CORATA Belgique
3ème congrès de Biologie clinique

Hôpital Erasme

ULB

Apports du monitoring du glucose en continu dans la gestion du diabète

Mercredi 23 septembre 2015

Laurent Crenier

Service dõEndocrinologie

ULB - Hôpital Erasme

Rappel technologique …

Le Navigator (Abbott) n'utilise pas le H_2O_2 mais un hydrogel conducteur indépendant de l'O_2 qui retient la GOx captive (technologie « *Wired Enzyme* »).

Après calibration par glycémies capillaires, le signal électrique (I_{SIG}) pourra être converti en concentration de glucose utile.

$$Glucose + FAD\text{-}GOx \rightarrow \delta - Gluconolactone + FADH_2\text{-}GOx \quad [1]$$

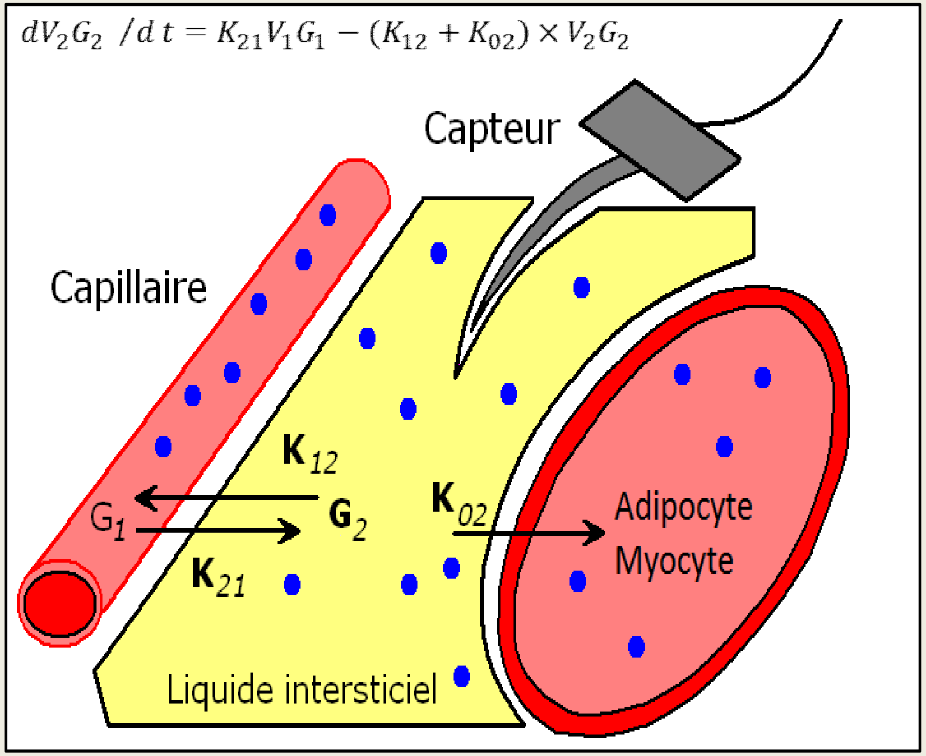
$$FADH_2\text{-}GOx + O_2 \rightarrow FAD\text{-}GOx + H_2O_2 \quad [2]$$

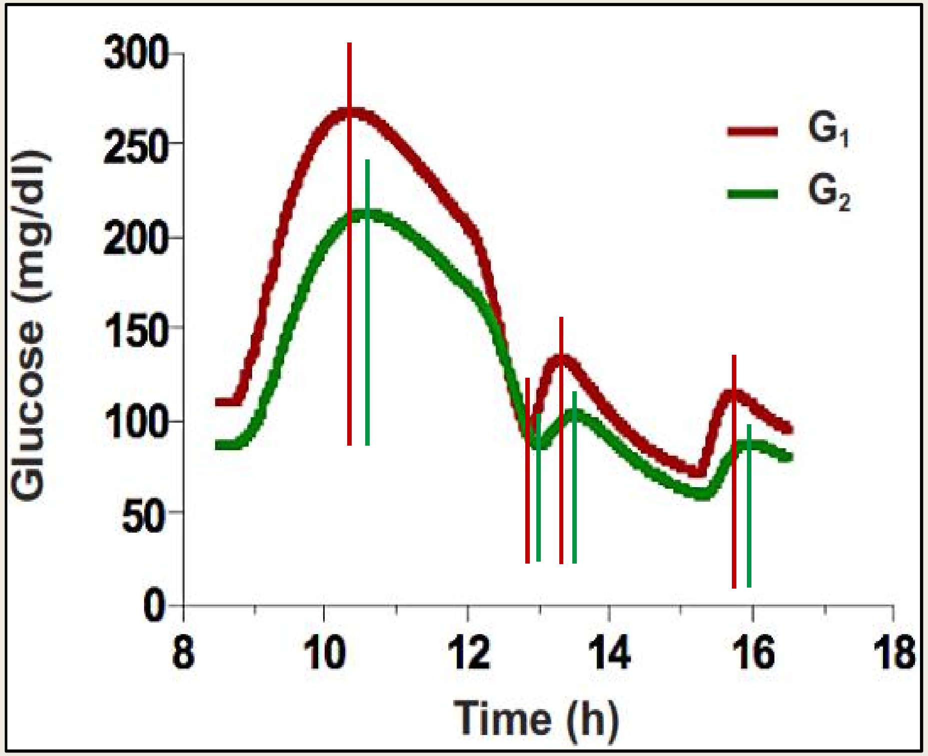
$$H_2O_2 \rightarrow 2H^+ + O_2 + 2e^- \text{ (Électrode Platine)} \quad [3]$$

Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

Electrode sous-cutanée → « Glucose lag » physiologique



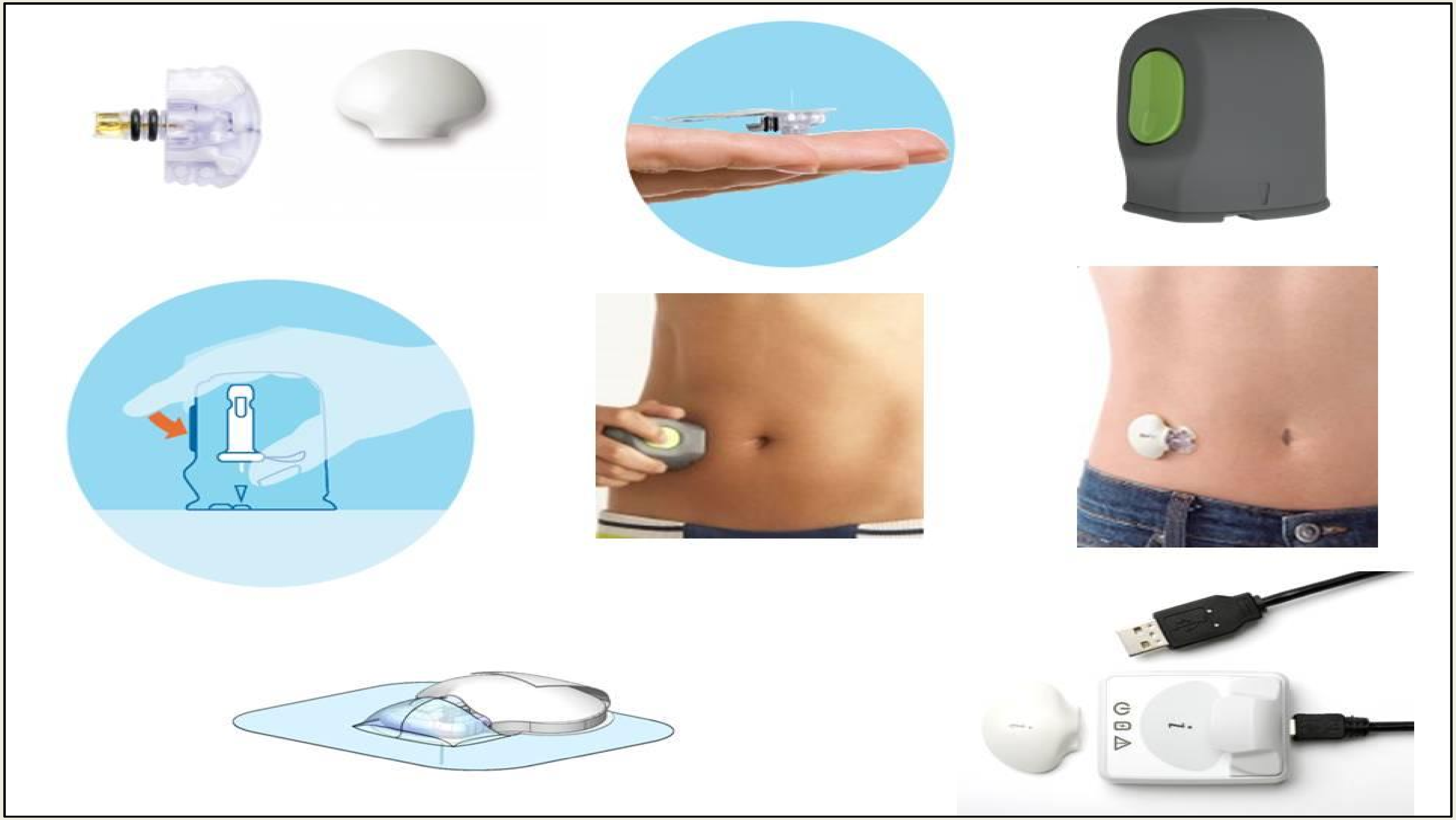


Modèle de lœquilibration du glucose interstitiel (**G_2**) avec la glycémie (**G_1**). Le glucose (●) sœchange rapidement entre le plasma et le liquide interstitiel en proportion (constantes K_{12} et K_{21}) de ses concentrations respectives alors que lûptake cellulaire draine le glucose hors de lînterstitium (K_{02}). K_{02} peut être en théorie dépendant de la présence dînsuline. Dâprès Koschinsky et al (2001) et Steil et al (2005). (**B**) Courbe G_2 simulée avec un délai dœquilibration G_1/G_2 de 12 minutes. Reproduit de Rebrin et al. (2010).

Apports du CGMS dans la gestion du diabète

Hōpital Erasme ULB

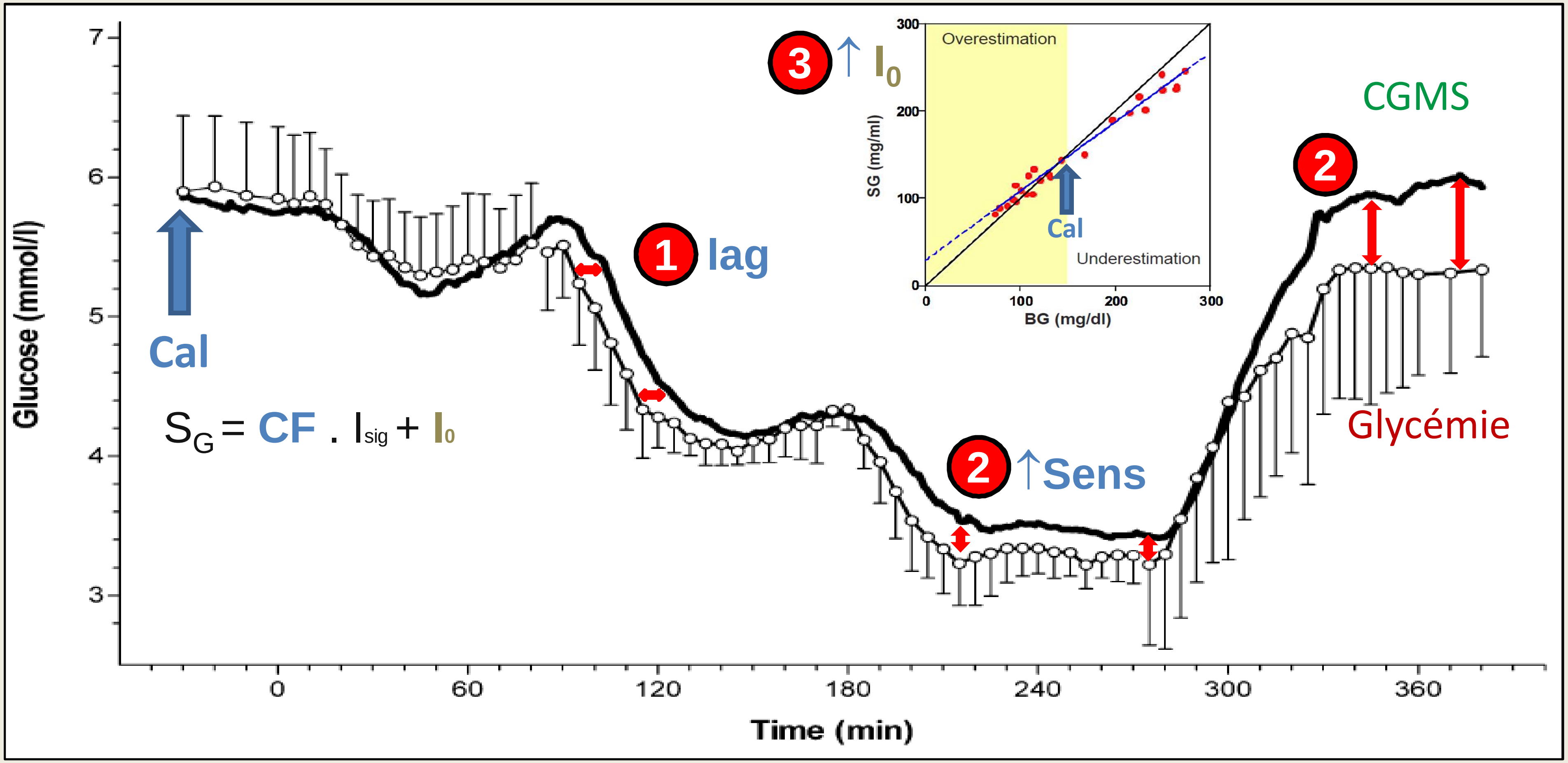
Mise en place d'un capteur (durée de vie ± 6 jours)



Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

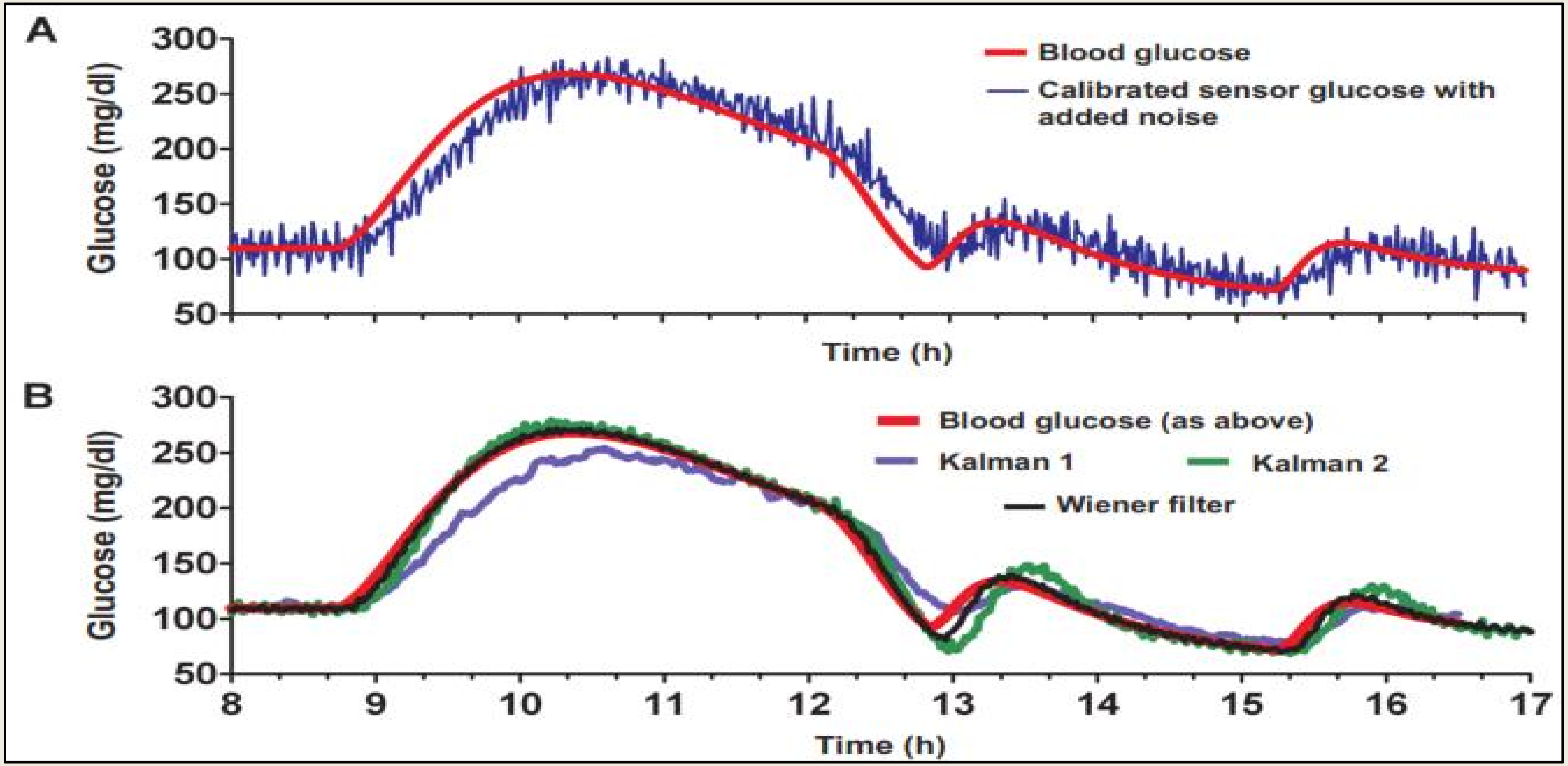
Profil CGMS : de la théorie à la clinique …



Plasma glucose (open circles) together with sensor glucose (solid line) calculated using a one-point calibration at −30 min. Following a 30-min basal period (−30<t<0), plasma glucose was clamped at basal (0<t<90 min), 4.2 mmol/l (90<t<180 min) and 3.1mmol/l (180<t<270 min) and then allowed to return to normal levels (270<t<380 min). The glucose scale is expanded to highlight differences in sensor vs plasma glucose. ISF glucose delay : 6-8 minutes.

Steil et al. *Diabetologia* 2005; 48: 1833–1840

Profil CGMS : Avec ou sans filtre ?



*(**A**) Profil de glycémie simulé (en rouge) pour lequel a été ajouté un bruit aléatoire (en bleu). (**B**) Plusieurs types de filtres anti-bruit publiés dans la littérature (« Kalman 1 », « Kalman 2 » et « Wiener ») ont été appliqués à la courbe bleue avec bruit de fond. Reproduit de Rebrin et al (2010).*

Profils CGMS : Avec ou sans filtre ?

- Medtronic a breveté un filtre « passe-bas » qui utilise des seuils allant de ≈ 416 µHz à ≈ 833 µHz, il faut donc s'attendre à ce que l'iPro2 filtre d'emblée les oscillations d'une période de moins de 40 à 80 minutes.

- Abbott par contre a décrit un filtre à seuils variables (dynamique).

- Ces filtres sont basés sur le principe de « moyenne mobile » (convolution) qui imposent un délai supplémentaire à la restitution des données (mais algorithmes = secrets industriels …)

Profils CGMS : Implications pratiques

Å Le glucose lag physiologique ne dépasse pas 5 à 10 minutes.

Å Un délai supplémentaire (jusqu’à 10 minutes) peut être induit par les processus de filtration.

Å Il faut tenir compte de ce délai en clinique (par ex. pour alarmes)

Å De fréquentes calibrations (capillaires) sont nécessaires pour préserver la précision du monitoring.

Utilisations du CGMS en diabétologie

A. « Holter » de glycémie (rétrospectif)

B. « Real time » (stand alone)

C. Sensor Augmented Pump (couplé à une pompe à insuline)

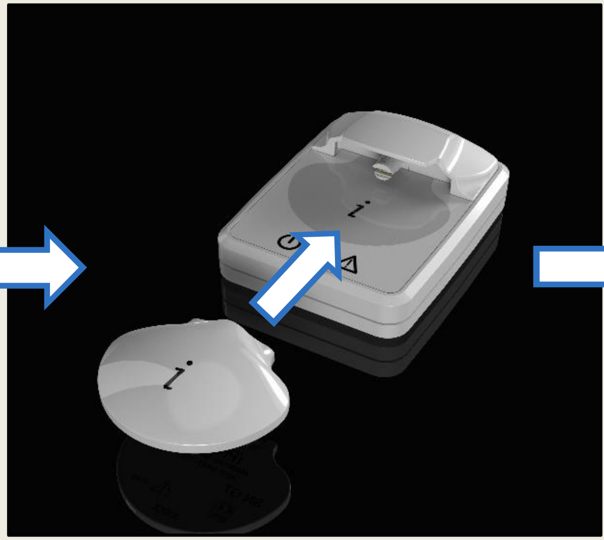
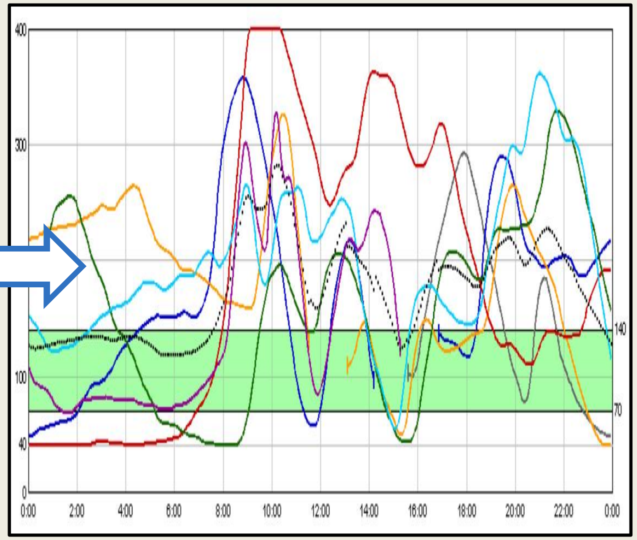
D. S A P + LGS / PLGM

Perspectives d'avenir

Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

A. Utilisation de type « Holter » (rétrospective)

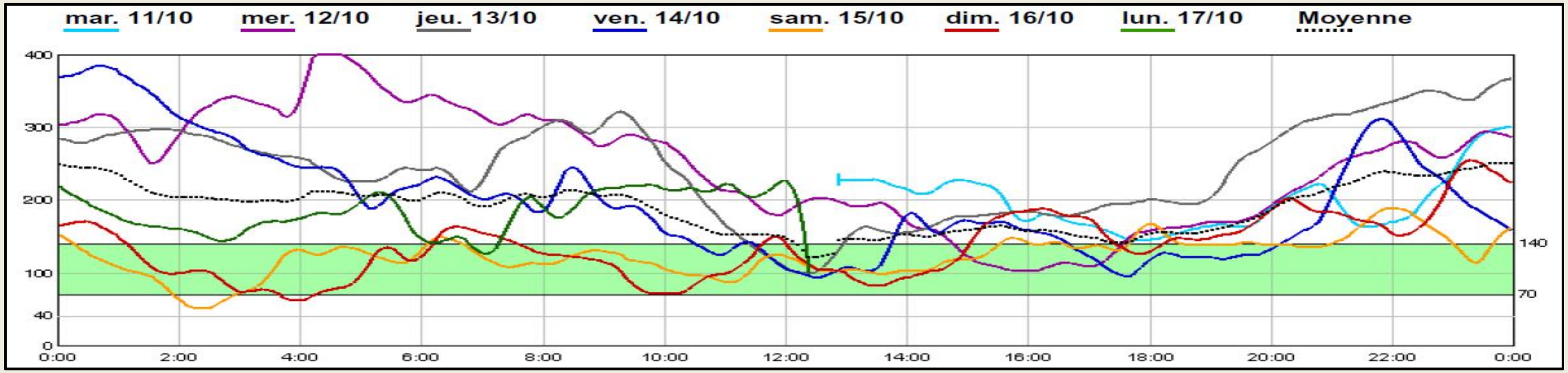
Système iPro® de Medtronic

- Enregistrement pendant 6 jours (données non accessibles au patient)
- Patient passif (aucune interaction avec le système)
- Glycémies capillaires requises pour calibration (antéro- et rétrograde)
- Analyse rétrospective par le personnel soignant
- Educationnel / Adaptation du schéma insulinique

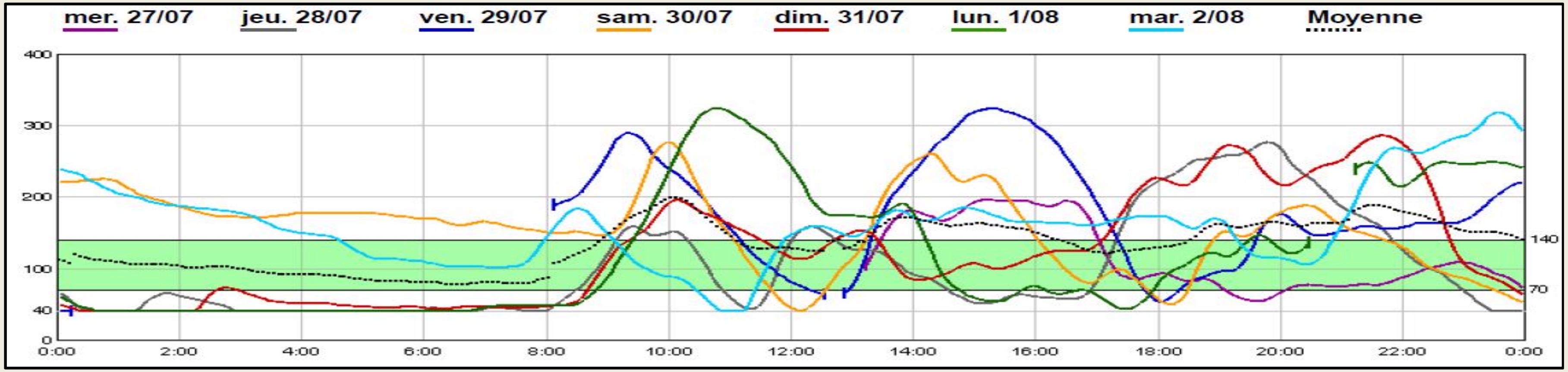
Apports du CGMS dans la gestion du diabète

Exemples de tracés CGM « Holter »

Sous-insulinisation nocturne



Bolus d'insuline pré-prandiaux insuffisants / hypoglycémies nocturnes

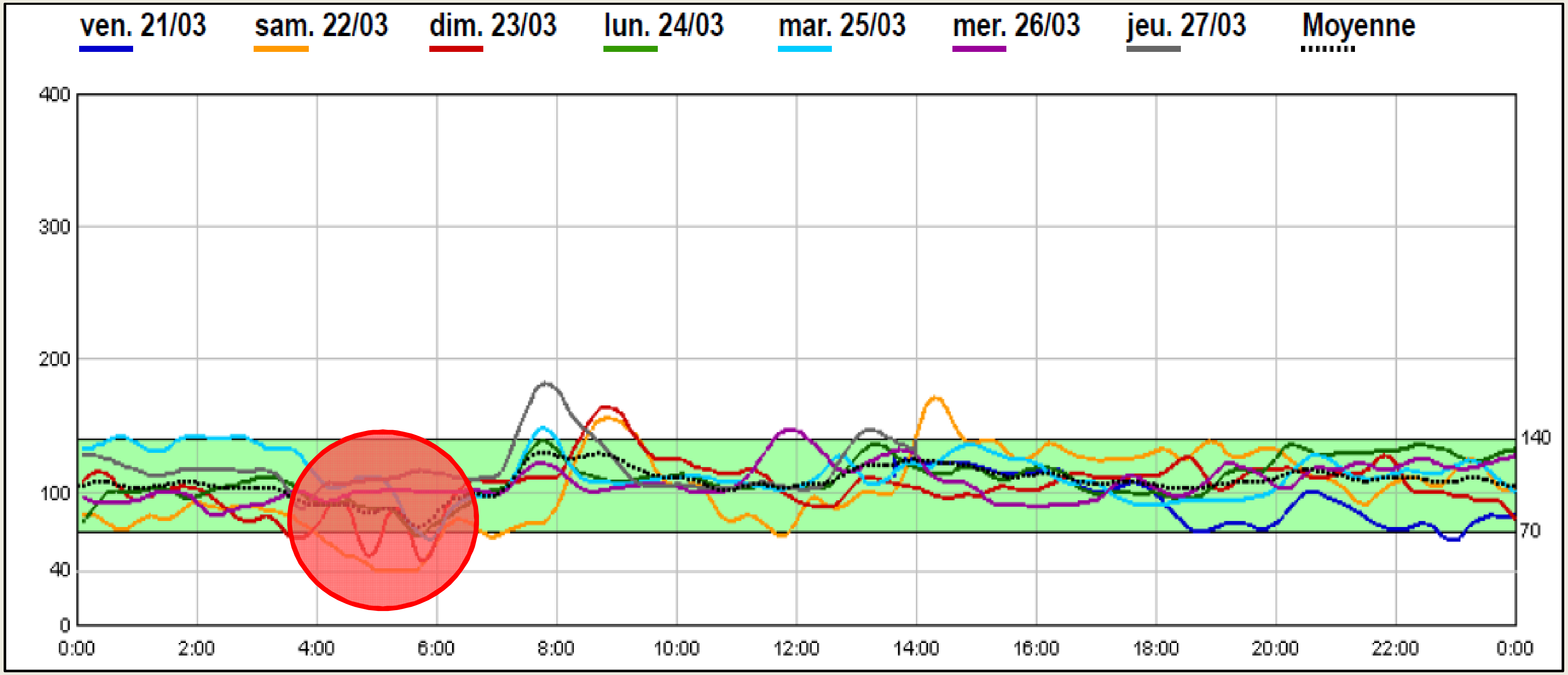


Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

Exemples de tracés CGM « Holter »

Volontaire sain : fausses hypoglycémies (compression nocturne du capteur)



Apports du CGMS dans la gestion du diabète

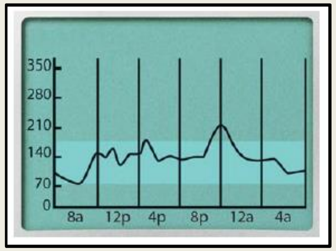
B. Utilisation de type « Real Time » (patient actif)

Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

CGMS « Real Time »

FreeStyle Navigator® (Abbott)



1 Senseur

2 Transmetteur radio

3 Récepteur radio

4 **Valeur instantanée du glucose**

5 **Flèche de tendance**

6 **Alarmes HI/LO**

7 Lecteur de glycémie capillaire

Apports du CGMS dans la gestion du diabète

Improved Glycemic Control in Poorly Controlled Patients with type 1 Diabetes Using Real-Time CGMS

Deiss D et al. Diabetes Care 2006; 29: 2730-32

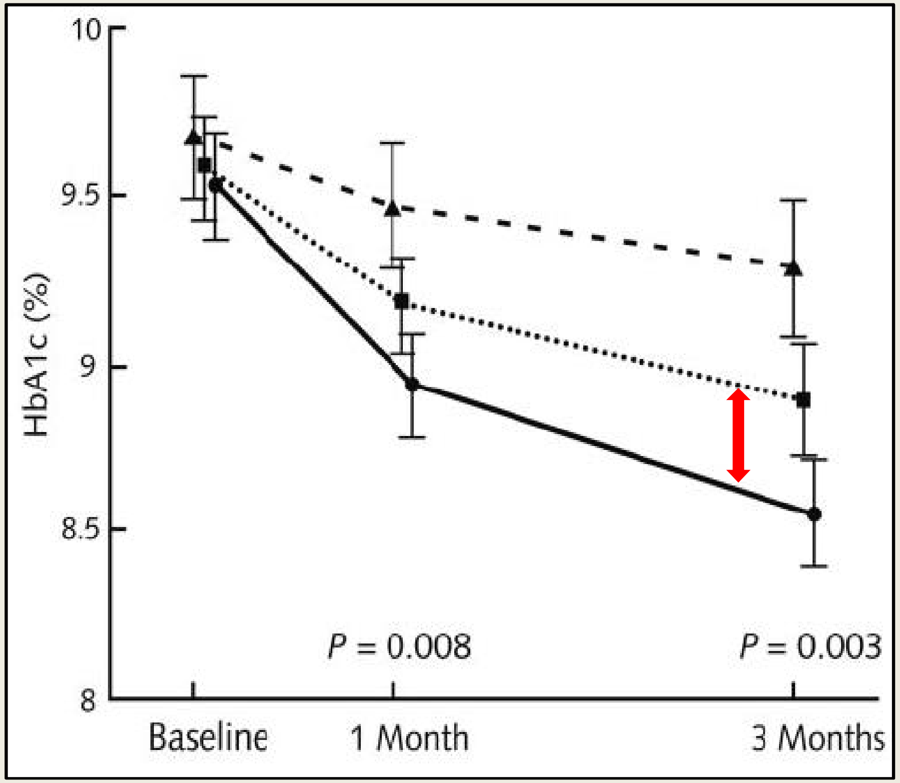


Figure 1 — Change from baseline at 1 and 3 months of HbA1C. Values are means ± SE. P values correspond to the difference in change from baseline between the continuous and control groups. (n=156)

ǒ : continuous group (arm 1)

ƴ : biweekly group (arm 2)

ƶ : control group.

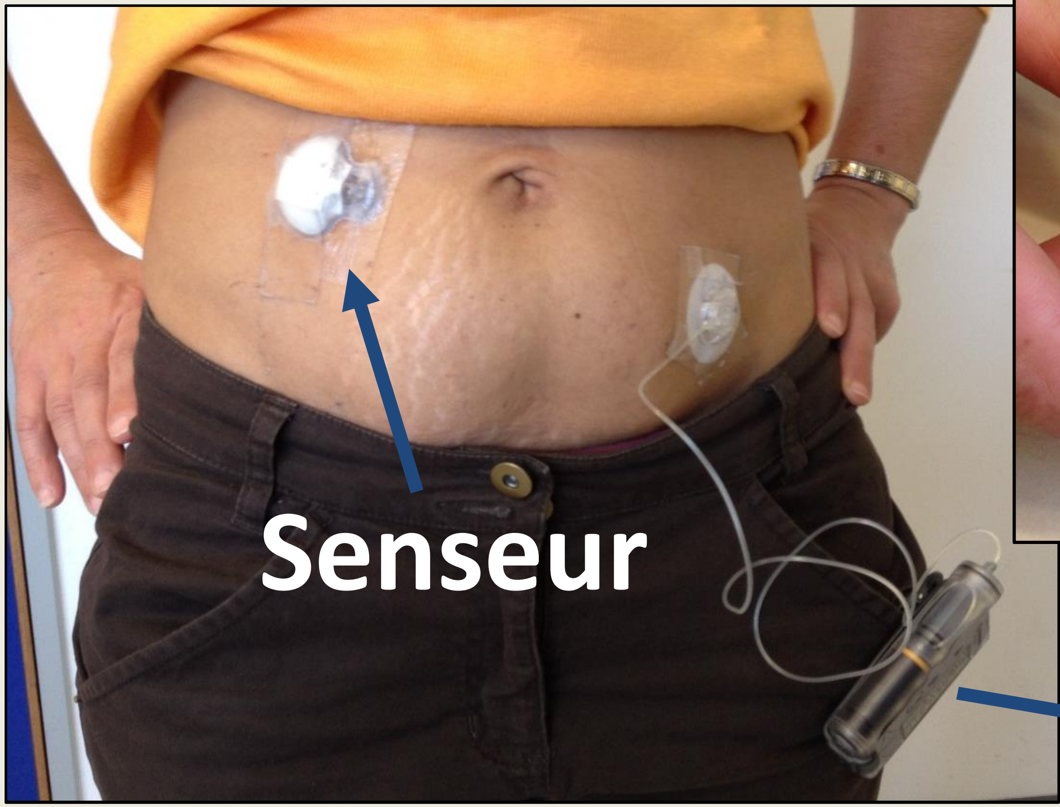
CGMS « Real Time » : indications principales

- Diabète instable (type 1) mal équilibré
- Hypoglycémies mal ressenties, comas hypoglycémiques (alarme hypo)
- NE REMPLACE PAS LES GLYCEMIES CAPILLAIRES mais permet des corrections plus fréquentes (alarme hyper) et une aide à la décision (tendances)
- Exige une éducation et une motivation particulière du patient
- PAS REMBOURSE PAR l'INAMI

Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

C. Sensor-Augmented Pump

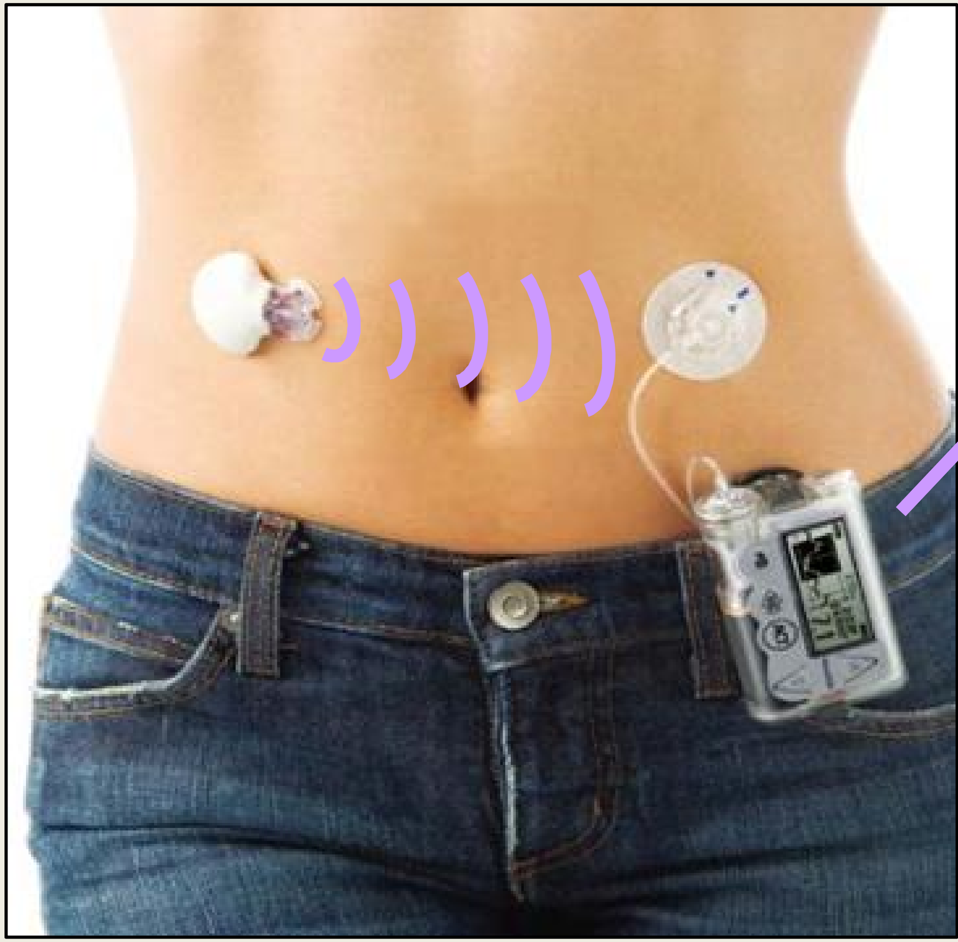


Pompe

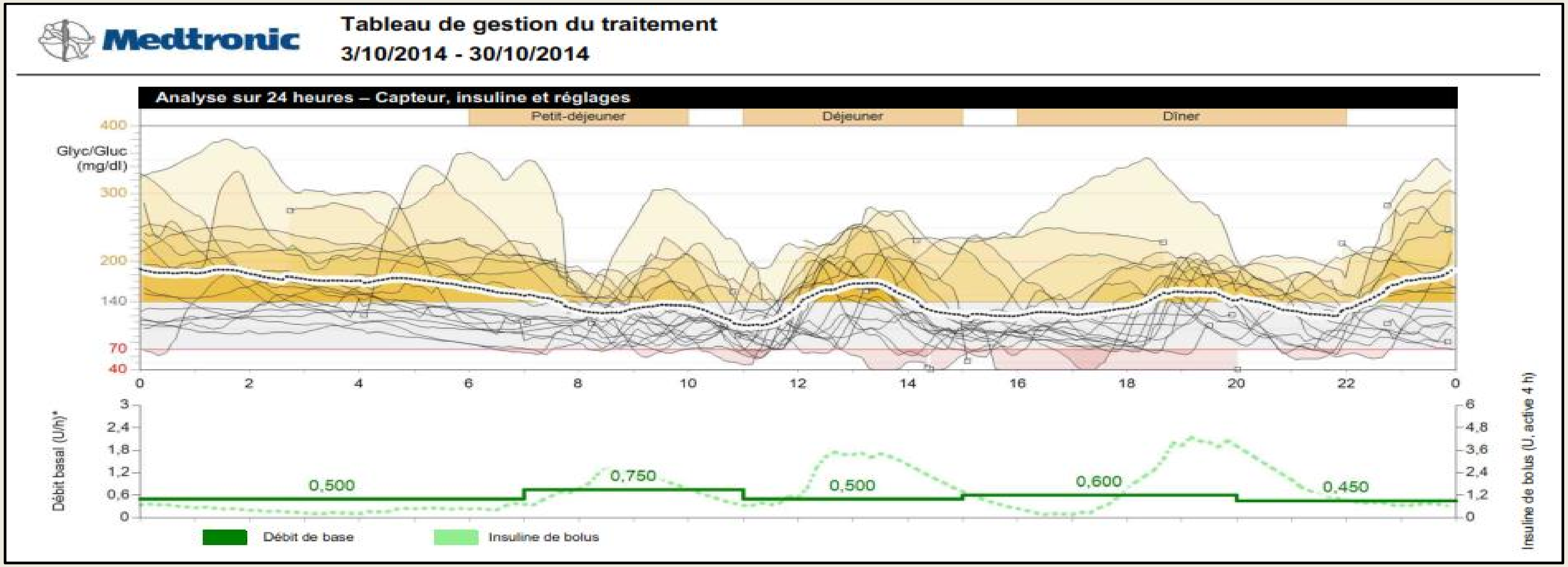
Apports du CGMS dans la gestion du diabète

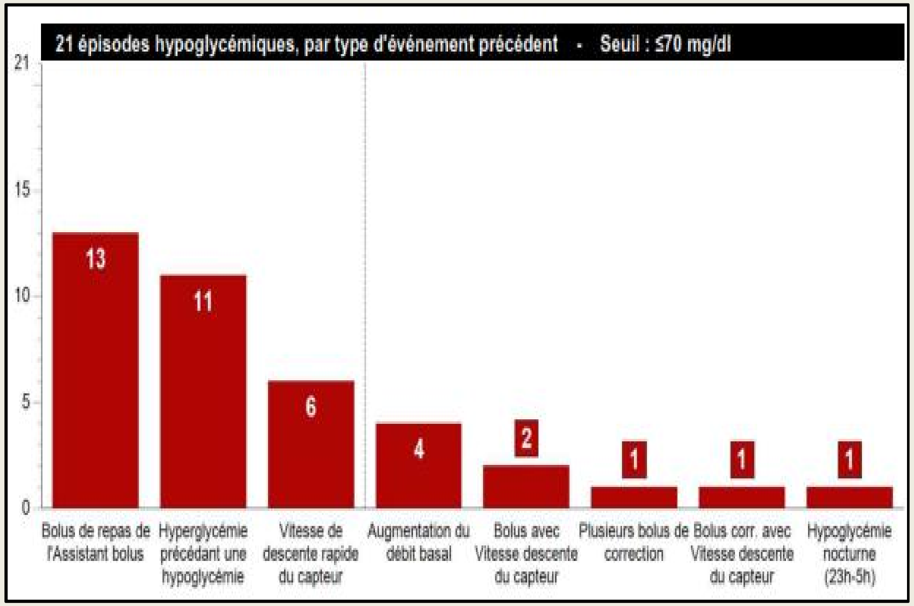
Hôpital Erasme ULB

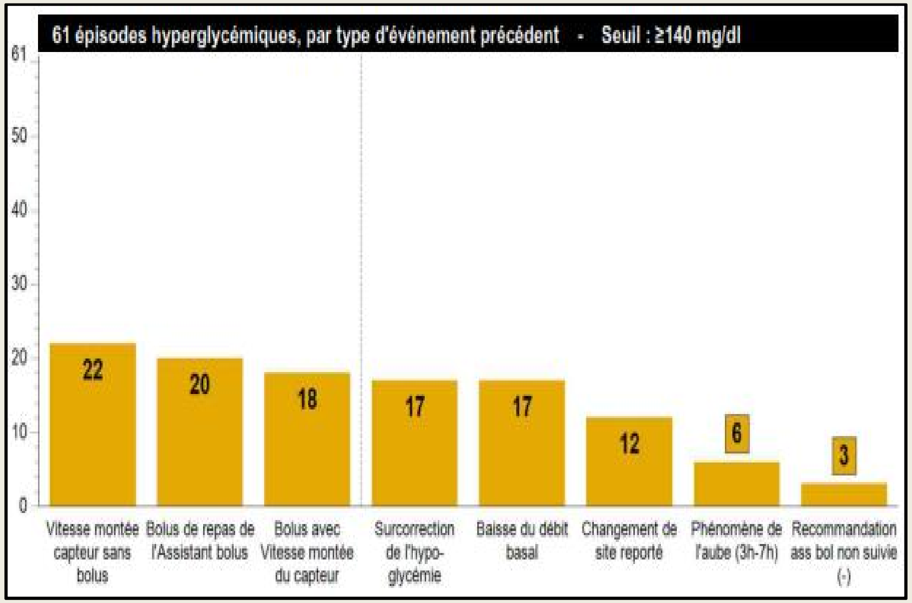
C. Sensor-Augmented Pump



Apports du CGMS dans la gestion du diabète







Sensor Augmented Pump (SAP)

Raccah D, Sulmont V, Reznik Y, Guerci B, et al. Incremental Value of Continuous Glucose Monitoring When Starting Pump Therapy in Patients With Poorly Controlled Type 1 Diabetes (The RealTrend Study).
Diabetes Care 2009; 32:2245–50.

