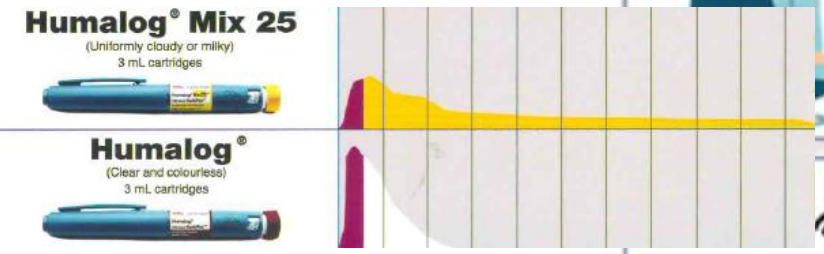
- Right Patient
- Right Drug
- Right Dose
- Right Time
- Right Route

\+

- Right Injection Device

HA Guidelines on Safe Medication Management - Prescribing, Dispensing and Administration

Right Drugs – beware of looks alike, sounds alike



Humalog vial instead of Humalog Mix25 pen was prescribed and administered

1

- M/77 with lung cancer and DM was suggested for Humalog Mix 75/25 (16u before breakfast; 8u before dinner) by Endocrine Team.

2

- Humalog vial instead of Humalog Mix25 pen was prescribed in the IPMOE, and a dose of 16u Humalog was administered.

3

- The error was detected by DM nurse during an insulin injection education referral.

4

- Fortunately patient's blood glucose levels remained stable

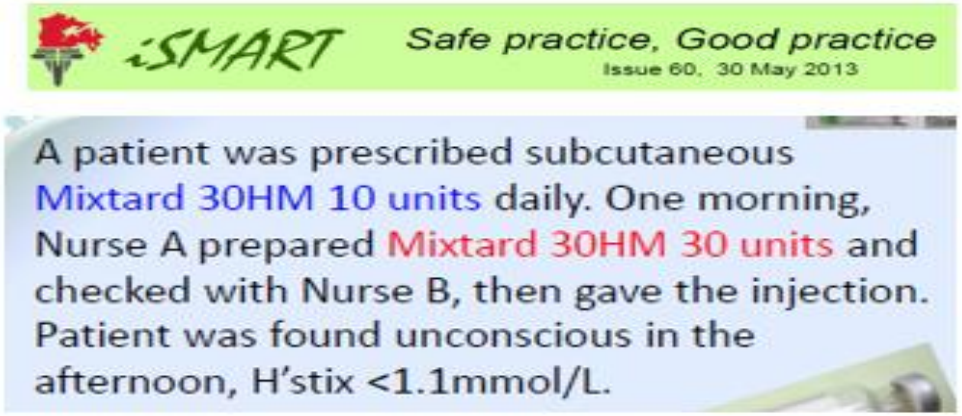
Right Dose – beware of looks alike, sounds alike

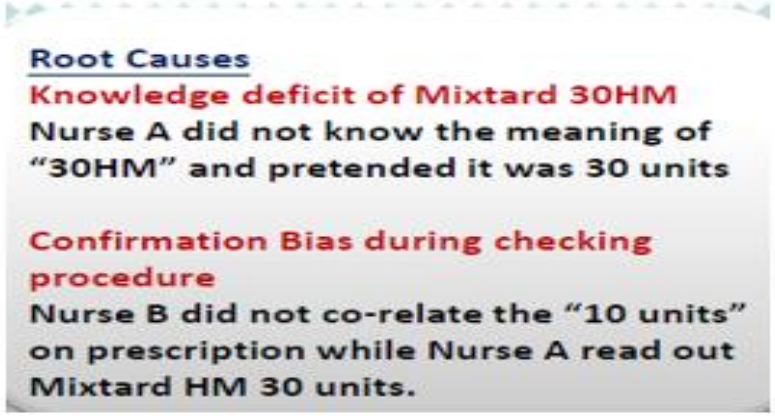
- Mixtard 30HM 10 units om mistaken as

  “30 units om”

- HumalogMix50 25units om mistaken as

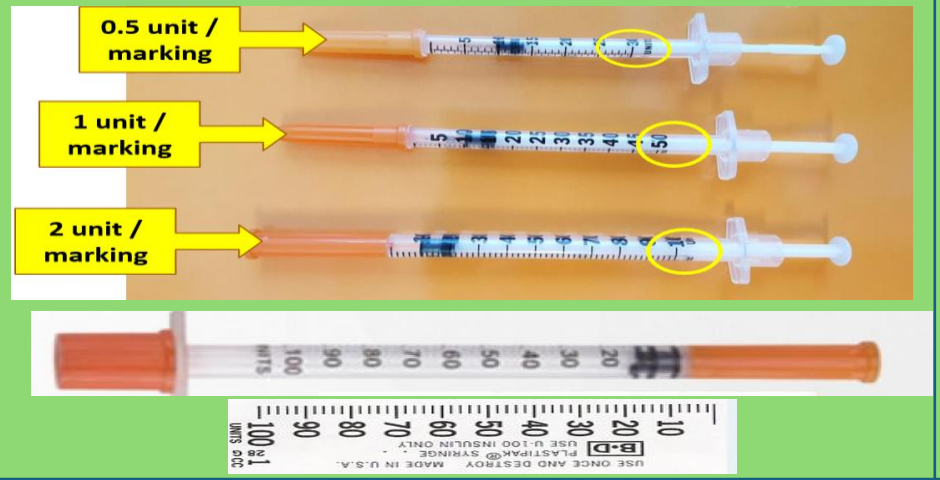
  “50 units om”





