



THE ED APPROACH OF THE CHILD WITH SUSPECTED METABOLIC DISEASE

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- Approach to a child with suspected metabolic disorder
- Types commonly seen
- ED presentation of metabolic emergencies
- ED management priorities
- Improve morbidity and mortality

Case Scenario

- 6 month old
- C/O vomiting, crying
- Past Hx ? Metabolic Disorder

- WHAT ?????



Challenges for EP

- Multiple phenotypes
- Non specific presentations
- Identify management priorities
- Mortality



CHALLENGES

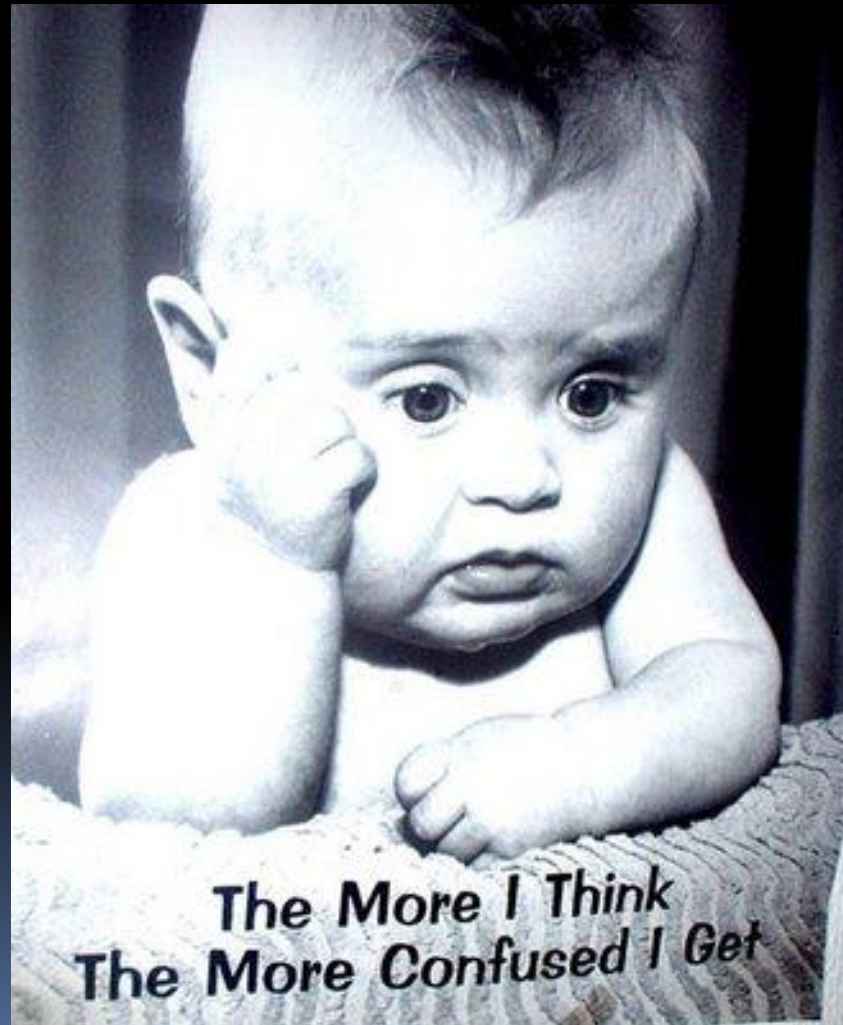
ANYONE CAN HOLD THE HELM WHEN THE SEA IS CALM.



Role of EP

- Identify risk population
- Early recognition
- Aggressive management
- Appropriate disposition

What to do ?



Approach to Suspected Metabolic Disorder

- History
- Consanguineous marriage
- Unexplained neonatal death
- Ethnic background (tribes)
- Sudden onset of s/s



