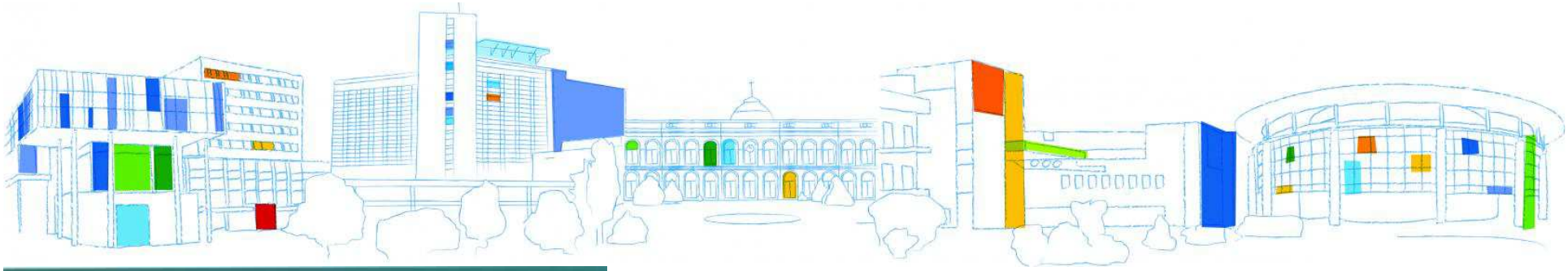

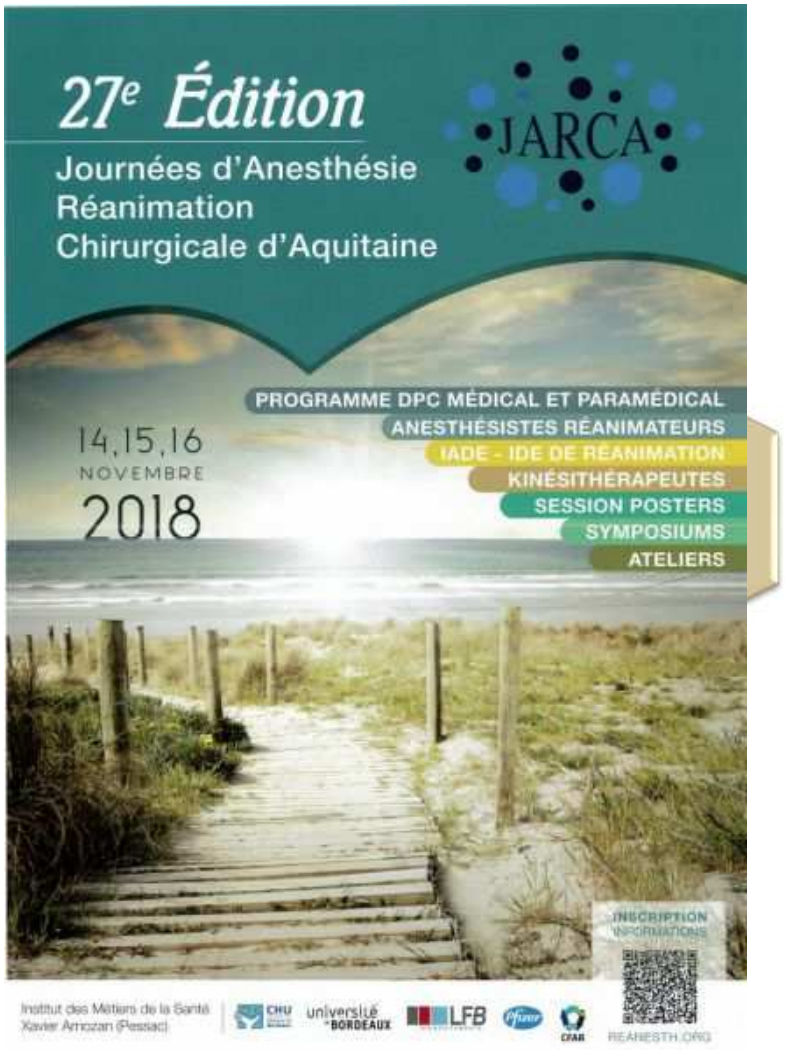

Optimisation de la nutrition en réanimation

Laurent.petit@chu-bordeaux.fr

CHU
Hôpitaux de
Bordeaux

Annales Françaises d'Anesthésie et de Réanimation 33 (2014) 202–218

RECOMMANDATIONS FORMALISÉES D'EXPERTS

Nutrition artificielle en réanimation
Guidelines for nutrition support in critically ill patient

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[c] *Service de nutrition, CHU de Clermont-Ferrand, 63003 Clermont-Ferrand cedex, France*
[d] *Unité de nutrition humaine, Clermont université, université d'Auvergne, BP 10448, 63000 Clermont-Ferrand, France*
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[f] *Service de réanimation médico-chirurgicale, hôpital Saint-Roch, CHU de Nice, 5, rue Pierre-Dévoluy, 06006 Nice cedex 1, France*
[g] *Service des soins intensifs, hôpital universitaire Erasme, 808, route de Lennik, 1070 Bruxelles, Belgique*
[h] *Service de réanimation médicale, hôpital Charles-Nicolle, CHU de Rouen, 1, rue de Germont, 76081 Rouen cedex, France*

Disponible sur Internet le 22 février 2014

SFAR
Société Française d'Anesthésie et de Réanimation

RFE : sfar/srlf/snep 2014

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Clinical Nutrition

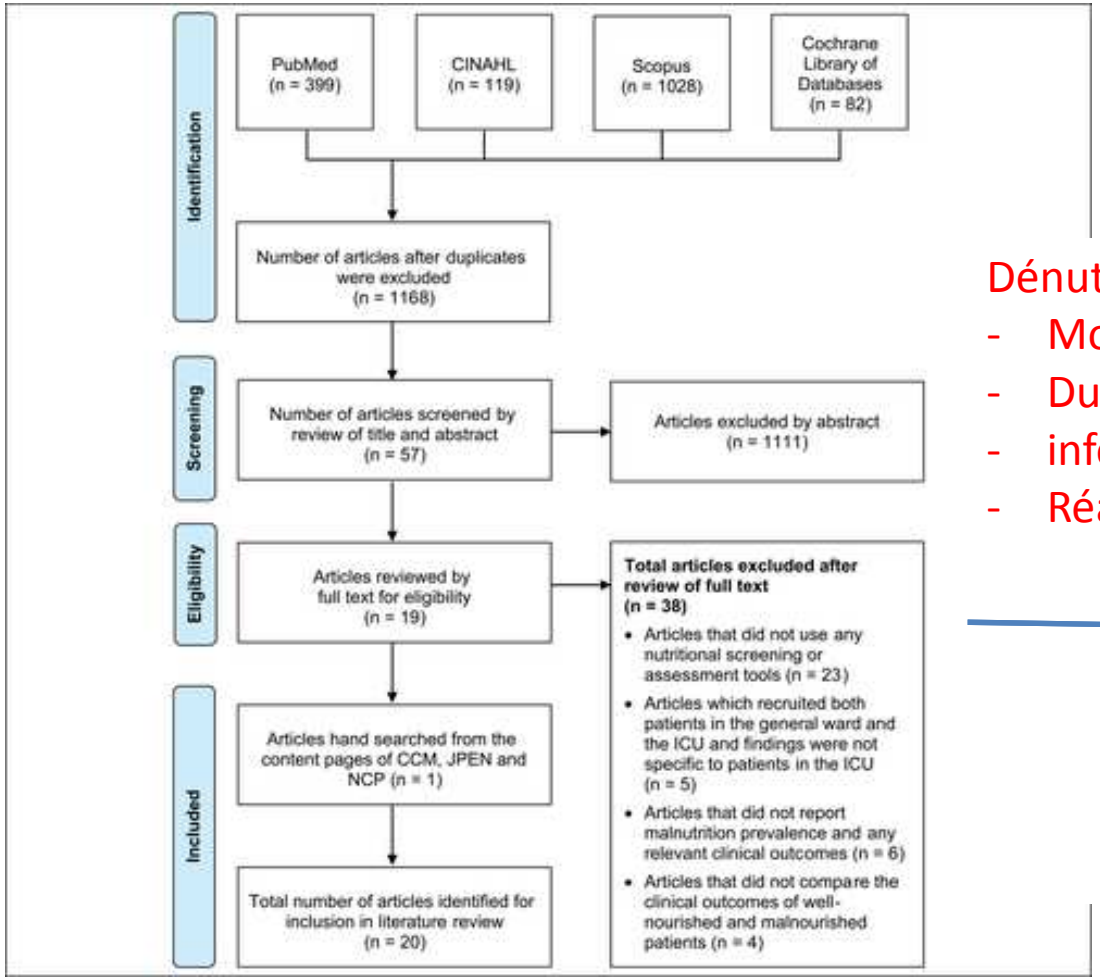
journal homepage: http://www.elsevier.com/locate/clnu

ESPEN Guideline

ESPEN guideline on clinical nutrition in the intensive care unit

Recommandation ESPEN 2018

Dénutrition et réanimation



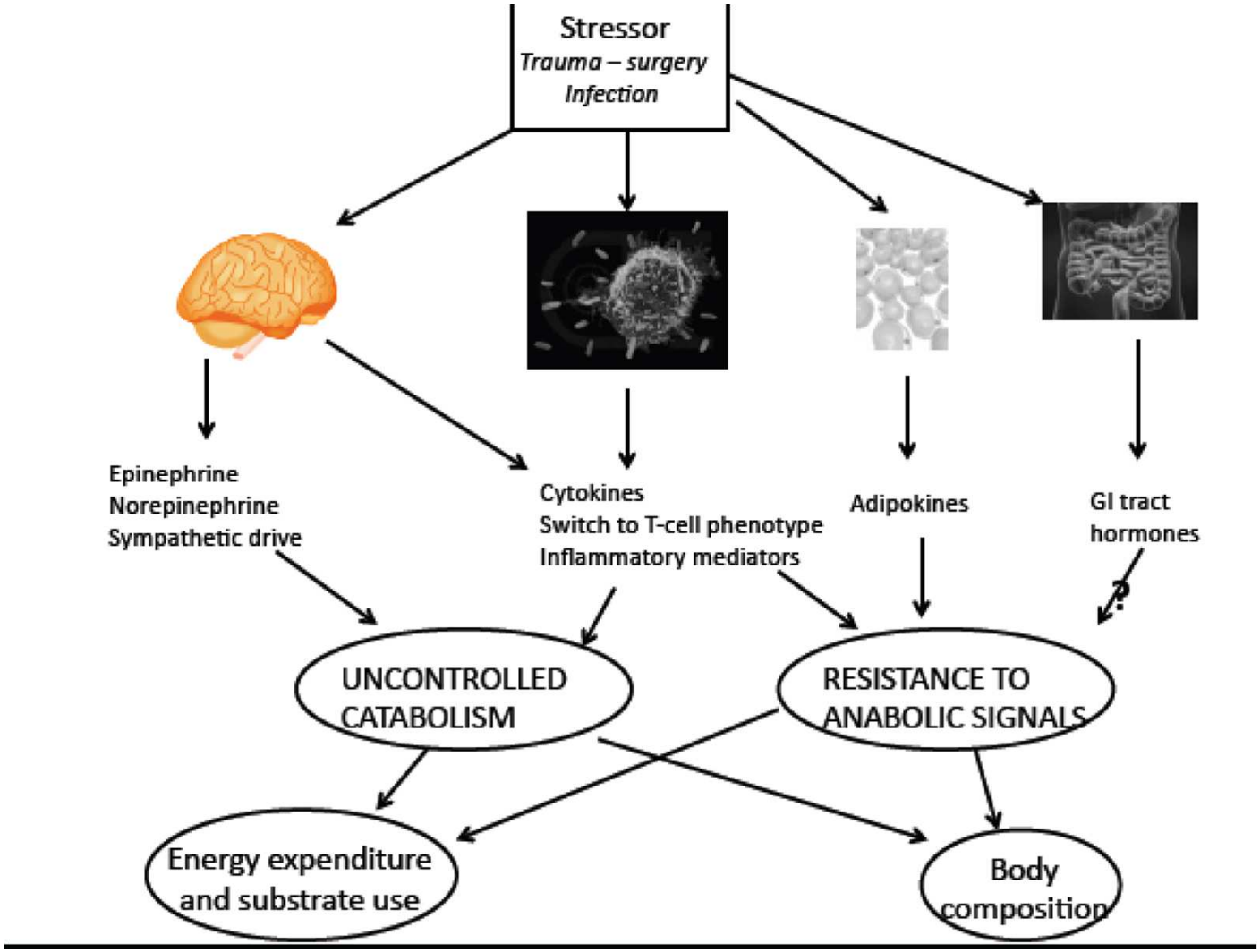
Dénutrition associée de façon indépendante

- Mortalité hospitalière
- Durée de séjour
- infections
- Réadmission

→ **incidence : 38 à 78 %**

Recommandation 1 « Every critically ill patient staying for more than 48 h in the ICU should be considered at risk for malnutrition. Strong consensus (96% agreement) »