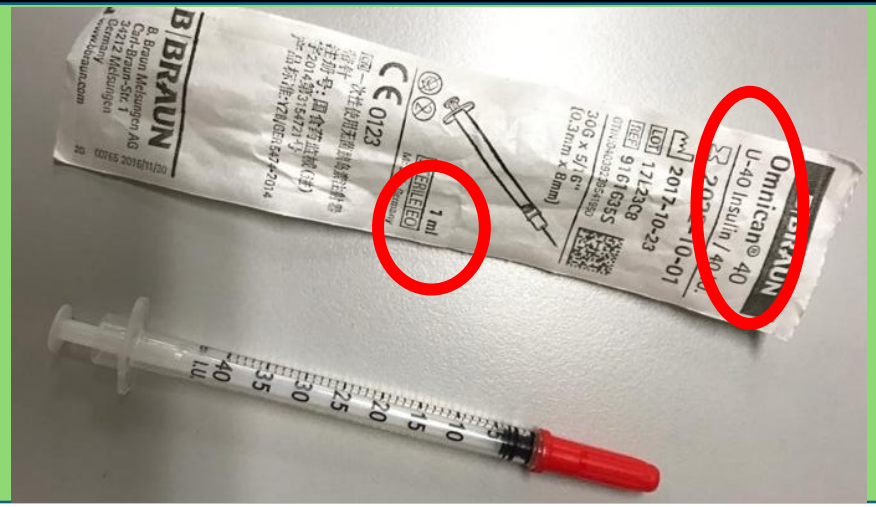
Right Dose - Insulin Syringe U-100 vs U-40

U-100
(0.3/0.5/1ml)



Insulin syringe **(U-100)** is used to draw insulin **(U-100)** from insulin vial

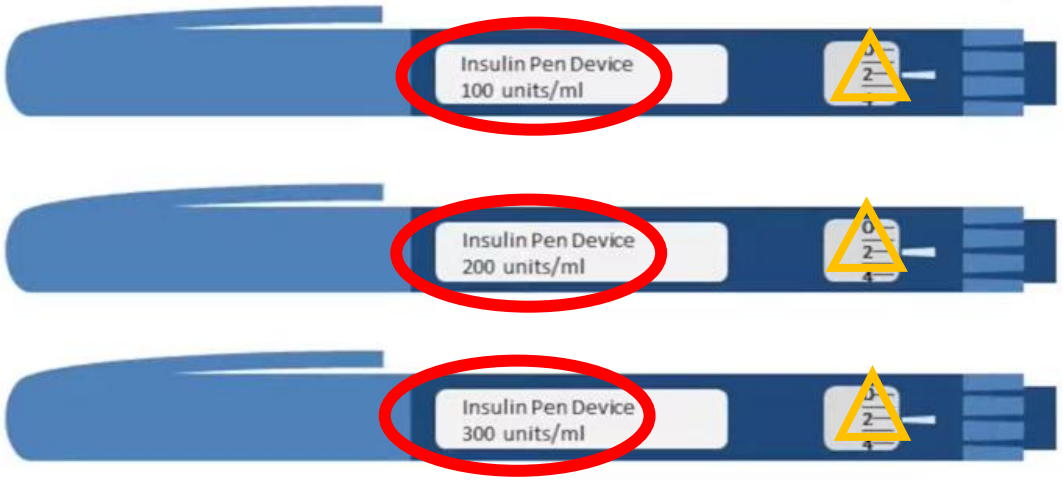
U-40
(1ml)



IMPORTANT

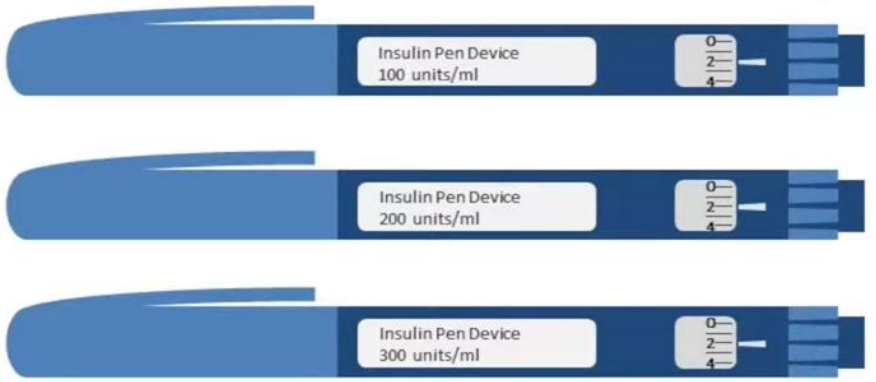
SHOULD NOT use U-40 syringe to withdraw insulin from U-100 insulin vial
-> WRONG DOSAGE!!!

Risk of different concentrations of insulin available



This is NOT a problem if the pens are used correctly in the normal way because the dial on the pen is calibrated to give the correct dosage in units

However, if you use an U-100 insulin syringe to withdraw insulin from the pen it can cause SERIOUS problems



0.2ml = 20 units of insulin

0.2ml = 40 units of insulin

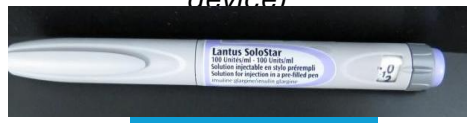
0.2ml = 60 units of insulin

Safety Measures in HA (A Risk Management Newsletter for Hospital Authority Healthcare Professionals. (2017). Risk Alert, 44)

Current safety measures applied to ALL insulin preparations in penfill and prefilled pen in HA

- The practice of using syringe to withdraw insulin from penfill or prefilled pen is **NOT allowed**
- The availability and correctly use of pen needle will be assured for the correct dosage in administrating insulin via penfill or prefilled pen

Insulin penfill cartridge
(to be used with corresponding insulin pen device)



Insulin prefilled pen

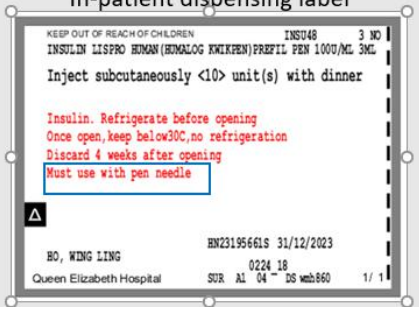
◆ ALL **prefilled-pen & penfill** insulin preparations with warning statement on drug label

