53. ULUSAL DİYABET KONGRESİ

19 - 23 NİSAN 2017

ELEXUS HOTEL / GİRNE - K.K.T.C.

53. ULUSAL DİYABET KONGRESİ

17:30-18:15	**UZMANINA DANIŞ 6**	**SALON 3**
	Yoğun bakım hastasının yönetimi: Metabolik değişimler, glukoz regülasyonu, nütrisyon desteği	*İbrahim Aslan*

YOĞUN BAKIM HASTA YÖNETİMİ

METABOLİK DEĞİŞİMLER
GLUKOZ REGÜLASYONU
NUTRİSYON DESTEĞİ

METABOLİK DEĞİŞİMLER

Sempatik Sinir Sistemi Stimülasyonu
Hipotalamo-Hipofiz Hormonları Salınım Değişiklikleri
Anabolik Faktörlere Karşı Periferik Dokularda Direnç Gelişimi
Hayati Organlara Substrat Girişinin Arttırılmasının Hedeflenmesi

Enerji Üretim Yolaklarının Değişimi
Alternatif Enerji Kullanımı
Enerji Alım ve Kullanım Kontrolünün Kaybolması
Enerji Tüketimdeki Değişim

Hiperglisemi

Vücut Kompozisyonunda Değişimler

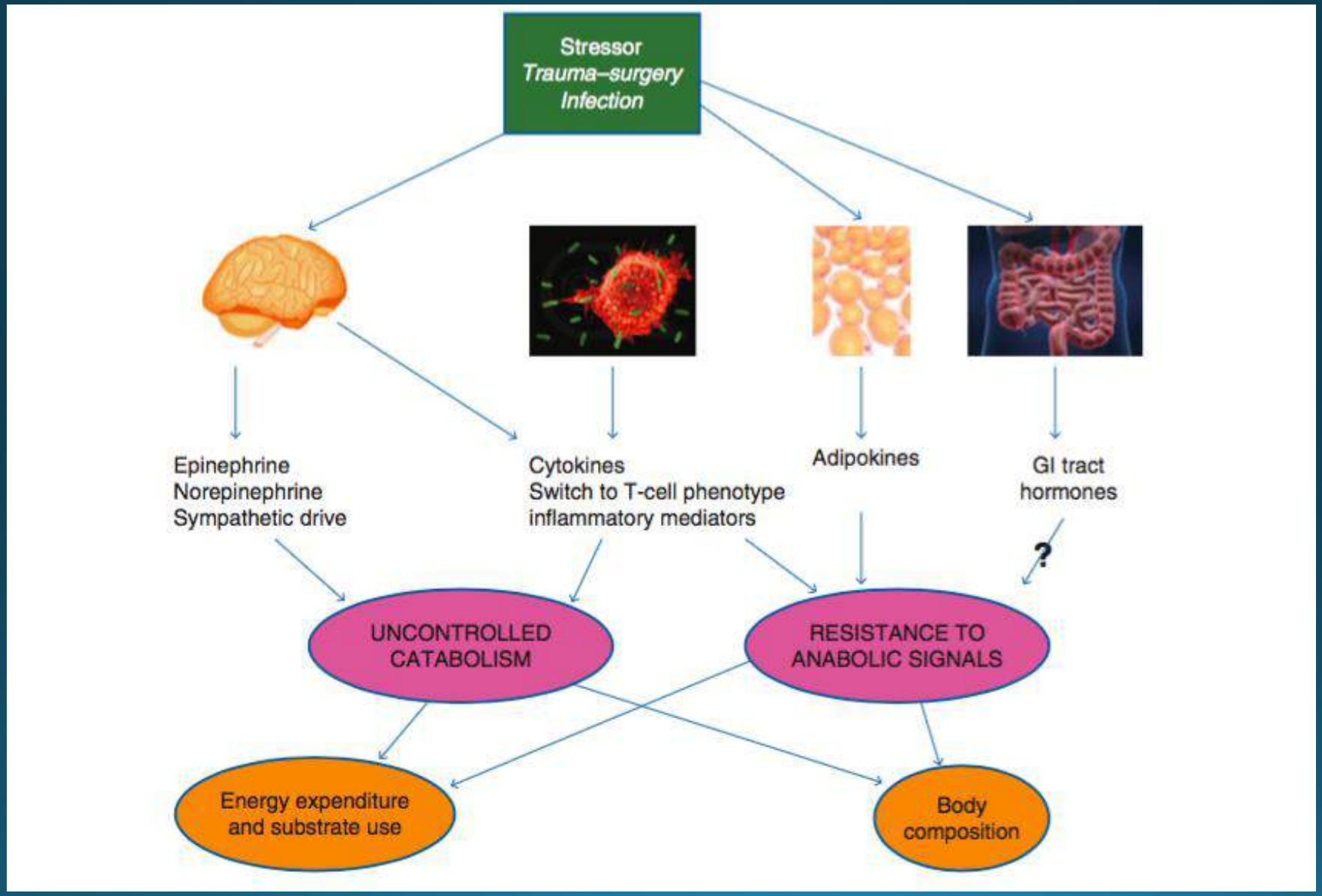
British Journal of Anaesthesia 113 (6): 945–54 (2014)
Advance Access publication 26 June 2014 · doi:10.1093/bja/aeu187

BJA

Metabolic response to the stress of critical illness

J.-C. Preiser[1]*, C. Ichai[2], J.-C. Orban[2] and A. B. J. Groeneveld[3]

[1] Department of Intensive Care, Erasme University Hospital, Free University of Brussels, 808 route de Lennik, 1070 Brussels, Belgium
[2] Department of Anesthesiology and Intensive Care, Hôpital Saint-Roch, University of Nice, France
[3] Department of Intensive Care, Erasmus Medical Center, Rotterdam, The Netherlands
* Corresponding author. E-mail: jean-charles.preiser@erasme.ulb.ac.be



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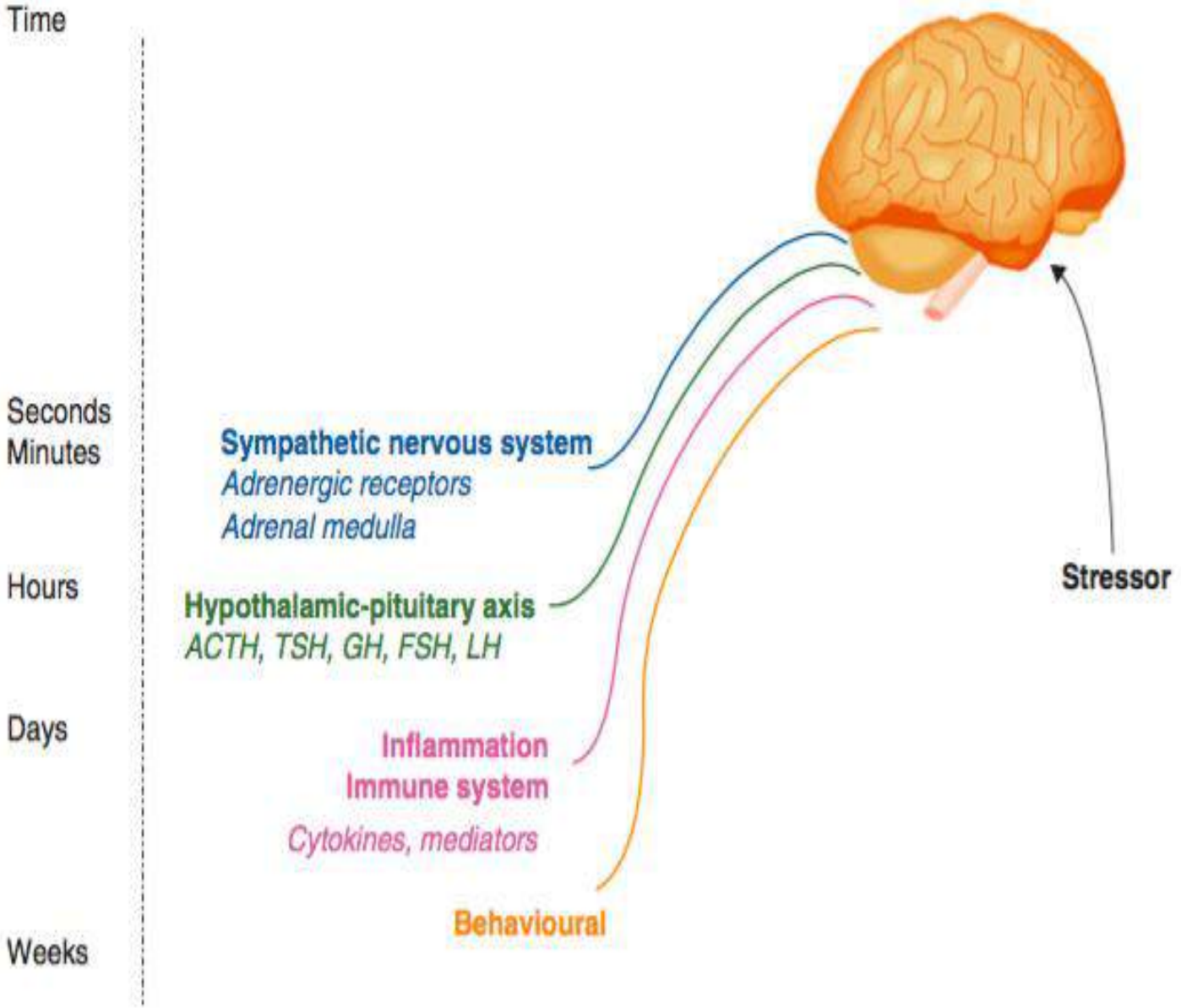
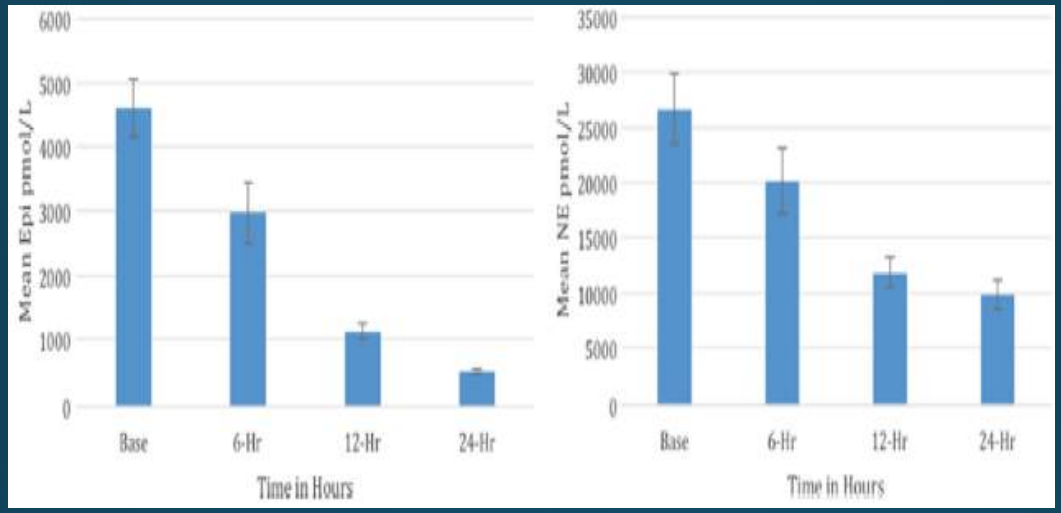


Sempatik Sinir Sistem Aktivasyonu

Sempatik Sinir Sistem Aktivasyonu

Beyin Travması



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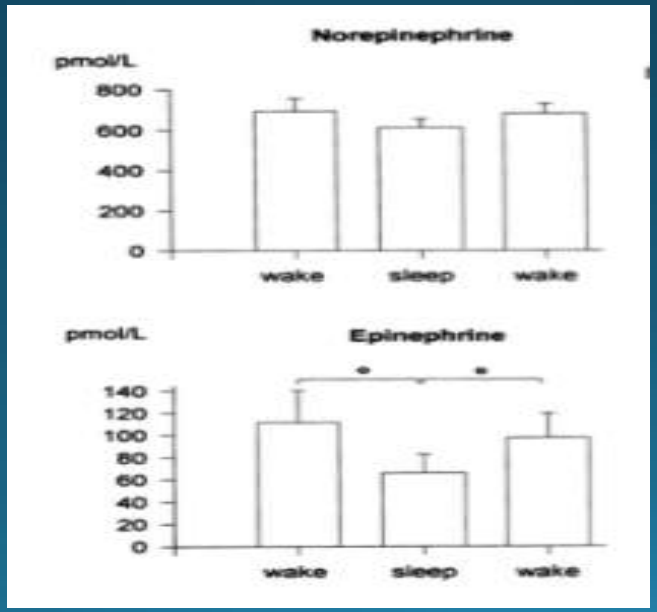


Nöroendokrin Bifazik Patern

CLINICAL REVIEW 95

Acute and Prolonged Critical Illness as Different Neuroendocrine Paradigms*

GREET VAN DEN BERGHE, FRANCIS DE ZEGHER, AND ROGER BOUILLON

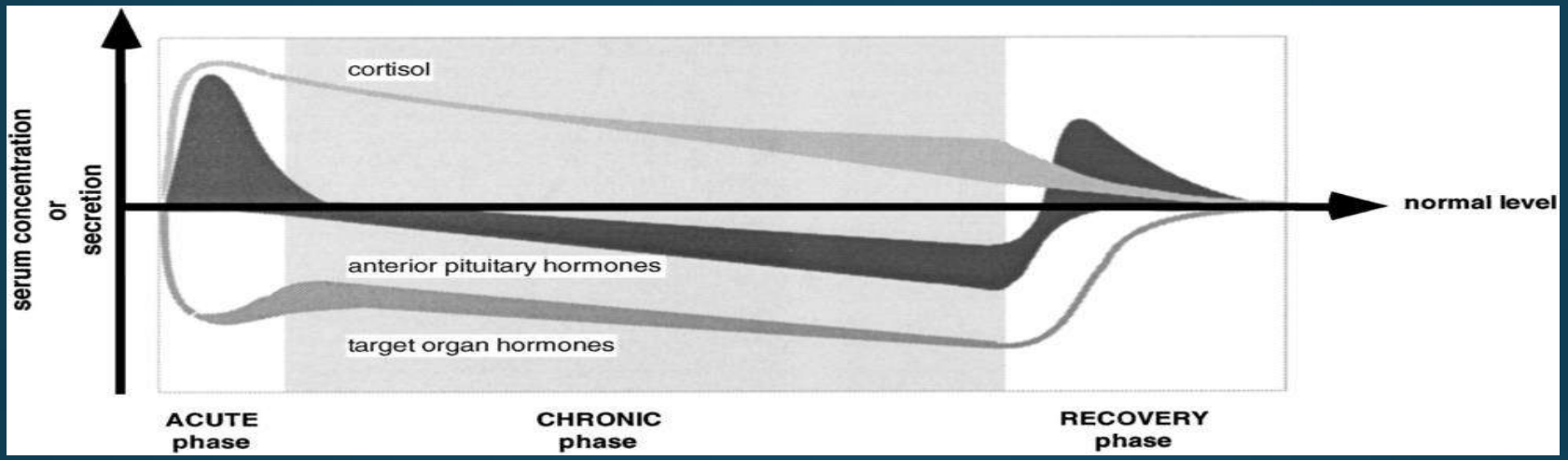
Clinical Nutrition

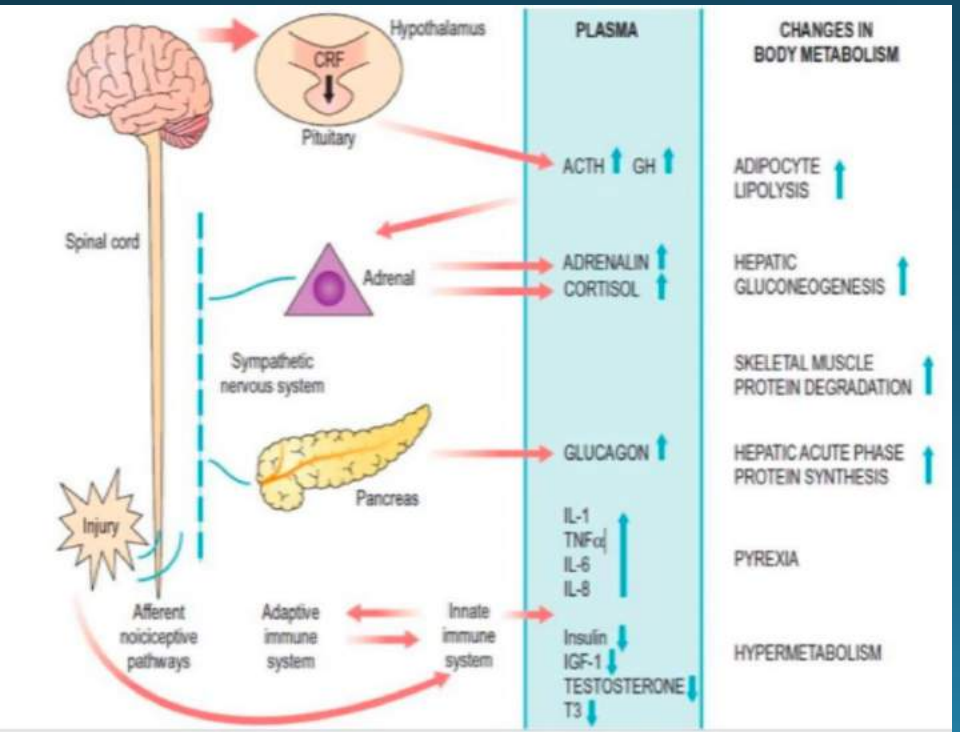
Review

The 2016 ESPEN Sir David Cuthbertson lecture: Interfering with neuroendocrine and metabolic responses to critical illness: From acute to long-term consequences*

Greet Van den Berghe

Bifazik Nöroendokrin Yanıt





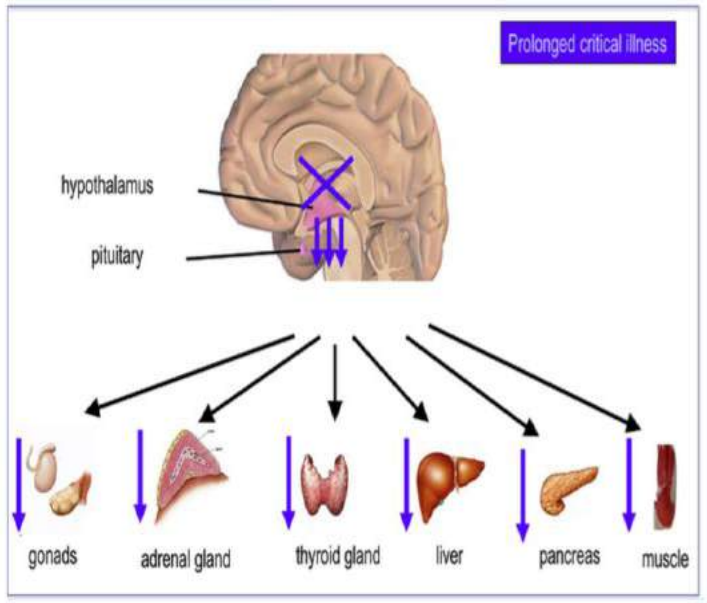
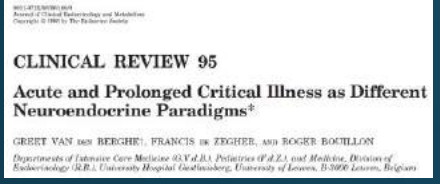


Fig. 1. Hypothalamic suppression drives suppression of target organs and may hereby contribute to the "accelerated aging" phenotype of prolonged critical illness.



CLINICAL REVIEW 95

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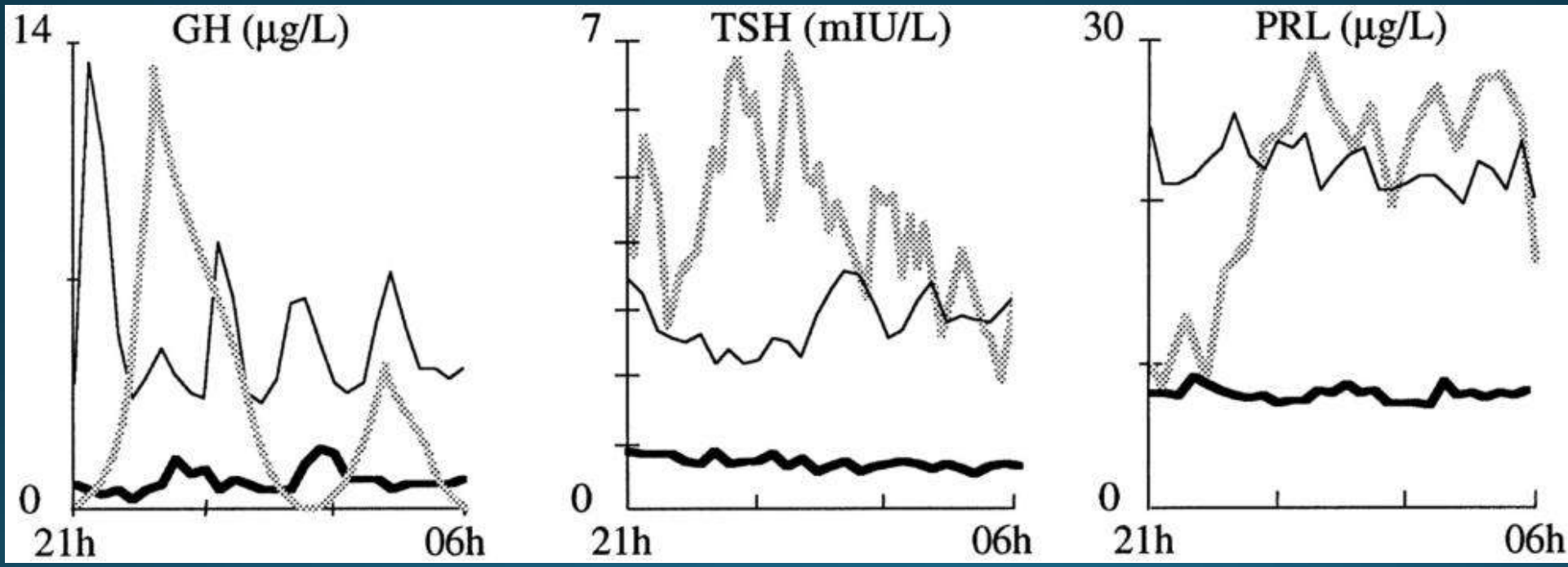
Departments of Intensive Care Medicine (G.V.d.B.), Pediatrics (F.d.Z.), and Medicine, Division of Endocrinology (R.B.), University Hospital Gasthuisberg, University of Leuven, B-3000 Leuven, Belgium

Kontrol (Açık)

Erken Dönem (İnce)

Geç Dönem (Kalın)



THYROID
Volume 24, Number 10, 2014
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DOI: 10.1089/thy.2014.0001

Non-Thyroidal Illness in the ICU: A Syndrome with Different Faces

Greet Van den Berghe

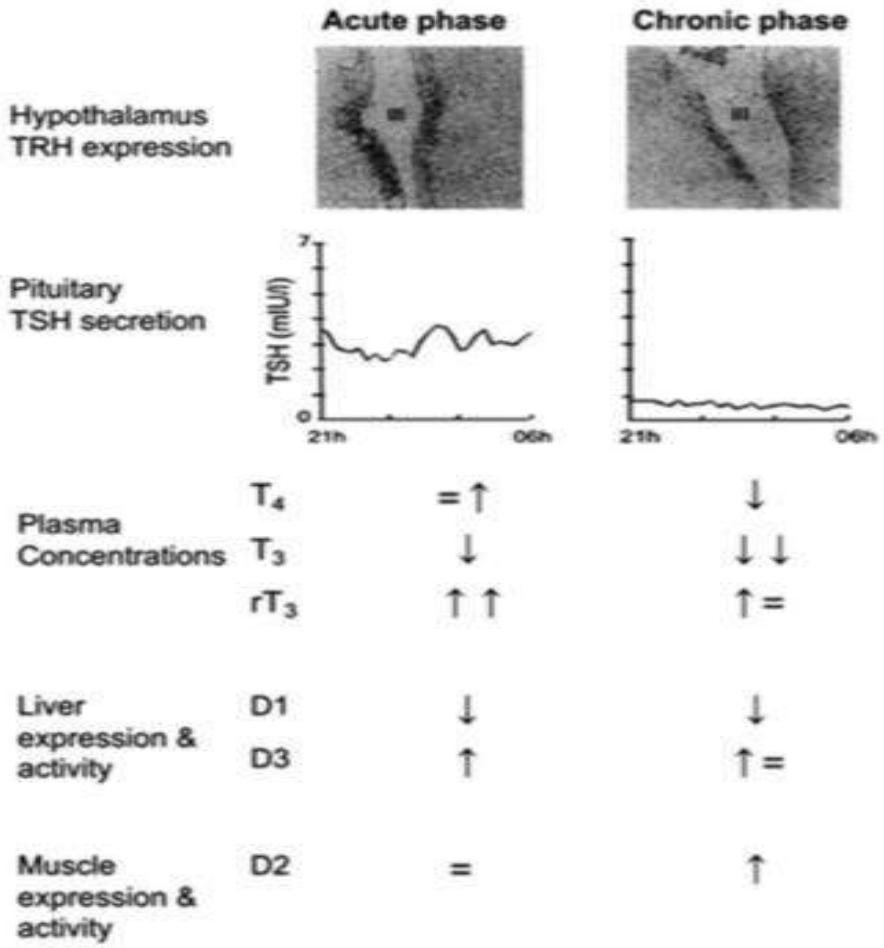


FIG. 1. Changes in the central and peripheral thyroid axis in acute versus prolonged critical illness. The upper panel shows reduced thyrotropin releasing hormone (*TRH*) gene expression in the hypothalamus of prolonged ill patients. The central panel illustrates adaptations in nocturnal thyrotropin (TSH) secretion with a loss of pulsatility during prolonged critical illness. The bottom panel summarizes schematically the changes in circulating thyroid hormone concentrations and changes in peripheral deiodinase enzyme activity levels. D1, type-1 deiodinase; D2, type-2 deiodinase; D3, type-3 deiodinase. Figure reproduced, with permission, from Boonen *et al.* (5).

Thyroid Hormone Increases Basal and Insulin-Stimulated Glucose Transport in Skeletal Muscle

The Role of GLUT4 Glucose Transporter Expression

Steven P. Weinstein, Elizabeth O'Boyle, and Richard S. Haber

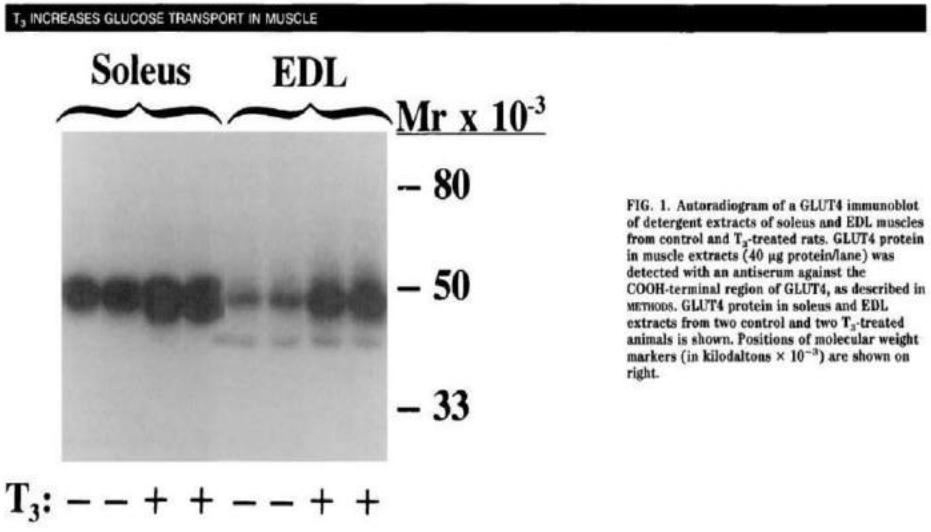


FIG. 1. Autoradiogram of a GLUT4 immunoblot of detergent extracts of soleus and EDL muscles from control and T_3-treated rats. GLUT4 protein in muscle extracts (40 μg protein/lane) was detected with an antiserum against the COOH-terminal region of GLUT4, as described in METHODS. GLUT4 protein in soleus and EDL extracts from two control and two T_3-treated animals is shown. Positions of molecular weight markers (in kilodaltons × 10^{-3}) are shown on right.

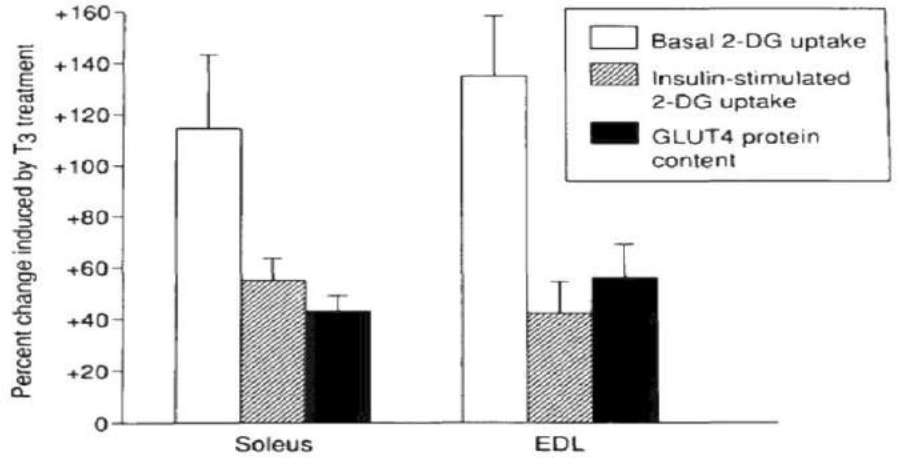
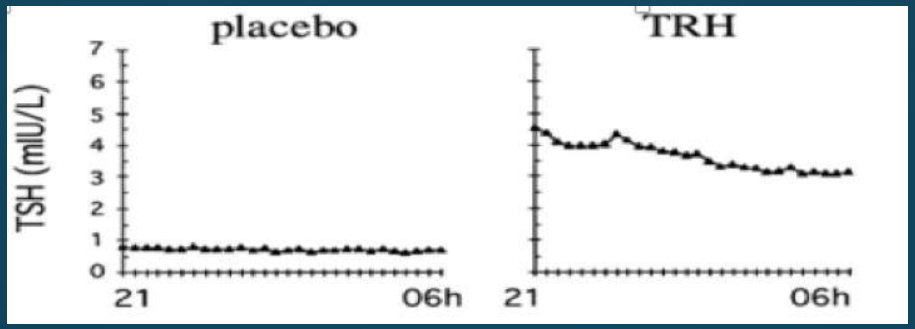
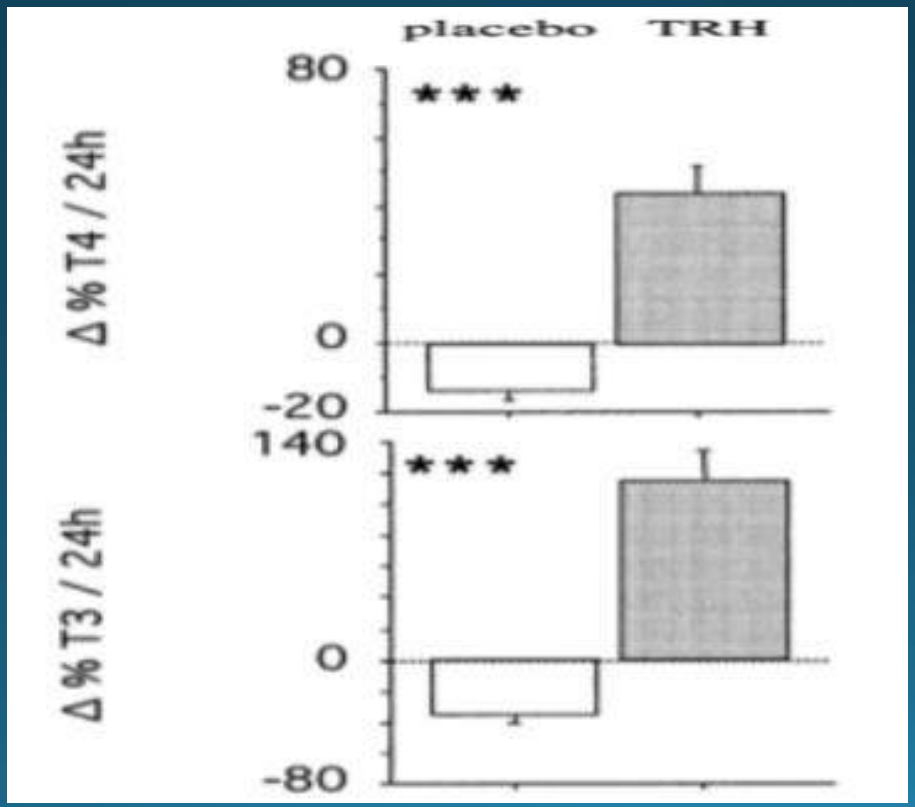


FIG. 2. Percentage increases in 2-DG uptake and GLUT4 protein content induced by T_3 treatment in soleus and EDL. The percentage change induced by T_3 treatment is plotted for basal and insulin-stimulated 2-DG uptake and for GLUT4 protein content (data from Tables 1 and 3). Percentage change for individual data points in T_3-treated animals was calculated based on mean control values in each experiment. Bars indicate 1 SE.

Geç Dönem (15-18 gün) TRH İnfüzyon (1mic/kg/h) TSH T4-T3 (24 saatlik) Yanıtları





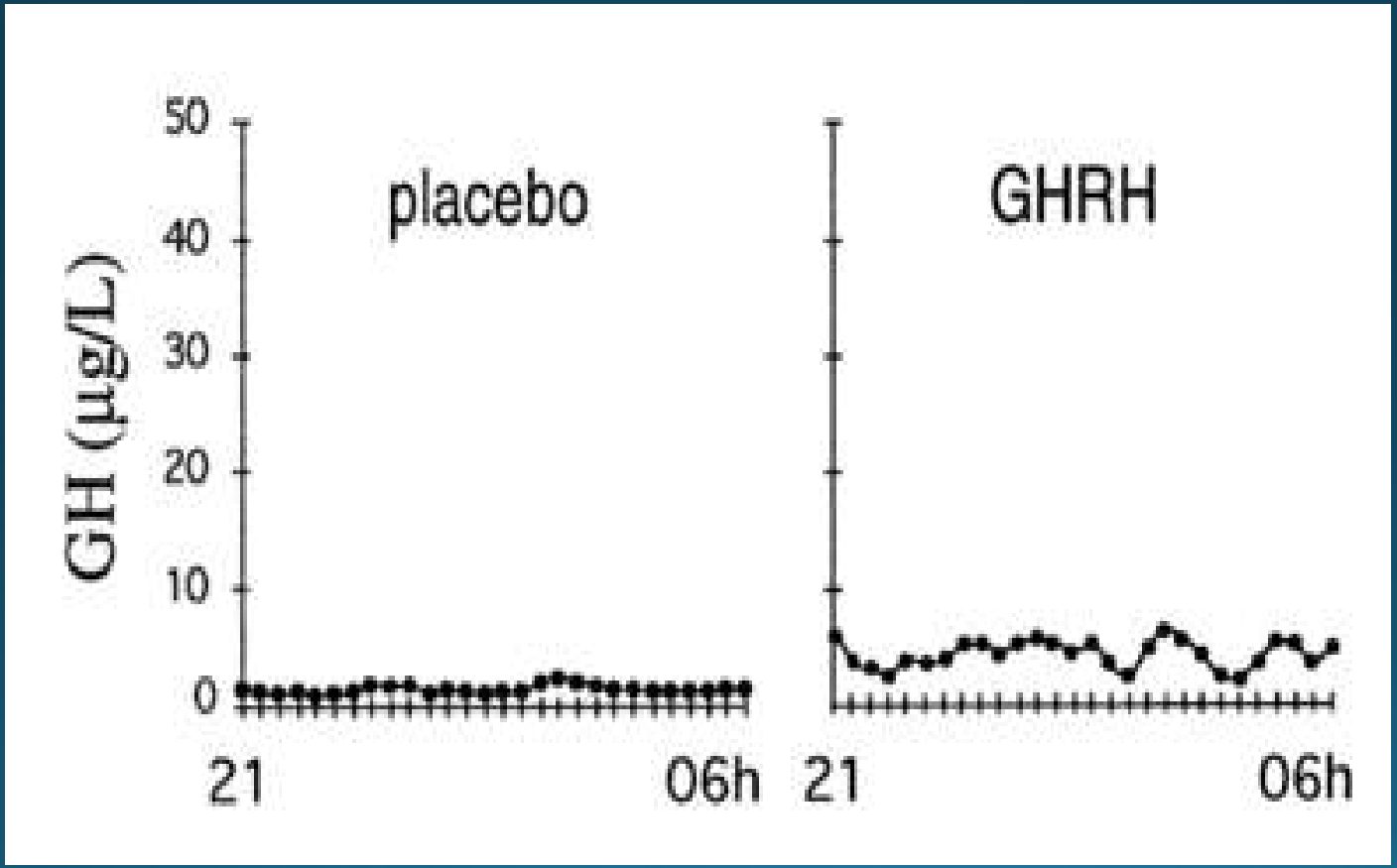
CLINICAL REVIEW 95

Acute and Prolonged Critical Illness as Different Neuroendocrine Paradigms*

GREET VAN DEN BERGHE†, FRANCIS DE ZEGHER, AND ROGER BOUILLON

Departments of Intensive Care Medicine (G.V.d.B.), Pediatrics (F.d.Z.), and Medicine, Division of Endocrinology (R.B.), University Hospital Gasthuisberg, University of Leuven, B-3000 Leuven, Belgium

Geç Dönem (13-48 gün)
GHRH İnfüzyon (1mic/kg/h)-GH Yanıtları

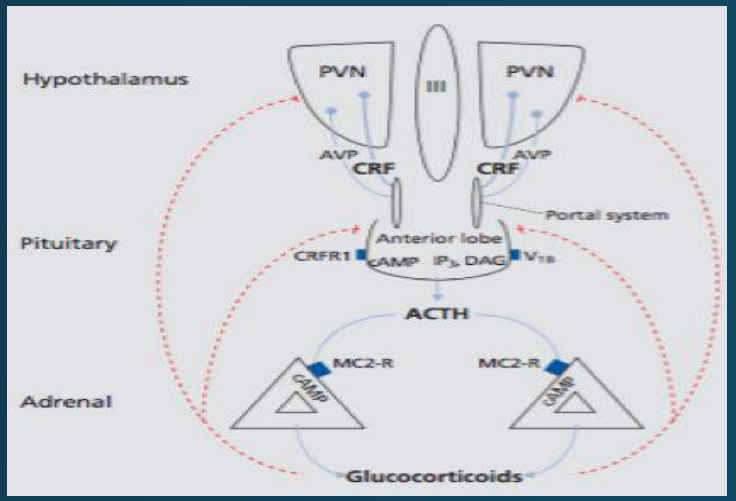


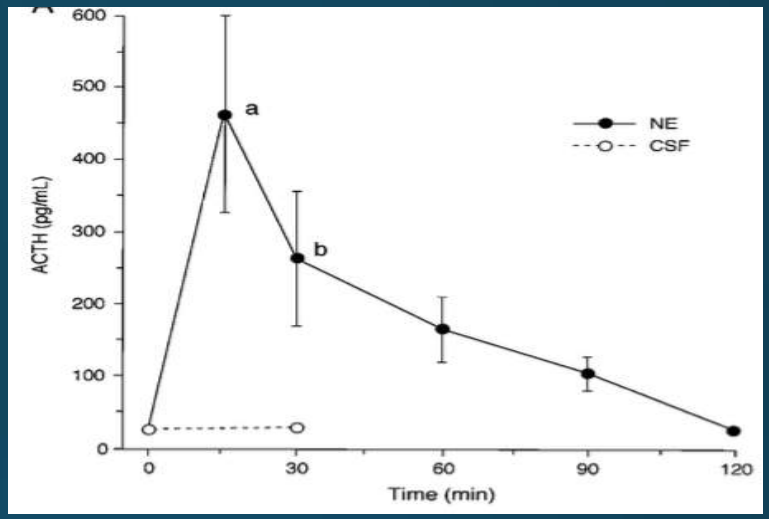
The role of the hypothalamic-pituitary-adrenal axis in neuroendocrine responses to stress

Sean M. Smith, PhD; Wylie W. Vale, PhD

Differential Regulation of Corticotropin-Releasing Hormone and Vasopressin Gene Transcription in the Hypothalamus by Norepinephrine

Norepinefrin İnjeksiyonu-ACTH Yanıtı
(Experimental- Paraventriküler Nükleus)





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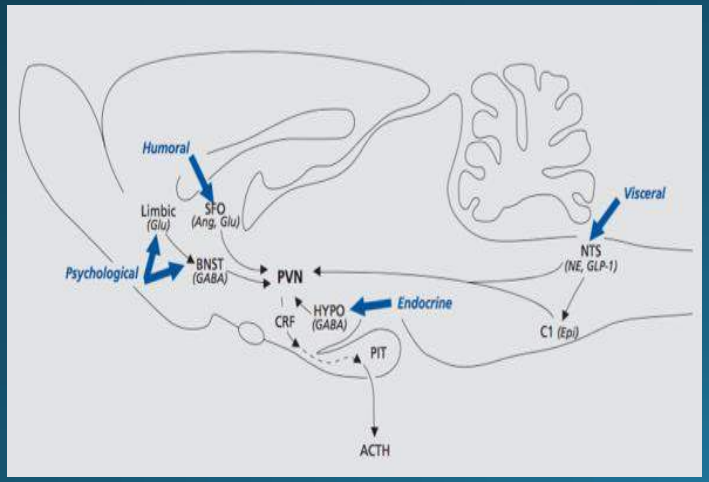
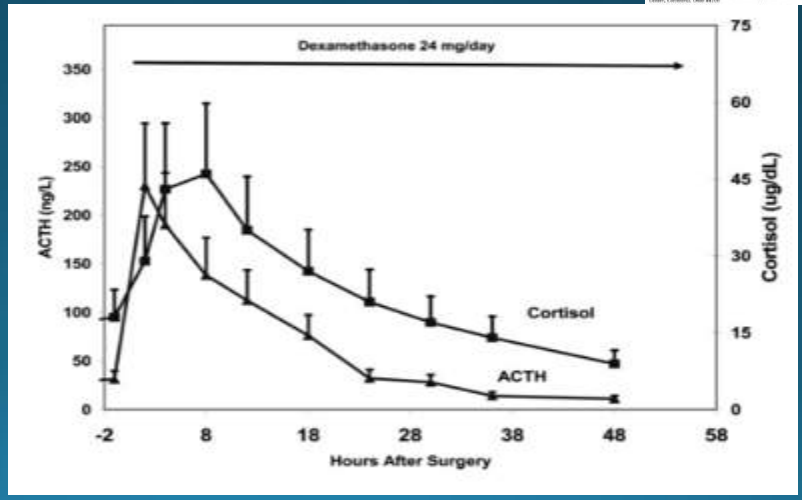
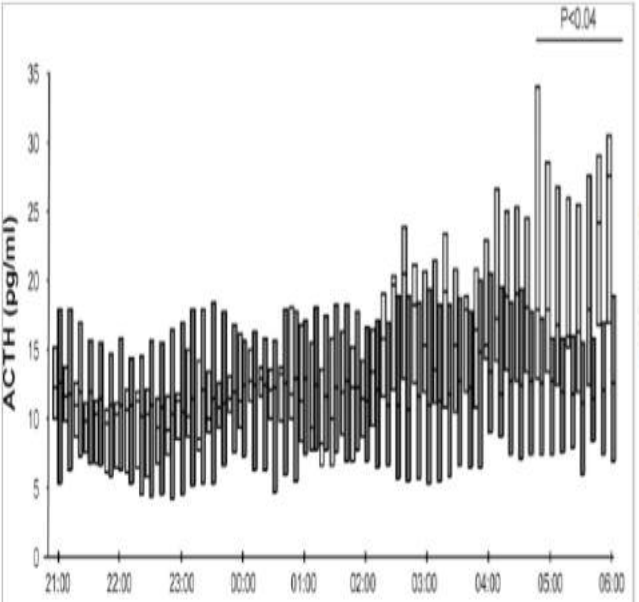
Dexametazon İnjeksiyonu
ACTH –Kortizol Yanıtı

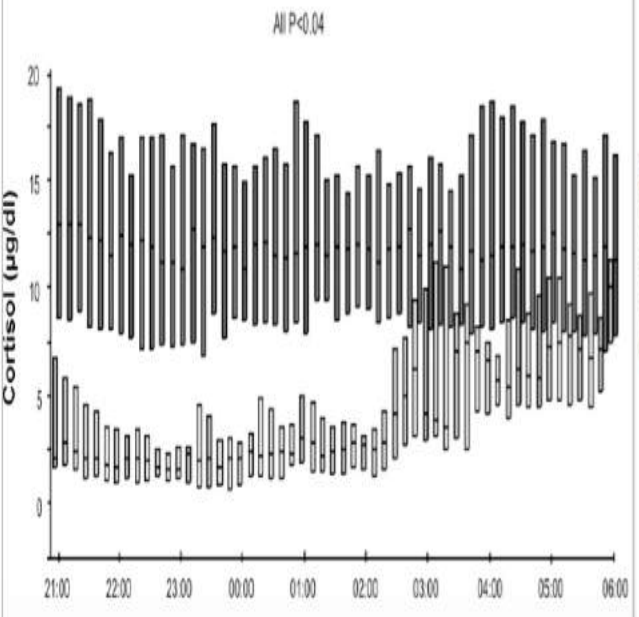
REVIEW: Hypothalamic Pituitary Adrenal Function during Critical Illness: Limitations of Current Assessment Methods





Am J Physiol Endocrinol Metab. 2014 Apr 15; 306(8): E883–E892.
Published online 2014 Feb 25. doi: 10.1152/ajpendo.00009.2014





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Baha M. Arafah
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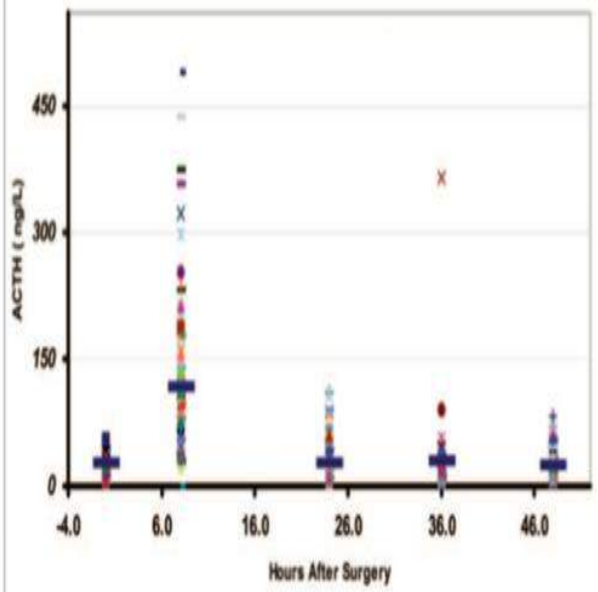
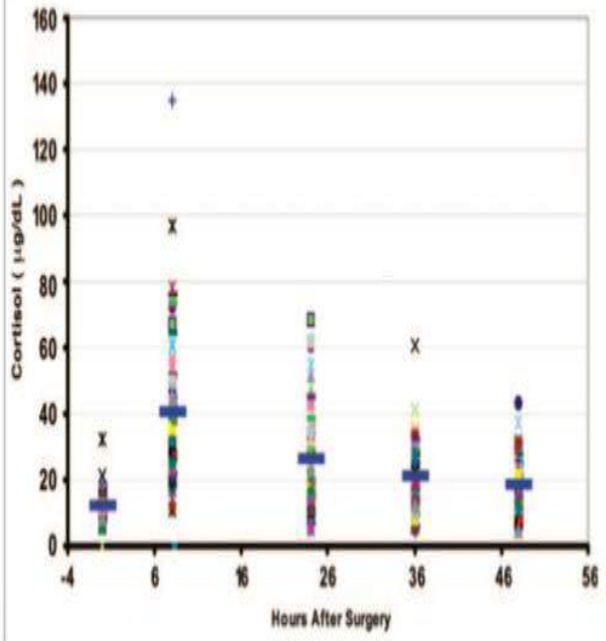
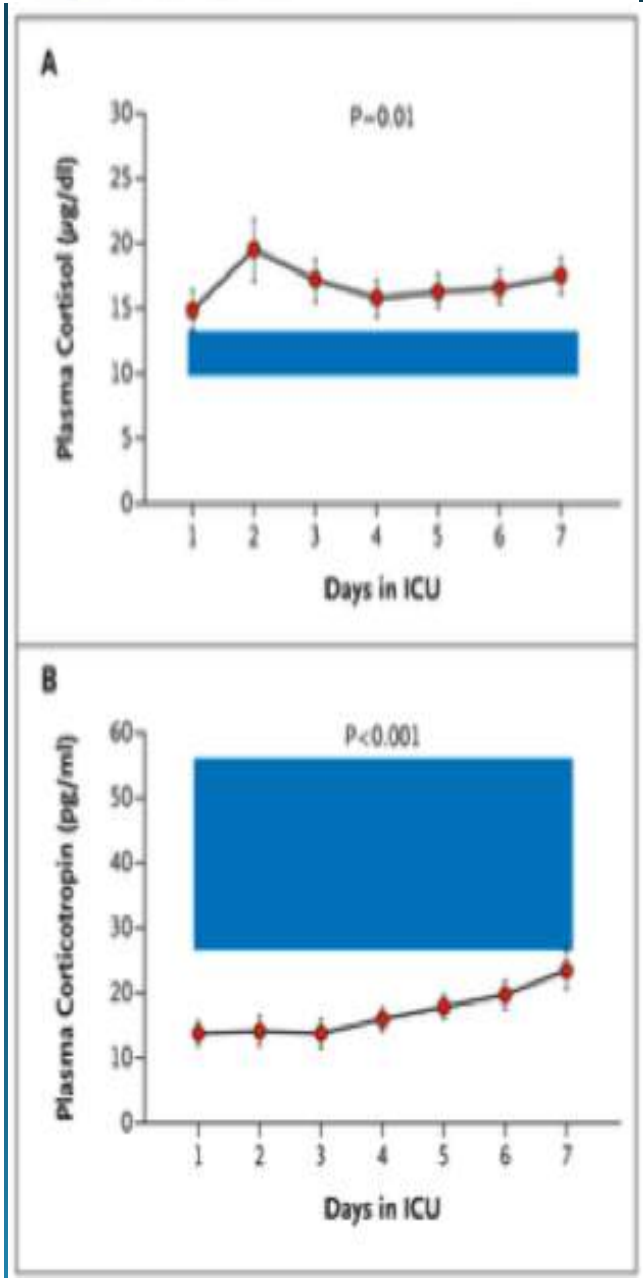




N Engl J Med. 2013 April 18; 368(16): 1477–1488. doi:10.1056/NEJMra1214969.

Reduced Cortisol Metabolism during Critical Illness

Eva Boonen, M.D., Hilke Vervenne, Ph.D., Philippe Meersseman, M.D., Ruth Andrew, Ph.D., Leen Mortier, Ph.D., Pieter E. Declercq, Pharm.D., Ph.D., Yoo-Mee Vanweijngaerden, M.D., Isabel Spriet, Pharm.D., Ph.D., Pieter J. Wouters, M.Sc., Sarah Vander Perre, B.Sc., Lies Langouche, Ph.D., Ilse Vanhorebeek, Ph.D., Brian R. Walker, M.D., and Greet Van den Berghe, M.D., Ph.D.
Clinical Division and Laboratory of Intensive Care Medicine, Department of Cellular and Molecular Medicine (E.B., H.V., Y.-M.V., P.J.W., S.V.P., L.L., I.V., G.V.B.), the Medical Intensive Care Unit, Department of Internal Medicine (P.M.), and the Department of Pharmacy (I.S.), KU Leuven, Leuven; and the Department of Laboratory Medicine, Jessa Hospital, Hasselt (L.M., P.E.D.) — both in Belgium; and the Centre for Cardiovascular Science, University of Edinburgh, Edinburgh, United Kingdom (R.A., B.R.W.).



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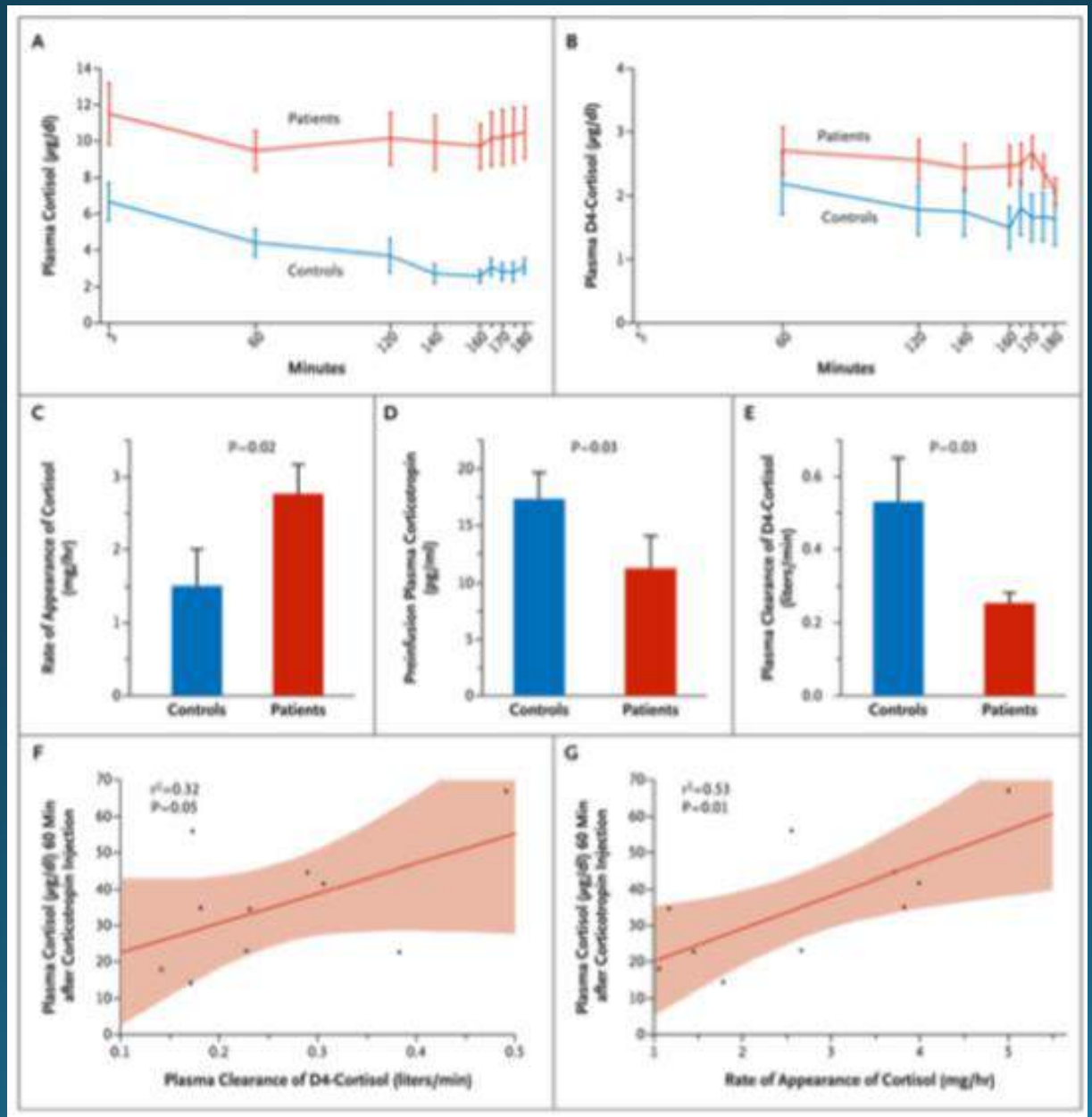
Clinical Division and Laboratory of Intensive Care Medicine, Department of Cellular and Molecular Medicine (E.B., H.V., Y.-M.V., P.J.W., S.V.P., L.L., I.V., G.V.B.), the Medical Intensive Care Unit, Department of Internal Medicine (P.M.), and the Department of Pharmacy (I.S.), KU Leuven, Leuven; and the Department of Laboratory Medicine, Jessa Hospital, Hasselt (L.M., P.E.D.) — both in Belgium; and the Centre for Cardiovascular Science, University of Edinburgh, Edinburgh, United Kingdom (R.A., B.R.W.).



Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

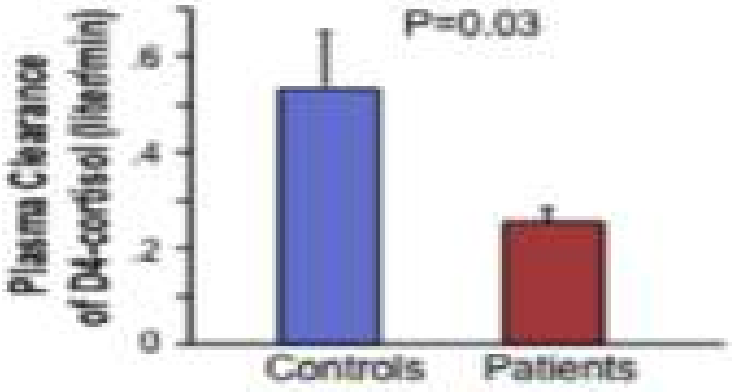
Review

The 2016 ESPEN Sir David Cuthbertson lecture: Interfering with neuroendocrine and metabolic responses to critical illness: From acute to long-term consequences☆

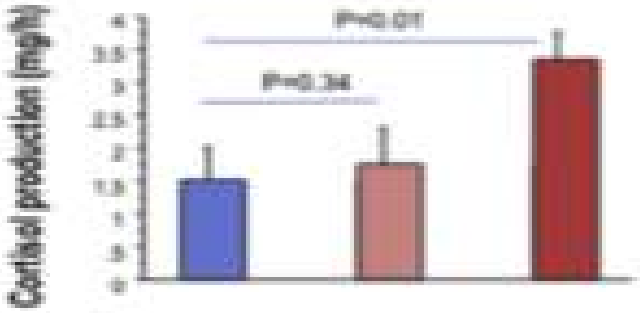
Greet Van den Berghe

Clinical Division and Laboratory of Intensive Care Medicine, Department Cellular and Molecular Medicine, KU Leuven University and Hospitals, B-3000 Leuven, Belgium

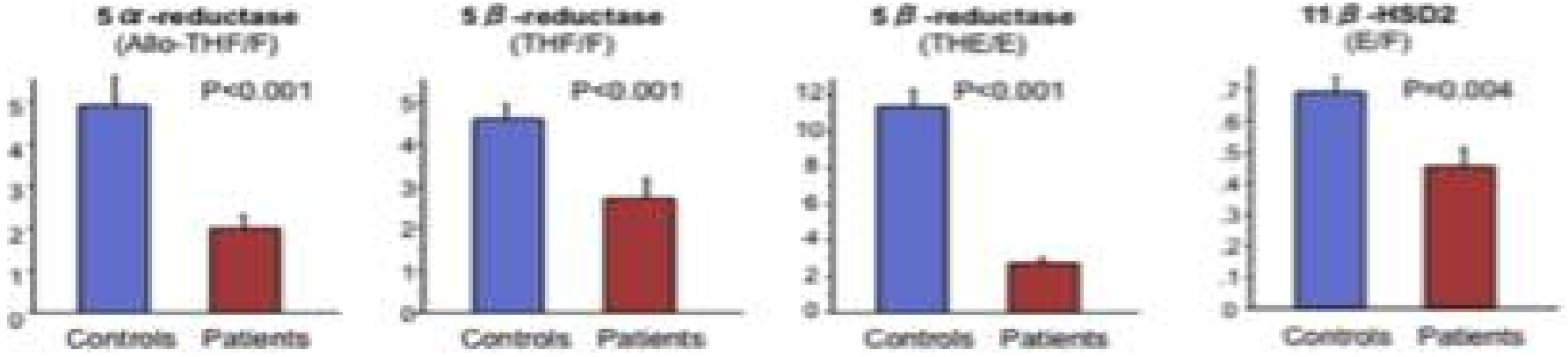
Cortisol clearance



Cortisol production



Activities of cortisol metabolizing enzymes



İmmün-İnflammatuvar Yanıt

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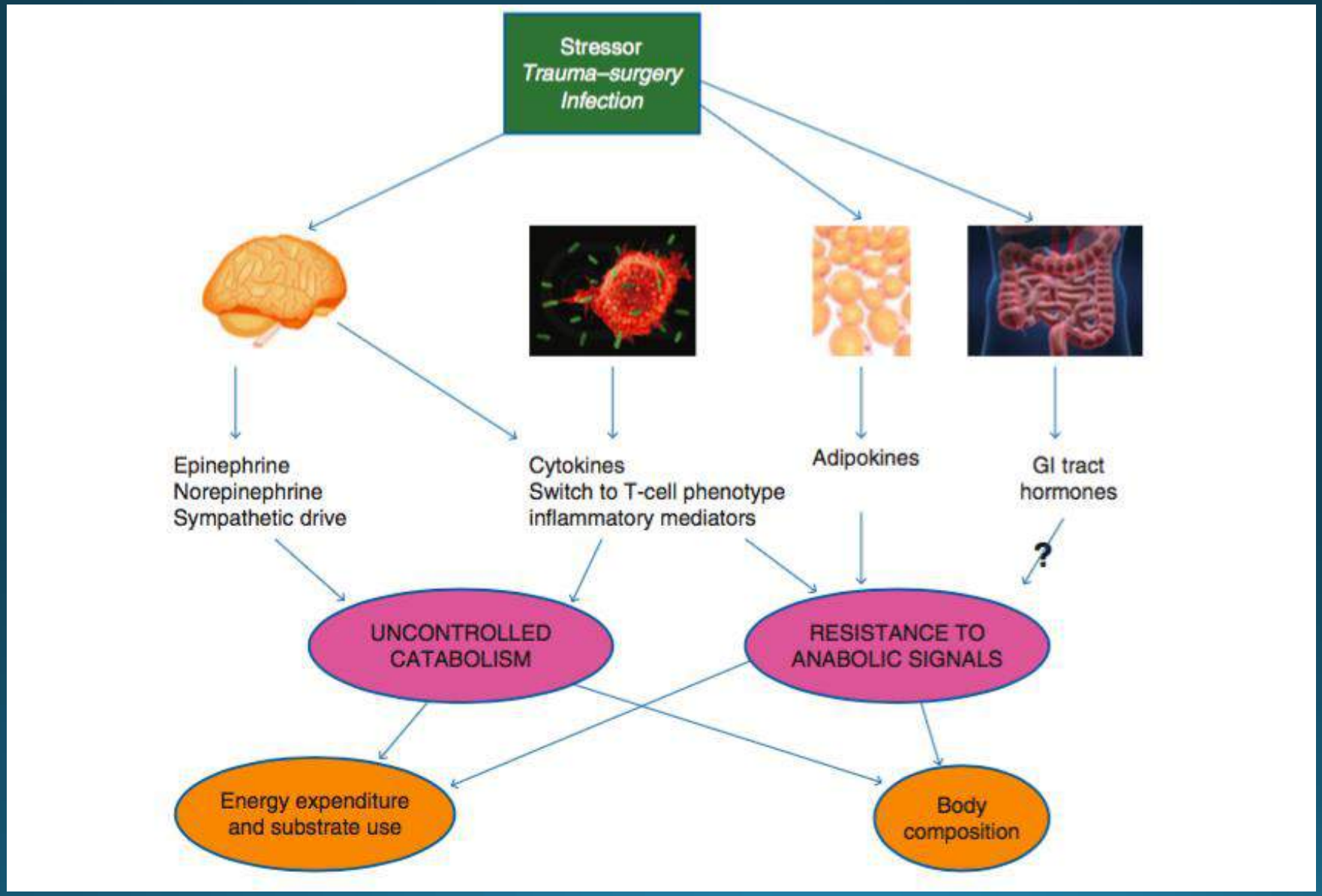
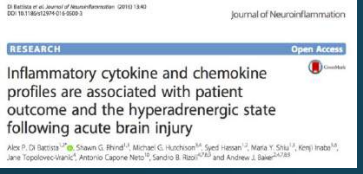
[3] Department of Intensive Care, Erasmus Medical Center, Rotterdam, The Netherlands
* Corresponding author. E-mail: jean-charles.preiser@erasme.ulb.ac.be



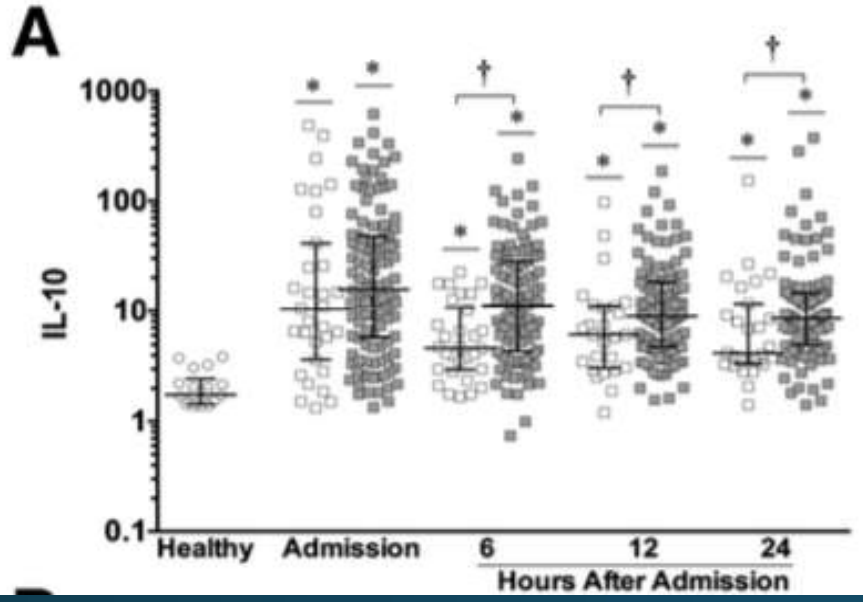

Journal of Neuroinflammation

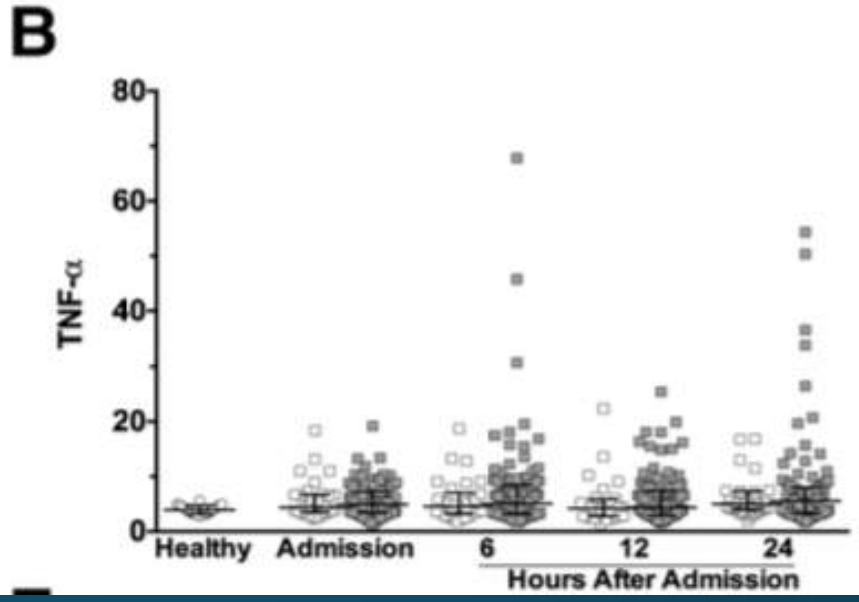
RESEARCH Open Access

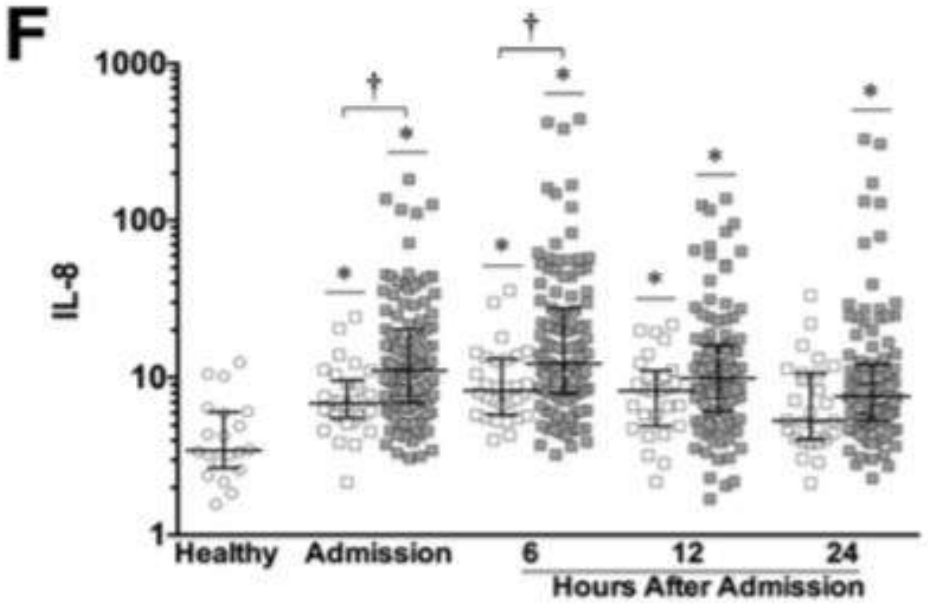
Inflammatory cytokine and chemokine profiles are associated with patient outcome and the hyperadrenergic state following acute brain injury

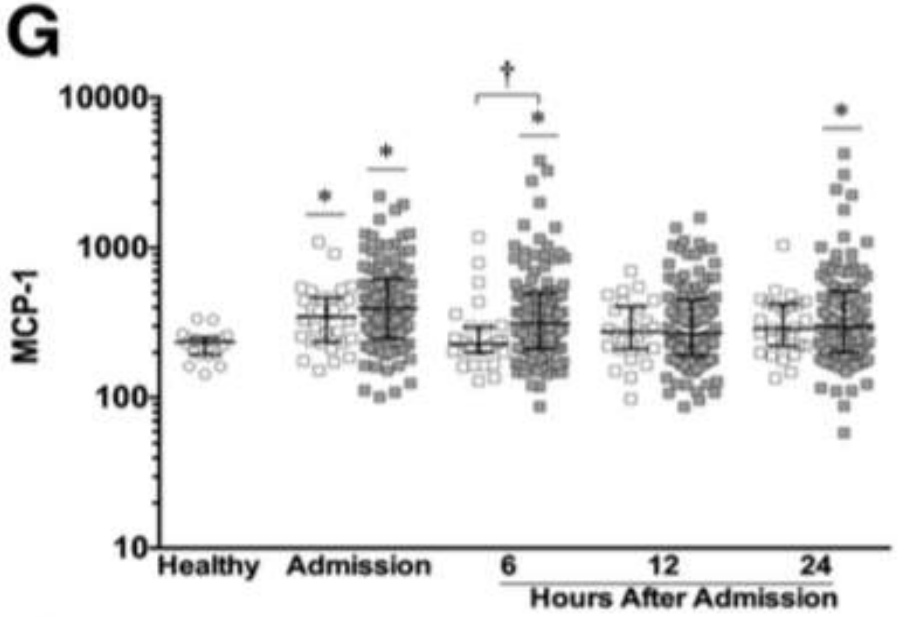
İmmün-İnflammatuvar Yanıt

Sitokin-Kemokin









Journal of Neuroinflammation

RESEARCH Open Access

Inflammatory cytokine and chemokine profiles are associated with patient outcome and the hyperadrenergic state following acute brain injury

Alex P. Di Battista[1*], Shawn G. Rhind[2], Michael G. Hutchison[3,4], Syed Hassan[1], Maria Y. Shiu[1], Kenji Inaba[3,4], Jane Topolovec-Vranic[5], Antonio Capone Neto[3,4], Sandro B. Rizoli[3,4,6] and Andrew J. Baker[3,4,7,8]

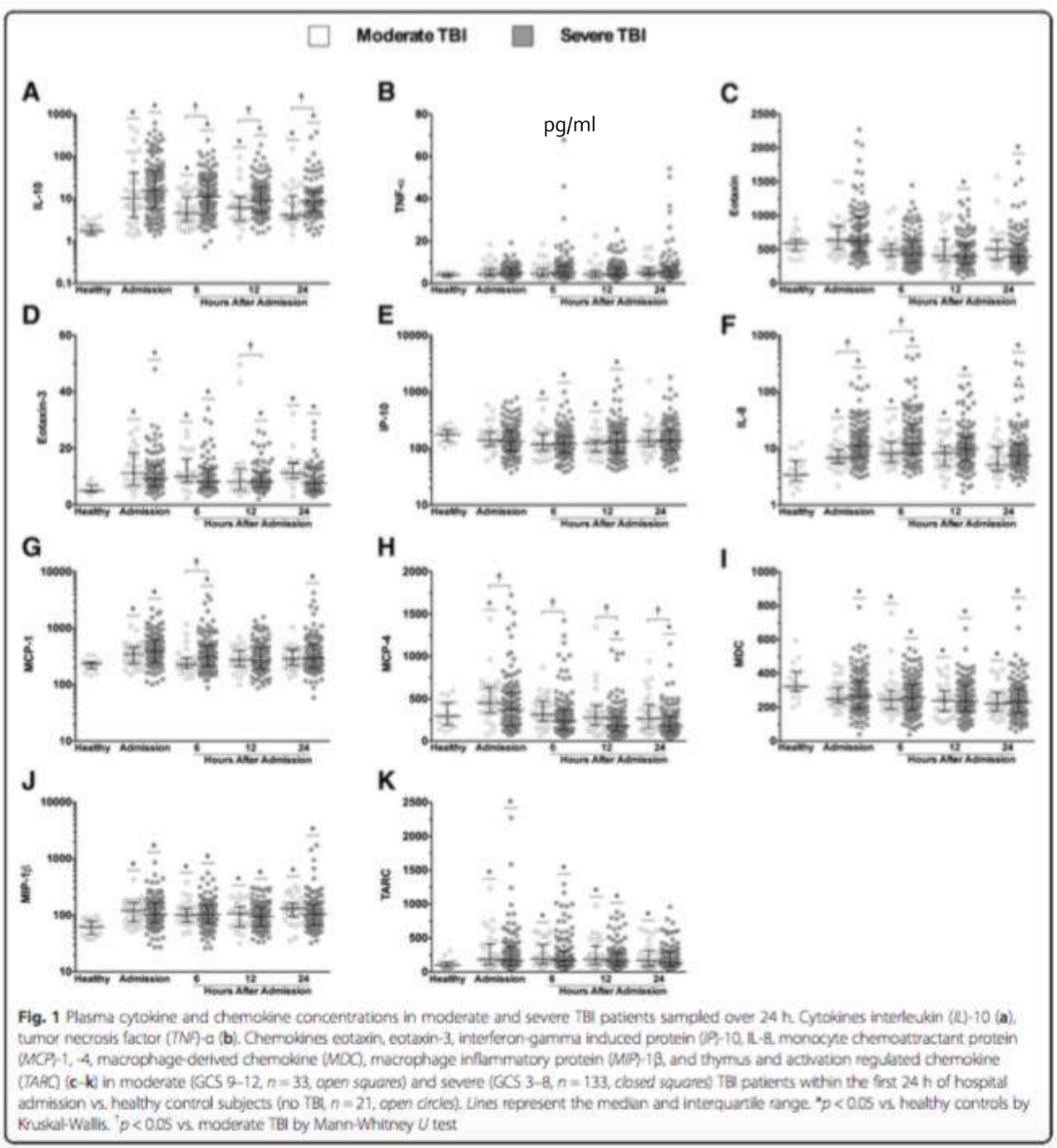


Fig. 1 Plasma cytokine and chemokine concentrations in moderate and severe TBI patients sampled over 24 h. Cytokines interleukin (*IL*)-10 (**a**), tumor necrosis factor (*TNF*)-α (**b**). Chemokines eotaxin, eotaxin-3, interferon-gamma induced protein (*IP*)-10, IL-8, monocyte chemoattractant protein (*MCP*)-1, -4, macrophage-derived chemokine (*MDC*), macrophage inflammatory protein (*MIP*)-1β, and thymus and activation regulated chemokine (*TARC*) (**c**–**k**) in moderate (GCS 9–12, $n = 33$, *open squares*) and severe (GCS 3–8, $n = 133$, *closed squares*) TBI patients within the first 24 h of hospital admission vs. healthy control subjects (no TBI, $n = 21$, *open circles*). *Lines* represent the median and interquartile range. *$p < 0.05$ vs. healthy controls by Kruskal-Wallis. †$p < 0.05$ vs. moderate TBI by Mann-Whitney *U* test

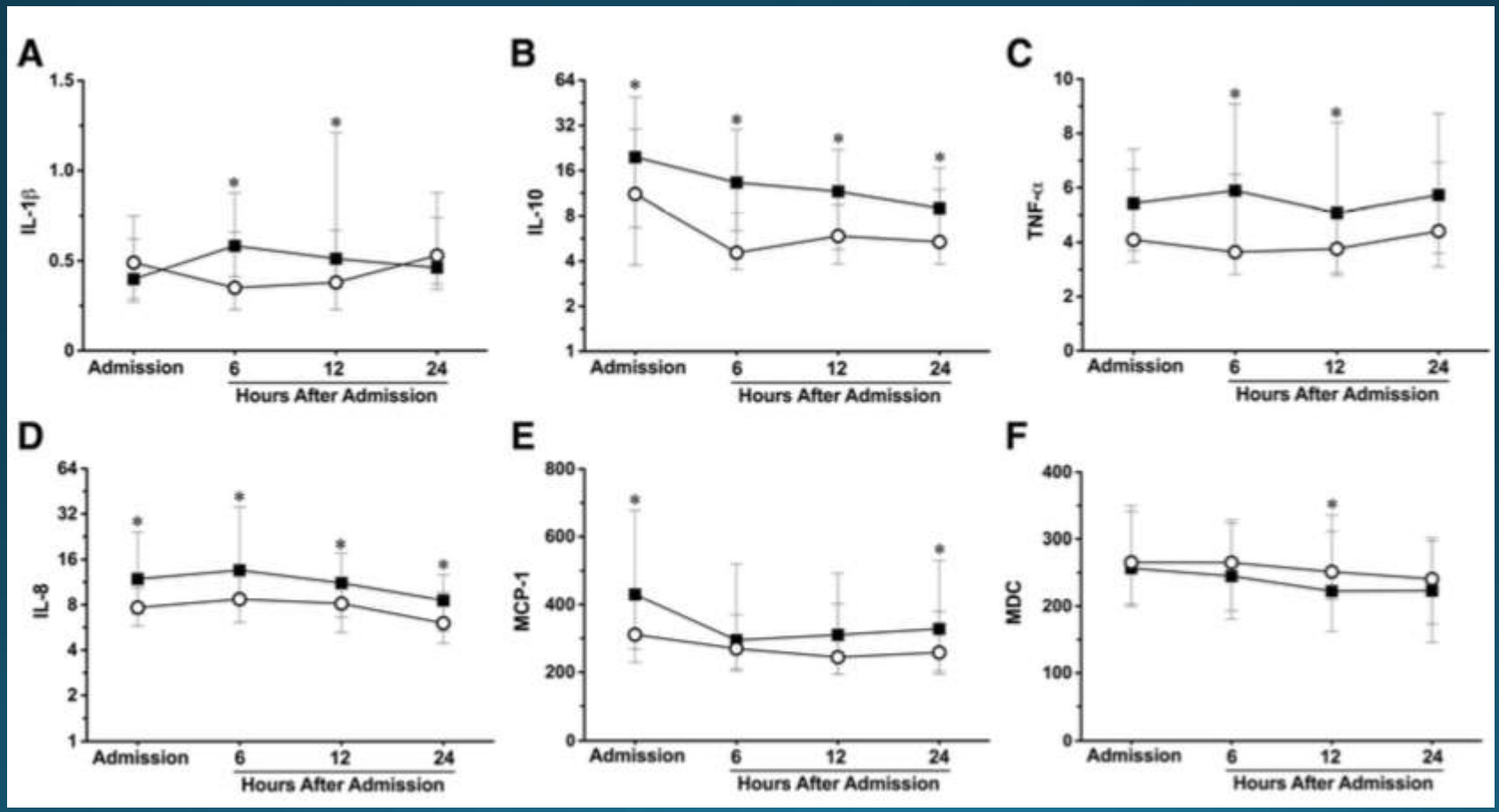
Di Battista et al. Journal of Neuroinflammation (2016) 13:40
DOI 10.1186/s12974-016-0500-3

Journal of Neuroinflammation

RESEARCH Open Access

Inflammatory cytokine and chemokine profiles are associated with patient outcome and the hyperadrenergic state following acute brain injury

Alex P. Di Battista[1,2*], Shawn G. Rhind[1,3], Michael G. Hutchison[3,4], Syed Hassan[1,2], Maria Y. Shiu[1,3], Kenji Inaba[3,5], Jane Topolovec-Vranic[4], Antonio Capone Neto[10], Sandro B. Rizoli[6,7,8,9] and Andrew J. Baker[2,4,7,8,9]



Adipoz Doku
Gastrointestinal Sistem Hormonları

Hindawi Publishing Corporation
International Journal of Inflammation
Volume 2012, Article ID 972384, 7 pages
doi:10.1155/2012/972384

Review Article

Sepsis-Induced Adipokine Change with regard to Insulin Resistance

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TABLE 1: Proinflammatory or anti-inflammatory properties of adipokines, serum level changes of adipokines in septic or obese patients, and influence of adipokines on insulin sensitivity in patients with sepsis or obese patients.

Adipokine	Anti-inflammatory	Pro-inflammatory effect	Humans with sepsis	Humans with obesity	Insulin sensitivity
Adiponectin	+		↓	↓	↑
Chemerin	+		↑	↑	↓
Resistin		+	↑	→	→
PAI-1		+	↑	↑	↓
Visfatin		+	↑	↑	
MCP-1		+	↑	↑	↓
TNF-α		+	↑	→ (?)	↓
IL-1		+	↑	↑	↓
IL-6		+	↑	↑	↓
IL-8		+	↑	↑	↓
IL-10	+		↑	↑	↑
Leptin	→	→	→	↑	?
RBP 4		+	↓	↑	↓

Deane et al. Critical Care 2010, 14:228
http://ccforum.com/content/14/5/228

CRITICAL CARE

REVIEW

Bench-to-bedside review: The gut as an endocrine organ in the critically ill

Adam Deane[1,2,3*], Marianne J Chapman[1,3], Robert JL Fraser[4,5] and Michael Horowitz[4,5]

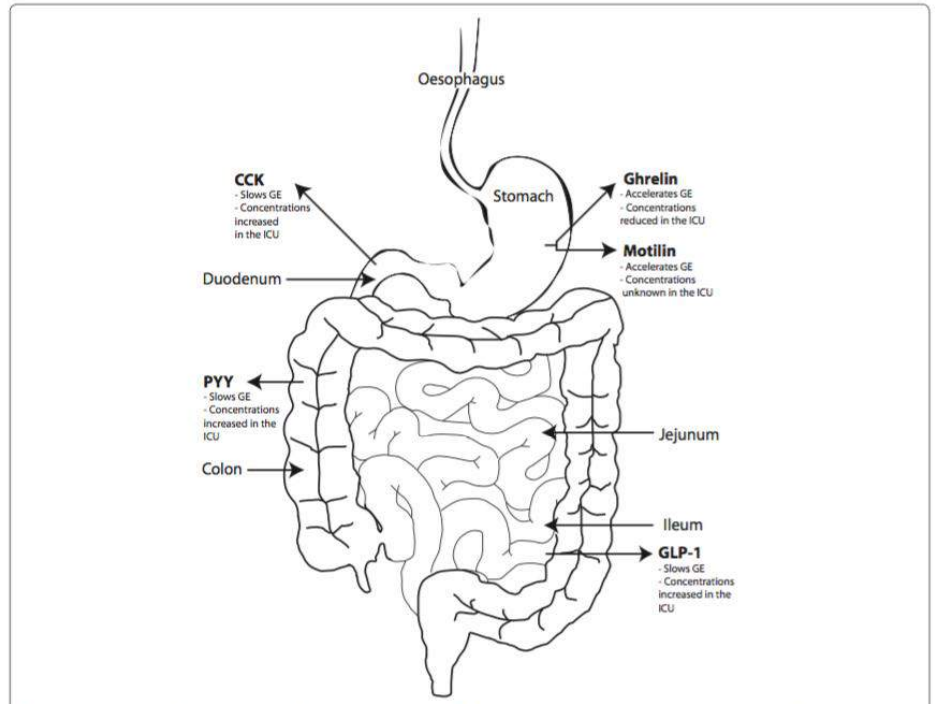

Figure 1. Hormones affecting gastric emptying in health and critical illness. Effect of hormones on gastric emptying (GE) in health and their known fasting concentrations in the critically ill. CCK, cholecystokinin; GLP, glucagon-like peptide; ICU, intensive care unit; PYY, peptide YY.

Gastrik Boşalım

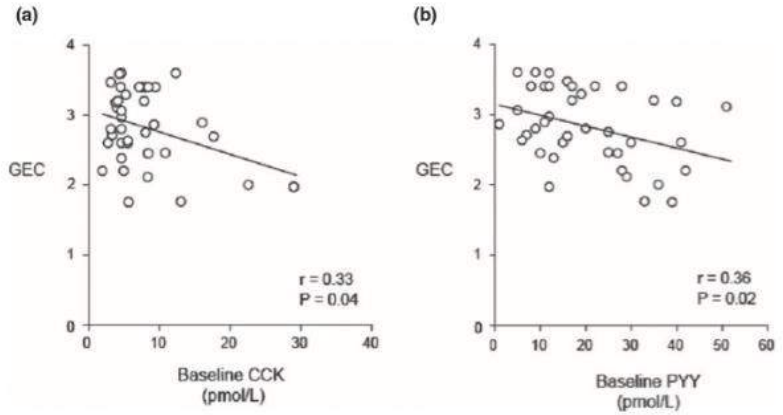

Figure 3. Relationship between rate of gastric emptying and fasting cholecystokinin and peptide YY concentrations. Relationship between the rate of gastric emptying (measured using an isotope breath test and calculated as the gastric emptying coefficient (GEC); greater number, more rapid emptying) and **(a)** fasting cholecystokinin (CCK) concentrations ($r = -0.33$; $P = 0.04$) and **(b)** fasting peptide YY (PYY) concentrations ($r = -0.36$; $P = 0.02$) in 39 critically ill patients. Reproduced with permission from [55].

Deane et al. Critical Care 2010, 14:228
http://ccforum.com/content/14/3/228

CRITICAL CARE

REVIEW

Bench-to-bedside review: The gut as an endocrine organ in the critically ill

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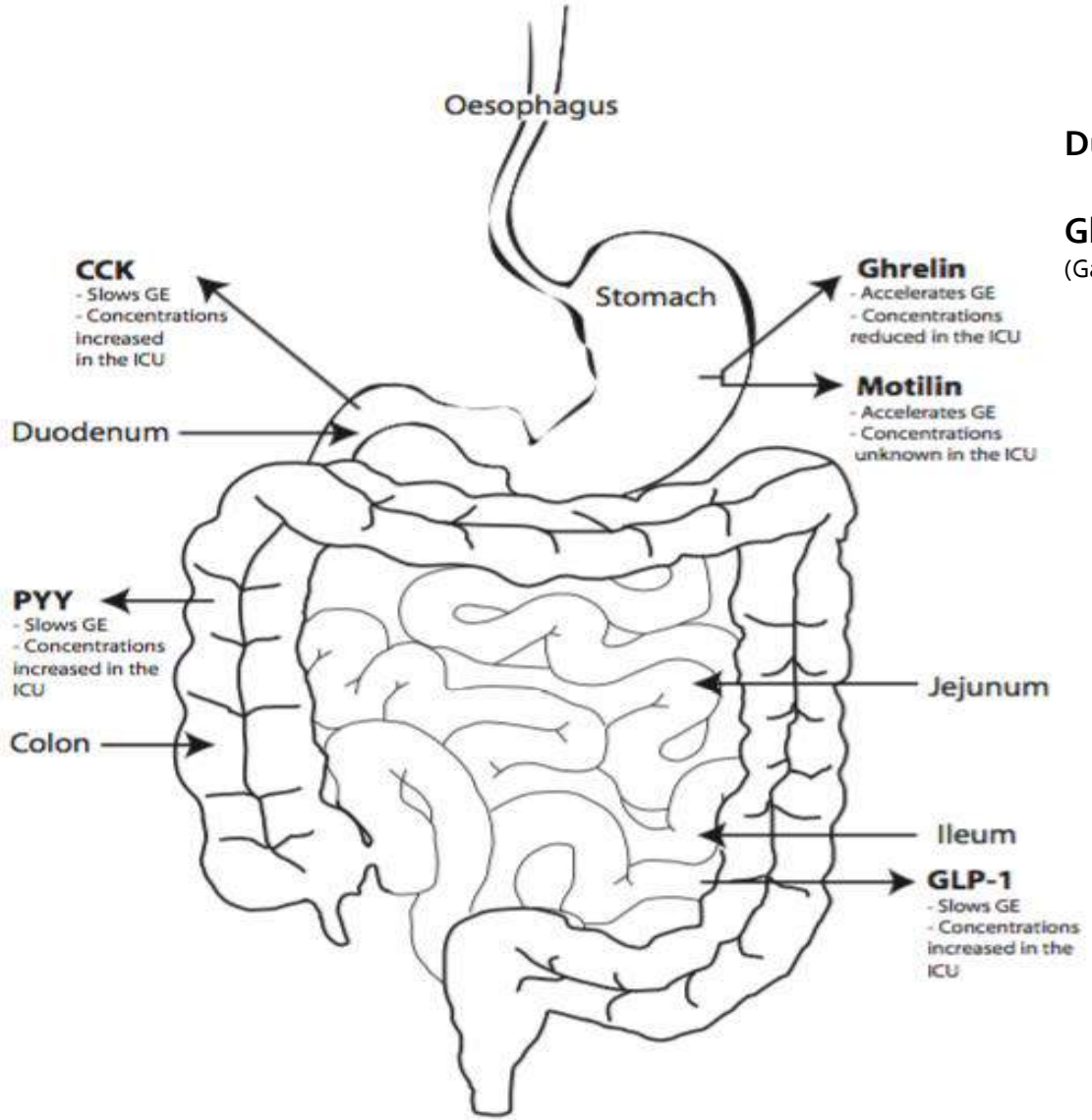
Gastrik Boşalım Hızı Yavaşlar

Düzeyi Artanlar

CCK
(Gastrik Boşalımı Yavaşlatır)

PYY
(Gastrik Boşalımı Yavaşlatır)

GLP 1
(Gastrik Boşalımı Yavaşlatır)



Düzeyi Azalanlar

Ghrelin
(Gastrik Boşalımı Hızlandırır)

Figure 1. Hormones affecting gastric emptying in health and critical illness. Effect of hormones on gastric emptying (GE) in health and their known fasting concentrations in the critically ill. CCK, cholecystokinin; GLP, glucagon-like peptide; ICU, intensive care unit; PYY, peptide YY.

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CRITICAL CARE

REVIEW

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Gastrik Boşalım

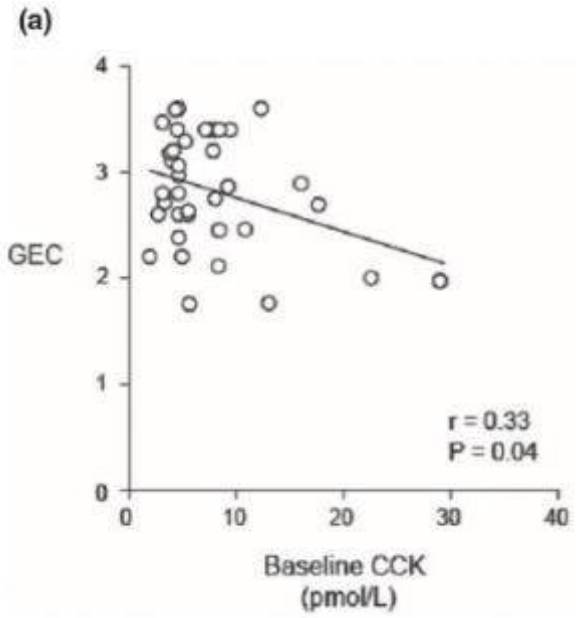

Figure 3. Relationship between rate of gastric emptying and fasting cholecystokinin and peptide YY concentrations. Relationship between the rate of gastric emptying (measured using an isotope breath test and calculated as the gastric emptying coefficient (GEC); greater number, more rapid emptying) and **(a)** fasting cholecystokinin (CCK) concentrations ($r = -0.33$; $P = 0.04$) and **(b)** fasting peptide YY (PYY) concentrations ($r = -0.36$; $P = 0.02$) in 39 critically ill patients. Reproduced with permission from [55].

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CRITICAL CARE

REVIEW

Bench-to-bedside review: The gut as an endocrine organ in the critically ill

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Karbonhidrat Absorbsiyonu

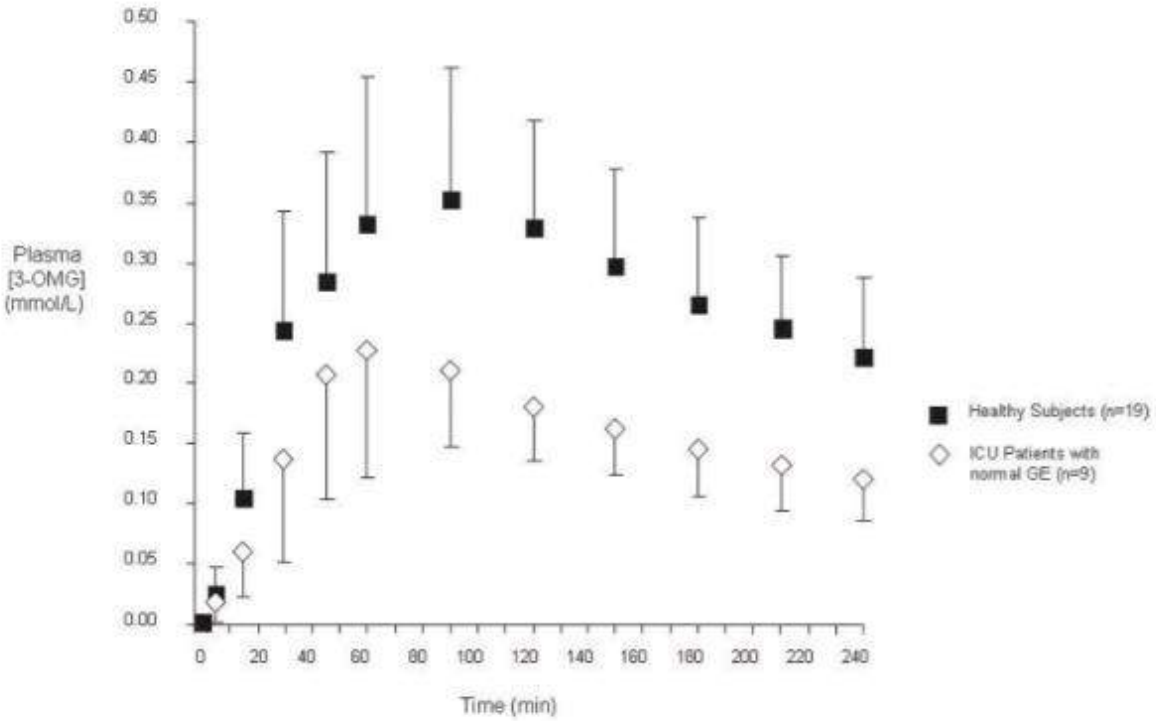

Figure 2. Absorption of carbohydrate is impaired in the critically ill. In nine critically ill patients (with normal gastric emptying (GE)) both peak and area under the curve (AUC) concentrations for plasma 3-O-methyl-glucose [3-OMG] (an index of glucose absorption) were markedly attenuated when compared with 19 healthy subjects. [3-OMG] $AUC_{0-240\ min}$: critically ill patients, 38.9 ± 11.4 mmol/l/min vs. healthy subjects, 66.6 ± 16.8 mmol/l/min; $P < 0.001$ (mean ± standard deviation). Reproduced from [12]. ICU, intensive care unit.

Deane et al. Critical Care 2010, 14:228
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CRITICAL CARE

REVIEW

Bench-to-bedside review: The gut as an endocrine organ in the critically ill

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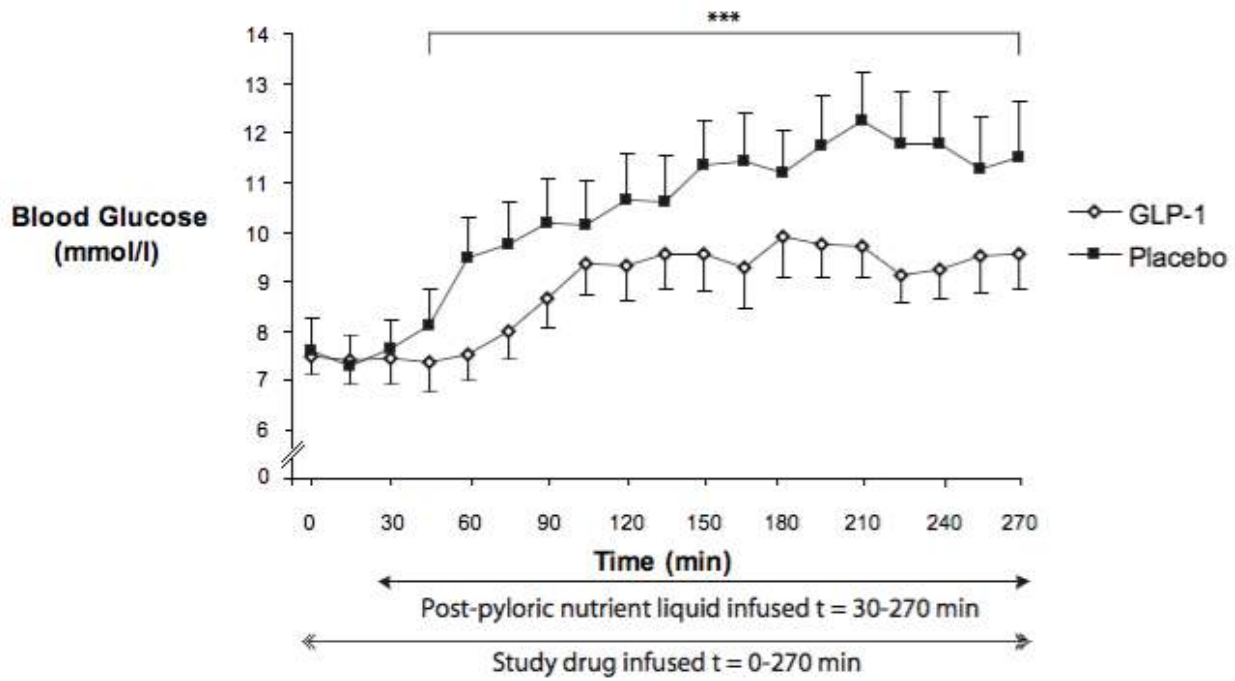


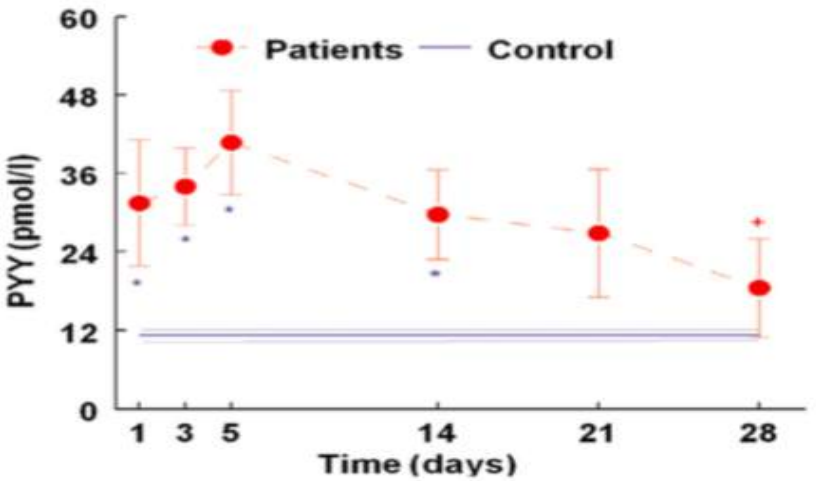
Figure 4. The effect of glucagon-like peptide-1 on glycaemia in critically ill patients. In a cross-over study, exogenous glucagon-like peptide (GLP)-1 (1.2 pmol/kg/min) markedly attenuated the overall glycaemic response to intraduodenal nutrient infusion. Area under the curve$_{30-270\ min}$: GLP-1, 2,077 ± 144 mmol/l/min vs. placebo, 2,568 ± 208 mmol/l/min; $n = 7$; ***$P < 0.05$. Reproduced from [81].

Changes in appetite related gut hormones in intensive care unit patients: a pilot cohort study

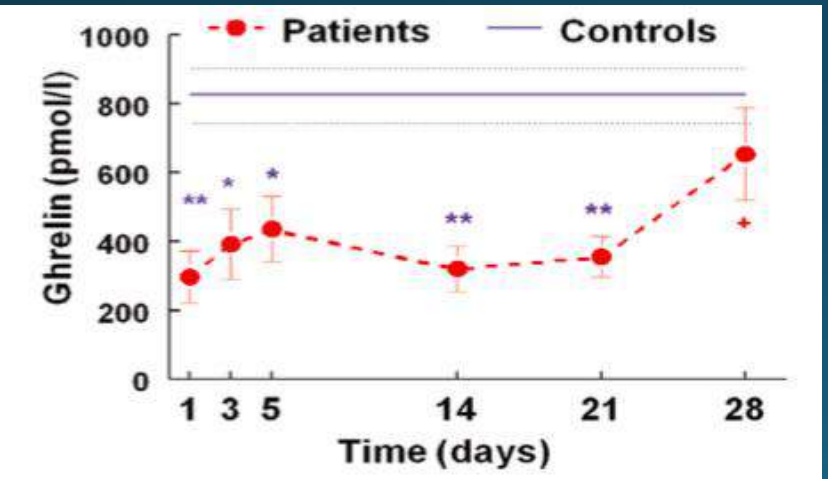
Mohsen Nematy[1], Jacqui E O'Flynn[2], Lieal Wandrag[2], Audrey E Brynes[3], Stephen J Brett[4], Michael Patterson[5], Mohammad A Ghatei[6], Stephen R Bloom[7] and Gary S Frost[8]

Received: 24 Aug 2006 Accepted: 28 Nov 2006 Published: 28 Dec 2006

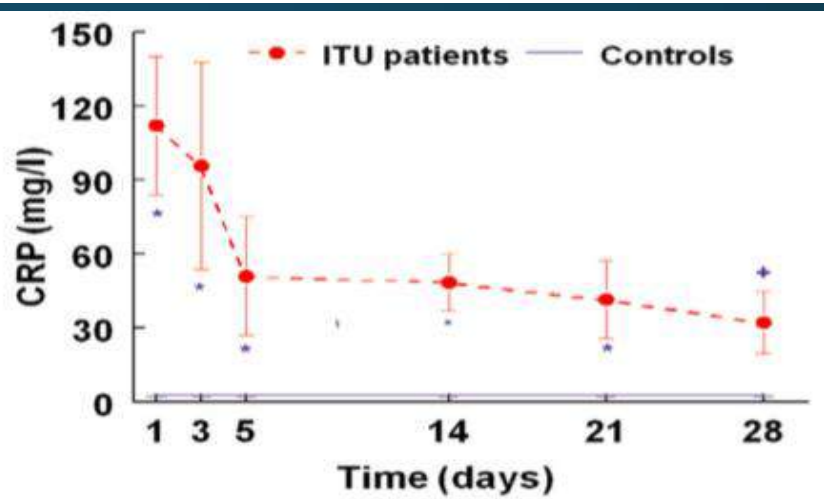
İştah Üzerine Etki



Pattern of plasma peptide (PYY; mean ± standard error of the mean) during intensive care unit (ICU) stay (n = 7 patients) compared with healthy age and body mass index matched control group (n = 31). Filled circles, ICU patients; solid line, control group; doted line, error bar in control group; * $p < 0.05$ for patients versus controls. There was no significant difference between patients and control subjects on day 21 and 28. $^{+}p < 0.05$ for patient day 3 and 5 versus patient day 28.



Pattern of plasma ghrelin (mean ± standard error of the mean) during intensive care unit (ICU) stay (n = 8 patients) compared with healthy age and body mass index matched control group (n = 36). Filled circles, ICU patients; solid line, control group; doted line, error bar in control group; * $p < 0.05$. ** $p < 0.001$ patients versus controls. There was no significant difference between patients and control subjects on day 21 and 28. $^{+}p < 0.05$ for patient day 1 versus patient day 28.



Pattern of plasma C-reactive protein (CRP; mean ± standard error of the mean) during intensive care unit (ICU) stay (n = 8 patients) compared with healthy age and body mass index matched control group (n = 36). Filled circles, ICU patients; solid line, control group; doted line, error bar in control group; * $p < 0.05$. ** $p < 0.001$ patients versus controls. There was no significant difference between patients and control subjects on day 28. $^{+}p < 0.05$ for patient day 1 versus patient day 28.

GLUKOZ REGÜLASYONU

Hiperglisemi

Patogenez

Periferik ve Hepatik İnsulin Rezistansı

Hepatik ve Renal Glukoz Üretim Artışı

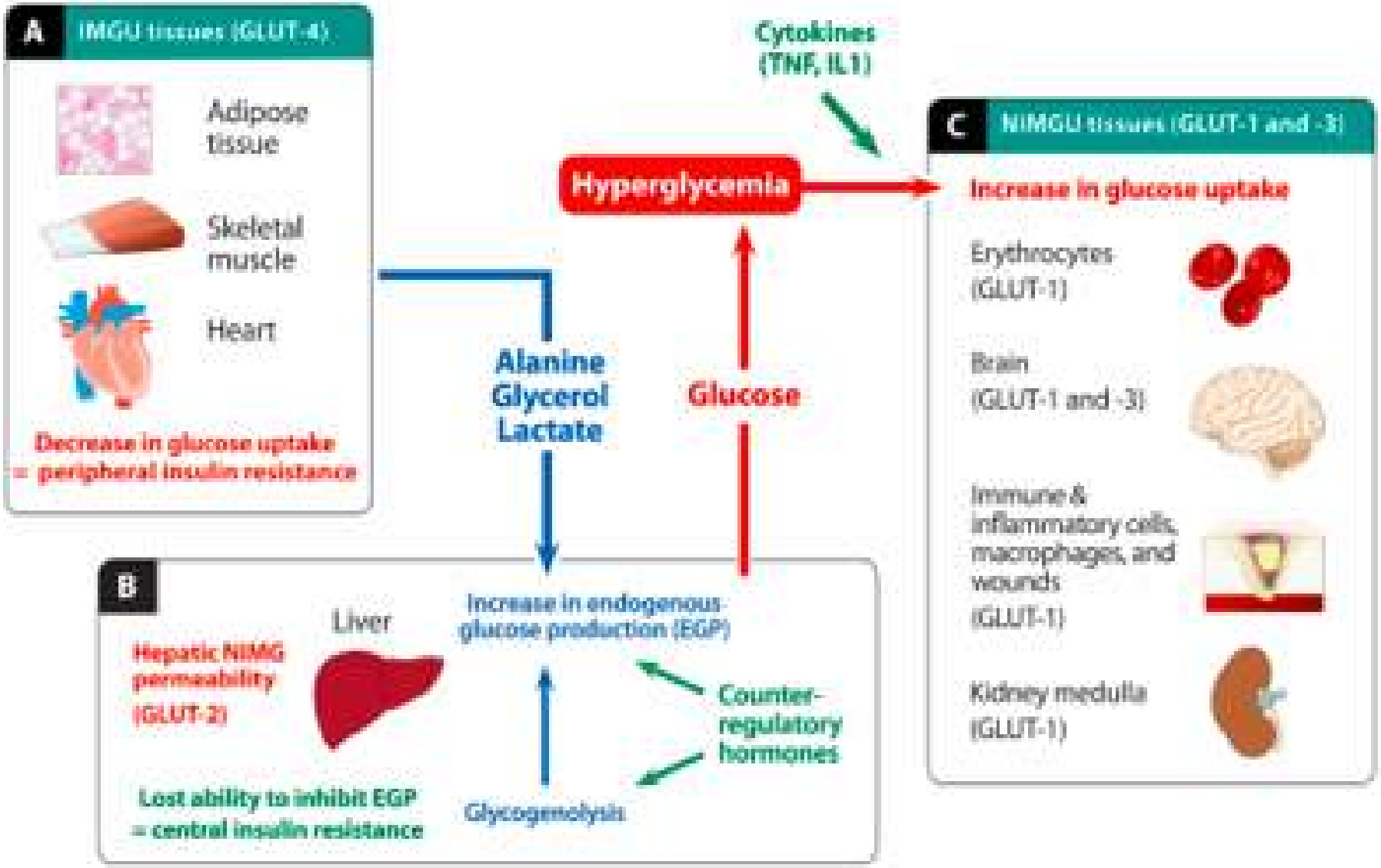
Glukoz Yüklenmesi (IV infüzyonlar)

Clinical Concepts and Commentary

Bruno Riou, M.D., Ph.D., Editor

Glycemic Control in the Intensive Care Unit and during the Postoperative Period

Diane Lena, M.D.,* Pierre Kalfon, M.D.,† Jean-Charles Preiser, M.D., Ph.D.,‡ Carole Ichai, M.D., Ph.D.§



Trends Endocrinol Metab. 2009 November ; 20(9): 429–435. doi:10.1016/j.tem.2009.06.004.

Acute Insulin Resistance Following Injury

Li Li[1] and Joseph L. Messina[1,2,3]
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[2] Veterans Affairs Medical Center, Birmingham, Alabama 35233

İnsulin Rezistansı

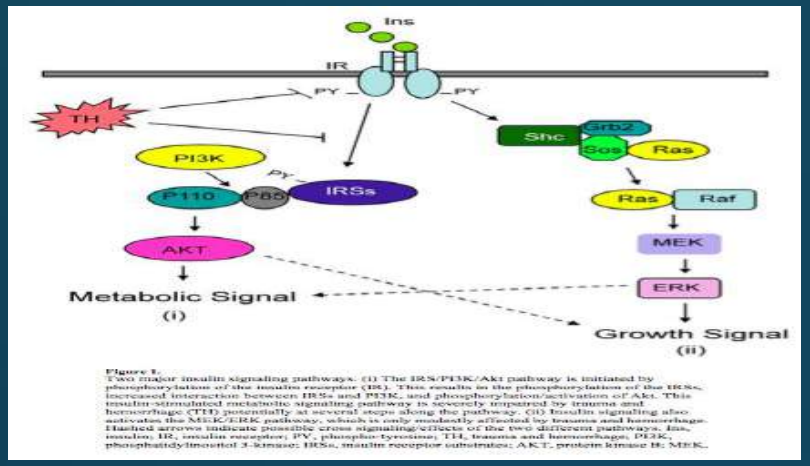

Figure 1.
Two major insulin signaling pathways. (i) The IRS/PI3K/Akt pathway is initiated by phosphorylation of the insulin receptor (IR). This results in the phosphorylation of the IRSs, increased interaction between IRSs and PI3K, and phosphorylation/activation of Akt. This insulin-stimulated metabolic signaling pathway is severely impaired by trauma and hemorrhage (TH) potentially at several steps along the pathway. (ii) Insulin signaling also activates the MEK/ERK pathway, which is only modestly affected by trauma and hemorrhage. Hashed arrows indicate possible cross signaling/effects of the two different pathways. Ins, insulin; IR, insulin receptor; PY, phospho-tyrosine; TH, trauma and hemorrhage; PI3K, phosphatidylinositol 3-kinase; IRSs, insulin receptor substrates; AKT, protein kinase B; MEK,

İnsulin Rezistansı
KC-TNF-alfa
15

İnsulin Rezistansı
Kas-Kortikosteroid
60

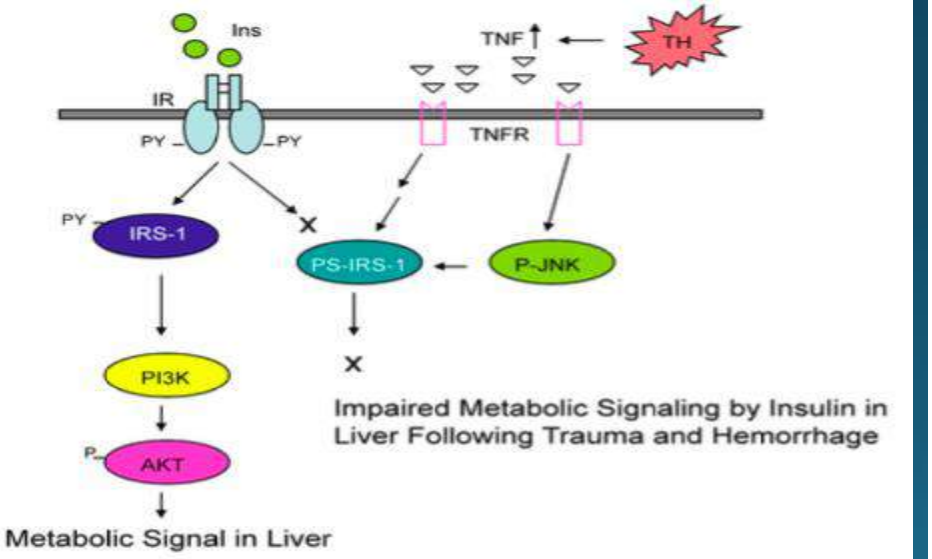

Figure 2.
TNFα-mediated acute hepatic insulin resistance after trauma and hemorrhage (TH). Following trauma and hemorrhage, TNFα levels increase, bind to the TNF receptor (TNFR) on the cell membrane, which activates JNK and serine (rat S307, human S312) phosphorylation of IRS-1. This inhibits tyrosine phosphorylation of IRS-1, which decreases association of PI3K with IRS-1 and impairs Akt phosphorylation, resulting in acute insulin resistance in liver following trauma and hemorrhage. This mechanism may not occur in skeletal muscle. Ins, insulin; IR, insulin receptor; PY, phospho-tyrosine; TH, trauma and hemorrhage; PI3K, phosphatidylinositol 3-kinase; IRSs, insulin receptor substrates; AKT, protein kinase B; TNF, tumor necrosis factor; TNFR, tumor necrosis factor receptor; PS, phosphor-serine; JNK, c-Jun NH_2-Terminal Kinase.

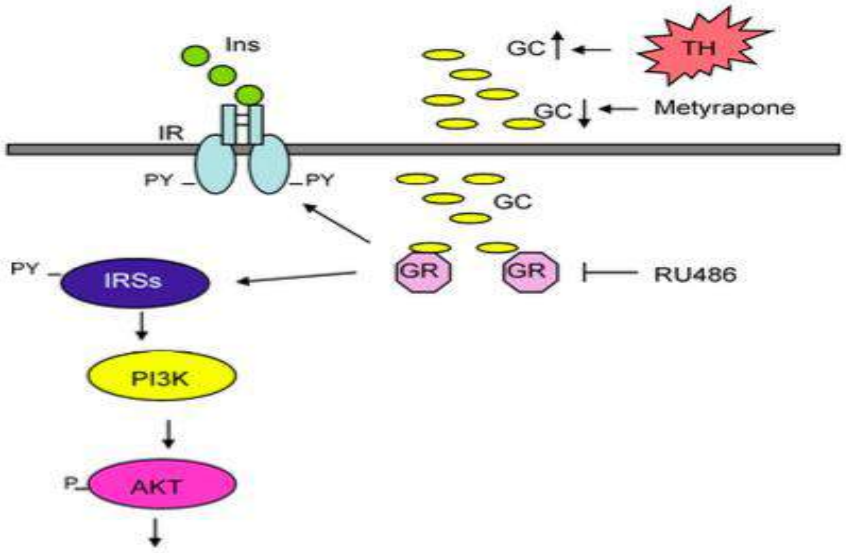

Figure 3.
Glucocorticoid-mediated acute insulin resistance in skeletal muscle after trauma and hemorrhage (TH). Blocking the production of glucocorticoids by metyrapone or their action by RU486 inhibits the development of insulin resistance in skeletal muscle, but not liver, thereby allowing an increase in insulin-induced phosphorylation of IR, IRS-1 and Akt. Ins, insulin; IR, insulin receptor; PY, phospho-tyrosine; TH, trauma and hemorrhage; PI3K, phosphatidylinositol 3-kinase; IRSs, insulin receptor substrates; AKT, protein kinase B; GC, glucocorticoids; GR, glucocorticoid receptor.

Glikoneogenez
Glukojenoliz

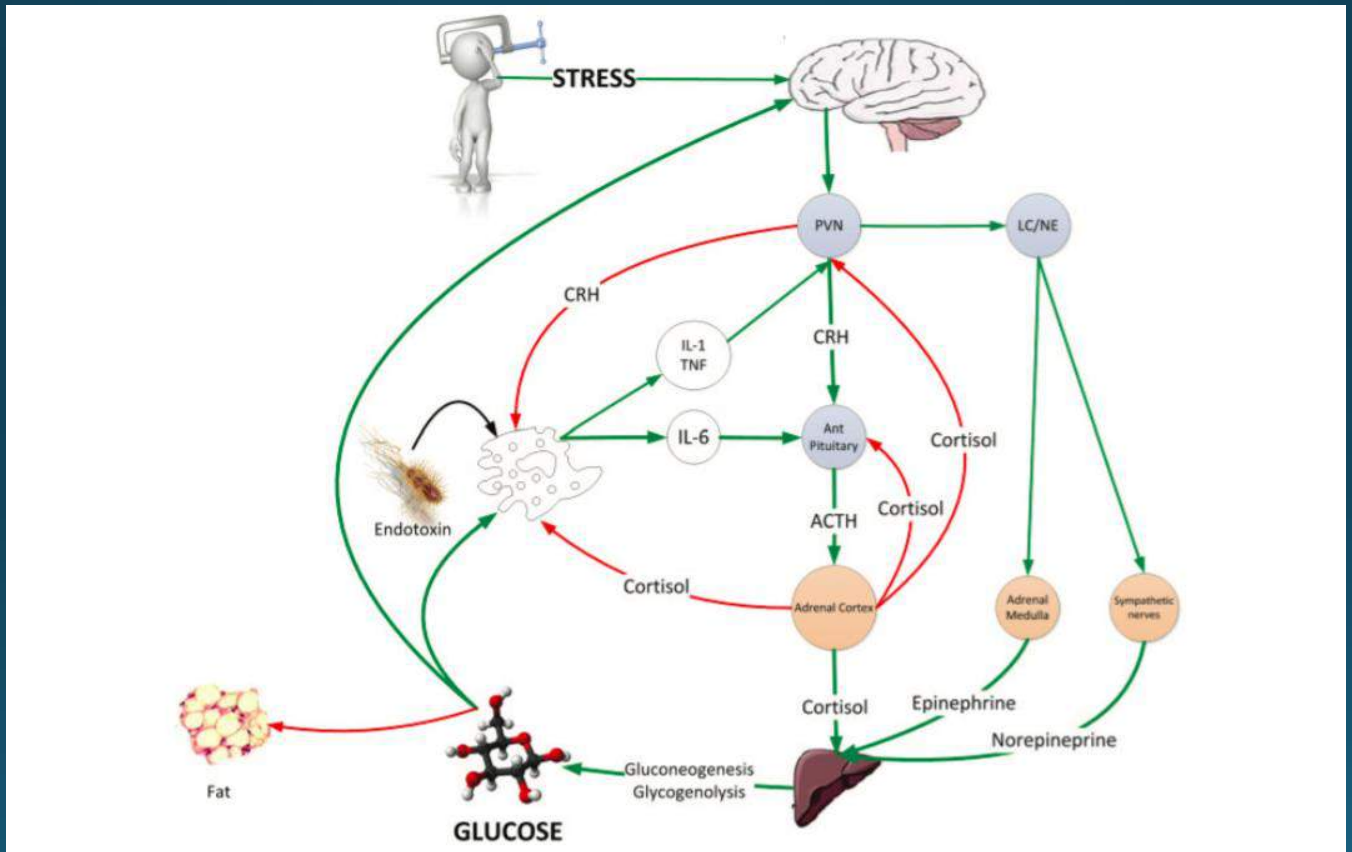

Figure 1. The neuroendocrine response to stress is characterized by gluconeogenesis and glycogenolysis resulting in stress hyperglycemia providing the immune system and brain with a ready source of fuel. ACTH, adrenocorticotrophic hormone; CRH, corticotrophin releasing hormone; LC/NE, locus ceruleus norepinephrine system; PVN, paraventricular nucleus.

British Journal of Anaesthesia 113 (6): 945–54 (2014)
Advance Access publication 26 June 2014 · doi:10.1093/bja/aeu187

BJA

Metabolic response to the stress of critical illness

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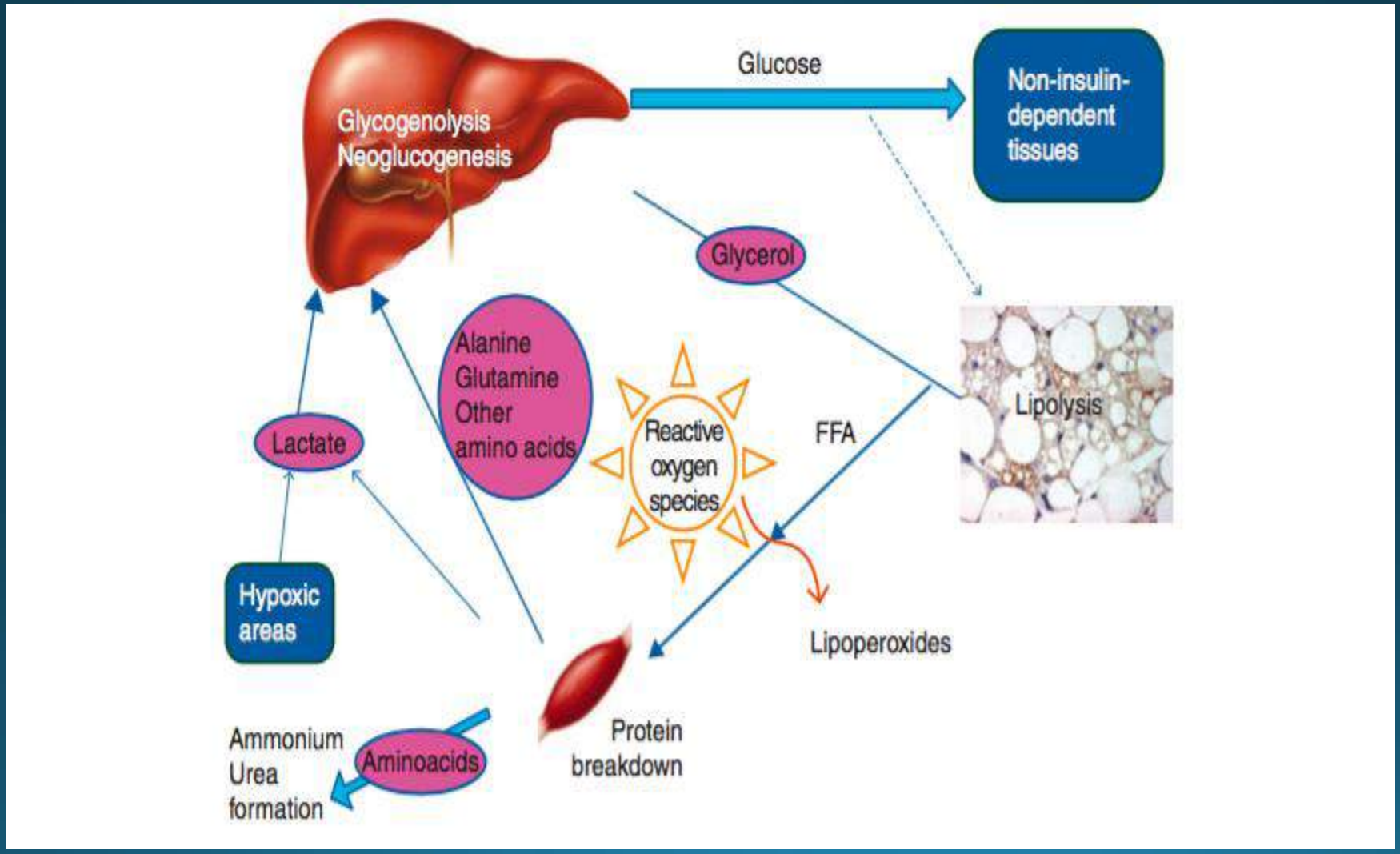
[3] Department of Intensive Care, Erasmus Medical Center, Rotterdam, The Netherlands
* Corresponding author. E-mail: jean-charles.preiser@erasme.ulb.ac.be

Glikoneogenez
Glukojenoliz



British Journal of Anaesthesia 113 (6): 945–54 (2014)
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BJA

Metabolic response to the stress of critical illness

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[1] Department of Intensive Care, Erasme University Hospital, Free University of Brussels, 808 route de Lennik, 1070 Brussels, Belgium
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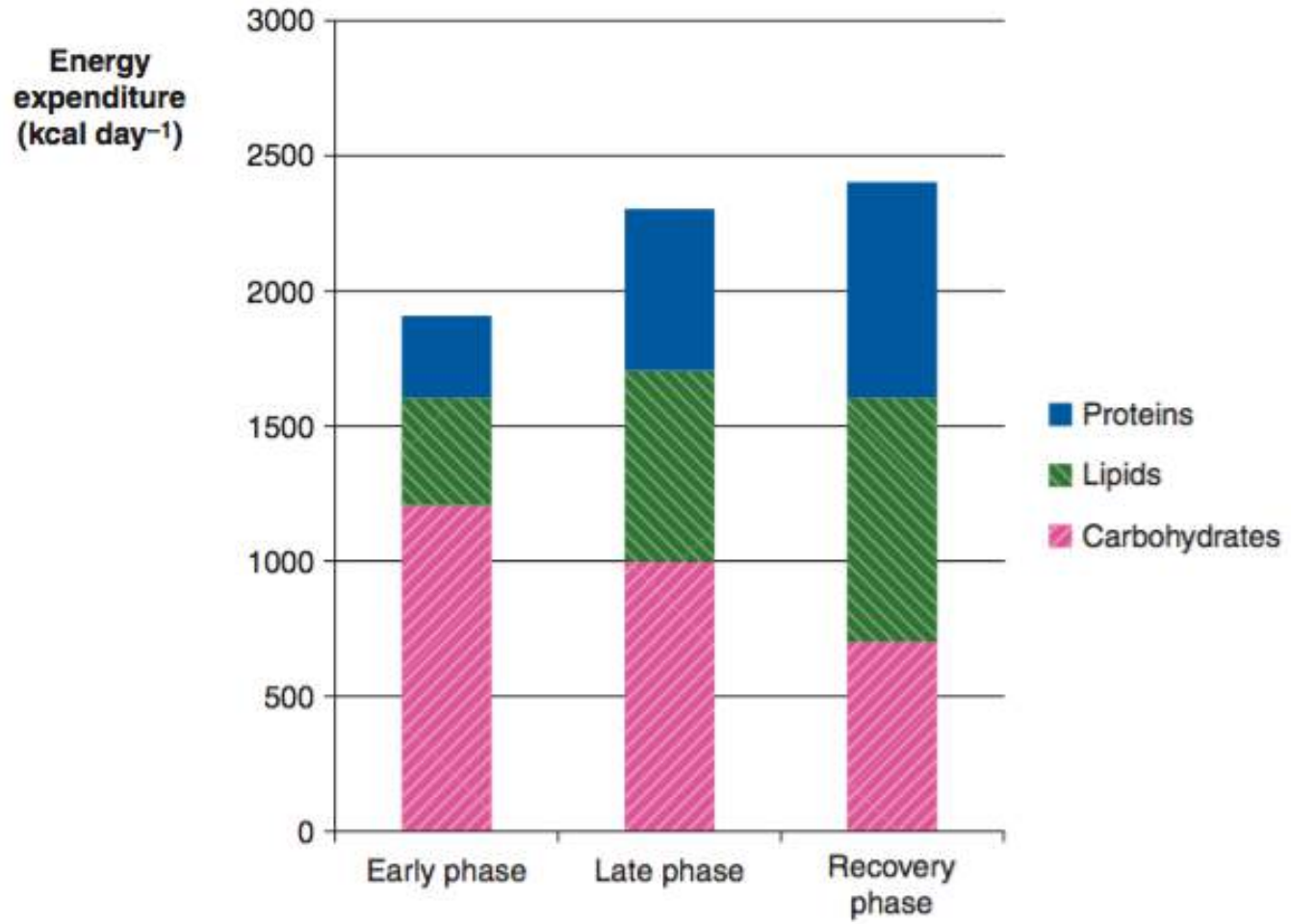
* Corresponding author. E-mail: jean-charles.preiser@erasme.ulb.ac.be



GLUKOZ REGÜLASYONU

İnsulin -GLUT 4

Glukagon

GLUKOZ REGÜLASYONU

Hedefler
Yönetim

AACE-ICU

Year	Organization	Patient Population	Treatment Threshold	Target Glucose Level	Definition of Hypoglycemia	Updated Since NICE_SUGAR Trial, 2009
2009	American Association of Clinical Endocrinologists and American Diabetes Association	ICU patients	180	140-180	<70	Yes
2009	Surviving Sepsis Campaign	ICU patients	180	150	Not stated	Yes
2009	Institute for Healthcare Improvement	ICU patients	180	<180	<40	Yes
2008	American Heart Association	ICU patients with acute coronary syndromes	180	90-140	Not stated	No
2007	European Society of Cardiology and European Association for the Study of Diabetes	ICU patients with cardiac disorders	Not stated	"Strict"	Not stated	No

Kavanagh BP, McCowen KC. *N Engl J Med.* 2010;363:2540-2546.

AACE

Kan Glukoz Hedef Değer

140-180 mg/dL

Hipoglisemi Gelişiminden Kaçın

İntravenöz İnsulin İnfüzyonu Uygula

- Kan Glukoz Değeri <100 mg/dL Yeniden Değerlendir
- Kan Glukoz Değeri <70 mg/dL Tedaviyi Değiştir

Moghissi ES, et al. *Endocr Pract*. 2009;15:353-369.

Uygulama

Kan Şekeri>180 mg/dl (2 kez)

Kristalize İnsulin 1U/ 1 mL 0.9% NaCl

Kan şekeri : 350mg/dl
350/100: 3.5

- IV Bolus = 3.5 U + İnfusion Hızı : 3.5 U/h
- **İnfüzyon Miktar Değişimi: 0.5 U/h ve Katları**

Doz Değişimleri
Hasta Verilerine Göre Düzenle

Kan Şeker Takipleri Aralıkları
Saat Başı-2 Saat-4 Saat
Hasta Verilerine Göre Düzenle

İnsulin İnfuzyon Protokol Örneği

Yale

Insulin infusion: Mix 1 U regular human insulin per 1 mL 0.9% NaCl Administer via infusion pump in increments of 0.5 U/h

Blood glucose target range:

120-160 mg/dL

Use glucose meter to monitor blood glucose hourly

Bolus and initial infusion rate:

Divide initial BG by 100, round to nearest 0.5 U for bolus and initial infusion rates

Example: Initial BG = 325 mg/dL: 325/100 = 3.25, round up to 3.5:
IV bolus = 3.5 U + start infusion at 3.5 U/h

Subsequent rate adjustments:

Changes in infusion rate are determined by the current infusion rate and the hourly rate of change from the prior BG level

Yale-New Haven Hospital
ICU Insulin Infusion Protocol (IIP) for Adults

The following IIP is intended for use in hyperglycemic adult patients in the ICU, adapted from our earlier protocols. In keeping with the latest glucose guidelines from national organizations, it should NOT be used in diabetic ketoacidosis (DKA) or hyperosmolar hyperglycemic state (HHS), as these patients may require higher initial insulin doses, IV dextrose at some point, and important adjunctive therapies for their fluid/electrolyte/acid-base disturbances. See Tab 5 Guidelines or YNHH Clinical Practice Manual (CPM) for further instructions. In any patient with BG > 500 mg/dL, the initial bolus should also be carefully reviewed with the MD, since a higher initial insulin dose and additional monitoring/therapy may be required. If the patient's response to the insulin infusion is at any time unusual or unexpected, or if any situation arises that is not adequately addressed by this protocol, the MD must be contacted for assessment and further orders.

Getting Started

1.) PATIENT SELECTION: Begin IIP in any ICU patient with more than 2 BGs >180 mg/dl who is not expected to rapidly normalize their glycemic status. Patients who are eating (see #9 below); transferring out of ICU imminently (<24 hrs); or pre-terminal or being considered for CMO status are generally not appropriate candidates for this IIP.

2.) TARGET BLOOD GLUCOSE (BG) RANGE: **120-160 mg/dL** 3.) ORDERS: MD order required for use in the ICU.

4.) INSULIN INFUSION SOLUTION: Obtain from pharmacy (1 unit Regular Human Insulin / 1 cc 0.9 % NaCl).

5.) PRIMING: Before connecting, flush 20 cc infusion through all tubing. 6.) ADMINISTRATION: Via infusion pump in 0.5 units/hr increments.

7.) BOLUS & INITIAL INFUSION RATE: Divide initial BG level by 100, then round to nearest 0.5 units for bolus AND initial infusion rate.
Examples: 1.) Initial BG = 325 mg/dL: 325 ÷ 100 = 3.25, round ↑ to 3.5: IV bolus 3.5 units + start infusion @ 3.5 units/hr.
2.) Initial BG = 274 mg/dL: 274 ÷ 100 = 2.74, round ↓ to 2.5: IV bolus 2.5 units + start infusion @ 2.5 units/hr.

8.) CAUTION: If enteral/parenteral (TPN, PPN, Tube feeds) nutrition abruptly stopped, reduce infusion rate by 50%.

9.) Patients requiring IV insulin are usually NPO. In the rare patient who is eating, consider giving SQ Aspart PC to 'cover' the meal (administer 1 unit /15 grams carbohydrates consumed (usual dose 3-6 units.) In this circumstance don't increase infusion rate during the first 3 hrs PC.

10.) Patients with T1DM, insulin-requiring T2DM, and those requiring >1 unit/hr should be transitioned to SQ insulin prior to discharge from ICU.

BG Monitoring

While on infusion, use glucose meter to check BG **hourly**. Once stable (3 consecutive values in target range), may reduce checks to **q 2 hr**. If stable for 12-24 hrs, may space checks to **q 4 hr**. *Resume hourly checks until stable again if:* any BG out of range; any change in insulin infusion rate; any significant change in clinical condition; initiation/discontinuation of steroids, pressors, TPN/PPN/tube feeds, dialysis, CVVH, or CAVH. In patients who are vasoconstricted/hypotensive, capillary BG (i.e., fingersticks) may be inaccurate; venous or arterial blood is preferred in this setting.

Adjusting Infusion Rate

If BG ≤ 50 mg/dL:
D/C INSULIN INFUSION & administer 1 amp (25 g) D50 IV; recheck BG q 15 minutes until ≥90 mg/dl.
➡ Then, recheck BG q 1 hr; when ≥140 mg/dL, wait 30 min, restart insulin infusion at 50% of most recent rate

If BG 50-74 mg/dL:
D/C INSULIN INFUSION & administer 1/2 Amp (12.5 g) D50 IV; recheck BG q 15 minutes until ≥90 mg/dl.
➡ Then, recheck BG q 1 hr; when ≥140 mg/dL, wait 30 min, then restart infusion at 50% of most recent rate.

If BG 75-99 mg/dL:
D/C INSULIN INFUSION. Recheck BG q 15 minutes until BG reaches or remains ≥90 mg/dl.
➡ Then, recheck BG q 1 hr; when ≥140 mg/dL, wait 30 min, then restart infusion at 75% of most recent rate.

If BG ! 100 mg/dL:

STEP 1: Determine the CURRENT BG LEVEL - identifies a COLUMN in the table:

BG 100-119 mg/dL	BG 120-159 mg/dL	BG 160-199 mg/dL	BG ! 200 mg/dL

STEP 2: Determine the RATE OF CHANGE from the prior BG level - identifies a CELL in the table - Then move right for INSTRUCTIONS:
[Note: If the last BG was measured 2 or more hrs before the current BG, calculate the hourly rate of change. Example: If the BG at 2PM was 150 mg/dL and the BG at 4PM is 120 mg/dL, the total change over 2 hours is -30 mg/dL; however, the hourly change is –30 mg/dL ÷ 2 hours = -15 mg/dL/hr.]

BG 100-119 mg/dL	BG 120-159 mg/dL	BG 160-199 mg/dL	BG ! 200 mg/dL	INSTRUCTIONS*
		BG " by > 60 mg/dL/hr	BG "	" INFUSION by "2#"
	BG " by > 40 mg/dL/hr	BG " by 1-60 mg/dL/hr *OR* BG UNCHANGED	BG UNCHANGED *OR* BG ↓ by 1-20 mg/dL/hr	" INFUSION by "#"
BG "	BG " by 1-40 mg/dL/hr, BG UNCHANGED, *OR* BG ↓ by 1-20 mg/dL/hr	BG ↓ by 1-40 mg/dL/hr	BG ↓ by 21-60 mg/dL/hr	NO INFUSION CHANGE
BG UNCHANGED *OR* BG ↓ by 1-20 mg/dL/hr	BG ↓ by 21-40 mg/dL/hr	BG ↓ by 41-60 mg/dL/hr	BG ↓ by 61-80 mg/dL/hr	↓ INFUSION by "#"
BG ↓ by > 20 mg/dL/hr over last hour†	BG ↓ by > 40 mg/dL/hr	BG ↓ by > 60 mg/dL/hr	BG ↓ by > 80 mg/dL/hr	HOLD x 30 min, then ↓ INFUSION by "2#"

†D/C INSULIN INFUSION; %BG in 15 min to be sure ! 90 mg/dl. Then recheck BG q 1 hr; when ! 140 mg/dl, restart infusion @75% of most recent rate.

STEP 3: CHANGES IN INFUSION RATE* ("#") are determined by the current rate:

Current Rate (Units/hr)	# = Rate Change (Units/hr)	2# = 2X Rate Change (Units/hr)
< 3.0	0.5	1
3.0 – 6.0	1	2
6.5 – 9.5	1.5	3
10.0 – 14.5	2	4
15 – 19.5	3*	6*
! 20*	4*	8*

* Depending on the clinical circumstances, infusion rates typically range between 2-10 units/hr. Doses in excess of 20 units/hr are unusual, and, if required, the responsible MD should be notified to explore other potential contributing factors (including technical problems, such as dilution errors, etc.)

Yale

İnsulin infuzyon: Mix 1 U regular human insulin per 1 mL 0.9% NaCl Administer via infusion pump in increments of 0.5 U/h

Blood glucose target range:

120-160 mg/dL

Use glucose meter to monitor blood glucose hourly

Bolus and initial infusion rate:

Divide initial BG by 100, round to nearest 0.5 U
for bolus and initial infusion rates

Example: Initial BG = 325 mg/dL: 325/100 = 3.25, round up to 3.5:
IV bolus = 3.5 U + start infusion at 3.5 U/h

Subsequent rate adjustments:

Changes in infusion rate are determined by the current infusion rate and the hourly rate of change from the prior BG level

İnsulin İnfuzyonu Protokol Örneği

If BG ! 100 mg/dL:

STEP 1: Determine the CURRENT BG LEVEL - identifies a COLUMN in the table:

BG 100-119 mg/dL	BG 120-159 mg/dL	BG 160-199 mg/dL	BG ! 200 mg/dL

STEP 2: Determine the RATE OF CHANGE from the prior BG level - identifies a CELL in the table - Then move right for **INSTRUCTIONS:**

[Note: If the last BG was measured 2 or more hrs before the current BG, calculate the hourly rate of change. Example: If the BG at 2PM was 150 mg/dL and the BG at 4PM is 120 mg/dL, the total change over 2 hours is -30 mg/dL; however, the hourly change is –30 mg/dL ¸ 2 hours = -15 mg/dL/hr.]

BG 100-119 mg/dL	BG 120-159 mg/dL	BG 160-199 mg/dL	BG ! 200 mg/dL	INSTRUCTIONS*
		BG " by > 60 mg/dL/hr	BG "	" INFUSION by "2#"
	BG " by > 40 mg/dL/hr	BG " by 1-60 mg/dL/hr *OR* BG UNCHANGED	BG UNCHANGED *OR* BG ↓ by 1-20 mg/dL/hr	" INFUSION by "#"
BG "	BG " by 1-40 mg/dL/hr, BG UNCHANGED, *OR* BG ↓ by 1-20 mg/dL/hr	BG ↓ by 1-40 mg/dL/hr	BG ↓ by 21-60 mg/dL/hr	NO INFUSION CHANGE
BG UNCHANGED *OR* BG ↓ by 1-20 mg/dL/hr	BG ↓ by 21-40 mg/dL/hr	BG ↓ by 41-60 mg/dL/hr	BG ↓ by 61-80 mg/dL/hr	↓ INFUSION by "#"
BG ↓ by > 20 mg/dL/hr *see below*†	BG ↓ by > 40 mg/dL/hr	BG ↓ by > 60 mg/dL/hr	BG ↓ by > 80 mg/dL/hr	HOLD x 30 min, then ↓ INFUSION by "2#"

†D/C INSULIN INFUSION; %BG in 15 min to be sure ! 90 mg/dl. Then recheck BG q 1 hr; when ! 140 mg/dl, restart infusion @75% of most recent rate.

STEP 3: CHANGES IN INFUSION RATE* ("#") are determined by the current rate:

Current Rate (Units/hr)	# = Rate Change (Units/hr)	2# = 2X Rate Change (Units/hr)
< 3.0	0.5	1
3.0 – 6.0	1	2
6.5 – 9.5	1.5	3
10.0 – 14.5	2	4
15 – 19.5	3*	6*
! 20*	4*	8*

* Depending on the clinical circumstances, infusion rates typically range between 2-10 units/hr. Doses in excess of 20 units/hr are unusual, and, if required, the responsible MD should be notified to explore other potential contributing factors (including technical problems, such as dilution errors, etc.)

İnsulin İnfuzyon Protokol Örneği

FINAL3 01.03.11

Yale-New Haven Hospital
ICU Insulin Infusion Protocol (IIP) for Adults

The following IIP is intended for use in hyperglycemic adult patients in the ICU, adapted from our earlier protocols, in keeping with the latest glucose guidelines from national organizations. It should NOT be used in diabetic ketoacidosis (DKA) or hyperosmolar hyperglycemic state (HHS), as these patients may require higher initial insulin doses, IV dextrose at some point, and important adjunctive therapies for their fluid/acid-base/electrolyte/divalent status. (See 'DKA Guidelines' in YNHH Clinical Practice Manual (CPM) for further instructions.) In any patient with BG >500 mg/dL, the initial orders should also be carefully reviewed with the MD, since a higher initial insulin dose and additional monitoring/therapy may be required. If the patient's response to the insulin infusion is at any time unusual or unexpected, or if any situation arises that is not adequately addressed by this protocol, the MD must be contacted for assessment and further orders.

Getting Started

1.) PATIENT SELECTION: Begin IIP in any ICU patient with more than 2 BGs >180 mg/dl who is not expected to rapidly normalize their glycemic status. Patients who are eating (see #9 below); transferring out of ICU imminently (<24 hrs); or pre-terminal or being considered for CMO status are generally not appropriate candidates for this IIP.

2.) **TARGET** BLOOD GLUCOSE (BG) RANGE: **120-160 mg/dL** 3.) ORDERS: MD order required for use in the ICU.

4.) INSULIN INFUSION SOLUTION: Obtain from pharmacy (1 unit Regular Human Insulin / 1 cc 0.9 % NaCl).

5.) PRIMING: Before connecting, flush 20 cc infusion through all tubing. 6.) ADMINISTRATION: Via infusion pump in 0.5 units/hr increments.

7.) BOLUS & INITIAL INFUSION RATE: Divide initial BG level by 100, then round to nearest 0.5 units for bolus AND initial infusion rate.

Examples: 1.) Initial BG = 325 mg/dL: 325 ÷ 100 = 3.25, round ↑ to 3.5: IV bolus 3.5 units + start infusion @ 3.5 units/hr.

2.) Initial BG = 274 mg/dL: 274 ÷ 100 = 2.74, round ↓ to 2.5: IV bolus 2.5 units + start infusion @ 2.5 units/hr.

8.) **CAUTION:** If enteral/parenteral (TPN, PPN, Tube feeds) nutrition abruptly stopped, reduce infusion rate by 50%.

9.) Patients requiring IV insulin are usually NPO. In the rare patient who is eating, consider giving SQ Aspart PC to 'cover' the meal (administer 1 unit /15 grams carbohydrates consumed (usual dose 3-6 units.) In this circumstance don't increase infusion rate during the first 3 hrs PC.

10.) Patients with T1DM, insulin-requiring T2DM, and those requiring >1 unit/hr should be transitioned to SQ insulin prior to discharge from ICU.

BG Monitoring

While on infusion, use glucose meter to check BG **hourly**. Once stable (3 consecutive values in target range), may reduce checks to **q 2 hr**. If stable for 12-24 hrs, may space checks to **q 4 hr**. *Resume hourly checks until stable again if:* any BG out of range; any change in insulin infusion rate; any significant change in clinical condition; initiation/discontinuation of steroids, pressors, TPN/PPN/tube feeds, dialysis, CVVH, or CAVH. In patients who are vasoconstricted/hypotensive, capillary BG (i.e., fingersticks) may be inaccurate; venous or arterial blood is preferred in this setting.

Adjusting Infusion Rate

If BG < 50 mg/dL:

D/C INSULIN INFUSION & administer 1 amp (25 g) D50 IV; recheck BG q 15 minutes until ≥90 mg/dl.

➡ Then, recheck BG q 1 hr; when ≥140 mg/dL, wait 30 min, restart insulin infusion at 50% of most recent rate

If BG 50-74 mg/dL:

D/C INSULIN INFUSION & administer 1/2 Amp (12.5 g) D50 IV; recheck BG q 15 minutes until ≥90 mg/dl.

➡ Then, recheck BG q 1 hr; when ≥140 mg/dL, wait 30 min, then restart infusion at 50% of most recent rate.

If BG 75-99 mg/dL:

D/C INSULIN INFUSION. Recheck BG q 15 minutes until BG reaches or remains ≥90 mg/dl.

➡ Then, recheck BG q 1 hr; when ≥140 mg/dL, wait 30 min, then restart infusion at 75% of most recent rate.

Hipoglisemi
IV Bolus 25 gr Dextroz
(5 Dakika içinde)

Kan Şekeri Yükselmesi
5. Dakika : 162 -31
15. Dakika 63.5-38.8

ACADEMIC EMERGENCY MEDICINE • July 1998, Volume 5, Number 7

Effect of 50 Milliliters of 50% Dextrose in Water Administration on the Blood Sugar of Euglycemic Volunteers

JERRY R. BALENTINE, DO, THEODORE J. GAETA, DO, DIANA KESSLER, DO, EMILIA BAGIELLA, PHD, TEDDY LEE, DO

Comparison of intramuscular glucagon and intravenous dextrose in the treatment of hypoglycaemic coma in an accident and emergency department

A. W. PATRICK[1], A. COLLIER[1], D. A. HEPBURN[1], D. J. STEEDMAN[2], B. F. CLARKE[1] & C. ROBERTSON[2]
[1]Diabetic Department and [2]Accident and Emergency Department, Royal Infirmary, Edinburgh

Hipoglisemi

IV Bolus 25 gr Dextroz
(5 Dakika içinde)
Kan Şekeri Yükselmesi
5. Dakika : 162 -31
15. Dakika :63.5-38.8

IV Bolus 25 gr Dextroz
IM -Glukagon
Yanıtları

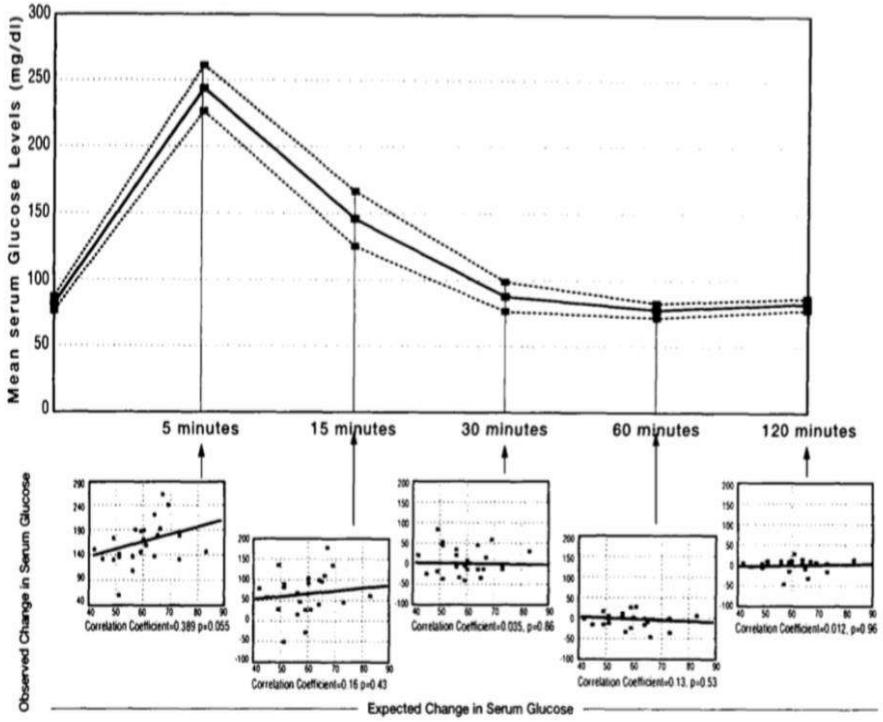


Figure 1. (*Top*) Mean serum glucose levels and their 95% confidence intervals with respect to time. (*Bottom*) Correlation analysis with Pearson's correlation coefficients for *observed* and *expected* changes in serum glucose.

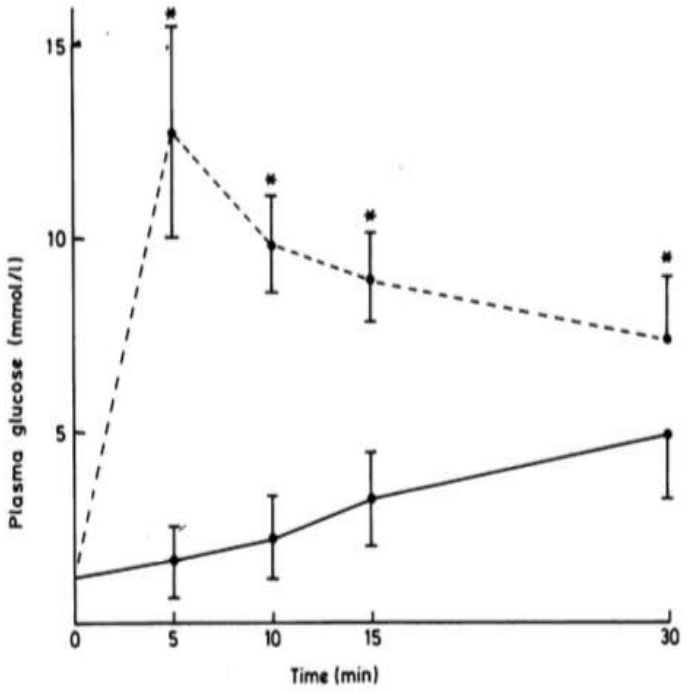


Fig. 1 Glycaemic profiles after glucagon (solid line) and dextrose (dotted line) expressed as means (SD). Significant differences between two values are indicated by *.

İV–SC Geçiş

Yemek Yemeye Başlanması -Kan Glukoz Değerinin Stabil Olması

Bazal SC İnsulin ; İV insulin Kesilmeden 1-2 Saat Önce Başlanmalı

İnsulin İhtiyacını Hesapla (24 Saatlik)
(Stabil ise Son 6-8 Saatlik İnsulin)

Günlük Total İV Kullanımın %60-80' i ile Başla

İnsulin Oranları ; %50-%50
(Bazal- Kısa veya Hızlı Etkili)

Dikkat

Steroid Kullanılması
Bazal insulin İnfüzyon Hızı>2U/h ve Kan Glukoz Düzeyi>130 ,
Bazal İnsulin Dozu>48 U

Umpierrez G, et al. *J Clin Endocrinol Metab*. 2012;97:16-38.

Diabetes Care Volume 40, Supplement 1, January 2017

14. Diabetes Care in the Hospital

American Diabetes Association

Diabetes Care 2017;40(Suppl. 1):S120–S127 | DOI: 10.2337/dc17-S017

Table 14.1—Insulin dosing for enteral/parenteral feedings

Situation	Basal/nutritional	Correctional
Continuous enteral feedings	Continue prior basal or, if none, calculate from TDD or consider 5 units NPH/detemir every 12 h or 10 units glargine daily Nutritional: regular insulin every 6 h or rapid-acting insulin every 4 h, starting with 1 unit per 10–15 g of carbohydrate; adjust daily	SQ regular insulin every 6 h or rapid-acting insulin every 4 h for hyperglycemia
Bolus enteral feedings	Continue prior basal or, if none, calculate from TDD or consider 5 units NPH/detemir every 12 h or 10 units glargine daily Nutritional: give regular insulin or rapid-acting insulin SQ before each feeding, starting with 1 unit per 10–15 g of carbohydrate; adjust daily	SQ regular insulin every 6 h or rapid-acting insulin every 4 h for hyperglycemia
Parenteral feedings	Add regular insulin to TPN IV solution, starting with 1 unit per 10 g of carbohydrate; adjust daily	SQ regular insulin every 6 h or rapid-acting insulin every 4 h for hyperglycemia

IV, intravenous; SQ, subcutaneous; TDD, total daily dose; TPN, total parenteral nutrition.

Hipoglisemi Riski

Yaşlılık

Yetersiz Oral Alım, Beslenmenin Geciktirilmesi

Kronik Renal Yetmezlik

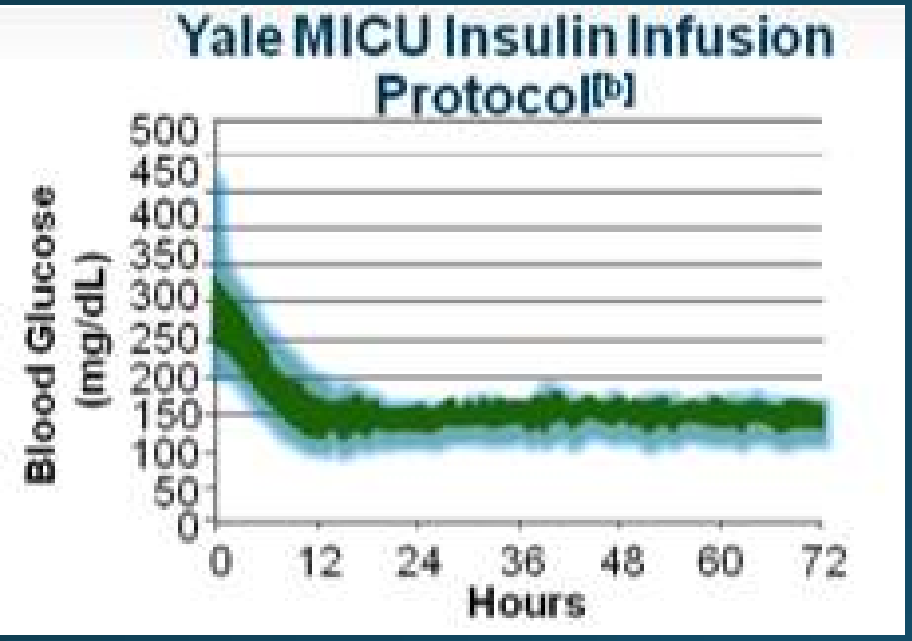
Karaciğer Hastalığı

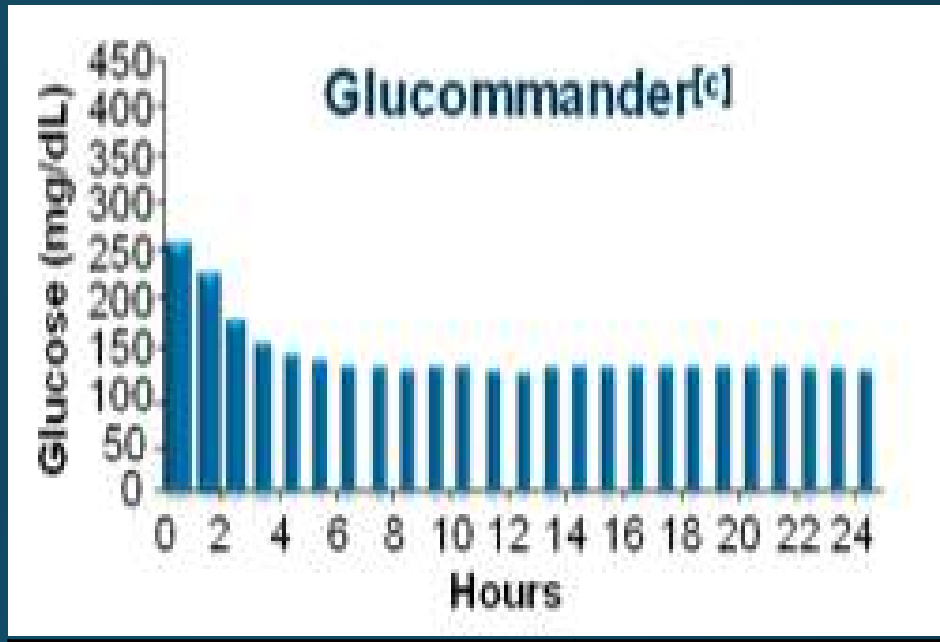
IV Dextroz, Enteral,Total Parenteral Beslenmenin Kesilmesi

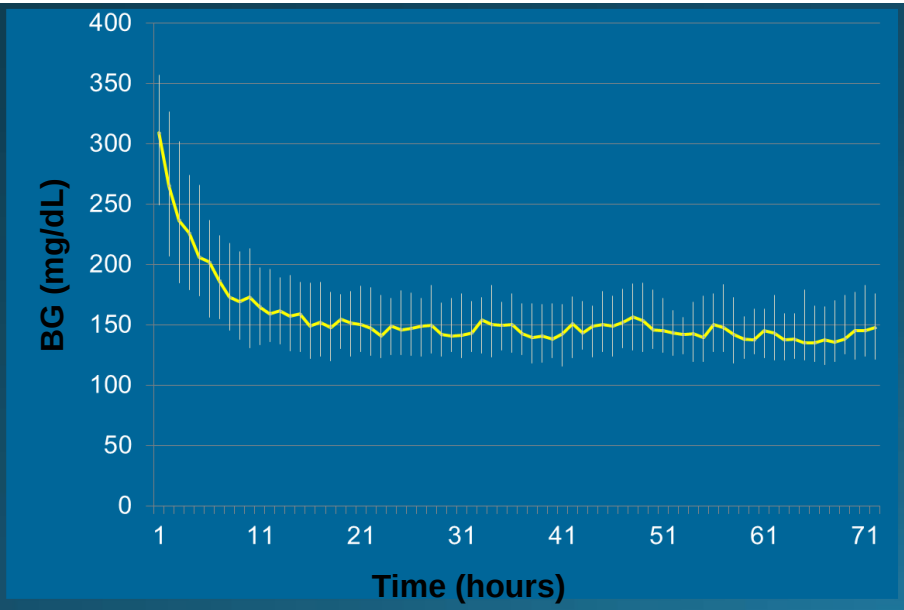
ACE/ADA Task Force on Inpatient Diabetes. *Endocr Pract*. 2006;12:458-468.

ACE Task Force on Inpatient Diabetes and Metabolic Control. *Endocr Pract*. 2004;10:77-82.

İnsulin İnfuzyon Protokol Sonuçları

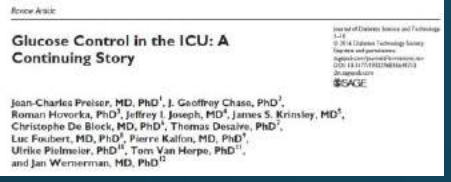






Variable	Median Value (interquartile range)
Preinfusion BG, mg/dL	309 (251-359)
BG once target (<160 mg/dL) reached, mg/dL	150 (127-180)
Nadir BG during infusion, mg/dL	89 (80-101)
Time to target (BG <160 mg/dL), h	7 (5-12)
Hours on infusion	59 (25-127)
Infusion dose, units/h	3.5 (2.5-4.5)

Shetty S, et al. *Endocr Pract*. 2012;18:363-370.


Review Article

Glucose Control in the ICU: A Continuing Story

Jean-Charles Preiser, MD, PhD[1], J. Geoffrey Chase, PhD[2], Roman Hovorka, PhD[3], Jeffrey I. Joseph, MD[4], James S. Krinsley, MD[5], Christophe De Block, MD, PhD[6], Thomas Desaive, PhD[7], Luc Faubert, MD, PhD[8], Pierre Kalfon, MD, PhD[9], Ulrike Pielmeier, PhD[10], Tom Van Herpe, PhD[11], and Jan Wernerman, MD, PhD[12]

İnsulin İnfuzyon Protokol Sonuçları

Mortalite

Hipoglisemi
Hiperglisemi
Glisemik Variyabilite

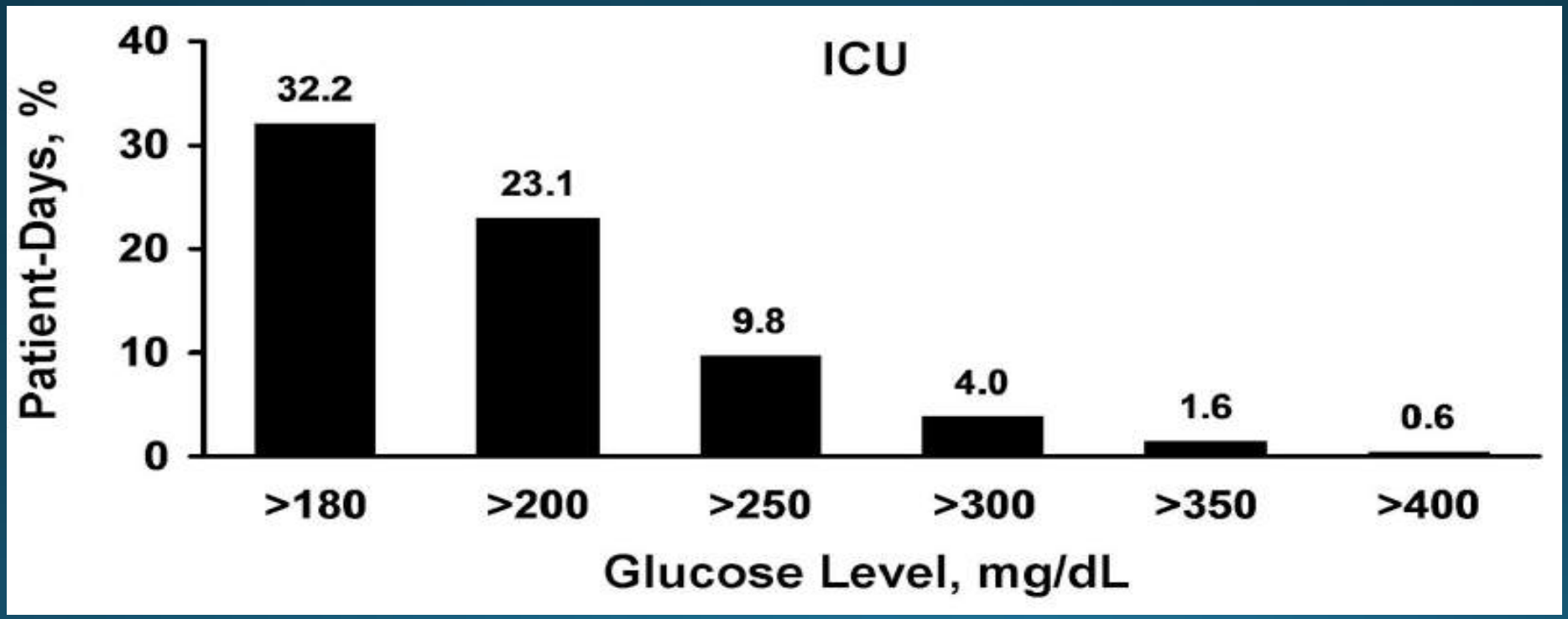
Hiperglisemi

ICU Hiperglisemi < % 68

5 yıllık DM Gelişme Oranı (OGTT ile Takip)

Hiperglisemi Grubu %17 - Kontrol Grubu % 4

Glikoz Değişimleri



12 million BG readings from 653,359 ICU patients; mean BG: 167 mg/dL.

Swanson CM, et al. *Endocr Pract*. 2011;17:853-861.


Metabolic Management during Critical Illness:
Glycemic Control in the ICU

Hipoglisemi Prevalans (ICU)

Study	Hypoglycemia rate (≤ 40 mg/dL)	
	Intensive(%)	Control (%)
van den Berghe et al 2001[10]	5	0.7
van den Berghe et al 2006[9]	18.7	3.1
Glucontrol[8]	8.7	2.7
VISEP[6,41]	17.0	4.1
NICE-SUGAR[7]	6.8	0.5

Seminars in Respiratory and Critical Care Medicine Vol. 36 No. 6/2015

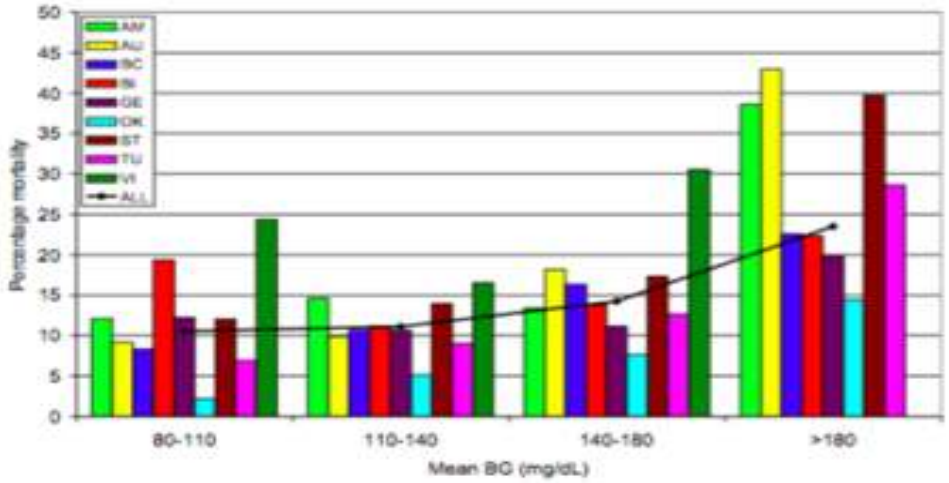
CRITICAL CARE
RESEARCH Open Access

Diabetic status and the relation of the three domains of glycemic control to mortality in critically ill patients: an international multicenter cohort study

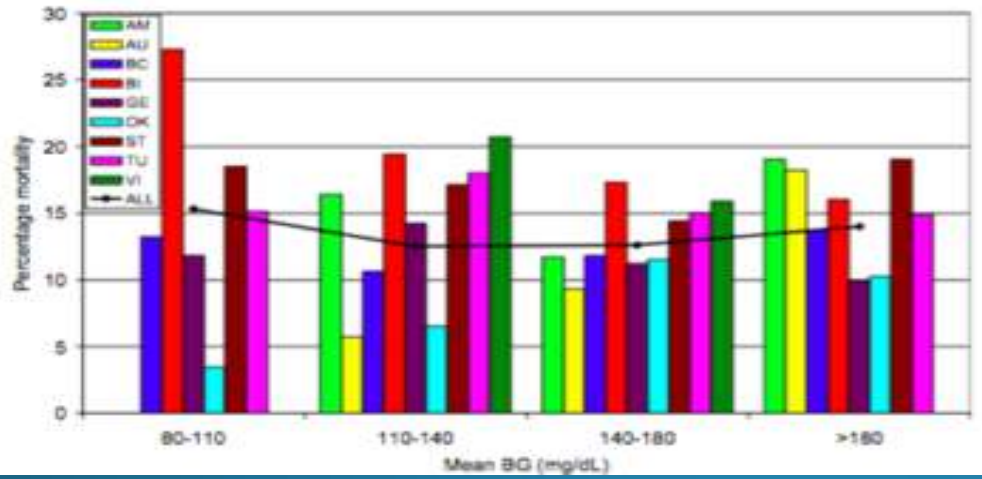
James S Kerr[1*], Mortele Eg[2], Alex Kay[1], Amin N Devendra[3], Philipp Schuetz[4], Paula M Meuret[5], Marcus J Schultz[6], Rosemarijn TM van Iwaarden[6], Marita Wyckoff[7], Ian MJ Mackenzie[8], Dilkit Annane[9], Peter Stow[10], Stanley A Nasraway[11], Sharon Hebenstreit[12], Ulrike Holzinger[13], Jean-Charles Preiser[14], Jean-Louis Vincent[15] and Rinaldo Bellomo[16]

Glukoz Kontrol Düzeyi Mortalite

A. Non-diabetics



B. Diabetics

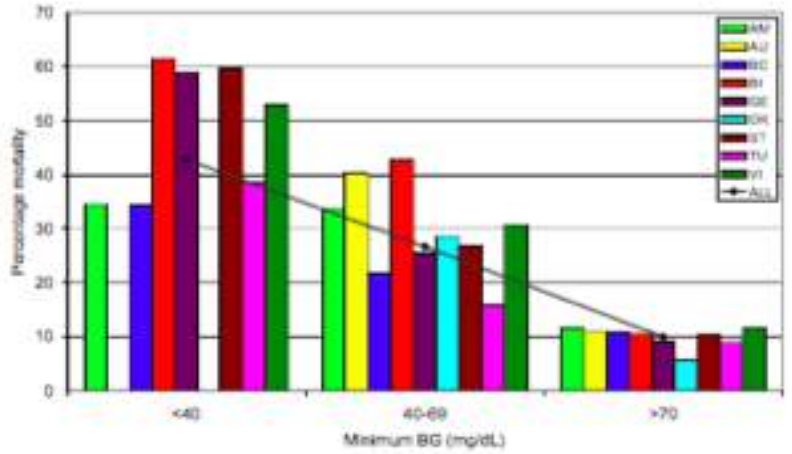


CRITICAL CARE
RESEARCH Open Access

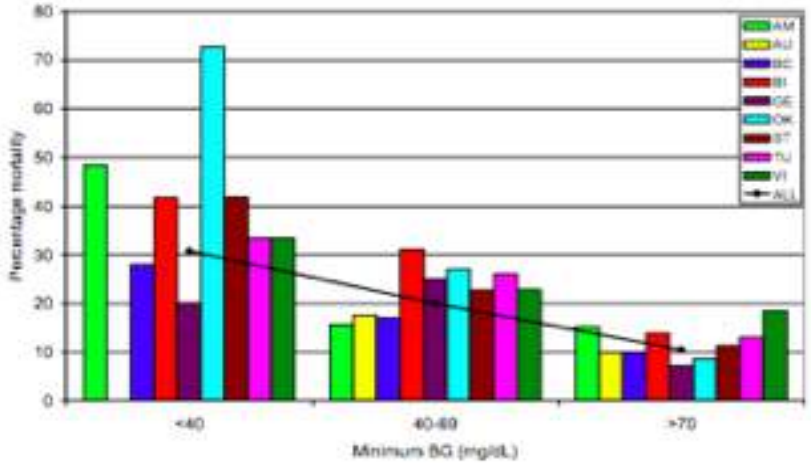
Diabetic status and the relation of the three domains of glycemic control to mortality in critically ill patients: an international multicenter cohort study

James S Kennedy[1*], Mortaza Eji[2], Alex Kou[1], Amin N Devendra[3], Philipp Schuetz[4], Paula M Maurer[5], Marcus J Schultz[6], Rosemarijn TM van Iwaarden[6], Marita Wyckoff[7], Ian MJ Mackenzie[8], Dillali Annane[9], Peter Stow[10], Stanley A Nasraway[11], Sharon Hebenstreit[12], Ulrike Holzinger[13], Jean-Charles Preiser[14], Jean-Louis Vincent[15] and Rinaldo Bellomo[16]

A. Non-diabetics



B. Diabetics



Hipoglisemi Mortalite

CLINICAL CONCEPTS AND COMMENTARY

Bruno Riou, M.D., Ph.D., Editor

Glycemic Control in the Intensive Care Unit and during the Postoperative Period

Diane Lena, M.D.,* Pierre Kalfon, M.D.,† Jean-Charles Preiser, M.D., Ph.D.,‡ Carole Ichai, M.D., Ph.D.§

TABLE 1. Major Differences between the Seven Major Interventional Studies Evaluating Glycemic Control in ICUs

		Van den Berghe *et al.*[2]	Van den Berghe *et al.*[3]	NICE-SUGAR[8]	Preiser *et al.*[7]	Brunkhorst *et al.*[6]	De La Rosa *et al.*[5]	Arabi *et al.*[4]
Number of eligible patients		1,562	2,110	7,294	1,108	600	812	780
Number of patients included		1,548	1,200	6,022	1,101	488	504	523
Percentage of medical patients		0	100	62.9	40.4	46.9	48.8	83.2
Percentage of surgical / postoperative admissions		96.0	0	37.1	56.1	NA	17.2	16.8
Mean admission APACHE II score		9.0	23.0	21.1	15.0	20.2	15.6	22.8
Percentage of calories given intravenously		87.0	87.0	29.5	27.0	66.0	7.0	7.9
Target control (mM)		10.1-11.1	10.1-11.1	7.8-10.0	7.8-10.0	10.1-11.1	10.1-11.1	10.1-11.1
Target IIT (mM)		4.4-6.1	4.4-6.1	4.4-6.1	4.4-6.1	4.4-6.1	4.4-6.1	4.4-6.1
BG values reached [mM - mean (SD) or median (IQR 25-75)]	Control	8.5+/-1.8	8.5+/-1.7	8.1+/-1.4	7.7+/-1.9	8.4+/-1.8	8.2 (6.8-10)	9.5+/-1.9
	IIT	5.7+/-1.1	6.1+/-1.6	6.6+/-1.4	6.1+/-2.0	6.2+/-1.0	6.5 (5.6-7.8)	6.4+/-1.0
Mortality rate (%)		8.0	26.8	24.9	15.3	35.4	31.2	17.1
Hypoglycemia rate (%)	Control	0.8	3.1	0.5	2.7	4.1	1.7	3.1
	IIT	5.0	18.7	6.8	8.7	17.0	8.5	28.6
Mean amount of insulin infused (U/day)	Control	33	10	17	10	5	12	31
	IIT	71	59	50	43	32	52	71
Percentage of patients treated with insulin	Control	39	70	69	66	74	47	75
	IIT	99	98	97	96	98	97	99
Percentage of patients with preexisting diabetes		13	17	20	18	30	12	40

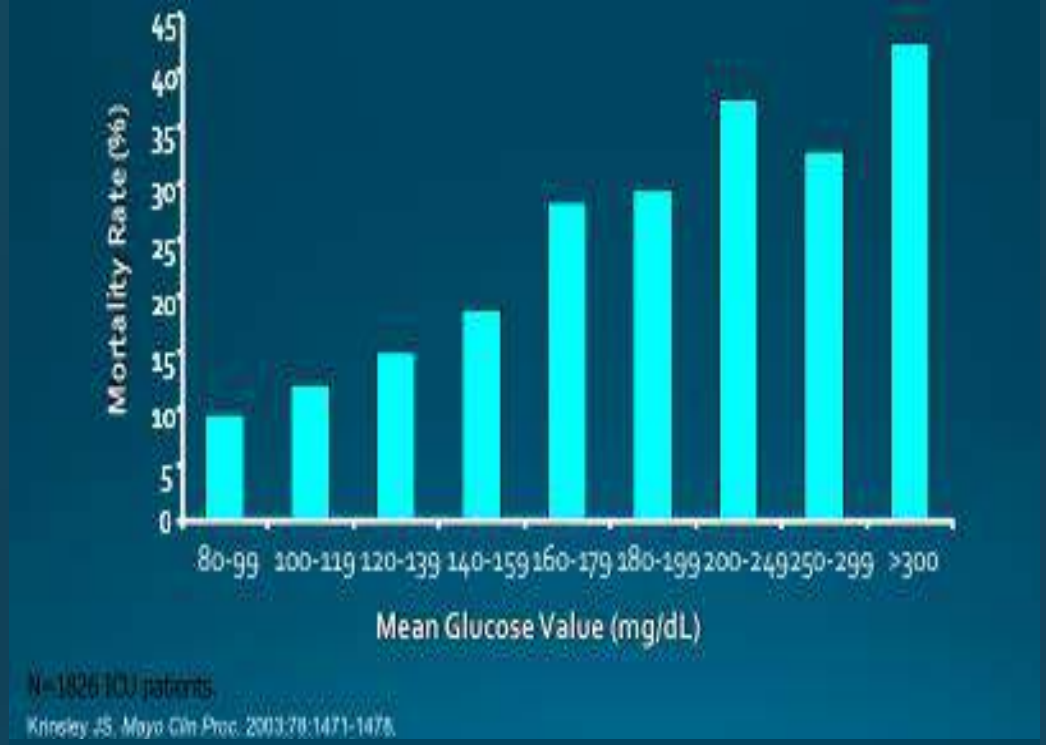
APACHE II = Acute Physiology and Chronic Health; ICU = intensive care unit; IIT = intensive insulin therapy; IQR = interquartile range; NA = not analyzed; NICE-SUGAR = Normoglycaemia in Intensive Care Evaluation Survival Using Glucose Algorithm Regulation.

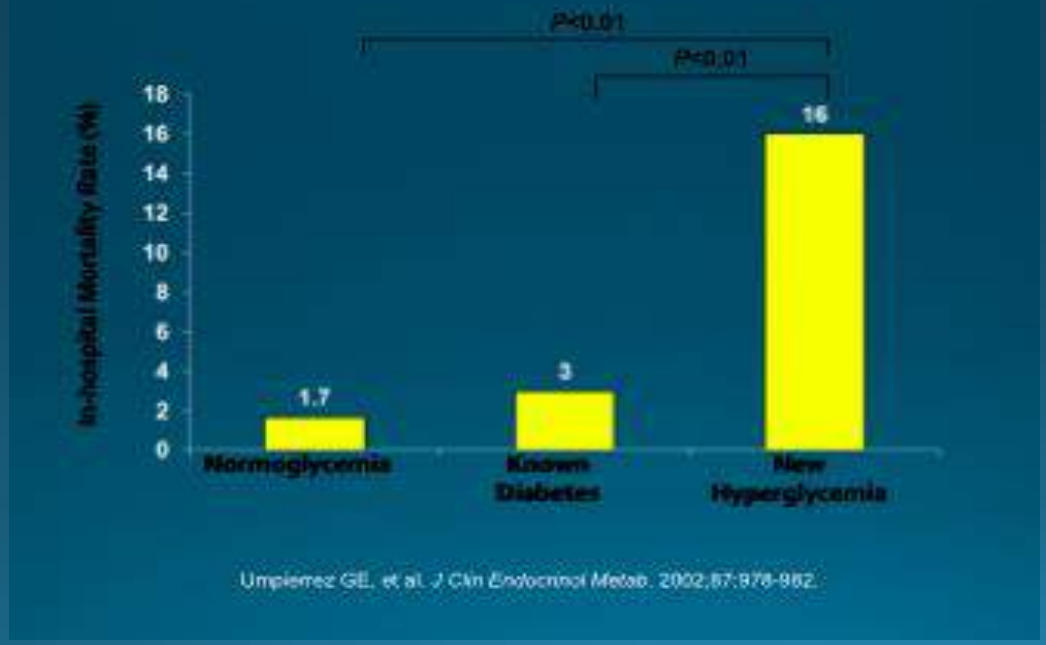
Mortalite

Hipoglisemi

Prevalans

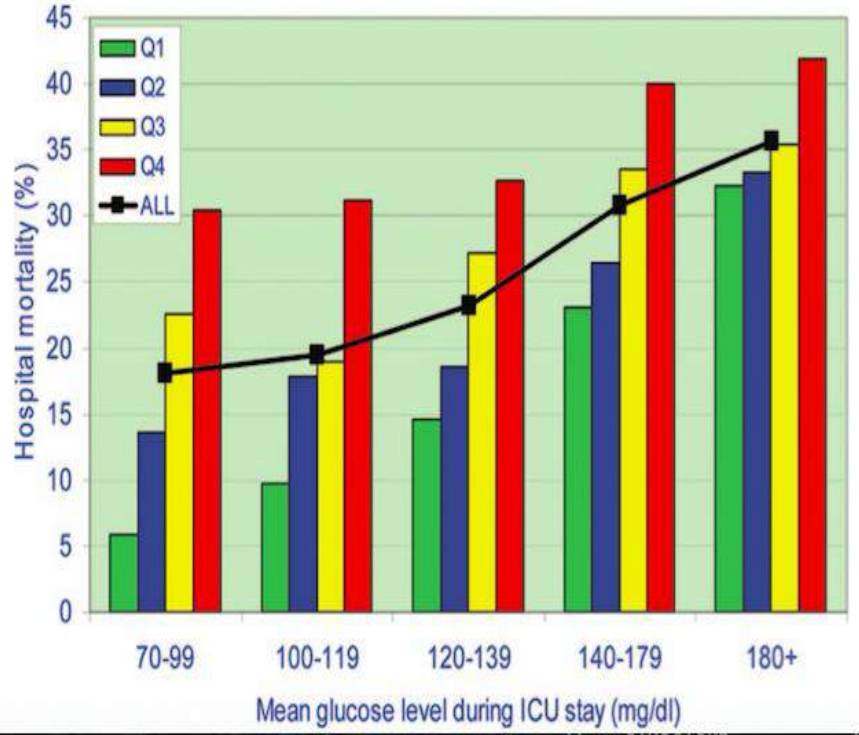
Hiperglisemi Mortalite





Glisemik Variyabilite Mortalite

Mean Glucose (mg/dL)	Quartile 1	Quartile 2	Quartile 3	Quartile 4
70–99 (n = 410)	1.5–9.9	9.9–15.4	15.5–23.5	23.5–93.3
100–119 (n = 1031)	1.5–13.2	13.2–20.1	20.1–28.3	28.3–90.5
120–139 (n = 794)	1.0–20.4	20.4–29.1	29.1–41.1	41.1–114.0
140–179 (n = 621)	2.5–30.3	30.5–46.9	47.2–66.4	67.0–179.7
180+ mg/dL (n = 396)	7.8–53.3	53.4–79.9	80.1–125.1	127.8–643.8
All (n = 3252)	1.0–17.0	17.0–27.7	27.8–47.9	48.0–643.8



NÜTRİSYON DESTEĞİ

AMAÇ

Vücut kitlesini korumak

Metabolik komplikasyonlardan uzak kalmak

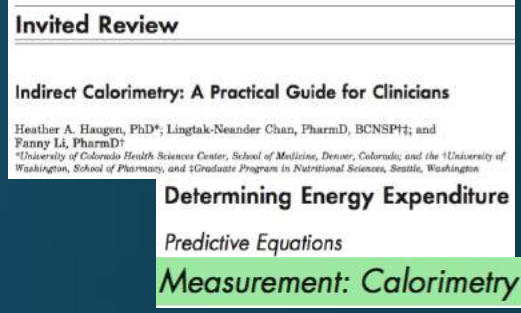
Metabolik cevabı kuvvetlendirmek

Kaybedilen vücut kitlesini geri koymak

Oksidatif stresi engellemek

İmmun cevabı modüle etmek
- Enteral beslenme
- Uygun makro ve mikronutrients
- Glutamine, arginine, omega-3-FA, antioxidants

İnflamatuar cevabı modüle etmek
- Uygun lipid seçenekleri


Invited Review

Indirect Calorimetry: A Practical Guide for Clinicians

Heather A. Haugen, PhD*; Lingtak-Neander Chan, PharmD, BCNSP†‡; and Fanny Li, PharmD†

*University of Colorado Health Sciences Center, School of Medicine, Denver, Colorado; and the †University of Washington, School of Pharmacy, and ‡Graduate Program in Nutritional Sciences, Seattle, Washington

Determining Energy Expenditure

Predictive Equations

Measurement: Calorimetry

Enerji Tüketim Ölçümleri

(İndirek Kalorimetri)

Diğer Formüller

25-30kcal/kg

Doz-Kilo Hesabı

Doz Kilosu: İdeal Kilo+(Şuanki kilo – İdeal Kilo) X 0.25

İdeal Kilonun %110 'u

Kalori Hesabı

Düşük Kalorli (400kcal/gün)

Başlama: 8-10 kcal/kg/gün

Hedef : 25-30 kcal/kg/gün

Protein

0.8-1.5 g/kg/gün

Ciddi Yanıklarda : 2g/kg/gün

Barsakların Önemi

İmmünolojik savunma

Barsaklara ilişkin lenf dokusu,
Sekretuvar IgA

Nonimmünolojik savunma

Tükrük sekresyonu,
Mide asiditesi,
Safra tuzları,
Peristaltizm,
İntestinal mikroflora

Enteral Nutrisyon

Gastrik

Nazogastrik-Oragastrik Tüp :

Tüp pozisyonu radyografik değerlendir
Gastrik Dekompresyon,
Nazal Özafagial Erozyon,Sinüzit

Perkütan Endoskopik Gastrostomi :

Postpilorik

Duodenum birinci ikinci parçası (Mide Sonrası 5cm)
Tüp pozisyonu radyografik değerlendir
Metoklorpromid -Uygulamadan 10 dakika önce
Bazen Endoskopi ihtiyacı olabilir (Duodenal obstrüksiyon Gastroözafageal reflü)

Kontrendikasyon

Enteral

Hemodinamik instabilite
İleus
Üst GİS Kanama
Kusma – İshal
GİS İskemi
Fistül ,Yeni Anastomoz vs

Parenteral

Hiperosmalarite
Ciddi Hiperglisemi, Elektrolit Bozukluğu
Overvolemi
Sepsis vs

FORMULASYON TİPLERİ

Standard

Konsantre

Predigested
(Elementel-Semi Elementel)

Standard

(1kcal/ml)

-Ozmolarite (İzotonik)

-Kalori Miktarı-Yoğunluğu (1Kcal/ml)

-Protein miktarı /Oranı (40 gr/1000kcal)

-Önerilen non protein Kalori/ nitrojen oranı yaklaşık :130

-1000 ml üzeri alındığında günlük vitamin ve minerallerini hepsini karşılamalı

-Basit ve Komplex Karbonhidratlar içermeli

-Uzun zincirli yağasidi (Biraz orta zincirli ve Omega-3 yağasidi içermeli)

Konsantre
(1.2,1.5,2.0 kcal/ml)

-Overvolemili, Solunum Yetmezlikli hastalarda tercih edilebilir

-İshal (750 mOsm/Lüzerinde) Dumping Sendromu (Hızlı Verilme Durumu)

Predigested
(Elementel-Semi Elementel)
(1,1.5 kcal/ml)

-Protein içerikleri kısa zincirli peptidlere hidrolize olmuştur

-Karbonhidrat içeriği daha az komplex formdadır

-Şilotorax, Pankreatik Enzimlere cevapsız Malabsorbsiyon Sendromlarında tercih edilebilir

Renal Hastalıklar için Formül
Glisemik Kontrollü Formül

Kompozisyon

Karbonhidrat/Yağ Oranı

Standart Enteral Formül Kalori İçeriği

(Kalorinin % 49-53'ü Karbonhidrat, %29-30 'u Yağ)

KH /Yağ Oranı Etki

(Mortalite Oranlarını , ICU yatış Süresini Etkilemiyor)

Protein Miktarı

*Yüksek Proteinli Enteral Beslenme (-1.2,2.0 g / İdeal Kilo-)

*Mortalitede %50 Azalma (Enerji İhtiyacı Karşılanmış Hastalarda)

Düşük Proteinli Enteral Beslenme (-15-35 g/1000 ml)

Renal Formuller

Sıvı elektrolit dengesine dikkat edilmeli

(Hiperpotasemi ,Hiperfosfatemi,Protein alımını 2.5 g/kg a kadar tolere edebildiği bildiriliyor)

Kompozisyon

Peptidler

Omega-3 Yağ Asidleri,Antioksidanlar (Mortalite Oranlarını Etkilemiyor)

Glutamin, Arginin

Prebiyotik,Probiyotikler

Fiber

*Vitaminler,Eser Elementler (Bazı Metaanalizlerde Mortalite Oranlarını Düşürüyor (%27 %20)

İmmun Modulatörler

Uygulama

(Hastaya Göre Bireyselleştir)

Başlama

İlk 48 Saat
Hedefe Ulaşma 5-7 gün

Miktar ve Hız

Başlangıç
10-30 ml /saat ****Hedeflenen miktarın %25-30 u
8-10 kcal/kg

Hedef
25-30 kcal/kg

Sürekli /Bolus
(Mortalite Oranlarını , ICU yatış Süresini Etkilemiyor)

Takip

Gastrik Rezidüel Volüm (<500 ml*)
Sıvı -Elektrolit Bozukluğu
Barsak Disfonksiyonu
Refeeding Sendromu

Komplikasyon

Aspirasyon
(30-45 derece sırt elevasyonu) (Motilite ajanlar: Metoklorpropamid,Eritromisin)

Diyare
(Enteral Nütrisyon: %15-18*** Almayan : %6)

Metabolik
(Hiperglisemi,Refeeding Sendromu,Eser Element Eksikliği)

Sıvı Açığı
Formüller
%70-80 sıvı içerir ---25kcal/kg —-- 1kcal/ml yaklaşık 20 ml/kg sıvıdesteği verir

Mekanik **(Fiber bezoar)**

Parenteral Nutrisyon

Dextroz

Konsantre
Kalori :3.4kcal/gr)

Amino Asidler –Elektrolitler

Stok solusyon %5.5-15
Kalori: 4kcal/g-)

Lipidler

%20 lik Emülsiyon :
Kalori :10kcal/g-2kcal/ml)
%10 luk Emülsiyon :
Kalori : 11kcal/g-1.1kcal/ml)

Vitaminler - Eser Elementler

Parenteral Nutrisyon

Takip

Gün: Elektrolitler Glukoz Ca Mg P
Hafta: ALT AST Bilürbinler Trigliserid

Komplikasyon

İnfeksiyon

Metabolik Yan Etkiler
(Hiperglisemi,Refeeding Sendrom (Hipofosfatemi,HipokalemiHipomagnezemi),Hepatik Disfonksiyon)

Venöz Katater Komplikasyonları
(Kanama,Pnomotorax,Tromboz,Aritmi,Hava Embolisi)

CONFERENCE REPORTS AND EXPERT PANEL

Early enteral nutrition in critically ill patients: ESICM clinical practice guidelines

Annika Reintam Blaser[1,2*], Joel Starkopf[1,3], Waleed Alhazzani[4,5], Mette M. Berger[6], Michael P. Casaer[7], Adam M. Deane[8], Sonja Fruhwald[9], Michael Hiesmayr[10], Carole Ichai[11], Stephan M. Jakob[12], Cecilia I. Loudet[13], Manu L. N. G. Malbrain[14], Juan C. Montejo González[15], Catherine Pougom Butz[16], Martijn Poeze[17], Jean-Charles Preiser[18], Pierre Singer[19,20], Arthur R.H. van Zanten[21], Jan De Waele[22], Julia Wendon[23], Jan Wernerman[24], Tony Whitehouse[25], Alexander Wilmer[26], Heleen M. Oudemans-van Straaten[27] and ESICM Working Group on Gastrointestinal Function

Erken Enteral-Erken Parenteral

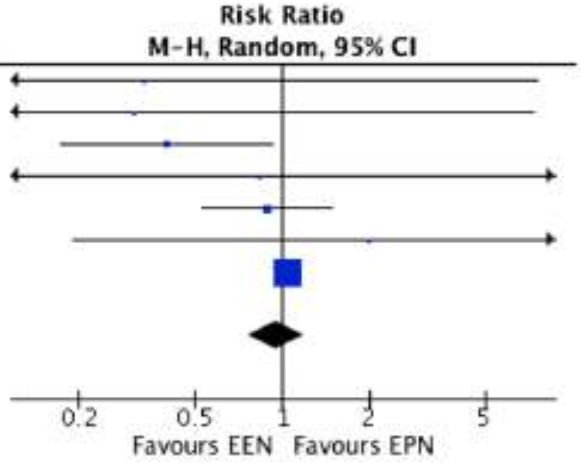
Erken Enteral- İnfeksiyon Riski Düşük

a Mortality

Study or Subgroup	EEN Events	EEN Total	EPN Events	EPN Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Kompan 1999	0	14	1	14	0.5%	0.33 [0.01, 7.55]	1999
Kompan 2004	0	27	1	25	0.5%	0.31 [0.01, 7.26]	2004
Lam 2007	6	41	15	41	6.5%	0.40 [0.17, 0.93]	2007
Justo Meirelles 2011	1	12	1	10	0.7%	0.83 [0.06, 11.70]	2011
Altintas 2011	13	30	20	41	15.5%	0.89 [0.53, 1.49]	2011
Sun 2013	2	30	1	30	0.9%	2.00 [0.19, 20.90]	2013
Harvey 2014	450	1186	431	1185	75.4%	1.04 [0.94, 1.16]	2014
Total (95% CI)		**1340**		**1346**	**100.0%**	**0.95 [0.76, 1.19]**	
Total events	472		470				

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 6.60$, df = 6 (P = 0.36); $I^2 = 9\%$

Test for overall effect: Z = 0.46 (P = 0.64)



b Infections

Study or Subgroup	EEN Events	EEN Total	EPN Events	EPN Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Moore 1989	1	29	6	30	4.1%	0.17 [0.02, 1.35]	1989
Kompan 2004	9	27	16	25	18.5%	0.52 [0.28, 0.96]	2004
Lam 2007	10	41	25	41	18.8%	0.40 [0.22, 0.72]	2007
Altintas 2011	7	30	13	41	15.1%	0.74 [0.33, 1.62]	2011
Justo Meirelles 2011	2	12	4	10	7.0%	0.42 [0.10, 1.82]	2011
Sun 2013	3	30	10	30	9.5%	0.30 [0.09, 0.98]	2013
Harvey 2014	251	1195	261	1188	26.9%	0.96 [0.82, 1.11]	2014
Total (95% CI)		**1364**		**1365**	**100.0%**	**0.55 [0.35, 0.86]**	
Total events	283		335				

Heterogeneity: $Tau^2 = 0.19$; $Chi^2 = 17.26$, df = 6 (P = 0.008); $I^2 = 65\%$

Test for overall effect: Z = 2.60 (P = 0.009)

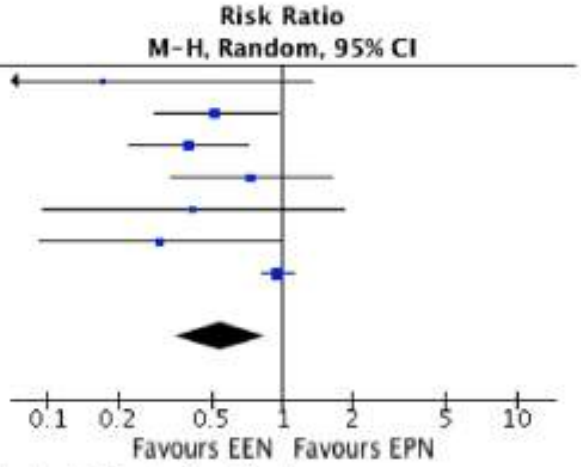


Fig. 1 Forest plots (**a** mortality; **b** infections) Question 1A: early EN (EEN) vs. early PN (EPN) in unselected critically ill patients

CONFERENCE REPORTS AND EXPERT PANEL

Early enteral nutrition in critically ill patients: ESICM clinical practice guidelines

Annika Reintam Blaser[1*], Joel Starkopf[2,3], Waleed Alhazzani[4,5], Mette M. Berger[6], Michael P. Casaer[7], Adam M. Deane[8], Sonja Fruhwald[9], Michael Hiesmayr[10], Carolo Ichai[11], Stephen M. Jakob[12], Cecilia I. Loudet[13], Manu L. N. G. Malbrain[14], Juan C. Montejo Gonzalez[15], Catherine Paugam-Burtz[16], Martin Poeze[17], Jean-Charles Preiser[18], Pierre Singer[19,20], Arthur R.H. van Zanten[21], Jan De Waele[22], Julia Wendon[23], Jan Wernerman[24], Tony Whitehouse[25], Alexander Wilmer[26], Heleen M. Oudemans-van Straaten[27] and ESICM Working Group on Gastrointestinal Function

Erken Enteral-Geç Enteral

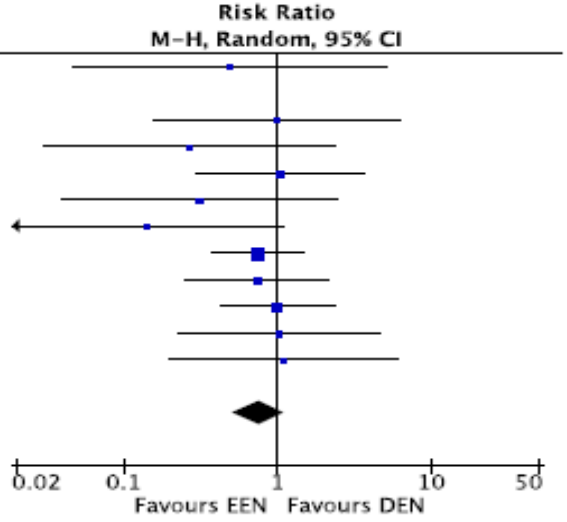
Erken Enteral- İnfeksiyon-Mortalite Riski Düşük

a Mortality

Study or Subgroup	EEN Events	EEN Total	DEN Events	DEN Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Moore 1986	1	32	2	31	2.6%	0.48 [0.05, 5.07]	1986
Chiarelli 1990	0	10	0	10		Not estimable	1990
Eyer 1993	2	19	2	19	4.2%	1.00 [0.16, 6.38]	1993
Chuntrasakul 1996	1	21	3	17	3.1%	0.27 [0.03, 2.37]	1996
Singh 1998	4	21	4	22	9.3%	1.05 [0.30, 3.66]	1998
Minard 2000	1	12	4	15	3.4%	0.31 [0.04, 2.44]	2000
Pupelis 2001	1	30	7	30	3.5%	0.14 [0.02, 1.09]	2001
Malhotra 2004	12	100	16	100	30.1%	0.75 [0.37, 1.50]	2004
Peck 2004	4	14	5	13	12.5%	0.74 [0.25, 2.18]	2004
Nguyen 2008	6	14	6	14	19.9%	1.00 [0.43, 2.35]	2008
Moses 2009	3	29	3	30	6.3%	1.03 [0.23, 4.71]	2009
Chourdakis 2012	3	34	2	25	5.0%	1.10 [0.20, 6.12]	2012
Total (95% CI)		**336**		**326**	**100.0%**	**0.76 [0.52, 1.11]**	
Total events	38		54				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 5.61$, df = 10 (P = 0.85); $I^2 = 0\%$

Test for overall effect: Z = 1.44 (P = 0.15)



b Infections

Study or Subgroup	EEN Events	EEN Total	DEN Events	DEN Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Moore 1986	3	32	9	31	6.4%	0.32 [0.10, 1.08]	1986
Chiarelli 1990	3	10	7	10	8.3%	0.43 [0.15, 1.20]	1990
Eyer 1993	8	19	4	19	8.4%	2.00 [0.72, 5.53]	1993
Hasse 1995	3	14	8	17	7.2%	0.46 [0.15, 1.40]	1995
Watters 1997	1	13	4	15	2.5%	0.29 [0.04, 2.27]	1997
Singh 1998	3	21	8	22	6.6%	0.39 [0.12, 1.28]	1998
Minard 2000	6	12	7	15	12.4%	1.07 [0.49, 2.34]	2000
Pupelis 2001	1	30	8	30	2.6%	0.13 [0.02, 0.94]	2001
Malhotra 2004	21	100	30	100	21.3%	0.70 [0.43, 1.14]	2004
Nguyen 2008	3	14	6	14	6.7%	0.50 [0.15, 1.61]	2008
Chourdakis 2012	13	34	12	25	17.5%	0.80 [0.44, 1.44]	2012
Total (95% CI)		**299**		**298**	**100.0%**	**0.64 [0.46, 0.90]**	
Total events	65		103				

Heterogeneity: $Tau^2 = 0.08$; $Chi^2 = 13.41$, df = 10 (P = 0.20); $I^2 = 25\%$

Test for overall effect: Z = 2.58 (P = 0.010)

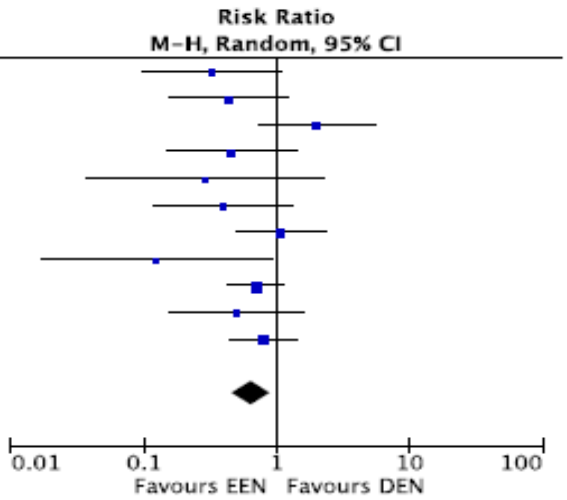


Fig. 2 Forest plots (**a** mortality; **b** infections) Question 1B: early EN (EEN) vs. delayed EN (DEN) in unselected critically ill patients

Critical Care Nutrition
www.criticalcarenutrition.com

NUTRIC Score[1]

The NUTRIC Score is designed to quantify the risk of critically ill patients developing adverse events that may be modified by aggressive nutrition therapy. The score, of 1-10, is based on 6 variables that are explained below in Table 1. The scoring system is shown in Tables 2 and 3.

Table 1: NUTRIC Score variables

Variable	Range	Points
Age	<50	0
	50 - <75	1
	≥75	2
APACHE II	<15	0
	15 - <20	1
	20-28	2
	≥28	3
SOFA	<6	0
	6 - <10	1
	≥10	2
Number of Co-morbidities	0-1	0
	≥2	1
Days from hospital to ICU admission	0 - <1	0
	≥1	1
IL-6	0 - <400	0
	≥ 400	1

Table 2: NUTRIC Score scoring system: if IL-6 available

Sum of points	Category	Explanation
6-10	High Score	➢ Associated with worse clinical outcomes (mortality, ventilation). ➢ These patients are the most likely to benefit from aggressive nutrition therapy.
0-5	Low Score	➢ These patients have a low malnutrition risk.

Table 3. NUTRIC Score scoring system: If no IL-6 available*

Sum of points	Category	Explanation
5-9	High Score	➢ Associated with worse clinical outcomes (mortality, ventilation). ➢ These patients are the most likely to benefit from aggressive nutrition therapy.
0-4	Low Score	➢ These patients have a low malnutrition risk.

*It is acceptable to not include IL-6 data when it is not routinely available; it was shown to contribute very little to the overall prediction of the NUTRIC score.[2]

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[1] Heyland DK, Dhaliwal R, Jiang X, Day AG. Identifying critically ill patients who benefit the most from nutrition therapy: the development and initial validation of a novel risk assessment tool. Critical Care. 2011;15(6):R268.
[2] Rahman A, Hasan RM, Agarwala R, Martin C, Day AG, Heyland DK. Identifying critically-ill patients who will benefit most from nutritional therapy: Further validation of the "modified NUTRIC" nutritional risk assessment tool. Clin Nutr. 2015. [Epub ahead of print]

NRS-2002 (Nutritional Risk Screening)

Tarama			
Nütrisyon Durumundaki Bozulma		Hastalığın Şiddeti (gereksinimlerde artış)	
Yok **Skor 0**	Normal nütrisyon durumu	Yok **Skor 0**	Normal besinsel gereksinimler
Hafif **Skor 1**	3 ayda > %5 kilo kaybı ya da geçen haftaki besin alımı normal gereksinimlerin %50-75'inin altında	Hafif **Skor 1**	Kalça Kemiğinde Kırık*, Özellikle akut komplikasyonları olan kronik hastalar: siroz*, KOAH*, *kronik hemodiyaliz, diabet, onkoloji*
Orta **Skor 2**	2 ayda > %5 kilo kaybı ya da BKİ 18.5 – 20.5 + genel durum bozukluğu ya da geçen haftaki besin alımı normal gereksinimlerin %25-50'si	Orta **Skor 2**	Majör abdominal cerrahi*, İnme*, *Şiddetli pnömoni, hematolojik malignite*
Şiddetli **Skor 3**	1 ayda > %5 kilo kaybı (3 ayda > %15) ya da BKİ < 18.5 + genel durum bozukluğu ya da geçen haftaki besin alımı normal gereksinimlerin %0-25'i	Şiddetli **Skor 3**	Kafa travması*, Kemik iliği transplantasyonu*, *Yoğun Bakım hastaları (APACHE > 10)*
Skor:	+	**Skor**	= Toplam skor
Yaş	≥70 yaş ise toplam skora 1 ekle		**= yaşa uyarlanmış toplam skor**
Skor ≥3: Hasta nütrisyon riski altındadır ve bir nütrisyon planı başlatılır			
Skor <3: haftada bir taranmalı. Eğer majör operasyon planı varsa yine bir nütrisyon planı geliştirilmelidir			

NRS-2002 varolan randomize klinik çalışmalara dayanmaktadır. *işaretli tanısı olan hastaların kategorizasyonunu doğrudan destekleyen bir çalışma var. İtalik gösterilen tanılar yanda verilen prototiplere dayanmaktadır. Nütrisyon riski, o andaki nütrisyon durumu ve bunun stres metabolizması nedeniyle artan gereksinimlere bağlı olarak bozulması riski şeklinde tanımlanır.

Nütrisyon destek planı şu hastalarda endikedir:

(1) şiddetli malnütrisyonda (skor = 3), ya da (2) ağır hasta (skor = 3) ya da (3) orta derecede malnütrisyon + hafif hasta (skor 2+1) ya da (4) hafif malnütrisyon + orta derecede hasta (skor 1+2)

Hastalığın derecesine ilişkin prototipler:
Skor=1: kronik hastalığı olup komplikasyonlar nedeniyle hastaneye yatan bir hasta. Halsiz – düşkün durumdadır ancak düzenli olarak yataktan kalkabilir. Protein gereksinimleri artmıştır ancak oral diyet ya da suplemanlarla karşılanabilir.
Skor=2: majör abdominal cerrahi gibi bir hastalık nedeniyle yatağa bağlı bir hasta. Protein gereksinimleri yüksek, klinik beslenme yöntemleri gerekli ve bu sayede açıkları kapatılabiliyor
Skor=3: ventilasyon desteği altındaki yoğun bakım hastası. Protein gereksinimleri yüksek ve klinik beslenme yöntemleriyle karşılanamıyor. Protein yıkımı ve azot kaybı giderilebiliyor.

Example : Conversion from intravenous insulin therapy

1. Intravenous insulin drip rate averaged 1.8 U/h with final glucose level 98 mg/dL
2. Calculate average insulin infusion rate for last 6 h = 2.1 U/h and multiply x 24 to get total daily insulin requirement
   (2.1 x 24 = 50 U/24 h)
3. Multiply this 24-h dose (50 U) x 80% to obtain glargine
   dose = 40 U, which is given and the infusion is stopped
4. Multiply the glargine dose by 10% to give as a rapid-acting insulin (eg, aspart, lispro, or glulisine) at the time the glargine is given and the infusion is stopped
5. Give 10% of the glargine dose as prandial doses before
   each meal

- Initiate prandial doses of rapid-acting analogue with the first dietary trays, even if patient is receiving IV insulin infusion
- Find a 6- to 8-h interval during IV insulin infusion when the following conditions are met:
  - Out of the ICU
  - No oral intake (eg, nighttime)
  - No IV dextrose administration
- Use the average insulin infusion rate during this interval to project an average 24-h based insulin requirement (6-h total dose x 4; 8-h total dose x 3, and so forth)
- Calculate the initial insulin glargine dose at 80% of the 24-h basal insulin requirement during the previous time interval
- Stop IV infusion of insulin 2 h after first insulin glargine dose
- Monitor blood glucose preprandially, at bedtime, and at 3:00 a.m.
- Order a correction dose algorithm for use of a rapid-acting analogue to treat hyperglycemia to start after IV insulin infusion is terminated
- Revise total 24-h dose of insulin daily
- Revise the distribution of basal and prandial insulin daily to approach 50% basal and 50% prandial

Furnary AP, Braithwaite SS. *Am J Cardiol*. 2006;98:557-564.

Example : Estimating insulin doses when no IV insulin therapy has been given

1. Calculate estimated total daily dose of insulin as follows:
   - Type 2 diabetes (known): 0.5 to 0.7 U/kg
   - Type 1 diabetes (known): 0.3 to 0.5 U/kg
   - Unknown 0.3 to 0.5 U/kg
2. Divide total daily dose of insulin into 50% basal as glargine and 50% prandial as aspart, lispro, or glulisine
3. Divide prandial insulin into 3 equal doses to be given with meals

Example: Patient has received an average of 2 U/h IV during previous 6 h. Recommended doses are as follows:

SC TDD is 80% of 24-h insulin requirement:

80% of (2 U/h x 24) = 38 U

Basal dose is 50% of SC TDD:

50% of 38 U = 19 U of long-lasting analogue

Bolus total dose is 50% of SC TDD:

50% of 38 U = 19 U of total prandial rapid-acting analogue or ~6 U with each meal

Correction dose is actual BG minus target BG divided by the CF, and CF is equal to 1700 divided by TDD:

CF = 1700 ÷ 38 = ~40 mg/dL

DeSantis AJ, et al. *Endocr Pract*. 2006;12:491-505.

ACADEMIC EMERGENCY MEDICINE • July 1998, Volume 5, Number 7

Effect of 50 Milliliters of 50% Dextrose in Water Administration on the Blood Sugar of Euglycemic Volunteers

JERRY R. BALENTINE, DO, THEODORE J. GAETA, DO, DIANA KESSLER, DO, EMILIA BAGIELLA, PHD, TEDDY LEE, DO

IV Bolus 25 gr Dextroz (5 Dakika içinde)

Kan Şekeri Yükselmesi
5. Dakika : 162 -31
15. Dakika :63.5-38.8

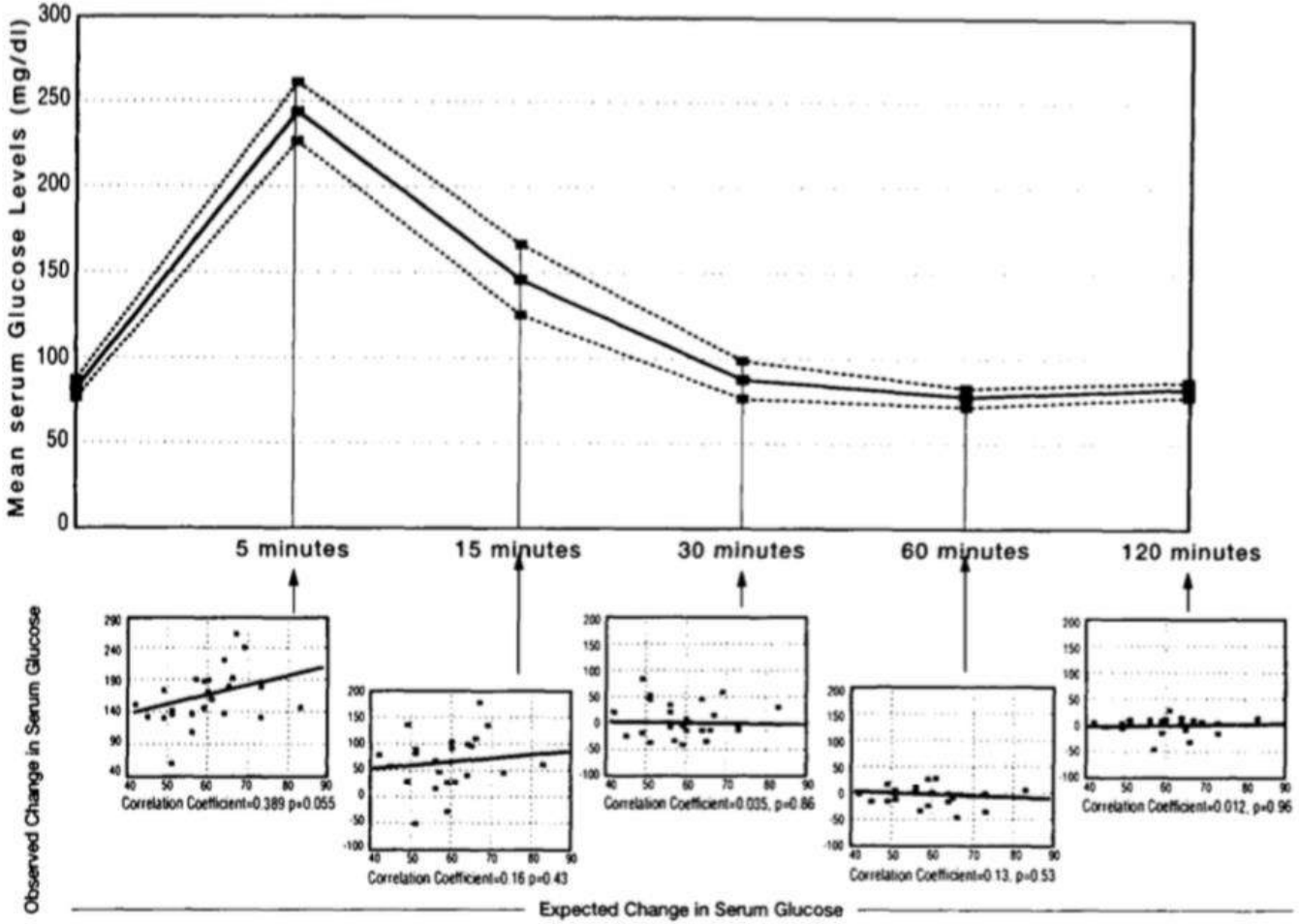


Figure 1. (*Top*) Mean serum glucose levels and their 95% confidence intervals with respect to time. (*Bottom*) Correlation analysis with Pearson's correlation coefficients for *observed* and *expected* changes in serum glucose.

Archives of Emergency Medicine, 1990, 7, 73–77

Comparison of intramuscular glucagon and intravenous dextrose in the treatment of hypoglycaemic coma in an accident and emergency department

A. W. PATRICK[1], A. COLLIER[1], D. A. HEPBURN[1], D. J. STEEDMAN[2], B. F. CLARKE[1] & C. ROBERTSON[2]
[1]*Diabetic Department and* [2]*Accident and Emergency Department, Royal Infirmary, Edinburgh*

IV Bolus 25 gr Dextroz
IM -Glukagon
Yanıtları

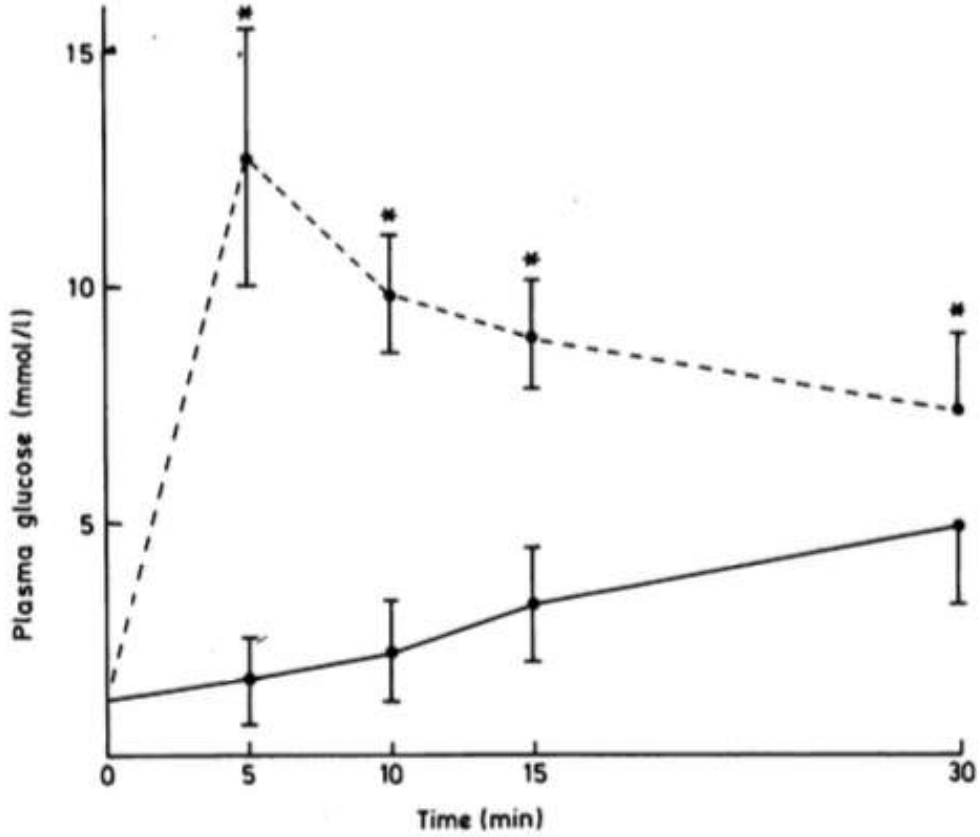


Fig. 1 Glycaemic profiles after glucagon (solid line) and dextrose (dotted line) expressed as means (SD). Significant differences between two values are indicated by *.

World Journal of Critical Care Medicine

Glycemic control in critically ill patients

Chien-Wei Hsu

ICU protocol for glycemic management

MD signature_____

Date_____

Goal

The goal of this protocol is to maintain the glucose level between 140 and 160 mg/dL

Monitoring

The initial blood glucose level is monitored every 1-2 h until a stable infusion rate is reached, then decreased to every 4 h while the blood glucose concentration is stable

Management of insulin infusion

Continuous insulin infusion (100 IU of Actrapid HM in 99 mL of 0.9% NaCl) with the use of a pump is started when the blood glucose is > 180 mg/dL on two successive measurements

Blood glucose levels are controlled by the neuro-fuzzy method. The first row at the top of the chart in the appendix displays the range of blood glucose values measured, while the first column on the left displays the range of possible blood glucose values measured 1-4 h previously. The adjusted infusion rate is at the intersection between the perpendicular lines drawn from the present blood glucose values and the blood glucose values found 1-4 h previously

Initial dose: patients received oral hypoglycemic agents or up to 12 U/d of insulin, starting with 0.5 U/h of insulin if patients previously received insulin > 12 U/d, and 0.5 U/h for every 10 U > 12 U/d

Present blood glucose value (mg/dL)

Preceding blood glucose value (mg/dL) (1-4 h before)	≤ 80	81-100	101-120	121-140	141-160	161-180	181-200	201-220	221-240	241-260	> 260
≤ 80	-0.3	-0.2	0.1	0.5	0.8	1.2	1.3	1.4	1.5	1.5	1.5
81-100	-0.5	-0.4	-0.2	0.2	0.6	1	1.2	1.4	1.4	1.5	1.5
101-120	-0.7	-0.7	-0.4	0.0	0.4	0.8	1.1	1.3	1.4	1.4	1.5
121-140	-0.9	-0.8	-0.6	-0.3	0.2	0.6	1	1.2	1.3	1.4	1.4
141-160	-1	-1	-0.6	-0.5	0.0	0.6	0.9	1.1	1.3	1.4	1.4
161-180	-1.2	-1.1	-1	-0.7	-0.2	0.3	0.7	1	1.2	1.3	1.4
181-200	-1.3	-1.3	-1.1	-0.8	-0.4	0.1	0.6	0.9	1.2	1.3	1.4
201-220	-1.4	-1.4	-1.2	-1.0	-0.8	-0.1	0.4	0.8	1.1	1.3	1.4
221-240	-1.4	-1.4	-1.3	-1.1	-0.5	-0.3	0.2	0.7	1	1.2	1.3
241-260	-1.5	-1.5	-1.4	-1.2	-0.6	-0.5	0.1	0.6	0.9	1.2	1.3
> 260	-1.5	-1.5	-1.4	-1.3	-1	-0.6	0	0.5	0.9	1.1	1.3

Management of hypoglycemia

If the blood glucose concentration is ≤ 60 mg/dL, the protocol directs the nurses to stop the insulin infusion, and notifies physicians to administer 50% dextrose immediately, with blood glucose measurements repeated after 30 min

Switch to subcutaneous insulin-injection

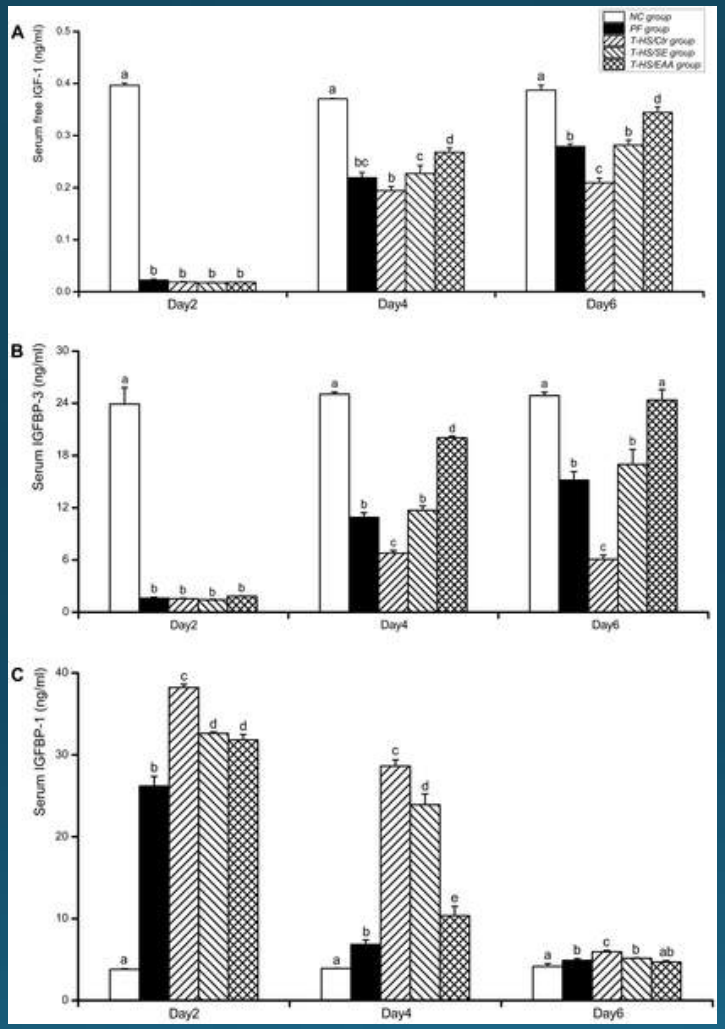
If the insulin dose is < below 3 IU/h, a conversion of the intravenous infusion to a subcutaneous insulin injection is considered. The insulin infusion is often discontinued before the patient is discharged from the ICU

PLOS ONE

Essential Amino Acid Enriched High-Protein Enteral Nutrition Modulates Insulin-Like Growth Factor-1 System Function in a Rat Model of Trauma-Hemorrhagic Shock

Xianfeng Xia, Xinying Wang*, Qiurong Li, Ning Li, Jieshou Li

Figure 5. ELISA analysis of IGF-1-IGFBPs axis expression.



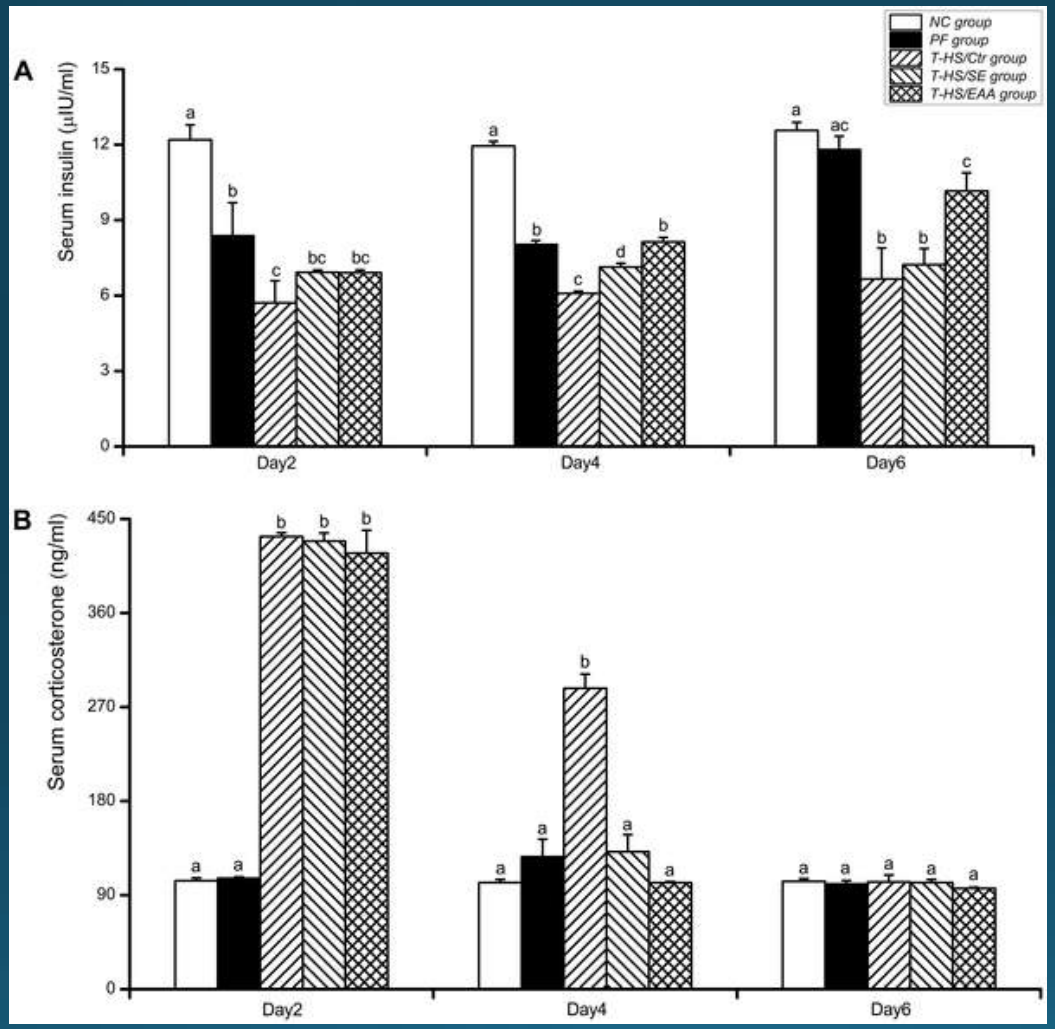
Xia X, Wang X, Li Q, Li N, Li J (2013) Essential Amino Acid Enriched High-Protein Enteral Nutrition Modulates Insulin-Like Growth Factor-1 System Function in a Rat Model of Trauma-Hemorrhagic Shock. PLOS ONE 8(10): e77823. https://doi.org/10.1371/journal.pone.0077823
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0077823

PLOS ONE

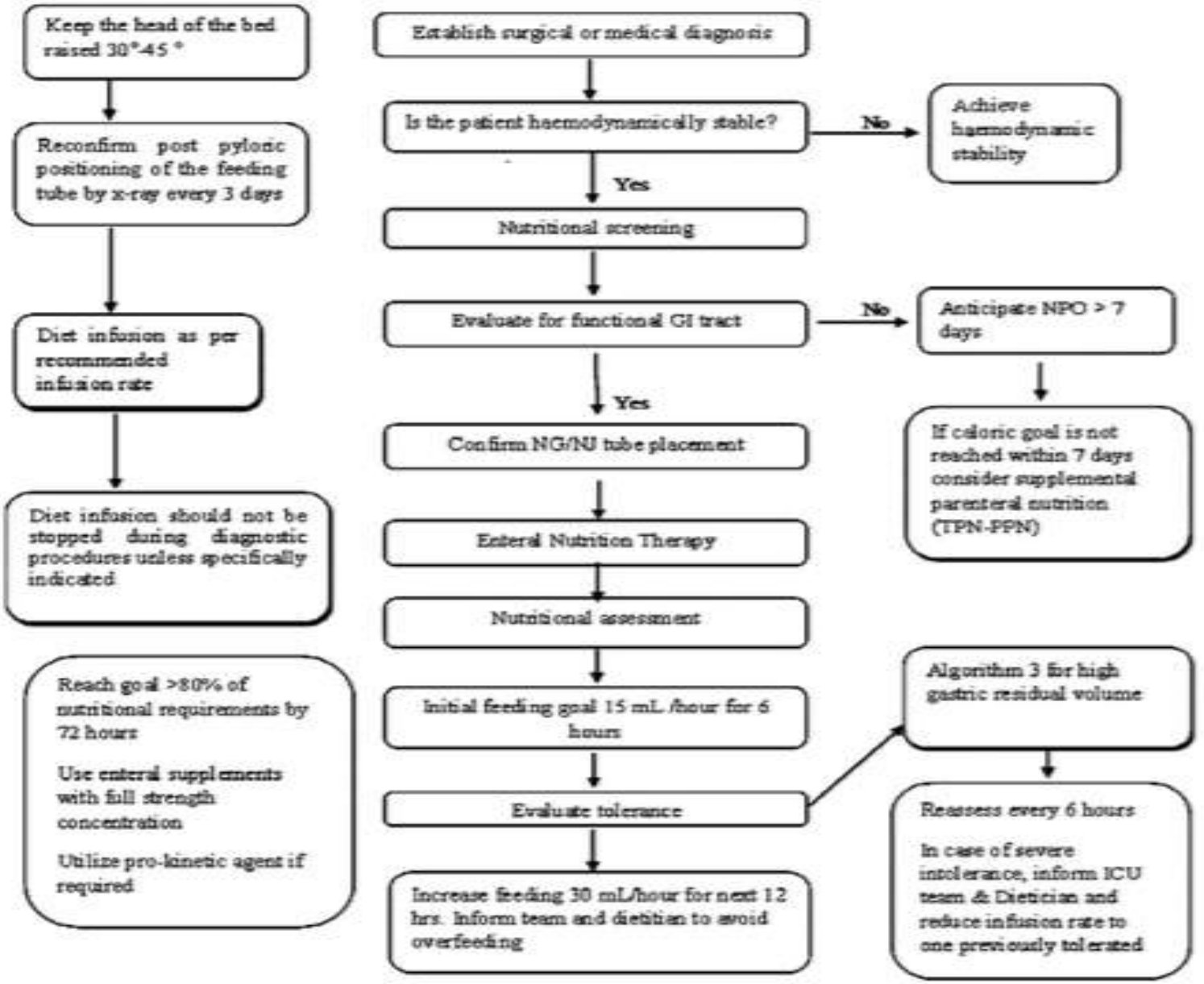
Essential Amino Acid Enriched High-Protein Enteral Nutrition Modulates Insulin-Like Growth Factor-1 System Function in a Rat Model of Trauma-Hemorrhagic Shock

Xianfeng Xia, Xinying Wang*, Qiurong Li, Ning Li, Jieshou Li

Figure 6. ELISA analysis of serum hormones concentrations.



Xia X, Wang X, Li Q, Li N, Li J (2013) Essential Amino Acid Enriched High-Protein Enteral Nutrition Modulates Insulin-Like Growth Factor-1 System Function in a Rat Model of Trauma-Hemorrhagic Shock. PLOS ONE 8(10): e77823. https://doi.org/10.1371/journal.pone.0077823
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0077823



GI: Gastrointestinal. NPO: Nil per oral. NG/NJ: Naso-Gastric/Naso-Jejunal. TPN: Total parenteral nutrition. PPN: Peripheral parenteral nutrition. ICU: Intensive care unit.

Figure-1: Intensive care enteral and parenteral feeding.

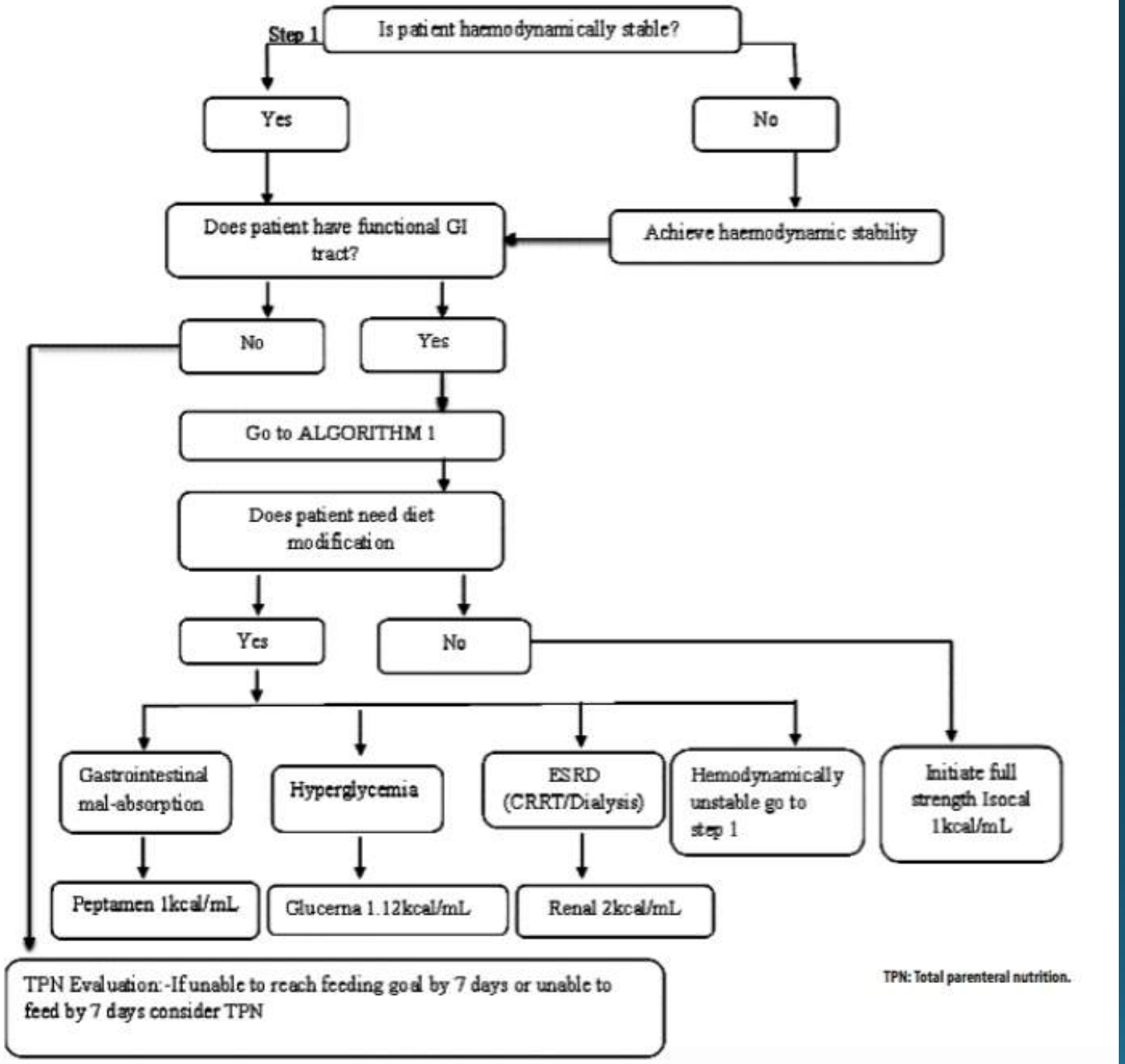


Figure-2: Selection of enteral formulation.

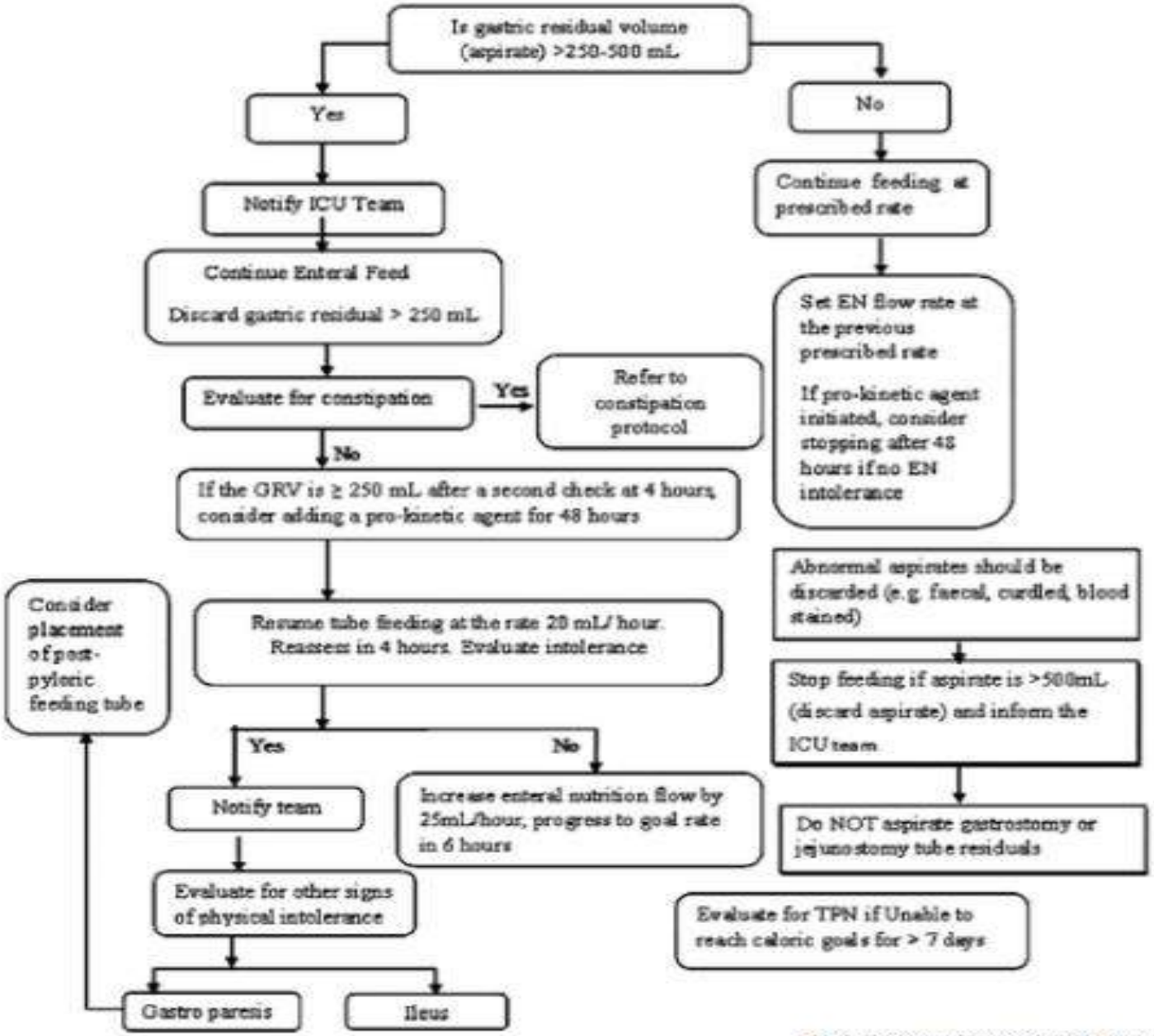
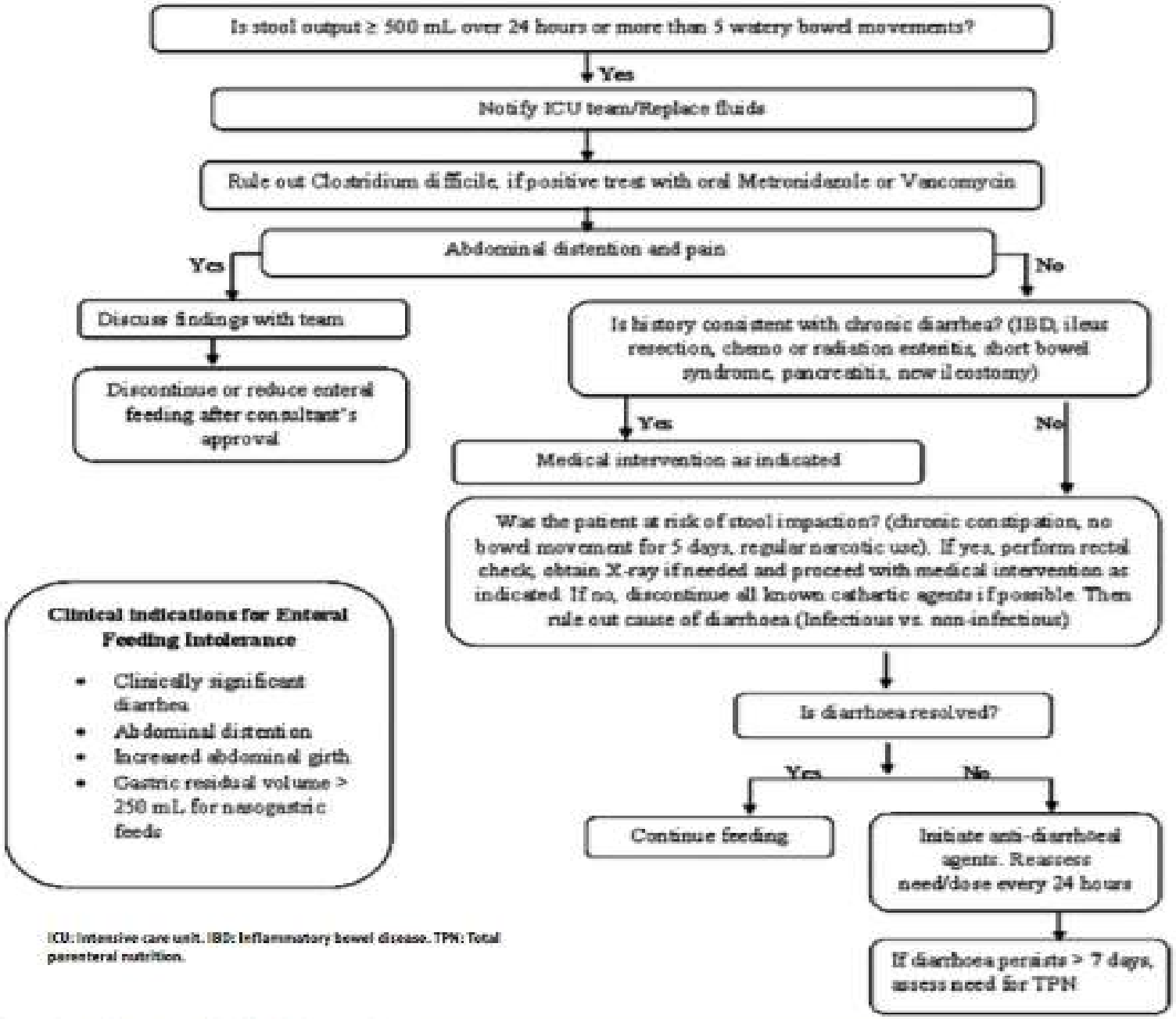


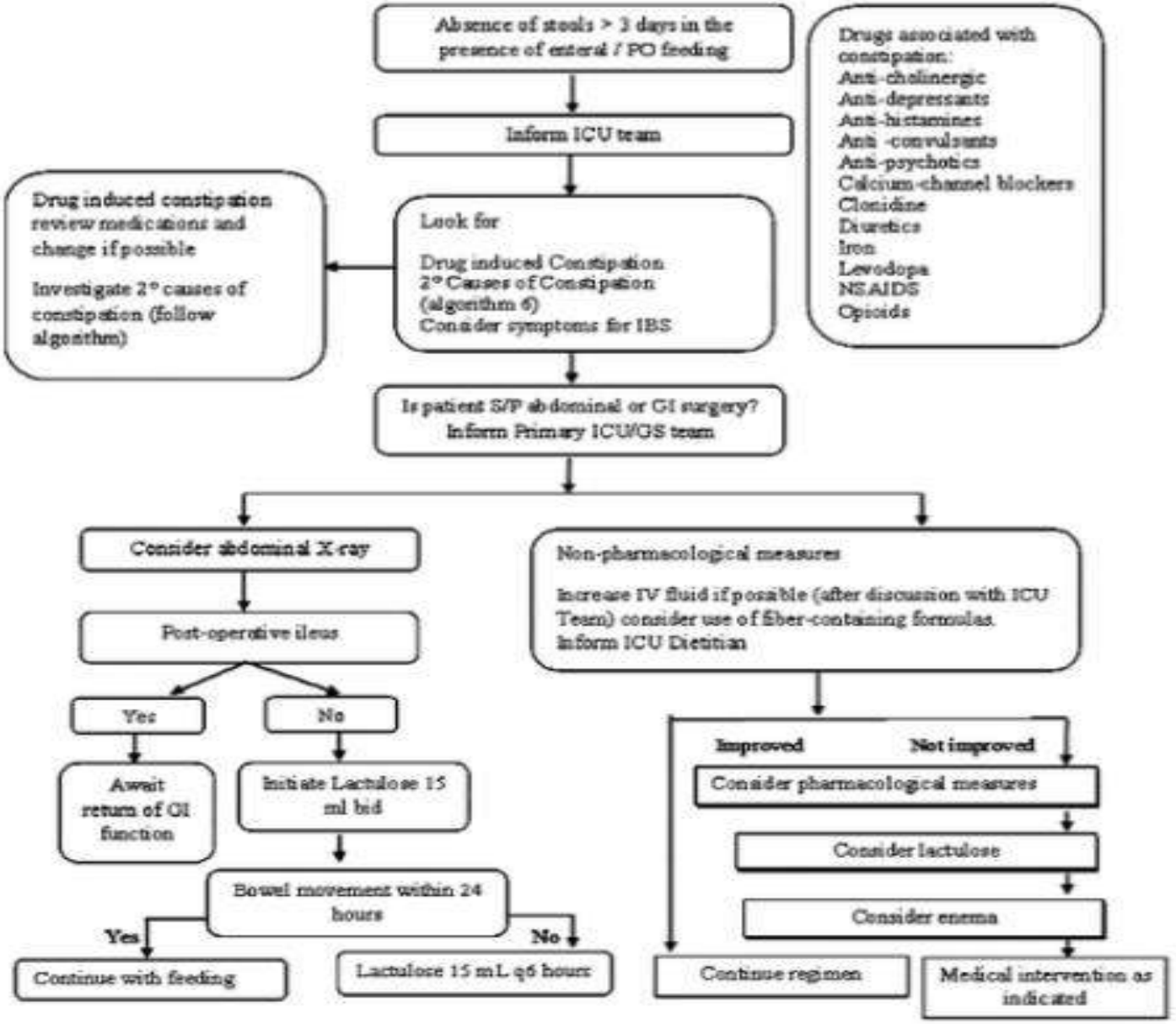
Figure-3: Intensive care enteral feeding: gastric residual volume protocol.

ICU: Intensive care unit. GRV: Gastric residual volumes. EN: Enteral nutrition. TPN: Total parenteral nutrition



ICU: Intensive care unit. IBD: Inflammatory bowel disease. TPN: Total parenteral nutrition.

Figure-4: Intensive care enteral feeding: diarrhoea protocol.



ICU: Intensive care unit. NSAIDS: Non-steroidal anti-inflammatory drugs. IBS: Irritable bowel syndrome. GI: Gastrointestinal. GS: General Surgery. IV: Intravenous.

Figure-5: Intensive care enteral feeding: constipation protocol.

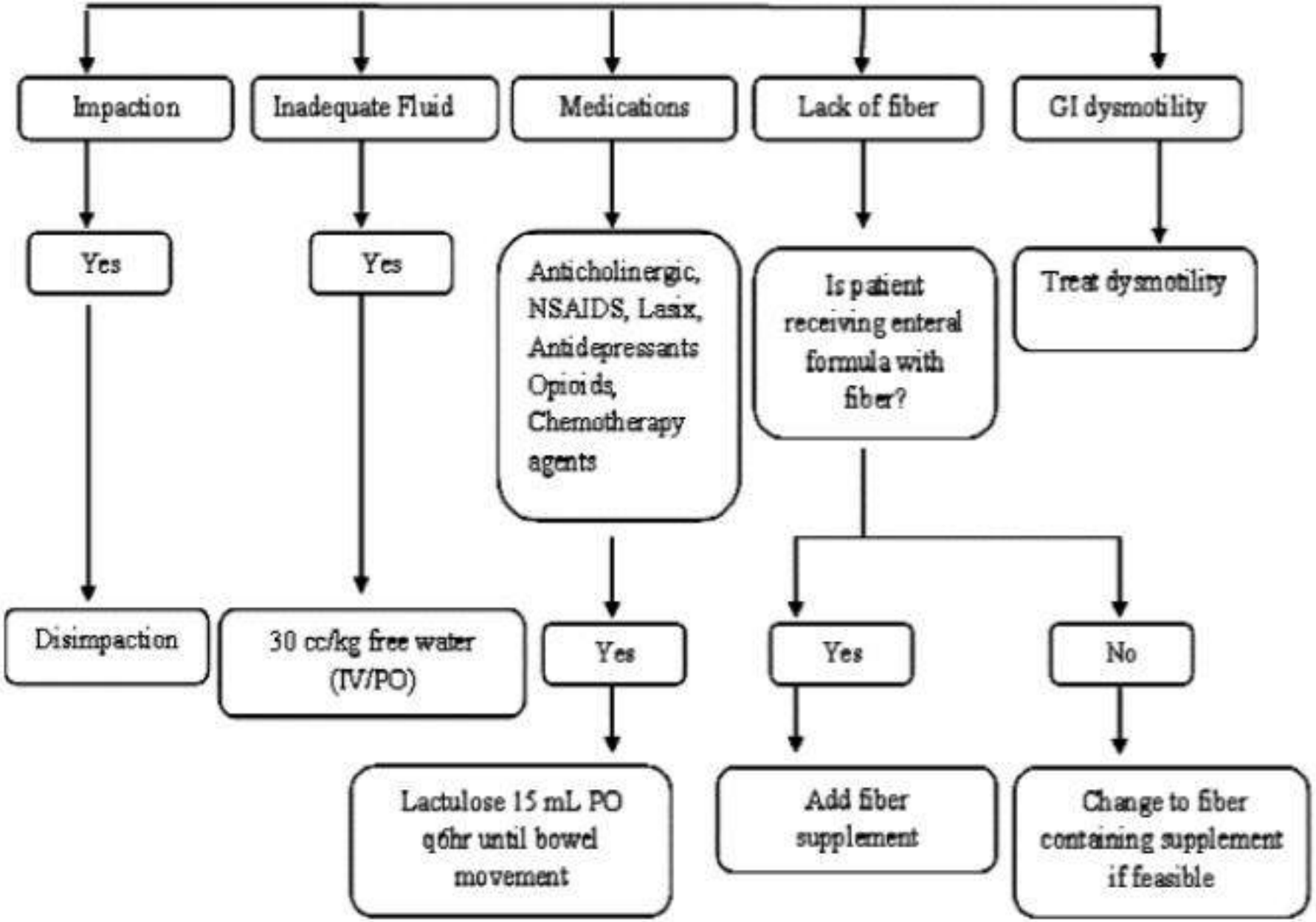
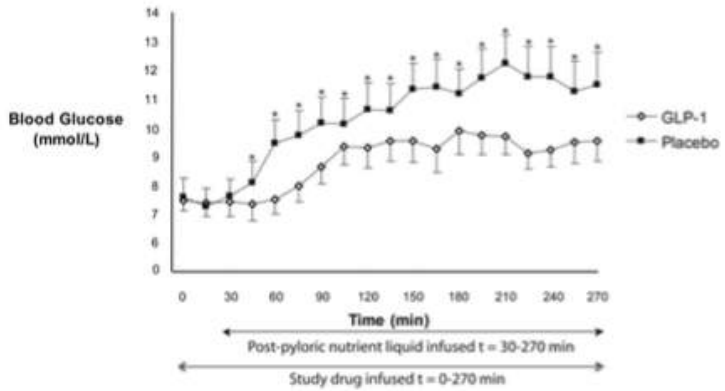


Figure-6: Intensive care enteral feeding: constipation protocol.

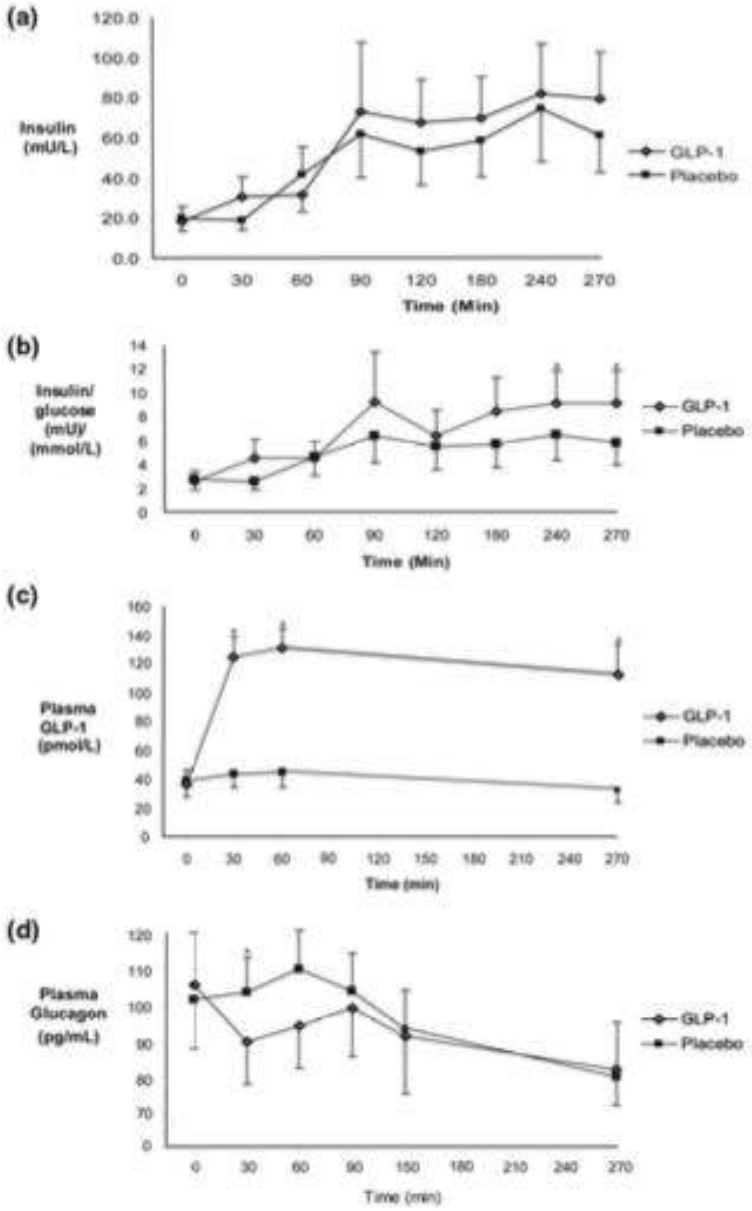
GI: Gastrointestinal
NSAIDS: Non-steroidal anti-inflammatory drugs.

The effect of exogenous glucagon-like peptide-1 on the glycaemic response to small intestinal nutrient in the critically ill: a randomised double-blind placebo-controlled cross over study

Adam M Deane[1,2], Marianne J Chapman[1,2], Robert JL Fraser[3,4], Carly M Burgstad[5], Laura K Besanko[3] and Michael Horowitz[4]



Exogenous glucagon-like peptide-1 (GLP-1) attenuated the rise in blood glucose levels and the overall glycaemic response to intra-duodenal nutrient infusion. ($AUC_{30-270\ min}$ GLP-1 2077 ± 144 mmol/l min vs. placebo 2568 ± 208 mmol/l min; $P = 0.02$). Data are mean ± SEM (n = 7). * $P < 0.05$.



Plasma Hormone concentrations. There was no increase in total postprandial insulin secretion **(a)**, however the plasma insulin/blood glucose ratio was increased at t = 270 minutes **(b)**. Exogenous glucagon-like peptide-1 (GLP-1) infusion increased plasma GLP-1 concentrations **(c)** and caused a transient, but non-sustained, suppression of glucagon **(d)**. Data are mean ± SEM (n = 7). * $P < 0.05$.

CRITICAL CARE
VIEWPOINT

Stress hyperglycemia: an essential survival response!

Paul E Marik* and Rivadis Bellomo

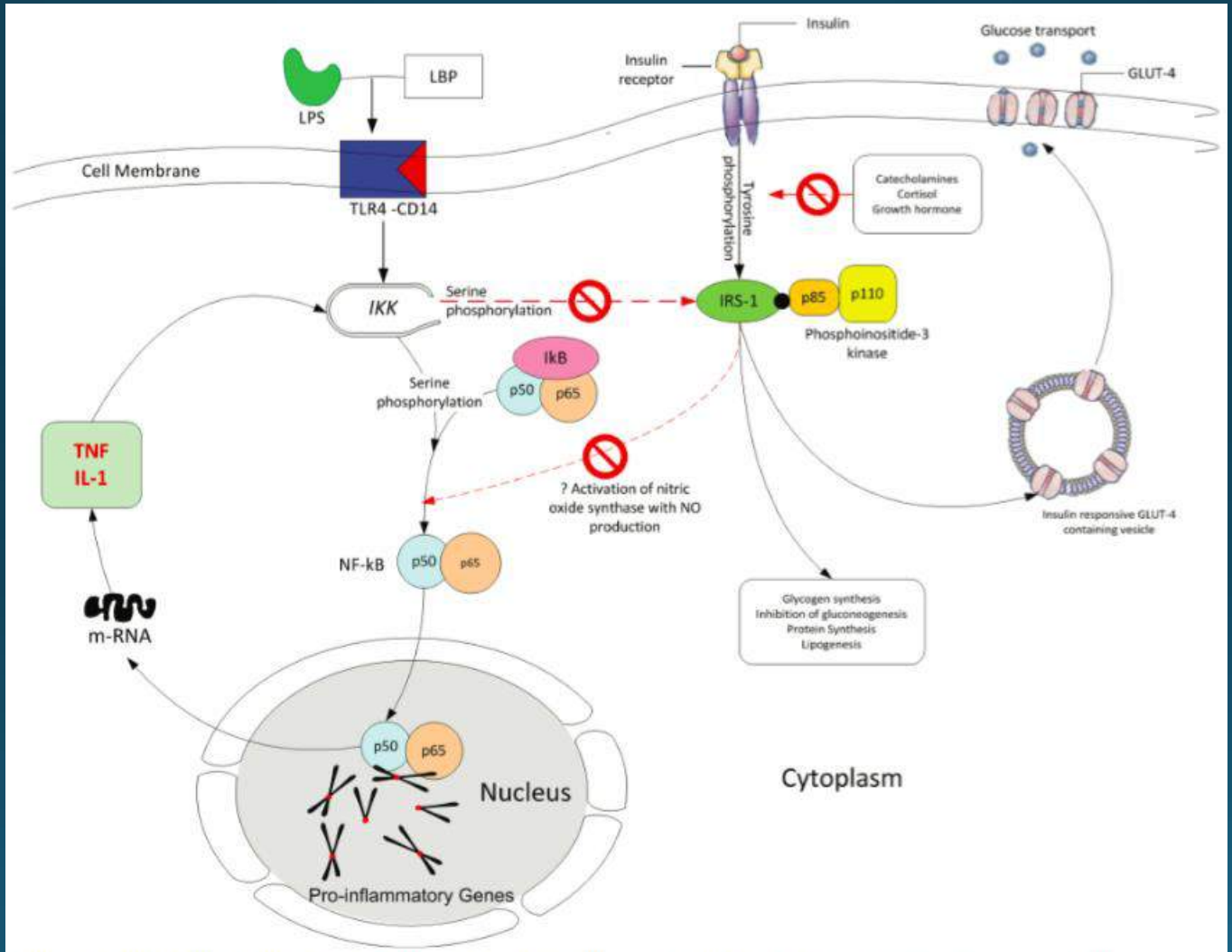


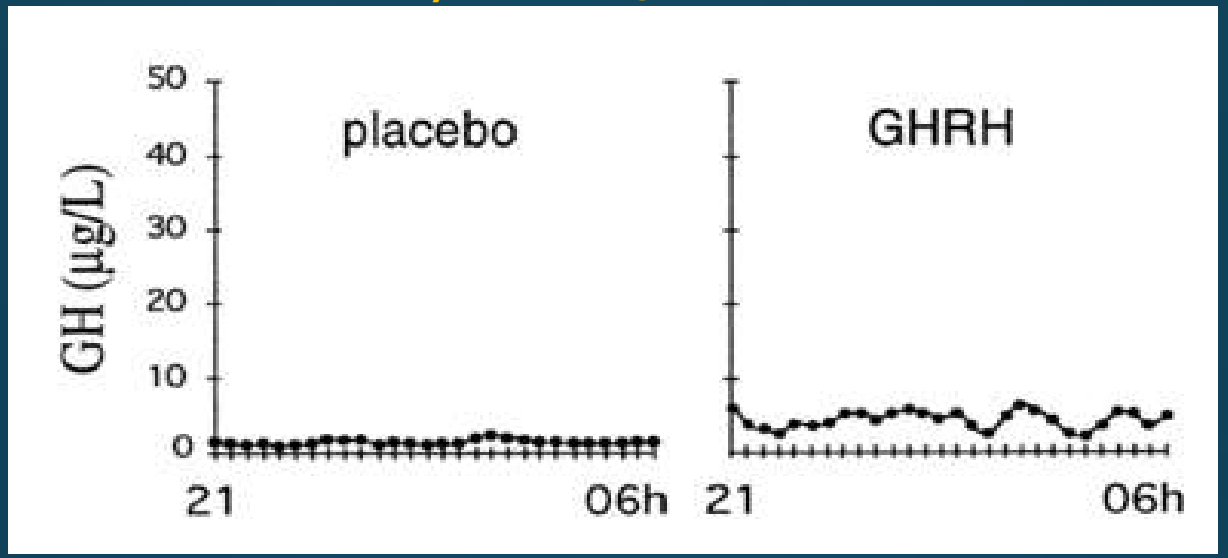
Figure 2. Postulated interaction between the insulin signaling pathway and activation of the pro-inflammatory cascade in the pathogenesis of insulin resistance in sepsis. GLUT, glucose transporter; IκB, inhibitor κB; IKK, inhibitor κB kinase; IRS-1, insulin receptor substrate-1; LBP, lipopolysaccharide binding protein; LPS, lipopolysaccharide; NF-κB, nuclear factor-kappa B; NO, nitric oxide; TLR4, Toll-like receptor-4.

CLINICAL REVIEW 95

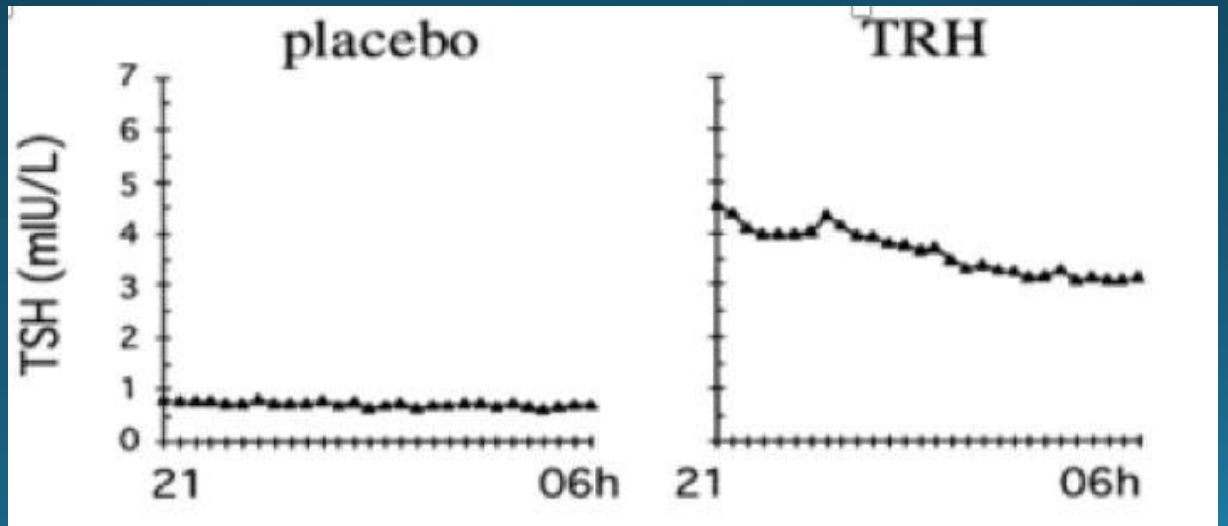
Acute and Prolonged Critical Illness as Different Neuroendocrine Paradigms*

GREET VAN DEN BERGHE†, FRANCIS DE ZEGHER, AND ROGER BOUILLON

Geç Dönem (13-48 gün)
GHRH İnfüzyon (1mic/kg/h)-GH Yanıtları

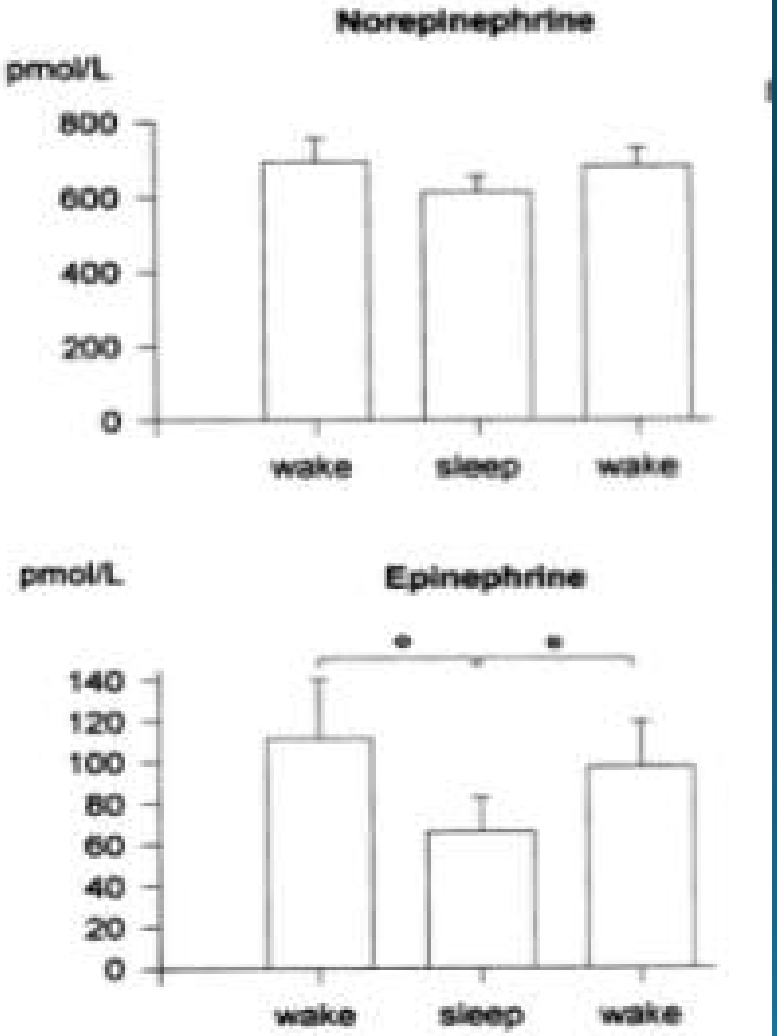


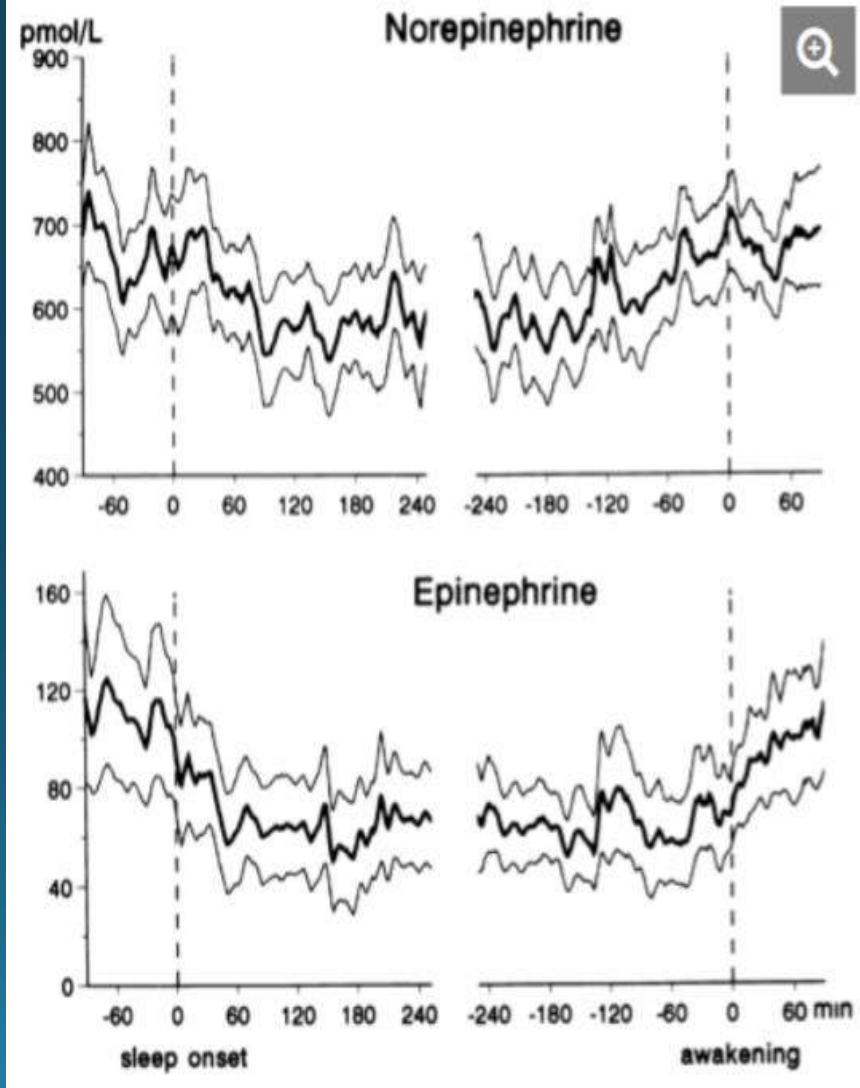
Geç Dönem (15-18 gün)
TRH İnfüzyon (1mic/kg/h)-TSH Yanıtları



Plasma Epinephrine and Norepinephrine Concentrations of Healthy Humans Associated With Nighttime Sleep and Morning Arousal

Christoph Dodt, Ulrike Breckling, Inge Derad, Horst Lorenz Fehm, Jan Born





Afferent Nöronlar (Travma-Periferik Doku Hasarı Aktifler)
Kemoreseptörler (Hipoksemi , Hiperkapni Aktifler)
Baroreseptörler (Hipovolemi Aktifler)
Beyindeki Mikrogliyal Hücreler (İnflammatuar Mediyatörler Hedef Alır)

Sempatik Sinir Sistemi

Neuroendokrin Sistem (Hipotalamus, Paraventriküler Nükleus, Hipofiz)

İmmün Sistem-İnflammatuvar Yanıt

Adipoz Doku ve Gastrointestinal Sistem Hormonları