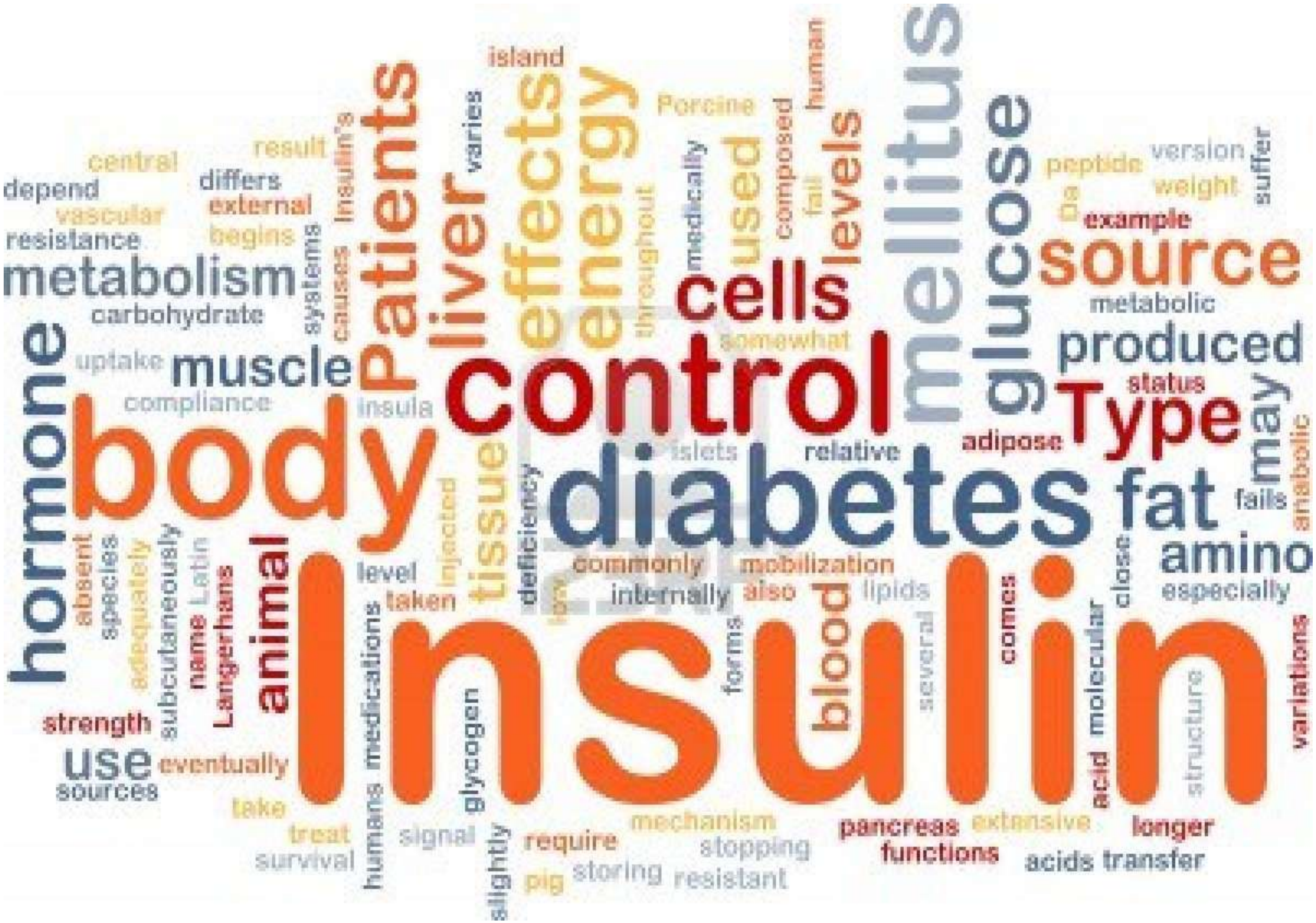

Insulin
diabetes
control
body
mellitus
glucose
source
Patients
liver
effects
energy
cells
levels
used
Type
fat
amino
produced
hormone
metabolism
muscle
animal
blood
tissue
island
Porcine
human
result
central
differs
depend
external
vascular
begins
resistance
carbohydrate
uptake
compliance
insula
varies
Insulin's
systems
causes
throughout
medically
composed
fail
version
peptide
weight
suffer
example
metabolic
somewhat
status
may
adipose
relative
islets
fails
anabolic
deficiency
injected
level
taken
commonly
mobilization
internally
also
lipids
especially
close
comes
molecular
acid
structure
variations
several
forms
absent
species
adequately
subcutaneously
Latin
name
Langerhans
strength
use
sources
eventually
take
treat
survival
signal
humans
medications
glycogen
slightly
require
pig
storing
mechanism
stopping
resistant
pancreas
functions
extensive
longer
acids
transfer

Insulin

- An aqueous hormonal solution made in the pancreas.
- Affects metabolism by allowing glucose to leave the blood and enter the body cells, preventing hyperglycemia.
- It is measured in units, e.g. 100 U per ml.
- it is available as
    1. 40U / ml ……. Used mainly for pets in the U.S.
    2. 100U / ml ……. The most common.
    3. 500U / ml ……. Not commercially dispensed.

Diabetes Mellitus

- Is a deficiency of insulin.
- Classified into :
  - **Type I**
    - Onset before the age of 30 years.
    - The pancreas beta cells stop producing insulin.
    - Insulin injection must be taken everyday to control blood glucose level.
  - **Type II**
    - Onset after the age of 30 years.
    - The pancreas produce *some* insulin but not enough.
    - In some cases the insulin produced isn't effective .."**Insulin Resistance**"
    - 95% of the diabetic patients are type II , 40% of them take insulin injections in conjunction with oral medications.

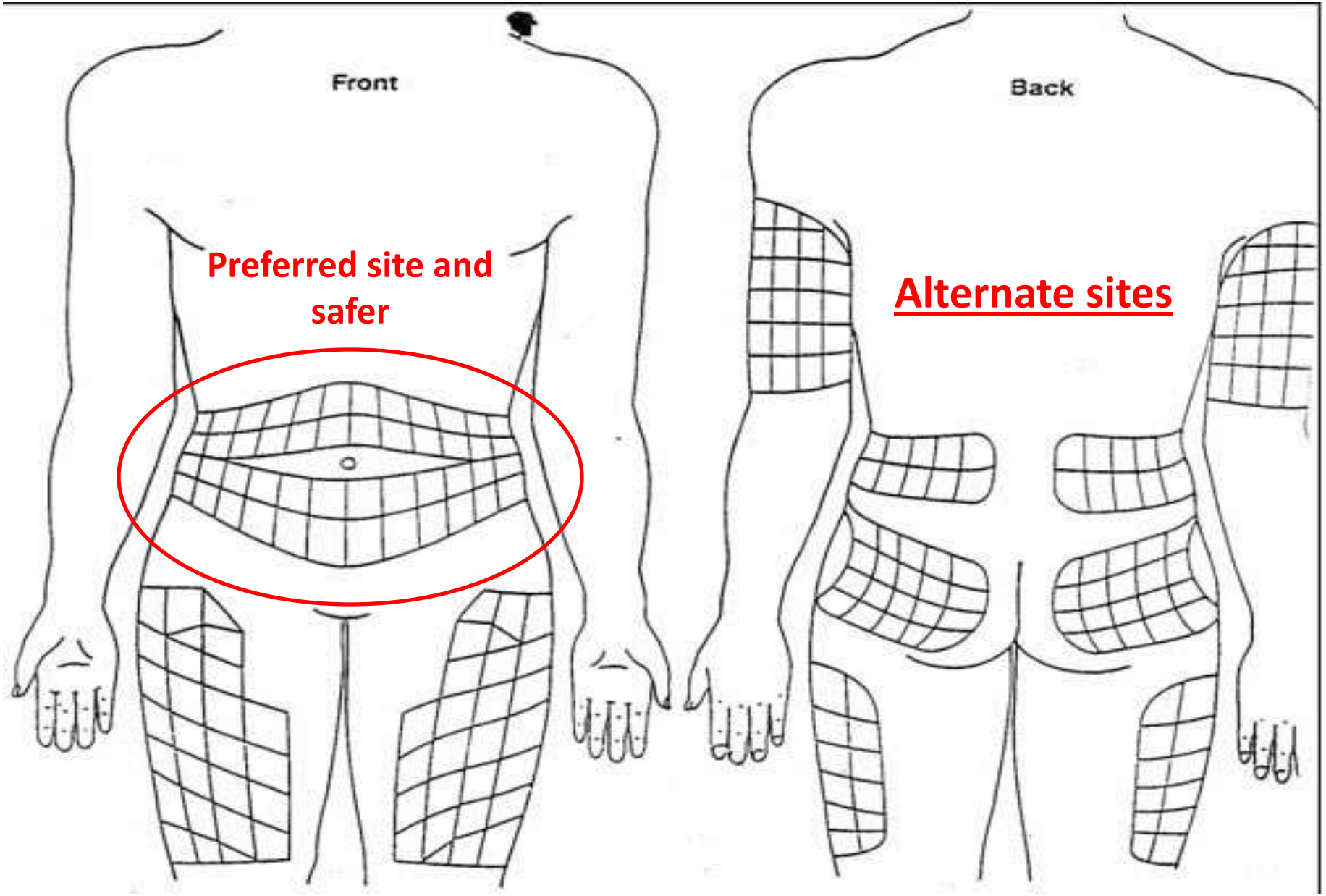
Hypoglycemia

- It is the most common complication of insulin therapy.
- Caused by:
  1. Injecting too much insulin.
  2. Missed or delayed meals.
  3. More physical activity than usual.

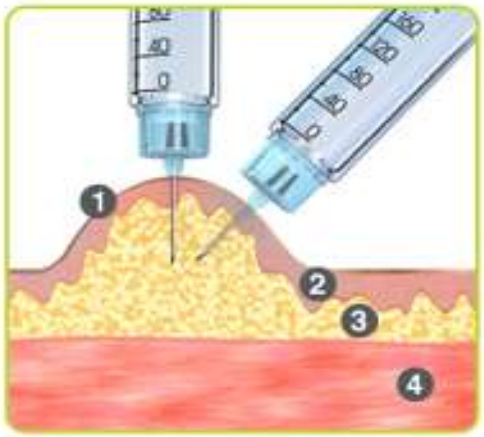
Treatment :

1. Always carry sugar in some form
2. If the patient can swallow .. Use *glucose tablets* (the ttt of choice, 5 g CHO /tablet). The American Diabetes Association recommends taking 15 to 20 g of glucose to treat hypoglycemia and retesting in 15 min.
3. At very low blood glucose level…**glucagon injection** is used.

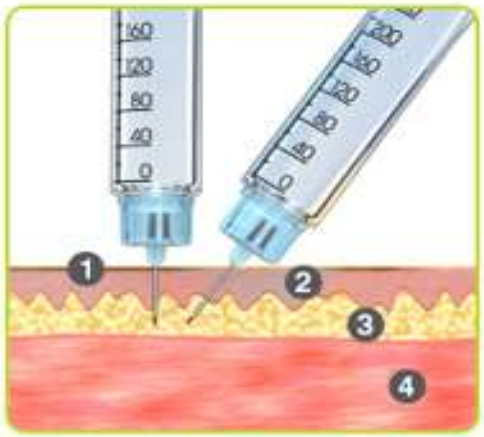
Injection Sites



How to give an insulin injection

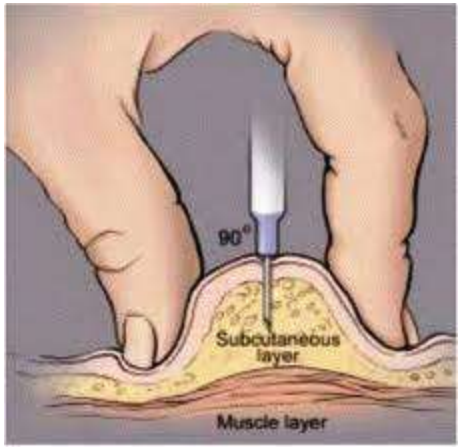


with skin fold



without skin fold

1. Epidermis
2. Dermis
3. Subcutaneous fatty tissue
4. Muscle



Species of Insulin

- ***Human Insulin:*** (the most common)
  - Biosynthetic / Recombinant DNA technology…. Bacteria genetically altered to create human insulin.
  - Semi synthetic .. Pork insulin genetically altered to produce human insulin.
- ***Beef Insulin*** … from the pancreas of cattle.
- ***Pork Insulin*** … from the pancreas of pigs.
- Beef – Pork Mixture …. Phased out

Insulin action times

- **Rapid or short** acting… Regular (R) , Lispro, aspart
- **Intermediate** acting …. Lente (L), neutral protamine hagedorn (NPH) or (N)
- **Long** acting … ultra lente (U), glargine

Onset And Duration

Type	Onset	Peak	Effective Duration	Maximum Duration
Rapid/short				
• **Humalog (lispro)**	15 min	0.5 – 1.5 h	3-4 h	4-6 h
• **Novolog (aspart)**	15 min	1-3 h		
• **Regular (R)**	½ - 1 h	2-3 h	3-6 h	6-8 h
Intermediate				
• **NPH (N)**	2-4 h	6-10 h	10 – 16 h	14-18 h
• **Lente (L)**	3-4 h	6-12 h	12 – 18 hr	16-20 h
Long				
• **Ultralente (U)**	6-10 h	10-16 h	18-20 h	20-24 h
• **Glargine (lantus)**	2 h	Peakless	24 h	24 h
Fixed combination of N & R				
• **70 % N and 30% R**	½ - 1 h	Dual	10-16 h	14-18 h
• **50 % N and 50% R**	½ - 1 h	Dual	10-16 h	14-18 h

Rapid acting Insulin

Regular insulin should be clear

intermediate acting Insulin

NPH Insulin is cloudy

Long acting Insulin

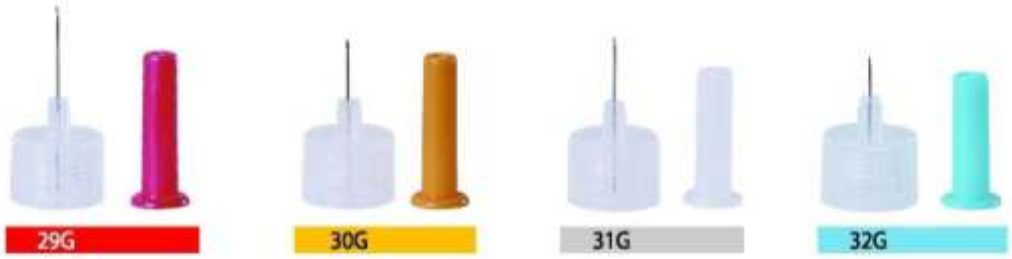
- ❑ Lantus must <u>not</u> be mixed with any other insulin or be diluted
- ❑It's not intended for IV
- ❑It's <u>clear</u> as regular insulin

Premixed Insulin

Insulin Syringe

1. **Standard U-100 (100 unit/ml)**
   Lo-dose U-100 syringe
   (30 unit/0.3ml or 50 unit/0.5 ml)

2. **Insulin pen and needles**



* Specification

Sizes	29G x 8, 13mm	30G x 8mm	31G x 5, 8mm	32G x 5, 8mm
Colors	Red	Yellow	White	Light blue

3. **Insulin pump**

used in conjunction with blood glucose monitoring and carb counting.

Insulin order

- A typical order of insulin must include:
  1. ***Name***
  2. ***Type***
  3. ***Dose or number of units***
  4. ***Time***
  5. ***Route (subcutaneous / IV)***

- ***Example :***

  Humulin R Regular U-100 insulin 14 U SC Stat

- ***Answer:***
  1. ***Name …. Humulin***
  2. ***Type…. regular***
  3. ***Dose or number of units…. 14 U***
  4. ***Time ….. Immediately***
  5. ***Route (subcutaneous / IV)…… subcutaneous***

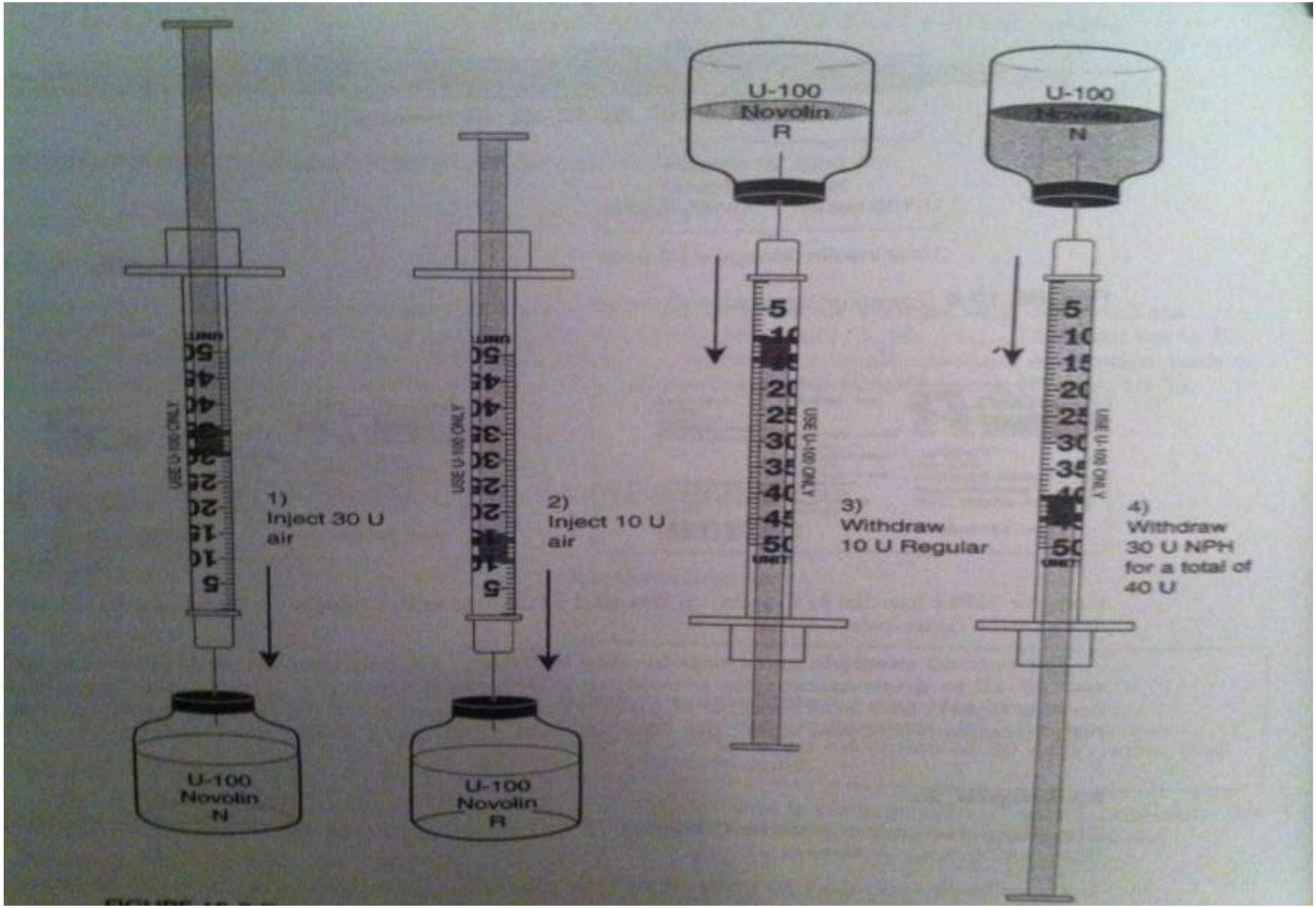
Mixing Insulin

- The patient may have two types of insulin prescribed at the same time. This gives insulin coverage within 15-20 min and lasts 14-20 hrs.
- To avoid injecting the patient twice , it's common practice to draw up insulin in the same syringe.
- **Rule:** Draw up **clear** insulin first **(regular)**
  then draw up **cloudy insulin (NPH)**
- **Only mix insulin with the same name** because there may be differing amounts and types of preservatives.
- ***Example:***

  The physician orders : Novolin R Regular U-100insulin 10 U with Novolin N NPH U-100 insulin 30 U SC ½ hr **ã** dinner

  1. Inject 30 units of air in NPH then remove the needle
  2. Inject 10 units of air in regular
  3. Turn the vial upside down and withdraw the 10 units
  4. Roll the vial of NPH in your hands to mix (don't shake), Turn the vial upside down and withdraw the 30 units.
- ***N.B. the regular vial shouldn't be contaminated with longer acting insulin,*** as a multiple dose regular vial may be used for IV infusion.

Example


1)
Inject 30 U
air
U-100
Novolin
N
2)
Inject 10 U
air
U-100
Novolin
R
U-100
Novolin
R
3)
Withdraw
10 U Regular
U-100
4)
Withdraw
30 U NPH
for a total of
40 U

Sliding Scale calculations

- A special insulin order is sometimes needed to cover a patient's increasing blood sugar level that is not yet regulated.
- only regular insulin is used due to its rapid action
- The physician will specify the amount of insulin in units that slide up or down based on a specific blood sugar level range.
- Sliding scales are individualized for each patient.
- ***Example:***

Order: Humulin R Regular U-100 insulin SC based on glucose reading at 1600

Glucose reading	Insulin dose
< 160	No coverage
160 – 220	2 U
221 – 280	4 U
281 – 340	6 U
341 – 400	8 U
> 400	15 U , call Dr.

IV Insulin Infusion

- Only **Regular** insulin is given by IV infusion.
- A piggyback infusion is always administered with an IV controlled infusion device.
- Discard the *first 2-3 ml* of combined infusion through IV tubing to prevent the insulin from binding to the tubing.
- The pharmacy standard insulin drip : ***100 Units Human Regular in 100 ml of NS***
- ***Example :***

Ordered :Regular human insulin 5 units/hr IV drip. Pharmacy has delivered 100 ml 0.9% NS with 100 U of regular human insulin.

a) How many ml/h will infuse 5U/h?

100 units ……. 100 ml

5 units …… ??? = 5ml

b) How many hours will the IV infuse?

5 ml …… 1 hr

100 ml ….. ??? = 20 hr.

Thank you