"Must **use with pen needle**" = 『必須配以注射筆針頭使用』

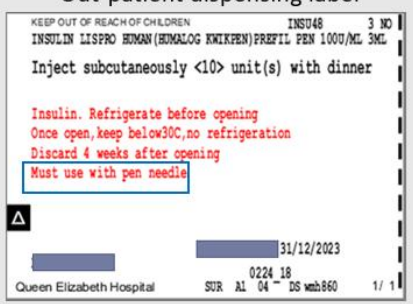
Prefilled Pen

e.g. Humalog Kwikpen prefill pen

In-patient dispensing label



Out-patient dispensing label

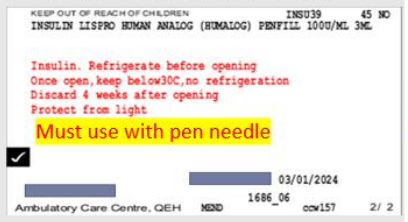


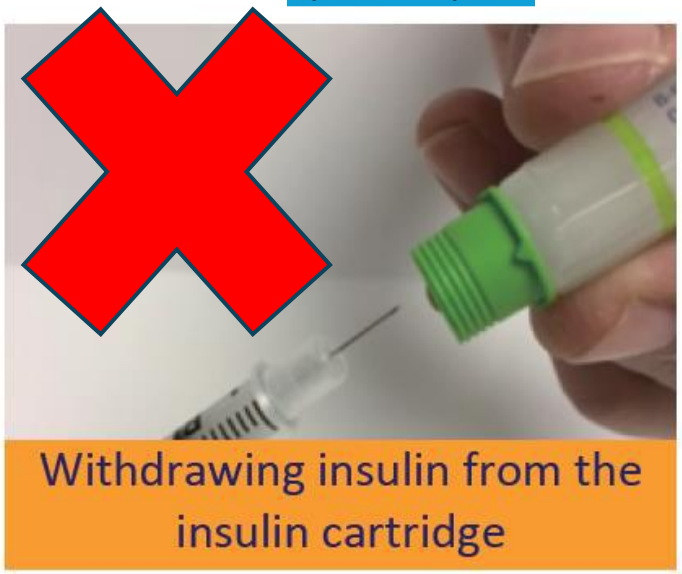
Penfill

e.g. Humalog Penfill

In-patient dispensing label

Out-patient dispensing label



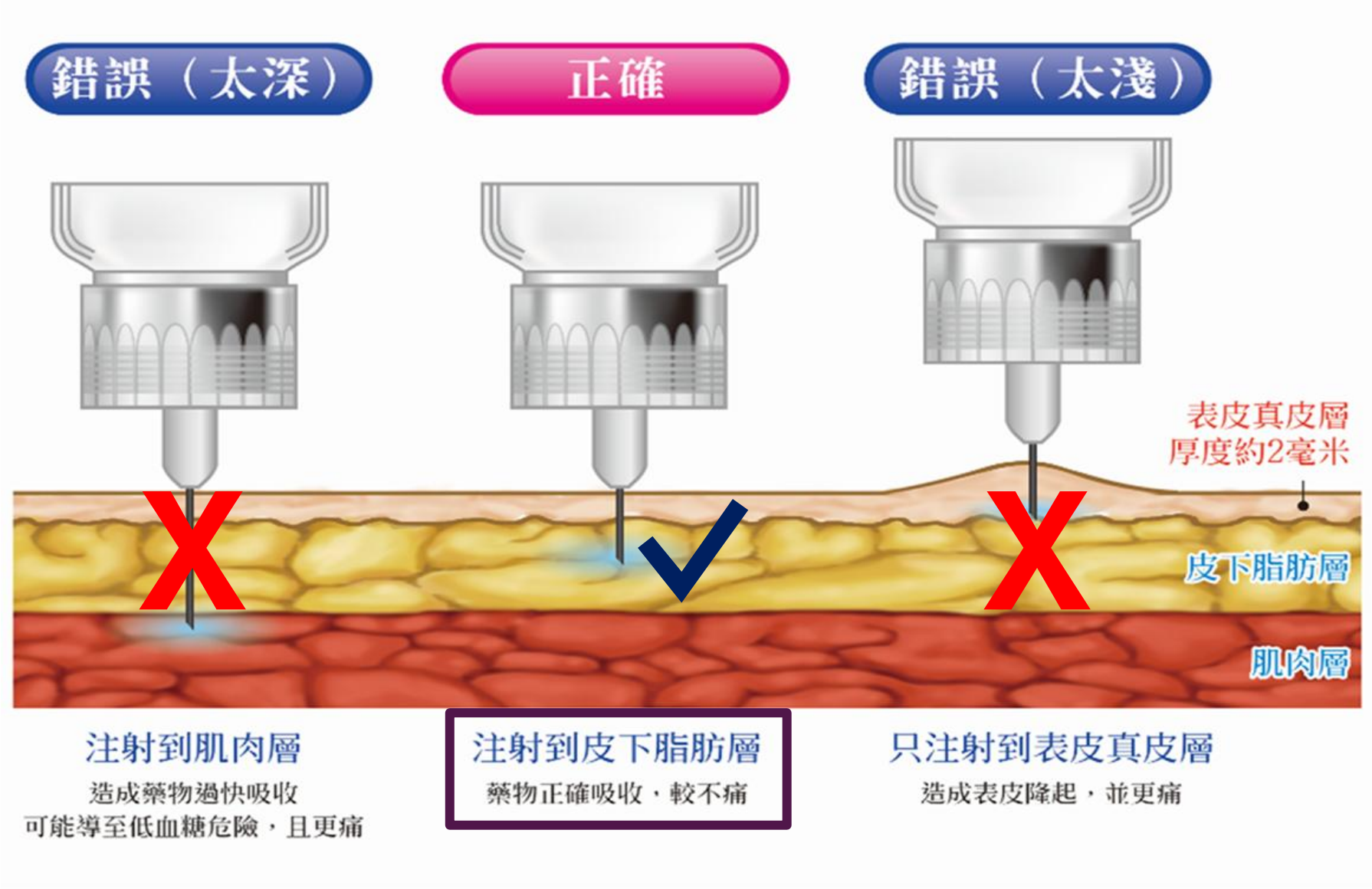


Withdrawing insulin from the insulin cartridge

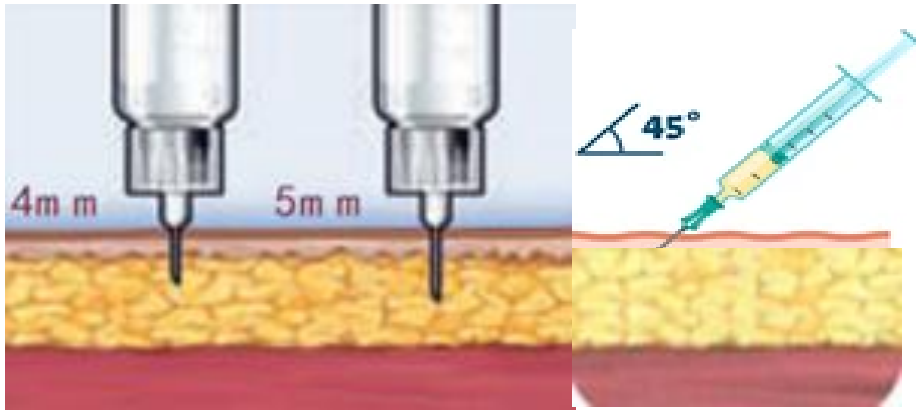
Right Time

- Bolus insulin
  - Rapid acting eg NovoRapid, Humalog -> 0-15mins before meals
  - Short acting eg Actrapid, Humulin R -> about 30mins before meals
  - Premixed insulin eg Mixtard 30, Humulin 70/30 -> about 30mins before meals
  - Premixed insulin analogue eg NovoMix 30, HumalogMix 25, HumalogMix 50, Ryzodec -> 0-15mins before meals
- Basal insulin
  - Once daily -> fix time every day e.g. Lantus or Tresiba
  - Twice daily -> ~ 30mins before b'fast and dinner e.g. Protaphane or Humulin N
- Correction insulin with sliding scale – should be matched with h'stix

