

**POST CPR CARE**

口訣 CPC+LKM (LinKou Memorial hospital)

1 .C: Cerebral

A. IICP control (口訣 4H+BLS), BLS 比較少用

- a. Head elevation
- b. Hyperosmotic agent { Mannitol 2.5ml/kg(Dose,0.5g/kg Max:75ml)/ Q6H  
3% NaCl 1ml/kg/hr, keep Na:150~155, Osmo:300~310
- c. Hyperventilation(不是主流 24~48 hrs)
- d. Hypothermia: 冰枕 keep BT:33~35°C
- e. BZD/bariturate
- f. Lasix
- g. Steroid Brain edema 分為 Cytogenic:如 Hypoxia  
Vasogenic: 如 Brain tumor or vasculitis  
Interstitial(少)

IICP sign  
Early (口訣 ABC: Anisocornid, Babinski, Cheyne-Stokes respiratory)  
Late: Cushing triad:Bradycardia,HTN,Irregular respiratory

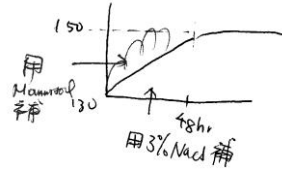
Steroid 在 Vasogenic brain edema 才比較有用,在 hypoxia 造成的水腫效果不大

B. Seizure(見 Seizure 一章)

#註: 3%NaCl 算法  $BW * 0.6 * \Delta Na = X \text{ ml } 3\%NaCl * 0.5(3\%NaCl \text{ 1L}=512\text{meq/L})$

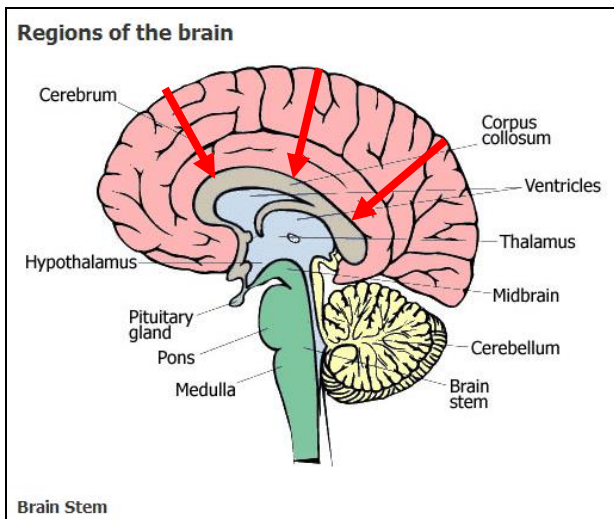
- (0.5 and 0.6 大致約分)
- 3% NaCl 1ml/kg 可上升 Na 1meq
- 可開 BW ml/hr 即為 1ml/kg/hr 的 dose,一小時上升 1meq

#註: Mannitol 大致上一兩天即可停掉



	Osmo	Toxicity	diruretics	caloric	Anti-inflammatory	cost
mannitol	↑ ↑	Nephron	+ (dehydration, BP ↓)	+	+	Expensive
3% NaCl	↑		-	-	-	Cheep

#IICP 圖示:



1. 一開始先增加腦壓壓迫腦實質。
2. 當壓迫到 hypothalamus (ANS 中樞), 開始出現 autonomic dysfunction (neurological shock)
  - (1) Catecholamine 大量釋放(約 2-3 hrs), 臨床上表現為 HR 快、BP 高。
  - (2) 當用完之後, HR & BP 會快速往下掉。
3. 當壓迫到 brainstem 後, 呈現 cardiopulmonary failure。

#低溫療法中要小心低溫期副作用 ACEI D

Arrhythmia, Coagulopathy, Electrolyte imbalance(**hypokalemia, hypomagnesia, hypocalcemia**)(所以要定期監測 e), infection(所以要給 prophylaxis 的 antibiotics: in PICU 至少 **vancomycin + fortum** ), Diuretics

#回溫要小心 IICP + seizure

#提供上次跟夏主任討論像在基隆沒有辦法做到真正的低溫療法, 我們還有甚麼其他的做法:

(1) 冰枕

(2) anti-pyretic agent (幾乎就是 Q4-6H 塞 Voren/Indomethacin

(3) 主任提供另外的建議: gastric lavage with ice water and give muscle relaxant (多半是因為肌肉 tremor 產熱導致, 所以可以使用)

(4) 不過, 如果能轉回去, 越快越好!! (主任希望 8 小時內可轉就轉)

## 2. P: Pulmonary: ARDS

特性(口訣 ABCD)

a. Acute onset

b. Bilateral

c. Non-Cardiac (須排除心因性)

d. Data( $PaO_2/FiO_2 < 200$ )

Tx: 1. Treat underlying

2. Lung protective strategy

-Optimal PEEP

-Hypercapnia ( $PaCO_2$  60-80mmHg)

-Low tidal volume (6-18ml/kg 之 tidal volume)

Oxygen index > 15 考慮 HFOV; Oxygen index > 35~40 考慮 ECMO

## 3. C: Cardiac: Ischemia heart

Tx: Milrinone 使用,並規則驗 Troponin-I 和 Myoglobin

## 4. L: Liver

Tx:也只能觀察

## 5. K: Kidney (acute renal failure)

Tx: A.限水(60~80%:為 insensible water loss+ U/O) + Diuretics

B.Diuretics Step 1: Lasix 1mg/kg/dose Q6H

Step 2: Lasix continuous 0.5~1mg/kg/hr= 12~24mg/kg/day

Step 3: Bumetanide 0.1mg/kg/dose q4-6h (Max: 10mg/day=1.5ml/hr)

C. monitor: K, Na, Mg

6. M ↗ Muscle : Rhabdomyolysis(LAB: 1-2D →Myoglobin 上升; 3-4D →CPK 上升; 7D→LDH 上升)  
(v.s AMI: 1-2D →TnI 上升; 3-4D →CK-MB 上升; 7D→LDH 上升)

