

Hiperglucemia en la fase aguda del ICTUS



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ORGANIZA



II JORNADAS INTERTERRITORIALES DE **URGENCIAS NEUROLÓGICAS**

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HOSPITAL UNIVERSITARIO PUERTA DEL MAR (CÁDIZ)



Hiperglucemia en la fase aguda del ICTUS



Importancia I

Med Clin (Barc). 2009;132(12):465-475



Conferencia de Consenso

Tratamiento de la hiperglucemia en el hospital

Hospital management of hyperglycemia

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CIBER de Diabetes y Enfermedades Metabólicas Asociadas, CIBERDEM, España

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^c Sociedad Española de Cardiología (SEC)

^d Sociedad Española de Medicina Intensiva, Crítica y Unidades Coronarias (SEMICYUC)

^e Grupo de Urgencias de la SEMI

^f Sociedad Española de Endocrinología y Nutrición (SEEN)

LA HIPERGLUCEMIA

- MARCADOR DE GRAVEDAD
- AUMENTA LA MORTALIDAD
- AUMENTA LAS TASAS DE INFECCIÓN
- AUMENTA LA ESTANCIA HOSPITALARIA
- CONTROL RIGUROSO EN PACIENTES CRÍTICOS MEJORA EL PRONÓSTICO

**SIN EMBARGO EL MANEJO DE LA HIPERGLUCEMIA
EN LA MAYORÍA DE LOS CENTROS SANITARIOS SIGUE SIENDO DEFICIENTE**



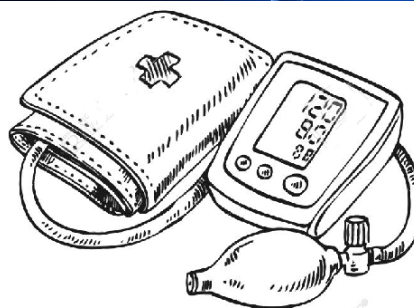
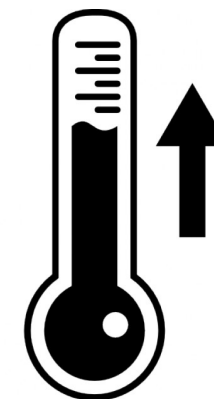
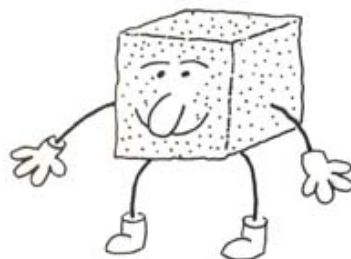


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Importancia II

NEUROPROTECCIÓN



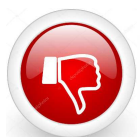
*Fuentes B, Díez Tejedor E.
General care in stroke: relevance
of glycemia and blood pressure levels.
Cerebrovasc Dis. 2007; 24(suppl 1): 134-42.*



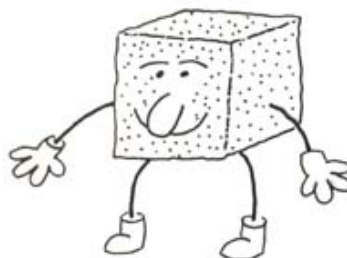
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Importancia III



PRONÓSTICO



< 50 mg/dl



> 400 mg/dl

Baird TA, Parsons MW, Phan T, Butcher KS, Desmond PM, Tress BM, et al. Persistent poststroke hyperglycemia is independently associated with infarct expansion and worse clinical outcome. *Stroke*. 2003; 34(9): 2208-14.

Fuentes B, Castillo J, San José B, Leira R, Serena J, Vivancos J, et al. The prognostic value of capillary glucose levels in acute stroke: the GLyemia in Acute Stroke (GLIAS) study. *Stroke*. 2009; 40(2): 562-8.

Álvarez-Sabín J, Molina CA, Montaner J, Arenillas JF, Huertas R, Ribo M, et al. Effects of admission hyperglycemia on stroke outcome in reperfusion tissue plasminogen activator-treated patients. *Stroke*. 2003; 34(5): 1235-41

Proceso Asistencial Integrado del Ictus. *Consejería de Ig*

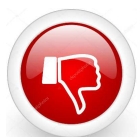




Hiperglucemia en la fase aguda del ICTUS



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Proceso Asistencial Integrado del Ictus. [Consejería de Igualdad y Políticas Sociales. Andalucía](#). 2015;5:28