Adaptation métabolique à l'agression



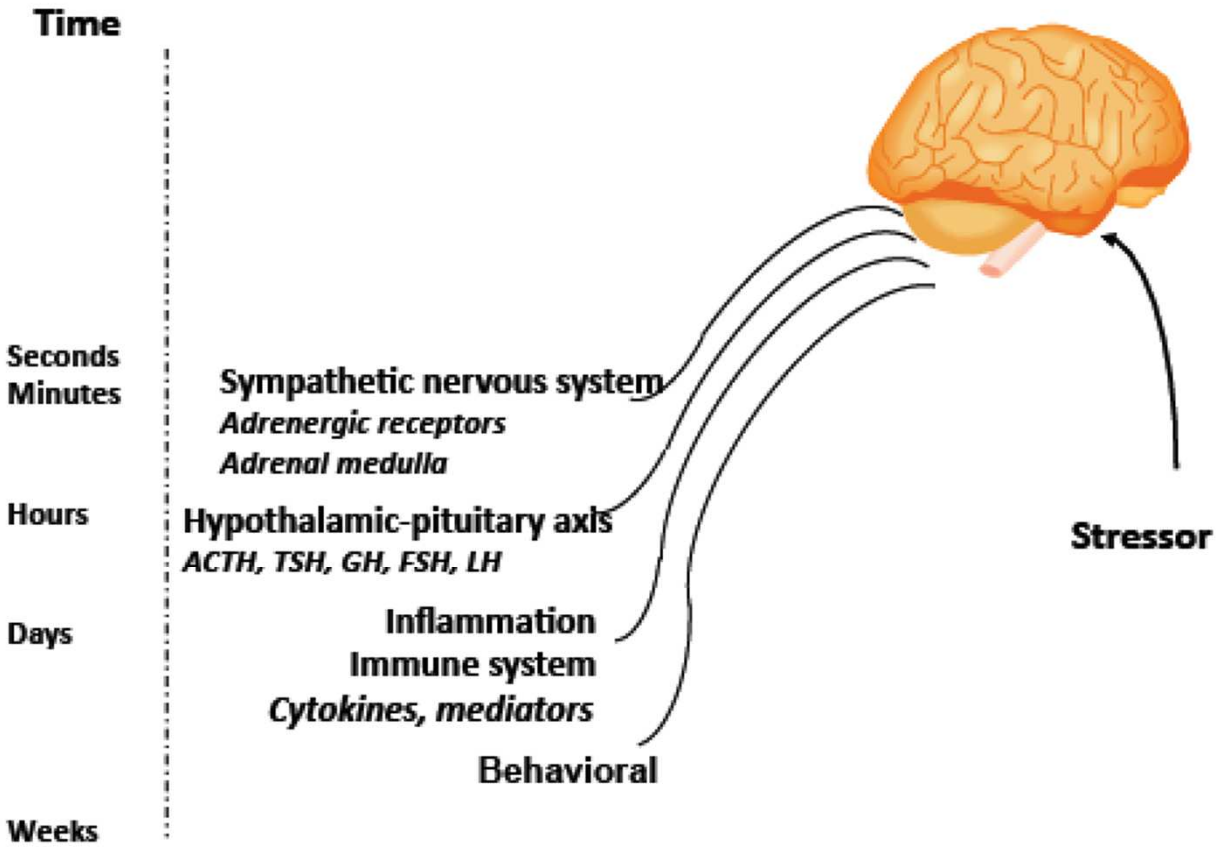
Adaptation métabolique au stress

British Journal of Anaesthesia Page 1 of 10
doi:10.1093/bja/aeu037

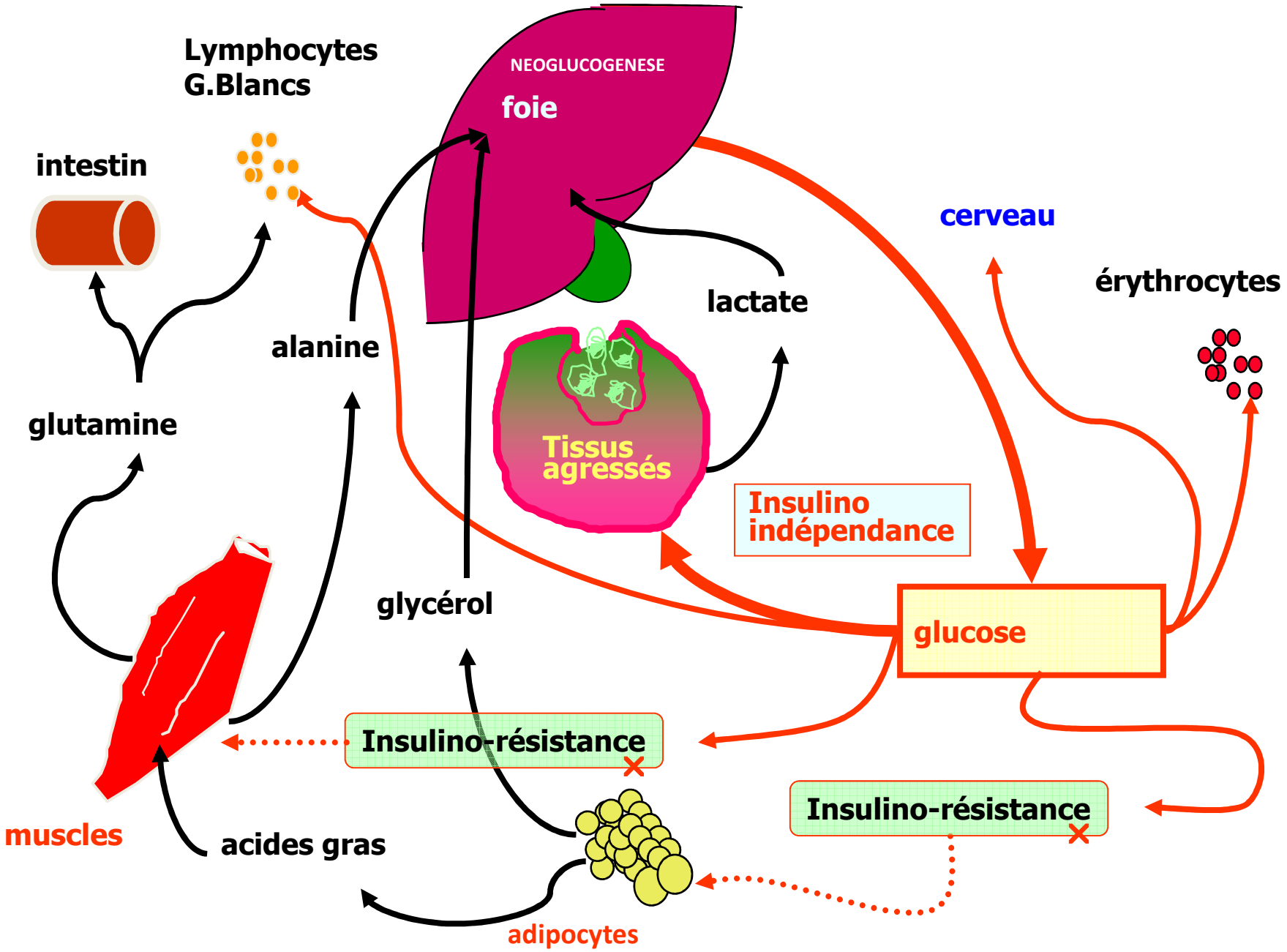
BJA

Metabolic response to the stress of critical illness

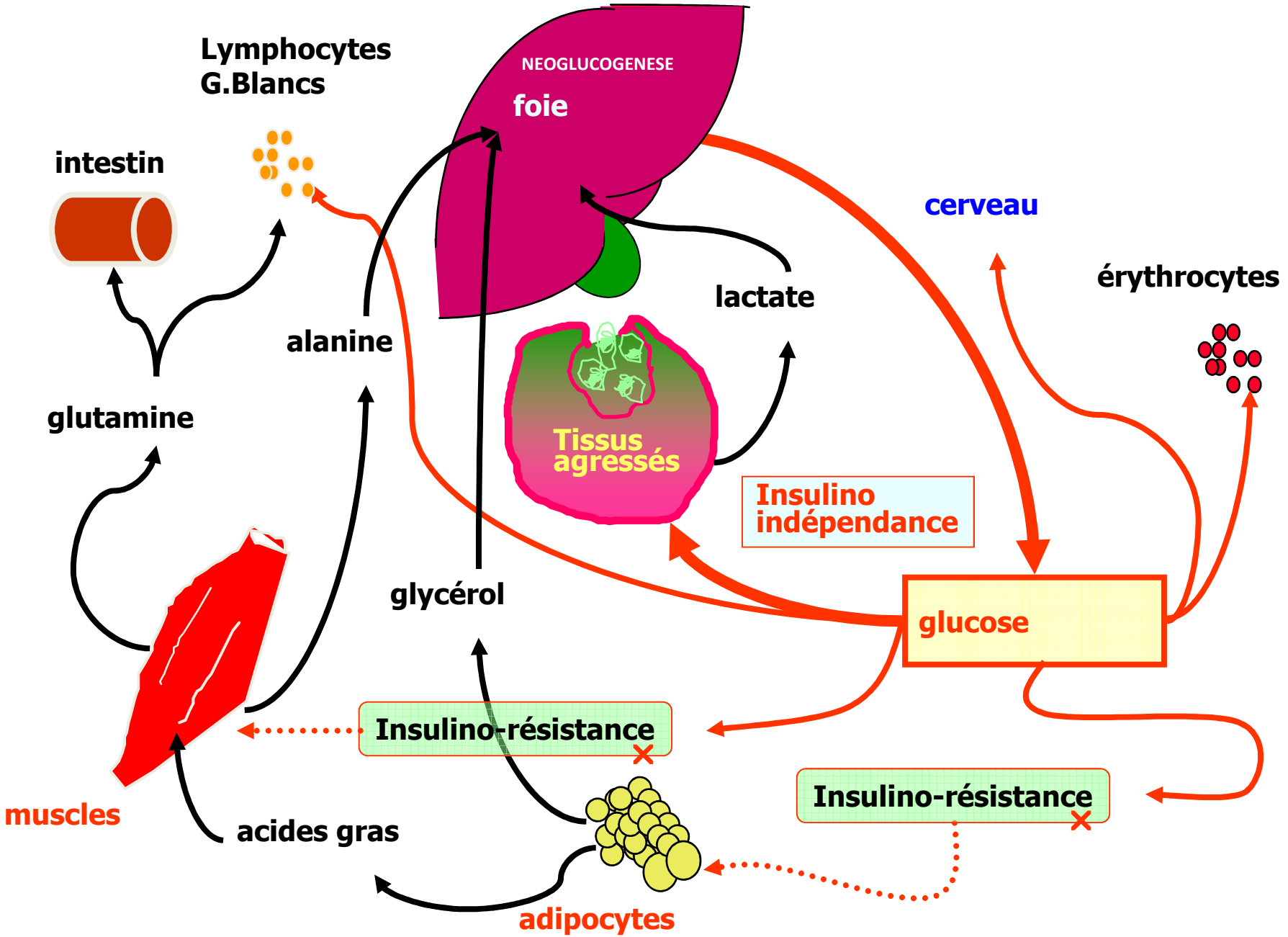
Preiser, Ichai, Orban, Groeneveld

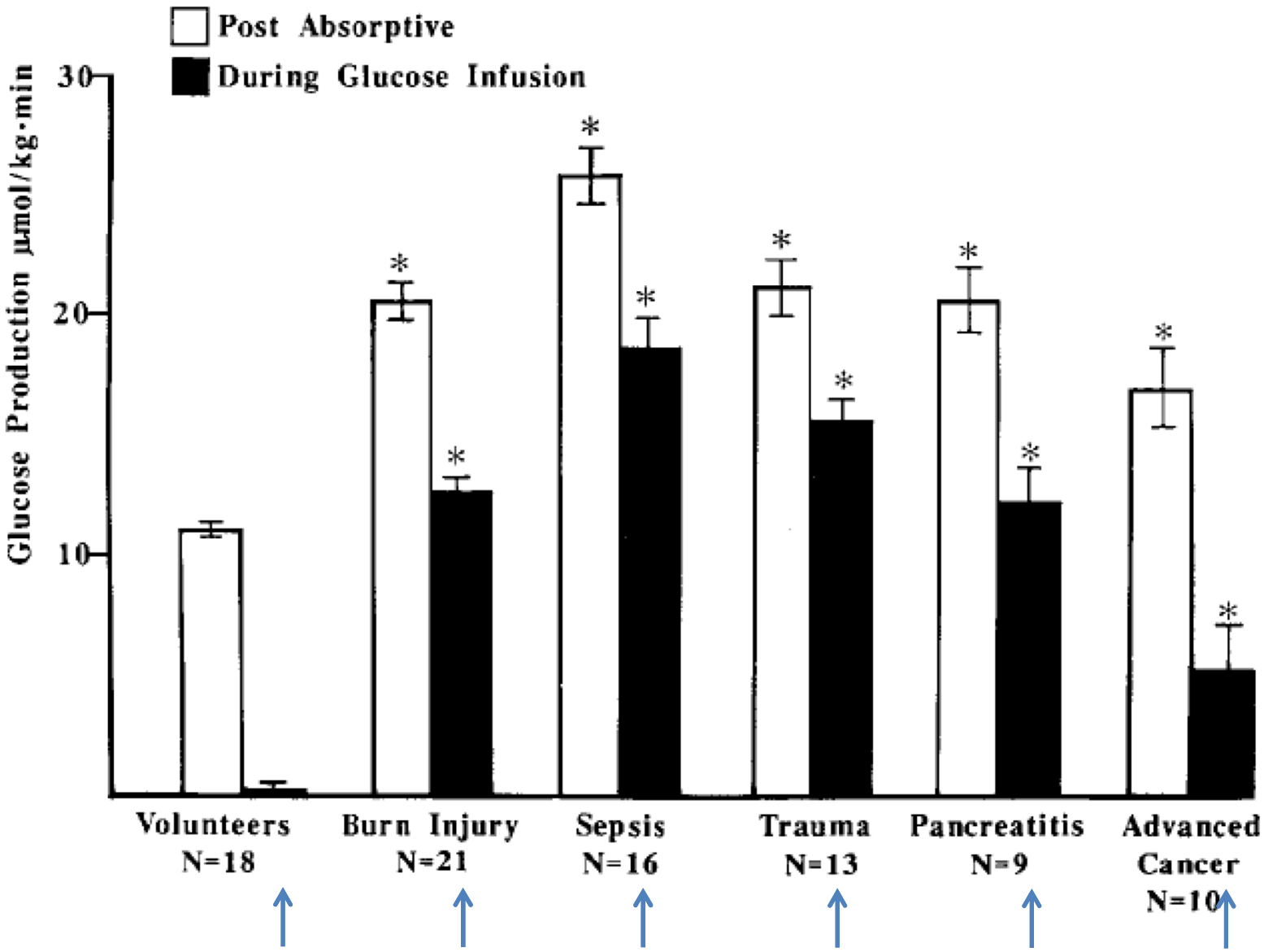


Adaptations métaboliques à l'agression



Adaptations métaboliques à l'agression

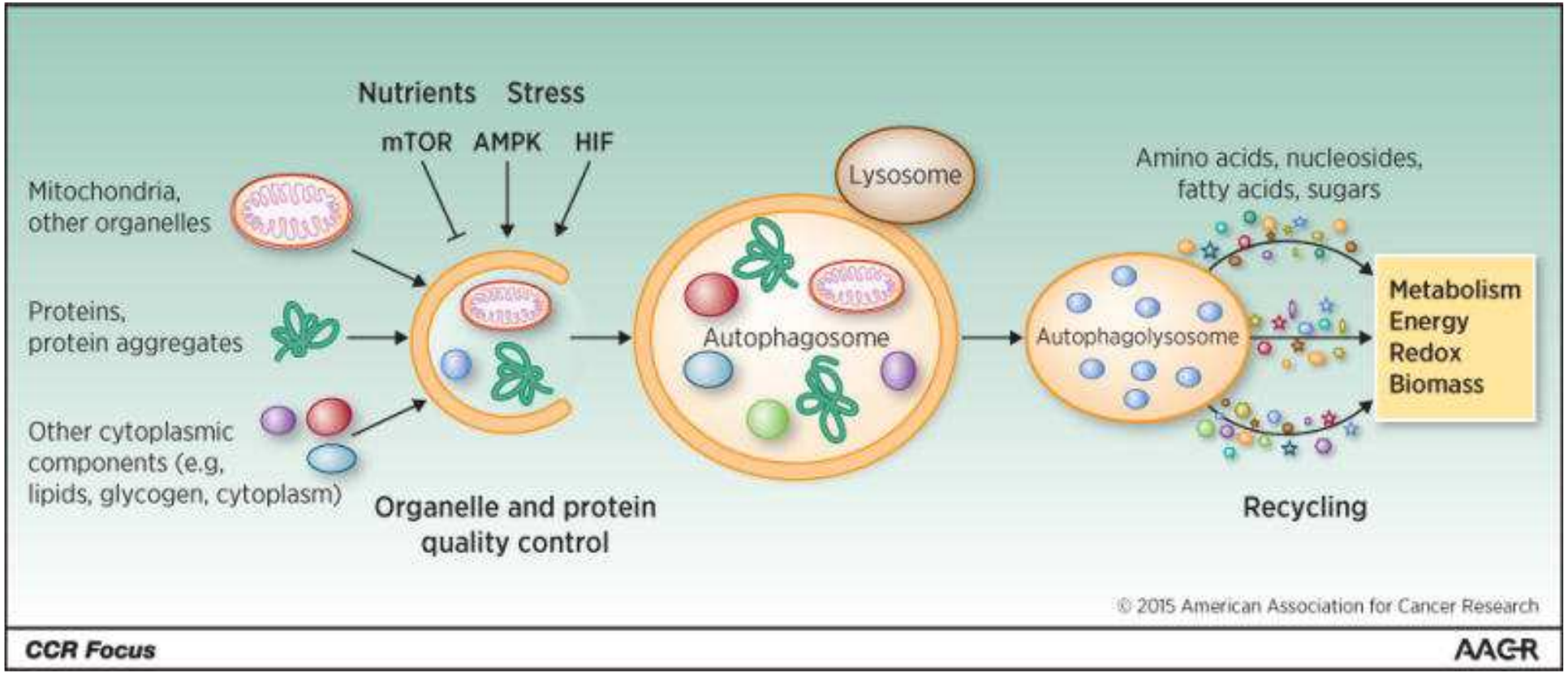




Perfusion de glucose

Wolfe Eur J clin Nutr 1999

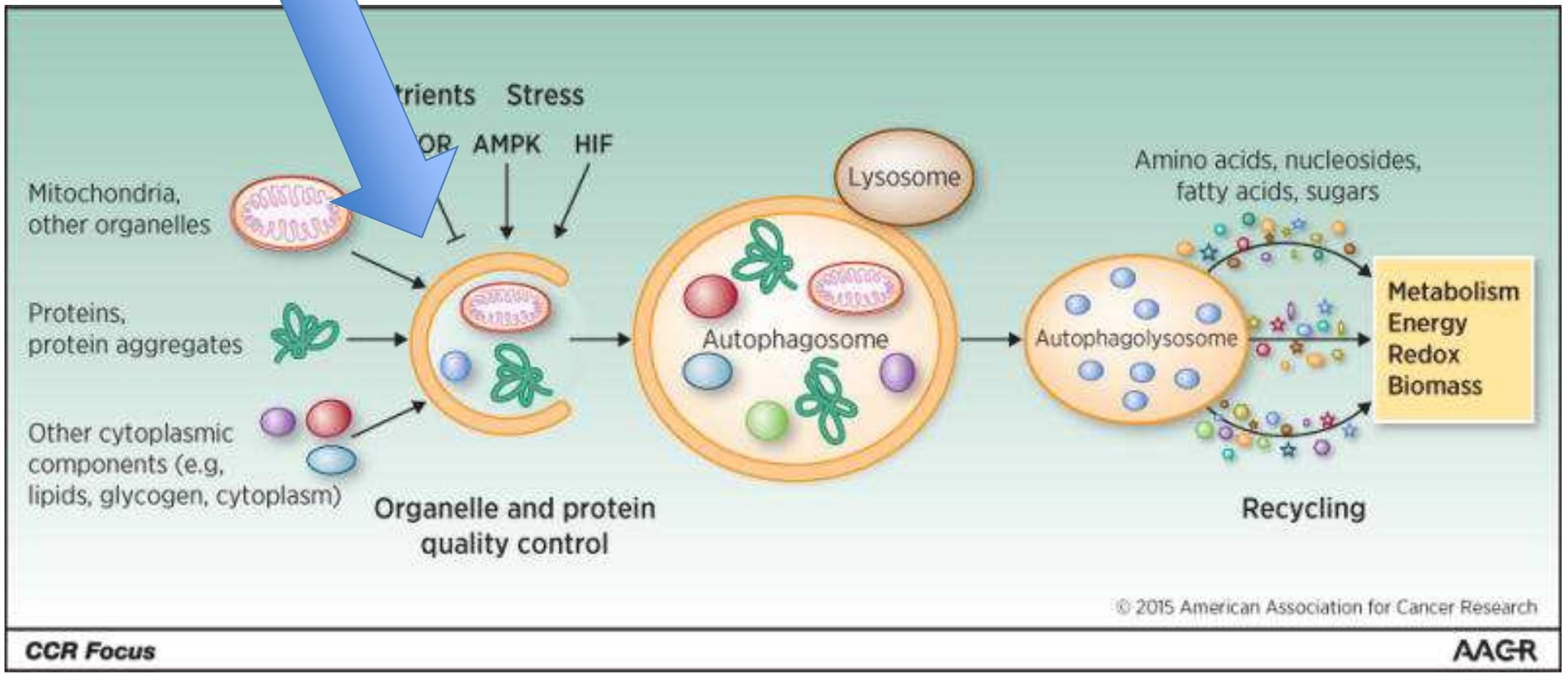
autophagie et réanimation



autophagie et réanimation

Hyperglycémie

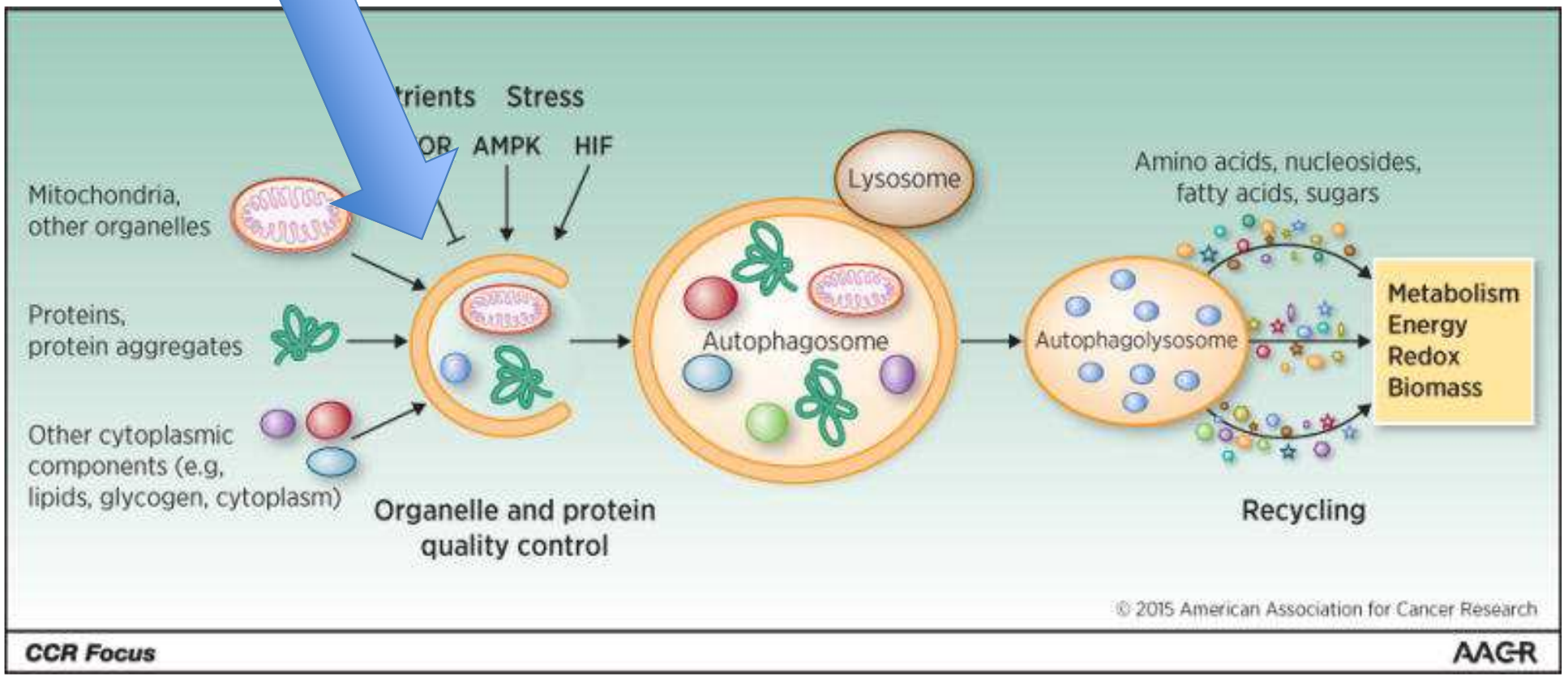
Inhibition

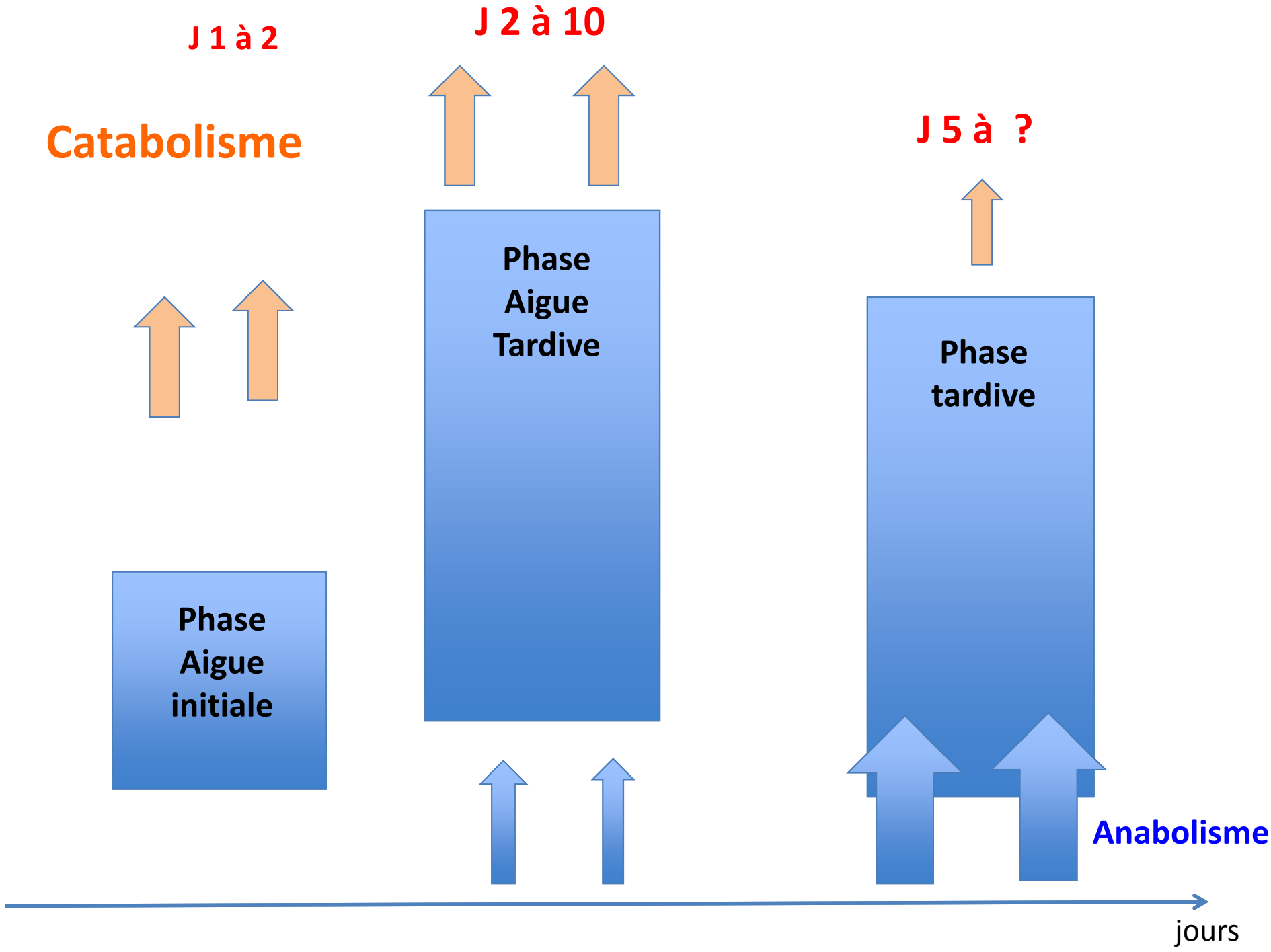


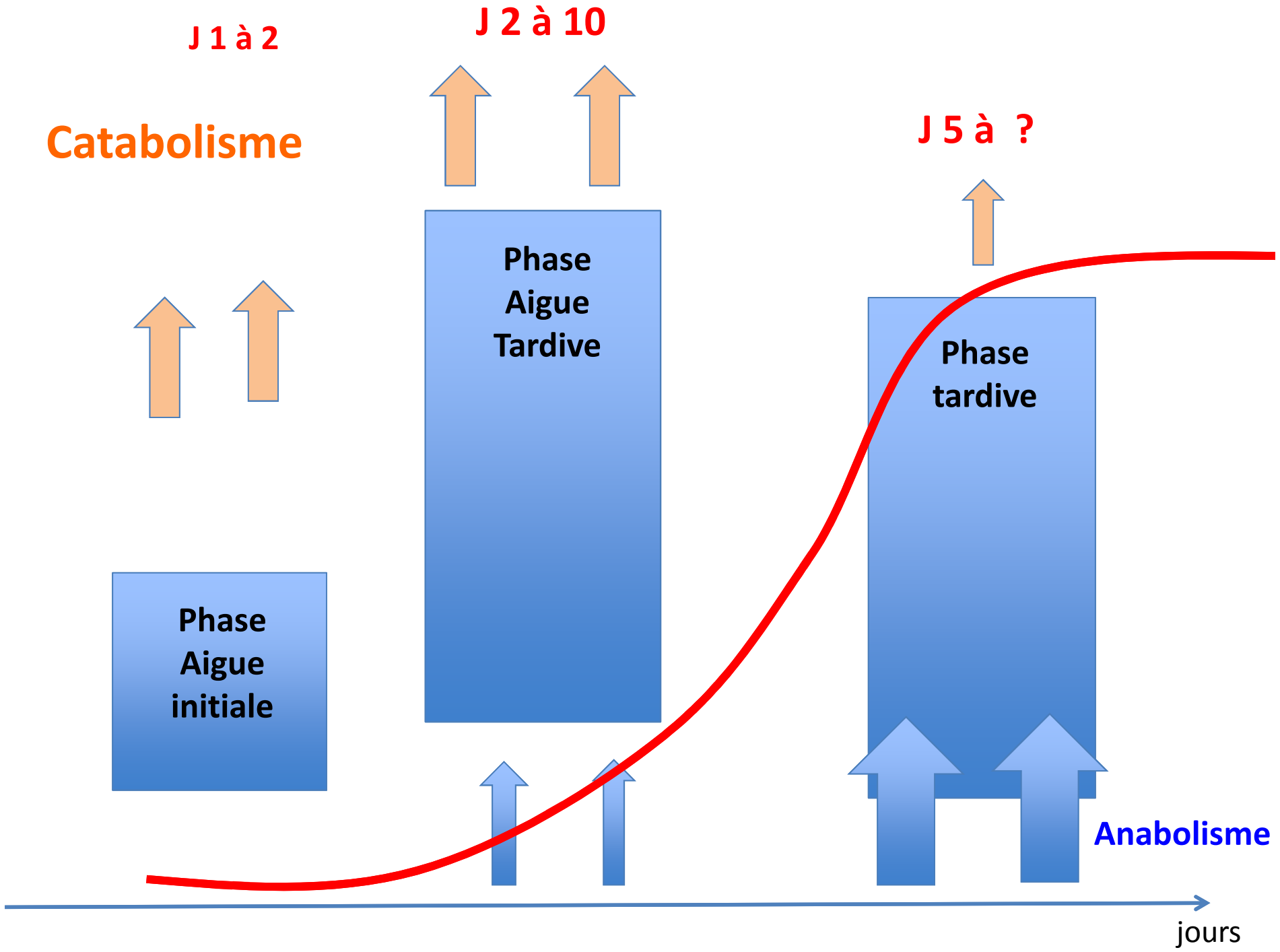
autophagie et réanimation

Nutrition excessive

Inhibition ?




J 1 à 2
J 2 à 10
J 5 à ?
Catabolisme
Phase Aigue Tardive
Phase tardive
Phase Aigue initiale
Anabolisme
jours


J 1 à 2
J 2 à 10
J 5 à ?
Catabolisme
Phase
Aigue
Tardive
Phase
tardive
Phase
Aigue
initiale
Anabolisme
jours

Quels besoins?

Recommandation 1 « Every critically ill patient staying for more than 48 h in the ICU should be considered at risk for malnutrition. Strong consensus (96% agreement) »

Quels besoins?

- Cas général (IMC < 35)

⇒ Phase aiguë : **20-25 kcal/kg/jours**.

⇒ Après stabilisation : **25-30 kcal/kg/jours**.