↘ Metabolic: Lactate acidosis

Hyperglycemia

## Post-neural damage care

1. Amantadine (Anti-NMDA):可以 ↓ glutamate, 5mg/kg/day x 1 month q12h (自費) after feeding

2. Piracetam:可增加腦部血流, 40mg/kg/day start 1 month later, Contraindication: Upper GI bleeding, Intra-Cranial Hemorrhage

3. Vitamin B6, dosage > 40mg/kg/day
4. Brain power basic
  - i. Fish oil, DHA (可用 IV Smof 代替, 註:SMOF 為 Soybean, MCT, Olive, Fish oil 的簡寫)
  - ii. Vitamin B complex: Hi-Beston(自費)
  - iii. Brain boost nutrition: Gingo ,請家屬自己買
5. consult 復健 for rehab

## SHOCK

SHOCK 原因的 D/Dx

D/DX: S: septic

H:Hypovolemic

O:obstruction(cardiac tamponade)

C:Cardiogenic

K:Kinetics(Distribution) {

- A: Anaphylaxis
- N:neurogenic
- P: pancreatitis

臨床表現也是: SHOCK

S: skin molting

H: HR ↑

O:O2 ↓

C:CNS

K:kidney( U/O ↓ )

處理口訣: 灌水 -> 強心 -> 增壓

- **Catecholamine resistant shock:** 特別是 AIR, Neuro 的病人, consider steroid

### Shock c/w skin rash

1. septic shock
2. Toxic shock syndrome
3. Kawasaki shock

### Monitor

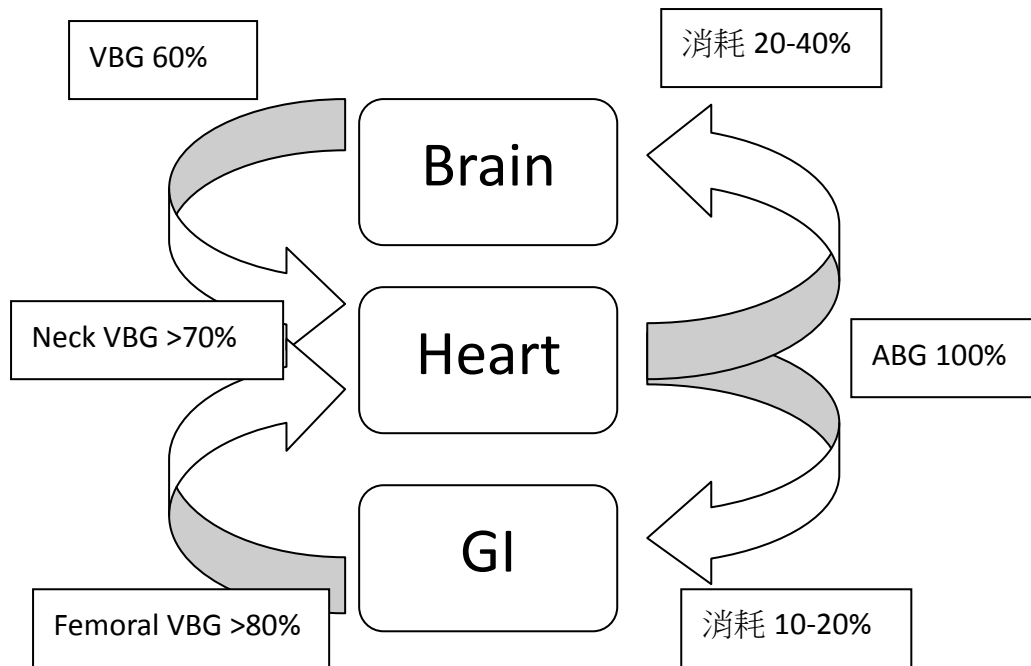
CVP level: neck > 6 mmHg, Femoral CVP = neck + abdominal pressure ( 6mmHg ) > 12 mmHg

但是 ileus, constipation, ascites, ventilator use may ↑ abdominal pressure

If ventilator use, **femoral CVP keep > 16 mmHg**

### Monitor perfusion in shock

1. Lactate
2. SVO2 keep > 70% , (Deep Coma, Hypothermia, Anesthesia, Metabolic disorder 代謝慢,要上修)



	Heart rate	$\beta$ effect	$\alpha$ effect
Dopamin		<10	>10
Bosmin	↑ ↑	↑ ↑ (low dose)	↑
Nor-epinephrine		↑	↑ ↑
Milrinone		↑	↓ ↓
Dobutamine	X	↑	↓
Nitroprusside	X	X	↓

**速算法:**

Dopamin, Dobutamine:  $BW \times 6 \text{ mg}$  in D5W dilute to 100cc run 10cc/hr = 10mcg/kg/min

Milrinone  $BW \times 0.3 \text{ mg}$  in D5W total 20cc run 3cc/hr (0.75mcg loading)x 30 min then 1cc/hr (0.25mcg)

Bosmin:

Resuscitation: 0.3cc dilute to 3cc (0.1mg/cc) give  $BW \times 0.1 \text{ (mL)}$  (0.01mg/kg)

Continuous:  $BW \times 0.15 \text{ mg}$  in D5W total 25 mL, run 0.1cc/hr = 0.1mcg/kg/min

Hydrocortisone: 2mg/kg/day (for SLE 长期使用 steroid, and Cerebral Palsy → adrenal insufficiency)

Albumin: if albumin <2.5, 1g/kg/day, max: nephrotic syndrome 2PC /day, non-nephrotic syndrome: 1PC/day

Amiodarone: Loading: 5mg/kg/dose loading over 25 min(在玻璃瓶), then 300 mg in 150cc D5W give  $BW \times 1/4 \text{ (mL/hr)} = 0.5\text{mg/kg/hr}$

Jusomin:

Resuscitation:  $BW \times 2 \text{ (mL)}$ , 小小孩可先半量, max: 4PC/day

$BW \times 0.3 \times Be \times 0.5 \text{ (mL)}$ , central line 可不用 dilute

for metabolic acidosis PH < 7.25 (adult), < 7.2 (child), < 6.9 (DKA)

# Neuroendocrine 變化

前三天會先 SIADH, 之後一兩天演變成 DI(Diabetes insipidus)3<sup>rd</sup> day, 之後間歇著 Cerebral salt wasting 7<sup>th</sup> day Adrenal insufficiency, 14<sup>th</sup> day hypothyroidism(主任說: DI 出現時間與 brain injury 的嚴重度成正比)