Bergenstal RM, Tamborlane WV, Ahmann A, Buse JB, et al. Effectiveness of Sensor-Augmented Insulin-Pump Therapy in Type 1 Diabetes (The STAR-3 Study).
NEJM 2010;363:311-20.

Battelino T, Conget I, Olsen B, et al. The use and efficacy of continuous glucose monitoring in type 1 diabetes treated with insulin pump therapy: a randomized controlled trial (The Switch Study).
Diabetologia 2012;55:3155-62.

Nørgaard K, Lalic NM, Jasinskiene E, Castan J, et al. Routine Sensor-Augmented Pump Therapy in Type 1 Diabetes: The INTERPRET Study.
Diabetes Technology & Therapeutics 2013;15:273-80.

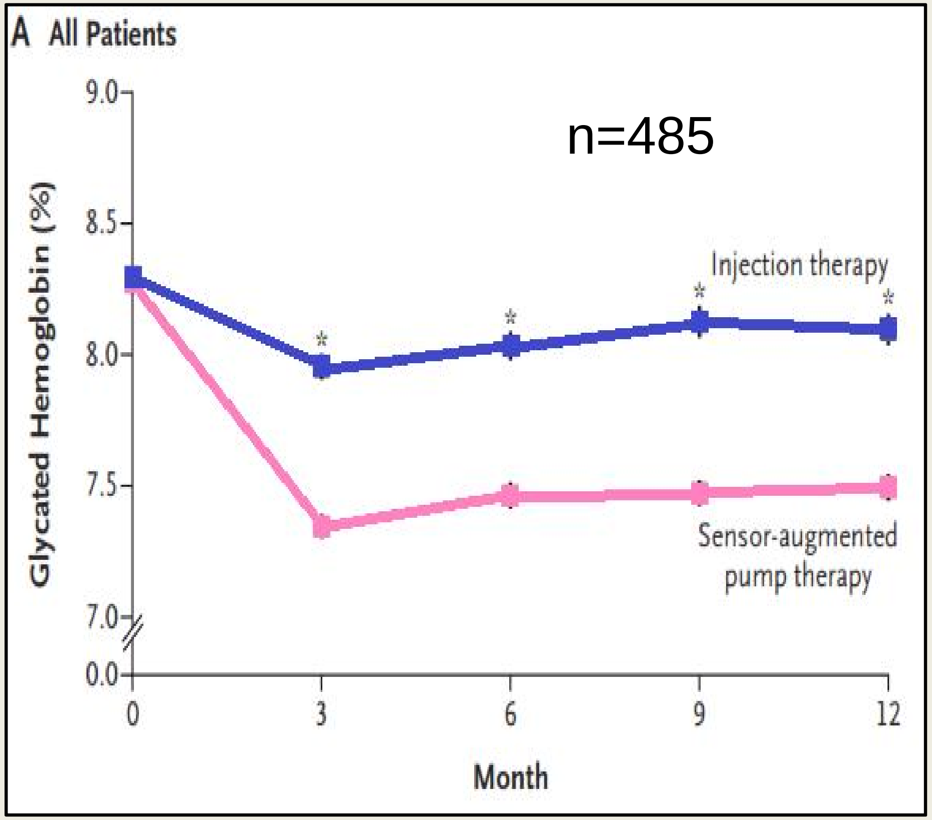
Apports du CGMS dans la gestion du diabète

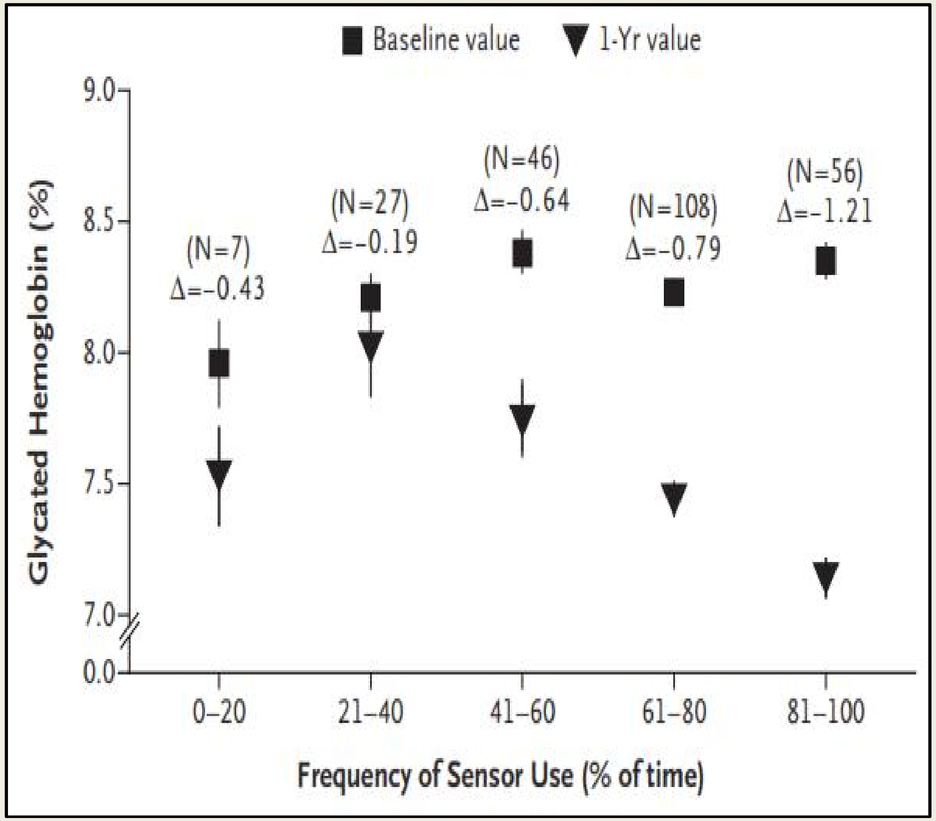
Hôpital Erasme ULB

The NEW ENGLAND JOURNAL *of* MEDICINE

Effectiveness of Sensor-Augmented Insulin-Pump Therapy in Type 1 Diabetes

Richard M. Bergenstal, M.D., William V. Tamborlane, M.D., Andrew Ahmann, M.D., John B. Buse, M.D., Ph.D., George Dailey, M.D., Stephen N. Davis, M.D., Carol Joyce, M.D., Tim Peoples, M.A., Bruce A. Perkins, M.D., M.P.H., John B. Welsh, M.D., Ph.D., Steven M. Willi, M.D., and Michael A. Wood, M.D., for the STAR 3 Study Group*





Bergenstal RM et al. *NEJM* 2010;363:311-20

Apports du CGMS dans la gestion du diabète

Hôpital Erasme | ULB

The NEW ENGLAND JOURNAL *of* MEDICINE

Effectiveness of Sensor-Augmented Insulin-Pump Therapy in Type 1 Diabetes

Richard M. Bergenstal, M.D., William V. Tamborlane, M.D., Andrew Ahmann, M.D., John B. Buse, M.D., Ph.D., George Dailey, M.D., Stephen N. Davis, M.D., Carol Joyce, M.D., Tim Peoples, M.A., Bruce A. Perkins, M.D., M.P.H., John B. Welsh, M.D., Ph.D., Steven M. Willi, M.D., and Michael A. Wood, M.D., for the STAR 3 Study Group*

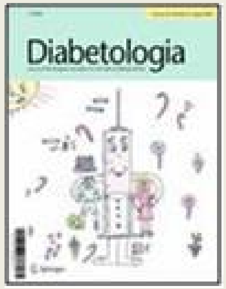
Table 2. Severe Hypoglycemia, Diabetic Ketoacidosis, and Area under the Curve Calculated from Continuous Glucose Monitoring.*

Variable	All Patients			Adults			Children		
	Sensor-Augmented Pump Therapy (N=247)	Injection Therapy (N=248)	P Value	Sensor-Augmented Pump Therapy (N=169)	Injection Therapy (N=167)	P Value	Sensor-Augmented Pump Therapy (N=78)	Injection Therapy (N=81)	P Value
Severe hypoglycemia									
No. of events	32	27	0.58	25	23	0.53	7	4	0.53
No. of patients	21	17		17	13		4	4	
Rate per 100 person-yr	13.31	13.48	0.84	15.31	17.62	0.66	8.98	4.95	0.35
Diabetic ketoacidosis									
No. of events	3	2	0.38	2	0	NA	1	2	0.49
No. of patients	3	1		2	0		1	1	
Rate per 100 person-yr	0.01	<0.01	0.60	0.01	0	NA	0.02	0.02	0.20
Area under the curve calculated from continuous glucose monitoring — $mg \cdot dl^{-1} \cdot min$									
>250 mg/dl									
At baseline	9.99±9.63	10.62±9.64		8.16±8.31	7.98±7.98		13.89±11.04	16.23±10.46	
At 1 yr	5.41±6.60	10.70±11.90	<0.001	3.74±5.01	7.38±8.62	<0.001	9.20±8.08	17.64±14.62	<0.001
>180 mg/dl									
At baseline	32.26±19.70	33.38±19.72		28.92±17.80	28.04±17.03		39.36±21.70	44.68±20.34	
At 1 yr	20.36±15.73	32.23±23.41	<0.001	16.06±12.84	26.01±19.52	<0.001	30.11±17.34	45.29±25.57	<0.001
<70 mg/dl									
At baseline	0.27±0.50	0.29±0.48		0.28±0.54	0.31±0.49		0.26±0.40	0.23±0.44	
At 1 yr	0.24±0.43	0.28±0.51	0.54	0.25±0.44	0.29±0.55	0.63	0.23±0.41	0.25±0.41	0.79
<50 mg/dl									
At baseline	0.02±0.09	0.02±0.06		0.02±0.10	0.02±0.07		0.01±0.04	0.02±0.05	
At 1 yr	0.02±0.05	0.02±0.08	0.25	0.02±0.04	0.03±0.09	0.16	0.02±0.07	0.01±0.05	0.64

Bergenstal RM et al. *NEJM* 2010;363:311-20

Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

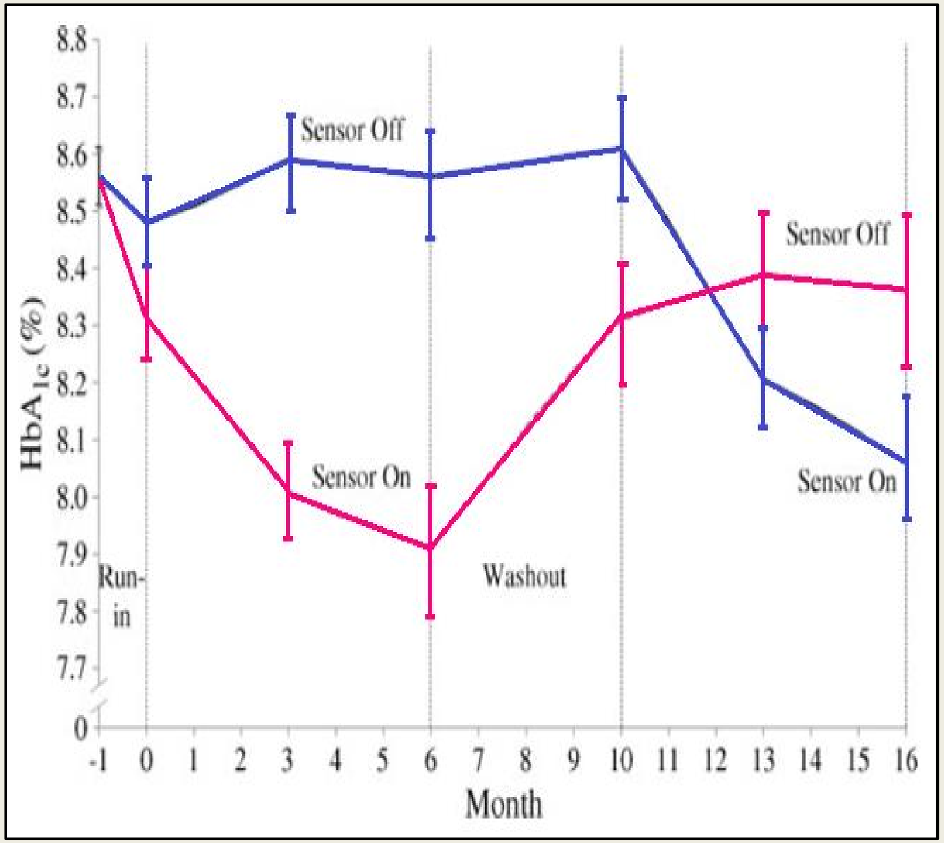


The use and efficacy of continuous glucose monitoring in type 1 diabetes treated with insulin pump therapy: a randomised controlled trial

Table 1 Baseline characteristics of study participants

n=153

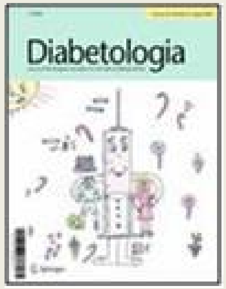
Characteristic	Sequence OFF/ON		
	All participants	Adults	Children
Sample size, *n*	76	41	35
Mean age (years)	28±17	42±11	12±3.2
Male sex, *n* (%)	37 (49)	20 (49)	17 (49)
Mean weight (kg)	66±21	79±13	52±20
Mean height (cm)	166±17	174±8.8	156±18
BMI (kg/m^2)	24±4.5	26±3.2	20±4.0
HbA_{1c} (%)	8.5±0.6	8.4±0.6	8.5±0.6
HbA_{1c} (mmol/mol)	69.4±6.5	68.3±6.5	69.4±6.5
Time since diagnosis of diabetes (years)	14±10	21±8.9	6.3±3.1
Time since start of CSII (years)	5.1±4.1	6.4±4.8	3.5±2.2



Battelino T et al. *Diabetologia* 2012;55:3155-62

Apports du CGMS dans la gestion du diabète

Hōpital Erasme ULB



The use and efficacy of continuous glucose monitoring in type 1 diabetes treated with insulin pump therapy: a randomised controlled trial

Å **4 SH** (5.70 per 100 patient-years) in the Sensor On arm

Å **2 SH** (2.83 per 100 patient-years) in the Sensor Off arm (p=0.40).

Å No difference in the number of SMBG values <70 mg/dl (On vs Off 7.3±5.5 vs 7.0±5.7; p=0.62).