Right Route


錯誤（太深）
正確
錯誤（太淺）
表皮真皮層
厚度約2毫米
皮下脂肪層
肌肉層
注射到肌肉層
造成藥物過快吸收
可能導至低血糖危險，且更痛
注射到皮下脂肪層
藥物正確吸收，較不痛
只注射到表皮真皮層
造成表皮隆起，並更痛

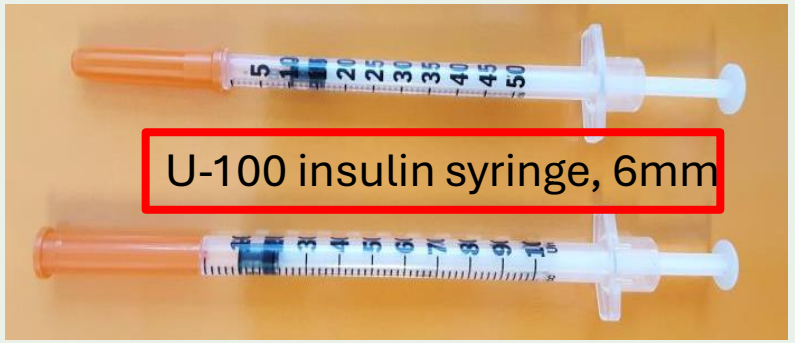
Different Needle Lengths



31G x 6mm
For subcutaneous injection

29G x 13mm
For other purpose eg add additive to bottle

Right Injection Devices

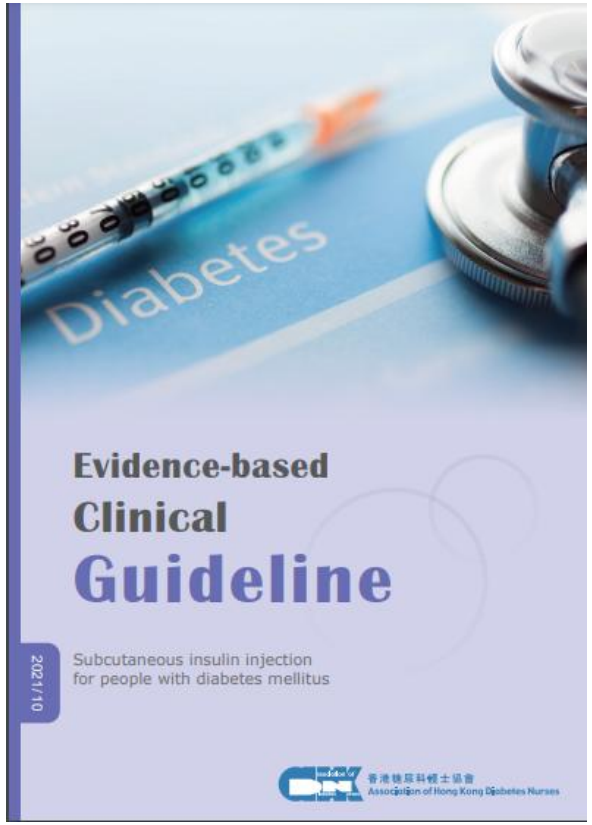
Vial (U-100)		
Penfill Cartridge		Novo Pen   Huma Pen  
Prefilled Pen	 	  4mm or 5mm

Content

- Learn more about Insulin
- How to give insulin safely
- Insulin Injection skill
- Adverse effect of insulin therapy
- Other DM Injectable (incretins) - Glucagon-like Peptide 1 Receptor Agonist

Subcutaneous insulin injection

- http://ahkdn.com/wp-content/uploads/2021/12/Injection-guidelines-20211109_eng.pdf

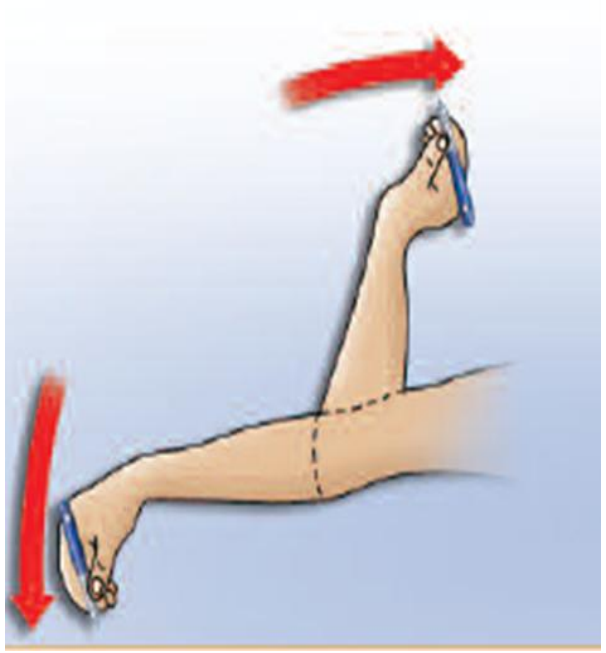


VIAL INSULIN

- Roll between palms 20 times

INSULIN PEN

- TIPPING “UP AND DOWN 180^{0}” 20 TIMES



A patient is giving Protaphane with an insulin pen. He had increased hypoglycemic attacks every time starting a new penfill.