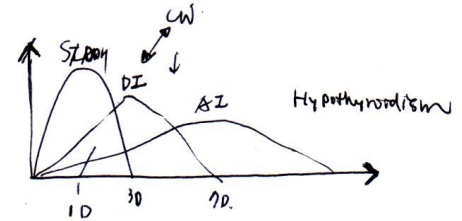
DI 特性: Urine SpGr <1.005, Serum Na > 150 → 一直尿水

DI control: 1.Line A (for deficiency): D5W

#註: 算法:  $BW * 0.6 * \frac{\text{Measure Na} - \text{Desire Na}(\text{抓 } 150) \text{ meq/L}}{\text{Desire Na}(150) \text{ meq/L}}$

$$\rightarrow BW * 1000(\text{ml}) * 0.6 * \frac{\Delta \text{ Na}}{150}$$

→ Bw\*4\* Δ Na (單位:ml) 的 water deficiency



Line B(For maintenance):D 0.225S

2.DDAVP use 1 puff Q4H prn(Max:2puff) if U/O > # ml/ Q4H

#註: 算法: 150% maintain 除以 6

@@如果 poor response to DDAVP, 以下三種可能

1. DDAVP deficiency (劑量不夠)
2. Nephrogenic DI

↗Iatrogenic :Aminoglycoside or K 低(因為 DDAVP 與 renal 鍵結需 K 幫忙)

↘Other: Hypothermia(Goal BT: 34.5~35.5' C)

3. Hyperglycemia (高血糖會利尿)

@@ 如果 DI 之後慢慢變成 Na 低, 以下三種可能

1. DDAVP overdose
2. Adrenal insufficiency
3. Cerebral salt wasting

	DDAVP overdose	Adrenal insufficiency	CSW
Urine sodium		40 – 100 or 120	>120
U/O	decrease	increase	increase

@@ Cortisone 不足可先補充; thyroxine 則需等到 14th Day 後再補充, 避免新代率高造成 Neuro 傷害

## Coma

- Coma scale <8 分 為 Coma
- Unconscious 病人的神經學檢查重點 (口訣: REM-BR)

R: respiratory pattern: Midbrain 以上的 lesion: Hyperventilation

DIVE → dorsal 掌管吸氣/ventral 掌管呼氣

呼吸 pattern: Cheyne-stokes → supratentorial lesion

Central neurogenic hyperventilation → midbrain

Apneusis → pons

Cluster breathing → lower pons

Ataxic breathing → medulla

**Figure -1. Respiratory patterns associated with closed head injury.**

Normal		Small Unilateral	
Cheyne-Stokes		Large Bilateral Supratentorial	cerebrum
Cheyne-Stokes variant		Large Unilateral	
Central neurogenic hyperventilation		Large Bilateral Partial	Midbrain
Apneustic		Large Bilateral Midpontine	Pons/medulla
Ataxic		Large Bilateral Posterior fossa	

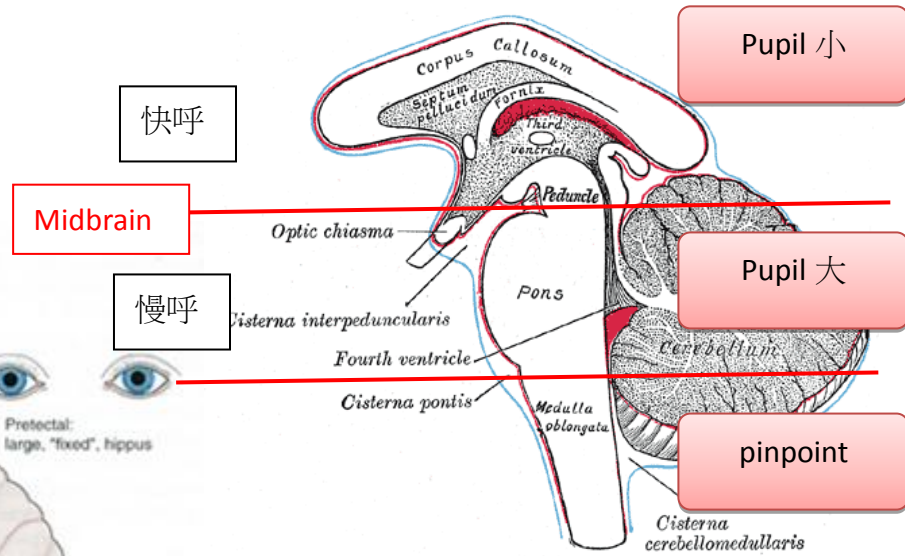
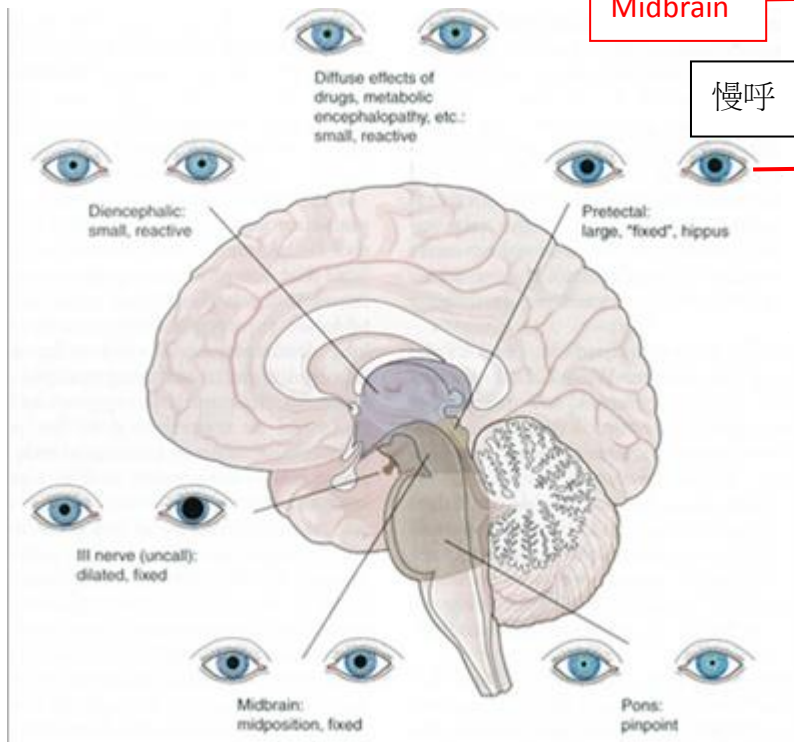
E: eye 觀察 pupil 的 size 及位置

size:   
 { Newborn 2~2.5mm  
 Children 2.5~3mm  
 Adult 3~3.5mm

IICP: sunset eye → 因為壓到 CN3

CN6 lesion: cross eye 鬥雞眼

Pinpoint lesion: pons



M: posture (motor 的重點是 posture, decorticate /decerebrate)