Approach to Suspected Metabolic Disorder

- **Features**
- Poor feeding
- Vomiting
- Lethargy
- Convulsion
- Coma

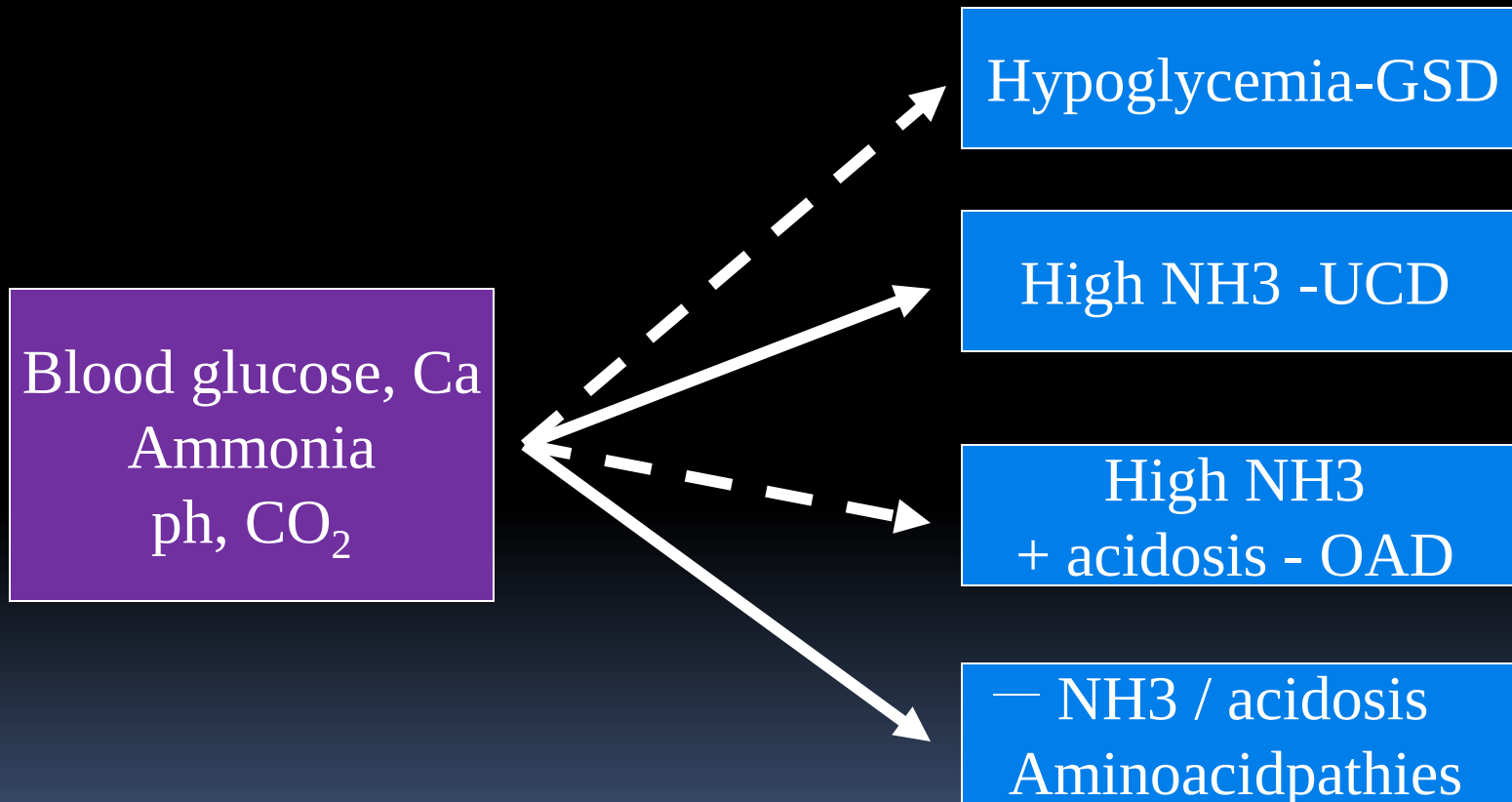


Labs

Blood glucose, Ca
Ammonia
ph, CO₂

Crisis may mimic sepsis

Approach to Suspected Metabolic Disorder



ED Presentation of IEM

- Metabolic crisis
 - Non life threatening ↔ Acute life threatening
- Sepsis
- Seizures





ED Presentation

Metabolic crisis is the most common
Emergency in Patients with Metabolic
Disorders





Hyperammonemia

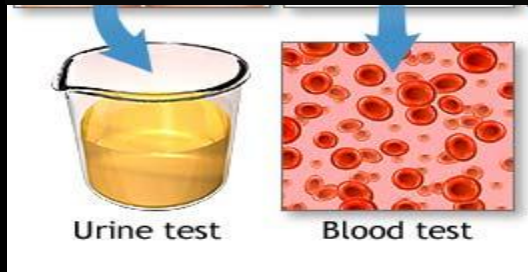
Metabolic
Acidosis

Metabolic Crisis

Dehydration

Hypoglycemia

Metabolic Crisis Continuum



MC
Ketones +
Acidosis $\pm$
NH3 +

ALTMC
GCS <10
 $\text{HCO}_3^- < 10 \text{ mEq/l}$
NH3 +++

Cerebral edema
Renal failure
CR failure

Qureshi et al First Mediterranean Emergency Conf, 2001; Italy
Lehnert. W et al. Eur J Pediatr (1994)[Suppl 1]:S68-80

History

- History.

- Vomiting 75%.
- Poor appetite 70%.
- Decrease activity 60%.
- Intercurrent illness 50%.

- Ozand et al J child Neurol 1991;6:196-219.



Physical Exam

- Physical exam
 - Level of consciousness
 - Signs of infection $\pm$

Patients with normal physical exam can be in metabolic crisis



Metabolic Crisis

- Laboratory

- Severe metabolic acidosis ($\text{HCO}_3 \leq 10\text{mmol/l}$)
- Elevated anion gap
- Hypoglycemia
- Hyperammonemia

- Qureshi et al First Mediterranean Emergency Conf, 2001; Italy

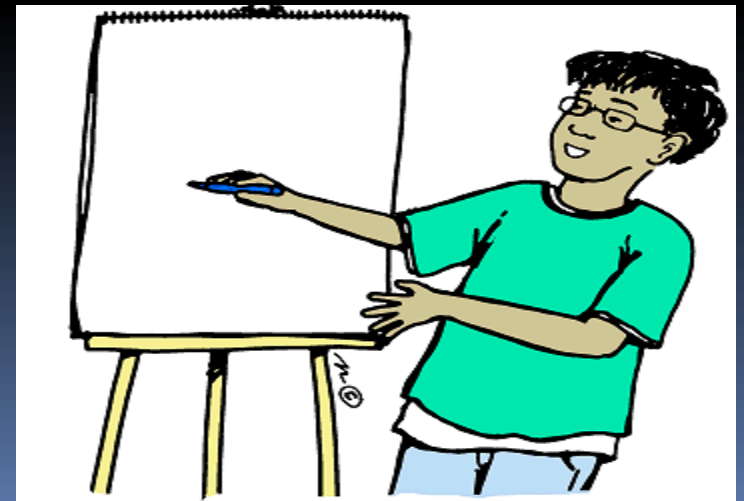
Physical Exam

- History and physical exam are not reliable in detecting the early stages of metabolic crisis
- **Blood** should be tested to rule out Metabolic crisis

- Henrique et al Brain & Develop 1994;16 (Suppl):86-93
- Qureshi et al First Mediterranean Emergency Conf, 2001, Italy

Management

A	airway	acidosis
B	breathing	
C	circulation	dehydration
D	drugs	detoxification



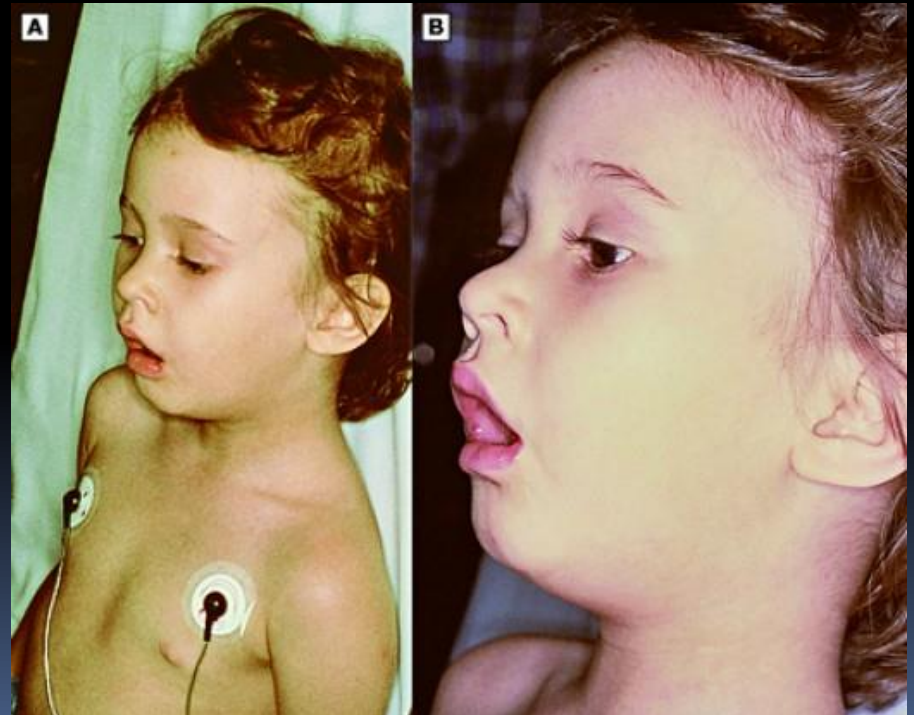
Life Threatening Crisis (1st Hour)