Encadré 2.1 – Pour évaluer précisément la dépense énergétique d'un patient de réanimation, il faut utiliser la calorimétrie indirecte (méthode de référence en tenant compte de ses limites d'utilisation) plutôt que les équations prédictives (Accord faible).

Encadré 4.6 – En l'absence de calorimétrie indirecte, il faut probablement avoir un objectif calorique total de 20–25 kcal/kg par jour à la phase aiguë et 25–30 kcal/kg par jour après stabilisation (Accord faible).

Estimation / mesures des besoins caloriques ?

Table 2. Rates of Underprescription and Overprescription of Energy Needs at a Group Level.

Predictive Equation Subgroup	Underestimation: No. of Estimates <90% of IC Values	Overestimation: No. of Estimates >110% of IC Values	No. of Predictive Equations Compared to IC Measurements
Fixed prescriptions	13 (39%)	4 (12%)	33
HB	31 (54%)	4 (7%)	57
IJ	2 (20%)	4 (40%)	10
Other	8 (21%)	7 (18%)	38
PSU	6 (27%)	0 (0%)	22
Total	60 (38%)	19 (12%)	160

HB, Harris-Benedict; IC, indirect calorimetry; IJ, Ireton-Jones; PSU, Penn-State.

Tatucu-Babet Jpen 2015

Irecommandation 2 : critically ill mechanically ventilated patients, EE should be determined by using indirect calorimetry. Grade of recommendation: B strong consensus (95% agreement)

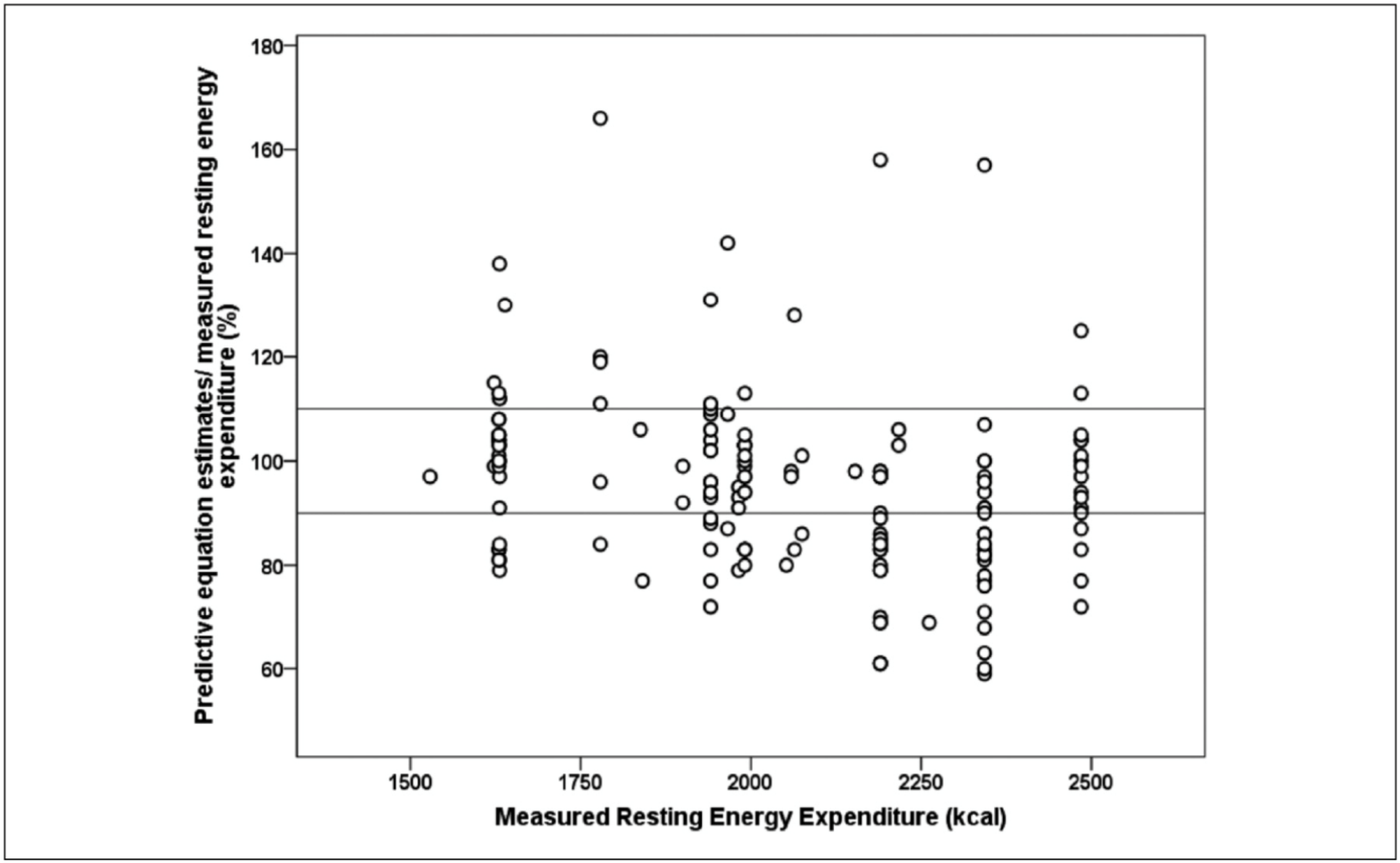


Figure 3. Degree of underprescription and overprescription of energy needs among all reviewed predictive equations (N = 160) based on mean values of predicted and measured resting energy expenditure.

Tatucu-Babet Jpen 2015

Irecommandation 2 : critically ill mechanically ventilated patients, EE should be determined by using indirect calorimetry. Grade of recommendation: B strong consensus (95% agreement)

Estimation / mesures des besoins

Recommandation 15 : In critically ill mechanically ventilated patients, EE should be determined by using indirect calorimetry. Grade B - strong consensus (95% agreement)

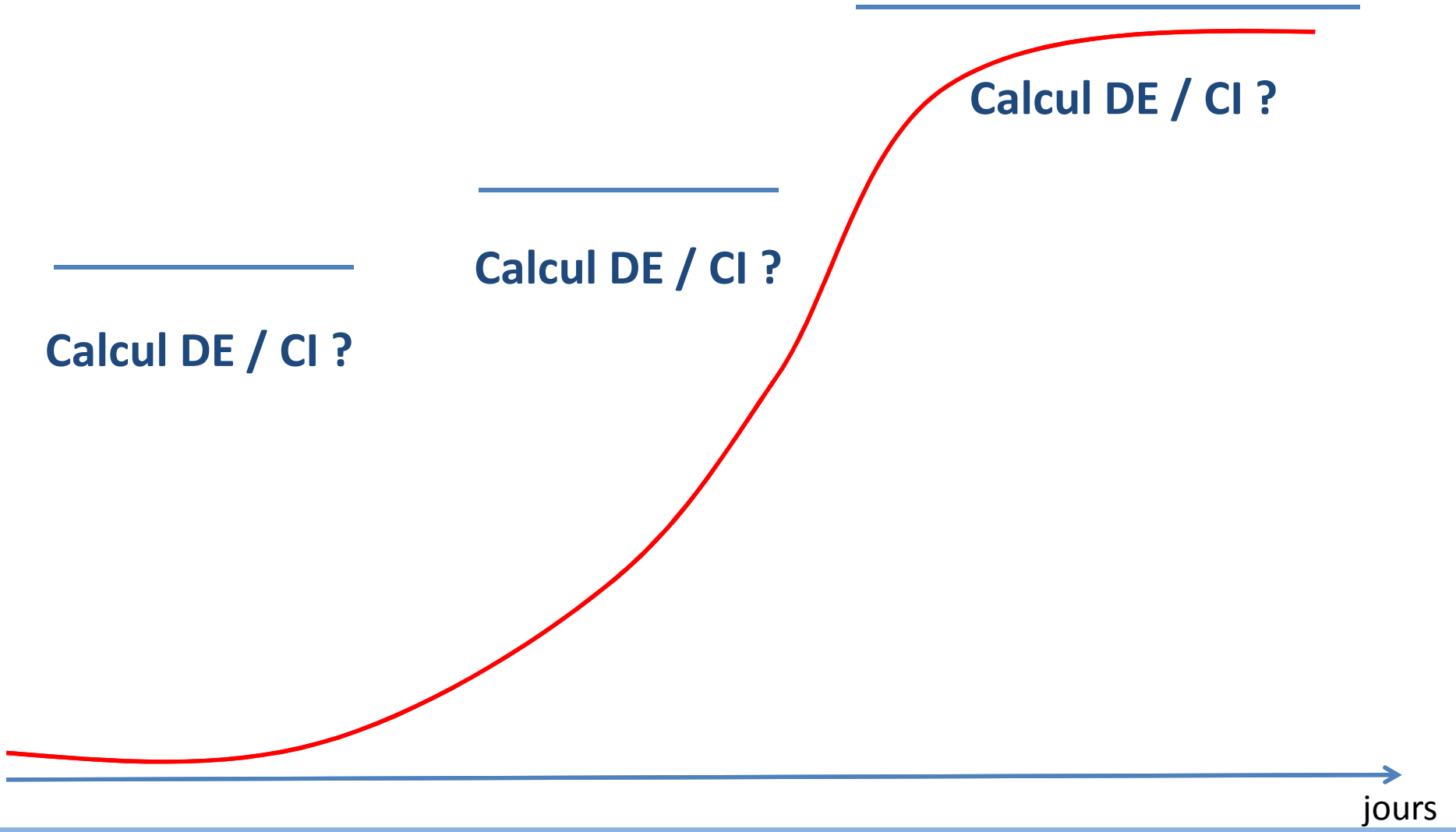
Estimation / mesures des besoins

IMC extrême

Patients « complexes »

Recommandation 15 : In critically ill mechanically ventilated patients, EE should be determined by using indirect calorimetry. Grade B - strong consensus (95% agreement)

Quand initier la nutrition ?



Recommandation 16 : If indirect calorimetry is used, isocaloric nutrition rather than hypocaloric nutrition can be progressively implemented after the early phase of acute

Quand initier la nutrition ?

Recommandation 1 « Every critically ill patient staying for more than 48 h in the ICU should be considered at risk for malnutrition. Strong consensus (96% agreement) »

Quand initier la nutrition ?

Q1 : Dés la « stabilisation » !!!!!

Recommandation 1 : Medical nutrition therapy shall be considered for all patients staying in the ICU, mainly for more than 48 h - Grade : GPP strong consensus (100% agreement)

Recommandation 5 : If oral intake is not possible, early EN (within 48 h) shall be performed/initiated in ICU patients rather than early PN : Grade A - strong consensus (100%

Quand initier la nutrition ?

Dés la stabilisation !!!!!

Contre indications (as ESICM guidelines)

- **Uncontrolled shock, (CI : AN)**
- **uncontrolled hypoxemia and acidosis, (CI : AN)**

- **Uncontrolled upper GI bleeding, (CI : EN)**
- **Gastric aspirate >500 ml/6 h, (CI : EN)**
- **Bowel ischemia, or bowel obstruction, (CI : EN)**
- **Abdominal compartment syndrome, (CI : EN)**

and high-output fistula without distal feeding access. (CI : EN)

Recommandation 5 : If oral intake is not possible, early EN (within 48 h) shall be performed/initiated in ICU patients rather than early PN : Grade A - strong consensus (100%)

Quand initier la nutrition ?

Ne sont pas des contre indications

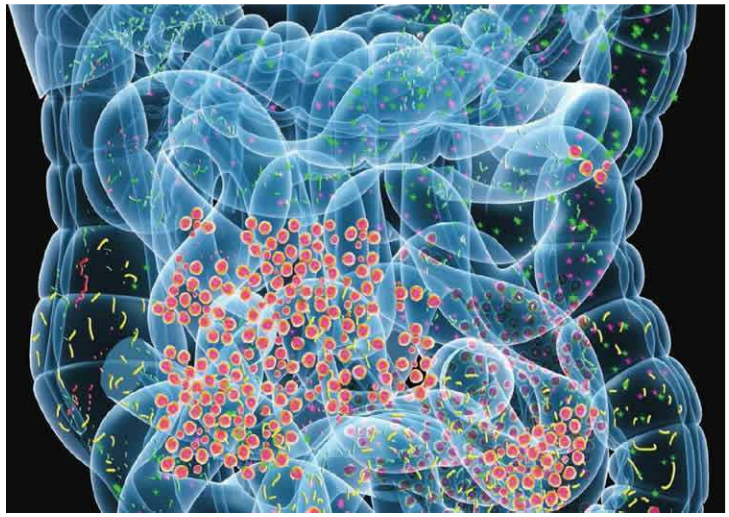
Recommandation 40 :

-> Early EN should be performed

- in patients receiving **ECMO**
- in patients with traumatic brain injury or stroke (ischemic or hemorrhagic)
- in patients with spinal cord injury
- in patients with **severe acute pancreatitis**
- in patients **after GI surgery or after abdominal aortic surgery**
- in patients with abdominal trauma when the continuity of the GI tract is confirmed/restored
- in patients receiving neuromuscular blocking agents
- in patients **managed in prone position**
- in patients **with open abdomen regardless of the presence of bowel sounds** unless bowel ischemia or obstruction is suspected in patients with diarrhea

Grade of recommendation B – strong consensus

Tube digestif en réanimation

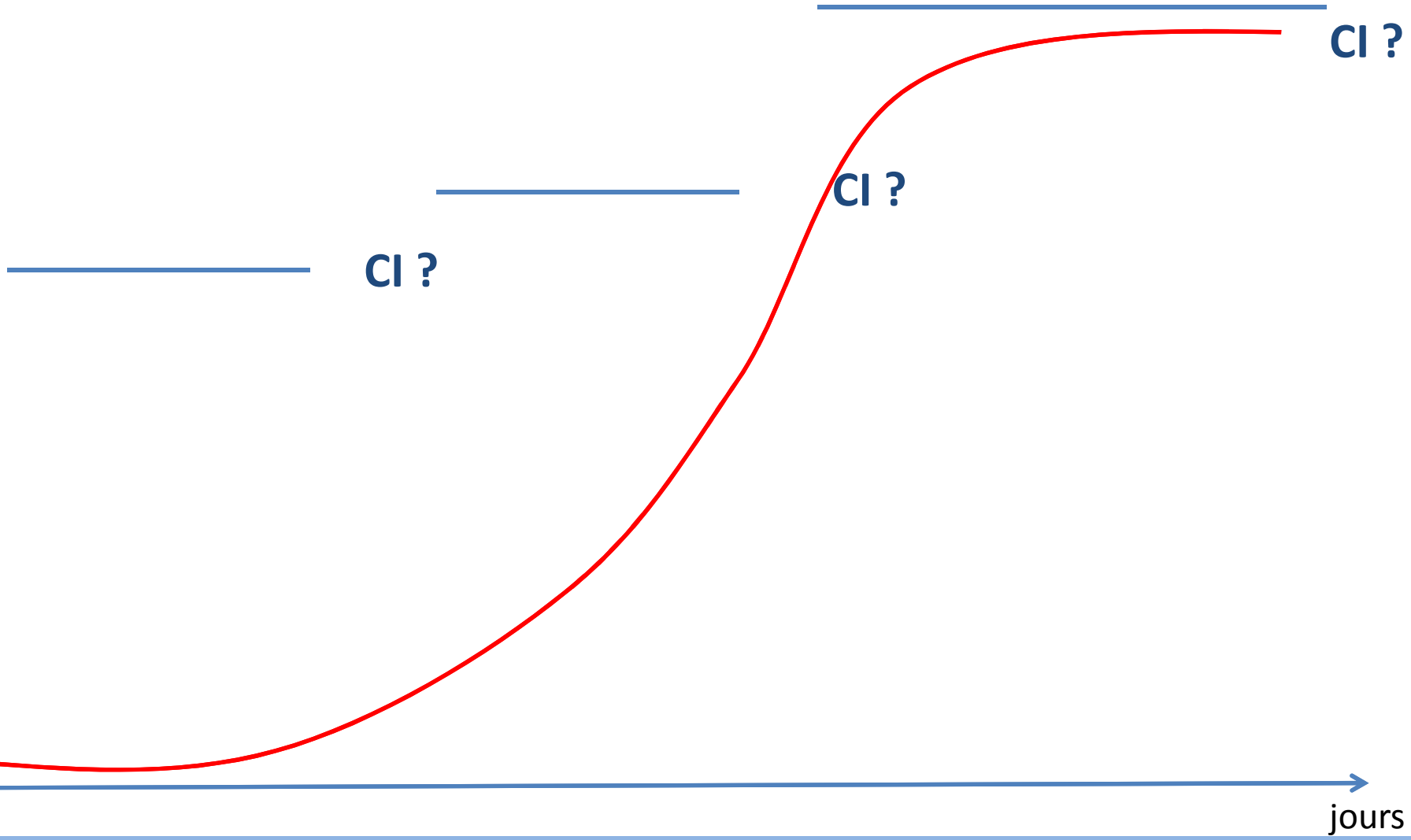


- **70 % du tissu lymphoïde de l'organisme**
- **Absence de NE :**
  - Atrophie villositaire, disparition tigh jonction
  - Favorise la translocation bactérienne
- **Microbiote:**
  - Déséquilibre entre les espèces
  - Activation Toll like recepteur -> inflammation (TNF, Inf…)

.

Barrett cur.op.Clin Nut Met 2015

Quand initier la nutrition ?



Recommandation 16 : If indirect calorimetry is used, isocaloric nutrition rather than hypocaloric nutrition can be progressively implemented after the early phase of acute

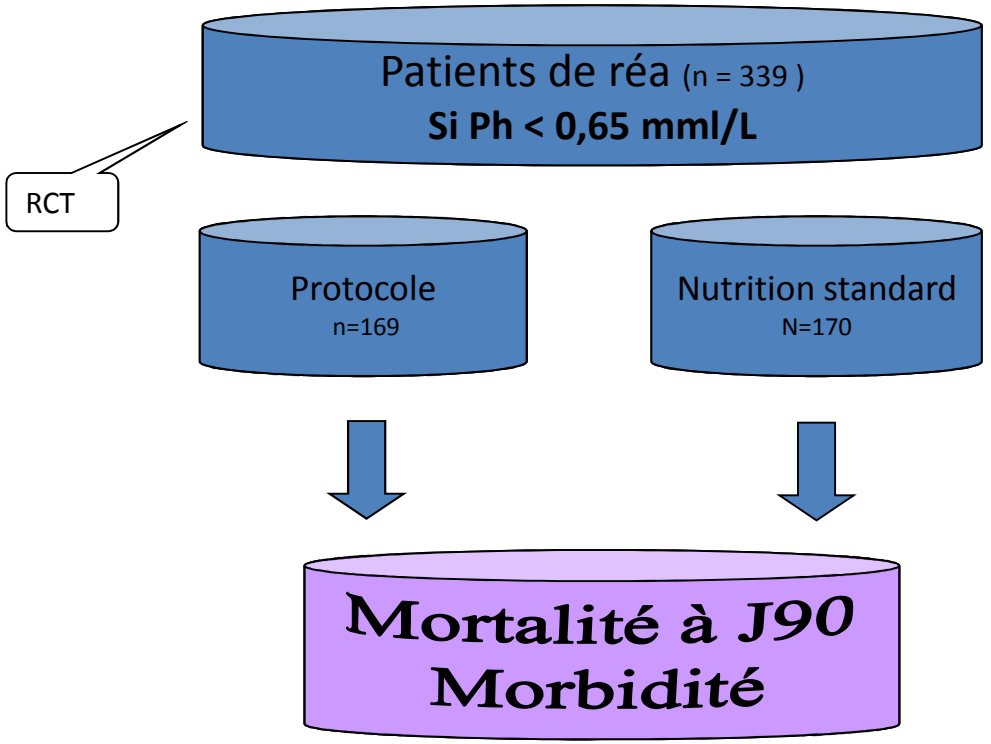
Quand initier la nutrition ?

Q2 : Dés la stabilisation « ioniques »

Recommendation 57 : In patients with refeeding hypophosphatemia energy supply should be restricted for 48 h and then gradually increased. Grade B - strong consensus (100%)
Recommendation 55 : Electrolytes (potassium, magnesium, phosphate) should be measured at least once daily for the first week. Grade : GPP strong consensus (92%)
Recommendation 56 : In patients with refeeding hypophosphatemia (< 0.65 mmol/ l or a drop of > 0.16 mmol/l), electrolytes should be measured 2- 3 times a day and supplemented if needed. Grade : GPP - strong (100%)

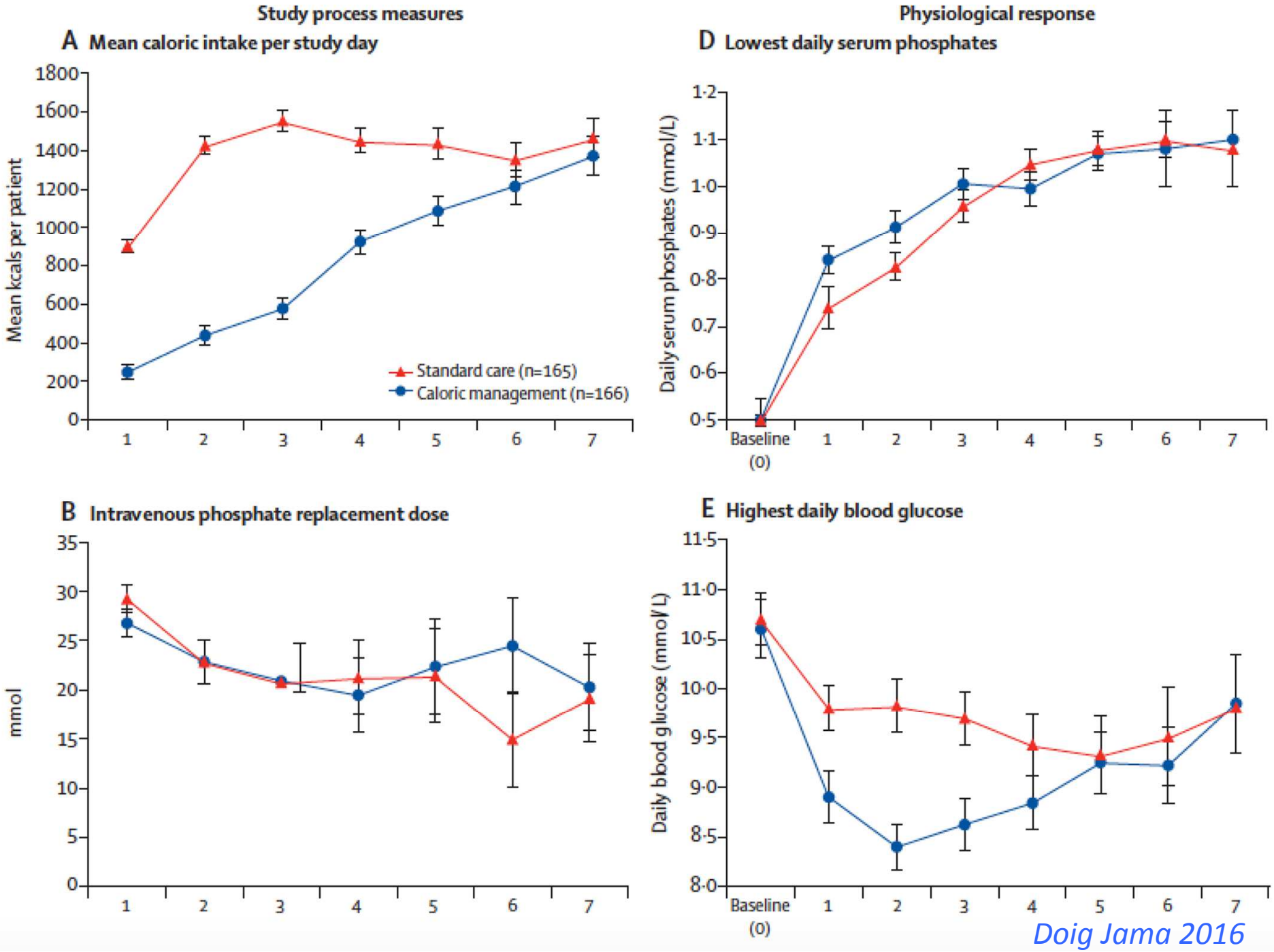
Restricted versus continued standard caloric intake during the management of refeeding syndrome in critically ill adults: a randomised, parallel-group, multicentre, single-blind controlled trial

*Gordon S Doig, Fiona Simpson, Philippa T Heighes, Rinaldo Bellomo, Douglas Chesher, Ian D Caterson, Michael C Reade, Peter W J Harrigan, for the Refeeding Syndrome Trial Investigators Group**

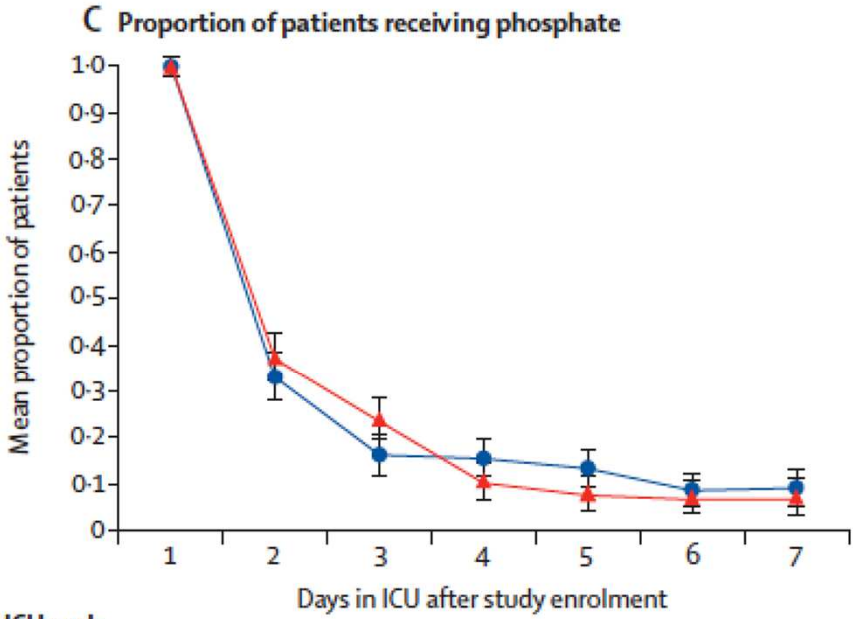


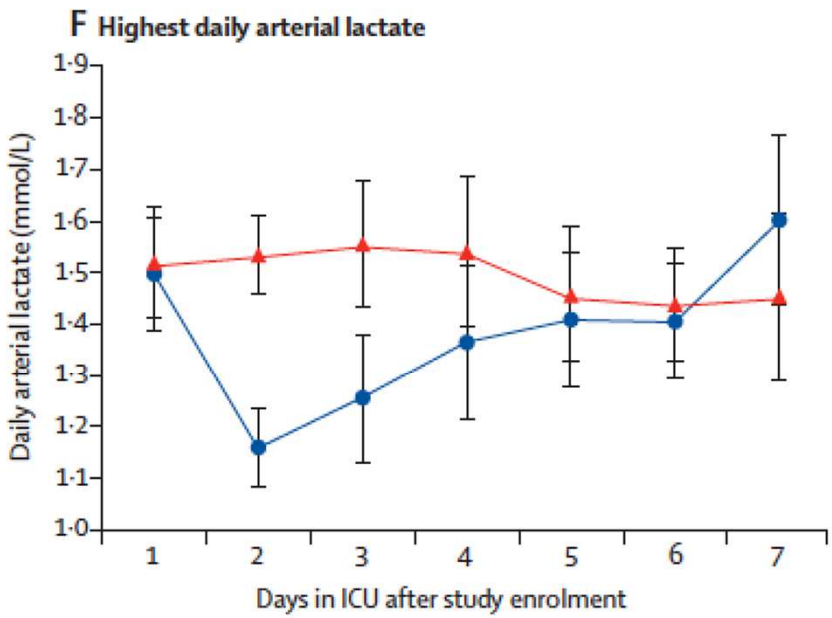
- 20 kcal/h
- Stabilisation 2-3 j
- Puis 40 kcal/h J+1
- Puis 60 kcal/h J+2
- Puis 100 % DE
  ↘ 20kcl/h si Ph<0,71)

Doig Jama 2016



Doig Jama 2016





Patients in ICU each study day							
Standard care	165	165	157	138	123	110	95
Caloric management	166	166	159	141	126	114	97

	165	165	157	138	123	110	95
	166	166	159	141	126	114	97

Doig Jama 2016

	Standard care (n=165 patients)	Caloric management (n=166 patients)	Risk difference (95% CI)	p value
Vital status (% alive)				
ICU discharge status	150/165 (91%)	157/166 (95%)	3·7% (–5·3 to 12·7)	0·20
Hospital discharge status	135/165 (82%)	151/166 (91%)	9·2% (0·7 to 17·7)	0·017
Day 60 status	128/163 (79%)*	149/164 (91%)*	12·3% (3·9 to 20·7)	0·002
Day 90 status	128/163 (79%)*	143/164 (87%)*	8·7% (0·04 to 17·0)	0·041
Length of stay (days)				
ICU	10·0 (9·2 to 10·9)	11·4 (10·5 to 12·4)	1·4 (–0·42 to 3·5)	0·14
Hospital	21·7 (20·0 to 23·5)	27·9 (25·7 to 30·3)	6·2 (2·0 to 11·2)	0·003
Quality of life and physical function scores† (n responses available for analysis)				
RAND-36 general health	53·4 (22·6; n=124/128)	46·0 (26·0 n=136/143)	–7·5 (–13·4 to –1·5)	0·014
ECOG performance status	1·3 (1·0; n=125/128)	1·5 (1·1; n=135/143)	0·18 (–0·08 to 0·43)	0·18
RAND-36 physical function	47·3 (35·0; n=123/128)	40·9 (33·4; n=135/143)	–6·4 (–14·8 to 2·0)	0·13

Recommendation 57 : In patients with refeeding hypophosphatemia energy supply should be restricted for 48 h and then gradually increased. Grade B - strong consensus (100%)
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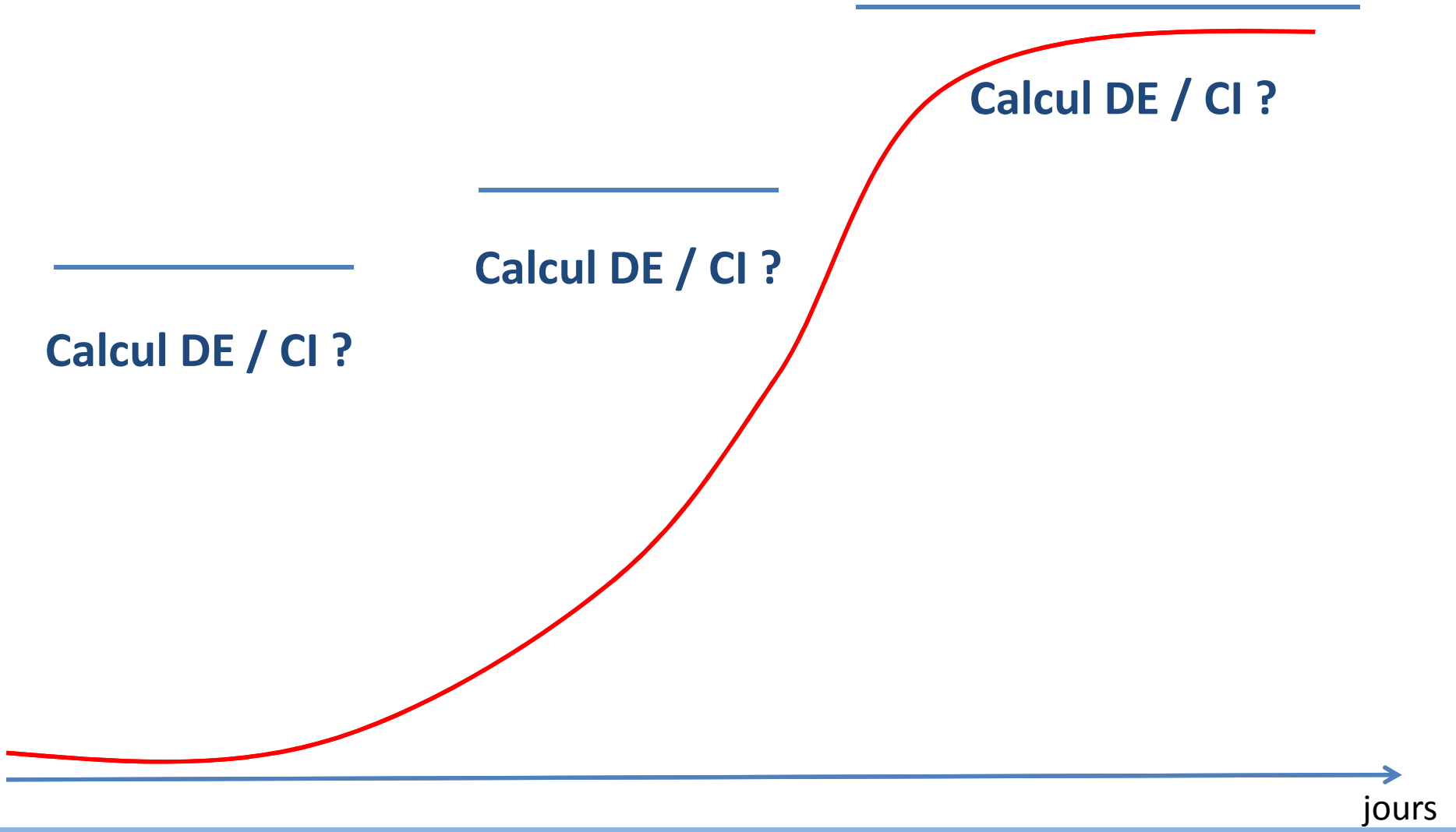
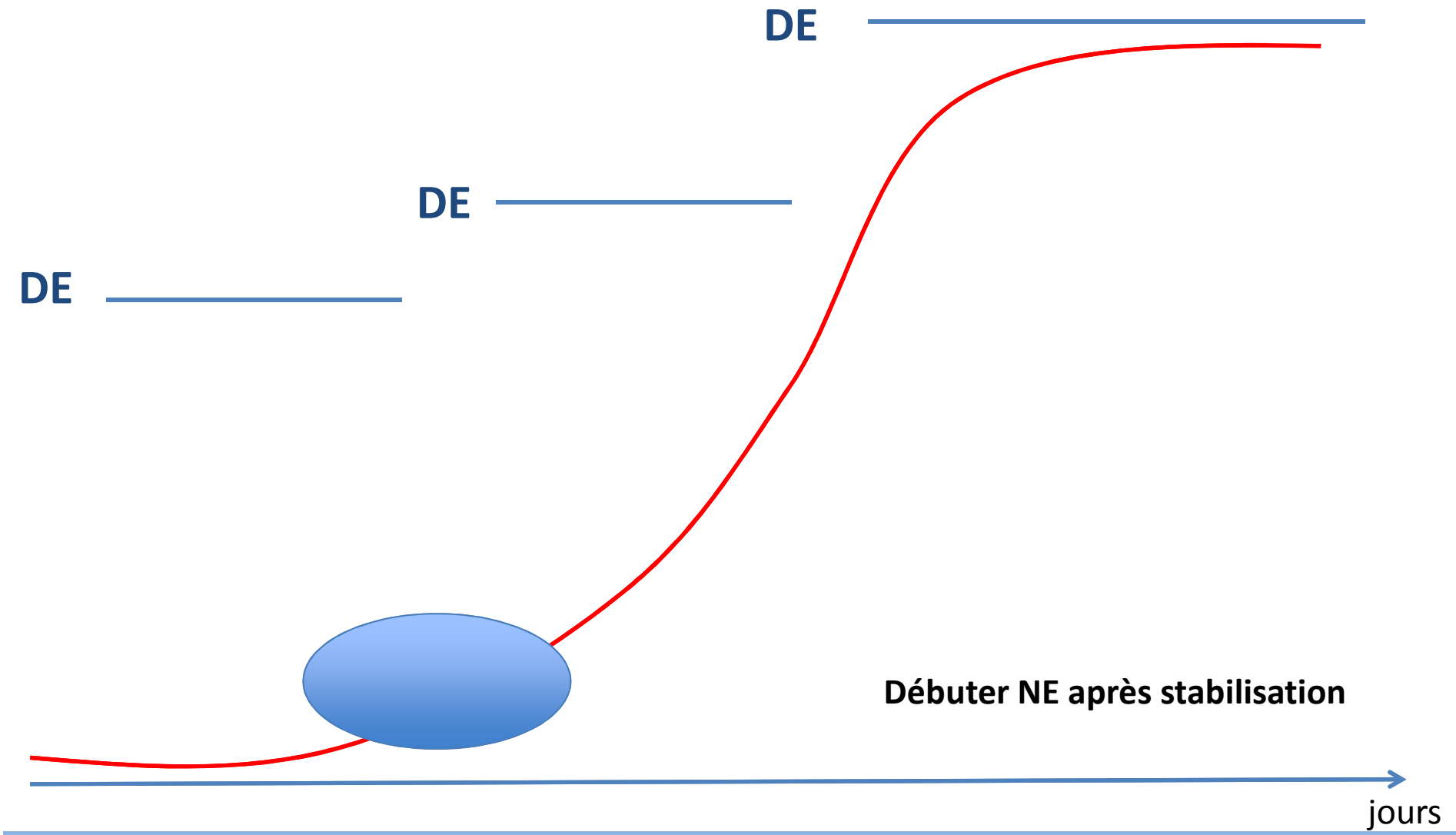
Quand initier la nutrition ?



Recommandation 16 : If indirect calorimetry is used, isocaloric nutrition rather than hypocaloric nutrition can be progressively implemented after the early phase of acute

Quand initier la nutrition ?



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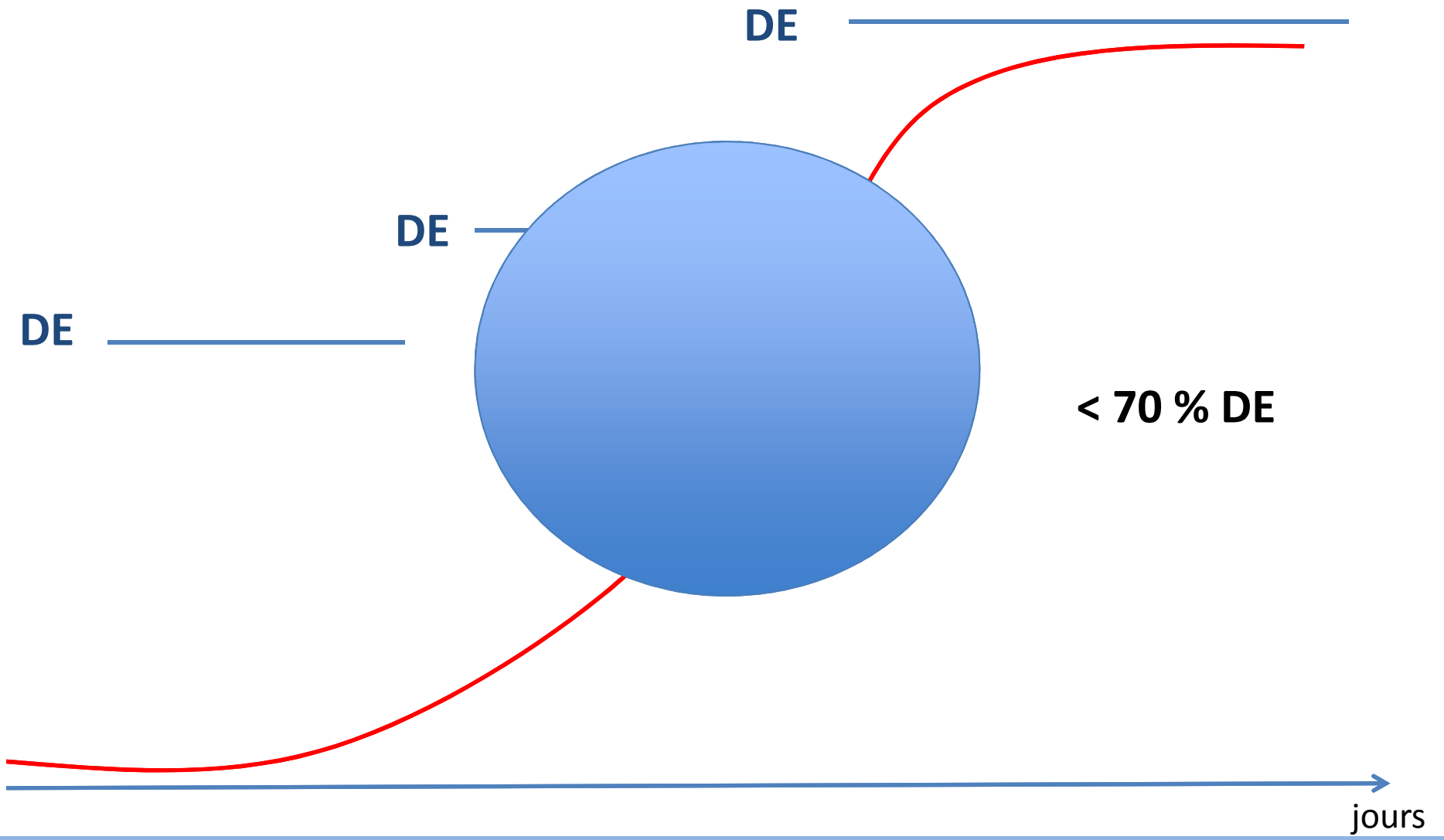
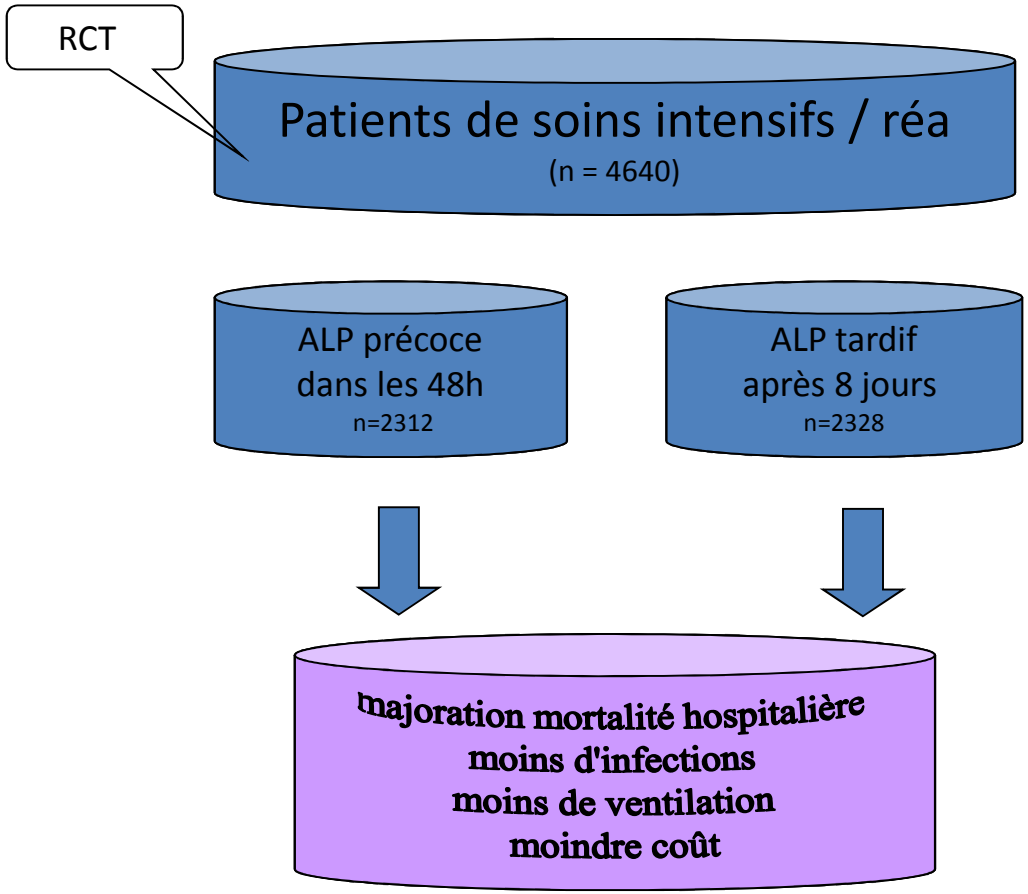


Recommandation 19 : If predictive equations are used to estimate the energy need, hypocaloric nutrition (below 70% estimated needs) should be preferred over isocaloric nutrition

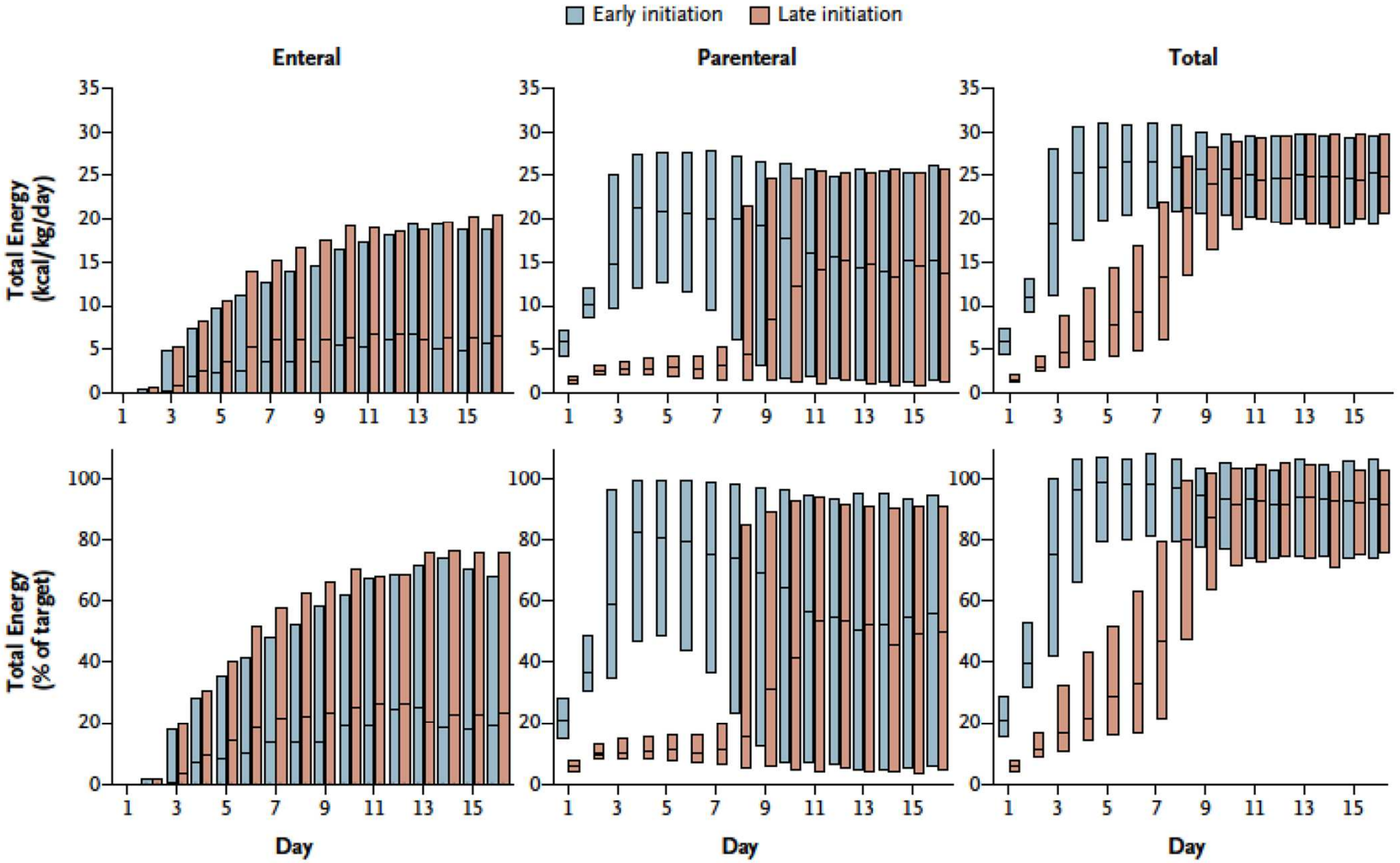
The NEW ENGLAND JOURNAL of MEDICINE

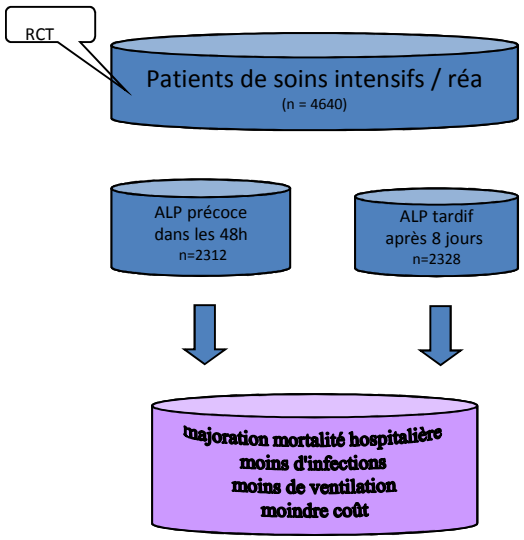
ORIGINAL ARTICLE

Early versus Late Parenteral Nutrition in Critically Ill Adults



Caeser *NEJM* 2011


Early initiation
Late initiation
Enteral
Parenteral
Total
Total Energy (kcal/kg/day)
Total Energy (% of target)
Day
No. in ICU
Late initiation 2328 1399 913 655 436 313 2328 1399 913 655 436 313 2328 1399 913 655 436 313
Early initiation 2312 1438 975 736 517 371 2312 1438 975 736 517 371 2312 1438 975 736 517 371



Variable	Late-Initiation Group (N=2328)	Early-Initiation Group (N=2312)	P Value
Safety outcome			
Vital status — no. (%)			
Discharged live from ICU within 8 days	1750 (75.2)	1658 (71.7)	0.007
Death			
In ICU	141 (6.1)	146 (6.3)	0.76
In hospital	242 (10.4)	251 (10.9)	0.63
Within 90 days after enrollment†	257 (11.2)	255 (11.2)	1.00
Nutrition-related complication — no. (%)	423 (18.2)	434 (18.8)	0.62
Hypoglycemia during intervention — no. (%)‡	81 (3.5)	45 (1.9)	0.001
Primary outcome			
Duration of stay in ICU§			
Median (interquartile range) — days	3 (2–7)	4 (2–9)	0.02
Duration >3 days — no. (%)	1117 (48.0)	1185 (51.3)	0.02
Hazard ratio (95% CI) for time to discharge alive from ICU	1.06 (1.00–1.13)		0.04
Secondary outcome			
New infection — no. (%)			
Any	531 (22.8)	605 (26.2)	0.008
Airway or lung	381 (16.4)	447 (19.3)	0.009
Bloodstream	142 (6.1)	174 (7.5)	0.05
Wound	64 (2.7)	98 (4.2)	0.006
Urinary tract	60 (2.6)	72 (3.1)	0.28
Inflammation			
Median peak C-reactive protein level during ICU stay (interquartile range) — mg/liter	190.6 (100.8–263.2)	159.7 (84.3–243.5)	<0.001
Mechanical ventilation			
Median duration (interquartile range) — days	2 (1–5)	2 (1–5)	0.02
Duration >2 days — no. (%)	846 (36.3)	930 (40.2)	0.006

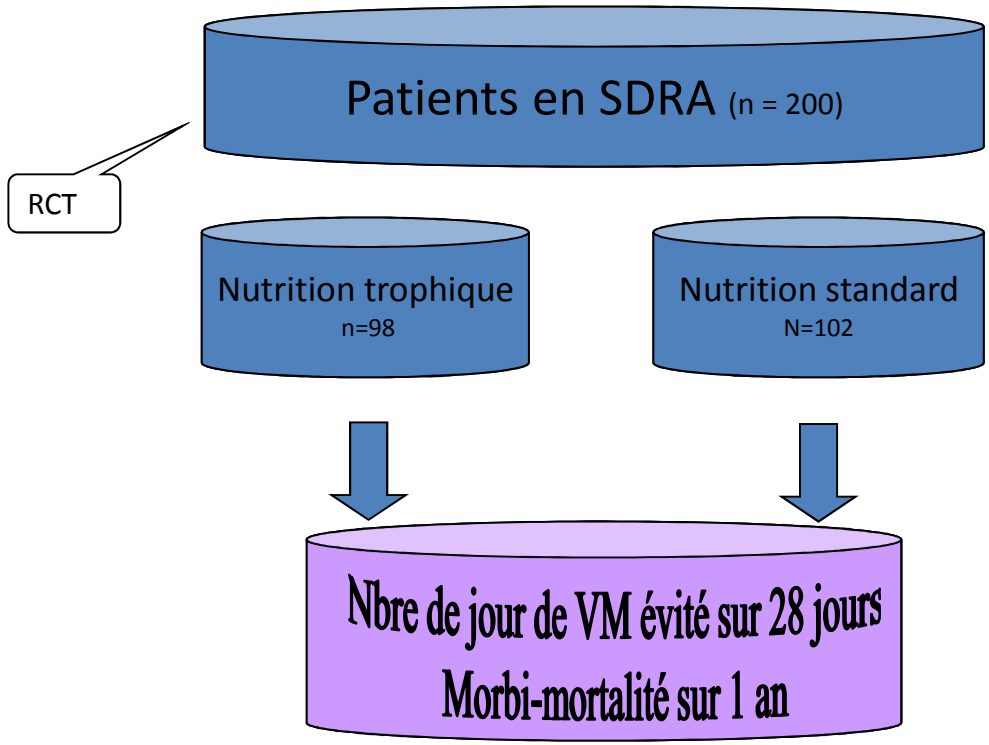
Caeser *NEJM* 2011

A Randomized Trial of Initial Trophic versus Full-Energy Enteral Nutrition in Mechanically Ventilated Patients with Acute Respiratory Failure

Todd W. Rice, MD, MSc[1], Susan Mogan, RN[1], Margaret A. Hays, RN, MSN[1], Gordon R. Bernard, MD[1], Gordon L. Jensen, MD, PhD[2], and Arthur P. Wheeler, MD[1]

[1]Division of Allergy, Pulmonary, and Critical Care Medicine, Vanderbilt University School of Medicine, Nashville, TN

[2]Department of Nutritional Sciences, Pennsylvania State University, University Park, PA



Rice CCM 2011

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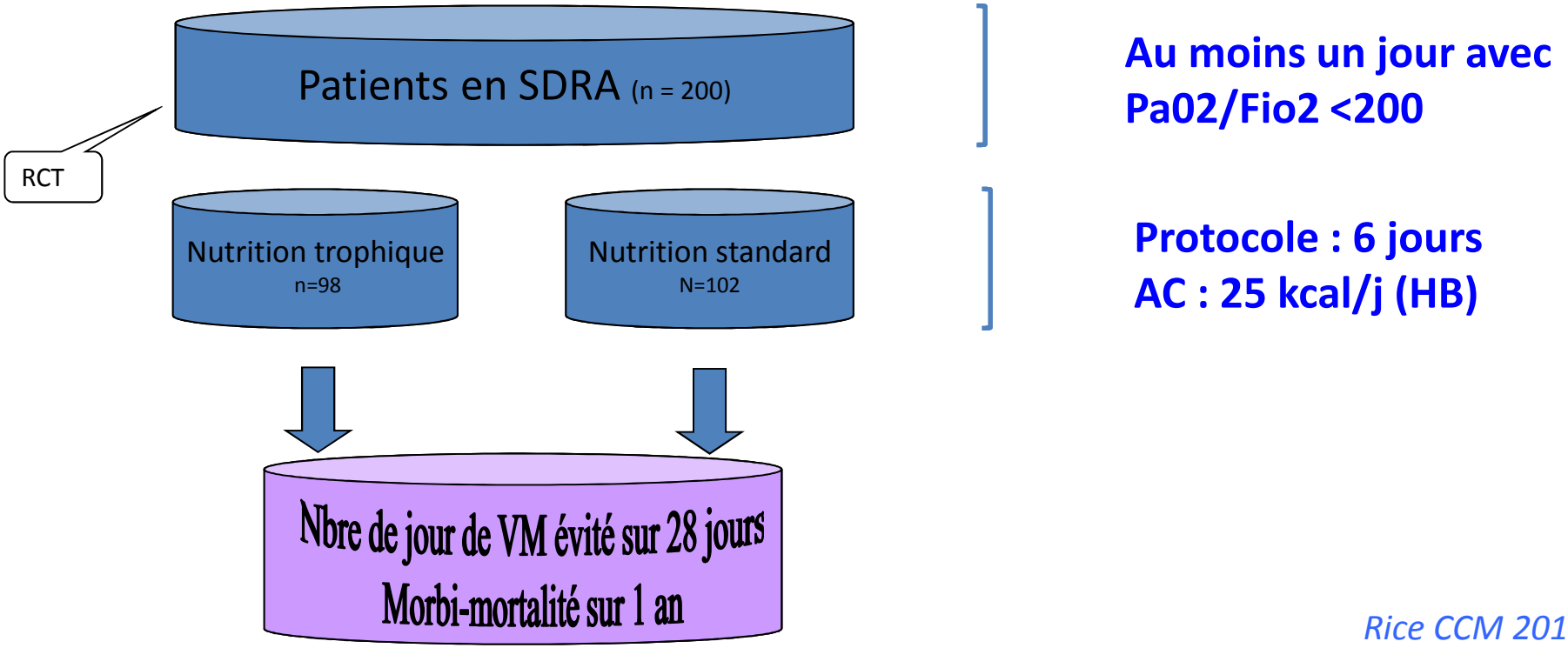
[1]Division of Allergy, Pulmonary, and Critical Care Medicine, Vanderbilt University School of Medicine, Nashville, TN

[2]Department of Nutritional Sciences, Pennsylvania State University, University Park, PA

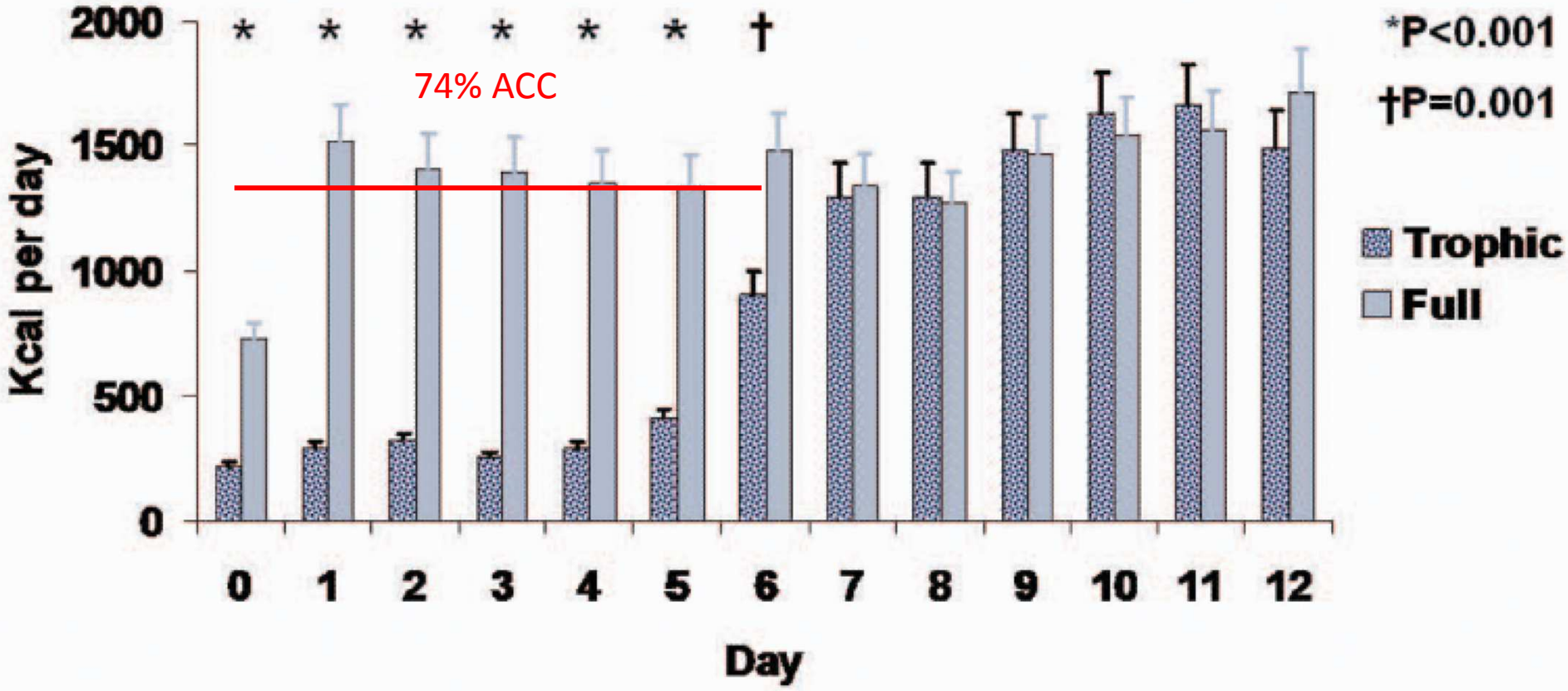


Au moins un jour avec Pa02/Fio2 <200

Protocole : 6 jours
AC : 25 kcal/j (HB)

Rice CCM 2011

Enteral Feed Calories Received Per Day



Rice CCM 2011

Characteristic	Trophic (N=98)	Full-Energy (N=102)	P-Value
Age (years)	53 ± 19	54 + 17	0.71
Female (%)	60.2	53.9	0.37
Caucasian (%)	84.7	91.2	0.25
ICU Diagnosis (%)			0.56
ALI	21	20	
Pneumonia	15	19	
Altered Mental Status/Neurological	14	15	
Sepsis	10	12	
Overdose	10	7	
APACHE II Score	26.9 ± 8.1	26.9 ± 6.6	0.94
Vasopressors (%)	35 (35.7%)	42 (41.2%)	0.43
FiO2 (%)	40.8 ± 25.0	42.3 ± 23.1	0.65
PEEP (cm H20)	7.6 ± 3.6	7.7 ± 3.7	0.82
PaO_2/FiO_2	181 ± 110	183 ± 122	0.91

Rice CCM 2011

Intolérance digestive haute ?

Intolérance gastrique?

Study or Subgroup	Post Pyloric Feeding Events	Total	Gastric Feeding Events	Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Davies 2002	4	31	11	35	29.8%	0.41 [0.15, 1.16]	2002
Montejo 2002	1	50	25	51	16.8%	0.04 [0.01, 0.29]	2002
Acosta-Escribano 2010	3	50	10	54	26.6%	0.32 [0.09, 1.11]	2010
Davies 2012	0	91	8	89	10.1%	0.06 [0.00, 0.98]	2012
Wan 2015	1	35	14	35	16.7%	0.07 [0.01, 0.51]	2015
Total (95% CI)		**257**		**264**	**100.0%**	**0.16 [0.06, 0.45]**	
Total events	9		68				

Heterogeneity: $Tau^2 = 0.65$; $Chi^2 = 7.94$, df = 4 (P = 0.09); $I^2 = 50\%$
Test for overall effect: Z = 3.48 (P = 0.0005)

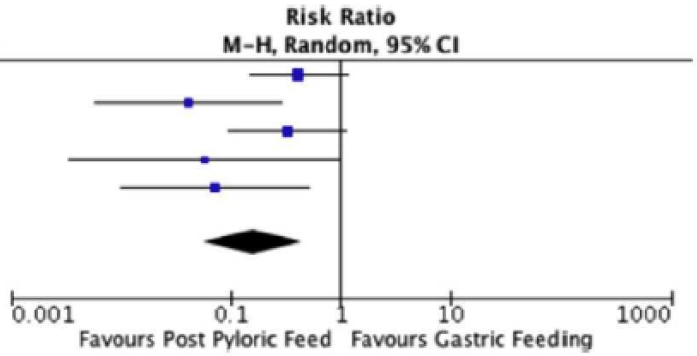
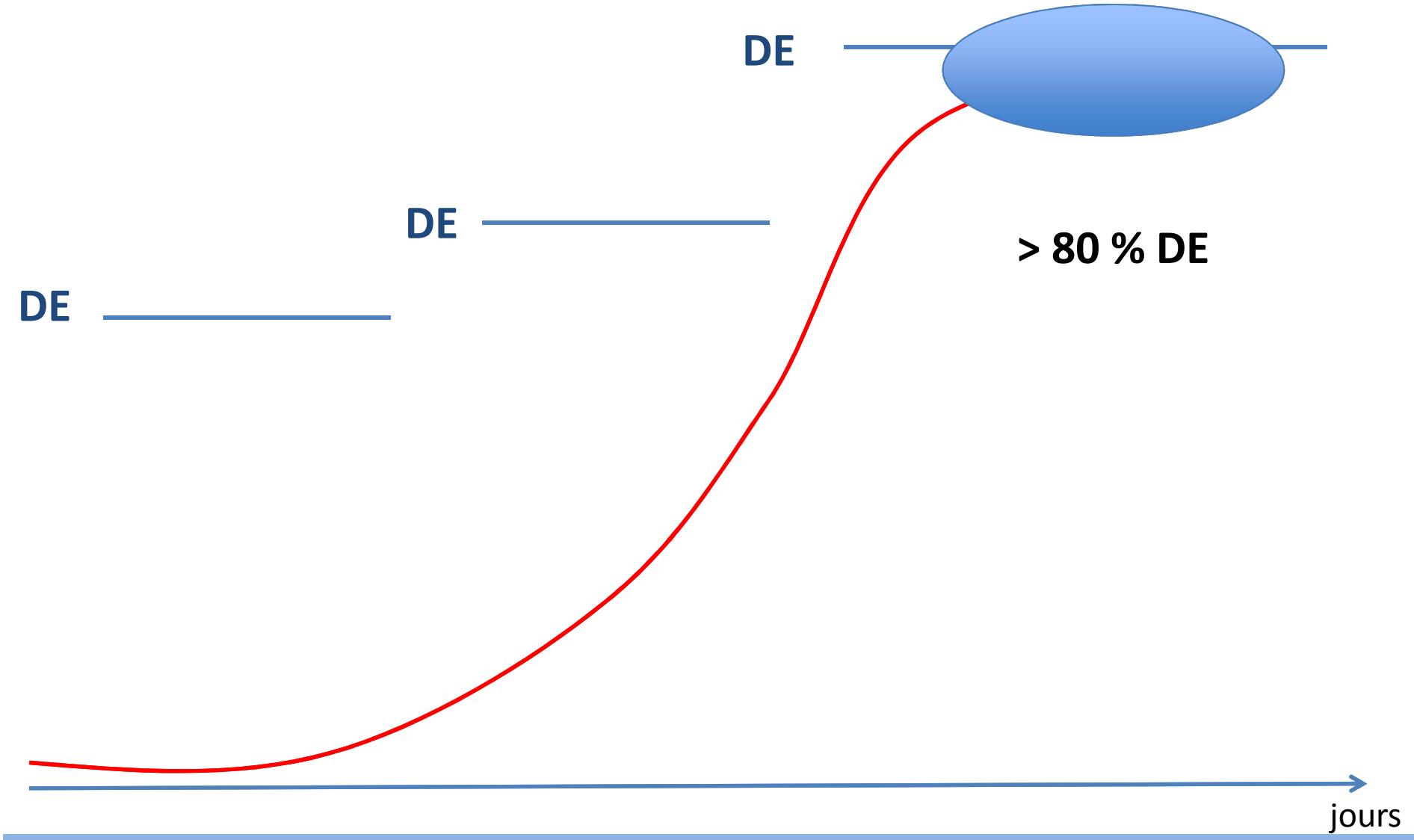


Fig. 5. Meta-analysis of feeding intolerance in patients receiving gastric or post pyloric feeding (Meta-analysis IV).

Recommandation 13 : In critically ill patients with gastric feeding intolerance, IV erythromycin should be used as a first line prokinetic therapy. Grade : B strong consensus (100%)

Quand initier la nutrition ?



Recommendation 18 : After day 3, caloric delivery can be increased up to 80-100% of measured EE Grade of recommendation: 0 - strong consensus (95%)

Nutrition parentérale ?

Recommendation 20 : In patients who do not tolerate full dose EN during the first week in the ICU, the safety and benefits of initiating PN should be weighed on a case-by-case

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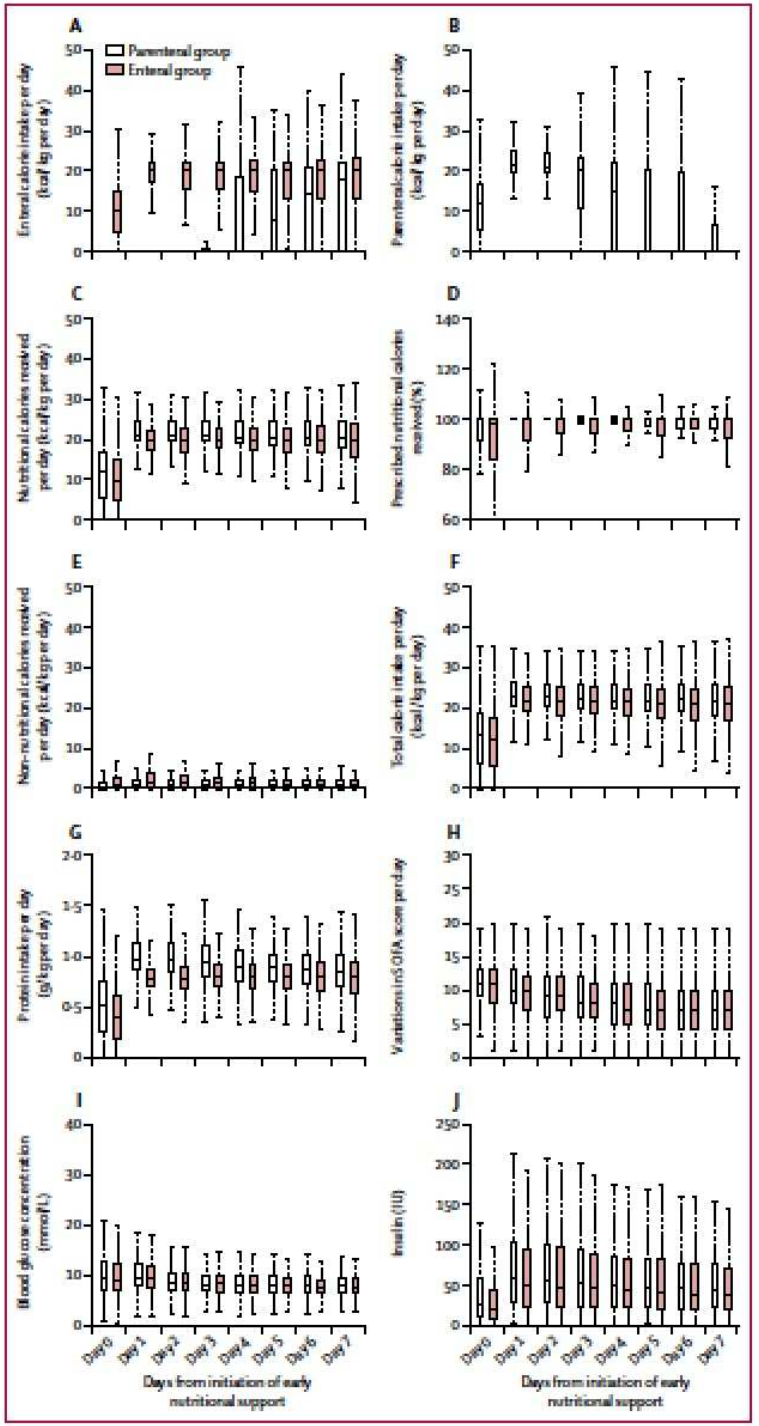

Reigner lancet 2018

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	Enteral group (n=1202)	Parenteral group (n=1208)	Absolute difference estimate (95% CI)	Hazard ratio (95% CI)	p value
Primary outcome					
Day 28 mortality	443/1202 (37%)	422/1208 (35%)	2·0 (−1·9 to 5·8)	..	0·33
Secondary outcomes					
Day 90 mortality	530/1185 (45%)	507/1192 (43%)	2·2 (−1·8 to 6·2)	..	0·28
ICU mortality*	429 (33%)	405 (31%)	..	1·10 (0·96 to 1·26)	0·17
Hospital mortality*	498 (36%)	479 (34%)	..	1·08 (0·95 to 1·22)	0·25
ICU length of stay (days)	9·0 (5·0 to 16·0)	10·0 (5·0 to 17·0)	..	..	0·08
Acute-care hospital length of stay (days)	17·0 (8·0 to 32·0)	18·0 (9·0 to 33·0)	..	..	0·11
Days without vasopressor support*	20·0 (0·0 to 25·0)	21·0 (0·0 to 26·0)	..	..	0·10
Days without dialysis*	27·0 (0·0 to 28·0)	27·0 (0·0 to 28·0)	..	..	0·52
Days without mechanical ventilation*	11·0 (0·0 to 23·0)	12·0 (0·0 to 23·0)	..	..	0·54
Infections					
ICU-acquired infection*	173 (14%)	194 (16%)	..	0·89 (0·72 to 1·09)	0·25
Ventilator-associated pneumonia*	113 (9%)	118 (10%)	..	0·96 (0·74 to 1·24)	0·75
Bacteraemia*	38 (3%)	55 (5%)	..	0·69 (0·46 to 1·04)	0·08
CVC-related infection*	29 (2%)	27 (2%)	..	1·07 (0·64 to 1·81)	0·79
Urinary tract infection*	18 (2%)	16 (1%)	..	1·13 (0·58 to 2·21)	0·73
Soft-tissue infection					
Patients (n)	1/1202	6/1208	..	..	..
Other infection*	11 (1%)	21 (2%)	..	0·52 (0·25 to 1·09)	0·08
Gastrointestinal complications					
Vomiting*	406 (34%)	246 (24%)	..	1·89 (1·62 to 2·20)	<0·0001
Diarrhoea*	432 (36%)	393 (33%)	..	1·20 (1·05 to 1·37)	0·009
Bowel ischaemia*	19 (2%)	5 (<1%)	..	3·84 (1·43 to 10·3)	0·007
Acute colonic pseudo-obstruction*	11 (1%)	3 (<1%)	..	3·7 (1·03 to 13·2)	0·04

Data are n/N (%), cumulative incidence (%), and median (IQR). Continuous data described as mean (SD) were compared using Student's *t* tests and categorical data described as median (IQR) were using Wilcoxon's nonparametric test. Outcomes reported as cumulative incidences were analysed using a competing risk approach, with death and ICU discharge as competing risks; the only exceptions were ICU mortality and hospital mortality, for which competing risks were only ICU discharge and hospital discharge, respectively. ICU-acquired infections included ventilator-associated pneumonia, bacteraemia, urinary tract infections, catheter-related infections, and other infections. Outcomes expressed as percentages of patients with each outcome were compared between the two groups using χ^2 tests. ICU=intensive-care unit. CVC=central venous catheter. *Number of days alive and free of specified organ support up to day 28.

Table 3: Outcomes

Nutrition parentérale ?

Recommendation 20 : In patients who do not tolerate full dose EN during the first week in the ICU, the safety and benefits of initiating PN should be weighed on a case-by-case

Nutrition parentérale ?

-> » vers » la fin de la première semaines

-> « plus tôt » si dénutrition préalable

Recommendation 20 : In patients who do not tolerate full dose EN during the first week in the ICU, the safety and benefits of initiating PN should be weighed on a case-by-case

Apport protéique ?

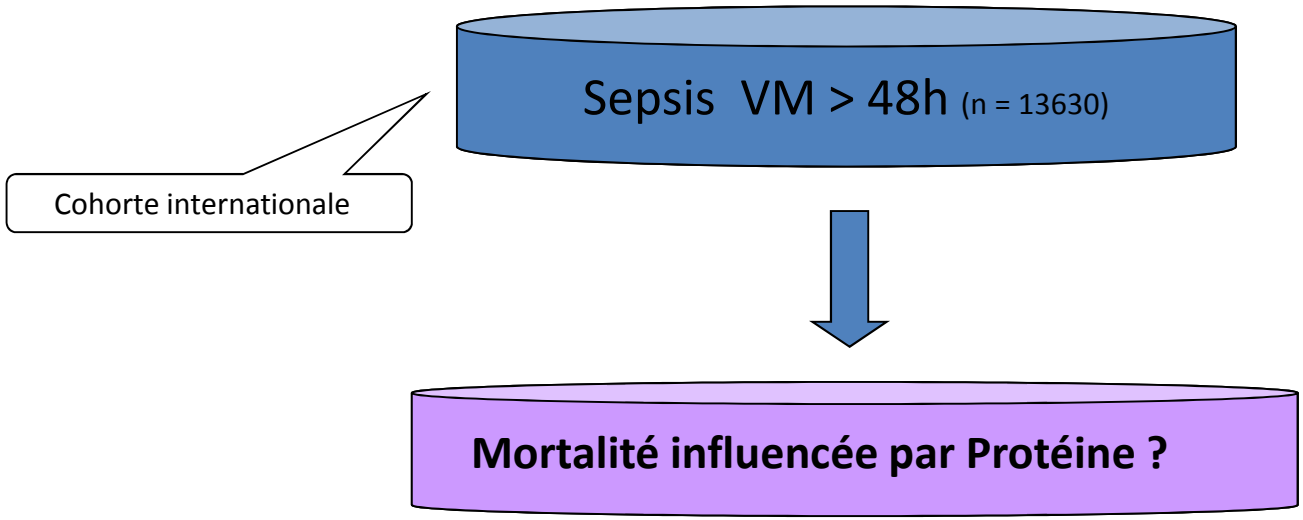
Recommendation 22 : During critical illness, 1.3 g/kg protein equivalents per day can be delivered progressively Grade : 0 - strong consensus (91%)

http://ccforum.com/content/18/1/R29

CRITICAL CARE

RESEARCH Open Access

Close to recommended caloric and protein intake by enteral nutrition is associated with better clinical outcome of critically ill septic patients: secondary analysis of a large international nutrition database



Données 0 -12 jours
NP exclu

Elke *CCM* 2014

Effet de l'apport calorique chez le patient septique

	Unadjusted			Adjusted		
	Odds ratio	95% CI	*P* value	Odds ratio	95% CI	*P* value
A: Total study population (n = 2,270)						
Energy intake						
Per 1,000 kcal	0.51	(0.41-0.64)	<0.001	0.61	(0.48-0.77)	<0.001
Protein intake						
Per 30 gram	0.70	(0.61-0.80)	<0.001	0.76	(0.65-0.87)	<0.001
B: Sensitivity analysis (n = 1,560)						
Energy intake						
Per 1,000 kcal	0.56	(0.44-0.71)	<0.001	0.61	(0.48-0.79)	<0.001
Protein intake						
Per 30 gram	0.72	(0.62-0.83)	<0.001	0.75	(0.64-0.87)	<0.001

Odds of 60-day mortality per increase of 1,000 kilocalories (top) and 30 gram of protein (bottom) received per day both unadjusted and adjusting for nutrition days, BMI, age, and APACHE II score. Panel A shows data in the total study population and Panel B the data for the patients included in the sensitivity analysis who received enteral nutrition at least 7 days in the ICU and who were alive and evaluable for subsequent outcome. CI, confidence interval; kcal, kilocalories.

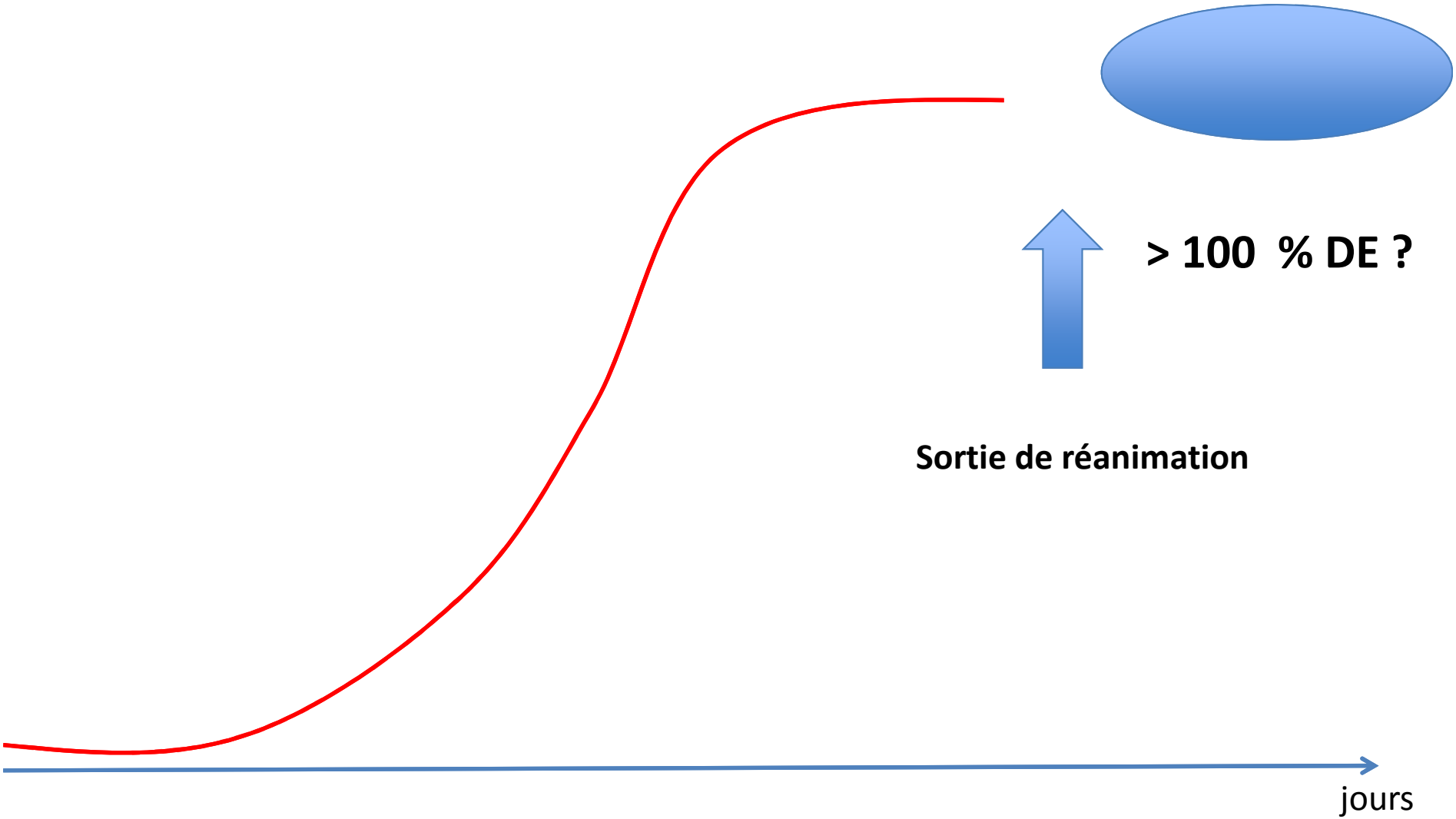
Elke *CCM* 2014

Apport protéique ?

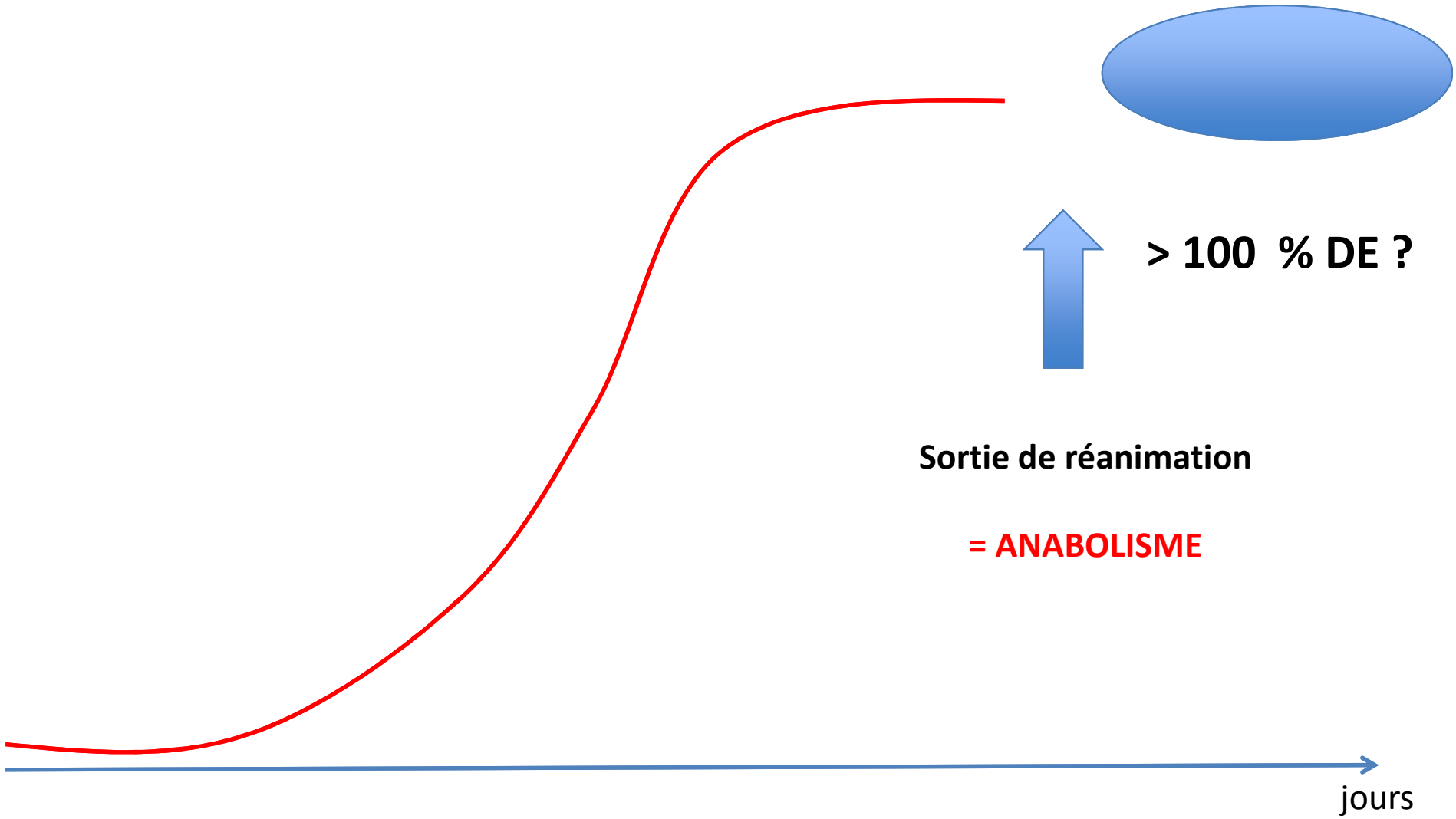
1,3 g/kg

Recommendation 22 : During critical illness, 1.3 g/kg protein equivalents per day can be delivered progressively Grade : 0 - strong consensus (91%)

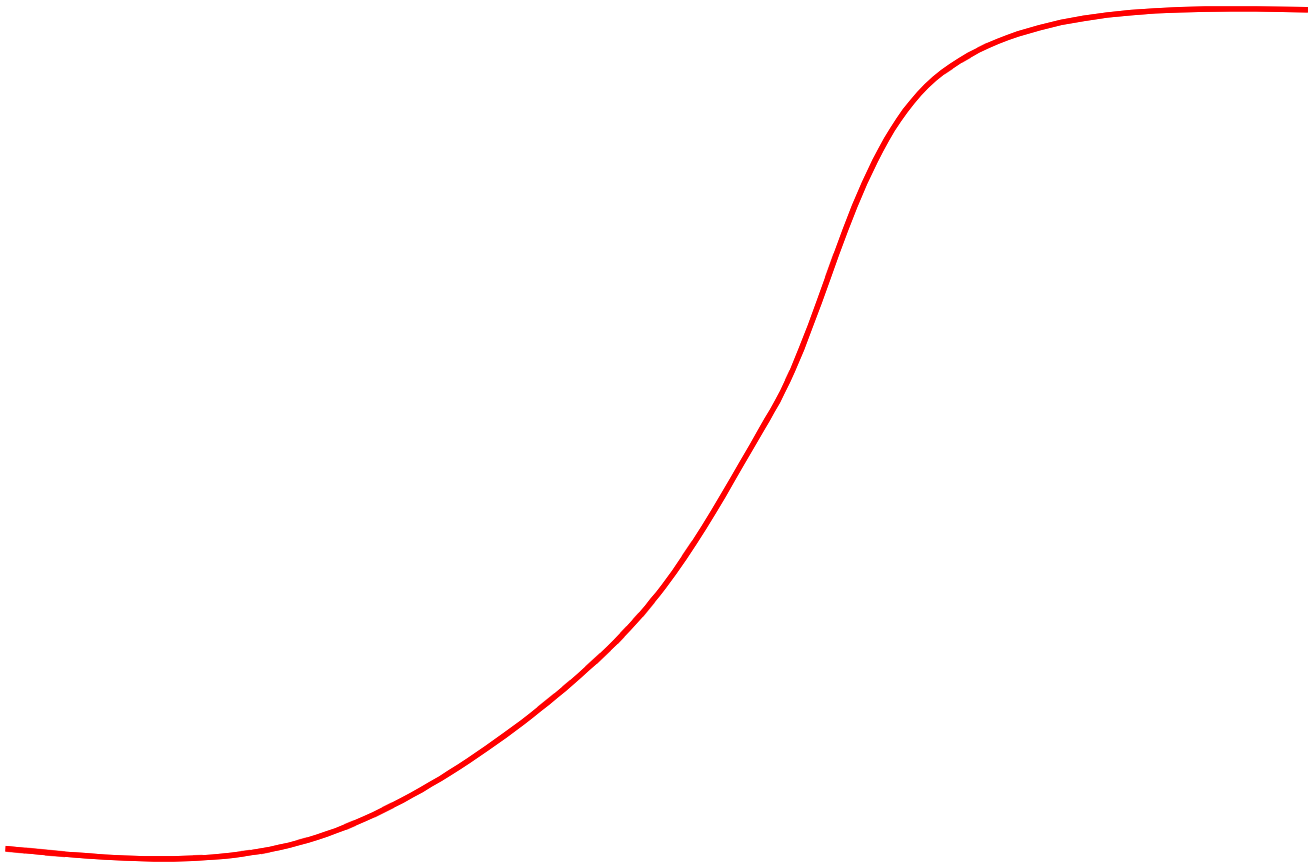
Après la réanimation ?



Après la réanimation ?



Travail en équipe



Encadré 6.6 – Il faut instituer une stratégie multidisciplinaire formalisée de NE (Accord faible).