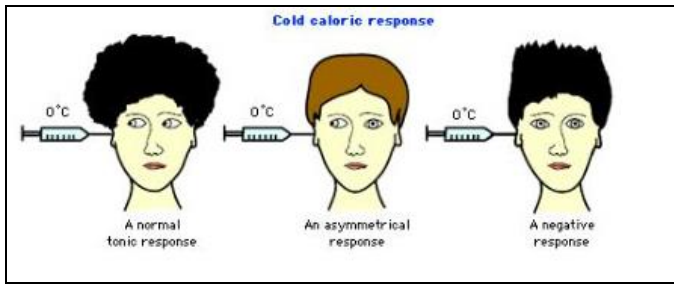
BR: Brainstem reflex

1. Light reflex midbrain 2→3
2. Corneal reflex: pons 5→6

3. Gag reflex: medulla: 9→10

4. -Doll eye sign [ +: brainstem okay  
-: brainstem depressed

- Cold Caloric test:



5. Early herniation sign: A: Anisocornia

B: Babinski sign

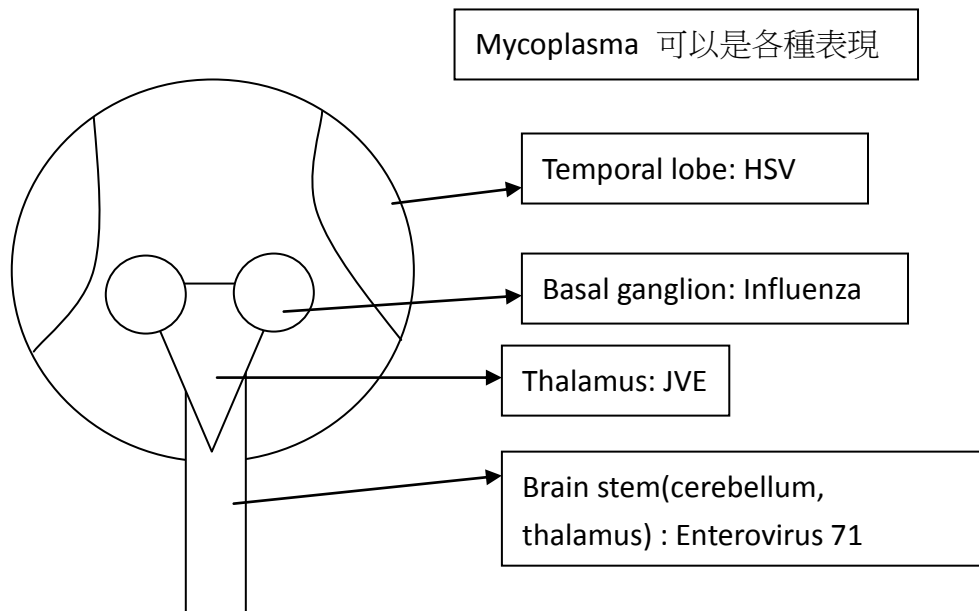
C: Cheyne stock respiratory pattern

6. Late IICP signs: Cushing triad = hypertension, tachycardia, RR ↓

## Encephalitiis

Encephalopathy = cortical dysfunction: behavior change, psychiatric, loss of conscious, seizure

Encephalitis = encephalopathy + 2/4 (EEG, MRI, CSF, Fever)



### Lab:

Pulse 前 check LDH, Ferritin, Anti-TPN, 後 follow Ferritin, LDH, encephalitis 套餐

● CSF 只有 lactate 高, 要注意 mitochondrial disease

### Treatment:

1. Seizure control
2. Anti-microbials
  - i. Tamiflu

- ii. Azithromycin 10mg/kg/dose QD
  - iii. Acyclovir 10mg/kg/dose q8h
3. Anti-inflammatory
- i. Methylprednisolone 1mg/kg/dose q6h, (if status or GCS < 8 → pulse therapy 1g/day)  
@Tapper pulse therapy 1mg/kg/dose q6h x 4 day, q8h x 2 day, q12h x 2 day, qd x 2 day  
@If use steroid > two week, tapper 要慢, 注意 adrenal crisis
  - ii. IVIG 2g/kg 分成五天打 or plasmaphoresis if s/s deteriorate
4. IICP control
- i. Mannitol 2.5cc/kg/dose (Max:75cc/dose) to prevent IICP +- Half saline  
@Status > 30 min, q6h x 3 days 再 tapper, seizure < 30min, 可打 stat one dose 即可  
@Tapper mannitol q8h x 1 day, q12h x 1 day, qd x 1 day

## Conscious change 口訣:AEIOU TIPS

1. Abuse/alcohol/anemia
2. Electrolyte/encephalopathy/endocrine/epilepsy
3. Infection/intussusception
4. Oxygen, opioid
5. Uremia
6. Trauma/Toxin/Temperature
7. Insulin /Hypoglycemia/inborn error of metabolism
8. Psychogenic/porphyria/pharmacology
9. Space occupy lesion, Stroke, SAH, seizure, sepsis

## Young stroke/TIA

### 1.血管本身

A. Vasculitis: check ANA, C3,C4,

B. Vasculopathy

- i. Metabolic: check TG, cholesterol , homocysteine ↑ , or Mitochondrial disease
- ii. Congenital: Moyamoya disease
- iii. Acquired: Trauma, carotid artery disease

MRA

### 2.血管內的 disorder(thrombus)

A.Hemologic: check PT/APTT, D-dimer, Protein C and S, anti-thrombin III

B.Cardiac: check cardiac echo for thrombus (CHD, valvular disease, operation)

C.Septic embolism

### 3.Intravascular calcification

A.If newborn: toxoplasma or CMV

B.If neurologic patient: suspect neuro-cutaneous disease: tuberous sclerosis, choroid plexus tumor(ex: papilloma, 發生率 2<sup>nd</sup> ventricle > 3<sup>rd</sup> > 4<sup>th</sup> )

ii.