- Normal saline 20-30cc/kg
- Na HCO₃ 3.0-4.0meq/kg
- Carnitine 100-150mg/kg
- Dextrose (BS < 3mmol/l) 1gm/kg
- Antibiotics ±

▪ Qureshi et al. Mid East J of EM; 4:(2) sept 2001, 103-104

Management

- Airway / Acidosis
 - Supplemental oxygen
 - Sodium bicarbonate
 - Tachypnea



Management

- Circulation / Dehydration
 - NS bolus
 - Treat dehydration
 - D10 $\frac{1}{4}$ NS+40mEq NaHCO₃ /L @ 1 $\frac{1}{2}$ rate
 - Increase urine output
 - Enhance acylcarnitines excretion

Management

- Drugs

- Dextrose

- Reverse catabolic state
 - Interrupt Protein breakdown

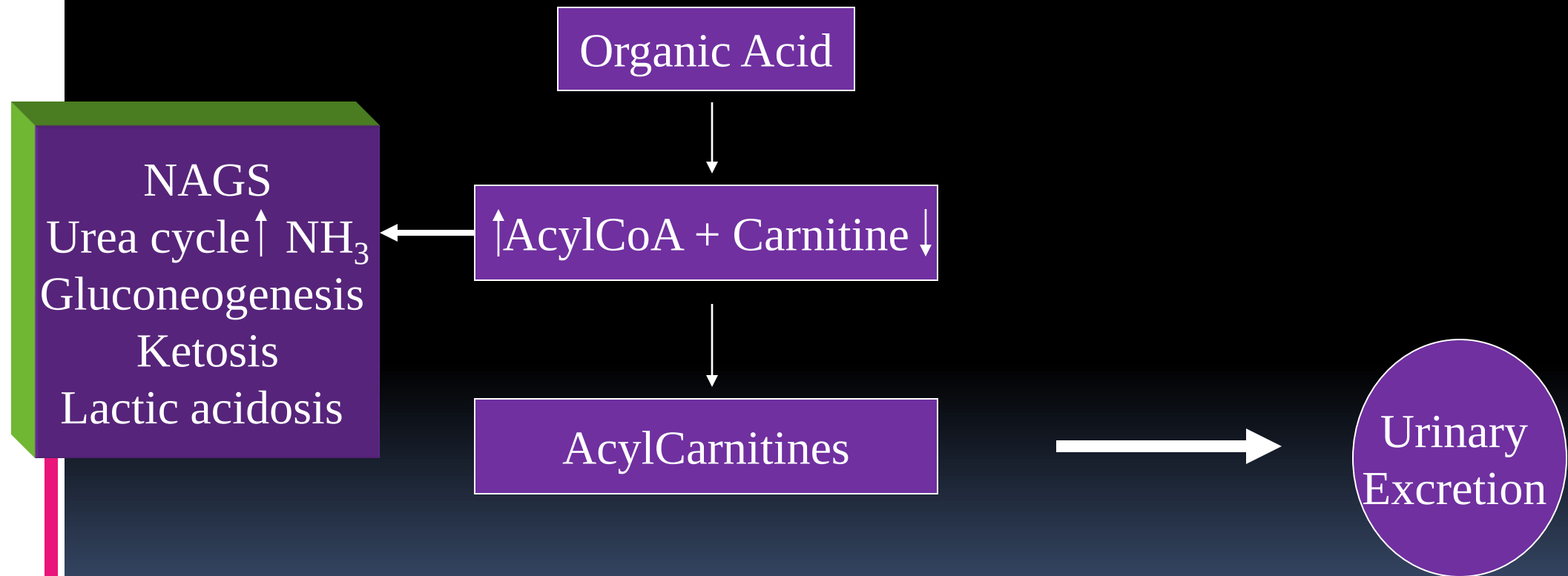
- Carnitine 100 mg/kg

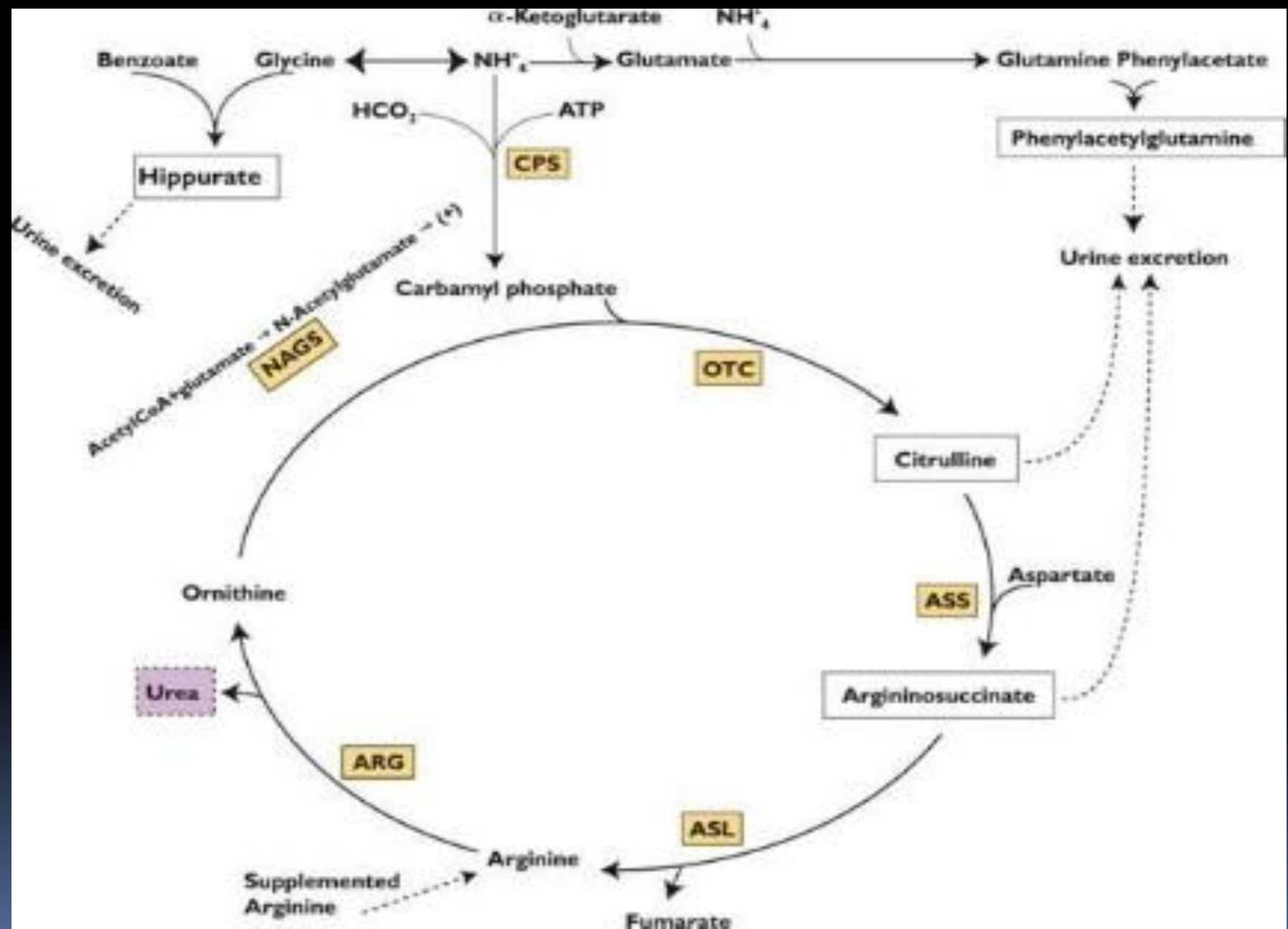
- Increase formation of acylcarnitines

- Roe CR et al. Carnitine therapy for propionic acidemia. *Lancet* 1982; I: 1411-2



Role of Carnitine in OAD





Mortality

- 15-40%
 - Aggressive management is required to reduce complications during episodes and improve neurologic outcome
-
- Rosenberg LE et al. The metabolic basis of inherited dis. 6th edn. 1989; 671-92
 - Lehnert. W et al. Eur J Pediatr (1994)[Suppl 1]:S68-80



Complications

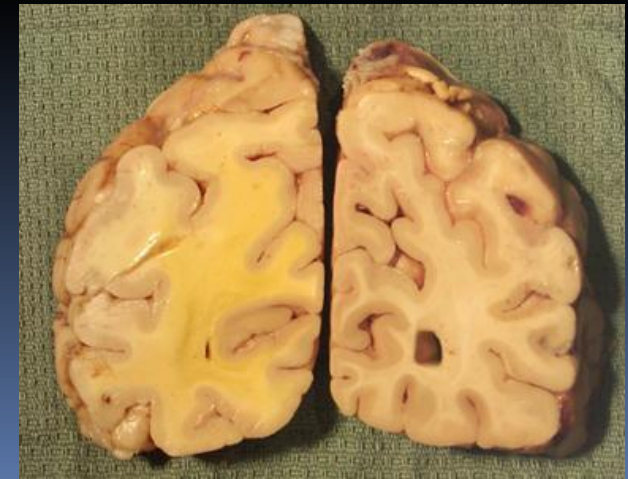
- Seizures
 - Cerebral edema
 - Sepsis
 - Hemodynamic instability
 - Acute renal insufficiency
- 

Case scenario

- 7 yr old known case of PPA, presents with lethargy for 1 day.
- VS HR 120, RR 24, BP 90/55 99% Sats
- Labs
 - Ph 7.25, Pco2 35, HCo3 16
 - After hydration
 - Ph 7.37, Pco2 45, HCo3 21
 - Nurses concerned after neuro assessment
 - "Pt drowsy"

Complications

- Rapid neuro deterioration with improving laboratory parameters
 - Cerebral edema
 - Intracranial bleed
- Riviello et al J Pediatr 1991; 119:42-5