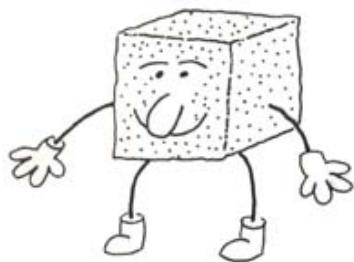




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Importancia IV



HIPERGLUCEMIA - ICTUS

- **PRECOZ < 8 HORAS**
 - No diabéticos 50%
 - Diabéticos 100%
- **TARDÍA 2º-3º DÍA**
 - No diabéticos 27%
 - Diabéticos 78%



Allport L, Baird T, Butcher K, Macgregor L, Prosser J, Colman P, et al. Frequency and temporal profile of poststroke hyperglycemia using continuous glucose monitoring. Diabetes Care. 2006; 29(8): 1839-44





Hiperglucemia en la fase aguda del ICTUS



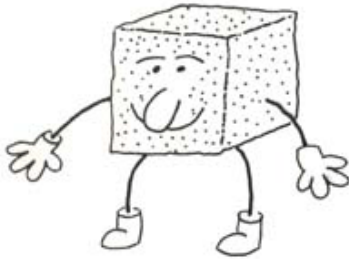
Tratamiento I

¿GLUCEMIA OBJETIVO?

¿DOSIS?

¿INSULINA?

¿CÓMO?





Hiperglucemia en la fase aguda del ICTUS



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Ad
Se

ORIGINAL ARTICLE

Intensive Insulin Therapy in Critically Ill Patients

Greet Van den Berghe, M.D., Ph.D., Pieter Wouters, M.Sc., Frank Weekers, M.D., Charles Verwaest, M.D., Frans Bruyninckx, M.D., Miet Schetz, M.D., Ph.D., Dirk Vlasselaers, M.D., Patrik and Roger Bouillon, M.D., Ph.D.

N Engl J Med 2001; 345:1359-1367 | November 8, 2001 | DOI: 10.1056/NE

Abstract

Article

References

Citing Articles (3152)

CONCLUSIONS

Intensive insulin therapy to maintain blood glucose at or below 110 mg per deciliter reduces morbidity and mortality among critically ill patients in the surgical intensive care unit.

TOOLS

PDF

E-Mail



insulin resistance are common in critically ill

MEDIA IN THIS
ARTICLE
FIGURE 1



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ORIGINAL ARTICLE

Intensive versus Conventional Glucose Control in Critically Ill Patients

The NICE-SUGAR Study Investigators

N Engl J Med 2009; 360:1283-1297 | March 26, 2009 | DOI: 10.1056/NEJM

Abstract

Article

References

Citing Articles (861)

BACKGROUND

one for blood glucose in critically ill patients

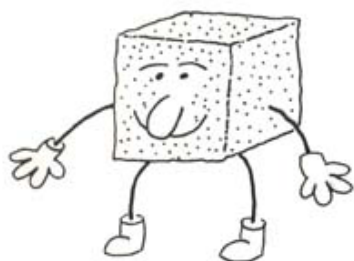
CONCLUSIONS

In this large, international, randomized trial, we found that intensive glucose control increased mortality among adults in the ICU: a blood glucose target of 180 mg or less per deciliter resulted in lower mortality than did a target of 81 to 108 mg per deciliter. (ClinicalTrials.gov number, [NCT00220987](#).)



Hiperglucemia en la fase aguda del ICTUS

Tratamiento I



HIPERGLUCEMIA - ICTUS

- ¿GLUCEMIA OBJETIVO?
- ¿DOSIS?
- ¿INSULINA?
- ¿CÓMO?

>180 mg/dl

140 – 180 mg/dl

SUMMARY OF RECOMMENDATIONS

I. Critically Ill Patients

- Insulin therapy should be initiated for treatment of persistent hyperglycemia, starting at a threshold of no greater than 180 mg/dL (10.0 mmol/L).
- Once insulin therapy has been started, a glucose range of 140 to 180 mg/dL (7.8 to 10.0 mmol/L) is recommended for the majority of critically ill patients. Intravenous insulin infusions are the preferred method for achieving and maintaining glycemic control in critically ill patients.
- Validated insulin infusion protocols with demonstrated safety and efficacy, and with low rates of occurrence of hypoglycemia, are recommended.
- With IV insulin therapy, frequent glucose monitoring is essential to minimize the occurrence of hypoglycemia and to achieve optimal glucose control.