## Seizure

### Step 1

BZD

Ativan	0.1mg/kg	Max: 4mg
Diazepam	0.25mg/kg	Max: 10mg
Midazolam	0.1mg/kg	Max:5mg

X 2 次

### Step2

Luminal (一支 100mg)	/ Dilantin (250mg)	/ VPA(depakine) (400mg)	/ Keppra (500mg)	Max:用 40kg 算 2 支
Max:7~8 支	3 支	2 支		

Loading: All loading 20mg/kg/dose run 20mins

Maintain: Luminal/Dilantin 2mg/kg/dose(6mg/kg/day) Q8H

VPA/ Keppra 30~60mg/kg/day Q8H

- 如果仍無效,可考慮加用 4 種廣效藥物

Depakine/Lamital/Keppra/ Tobramax

- 如果之前即有 AED 1.check level

2.Re-loading

Luminal	1mg/kg/dose	可上升 0.9
Dilantin	1mg/kg/dose	可上升 0.6
VPA	1mg/kg/dose	上升 4

### Step3

無效的話, on line and on ETT

Midazolam loading 0.1~0.2mg/kg/dose  
Infusion 2mcg/kg/min (約 BW/40)  
Max:20mcg/kg/min

Citosol/ propofol

Midazolam 會 distribution 到 fat,tapper  
要小心!! 另 > 10 mcg/kg/min BP 會  
drop

### Step4

Lidocaine 20=>100mcg/kg/min

### Step5

Ketogenic diet IV(Fat: sugar+ protein= 3~4:1), TG keep <500, avoid pancreatitis

- Status epilepsy 一定會 IICP!! 所以要 4H BLS 控制
- Hypoxemic ischemia encephalopathy 的 Seizure 藥物首選 Luminal/ BZD (side effect: 口鼻分泌物)

Post HIE

Acute stage AED Luminal→ Midazolam→  
Keppra/ Depakine/TPM/Lamicta

Chronic stage AED Luminal+ rivotril(現可用 clobazam)+ Keppra+ TPM

- Post traumatic seizure { Early: < 7 days,預後好

Late: > 7 days, 預後差

→ 7 days 後做 EEG, 如果沒 finding 可慢慢 taper 藥物  
有 finding, AED 要吃兩年

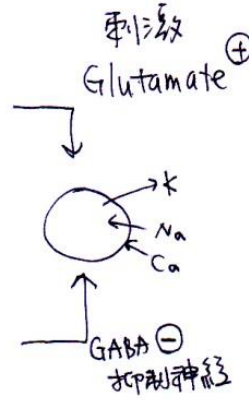
### AED 的選擇

1. Neurotransmitter:

- 興奮: Glutamate
- 抑制: GABA

2. Voltage-gate ion channel:

- 興奮: Na, Ca
- 抑制: K



\*\* Vitamin B6/GAD: 增進 Glutamate → GABA

機轉不明 但屬廣效

	BZD	PHT	Luminal	VPA	Keppra	Topamax	Lamital	Tegretal
Na blocker		++	+/-	+/-	?	+	++	++
沒有 K agnosit								
Ca blocker					+	+	+	
GABA agonist	++	+/-	++	++	?	+	+	
Glutamate blocker				+	?	++	+	

- 框起來的四種為廣效 → local and general 機轉都有  
VPA(有 IV form)/Keppra(有 IV form)/ TPM/ Lamicta
- 四種 renal 代謝: LG-TV(L: keppra, G:gabapentin, T:topamax, V:Vigabatrim)
- 四種易過敏(含苯環): Tegretal/Luminal/PHT/Lamital

## Seizure 型態

	Frontal lobe	Temporal lobe
特性	來的快去得快	有 aura
Aura	X	OO
Ictal period	OOO(因動作劇烈)	O(因小抽,focal)
Duration	短	長
Post ictal	X	OO
GI s/s	seldom	often

Seizure 一定要問 AIDD  
Aura, Ictal 表現, duration,  
post ictal 變化

## Seizure 原因(口訣:CDEFGHI)

C: CNS structure → 可排 CT, MRI

D: drug level

E: electrolyte(Na, Ca)/Encephalopathy(Hepatic, Uremic, Inborn error metabolism)

F: Febrile convulsion

G: glucose

H: HIE

I: infection → 可驗 CBC/DC CRP, PCT

/ Inflammation → SLE/vasculitis survey

AST/ALT

BUN/Cr

ABG, Lactate, ammonia,  
sugar

臨床 step 1 有無 fever

→ 有 fever: CNS infection/febrile  
convulsion

→ 無 fever, 如右 CDEFGHI

## Nystagmus

分 { Horizontal → ear 的問題 → 做 BAEP!

→ 小腦的問題 → 做 Finger-nose-finger

Vertical → brainstem 的問題: light reflex/corneal reflex/gag reflex/Doll's eye

## Brain CT

● Mass effect

1. 同側 ventricle 消失

2. Midline shift

3. Suprasella cistern(basal cistern)消失

● < 1y/o 有 0.4~0.5cm subdural space, 因為 frontal lobe 晚發育

● Basal cistern 五角形

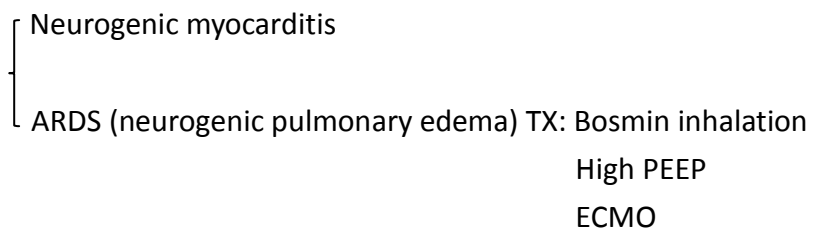
消失→怕 uncal herniation

→brainstem compression by uncal herniation

1. 會 Neurogenic shock (24~48hrs)
2. Autonomic dysfunction,(類似腸病毒, sugar/BP/HR ↑) 因為內源性 catecholamine 大量釋放