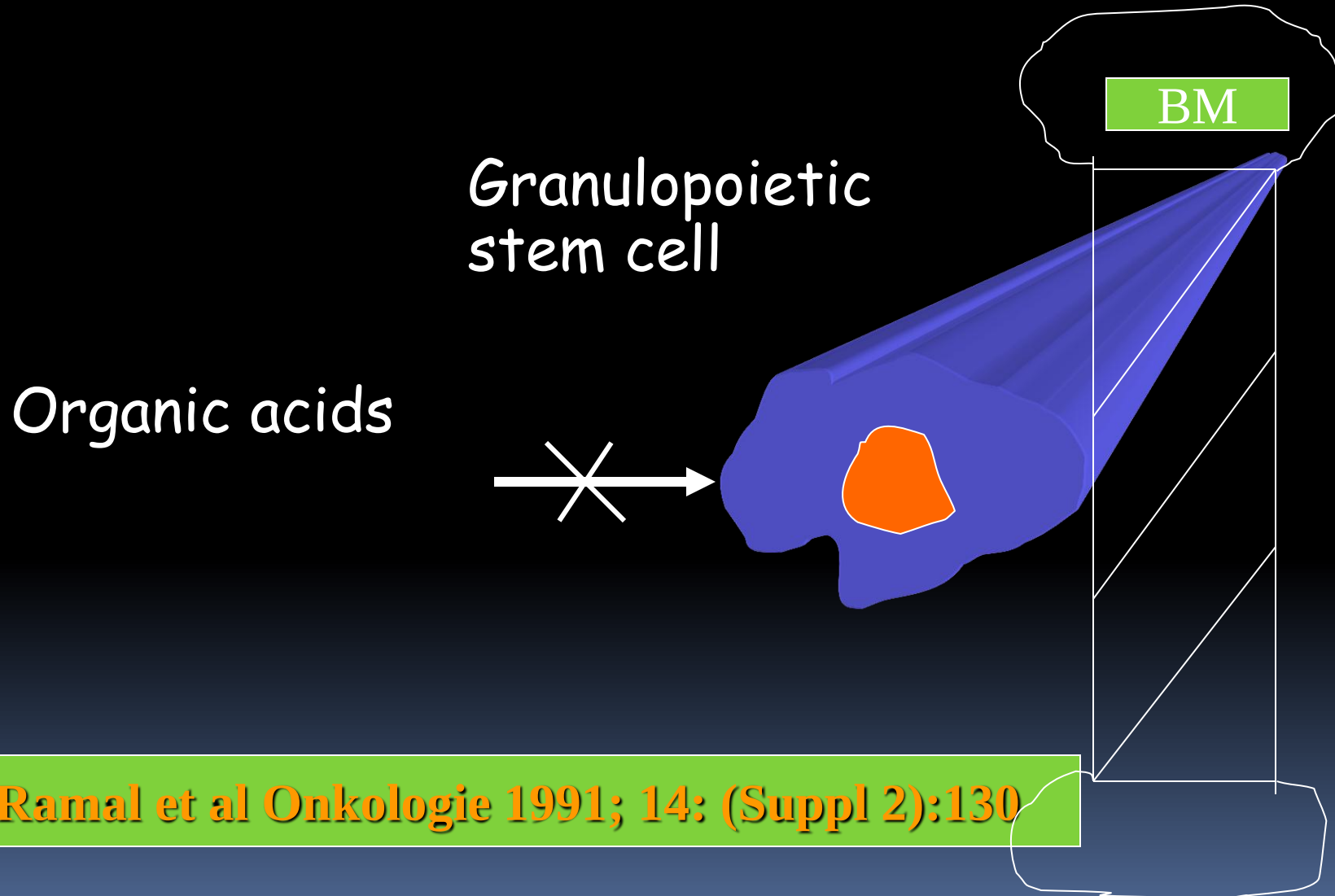


Sepsis

Sepsis is the second most common Emergency in Metabolic Disorders



Immune Dysfunction

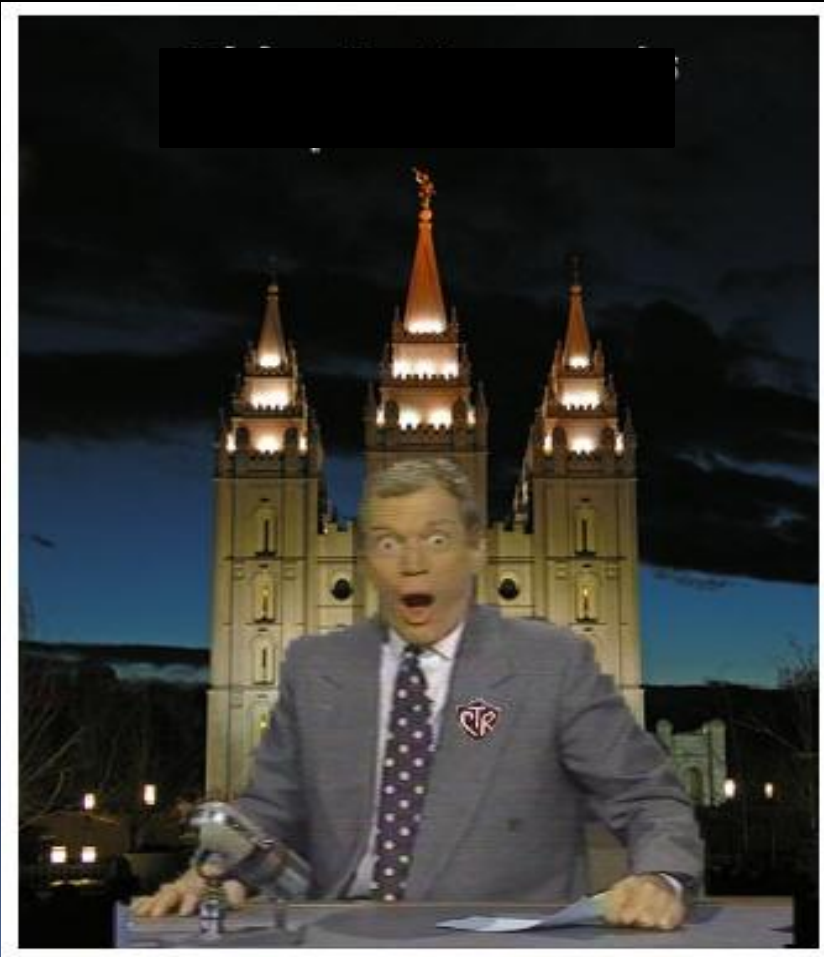


Ramal et al Onkologie 1991; 14: (Suppl 2):130

Immune Dysfunction

- Recurrent infections 57%
- Sepsis 15-25%
 - Gram positive
 - Gram negative
 - Candida
- Henriquez et al brain & develop 1994;16 (suppl):86-93
- Lehnert et al Eur J Pediatr 1994, 153(Suppl 1):S68-80
- Ozand et al brain & development 1994; 16(suppl): 46

To Avoid This when you see A
METABOLIC PATIENT ?





Remember !!!!!

- Failure to consider a metabolic disorder in the differential diagnosis in a previously healthy neonate with acute clinical deterioration
 - Failure to differentiate between sepsis and metabolic emergencies
 - Failure to perform rapid bedside glucose testing in any infant with suspected IEM
 - Failure to use sodium bicarbonate in patients with inborn error of metabolism
- 

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**Thank
You!!!**

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"If Ray Bradbury had written *The Caves*, the result might rival Margaret Peterson Haddix's *Running Out of Time*." —Richard Peck