Why?

Review technique:
Patient is shaking his insulin pen 2-3 times before injection.

Cloudy insulin must be well mixed before injection

Hospital Authority

Hospital Authority Specialty Advisory Group, Endocrinology (2018)

Procedure of insulin injection (Insulin pen)

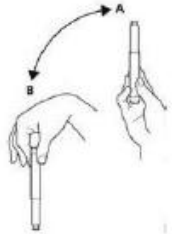
1

Clean hands. Prepare materials: insulin injection pen,+/- penfill insulin, pen needle and alcohol swab

2

Ensure the correct name of insulin, before expiry date and no abnormalities such as clumps or discolouration

3



Tip cloudy insulin up and down to 180° at least 20 cycles

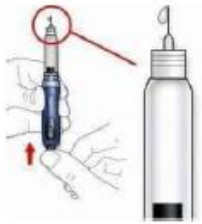
4

Clean the rubber membrane of the penfill insulin by alcohol swab. Screw on a new pen needle

5

Dial 1 to 2 units of insulin

6



Press the dose button for tesing. Repeat steps until a drop of insulin dripping out

7

Dial to the prescribed dose of insulin

8

Assess and confirm a suitable injection point. If necessary, pinch up a skin fold by using 2 fingers

9

Clean skin and wait till dry.Insert the pen needle compeletly into skin at 90°. Press the dose button until the display window shown "0"

10

Keep the pen needle in situ for at least 10 seconds

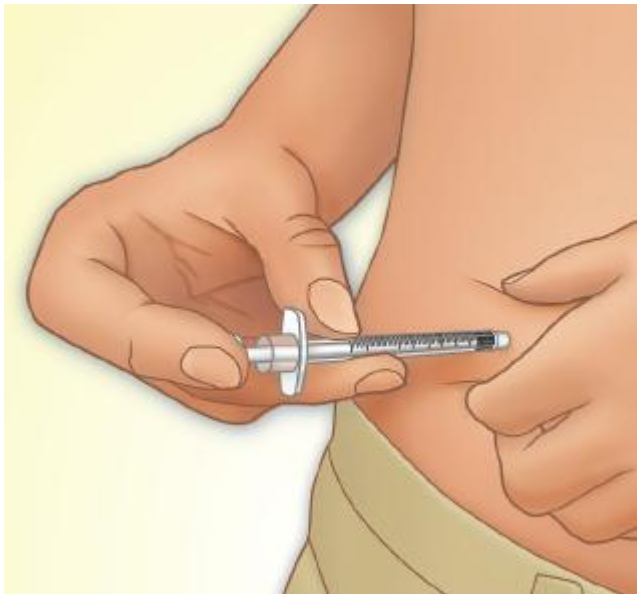
11

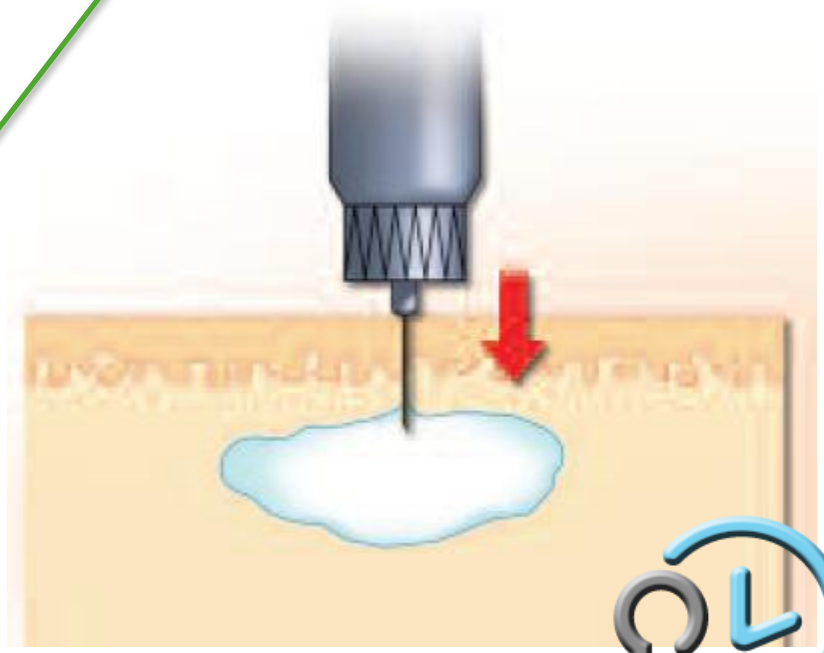
Withdraw the needle at the same angle. Press the injection point gently and avoid massage

12

Di
co

Injection hold-in time





10s or more

Appropriate Injection Technique

Recommendations for Subcutaneous Insulin Injection

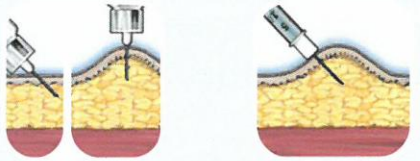
Use the shortest available needles (4mm pen needles / 6mm insulin syringes) for both adults & children[1,2,3,4,7]

4mm pen needle

Adults | Slim adults (BMI<19)

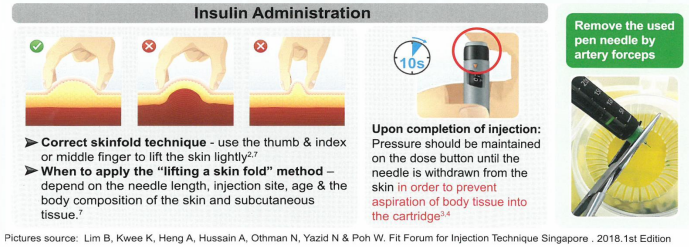
6mm insulin syringe

Adults[1] | Slim adults(BMI<19)[1,2,]



Adults[1,2,3,4,5,7]

- inject at a 90-degree angle or
- inject into a skin fold at a 90-degree angle for the slim adult (BMI<19) to prevent IMI



- **Correct skinfold technique** - use the thumb & index or middle finger to lift the skin lightly[2,7]
- **When to apply the "lifting a skin fold" method** – depend on the needle length, injection site, age & the body composition of the skin and subcutaneous tissue.[7]