最後 catecholamine 用完後

Cardiopulmonary failure



**MRI:** 參考北榮 Dr.莊銘榮 ppt

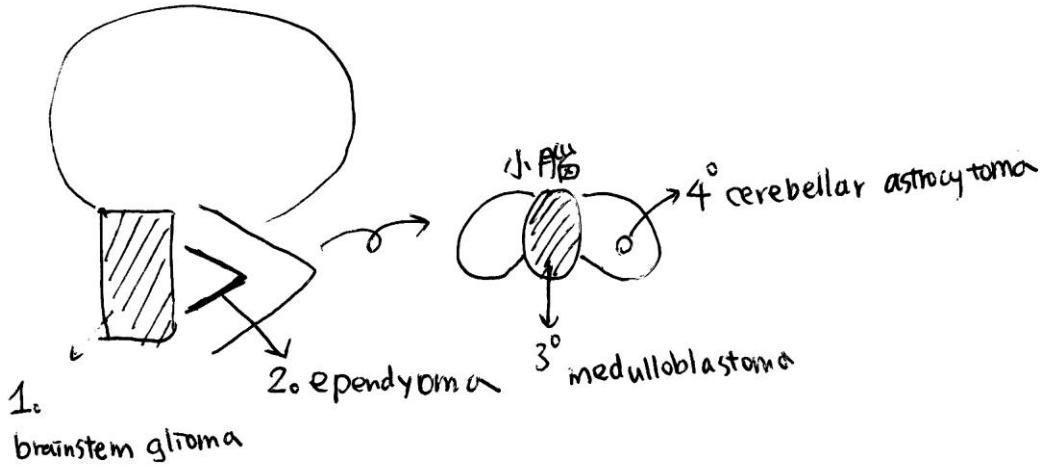
1. 先看 T1: 看 structure(類似 CT),有無 Infarction (hypo-dense), hydrocephalus, parenchymal mass lesion, tumor hemorrhage (hyper-dense)
2. T2 flaring: 看水腫, infection , inflammation, infarction 都會亮,再和 T1 比較
3. T1 +C
  - i. 腫瘤或感染會亮
4. DWI: 看 ischemia
  - i. ventricle 白 - infarction 黑, ventricle 黑 - infarction 白
  - ii. Stroke, Tumor, Infection 皆會造成 DWI signal 升高。
  - iii. DWI 對在 6 個小時內發生的 early ischemia 和 infarct 的偵測是高度 sensitive 和 specific。
  - iv. 相對的, 水分子的 diffusion 愈好, ADC 的值越高。
  - v. 在 Ring Enhancement lesion 的鑑別診斷中 High signal on DWI and low signal on ADC 傾向是 Abscess
5. 常見聯想
  - i. T2 很亮=> 水或腫
  - ii. T1 很亮=> 7-14 天的血或脂肪
  - iii. T1T2 都很暗=> 鈣化
  - iv. T2 很暗=> 很舊的血或脂肪
  - v. T1C+有顯影=> 腫瘤或感染
6. Hemorrhage
  - i. 看到 T1 Hyper-signal, 想到 Hemorrhage (MetHgb), 這時候出血時間是 3-14 天。(Subacute)
  - ii. T1 hyper => 再看 T2
    - i. T2 hypo 表示 MetHgb in RBC, 這時候出血時間是 3-7 天。(Early stage subacute)
    - ii. 若 T2 已經變 hyper 表示 MetHgb 已經跑出 RBC 變成 Free type 這時候出血時間為 7-14 天。(Late stage subacute)
  - iii. T1T2 都變 Hypo, 表示已經變成 Hemosiderin, 這時候出血時間大於 14 天。(Chronic)