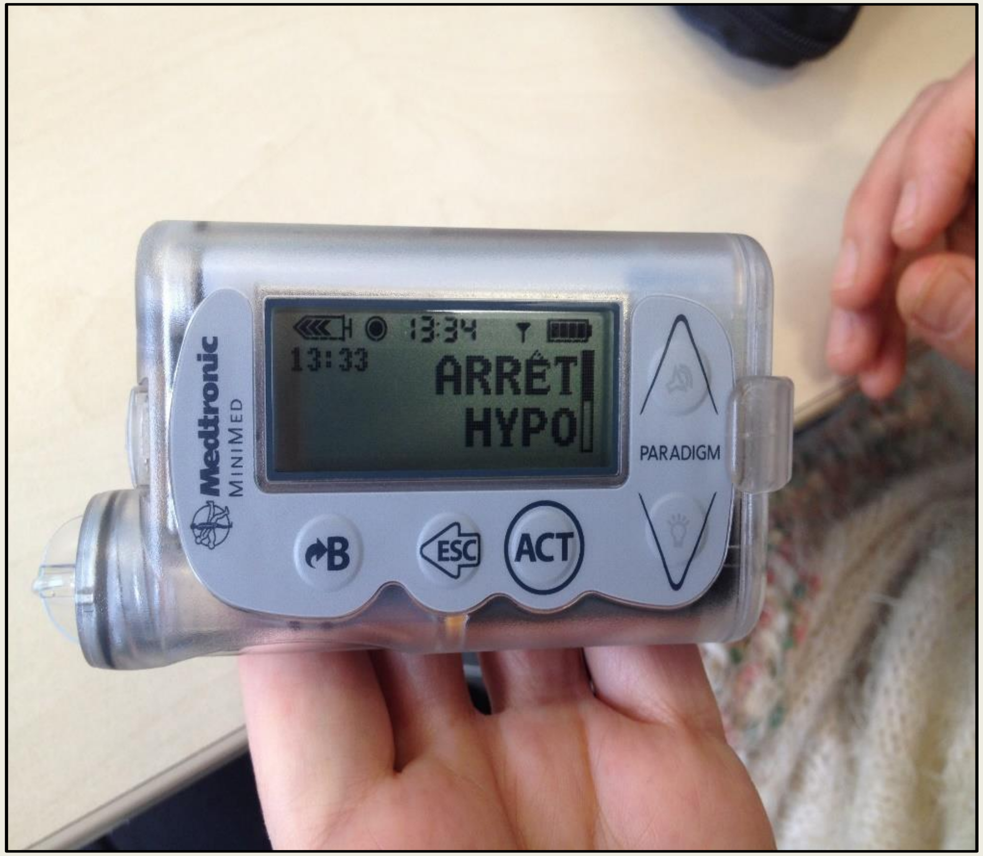
Å No difference in the rate of diabetic ketoacidosis

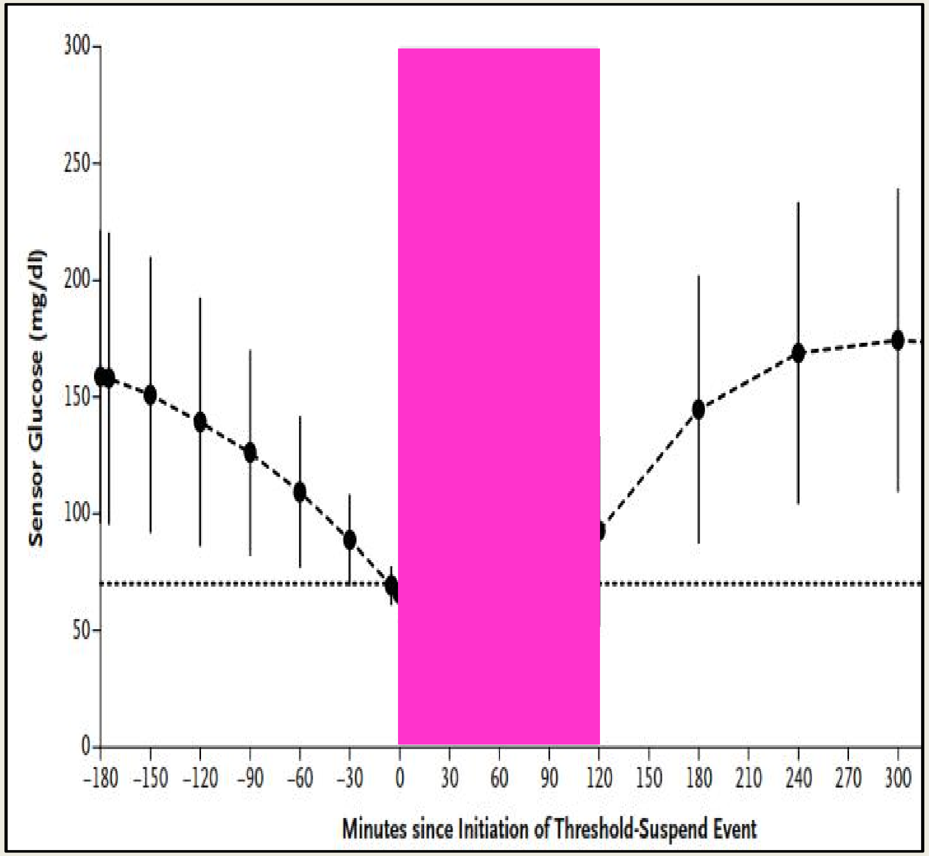
Table 2 Secondary glycemic endpoints

Variable (n=147[a])	Sensor Off	Sensor On	p value
Average daily glucose (mmol/l); median (interquartile range)	9.44 (8.38–10.50)	8.82 (7.94–9.99)	<0.001
Average daily min <3.9 mmol/l; median (interquartile range)	31 (10–57)	19 (7.9–38)	0.009
Average daily per cent of glucose readings <3.9 mmol/l; median (interquartile range)	2.6 (0.90–5.2)	1.7 (0.75–3.4)	0.005
Average daily min spent in euglycaemia (3.9–10.0 mmol/l); mean±SD	669±208	774±232	<0.001
Average daily per cent of glucose readings (3.9–10.0 mmol/l) median; (interquartile range)	57 (47–68)	65 (53–77)	<0.001
Average daily min >10.0 mmol/l; median (interquartile range)	429 (307–568)	348 (227–487)	<0.001
Average daily per cent of glucose readings >10.0 mmol/l; median (interquartile range)	38 (27–52)	32 (20–44)	<0.001
Average daily AUC <3·9 mmol/l per 24 h[b]; median (interquartile range)	71 (20–195)	41 (15–113)	0.002
Average daily AUC >10.0 mmol/l per 24 h[b]; median (interquartile range)	6097 (3,731–9,829)	4039 (2,304–7,665)	<0.001
Average daily AUC >13·9 mmol/l per 24 h[b]; median (interquartile range)	1362 (548–3,242)	722 (210–2,043)	<0.001
Average daily AUC <3.9 mmol/l and >10.0 mmol/l per 24 h[b]; median (interquartile range)	6,240 (3,987–10,158)	4,070 (2,318–7,917)	<0.001
24 h SD of glucose values (mmol/l)[c]	4.29±1.19	3.97±1.12	0.0007
MAGE (mmol/l)[b]	5.05	4.61	0.6075

Battelino T et al. *Diabetologia* 2012;55:3155-62

D. Sensor-Augmented Pump + LGS





Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

SAP with Automated Insulin Suspension

Ly TT, Nicholas JA, Retterath A, et al. Effect of Sensor-Augmented Insulin Pump Therapy and Automated Insulin Suspension vs Standard Insulin Pump Therapy on Hypoglycemia in Patients With Type 1 Diabetes. *JAMA* 2013;310:1240-47.

Bergenstal RM, Klonoff DC, Garg SK, et al. Threshold-based insulin-pump interruption for reduction of hypoglycemia (ASPIRE In-Home Study). *NEJM* 2013;369:224-32.

Choudhary P, Shin J, Wang Y, et al. Insulin pump therapy with automated insulin suspension in response to hypoglycemia: reduction in nocturnal hypoglycemia in those at greatest risk. *Diabetes Care* 2011;34:2023-5.

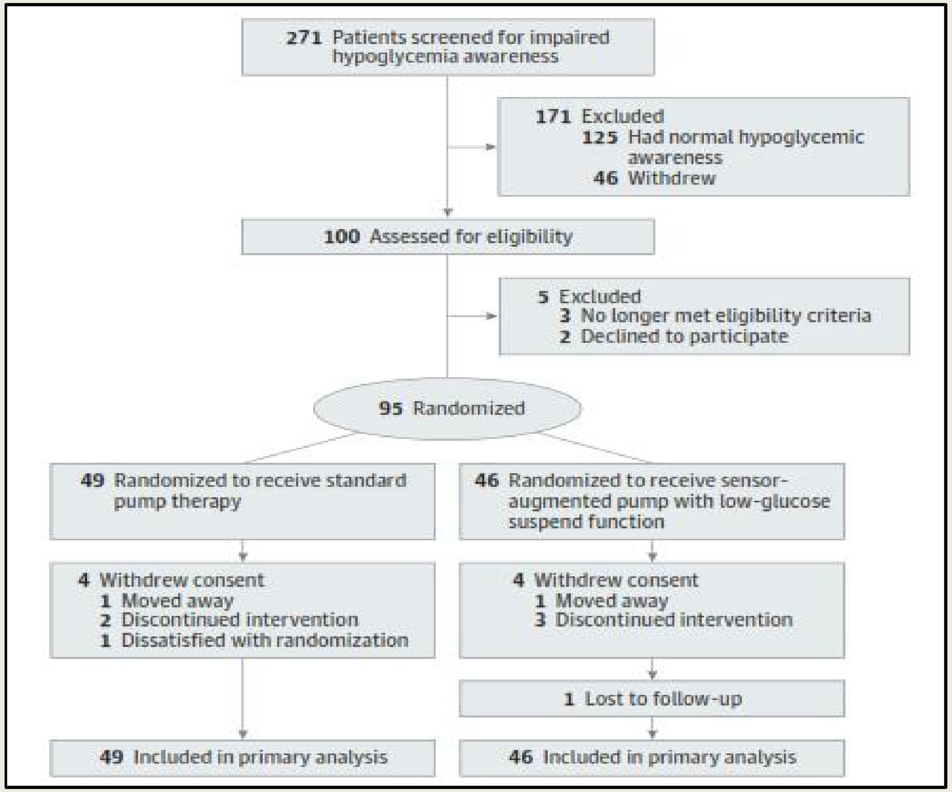
Ly TT, Brnabic AJ, Eggleston A, Kolivos A, et al. A cost-effectiveness analysis of sensor-augmented insulin pump therapy and automated insulin suspension versus standard pump therapy for hypoglycemic unaware patients with type 1 diabetes. *Value Health. 2014 Jul;17(5):561-9.*

Apports du CGMS dans la gestion du diabète

Original Investigation

Effect of Sensor-Augmented Insulin Pump Therapy and Automated Insulin Suspension vs Standard Insulin Pump Therapy on Hypoglycemia in Patients With Type 1 Diabetes
A Randomized Clinical Trial

	No. (%) of Participants	
	Insulin Pump (n = 49)	Sensor-Augmented Pump With Low-Glucose Suspension (n = 46)
Age, mean (SD) [range], y	19.7 (12.9) [5.4-48.6]	17.4 (10.6) [5.1-45.7]
Female	28 (57.1)	20 (43.5)
Age group, y		
4-<7	2 (4.1)	2 (4.3)
7-<12	14 (28.6)	13 (28.3)
12-<18	18 (36.7)	16 (34.8)
18-50	15 (30.6)	15 (32.6)
Duration of diabetes, mean (SD), y	12.1 (10.0)	9.8 (7.4)
Duration of pump therapy, mean (SD), y	4.4 (3.4)	3.8 (3.3)
Insulin/kg, mean (SD), U/kg	0.76 (0.23)	0.83 (0.17)



Ly TT, et al. *JAMA* 2013;310:1240-47.

Apports du CGMS dans la gestion du diabète

Original Investigation

Effect of Sensor-Augmented Insulin Pump Therapy and Automated Insulin Suspension vs Standard Insulin Pump Therapy on Hypoglycemia in Patients With Type 1 Diabetes
A Randomized Clinical Trial

	Insulin Pump (n = 49)	Sensor-Augmented Pump With Low-Glucose Suspension (n = 46)
Sum of Severe and Moderate Hypoglycemia		
Baseline		
Rate per 100 patient-months (95% CI)[a]	20.7 (13.8 to 30)	129.6 (111.1 to 150.3)
No. of events (total No. of patients)	28 (45)	175 (45)
End point		
6-Month rate per 100 patient-months (95% CI)[a]	11.9 (6.8 to 19.3)	28.4 (19.8 to 39.6)
No. of events (total No. of patients)	13 (45)	35 (41)
Incidence rate per 100 patient-months (95% CI)[b]	34.2 (22.0 to 53.3)	9.5 (5.2 to 17.4)
Patients modeled	45	41
Severe hypoglycemia[a]		
Baseline		
Rate per 100 patient-months (95% CI)	2.1 (0.8 to 4.6)	1.8 (0.6 to 4.3)
No. of events (total No. of patients)	6 (49)	5 (46)
End point		
6-Month rate per 100 patient-months (95% CI)	2.2 (0.5 to 6.5)	0 (0 to 2.4)
No. of events (total No. of patients)	6 (45)	0 (41)

HbA1c ≈ 7.4%

	Median (Interquartile Range)		
	Insulin Pump	Sensor-Augmented Pump With Low-Glucose Suspension	*P* Value[a]
Average time of glucose levels <70 mg/dL[b]			
Day			
Baseline	8.3 (2.8-13.0)	5.7 (2.8-8.2)	.15
Night			
Baseline	11.1 (3.1-21.3)	7.3 (2.4-16.4)	.20
Average time of glucose levels <60 mg/dL[b]			
Day			
Baseline	3.2 (0.7-9.0)	2.4 (0.4-4.4)	.15
Night			
Baseline	4.8 (0-12.9)	2.3 (0-9.5)	.38

Ly TT, et al. *JAMA* 2013;310:1240-47.

Apports du CGMS dans la gestion du diabète

The NEW ENGLAND JOURNAL *of* MEDICINE

Threshold-Based Insulin-Pump Interruption for Reduction of Hypoglycemia

Richard M. Bergenstal, M.D., David C. Klonoff, M.D., Satish K. Garg, M.D., Bruce W. Bode, M.D., Melissa Meredith, M.D., Robert H. Slover, M.D., Andrew J. Ahmann, M.D., John B. Welsh, M.D., Ph.D., Scott W. Lee, M.D., and Francine R. Kaufman, M.D., for the ASPIRE In-Home Study Group*

Eligibility

Å 16 to 70 years of age
Å Type 1 diabetes > 2 years
Å CSII > 6 months
Å HbA1c 5.8-10%
Å Excluded if > 1 SH/6 months
Å Excluded if CVD

2-week run-in phase

Å CGM use > 80%
Å Ó2 nocturnal hypo events (Ò65)

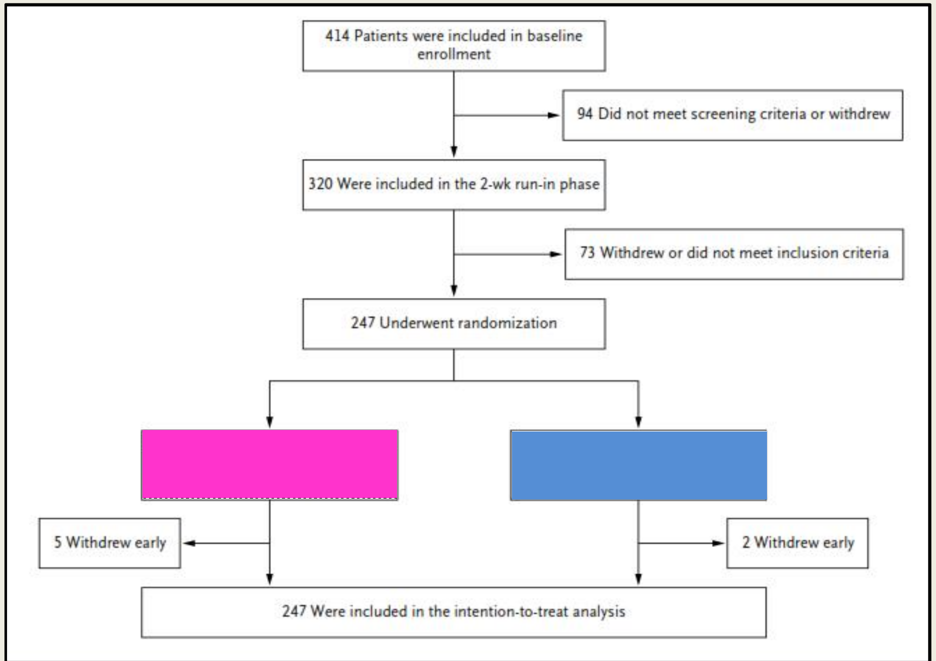


Figure 1. Enrollment, Randomization, and Inclusion in the Study Phase.
A total of 320 patients participated in the run-in phase. To advance to the study phase, patients had to have worn glucose sensors at least 80% of the time, and sensor data had to have shown at least two nocturnal hypoglycemic events. A total of 247 patients were randomly assigned to a study group: 121 to the threshold-suspend group and 126 to the control group.

NEJM 2013; 369;3: 224-232.

Apports du CGMS dans la gestion du diabète

Hôpital Erasme | ULB

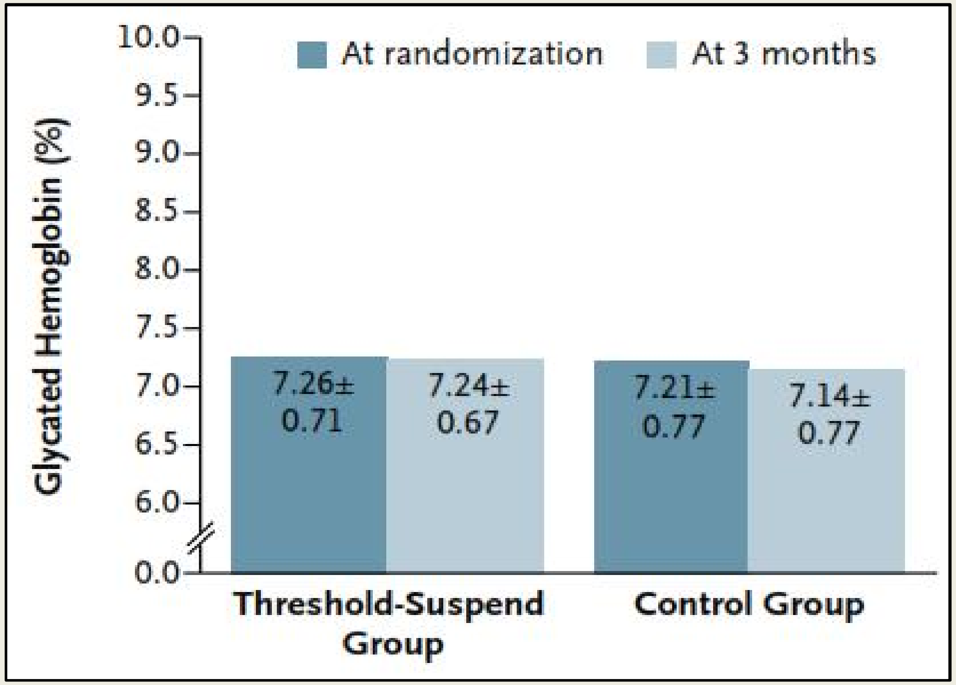
The NEW ENGLAND JOURNAL *of* MEDICINE

Threshold-Based Insulin-Pump Interruption for Reduction of Hypoglycemia

Richard M. Bergenstal, M.D., David C. Klonoff, M.D., Satish K. Garg, M.D., Bruce W. Bode, M.D., Melissa Meredith, M.D., Robert H. Slover, M.D., Andrew J. Ahmann, M.D., John B. Welsh, M.D., Ph.D., Scott W. Lee, M.D., and Francine R. Kaufman, M.D., for the ASPIRE In-Home Study Group*

Table 1. Baseline Characteristics of the Patients Who Underwent Randomization.*

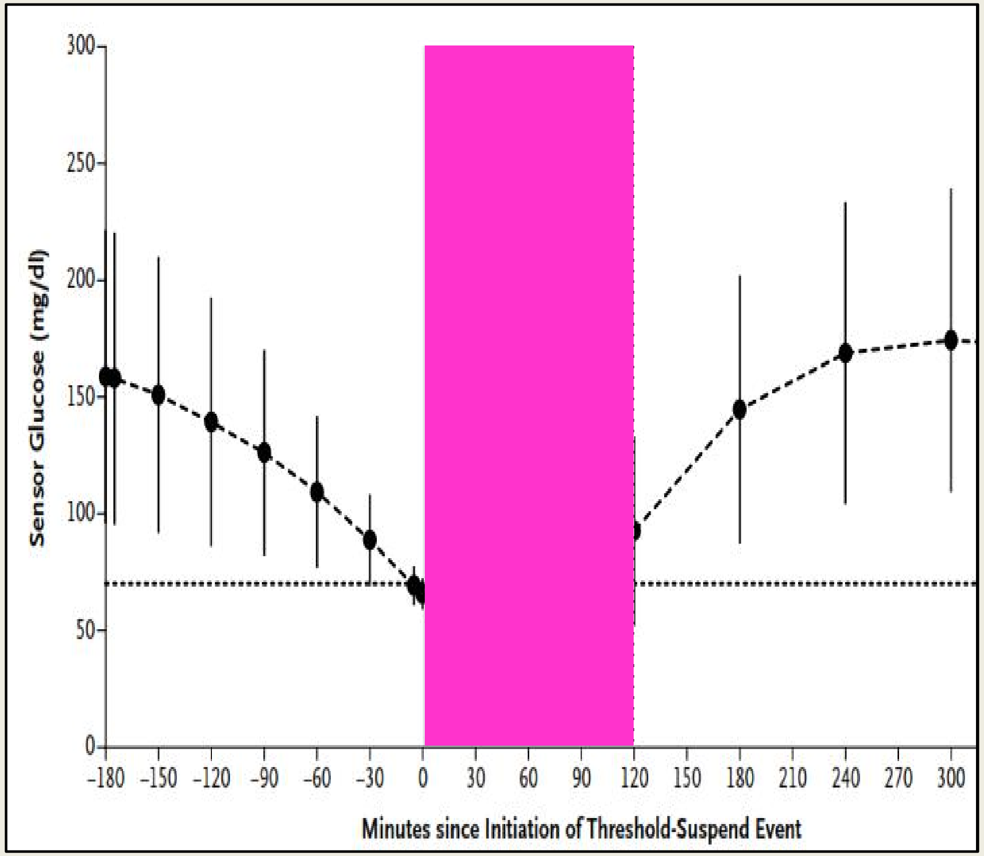
Characteristic	Threshold-Suspend Group (N=121)	Control Group (N=126)
Age (yr)		
Mean	41.6±12.8	44.8±13.8
Range	16–69	16–70
Duration of diabetes (yr)	27.1±12.5	26.7±12.7
Male sex (%)	38.0	39.7
Weight (kg)	79.6±15.9	79.1±15.1
Body-mass index†	27.6±4.7	27.1±4.3
Glycated hemoglobin at randomization (%)	7.26±0.71	7.21±0.77

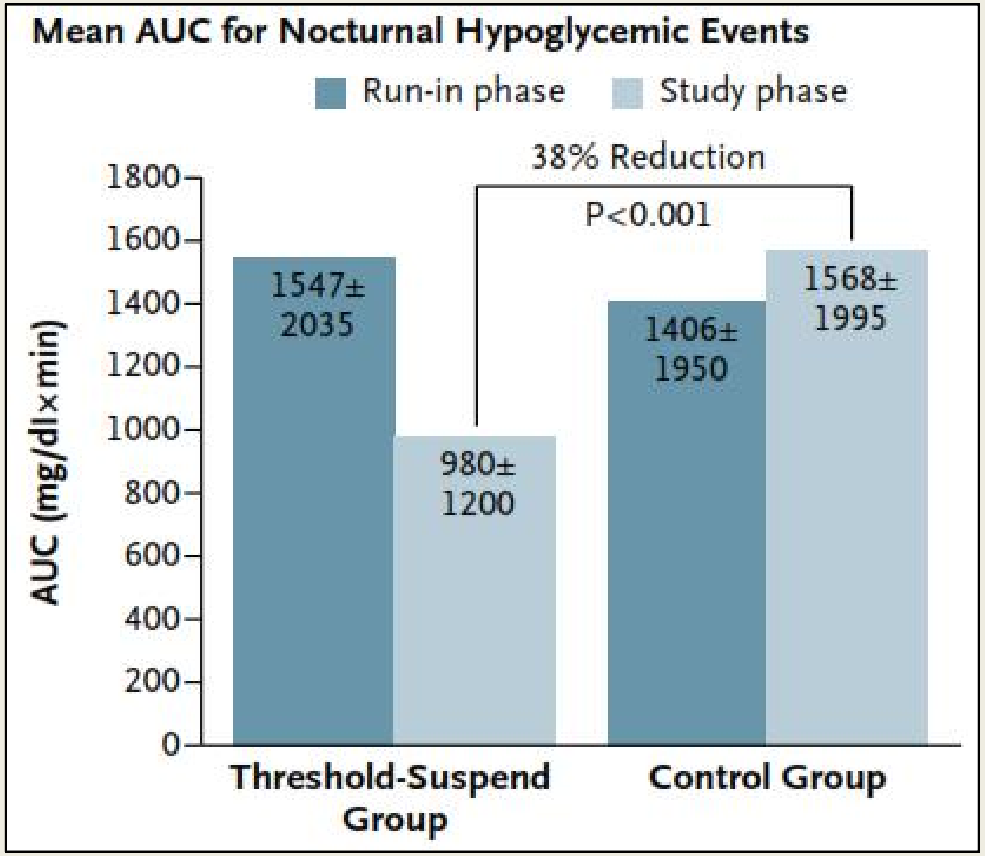


NEJM 2013; 369;3: 224-232.

The ASPIRE in-Home Study

Medtronic VEO pump automatic insulin infusion suspension feature (initial threshold setting <70 mg/dl)
Mandatory between 10 pm and 8 am; optional at other times.





NEJM 2013; 369;3: 224-232.

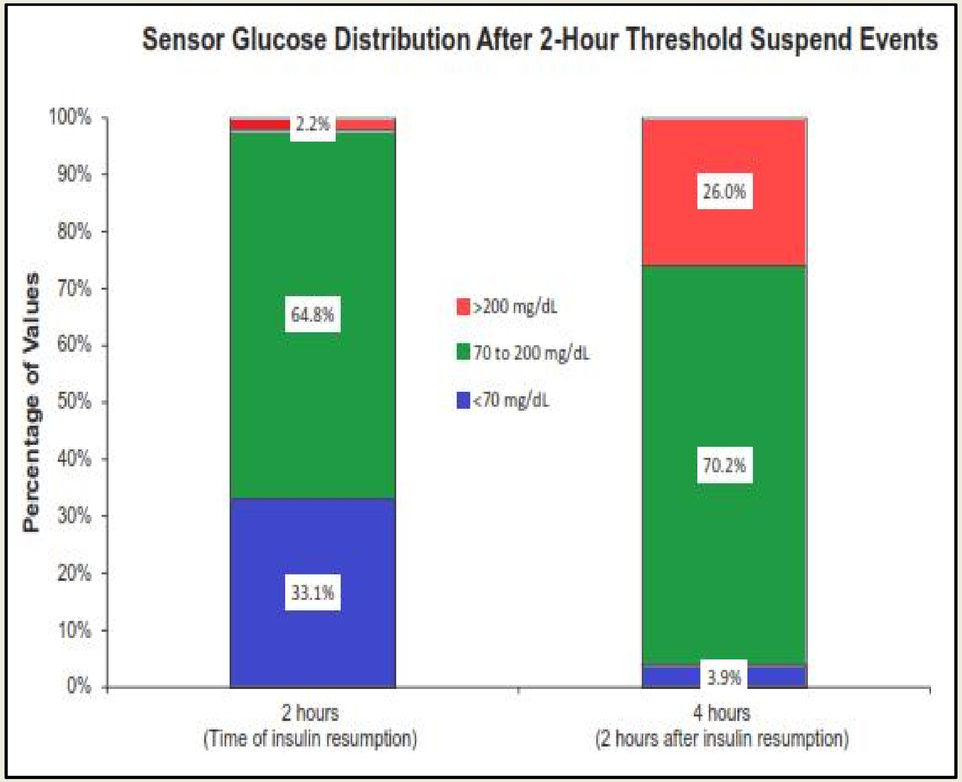
The ASPIRE in-Home Study

Severe hypoglycemia
0 events in the suspend group vs
0.13 per patient/year in the control group

Hypoglycemic events (details)

		Threshold Suspend (n=121)	Control (n=126)	
Nocturnal hypoglycemia events per patient-week	Run-In Phase	2.4 ± 1.2	2.5 ± 1.5	
				-31.8%
AUC of day and night hypoglycemia events, mg/dL × min	Run-In Phase	1153 ± 1647	1094 ± 1557	
	Study Phase	798 ± 965‡	1164 ± 1590	-31.4%
Day and night hypoglycemia events per patient-week	Run-In Phase	5.0 ± 2.8	5.1 ± 3.0	
				-29.7%

‡ Threshold Suspend versus Control, p<0.001.

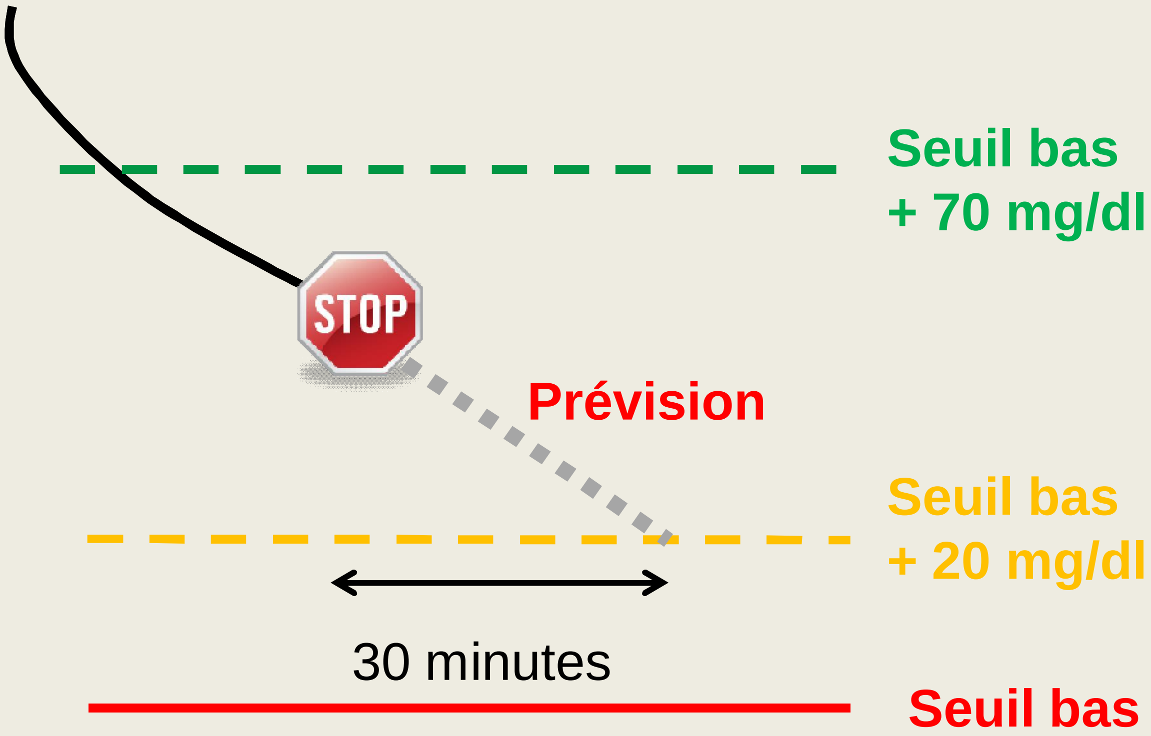


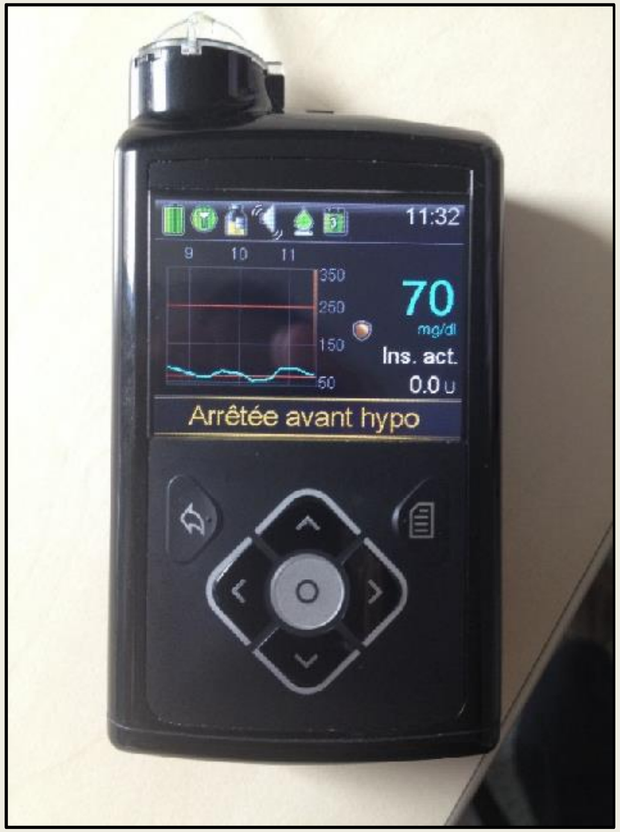
NEJM 2013; 369;3: 224-232.

Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

D. Sensor-Augmented Pump + PLGM

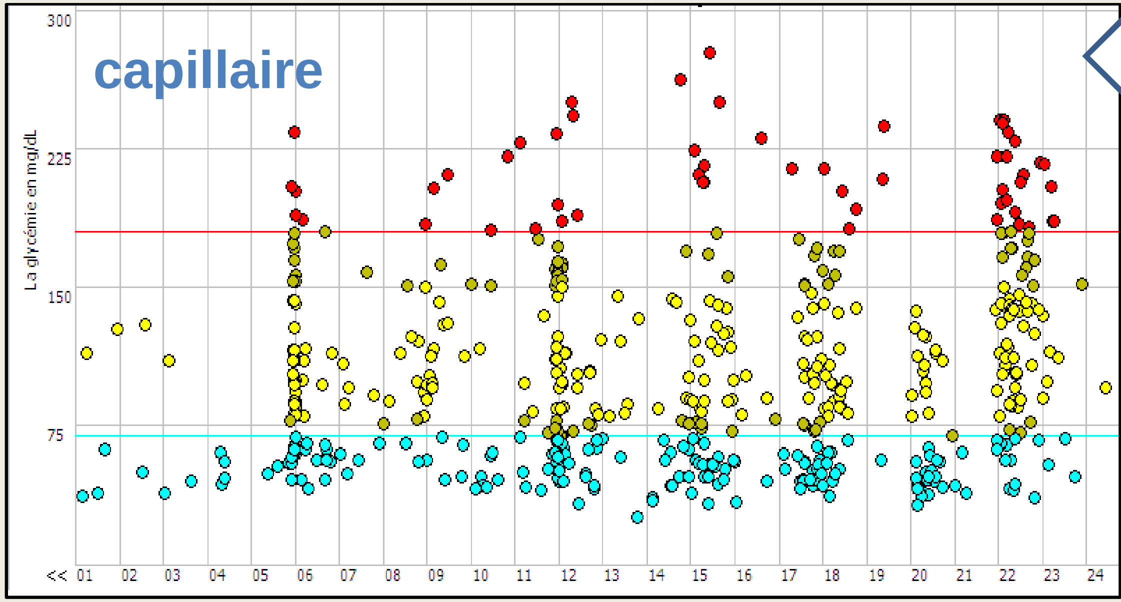




Apports du CGMS dans la gestion du diabète

Hôpital Erasme | ULB

Patient H62 ans, diabétique de type 1, S/P nombreux comas hypoglycémiques

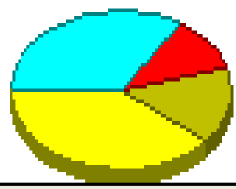


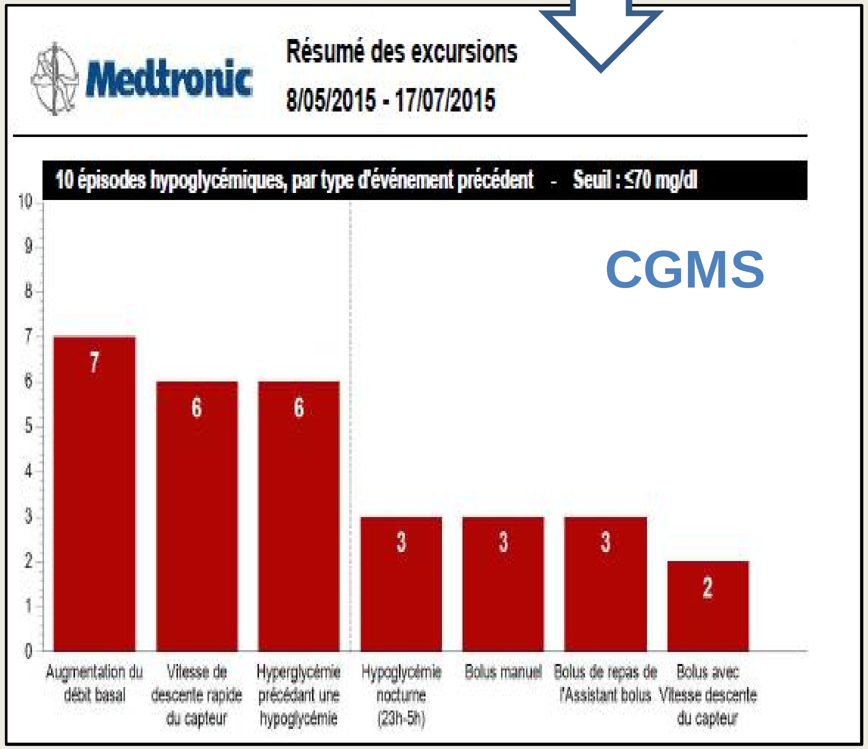
Sous B/P : 15 x H70 / semaine

Sous PLGM : 1 x H70 / semaine

20/07/14 - 19/10/14 (92 jours) 00:00 - 23:59 (Tous les jours)

Jours avec mesures :	92 (=100%)		
Nombre de mesures :	531 (=5,8 /jour)	SD:	±55 mg/dL
Moyenne	105 mg/dL	M80:	34
Valeur minimale/maximale :	26 / 356 mg/dL	M120:	39
Hypoglycémies	182 (=34%)		
Dans la plage normale	291 (=55%)		
dans la plage cible :	209 (=39%)		
Hyperglycémies	58 (=11%)		

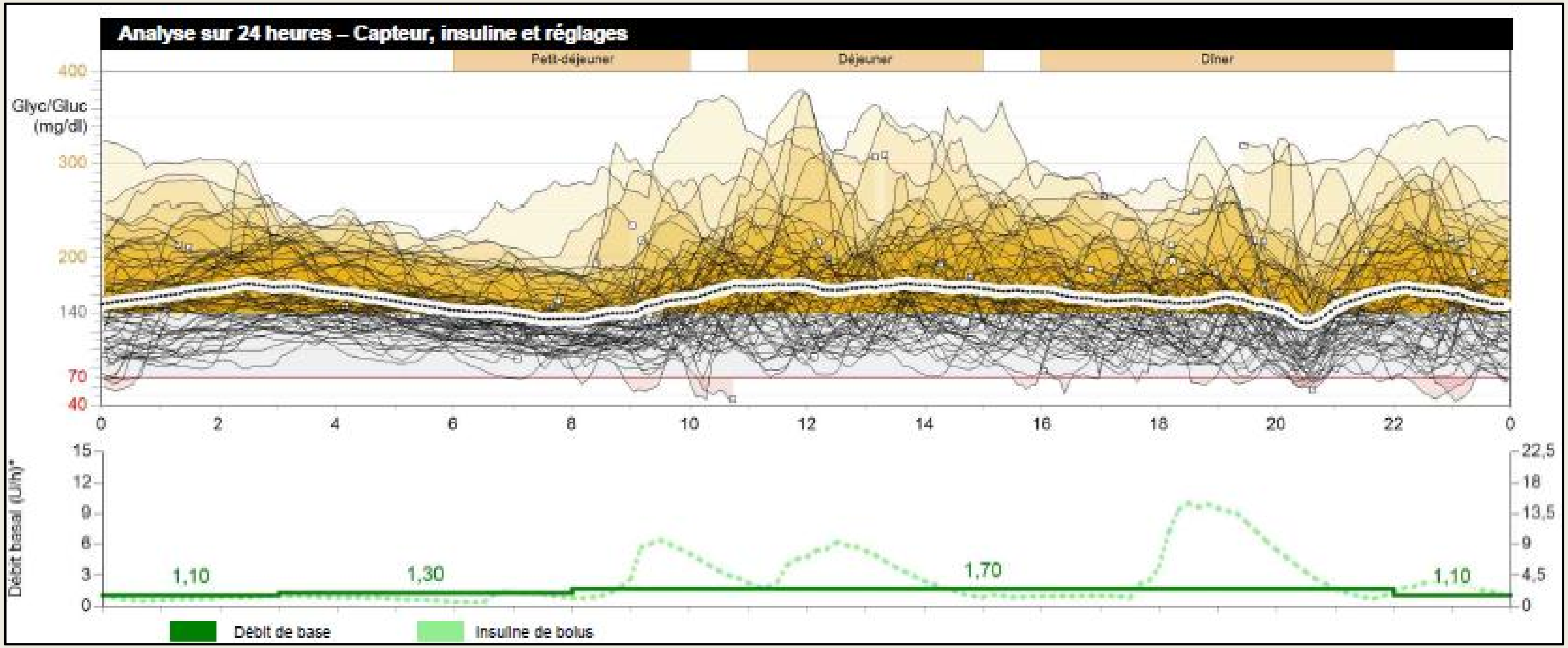




Apports du CGMS dans la gestion du diabète

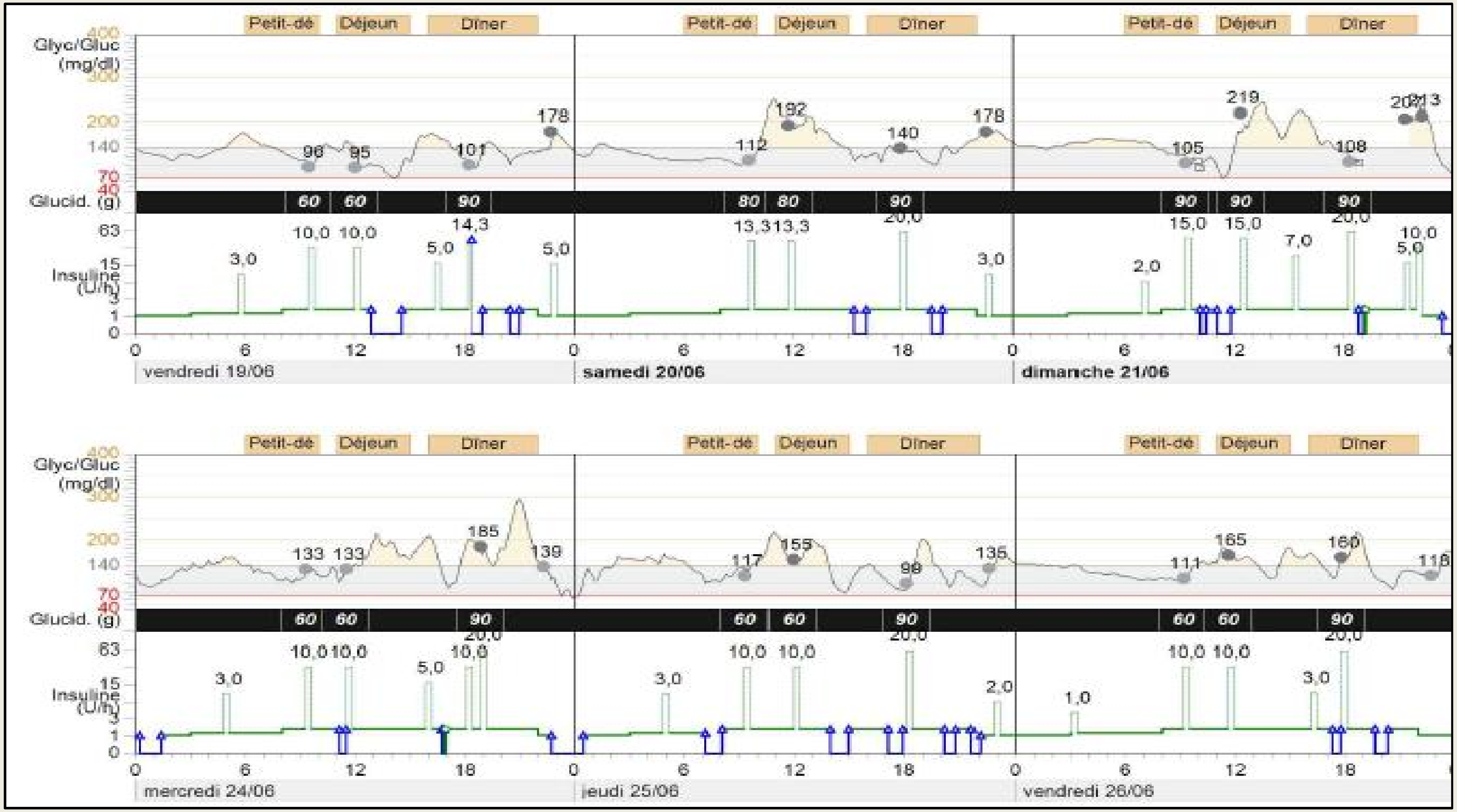
Hôpital Erasme | ULB

D. Sensor-Augmented Pump + PLGM

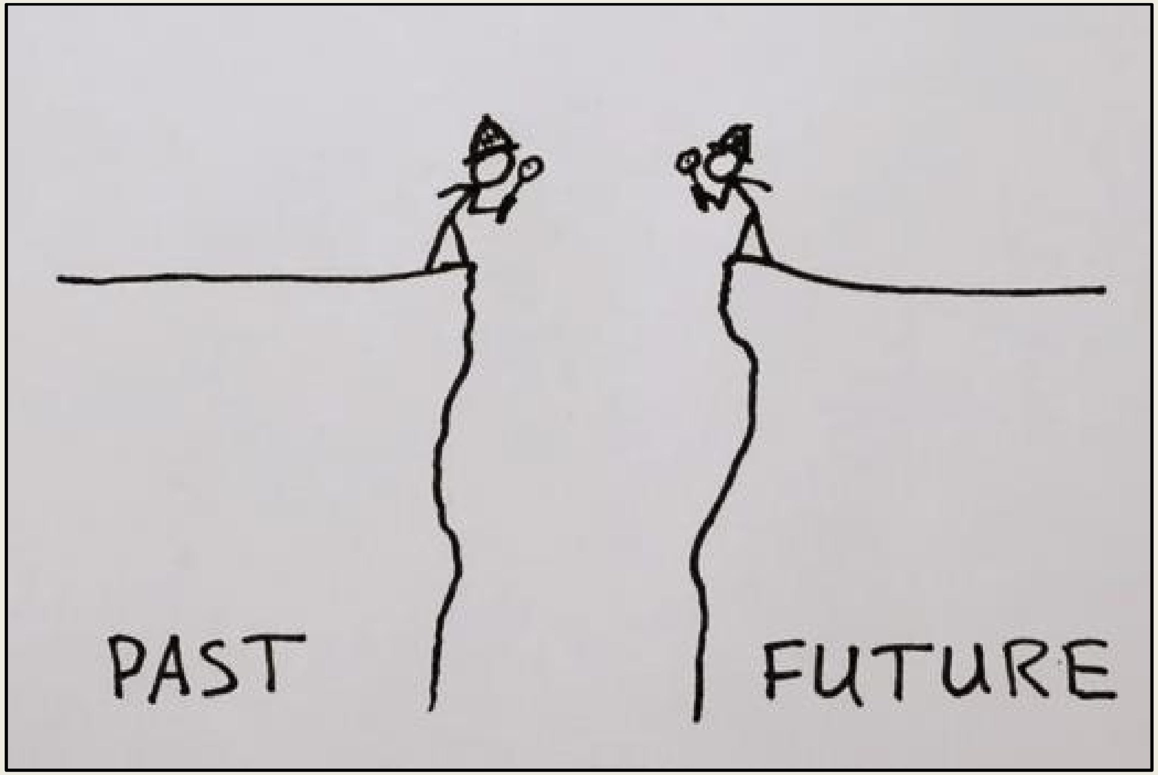


Apports du CGMS dans la gestion du diabète

D. Sensor-Augmented Pump + PLGM



PERSPECTIVES



Abbott Freestyle Libre

Capteur reste en place 14 jours (60ú)

Pas de calibrations nécessaires

Positionnement : remplacer les tests capillaires

Artificial Pancreas (closed loop)

AP@home Consortium. Day and night home closed-loop insulin delivery in adults with type 1 diabetes: three-center randomized crossover study.
Diabetes Care 2014;37:1931-7.

Russell SJ, El-Khatib FH, Sinha M, Magyar KL, et al. Outpatient Glycemic Control with a Bionic Pancreas in Type 1 Diabetes.
NEJM 2014; 371:313-25

AP@home Consortium. Assessing the effectiveness of 3 months day and night home closed-loop insulin delivery in adults with suboptimally controlled type 1 diabetes: a randomised crossover study protocol.
BMJ Open 2014;37:1931-7.

Medical News & Perspectives

Fully Automated Artificial Pancreas Finally Within Reach

Tracy Hampton, PhD

JAMA 2014; 311:22.

Apports du CGMS dans la gestion du diabète

Hôpital Erasme | ULB

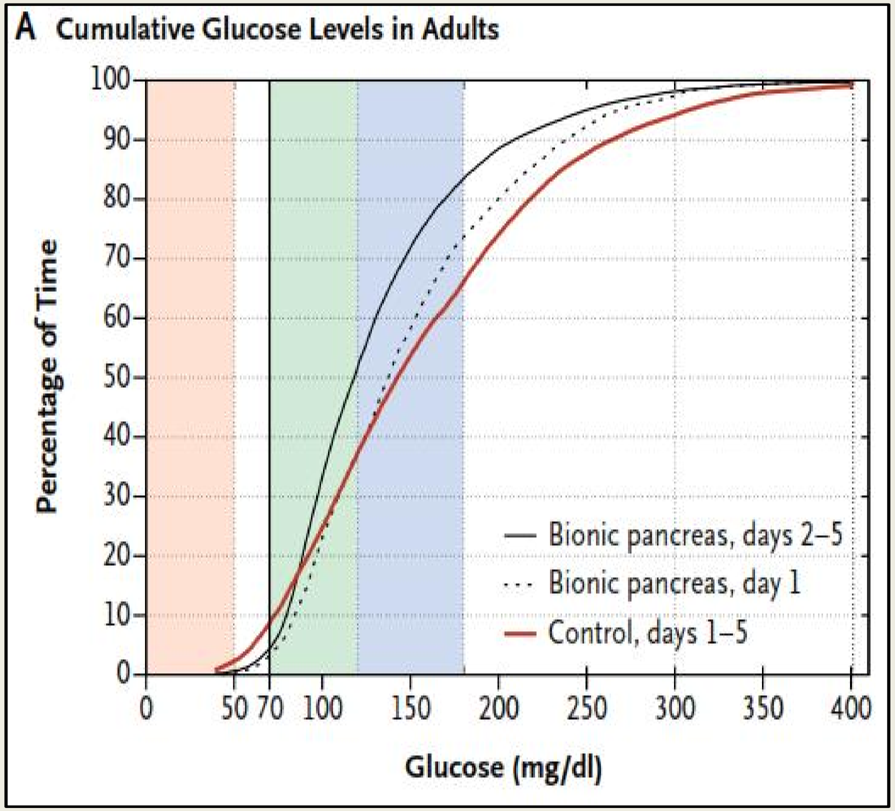
The NEW ENGLAND JOURNAL *of* MEDICINE

Outpatient Glycemic Control with a Bionic Pancreas in Type 1 Diabetes

Steven J. Russell, M.D., Ph.D., Firas H. El-Khatib, Ph.D., Manasi Sinha, M.D., M.P.H., Kendra L. Magyar, M.S.N., N.P., Katherine McKeon, M.Eng., Laura G. Goergen, B.S.N., R.N., Courtney Balliro, B.S.N, R.N., Mallory A. Hillard, B.S., David M. Nathan, M.D., and Edward R. Damiano, Ph.D.

Table 1. Characteristics of the Patients at Baseline.*

Characteristic	Adults†	Adolescents
No. of patients	20	32
Sex — no.		
Male	8	16
Female	12	16
Age (range) — yr	40±16 (21–75)	16±3 (12–20)
Weight (range) — kg	74±10 (50–94)	69±18 (41–128)
Body-mass index (range)‡	25±3 (18–33)	24±5 (17–45)
Diabetes duration (range) — yr	24±11 (5–45)	9±5 (1–18)
Daily insulin dose (range) — U/kg	0.50±0.11 (0.33–0.76)	0.80±0.18 (0.43–1.25)
Glycated hemoglobin (range) — %	7.1±0.8 (6.0–8.6)	8.2±1.0 (5.6–11.6)
Estimated average glucose level (range) — mg/dl§	158±23 (125–200)	189±30 (114–286)



NEJM 2014; 369;3: 224-232.

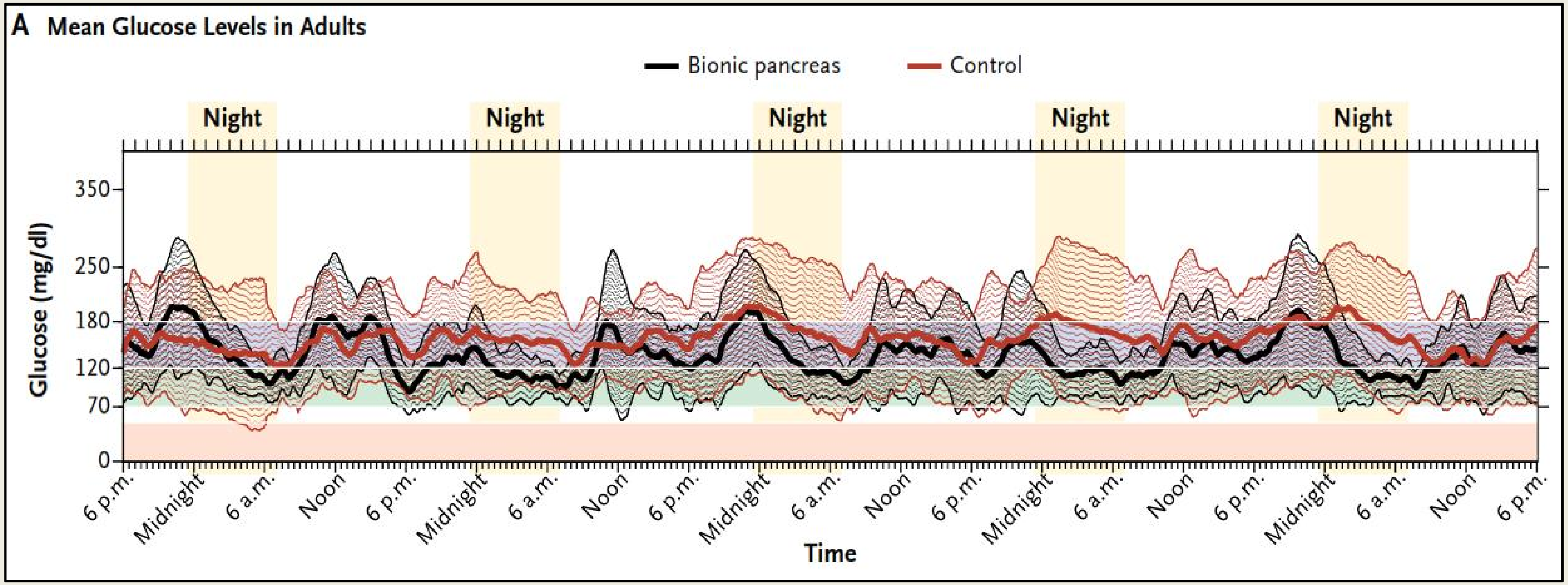
Apports du CGMS dans la gestion du diabète

Hôpital Erasme ULB

The NEW ENGLAND JOURNAL *of* MEDICINE

Outpatient Glycemic Control with a Bionic Pancreas in Type 1 Diabetes

Steven J. Russell, M.D., Ph.D., Firas H. El-Khatib, Ph.D., Manasi Sinha, M.D., M.P.H., Kendra L. Magyar, M.S.N., N.P., Katherine McKeon, M.Eng., Laura G. Goergen, B.S.N., R.N., Courtney Balliro, B.S.N, R.N., Mallory A. Hillard, B.S., David M. Nathan, M.D., and Edward R. Damiano, Ph.D.



133±13 vs. 159±30 mg/dl, P<0.001

NEJM 2013; 369;3: 224-232.

Pancréas artificiel en clinique?

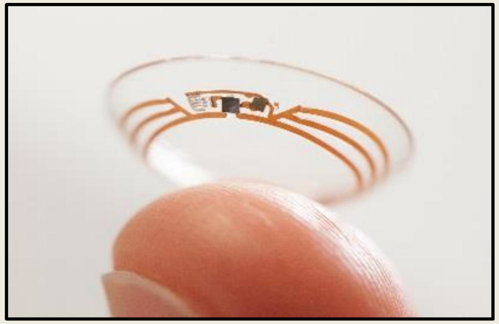
Autre option …

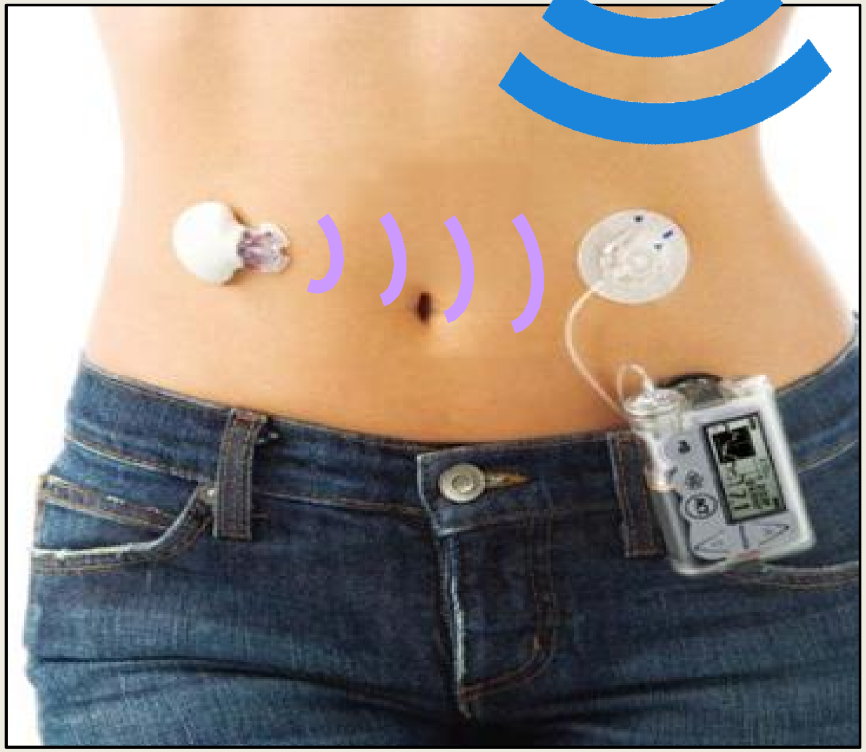
Apports du CGMS dans la gestion du diabète

Hōpital Erasme ULB

« Big data »

« Artificial Intelligence »





Adapted from E. Renard, oral presentation, Vienna, EASD 2014

Hôpital Erasme ULB

Je vous remercie pour votre attention