II. Noncritically Ill Patients

- For the majority of noncritically ill patients treated with insulin, the premeal BG target should generally be <140 mg/dL (<7.8 mmol/L) in conjunction with random BG values <180 mg/dL (<10.0 mmol/L), provided these targets can be safely achieved.
- More stringent targets may be appropriate in stable patients with previous tight glycemic control.
- Less stringent targets may be appropriate in terminally ill patients or in patients with severe comorbidities.
- Scheduled subcutaneous administration of insulin, with basal, nutritional, and correction components, is the preferred method for achieving and maintaining glucose control.
- Prolonged therapy with SSI as the sole regimen is discouraged.
- Noninsulin antihyperglycemic agents are not appropriate in most hospitalized patients who require therapy for hyperglycemia.

- Clinical judgment and ongoing assessment of clinical status must be incorporated into day-to-day decisions regarding treatment of hyperglycemia.

III. Safety Issues

- Overtreatment and undertreatment of hyperglycemia represent major safety concerns.
- Education of hospital personnel is essential in engaging the support of those involved in the care of inpatients with hyperglycemia.
- Caution is required in interpreting results of POC glucose meters in patients with anemia, polycythemia, hypoperfusion, or use of some medications.
- Buy-in and financial support from hospital administration are required for promoting a rational systems approach to inpatient glycemic management.

IV. Cost

- Appropriate inpatient management of hyperglycemia is cost-effective.

V. Discharge Planning

- Preparation for transition to the outpatient setting should begin at the time of hospital admission.
- Discharge planning, patient education, and clear communication with outpatient providers are critical for ensuring a safe and successful transition to outpatient glycemic management.

VI. Needed Research

- A selected number of research questions and topics for guiding the management of inpatient hyperglycemia in various hospital settings are proposed.

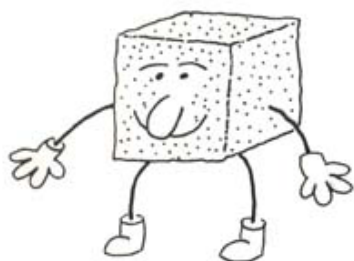


Kutcher ME, Pepper MB, Morabito D, Sunjaya D, Knudson MM, Cohen MJ. "Finding the sweet spot: Identification of optimal glucose levels in critically injured patients". *J Trauma*. 2011; 71(5):1108-14.

Finfer S, Chittock DR, Su SY, Blair D, Foster D, Dhingra V, et al. "Intensive versus conventional glucose control in critically ill patients". *N Engl J Med*. 2009; 360:1283-97

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Tratamiento I



HIPERGLUCEMIA - ICTUS

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- ¿DOSIS?
- ¿INSULINA?
- ¿CÓMO?

>180 mg/dl

140 – 180 mg/dl

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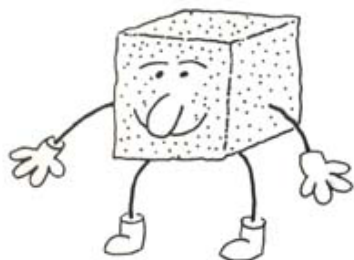
Finfer S, Chittock DR, Su SY, Blair D, Foster D, Dhingra V, et al. "Intensive versus conventional glucose control in critically ill patients". *N Engl J Med*. 2009; 360:1283-97



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Tratamiento I



¿GLUCEMIA OBJETIVO?

¿DOSIS?

¿INSULINA?

¿CÓMO?

>180 mg/dl

140 – 180 mg/dl

110 – 140 mg/dl

<110 mg/dl

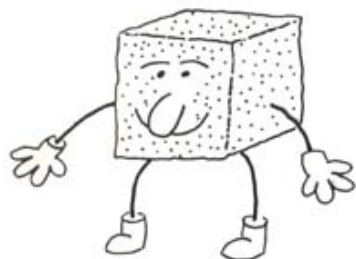
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Tratamiento I



¿GLUCEMIA OBJETIVO?

¿DOSIS?

¿INSULINA?

¿CÓMO?

>180 mg/dl

140 – 180 mg/dl

110 – 140 mg/dl

<110 mg/dl



- Se recomienda evitar hiperglucemias > de 155 mg/dL (Clase I. Nivel de evidencia B)7.

Jauch EC, Jeffrey L, Adams HP, Bruno A, Bart M, Khatri P. et al . American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Peripheral Vascular Disease. Guidelines for the Early Management of Patients With Acute Ischemic Stroke. 2013



Hiper glucemia en la fase aguda del ICTUS



Tratamiento II

¿GLUCEMIA OBJETIVO?

155 mg/dl

>180 mg/dl

140 – 180 mg/dl

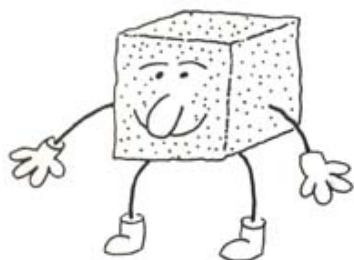
110 – 140 mg/dl

<110 mg/dl

¿DOSIS?

¿INSULINA?

¿CÓMO?





Hiperglucemia en la fase aguda del ICTUS



Tratamiento II

**HIPERGLUCENIA (>140 mg/dl):
INSULINA REGULAR (BOLO 0,1 UI/Kg.)**

glucemia	Insulina regular	Insulina regular
<150 mg/dl	No poner insulina	No poner insulina
150-200 mg/dl	4 UI sc	6 UI sc
201-250 mg/dl	6 UI sc	10 UI sc
251-300 mg/dl	8 UI sc	12 UI sc
301-350 mg/dl	10 UI sc	14 UI sc
>351mg/dl	4 UI iv + 12 UI sc	6 UI iv + 12 UI sc

¿DOSIS?

GL. CAPILAR	DM CONOCIDO Actrapid sc/6h	DM NO CONOCIDO Actrapid sc/6h
121-180mg/dl	6 unidades	4 unidades
181-240mg/dl	8 unidades	6 unidades
242-300mg/dl	10 unidades	8 unidades
301-400mg/dl	12 unidades	10 unidades
>401mg/dl	14 unidades	12 unidades

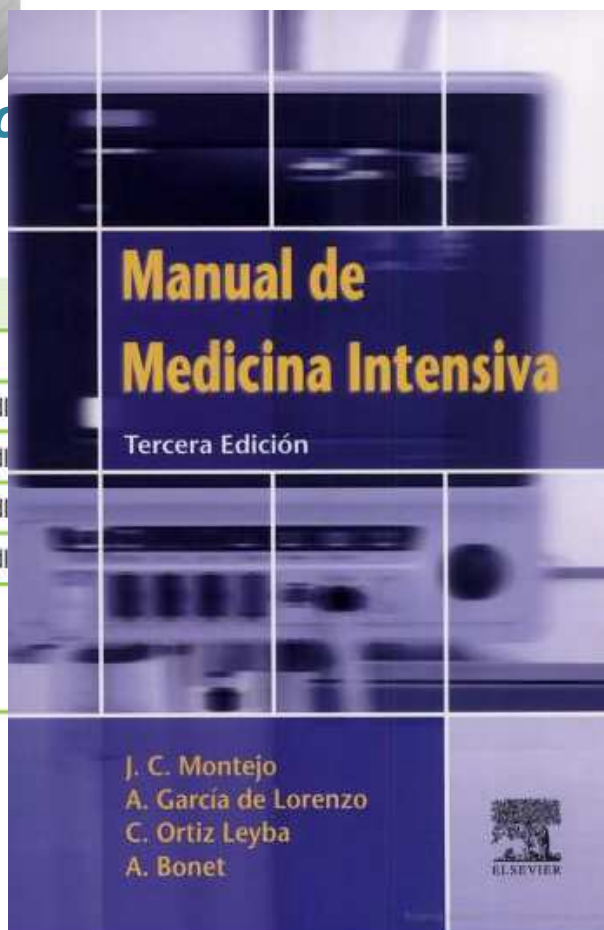


Hiperglucemia en la fase aguda del ICTUS



Tratamiento

glucemia
<150 mg/dl
150-200 mg/dl
201-250 mg/dl
251-300 mg/dl
301-350 mg/dl
>351mg/dl



HIPERGLUCENIA (>140 mg/dl):

INSUL

La insulina es el tratamiento básico de la hiperglucemia. Ésta debe administrarse siempre en infusión continua y con determinaciones frecuentes de la glucemia para ajustar la velocidad de infusión. El uso de bolos intermitentes mediante pautas deslizantes no es aconsejable, ya que la glucemia se comporta de forma errática y se pueden producir alteraciones importantes del volumen extracelular y de los electrolitos. La insulina debe mantenerse hasta que la hiperglucemia está definitivamente controlada.