# Brain tumor in pediatrics

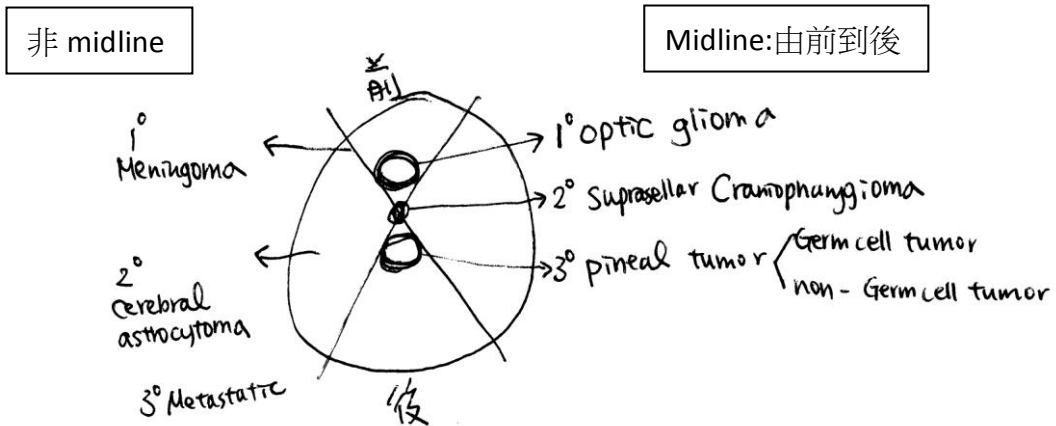
Brain tumor 以大腦天幕 分上下

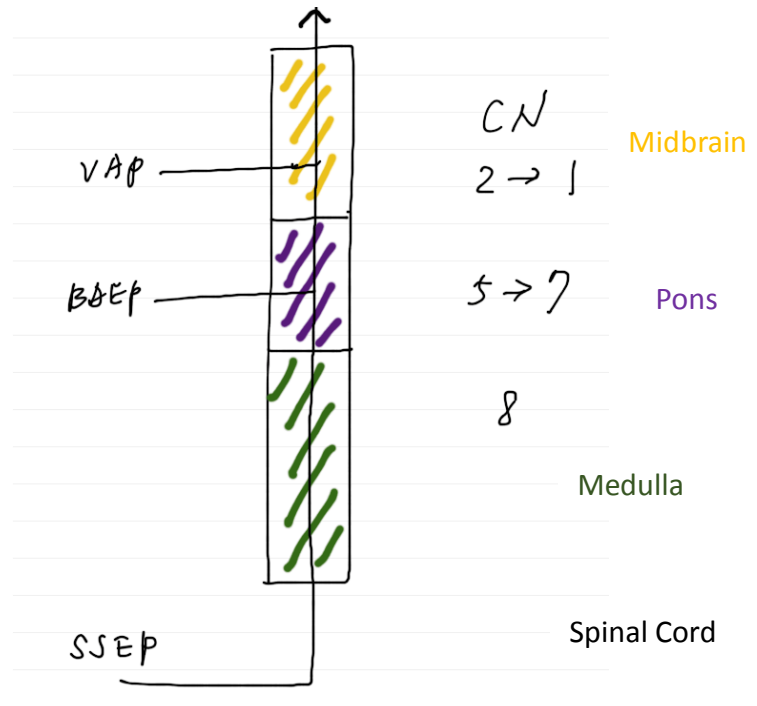
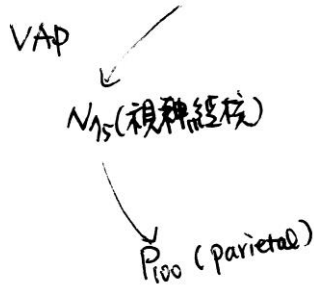
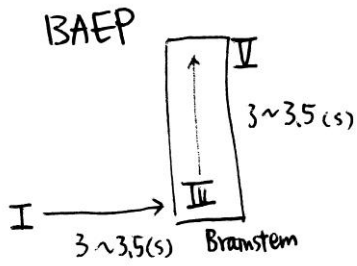
- 上: 1/3
- 下: 2/3 (兒童常見)

下: 四種常見 tumor 以位置記



上: { Midline  
非 midline





**VEP report**

	N75	P100
left	68 ms	101ms
right	63.0ms	109ms
	(約 75ms)	(約 100ms)

Right:

Threshold(db): \_ Stimulus(DB): 1= 40 2= 80

I= 1.95 II = \_\_\_ III=4.20 IV= \_\_\_ V=6.25

VI= \_\_\_ VII= \_\_\_

I-III= 2.25 III-V=2.05 I-V=4.30

1. I~III: auditory n. to pons, < 3 正常
2. III~V: 看 brain stem
3. I~V: <5.5-6.5 正常
4. V~VII: ~ cortex, 長庚沒有做

Left:

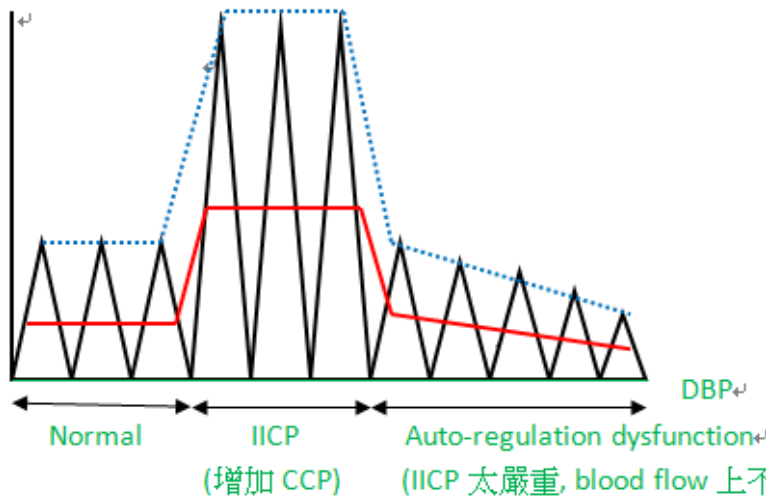
Threshold(db): \_ Stimulus(DB): 1= 80 2= 40

I= 1.90 II= \_\_\_ III=4.50 IV= \_\_\_ V=6.25

VI= \_\_\_ VII= \_\_\_

I-III= 2.60 III-V=1.75 I-V=4.35

# 如何從 brain sonogram 評估 IICP (我盡量按照建志學長教我的寫上去, 但確切的數值可能需  
要再確定)



— MAP ↴  
 - - - SBP ↴  
 — DBP ↴

Child newborn ↴

$PI = \Delta P / MAP = 0.6-1.0 \quad 0.6-1.2$  ↴  
 $RI = \Delta P / SBP = 0.4-0.6$  ↴

**STEP 1**

PI	N	↑	↑	N	N	↓
RI	N	N	↑	N	↓	↓

N=normal range

**STEP 2**

MAP	< 10 y/o	> 10 y/o	Adult
MCA	90 +/- 20	80 +/- 20	70 +/- 15
ACA	80 +/- 20	70 +/- 20	60 +/- 15
PCA	70 +/- 20	60 +/- 20	50 +/- 15

Q: 如何區分正常的 PI/RI 代表正常腦壓還是準備 progressed to auto-regulation dysfunction 之前的一小段 normal range?

