Insulin Delivery Devices

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Educational Objectives

- After viewing this program, participants should be able to:
  - Identify perceived barriers to initiating insulin therapy and assist patients in overcoming them.
  - Compare and contrast various insulin delivery strategies and assist patients in their choices.
  - Recommend the proper needle size and syringe selection for patients using insulin.
  - Describe the advantages and disadvantages of CSII therapy and provide guidance to potential candidates on the various types of devices available.
  - Discuss the various types of injection aids and insertion aids that might help a patient who has special needs.

Type 2 Diabetes: a progressive condition

- It is estimated that 50% of beta cell function has been lost by diagnosis.
- Beta cell function continues decline over time and secretagogues become less effective.
- Exogenous insulin will be required for blood glucose control.

United Kingdom Prospective Diabetes Study

Insulin...we may wait too long

- 25-30% of those diagnosed with type 2 diabetes use insulin.
- 40-50% should be.
- Barriers to insulin use:
  - Healthcare professionals
  - Patients and families

Patient Barriers to Insulin Use

- Last resort.
- Personal failure.
- Doubt clinical efficacy of insulin.
- Fear of weight gain.
- Perceived negative experience of others.
- Fear of hypoglycemia.
- Lack of self efficacy.
- Stigma of injections.
- Needle phobia.

Overcoming Psychological Insulin Resistance

- Identify personal obstacles.
- Preserve the patient’s sense of self-control.
- Enhance self-efficacy.
- Use insulin pens.
- Frame the message properly (it does not mean the patient has failed).
- Discuss the real risks of hypoglycemia.
- Tackle injection phobias.
- Pass along the good news about the benefits of IT.

Psychological Insulin Resistance: The Patient Perspective
Polonski et al The Diabetes Educator 2007 33: 241S
Overcoming Barriers

Helping patients overcome fear of injection may be made easier by:
- Proper education on efficacy of insulin
- Instructing patient on user friendly injection technique
- Demonstrating smaller needle sizes
- Using insulin pens
- Introducing injection aids

Overcoming Barriers

- Analog insulins allow for a more flexible lifestyle may offer advantages over NPH and Regular insulin
- Devices that make delivery of the insulin:
  - More discrete
  - Less painful
  - More accurate
  - More apt to be utilized for proper dosing

Types of Devices

- Syringes and vials
- Insulin pens
- Injection aids
- Continuous subcutaneous insulin infusion (CSII) or insulin pumps

Proper Training: Pharmacists Can Help

- In a survey of 4300 insulin users
  - 1/3 could not recall being trained on:
    - Mixing different insulins in a syringe
    - Rotating injection sites
    - How long to hold a pinched skin fold
  - 35% do not re-suspend NPH or premixed insulin
  - 21% taking multiple daily doses of insulin used the same site for more than one day
  - 32% had no routine for site selection

Syringe and Vial: Pros and Cons

- Pros
  - Least expensive
  - System may be preferred by payers
  - Allows mixing of insulin
  - Smaller sharper needles than ever
  - 100 unit dose capacity
- Cons
  - Lack of portability
  - Not discreet
  - Stigma attached to the system
  - Possibilities for error
  - Requires manual dexterity and visual acuity

Case Study

Jane

- Jane has a BMI of 36 and is now at maximum daily doses of metformin 2000mg, glimepiride 8mg, and pioglitazone 45mg. Her doctor has been suggesting insulin for the last few visits but Jane is reluctant to agree to try it. This time he was insistent and has suggested that she start on insulin glargine at a dose of 20 units each night. He gave her a sample pack of 1 cc 12.7 mm 28 G syringes along with a sample vial of glargine.
  - She hates the thought of giving herself a shot every night and to make matters worse the needles she has look awfully daunting
- Jane trusts you and is willing to talk with you about her concerns. The one thing she can’t seem to get past is the thought of a painful injection every night. What suggestions could you offer her.
Question

• Jane has a large amount of adiposity and in order to deliver the insulin dose for optimal absorption she will need a longer needle. The 12.7 mm length is her only option.
  • True
  • False

Skin Thickness-top Subcutaneous Layer-bottom
Skin thickness varies slightly with gender, race, BMI, and site.

- Mean skin thickness:
  - Arm=2.33 mm
  - Abdomen=1.87 mm
  - Buttock=2.41 mm

Subcutaneous thickness is much more variable according to BMI.

Video Demonstration of skin thickness

Syringes

- Syringe sizes
  - 100 unit (1cc)
  - 50 unit (.5cc)
  - 30 unit (.3cc)

- Common needle gauges
  - 28 Gauge
  - 29 Gauge
  - 30 Gauge
  - 31 Gauge

- Common needle lengths
  - 12-12.7 mm (1/2 inch)
  - 8 mm (5/16 inch)
  - 6 mm (1/4 inch)

Pen Needles

- NovoFine®
  - 6 mm 32 G
  - 8 mm 30 G
  - 12 mm 28 G

- NovoFine® Autocover® 8 mm 30 G

- NovoTwist®
  - 5 mm 32 G
  - 8 mm 30G

- BD Ultra-Fine™ Pen needles
  - Nano 4 mm x 32 G
  - Mini 5 mm x 31 G
  - Short 8 mm x 31 G
  - Original 12.7 mm x 29 G

- Various generic brands

Needle Length Comparison
Pen Needles
NovoFine® Autocover®

Device tutorial: Go to Quick Guide

Pen Devices: Pros and Cons

• Pros
  • Portable
  • Discrete
  • Convenient
  • Shortest/sharpest needles available
  • Accurate delivery
  • Time saver
  • Good for people with visual or dexterity impairments

• Cons
  • May be more expensive
  • Maximum dose
  • Must prime
  • May waste some insulin left in cartridge
  • May go out of date
  • Can’t make a custom mix

Disposable Pen Devices

• Lilly Original pen systems
  • Disposable
  • Maximum dose of 60 units deliverable in 1-unit increments
  • Contains 300 units of insulin
  • Accepts most pen needles

• Availability
  • Humulin N®
  • Humulin 70/30® (biphasic N/R mix)

Disposable Pen Devices

Original Lilly Pen

Pen tutorial PDF available at:

Disposable Pen Devices

• Byetta® pen systems
  • Disposable
  • Dose of 5 or 10 mcg
  • Accepts most pen needles

• Availability
  • Byetta® 5 mcg
  • Byetta® 10 mcg

Disposable Pen Devices

Pen tutorial available at:
http://www.byettahcp.com/getting-patients-started/dosing-and-administration
Disposable Pen Devices

- Lilly KwikPen™ systems
  - Disposable
  - Maximum dose of 60 units deliverable in 1 unit increments
  - Contains 300 units of insulin
  - Accepts most pen needles
- Availability
  - Humalog®
  - Humalog 75/25® Mix (biphasic L/PL mixture)
  - Humalog 50/50® Mix (biphasic L/PL mixture)

Pen tutorial available at:

Disposable Pen Devices

- SymlinPen™
- Novo Nordisk FlexPen®
  - Disposable
  - Maximum dose of 60 units deliverable in 1-unit increments
  - Contains 300 units of insulin
  - Accepts most pen needles including NovoTwist®
  - Also used for Victoza®
- Availability
  - Novolog®
  - Novolog 70/30 Mix®
  - Levemir®
  - Victoza®

Pen tutorial:
https://www.symlin.com/hcp/symlin-dosing.aspx#

Disposable Pen Devices

- Novo FlexPen® Systems
  - Novolog® Pen tutorial:

Disposable Pen Devices

- Levemir Flexpen®
  - Pen tutorial:
Disposable Pen Devices

- **Victoza Pen®**
  - Disposable
  - Dose of 0.6, 1.2, or 1.8 mg
  - Each pen consists of 3 ml containing 18 mg of solution

Pen tutorial:
http://www.novo-pi.com/victoza.pdf#patient
or
http://www.victozapro.com/patient-support.aspx

Novo Nordisk FlexTouch® Pen

Disposable Pen Devices

- **Sanofi SoloSTAR® Pen**
  - Disposable
  - Maximum dose of 80 units deliverable in 1-unit increments
  - Contains 300 units of insulin
  - Accepts most pen needles

Availability
- Lantus®
- Apidra®

Reusable Pen Devices

- **NovoPen® 3, NovoPen® Junior**
  - Reusable
  - Maximum dose of 70 units deliverable in 1-unit increments for the NovoPen® 3
  - Maximum dose of 35 units deliverable in 0.5-unit increments for the NovoPen® Junior
  - Cartridge contains 300 units of insulin
  - Accepts most pen needles

Availability
- Novolog cartridges only
Reusable Pen Devices
NovoPen® 3

Pen tutorial:

Reusable Pen Devices
NovoPen® Junior

Pen tutorial:
http://vimeo.com/20957903

Pen Devices
- Lilly HumaPen® LUXURA™ HD
  - Maximum dose of 30 units deliverable in .5 unit increments
  - Cartridge contains 300 units of insulin
  - Accepts most pen needles
  - Availability: Humalog®

Lilly HumaPen® Luxura™ HD

Pen Instructions PDF File

Bydureon™

System Demonstration Video
http://www.bydureonhcp.com/professional-education/learning-center

Interactive Learning Session
- Preparation
  - Gather materials
  - Decide where you are simulating the injection
    - At home
    - At public dining facility
- Materials
  - Pen Needles
  - Demo Pen
  - Alcohol swabs
  - Sharps container
Injection and Insertion Aids: some examples

- BDInject-Ease®
- Autoject 2
- BD Magni-Guide™
- I-Port™ Infusion set for multiple injections
- Insufion™ Infusion Set

Injection Aids

I-Port Advance™

I-Port Advance™ Inserter

Device tutorial:
http://www.i-port.com/iport-advance-howto.html

Injection Aids

Insufion™

Modern Insulin Pump

Tandem t:slim™
Some Insulin Pumps Features

- Battery or mechanically operated devices delivering insulin from a reservoir through a short-term use sub-cutaneous catheter
- Reservoir may contain a maximum of approximately 300 units of insulin
- Individualized programmable basal and bolus delivery capability for most
- Alarms to warn of low insulin, no delivery, low battery, other pump malfunctions for most
- "Smart pump" technology

Pros and cons of pump use

- Advantages
  - Increased flexibility of lifestyle
  - Individualized basal rate capability
  - Bolus dosing with punch of a button
  - Extended bolus capability
  - Less hypoglycemia
  - Lower insulin requirement
  - Less glucose variability
  - CGM interface available with some

- Disadvantages
  - DKA possible if pump or set malfunctions
  - Need for extensive training
  - Requires frequent SMBG
  - Site changes every 2-3 days
  - Cost

Conventional Pump Features

- Significant features of "smart pump" technology
  - SMBG (self monitored blood glucose) value manually entered into pump and/or meter transfers SMBG reading to pump
  - Pump does the math using "bolus wizard" feature
  - "Insulin on board" features can prevent overlapping of insulin when bolusing
  - Sophisticated data management capabilities
  - Alarms to prompt SMBG testing

New Generation Pumps

- "Patch Pumps" and "Micro pumps"
- Basal only and type 2 pumps
- Closing the loop with CGM (continuous glucose monitoring)

Some Of The Insulin Pump Brands Available In The U.S.

- Roche: Accu-Chek Spirit®
- Animas: One Touch Ping®
- Dana Diabecare IIS®
- Minimed Revel™
- Insulet Corporation: OmniPod®
- Tandem t:slim™
- V-Go™
Insulin Pumps

- Accu-Chek Spirit®
- Minimed Revel® With CGM sensor
- Dana Diabecare IIS®

- t:slim®
- V-Go™

Set Insertion

- Flexible cannula dwells in subcutaneous fat layer
- Set insertion using a spring-loaded device

Typical Infusion Site

- Fully connected
- Disconnecting from site

Wireless Communication Sensor to Pump

Interactive Session Web Sites

- OmniPod®
- OneTouch Ping®
- AccuChek Spirit®
- Dana Diabecare IIS
- t:slim®
- V-Go™
Conclusions

- Optimal glucose control, along with blood pressure and lipid management is necessary for most people with diabetes in order to be healthy through the years
- New technology, when used properly, gives people with diabetes an opportunity to achieve control easier
- Glucose control is judged not only by A1c but also by point in time SMBG values. New delivery devices make it possible to rapidly and accurately address glycemic excursions.
- Although short-term cost is greater, optimum control has been proven to reduce both macro-vascular and micro-vascular complications and may help offset long-term cost.
- Pharmacists can play a valuable role in increasing awareness of available new technologies and in training patients on their proper use.

The Pharmacist: Team Player

Don’t drop the ball........