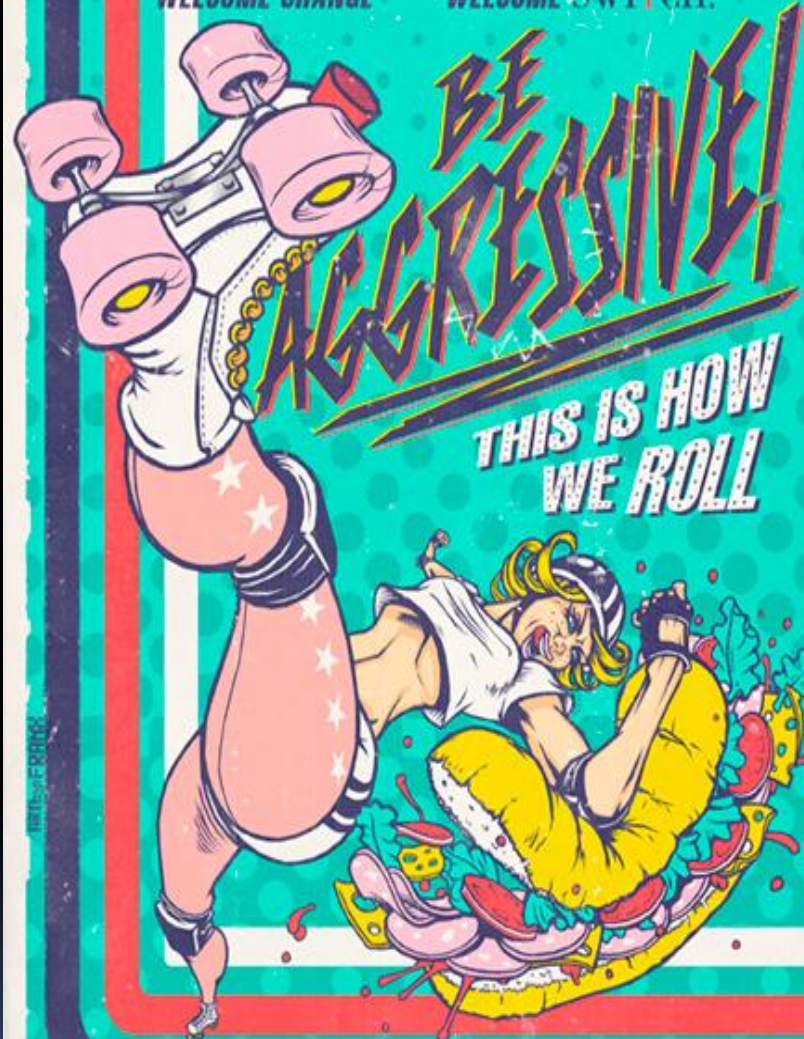
Running Out of Time



MARGARET PETERSON HADDIX

WELCOME CHANGE

WELCOME SWITCH.



BE AGGRESSIVE!

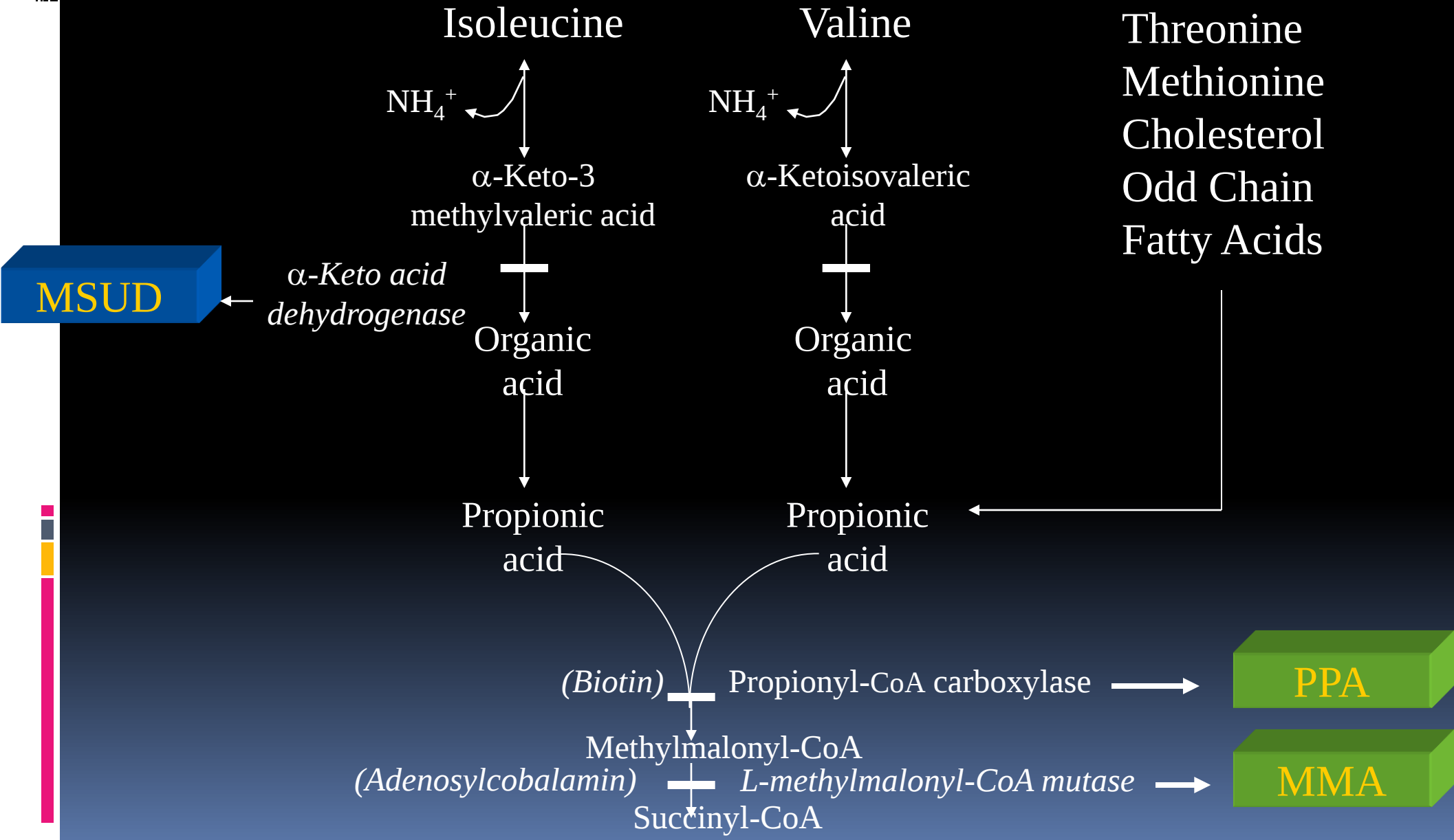
THIS IS HOW WE ROLL

TO DELIVER YOUR OWN ILLEGAL ELBOW DROP, MASH YOUR KEYPAD TO

GETBRAVE@SWITCHVERTISING.COM



ENZYMATIC DEFECTS IN OAD/ MSUD

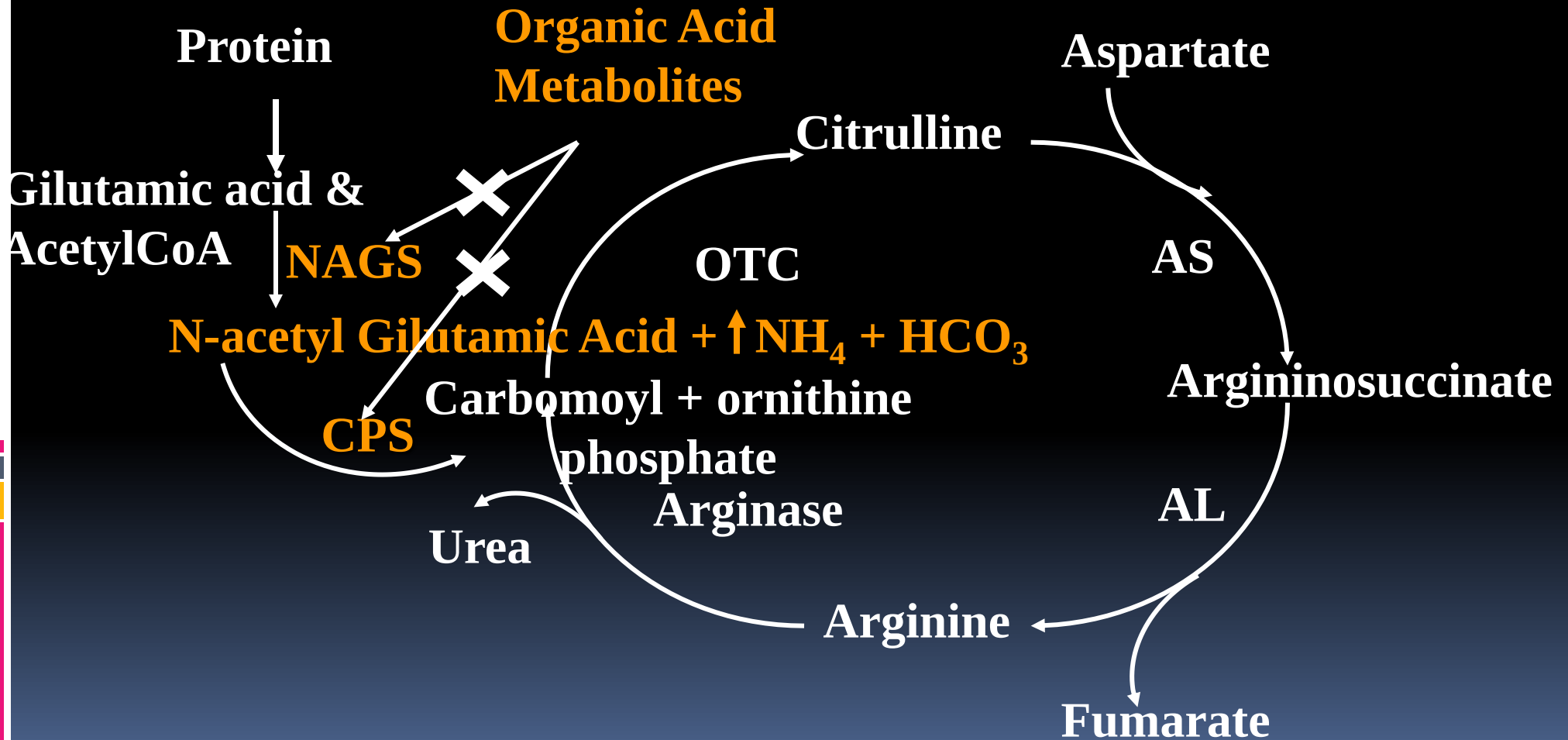




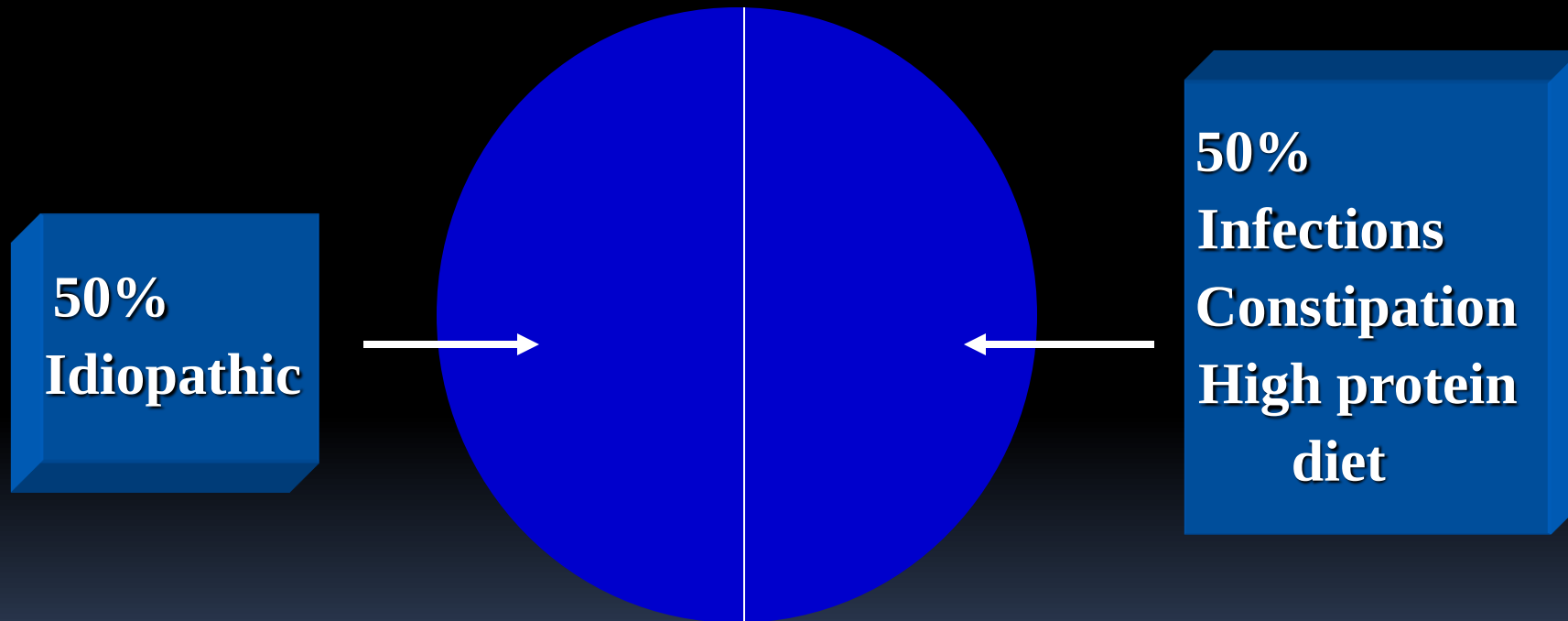
Metabolic Crisis

- Acute Life Threatening
 - Clinical
 - Acute onset of lethargy less than 24 hrs
 - Depressed level of consciousness
 - GCS of 10 or less upon arrival to ED
 - No signs of sepsis, trauma & drug overdose
- 