A: 若正常的 PI/RI 但 MAP 已經開始下降, 代表已經是嚴重進展到 dysfunction 的程度了

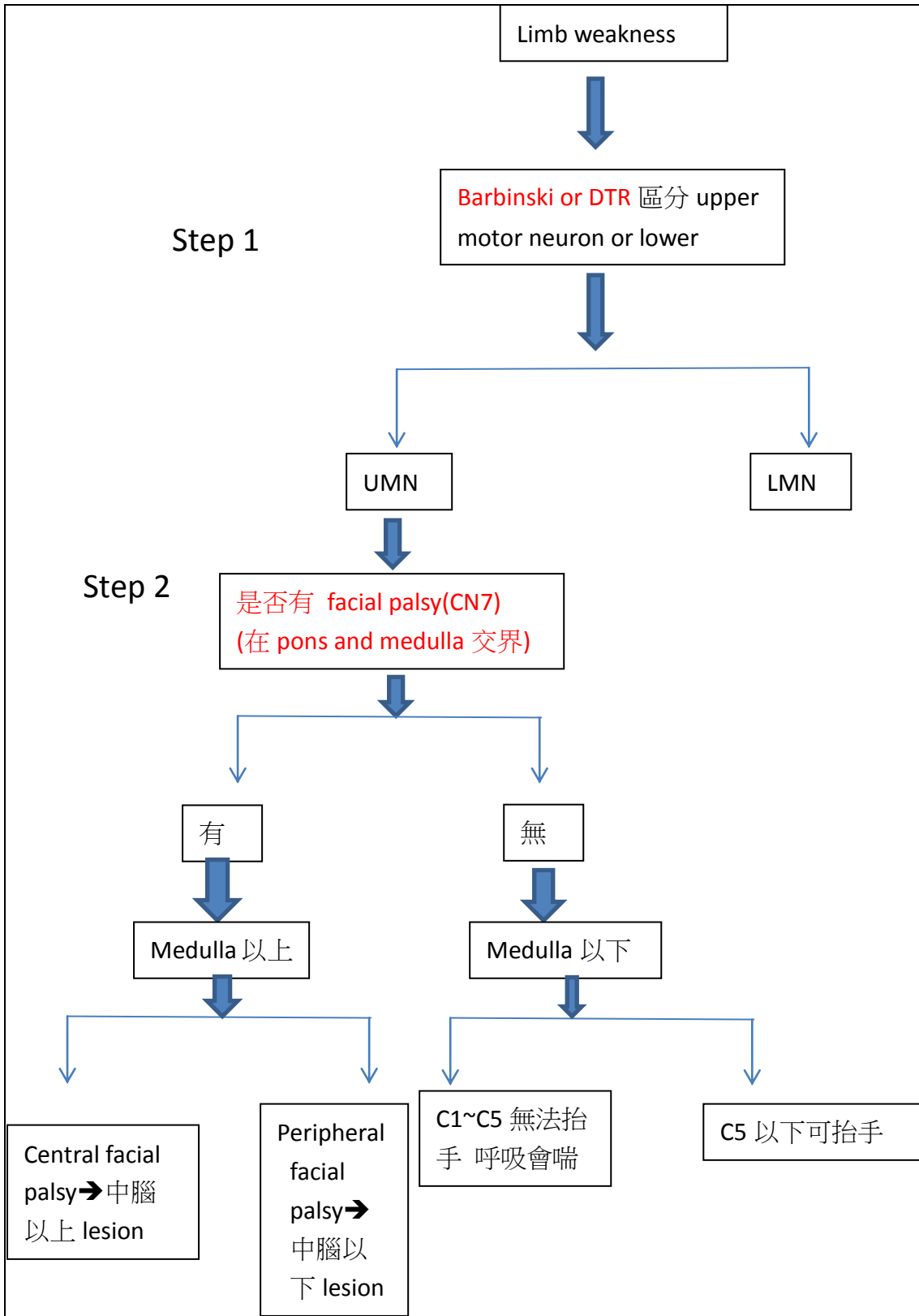
**Cholinergic storm(副交感 ↑)(口訣 SLUDGE)**

- S: salivation
- L: Lacrimation
- U: Urination
- D: defecation
- GE: gastric emisis
- Miosis(pupil 小)

解藥: Atropine 0.02mg/kg/dose

Max: 0.1mg/dose

# Limb weakness





● **Insensible water loss: 400(ml)/ BSA(m2)**

@但由呼吸器吐出的沒那麼多, 約計算出來的  $1/2 \sim 2/3$

**Hydration in PICU(especially 24~48 hrs)**

1. DKA → 10% of dehydration (max: 4000 mL 算) → 150~200% maintain
  2. Acute abdomen(Ischemia bowel) → 150~200% maintain
  3. Rhabdomyolysis/ Tumor lysis → 150~200% maintain
  4. Pancreatitis → 120~150% maintain
- 特殊情況 CPC: Cerebral edema / Pulmonary ARDS / CHF 需要限水 但又 Rhabdomyolysis → 80~100% maintain + early HD/CVVH
  - 若 CPC: Cerebral edema / Pulmonary ARDS / CHF 但又 Acute abdomen or pancreatitis → 100~120% maintain

Half saline 用於 1. Neuro 2.DKA 3.Acute abdomen

**Hyperglycemia in PICU**

1. DKA (\* blood sugar > 180 就會 glucouria 開始利尿).  
DKA 定義: a. sugar >250  
b. Ketone +  
c. PH < 7.2 or HCO<sub>3</sub> < 15

2. Acute CNS insult, EX: seizure, trauma, EV71
3. Sepsis
4. Pancreatitis
5. Drugs, Ex: steroid, TPN

Management: BW x 1 (mL) dilute to 2 倍 run 30 min

**RI run 法**

In DKA:

- i. 1<sup>st</sup> hr: Hydration, N/S challenge 20cc/kg x 1, don't give jusomin
- ii. 2<sup>nd</sup> hr~48hr: two bag system
  - i. 50u in N/S 500ml: 0.1u/ml run BW ml/hr → **0.1u/kg/hr**, initial K < 5, 加 KCL
  - ii. If sugar < 100, change to **0.05u/kg/hr**
  - iii. If sugar < 70, line B **add glucose: D0.225S(420) + 4PC 50% G/W (12.2%)**, 更高濃度需要 central line (central line max D25W)
  - iv. Monitor Sugar ↓ < 70~100/hr, 降太快會 cerebral edema (依照 IICP 處理)
- iii. >48hr: SC RI+ DM diet (Start feeding indication HCO<sub>3</sub> > 15, PH > 7.2 and Sugar < 250 mg/dL)
- iv. DKA with persist acicosis:
  - i. < 8 hr(12 hr): dehydration related
  - ii. >8 hr(12 hr): RI 不夠
- v. DKA 補 jusomin indication: PH < 6.9, CPCr, Arrythemia, 0.1 x BW x Be dilute 兩倍 run 30 min  
If sugar > 220, consider RI: 50u in N/S 500ml run BW/2 ml/hr → **0.05u/kg/hr**

## Blood transfusion

1. 洗腎, or acute blood loss ( $\Delta$  Hb > 2) → Keep Hb > 10

2. PT > 15.5S, aPTT > 75.5S → 輸 FFP

\* If PT prolonged and APTT 正常可打 **vitamin K1 0.1mg/kg stat**, