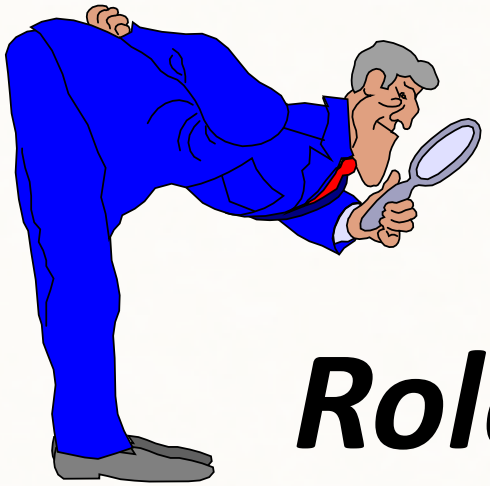
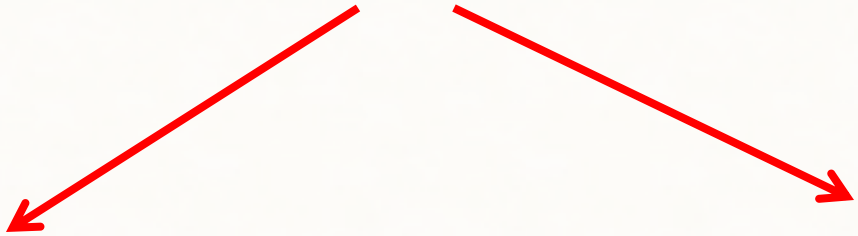


Role of Nutrients in Critically Ill Patients

Wafaa Taha Salem, MD, Professor of Anesthesia, Intensive care
Vice Dean of NCI, Cairo university

‘critically-ill patient’

- The term ‘critically-ill patient’ refers to a group of patients with diverse diseases,



The population of critically-ill patients is not a homogeneous population

- surgical,
- trauma
- medical .

They have very different or even opposing metabolic responses.

Critically-ill patients is not a homogeneous population

≠

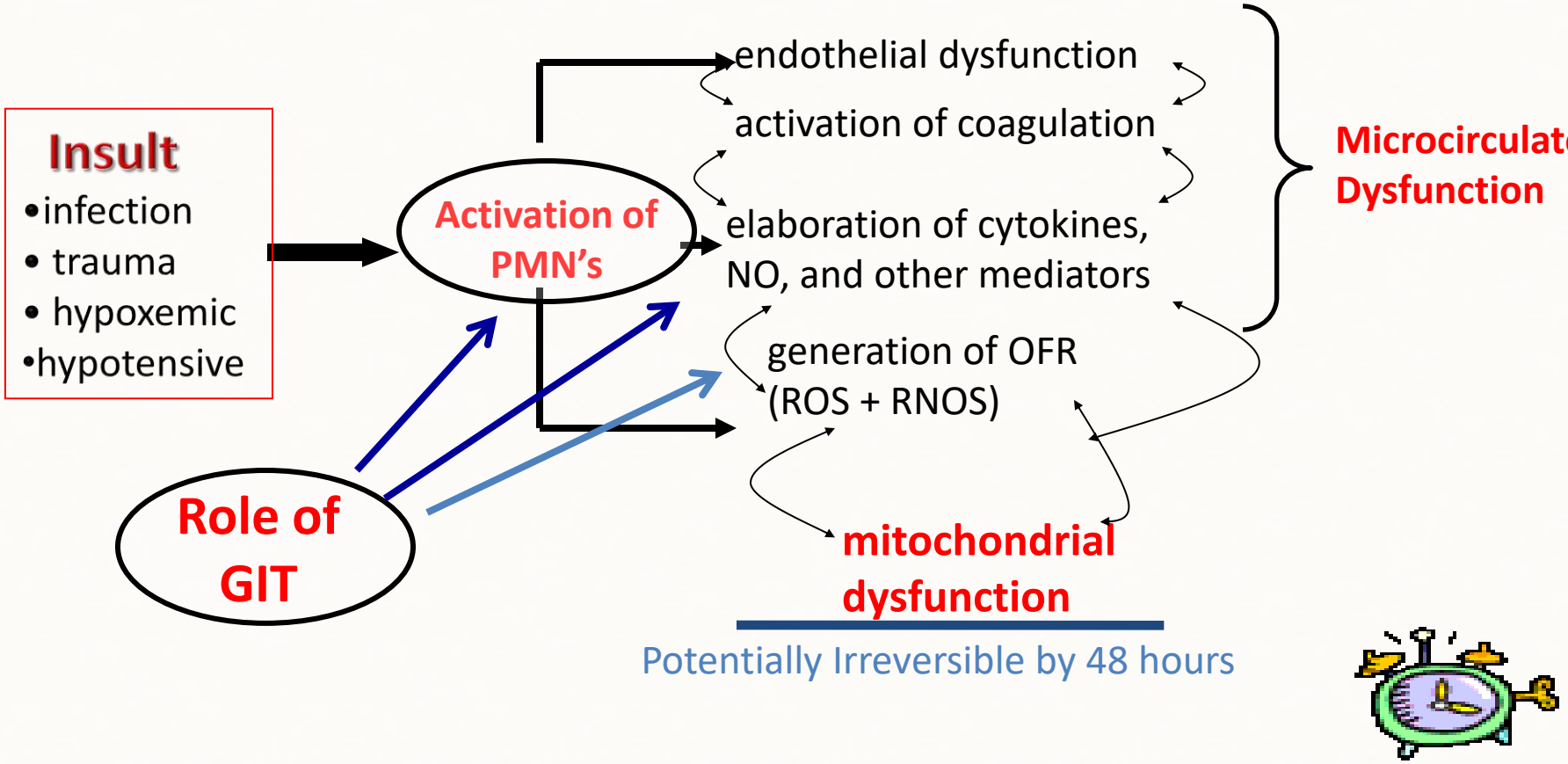
Nutrients requirement critically-ill patient