¿D

PILAR	DM CONOCIDO Actrapid sc/6h	DM NO CONOCIDO Actrapid sc/6h
<100mg/dl	6 unidades	4 unidades
100-120mg/dl	8 unidades	6 unidades
121-140mg/dl	10 unidades	8 unidades
141-160mg/dl	12 unidades	10 unidades
>160mg/dl	14 unidades	12 unidades



Hiperglucemia en la fase aguda del ICTUS



Tratamiento II HIPERGLUCEMIA EN URGENCIAS

HIPERGLUCEMIA SIMPLE

- ☐ Glucemias > 250 mg/dl
- ☐ Factor sensibilización insulina

HIPERGLUCEMIA GRAVE

- ☐ Cetoacidosis diabética
- ☐ E. hiperglucémico hiperosmolar

PAUTA BASAL BOLUS

- ☐ Pacientes estables estancias superiores a 12-24 horas
- ☐ Diabéticos
- ☐ Corticoides
- ☐ Estrés

TERAPIA INTRAVENOSA

- ☐ Pacientes inestables
- ☐ NPT
- ☐ Altas dosis corticoides
- ☐ Cálculo dosis
- ☐ Control rápido

Hiperglucemia en la fase aguda del ICTUS

1. CÁLCULO DE LA DOSIS

Glucemia al ingreso:

- < 150 mg/dl: 0.3 U.I/kg/día.
- 150-200 mg/dl: 0.4 U.I/kg/día.
- > 200 mg/dl: 0.5 U.I/kg/día.

DM + ADOs

0.3 - 0.5 U.I/kg/día.

DM + INSULINA + ADOs

Igual que "**DM + INSULINA**"
+ 20% de lo calculado.

DM + INSULINA

Suma total de U.I/día en
domicilio.

2. DISTRIBUCIÓN DE LA DOSIS

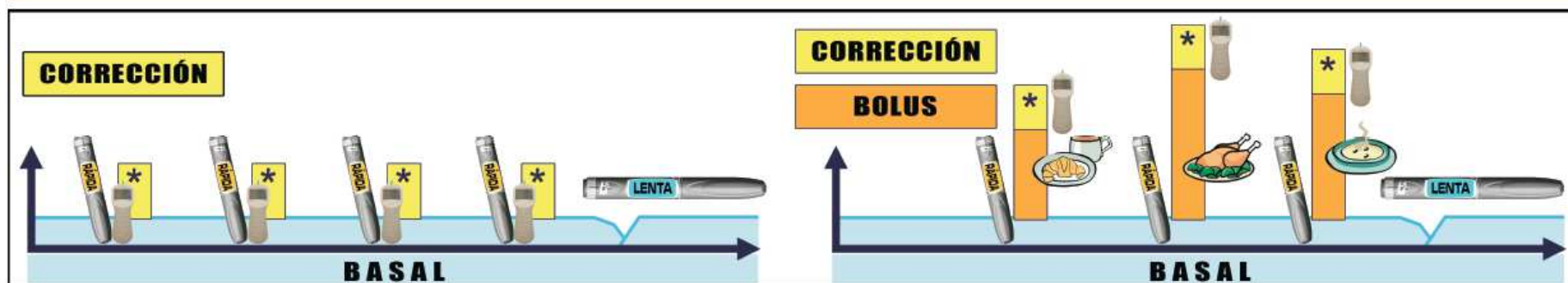
NO COME:

BASAL (50%) ± P. CORRECCIÓN (A, B, C)

COME:

BASAL (50%) + BOLUS* (50%) ± P. CORRECCIÓN (A, B, C)

*BOLUS: Repartir la dosis calculada entre desayuno (30%), almuerzo (40%) y cena (30%).



Hiperglucemia en la fase aguda del ICTUS

Tratamiento II



3. PAUTA DE CORRECCIÓN:

GLUCEMIA CAPILAR	PAUTA A (< 40 U/día o < 60 kg)	PAUTA B (40-80 U/día o 60-90 kg)	PAUTA C (> 80 U/día o > 90 kg)
< 80 mg/dl	- 1	- 1	- 2
80 - 129	0	0	0
130 - 149	0	+ 1	+ 1
150 - 199	+ 1	+ 1	+ 2
200 - 249	+ 2	+ 3	+ 4
250 - 299	+ 3	+ 5	+ 7
300 - 349	+ 4	+ 7	+ 10
> 349	+ 5	+ 8	+ 12

Protocolo manejo insulinización subcutánea. SAEDYN. Disponible en: http://www.saedyn.es/wp-content/uploads/2015/05/i_cartel_subcutanea_final_I_0031.pdf. Marzo 2016



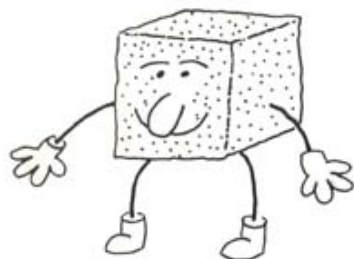
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¿DOSIS?

Tratamiento II

PAUTA DE CORRECCIÓN: A B C



GLUCEMIA CAPILAR mg/dl	PAUTA A < 40 UI/d o < 60 kg	PAUTA B 40-80 UI/d o 60-90 kg	PAUTA C > 80 UI/d o > 90 kg
150 - 199	2	3	4
200 - 249	4	5	6
250 - 299	5	7	9
300 - 349	6	9	12
> 350	7	10	14

Unidades previas diarias



Peso corporal





Tratamiento III

¿GLUCEMIA OBJETIVO?

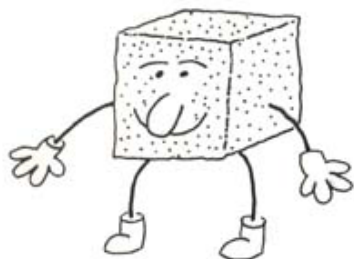
155 mg/dl

>180 mg/dl

140 – 180 mg/dl

110 – 140 mg/dl

<110 mg/dl



¿INSULINA?

¿CÓMO?

¿DOSIS?

GLUCEMIA CAPILAR mg/dl	PAUTA A < 40 UI/d o < 60 kg	PAUTA B 40-80 UI/d o 60-90 kg	PAUTA C > 80 UI/d o > 90 kg
150 - 199	2	3	4
200 - 249	4	5	6
250 - 299	5	7	9
300 - 349	6	9	12
> 350	7	10	14

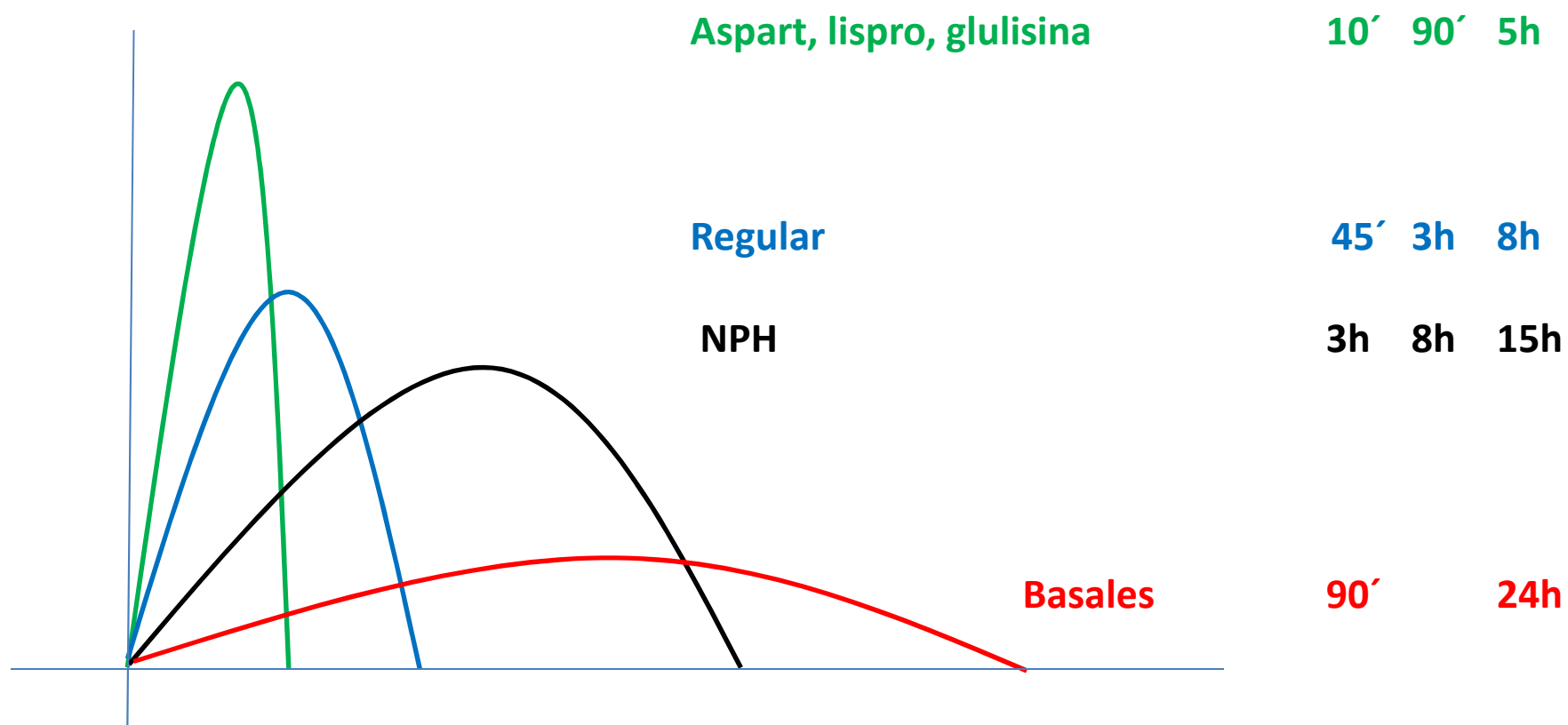
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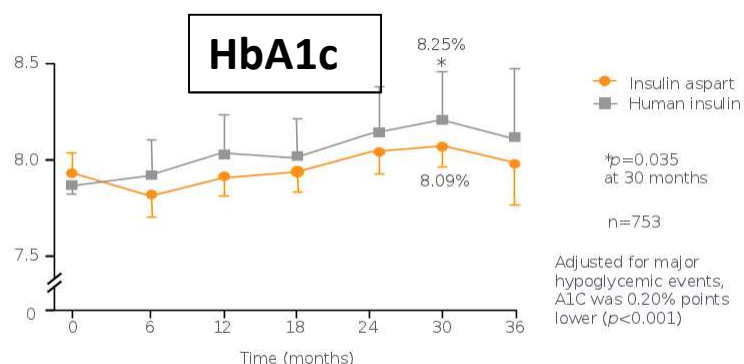
Tratamiento III



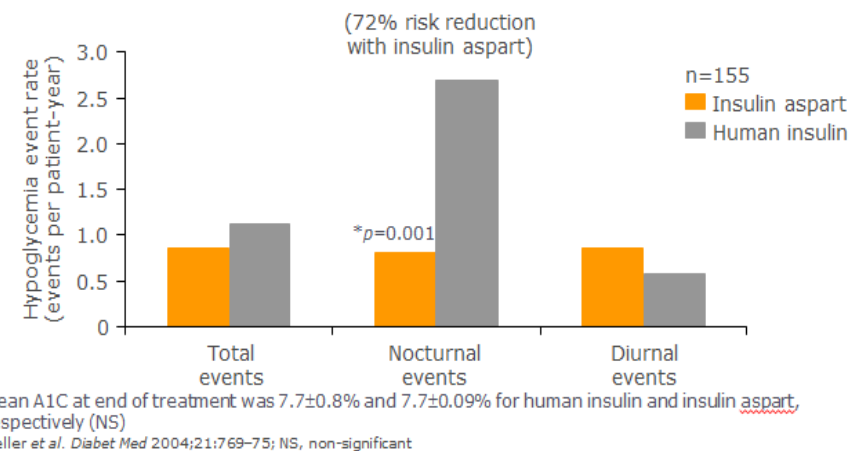
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Hipoglucemias

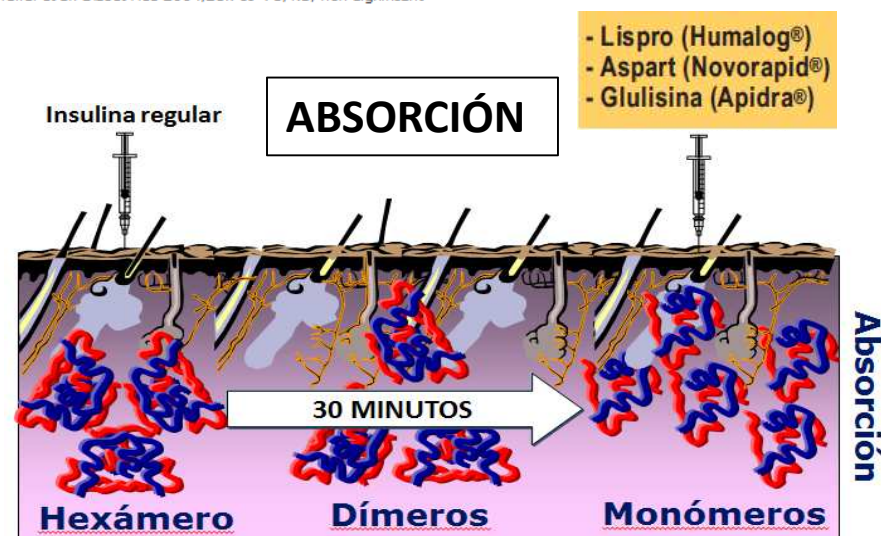
Tratamiento III



Home et al. Diabetes Res Clin Pract 2006;71:131-9



Seguridad

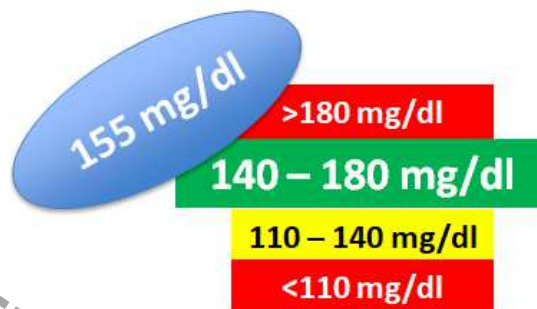


Home Insulin Aspart Medical Update V. 2.0 (19.02.2014)
Heinemann, et al. Diabet Med. 1996; 13:625-629



Tratamiento III

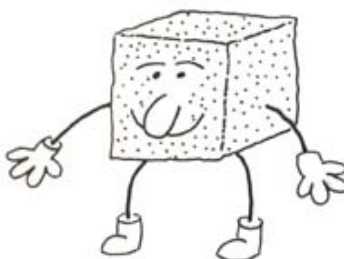
GLUCEMIA OBJETIVO



ANÁLOGOS DE INSULINA RÁPIDA

INSULINAS

- Lispro (Humalog®)
- Aspart (Novorapid®)
- Glulisina (Apidra®)



DOSIS

GLUCEMIA CAPILAR mg/dl	PAUTA A < 40 UI/d o < 60 kg	PAUTA B 40-80 UI/d o 60-90 kg	PAUTA C > 80 UI/d o > 90 kg
150 - 199	2	3	4
200 - 249	4	5	6
250 - 299	5	7	9
300 - 349	6	9	12
> 350	7	10	14

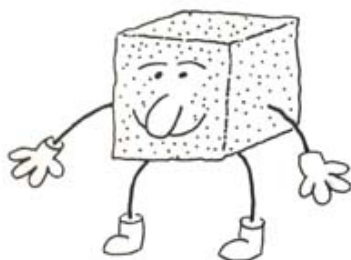
¿CÓMO?



Hiperglucemia en la fase aguda del ICTUS



Tratamiento IV



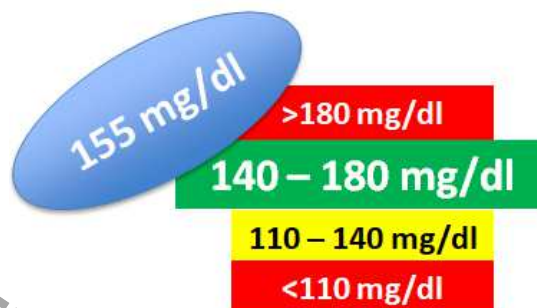
5.2 Vías de administración.

- ▶ Subcutánea: la vía ideal en la mayoría de los casos.
- ▶ Intravenosa:
 - Glucemia $>400\text{mg/dl}$.
 - Situaciones que precisan reducción rápida de la glucemia:
 - SCA: a partir de 180mg/dl .
 - Traumatizado grave: A partir de 180mg/dl .
 - Shock séptico: A partir de 180mg/dl .
 - Ictus: a partir de 150mg/dl .
 - Convulsiones: a partir de 170mg/dl .
 - Pos-PCR: a partir de 180mg/dl .
 - Cetosis grave ($\geq 3\text{mmol/L}$).

Barranco Zafra R, Romero Morales F, de la Cal Ramírez MA, Millán Reyes MJ, Palomares Ortega RJ. Protocolo de Urgencias Diabéticas Extrahospitalarias. Consejería de Igualdad, Salud y Políticas Sociales. 2013.

Tratamiento IV

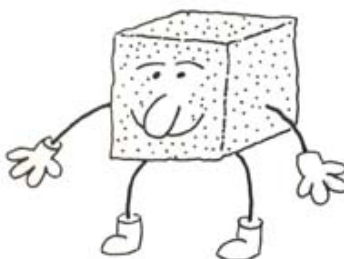
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CÓMO

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Conclusiones

1. El control de la glucemia mejora el pronóstico.
2. Es fundamental iniciar el tratamiento en la fase aguda.
3. Se indica tratamiento a partir de cifras de glucemia de 155 mg/dl
4. El rango óptimo para el paciente crítico es 140-180 mg/dl.
5. Es aconsejable el uso de análogos de insulina rápida sobre la insulina humana.
6. Las dosis deben controlar la hiperglucemia pero evitar la hipoglucemia.
7. Nuestro grupo de trabajo apuesta por el uso de pautas menos agresivas, en base a las necesidades de insulina del paciente o según el peso corporal, sobre la pautas de corrección aprobadas actualmente.