Upon completion of injection: Pressure should be maintained on the dose button until the needle is withdrawn from the skin in order to prevent aspiration of body tissue into the cartridge[3,4]

Pictures source: Lim B, Kwee K, Heng A, Hussain A, Othman N, Yazid N & Poh W. Fit Forum for Injection Technique Singapore . 2018.1st Edition

4mm pen needle

Children (2-6 yrs) | Children (>6 yrs) & Teens (slim) | Children (>6 yrs) & Teens

2 to 6 years / slim children & teens[2,3,7,8,9]

- Inject into a skin fold at a 90-degree angle to prevent IMI

>6 years old & teens[2,7]

- Injects at a 90-degree without a skin fold

6mm insulin syringe

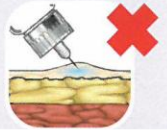
Children (2-6 yrs) | Children (>6 yrs) & Teens (slim) | Children (>6 yrs) & Teens

All children and teens[1,2]

- Inject with a 6mm insulin syringe into a skin fold at a 45-degree angle

Photo source:Fit Forum for Injection Technique Canada Recommendations (2016)

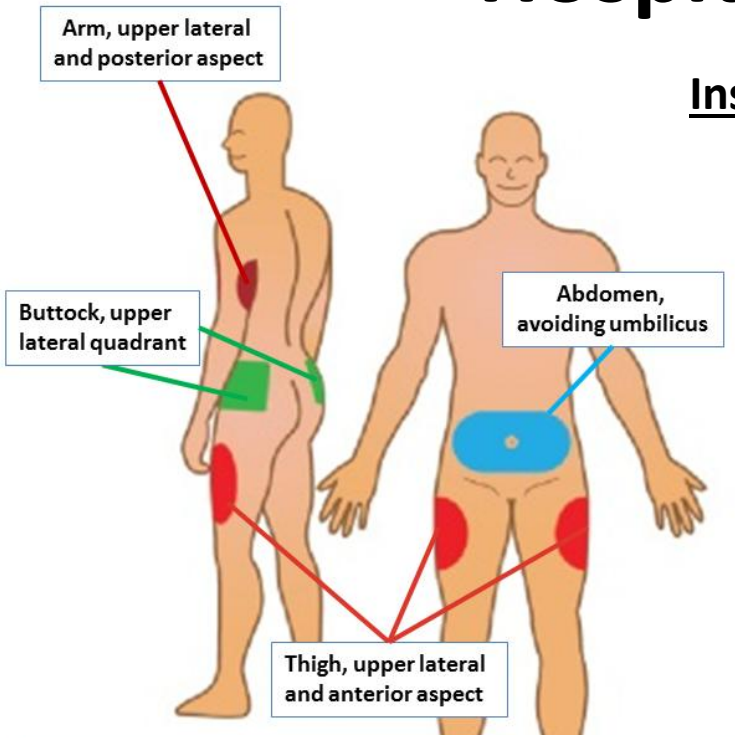
If using a 4 mm pen needle (in both adults and children), it should be **inserted perpendicularly into the skin, and not at an angle regardless of whether a skinfold is raised** (to prevent intradermal injection)[2,3,4,5]

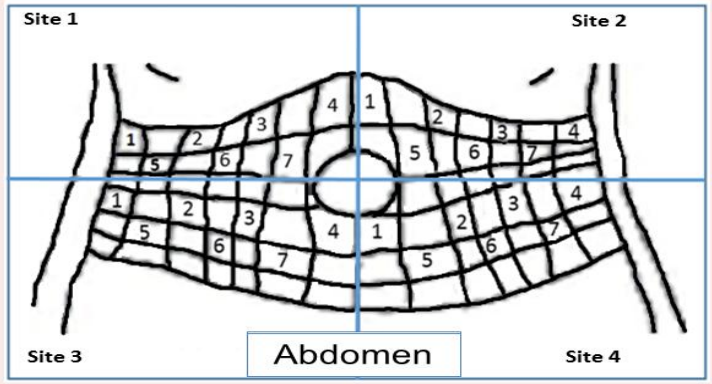


Hospital Authority

(Draft 1: 04/11/2016)

Insulin Injection Site





Change injection point every time, Rotate injection site regularly

Recommended injection area

- Abdomen, avoiding umbilicus
- Thigh, upper lateral and anterior aspect
- Buttock, upper lateral quadrant
- Arm, upper lateral and posterior aspect

A systematic rotation scheme for injection

1. Divide injection area into 2 to 4 injection sites
2. Inject in the same injection site at different injection points. There should be 1 inch to be apart from two injection points
3. Injection points should be rotated in the same area when using the same type of insulin
4. Regularly rotate injection site, (for example : weekly) from site 1 to site 2, site 3

Consideration

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

Safety removal of Pen needle

Safety Pen Needle
for Nurse Use

Conventional Pen Needles
For Patients or HCPs Use

Insulin practicalities

Storage

- Refer to storage guideline
- Must never be frozen
- Store away from source of heat
- If refrigeration not available, should issue vial / penfill for one month at one time

Mixing insulins

- Actrapid and Protaphane / Humulin R and Humulin N can be mixed without changing properties (not applicable for pen injection)
- Lantus cannot be mixed with any other types of insulin
- Check with the manufacturer before mixing any other insulin
- Nowadays, the practice “mixing of insulin” is not recommended

Take home message

- Good practice for insulin administration
- ‘Five’ rights + right device
- Proper pen needle disposal, avoid needle stick injury
- **Specialty Nursing Practice Guideline (HAHO)**
  Care of Patient with Subcutaneous Insulin Injection by Using Insulin Syringe & Insulin Pen (Version 2024)

Practice Guideline

Content

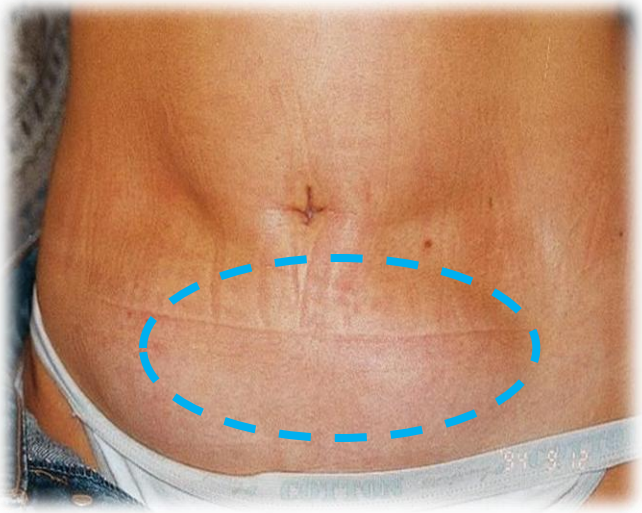
- Learn more about Insulin
- How to give insulin safely
- Insulin Injection skill
- Adverse effect of insulin therapy
- Other DM Injectable (incretins) - Glucagon-like Peptide 1 Receptor Agonist

Adverse effect of insulin therapy

- Hypoglycaemia
- Weight gain
- Lipoatrophy / lipohypertrophy
- Allergic reaction

Lipodystropy

Lipoatrophy 組織委縮



Lipohypertrophy 組織肥大

What is Lipohypertrophy?

- An accumulation of subcutaneous fat in response to the adipogenic actions of insulin at a site of multiple injections

(American Diabetes Association, 2025)

- Common complication of insulin therapy in subcutaneous tissue observed in patients with diabetes

(Richardson and Kerr, 2003)

- Associated with the lipogenic action of insulin at the site of injection and repeated trauma related to performing insulin injection at same site

(Barola et al., 2018)

Global Prevalence of Lipohypertrophy

Ultrasound scanning

- Median: 56.6%

(Abu Ghazaleh et al., 2018)

Observation and Palpation

- Overall: 41.8%
- Regional-wise analysis:
- Europe: 44.6%; Asia: 41.3%; Africa: 34.8%

(Wang, Zhang, Liu & Chen, 2021)

Local Prevalence of Lipohypertrophy

- Retrieved from Public Hospitals and clinics - MRAM
- Period: 01.04.2020 to 31.03. 2021
- 13.4 - 25.6% patients with lipohypertrophy noted
- 23,786 insulin users

Predisposing factors of Lipohypertrophy

Incorrect insulin injection technique

- Lack of proper site rotation
- Needle reuse

Insulin regimen

- High daily insulin dose
- Long insulin treatment duration
- Multiple injections
- Use of Human insulin

Consequences of Lipohypertrophy

Injection insulin into lipohypertrophy lesion will lead to:

- Unpredictable absorption profile of insulin

  (Famulla et al., 2016)

- Increase risk of severe hypoglycaemia

  (Famulla et al.,2016; Gentile et al.,2018; Johansson U-B et al., 2005; Xu et al., 2021

- Increase risk of adverse clinic outcomes and raise the healthcare cost

  (Campinos et al., 2017)

Prevention of Lipohypertrophy

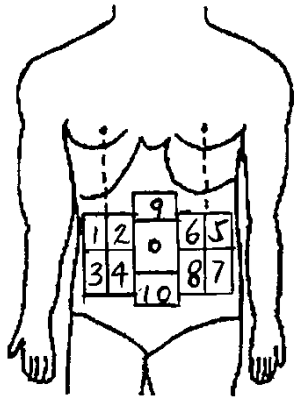
- Educate patient how to identify LH, correct injection technique, systematic site rotation and stop needle reuse

(Strolls, Santa Gentile, 2022)

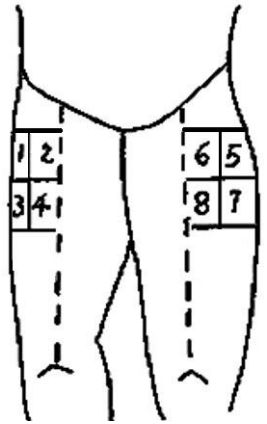
- Aware health care professions of ongoing assessment of injection sites

(Tian et. al., 2023)

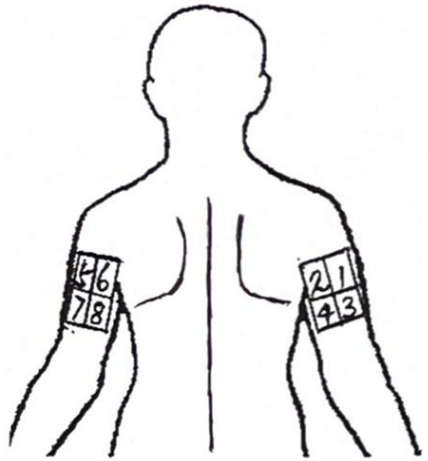
皮下脂肪増生位置圖



腹部
A1-A10

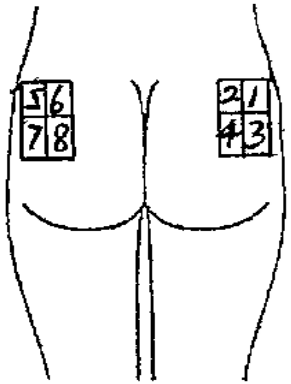


大腿
T1-T8



左手
Ua5-Ua8

右手
Ua1-Ua4



臀部
B1-B8

For documentation eg A4 (2x3cm)