Macronutrient
- Carbohydrate
- Lipids
- Proteins

Micronutrient
- Vitamins
- Minerals
- Trace elements

Immunonutrients
- Glutamine
- Arginine
- Omega-3 fatty acids

Pathophysiology of Critical Illness 1



oxidative stress == cellular energetic failure== organ failure

Death

How can Nutrients help the critically ill?

- Provide nutritional substrates to meet protein and energy requirements
- Help protect vital organs and reduce break down of skeletal muscle
- To provide nutrients needed for repair and healing of wounds and injuries
- To maintain gut barrier function
- Modulate underlying pathphysiological processes in critically ill to improve outcome .

When to start and how to give?

Critically-ill patients who are not expected to receive a complete oral diet for at least 3 consecutive days should receive specialized nutritional support (C).

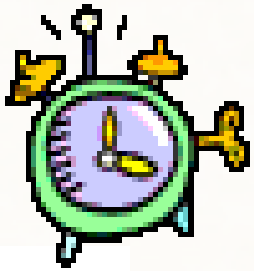
SEMICYUC:& SENPE Nutr Hosp 2011

Early administration, ranging from 24 to 72 h from admission to the ICU.

More (and Earlier) is Better!

If you feed them (better!)
They will leave (sooner!)

Early vs. Delayed EN: Effect on Infectious Complications



Review: Early Enteral Nutrition vs. delayed nutrient intake
Comparison: 01 Early EN vs. delayed nutrient intake
Outcome: 02 Infectious Complications

Study or sub-category	Early EN n/N	delayed n/N	RR (random) 95% CI	Weight %	RR (random) 95% CI	Year
Moore	3/32	9/31		3.96	0.32 [0.10, 1.08]	1986
Singh	7/21	12/22		9.81	0.61 [0.30, 1.25]	1998
Kompan	9/27	16/25		12.53	0.52 [0.28, 0.96]	1999
Minard	6/12	7/15		8.48	1.07 [0.49, 2.34]	2000
Malhotra	54/100	67/100		33.98	0.81 [0.64, 1.01]	2004
Peck	12/14	11/13		27.04	1.01 [0.74, 1.39]	2004
Nguyen	3/14	6/14		4.21	0.50 [0.15, 1.61]	2008
Total (95% CI)	220	220		100.00	0.76 [0.59, 0.98]	

Total events: 94 (Early EN), 128 (delayed)
Test for heterogeneity: Chi² = 9.22, df = 6 (P = 0.16), I² = 34.9%
Test for overall effect: Z = 2.09 (P = 0.04)

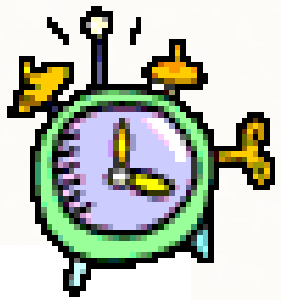
0.1 0.2 0.5 1 2 5 10

Favours Early EN Favours delayed

Updated 2009

www.criticalcarenutrition.com

Early vs. Delayed EN: Effect on Mortality



Review: Early Enteral Nutrition vs. delayed nutrient intake
Comparison: 01 Early EN vs. delayed nutrient intake
Outcome: 01 Mortality

Study or sub-category	Early EN n/N	Delayed n/N	RR (random) 95% CI	Weight %	RR (random) 95% CI	Year
Moore	1/32	2/31		2.77	0.48 [0.05, 5.07]	1986
Chiarelli	0/10	0/10			Not estimable	1990
Eyer	2/19	2/19		4.44	1.00 [0.16, 6.38]	1993
Chuntrasakul	1/21	3/17		3.24	0.27 [0.03, 2.37]	1996
Singh	4/21	4/22		9.76	1.05 [0.30, 3.66]	1998
Kompan 1999	0/14	1/14		1.57	0.33 [0.01, 7.55]	1999
Minard	1/12	4/15		3.61	0.31 [0.04, 2.44]	2000
Pupelis2000	1/11	5/18		3.77	0.33 [0.04, 2.45]	2000
Pupelis	1/30	7/30		3.69	0.14 [0.02, 1.09]	2001
Dvorak	0/7	0/10			Not estimable	2004
Kompan 2004	0/27	1/25		1.53	0.31 [0.01, 7.26]	2004
Malhotra	12/100	16/100		31.58	0.75 [0.37, 1.50]	2004
Peck	4/14	5/13		13.17	0.74 [0.25, 2.18]	2004
Nguyen	6/14	6/14		20.86	1.00 [0.43, 2.35]	2008
Total (95% CI)	332	338		100.00	0.68 [0.46, 1.01]	

Total events: 33 (Early EN), 56 (Delayed)
Test for heterogeneity: Chi² = 6.36, df = 11 (P = 0.85), I² = 0%
Test for overall effect: Z = 1.90 (P = 0.06)

0.1 0.2 0.5 1 2 5 10
Favours Early EN Favours delayed

Updated 2009

www.criticalcarenutrition.com

Routes of Nutrients supply critically ill patient

Enteral route

1. Nasogastric tube
2. Gastrostomy tube
3. jejunostomy

- Routine or standard use of the naso-jejunal tube in critically-ill patients is not associated with increased efficacy in provision of enteral nutrition or a lower rate of infectious complications **(A)**.
- Severe acute pancreatitis, Elevated gastric output. can be considered (C).

SEMICYUC:& SENPE Nutr Hosp 2011

What if you can't provide adequate early enteral nutrition?

… to PN or not to PN,

that is the question!

Complementary parenteral nutrition should be started when 60% of nutritional requirements are not met at the fourth day of admission, or for at least 2 consecutive days during the hospital stay (C).

SEMICYUC:& SENPE Nutr Hosp 2011

Original Communication

Near-Target Caloric Intake in Critically Ill Medical-Surgical Patients Is Associated With Adverse Outcomes

Journal of Parenteral and Enteral Nutrition
Volume 34 Number 3
May 2010 280-288

10.1177/0148607109353439
http://jpen.sagepub.com
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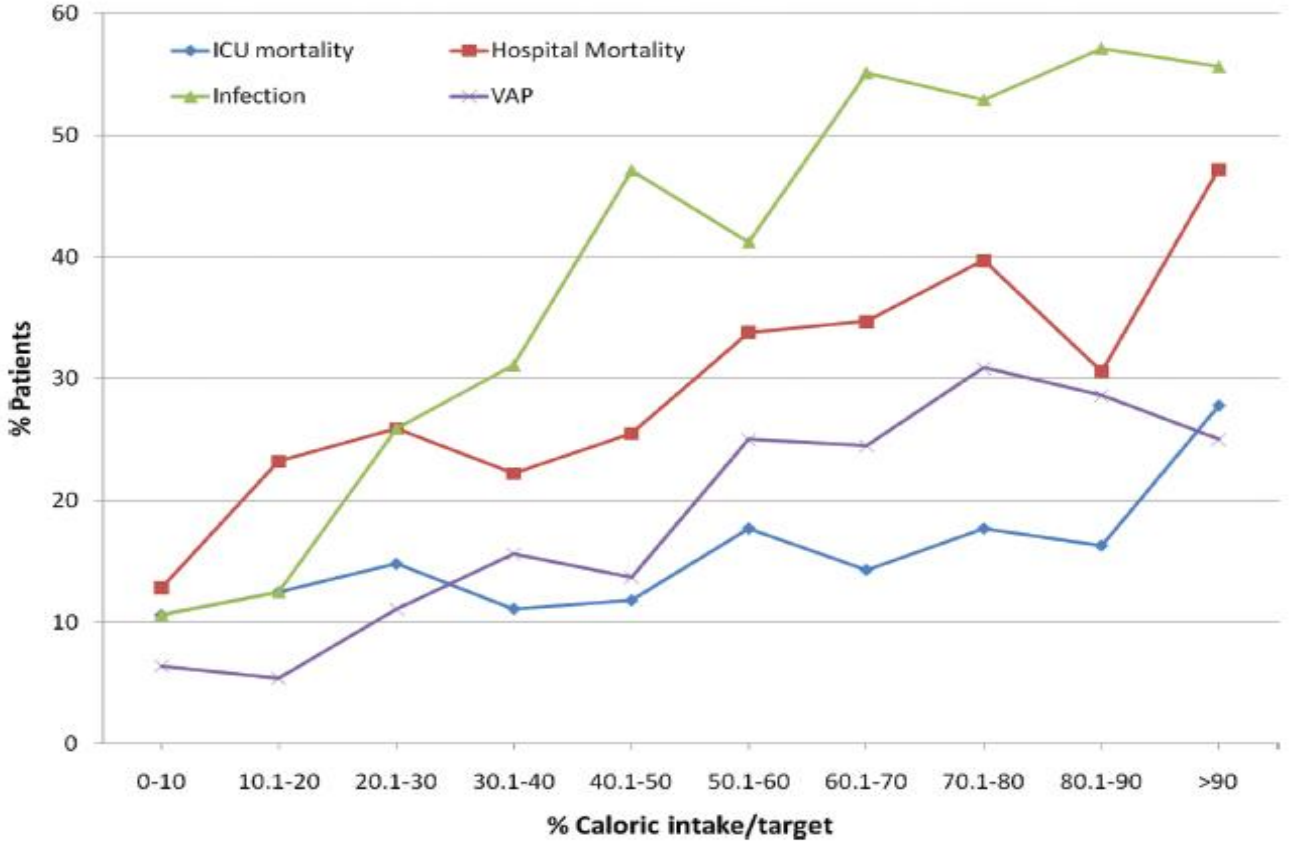


Figure 1. The association among intensive care unit (ICU) mortality, hospital mortality, ICU-acquired infections, and ventilator-associated pneumonia (VAP) rate and caloric intake/requirement.

The role of carbohydrates critically-ill , What type &amount should be supplied

- Stores are depleted in less than 24 hrs of fasting
- skeletal muscle protein breakdown-- AA convert to glucose in the liver

Glucose

- 4 g/kg/day
- 50% of the global energy requirements,
- maintaining blood sugar 140 and 180 mg/dL

insulin →

It is recommended, as most appropriate, to maintain glycemia levels below 150 mg/dl **(C).**

The role of lipids in critically-ill ,
What type &amount should be supplied

- **Providing energy**
  - concentrated
  - isotonic
  - non-glucose
- **Prevent essential fatty acids deficiency**
- **Absorption of fat-soluble vitamins**
- **Maintain the structure of cell membranes**
- **Modulate intracellular signals**
- **Modulate immune cell function**

lipids

➢The recommended lipid supply is 0.7-1.5 g/kg/day

➢ It is recommended to avoid single ω-6 supplies in critically-ill

➢ a high ω-3 content from fish oil should be indicated for patients with acute lung injury (ALI) and (ARDS)

➢ The lipid emulsion with mixtures of (MCT), (FO), (OO) well tolerated and are used with preference over LCT

➢ Up to 40% of non-protein calories may be provided.

✓Preferred concentrations of 30 or 20% vs 10%

✓longer perfusions rather than in short periods

The role of protein in critically-ill , What type &amount should be supplied.

In critically-ill patients, no specific formulation of amino acids has been defined for generic use (C).

Branched chain amino acid's – support immune cell functions.

The there is not sufficient evidence to justify the use of formula with excess branched chain amino acids in critically ill specially in septic patients.

SEMICYUC:& SENPE Nutr Hosp 2011

In general, the supply must be adjusted to an amount of

1-1.8 g/kg/day (B).

1.5 g/kg/day decreases protein catabolism by 70%,

Estimate protein requirement

UUN : 5- 10 **level 1 stress** (1.2 –1.3 g protein/ kg BW)

UUN : 10- 25 **level 2 stress** (2 g protein/ kg BW)

very high supplies are not recommended,

- 2 g/kg/day causes an increase in net protein degradation, drive urea genesis .
- **No improvement in overall balance**
- will not likely promote better nitrogen retention,

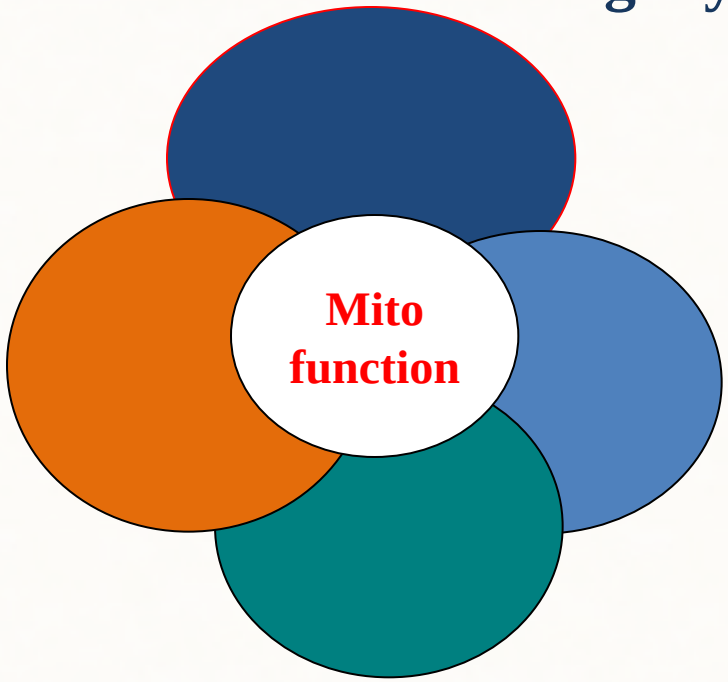
Kcal : N ratio

150: 1 (moderate stress) 80 –100 : 1 (severe stress)

The Role of Immunonutrients in Critically ill

Specific nutrients found to have effects on immune system, metabolism, and GIT structure and function

Mucosal Barrier Integrity



Oxidative stress

Inflammation

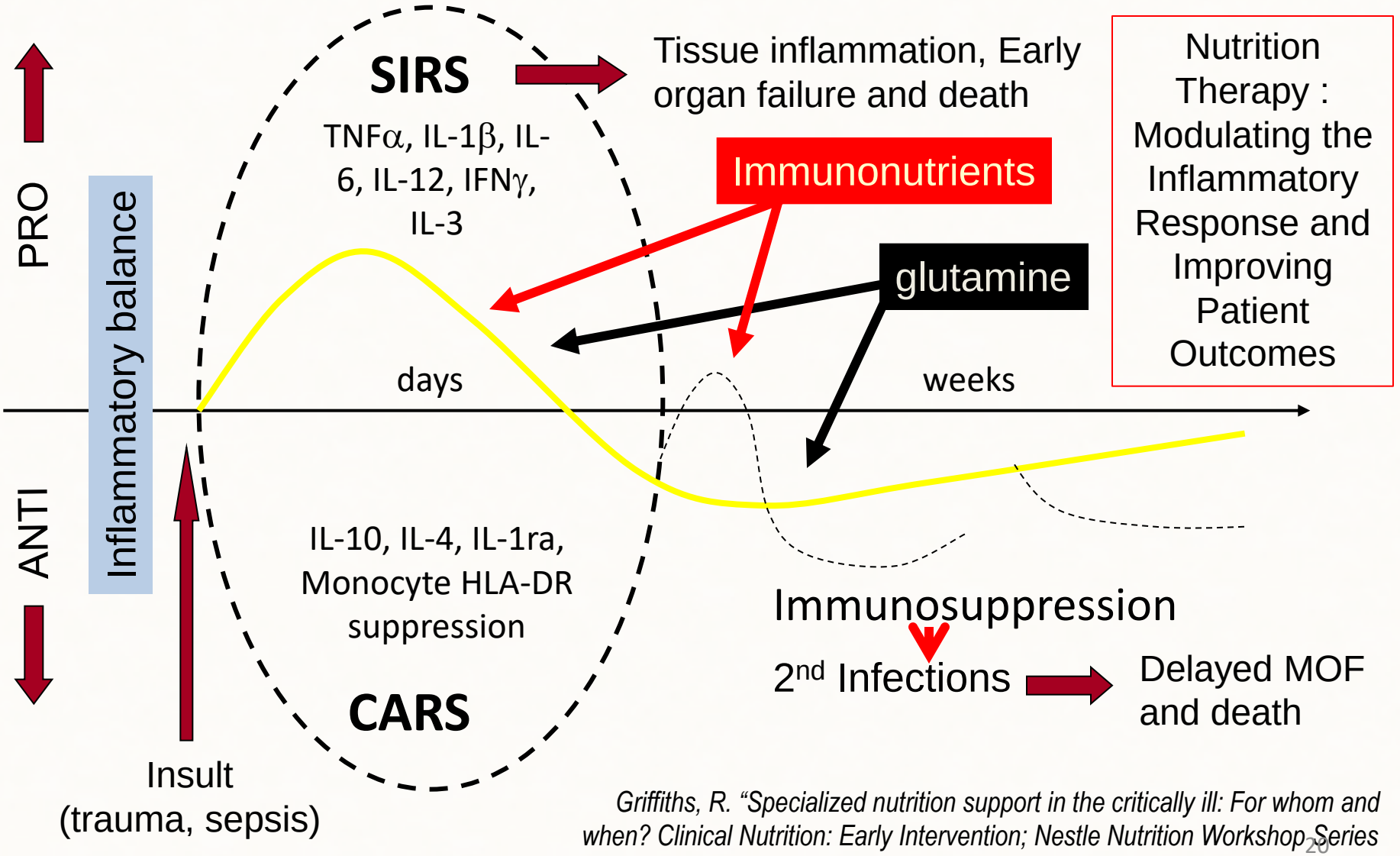
Cellular Immune Function

Glutamine

Arginine

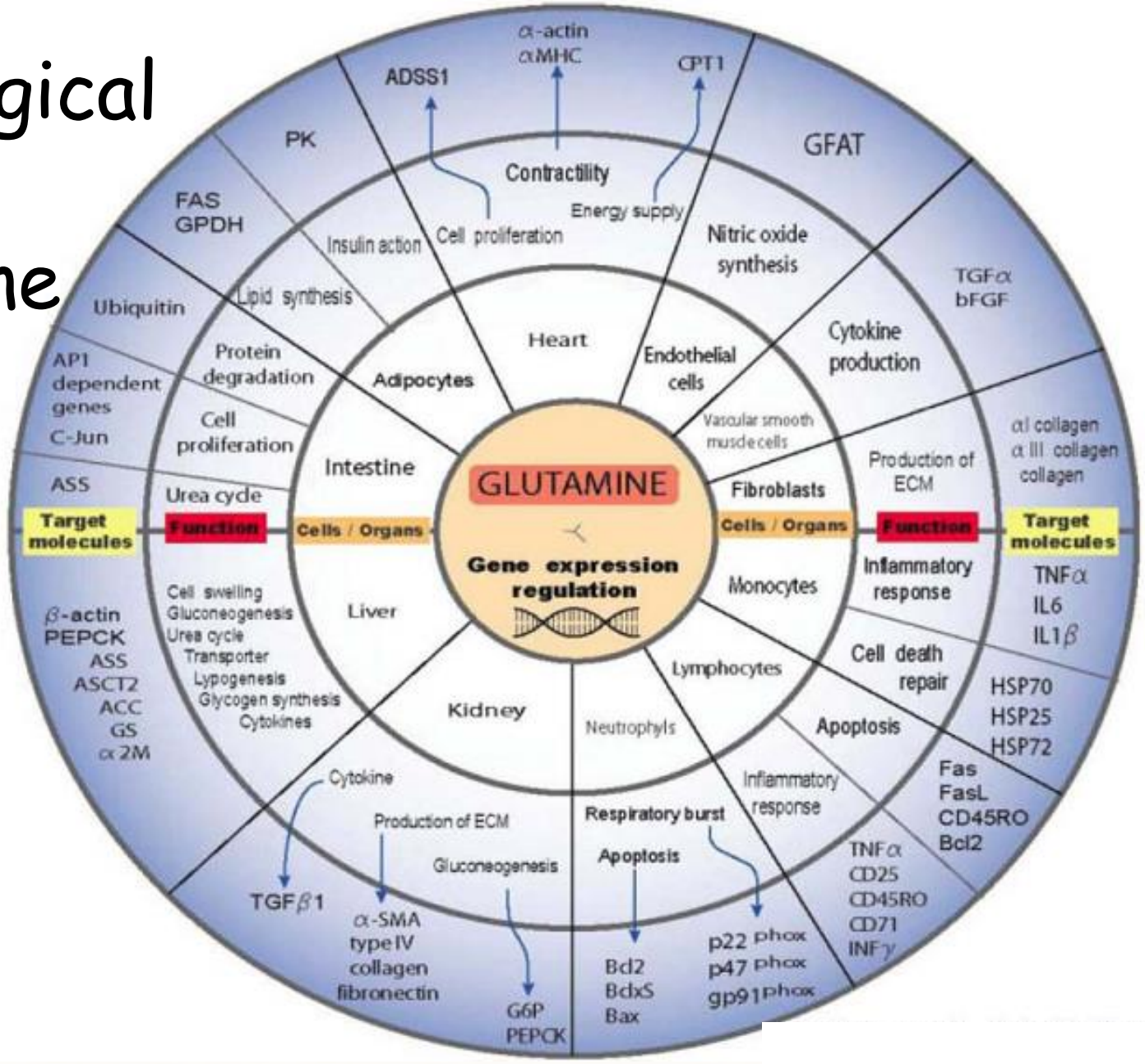
Omega-3 fatty acids

Inflammation and organ failure in the ICU



Griffiths, R. "Specialized nutrition support in the critically ill: For whom and when? Clinical Nutrition: Early Intervention; Nestle Nutrition Workshop Series

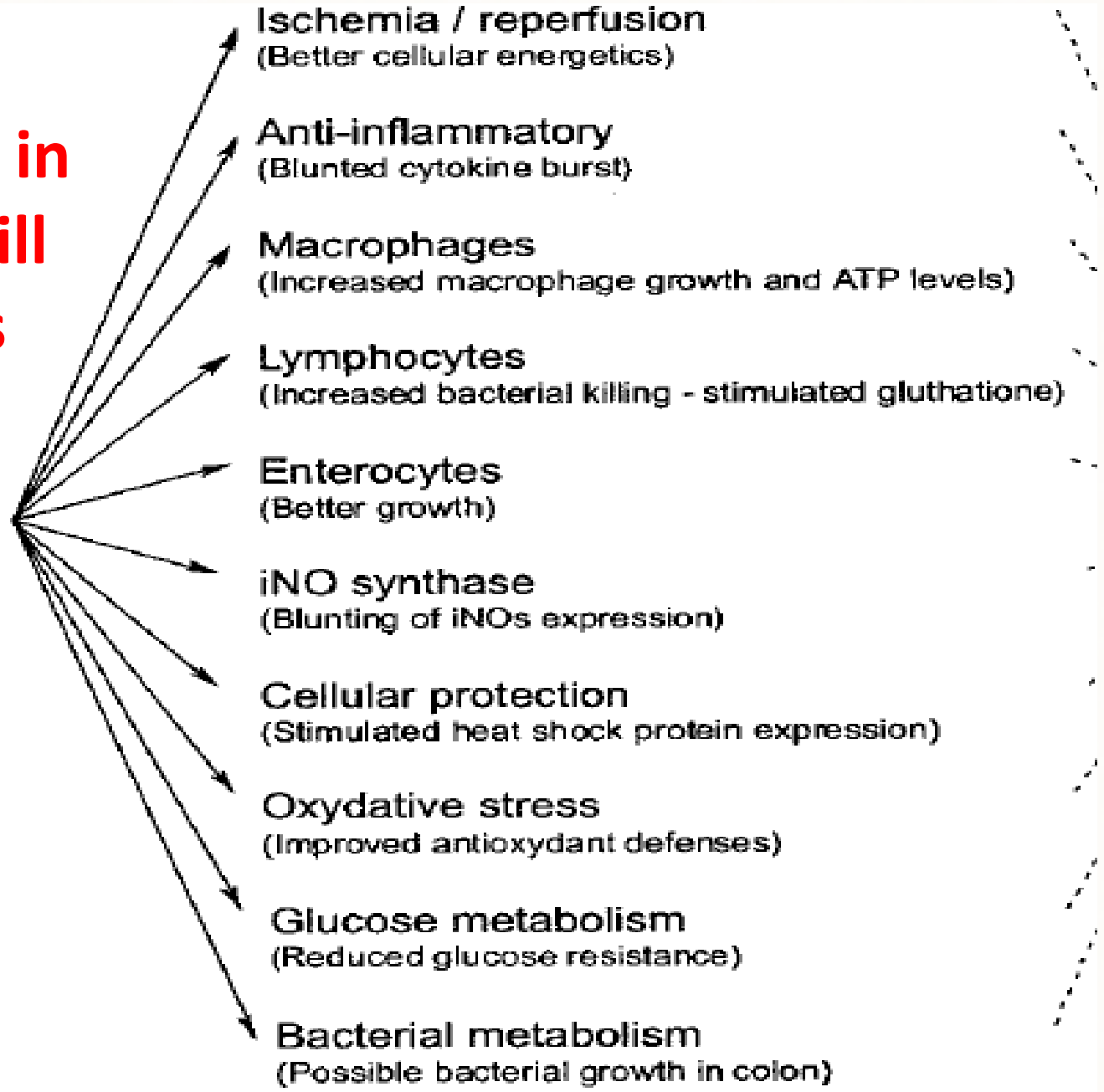
Physiological Role of Glutamine



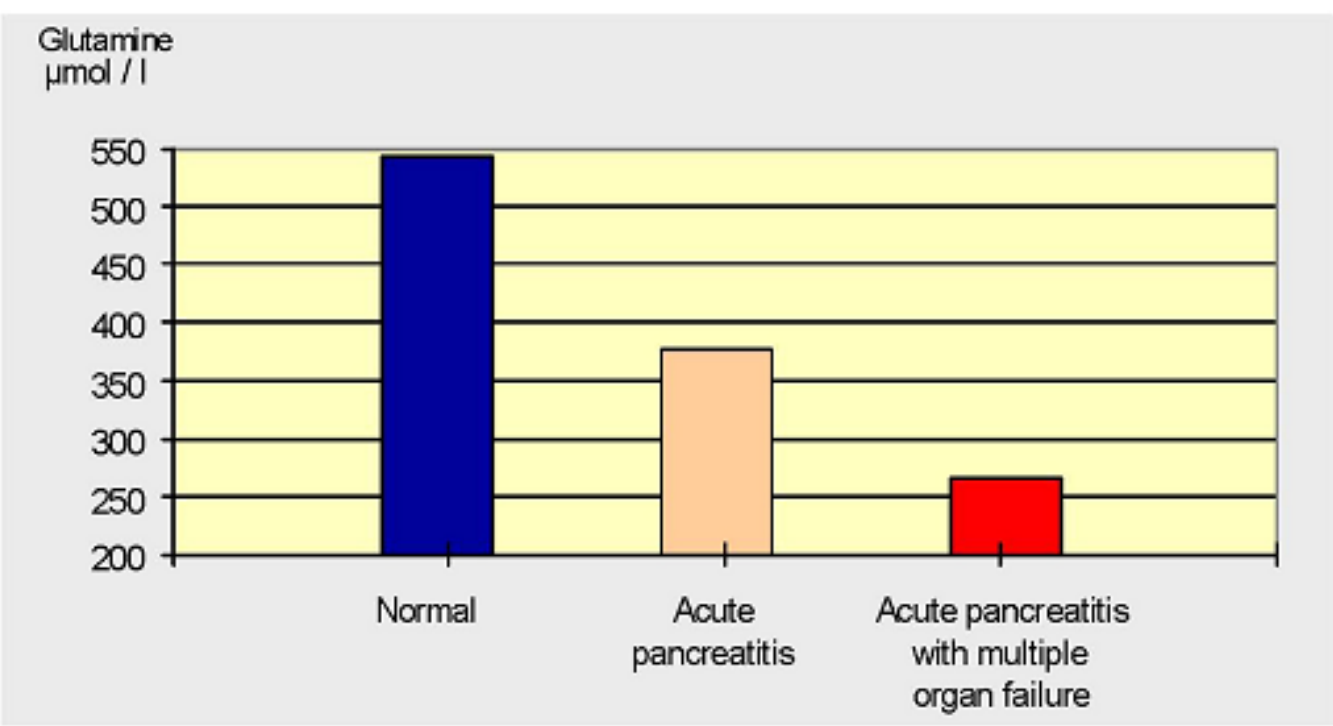
Curi R, et al, J Cell Physiol, 2005

Role of glutamine in Critically ill patients

Conditionally essential amino acid



Glutamine depletion in Plasma and Severity of Disease



- The sicker the patient the higher the glutamine demand
- Low plasma glutamine at admission to ICU associated with the risk of poor outcome

[1] Roth et al. 1986, [2] Oudemans-Van Straaten et al. 2001

Is glutamine administration of choice in Critically ill patients or sepsis?

In critically-ill patients intravenous administration of glutamine dipeptide (Ala-Gln) of 0.5 g/kg/day is recommended, complementing parenteral nutrition (A).

Although no studies have been performed in humans to evaluate the effect of glutamine on septic patients receiving PN When parenteral nutrition is indicated, it is recommended to use glutamine supplements (B).

When the patient is receiving EN It is recommend to give IV glutamine , as a supplement,

CLINICAL NUTRITION WEEK 2013
February 9-12, 2013

- Do not exceed Glutamine recommended dose (up to 0.5 g/ kg IBW) in critically ill patients
- A combined enteral and intravenous administration of glutamine can be used as long as the total does not exceed 0.5 g/ kg IBW

i.v. glutamine-containing product should not be given in patients with

- renal insufficiency
- multi-organ failure incl. metabolic acidosis
- insufficient clinical nutrition

Role of Arginine in Critically ill patients

It is a non essential amino acid

It is reduced in trauma and sepsis.

- an increase in acute phase reactants,
- It gives rise to an increase in nitrogenous compounds such as NO. with antibacterial activity
- It can increase substrates necessary for the synthesis of connective tissue (leads to wound healing).
- action as bowel neurotransmitter
- activity in insulin stimulation,
- regulator of microcirculation
- improve immune function. And promoting cell growth and cell differentiation
- modulation of cell signals

Are diets with mixtures of Pharmaconutrients indicated in critically ill (IMD)

There is a controversy about the outcomes and recommendations of the different meta analyses about (IMD)

(arginine,ω-3, nucleotides, antioxidants)

- In Sepsis; It may be associated with increased mortality.

Montejo JC,et al .Clin Nutr 2003

- there is sufficient evidence to use IMD in critically-ill patients, considering the benefits associated with their use and the lack of harmful effects

Marik PE, et al Intensive Care Med 2008

- A randomized, controlled, prospective study on PN vs EN enriched with Pharmaconutrients (mixture of arginine, ω -3 and antioxidants) in septic patients reported a greater intra-ICU mortality in the enteral group

Bertolini G, et al Intensive Care Med 2003

❖ last meta analysis published, concluded that only in the group of patients with sepsis, septic shock, or acute respiratory distress syndrome (ARDS), the use of IMD was associated with a significant decrease of mortality, secondary infections, and stay at the ICU, but provided this formula contained fish oil. SEMICYUC:& SENPE Nutr Hosp 2011

❖ IMD (arginine, ω-3, antioxidants) in septic patients in a critical condition. is associated with lower mortality compared with the use of a control diet SEMICYUC:& SENPE Nutr Hosp 2011

If unable to tolerate <700ml/d immune modulating formula should be stopped.

Antioxidants , vitamins and trace elements

The plasma concentration of micronutrients with antioxidant capacity decreases in critically-ill, particularly in septic patients

special attention should be paid to the supply of trace elements (particularly selenium, zinc and copper) and vitamins

The need for supplying micronutrients (vitamins and trace elements) **is set (A),**

But the amount cannot be established.

SEMICYUC:& SENPE Nutr Hosp 2011

❖ Meta-analysis of 15 randomized studies a combination of antioxidant vitamins and trace elements(selenium, zinc and copper)

> Reduces mortality and the duration of mechanical ventilation

> Does not improve infectious complications or length of stay

Canadian Clinical Practice Guidelines 2011

❖ The REDOX study,2013 on the potential beneficial effect of selenium for critically ill patients, Supplementation with antioxidants: selenium (i.v.) **plus** selenium, Vit. C+E, zinc, ß-carotene (enterally)

No significant difference found for 28-day mortality in any statistical analysis

High-dose selenium supplements alone may not be recommended routinely critically ill patients

Summary

The main Role of Nutrients is Improve Survival of Critically Ill Patients

- Energy: Carbohydrate and fat intake frees up protein (essential amino acids and nitrogen) so that it can be used for tissue building.
- Antioxidants, Vitamins and minerals: Control protein and energy metabolism through their coenzyme roles.
- Immunonutrients : Modulate underlying pathphysiological processes

Thanks
for listening

! Questions?