Biochemical Mechanism for Hyperammonemia in OAD



Precipitating Factors



▪ Ozand et al. J child Neuro 1991;6:196-219



Case Scenario

- 7 yr old with reduce activity 2 days
 - Hx
 - PE
- 



Case Scenario

- Labs
 - VBG
 - Lytes
 - CBC



Case Scenario

- Pat has a seizure
 - Repeat Seizure
 - ARREST
- 

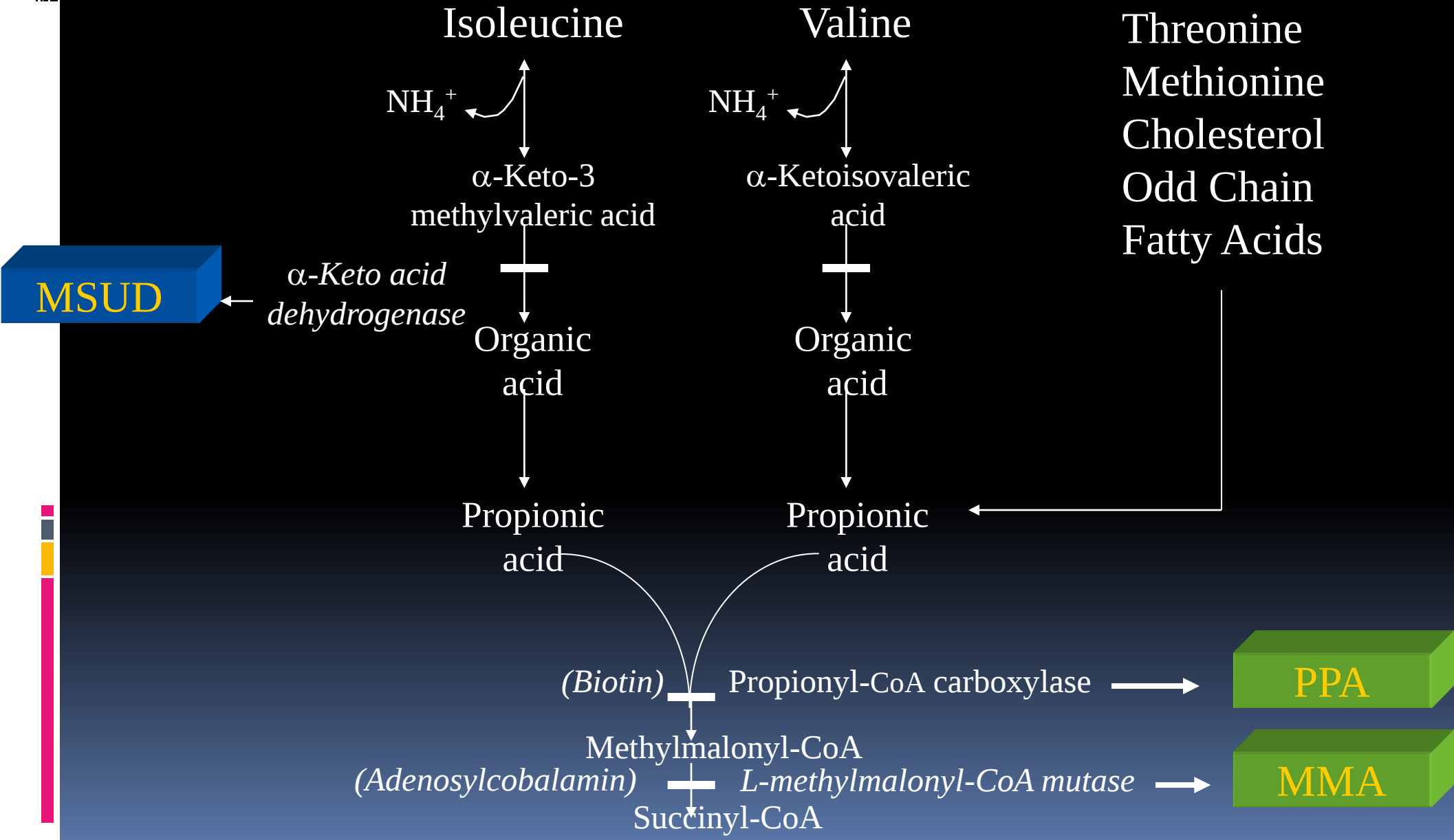


Case Scenario

- Pat has a seizure
- Repeat Seizure
- ARREST

CNS irritation
Cerebral edema

ENZYMATIC DEFECTS IN OAD/ MSUD





What happened ?

- MSUD
 - Lack of clinical markers
 - Tandem MS
- 



Tandem MS

- Detect abnormal metabolites
 - Blood
 - CSF
 - Urine
- 

Introduction

- Incidence: 1: 50,000 - 1:500,000 births
- Middle East: 1: 2000-5000 births
 - Lemieux et al. J inherited Metab Dis 1988;11:45-55
 - Rashed M et al. Brain dev (1994); 16(suppl): 1-6

Hyperammonemia

- Serum ammonia levels has been shown as the first marker for an impending metabolic crisis
- All other laboratory findings were within normal limits
- Qureshi et al first Mediterranean Emergency Conf, 2001; Italy



Ammonia

- Potent Neurotoxin
- Serum concentration correlates with the severity of the disease
- Are useful in monitoring therapy during an acute crisis



- Wolf B et al. J Pediatr 1978; 93: 471-473

Immune Dysfunction

- Infections 80%
 - B & T cell dysfunction
 - Unusual organisms
 - Gram positive
 - Gram negative
 - Candida
- Al Essa et al *Clinic Genetics*, 1998; 54:90-94



Laboratory Investigations

- Blood
 - CBC
 - Electrolytes
 - Ammonia
 - Acid base (ABG)
 - Urine
 - Ketones
- 



Seizures

- Primary disease 30%
- Repeated CNS insults 50%

- Ozand et al. J child Neuro 1991;6:196-219



Immune Dysfunction

- Neutropenia
- Thrombocytopenia
- Anemia

▪ Ramal et al Onkologie 1991; 14: (Suppl 2):130





Case Scenario

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Case Scenario

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