Devices: What's New and What Works: Glucometers, CGMs, and Insulin Pumps

Barcelona. September 2015

Congenital Hyperinsulinism Family Conference

Carmen Yoldi, RN
Diabetes Therapeutic Education
Endocrinology Unit

Sant Joan de Déu
HOSPITAL MATERNOINFANTIL - UNIVERSITAT DE BARCELONA

Agenda

- Glucometers
- Continuous glucose monitoring (CGM)
- Insulin pumps (CSII)

Glucometers

- ISO
- Reading seconds
- Blood drop size
- Data software analyze
- Telemedicine platforms
- Tendencies
- Insulin dose calulator
- Ketonemia

Insulin dose Calculator

Ketonemia

Glucometers

Accuracy

- **ISO**: International Organization for Standardization
  New ISO 15197:2013 ; total Implementation on 2016

(previous ISO: 2003)

- The new version accounts for **99% of results** (95% in 2003)
- Increased accuracy for glucose meter systems, in particular for glucose values greater than 75 mg/dl (4,2 mmol/l)
- Manufacturers of glucose meter systems must ensure their technology enables **accuracy +-15%** (20% in 2003)
- For the first time, the standard provides formal acceptance criteria for accuracy as regards testing by patients and assessment of interferents (including hematocrit).

Glucometers

What affect readings?

- Not washing hands
- Not drying hands
- Contamination by food / drink
- Temperature
- Size of blood drop (too small)
- Wiping first drop

Glucometers

Where to prick?

- **Finger**
- Ear lobe, toe, arm, thigh, the palm

No pain ??

- Controversy:

Alternative site testing is found to not be as accurate as capillary blood:

if eaten within the previous two hours.

Agenda

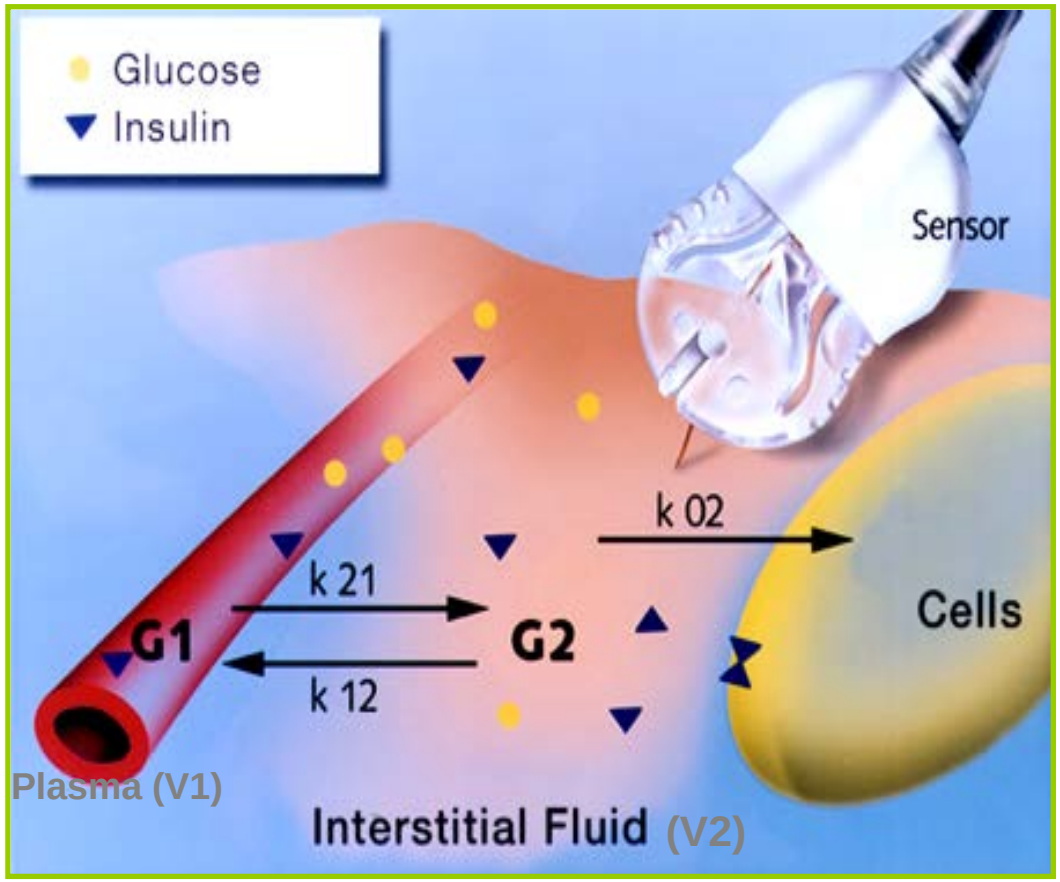
- Glucometers
- Continuous glucose monitoring (CGM)
- Insulin pumps (CSII)

Continuous Glucose Monitoring

- It consist in a continuous measure of glucose on the interstitial tissue by a specific sensor
- Allows to know the glycemic profile during all 24 hours a day and the glucose variability

Interstitial glucose vs plasma glucose

- Glucose on interstitial tissue (G2) is usually comparable to blood glucose (G1)

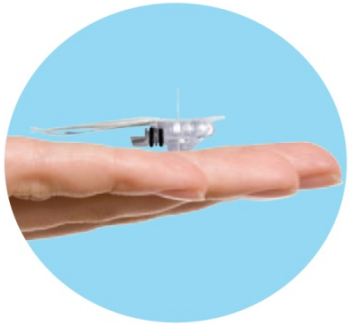


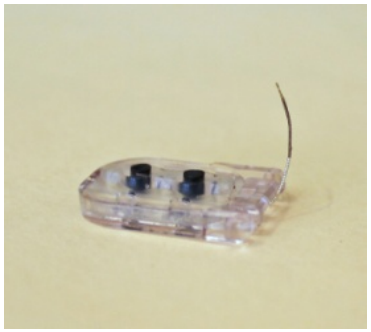
Rebrin, Kerstin, Garry M. Steil, William P. Van Antwerp and John J. Mastrototaro. Subcutaneous glucose predicts plasma glucose independent of insulin: implications for continuous monitoring. *Am. J. Physiol.* 277 (*Endocrinol. Metab.* 40): E561–E571, 1999

Continuous Glucose Monitoring

Cannula

Micro-filament combinning metal and enzyme glucose-oxidase





Enlite

8,75mm

Medtronic

Dexcom

Oblique insertion

FreeStyle Libre

5 mm

Abbott

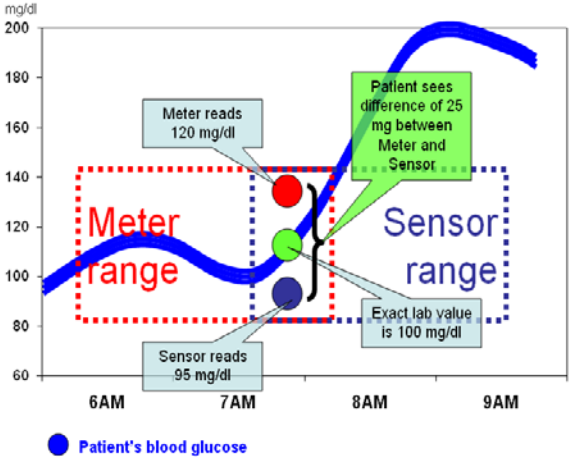
Diferences between glucose values on plasma, capillary e interstitial (sensor)

Under steady stable glucose values it could be said that

Interstitial glucose are balanced with plasma glucose,

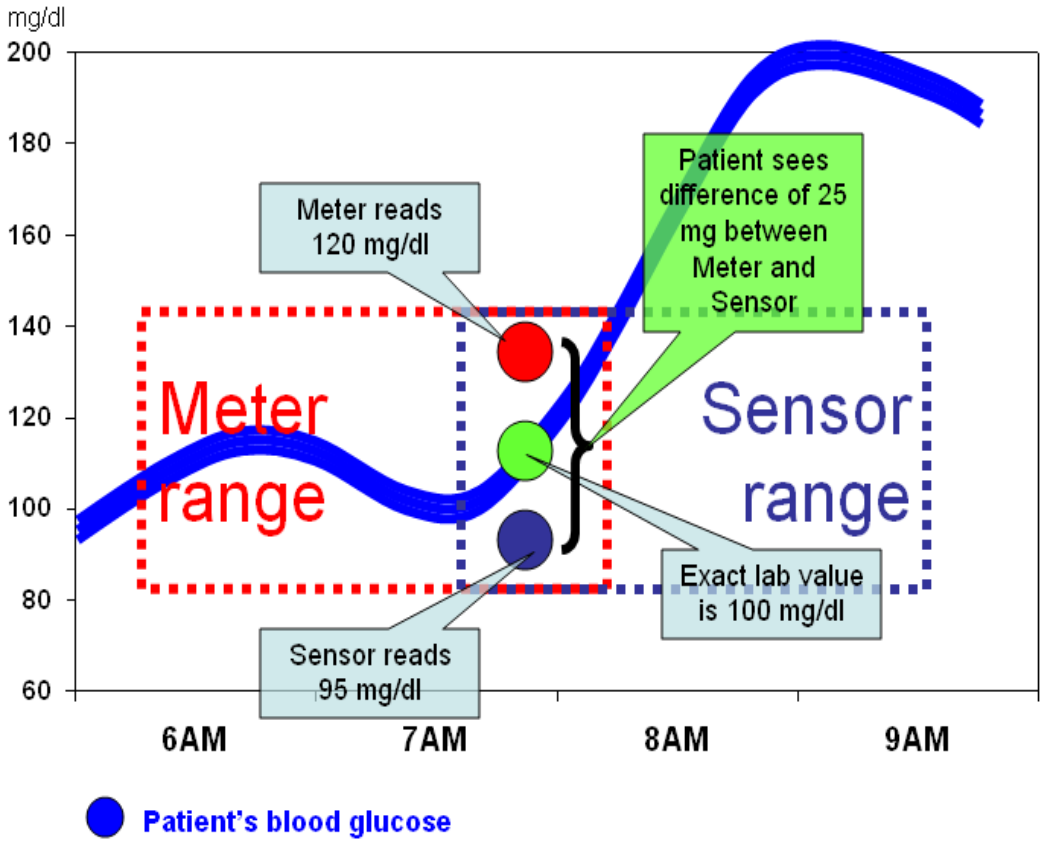
but,

changes on glucose concentration occur before in plasma glucose than in interstitial tissue. There is a delay time ~ 10 minuts (variable)



Diferences between glucose values on plasma, capillary e interstitial (sensor)

- Plasma glucose (lab) is 100 mg/dl
- Sensor glucose reads 95mg/dl at 7:25 AM
- Glucose value readed by meter is 120mg/d



Continuous Glucose Monitoring Systems

- Real time or interactive systems

Dexcom 4

Free Style Libre
Not aproved < 18y

Guardian
REAL-Time

Navigator

- Sensor Augmented System

640G

Paradigm Veo

Continuous Glucose Monitoring

Where?

- Buttocks
- Abdomen
- Arm

Not aproved < 18y

Continuous Glucose Monitoring

Why and when calibrate?

- It is necessary to introduce capillary glucose values into the device (except freestyle libre)
- Number of Calibration: diferences beetwen devices
- Best moment: stable values (wake up, before meals, bedtime)
- **Avoid calibration:**
    - Arrows in the device screen
    - Just after exercising

} Medtronic devices

Continuous Glucose Monitoring

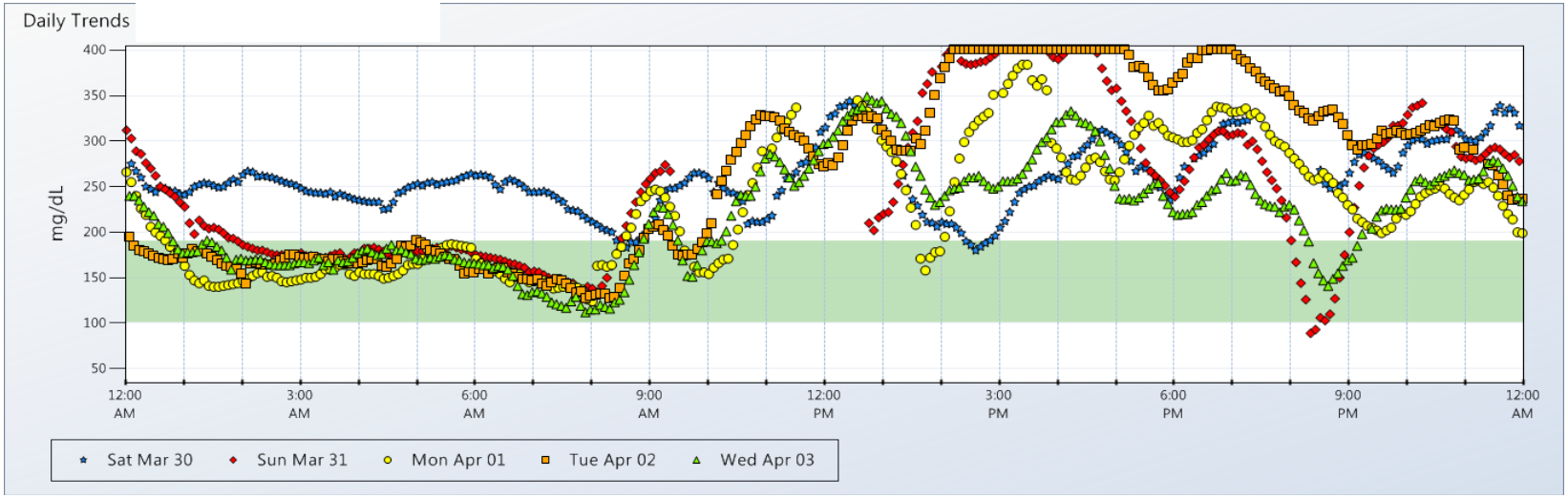
When is needed a glucose value by meter?

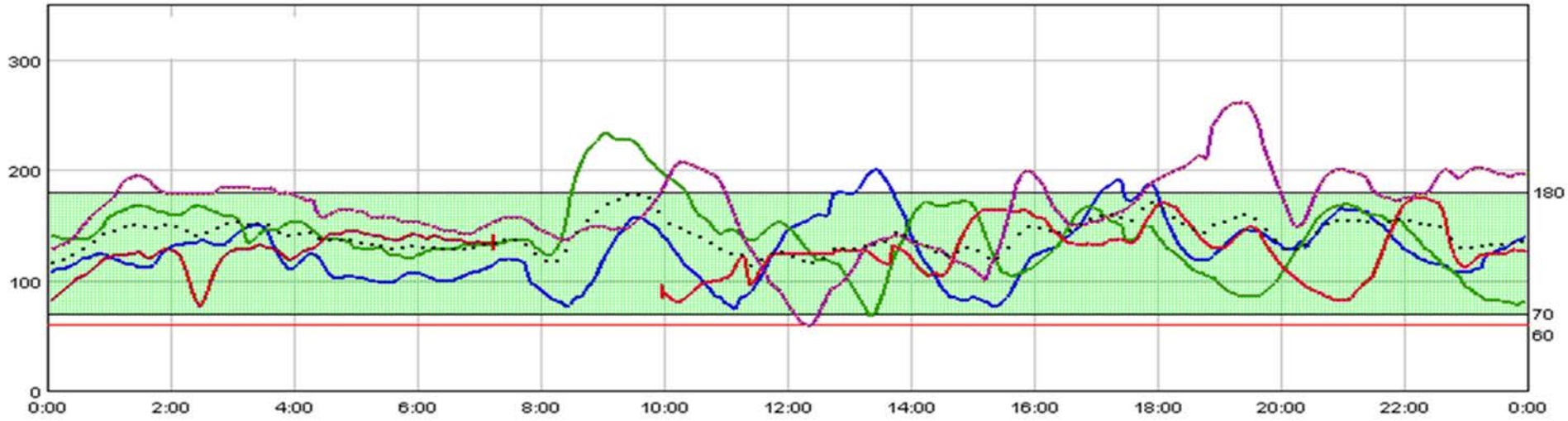
- Before calibration
- Before insulin dose administration
- If “discordants” symptoms beetwen patient and sensor values (ie. In case of hypoglycemia simptoms and no low values shown on the device)
- When hypo or hyperglycemia
- **Alarms** occurred

Important: Diferences beetwen glucose concentration in blood and in interstitial tissue must be trained

Continuous Glucose Monitoring

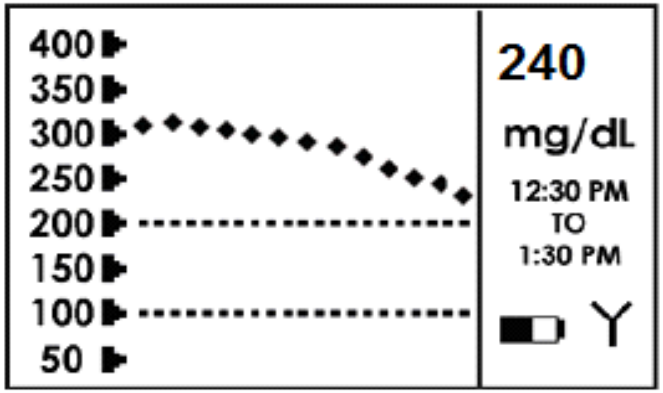
Data download by a specific software (retrospective analysis)

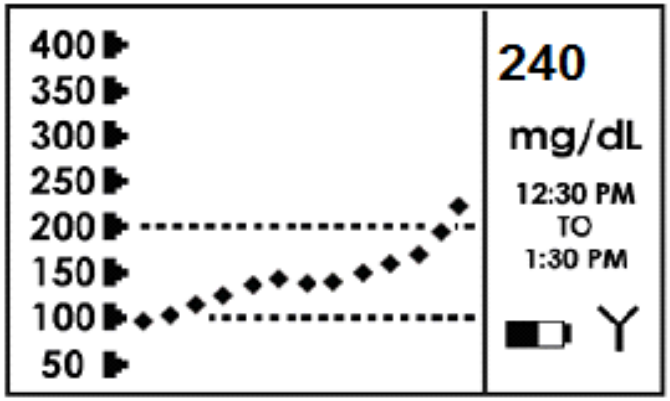


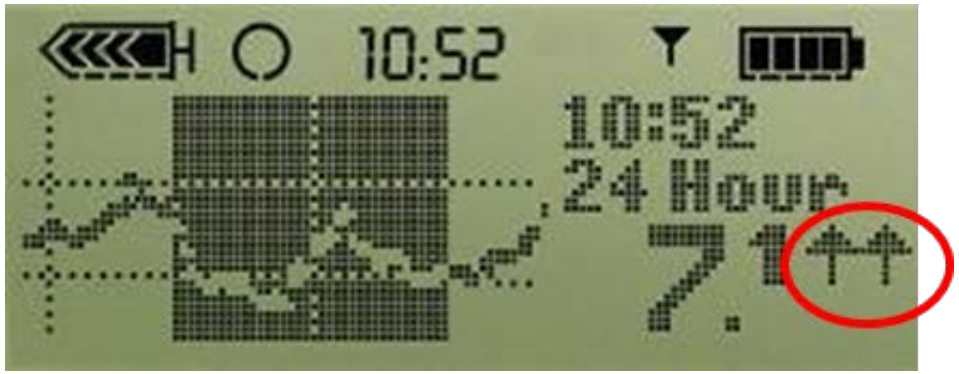


Continuous Glucose Monitoring

Data on the device screen (real time analysis)







Predictive analysis

Diferences between CGM systems

	Guardian Real Time Paradigm VEO 	Medtronic 640G 	Dexcom 4 	Freestyle libre 	Freestyle Navigator 
Life of the sensor	6 days		7 days	14 days	5 days
Initial calibraton period	2 hours	1 hour	2 hours	NO NO aproved on < 18 years old	10 hours
Nº calibrations	>2-4/day		2-4 / day	0 NO	4 - 5 days
Tendence arrows	YES		YES	YES	YES
High/low alarms	YES		YES	NO	YES
Alarms of prediction	YES	YES	YES	NO	YES
Stop insulin administration	NO	YES	NO	NO	NO
Readings	Each 5 minuts	Each 5 minuts	1 minut	1 minut, each scan	Each 5 minuts

Agenda

- Glucometers
- Continuous glucose monitoring (CGM)
- Continuous Subcutaneous Insulin Infusion (CSII) or Insulin pumps

Insulin Pump

Needs:
- Be avalaible to manage insulin dose algorithms
- Get familiar with technology

Benefits vs. MDI

- Small insulin doses needed
- Hypoglycaemia unawareness and/or frequent
- Quality of life
- MDI not working
- Aversion to injections and/ or needles: Less injections
- Unexpected situations

PUMP OPTIONS

- bolus wizard (calculator)
- tiny increments
- basal patterns
- tailor basal patterns for illness, sport, weekends

Disavantages

- Be connected to a device
- When glucose values >250mg/dl (13,8mmol/dl), be sure pump is working. Read Ketones

Sant Joan de Déu
HOSPITAL MATERNOINFANTIL - UNIVERSITAT DE BARCELONA