Content

- Learn more about Insulin
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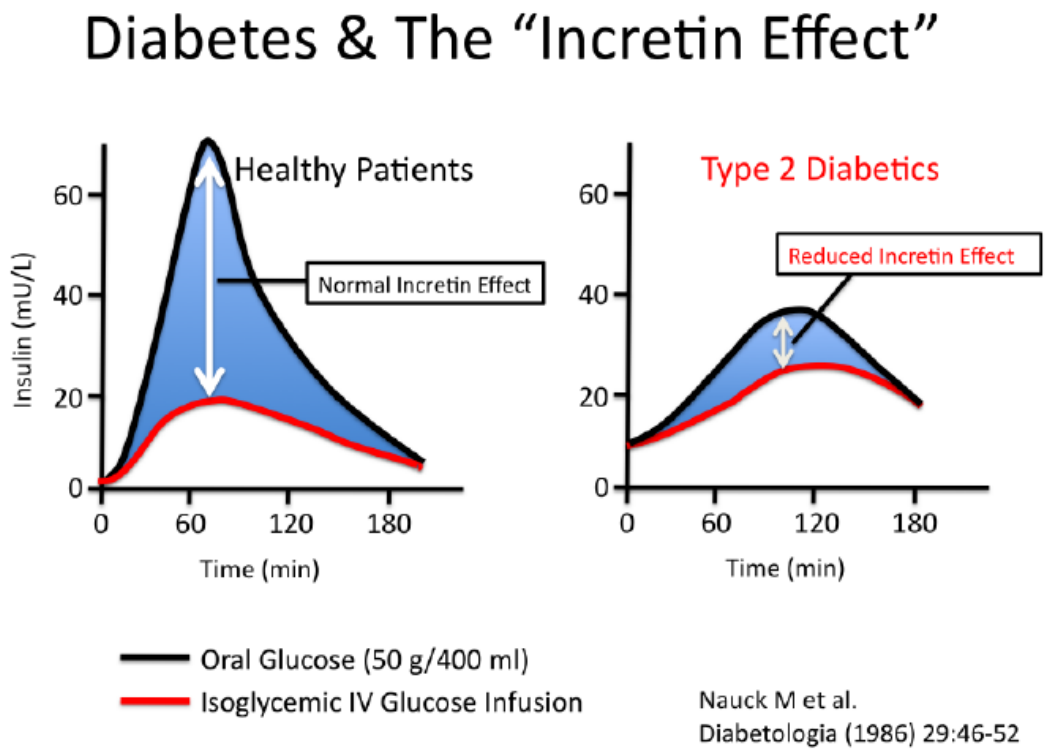
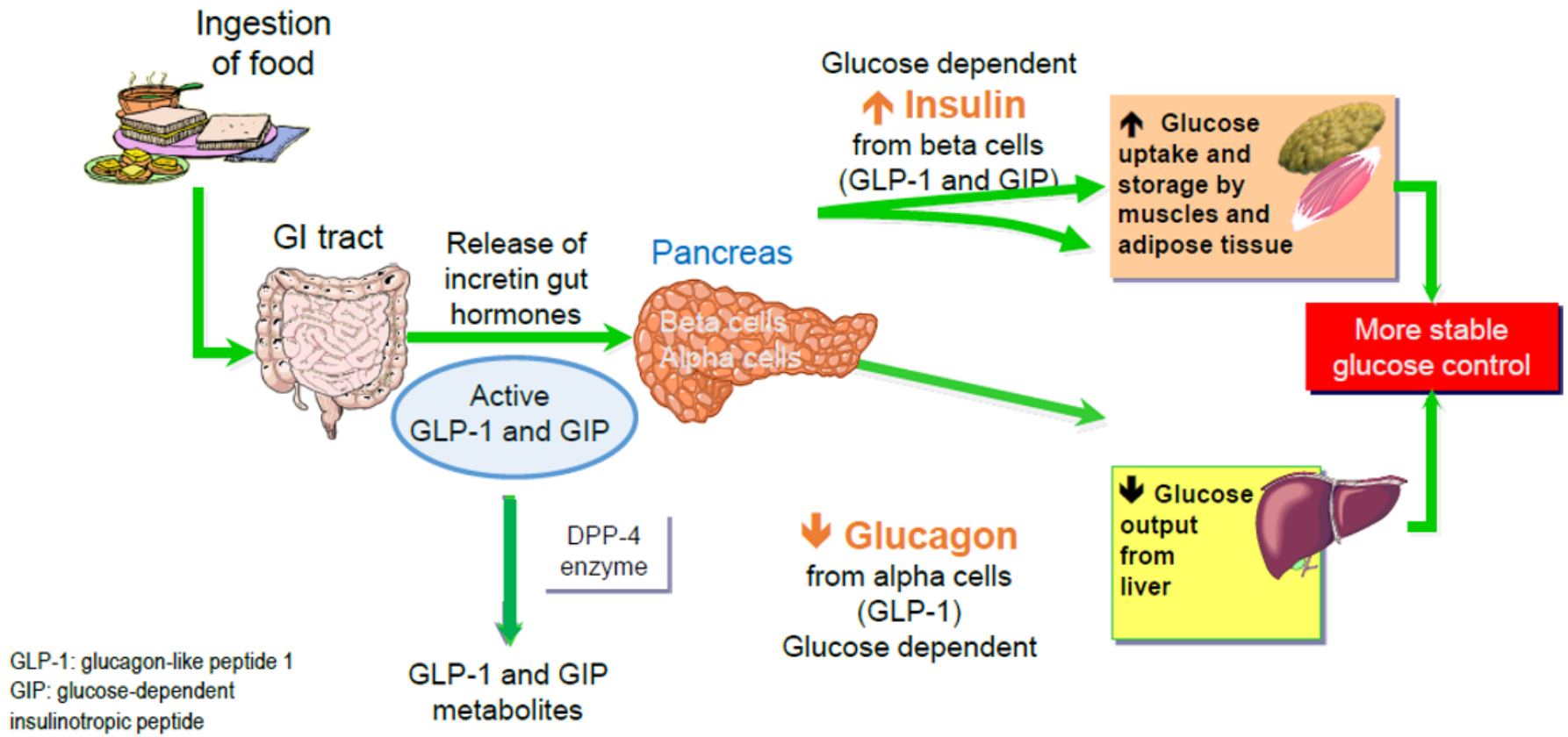
INCREASE SECRETION OF INSULIN



Action of Glucagon Like Peptide 1 (GLP-1) and Glucose-dependent Insulintrophic Peptide (GIP)



GLP-1: glucagon-like peptide 1
GIP: glucose-dependent insulinotropic peptide

Incretin axis is abnormal in T2DM : reduced release of GLP-1
reduced response to GIP

GLP1-RA / GLP1-RA + Basal Insulin Fixed Dose Combinations

Once weekly	Once daily	Basal insulin fixed dose combo
Dulaglutide (Trulicity®) 	Liraglutide (Victoza®) 	Insulin Degludec / Liraglutide (Xultophy®) 
Semaglutide (Ozempic®) 		Insulin Glargine / Lixisenatide (Soliqua®) 
Exenatide Extended Release (Bydureon Bcise®) 		

Injection Skill Demonstration

Where you can find the resources?

KCC -> QEH -> CND -> virtual library -> Endocrinology -> Nurse Empowerment -> Videos

- Demonstration of Pen injection
- Safety removal of Pen needle

HAGo prescription

Thank you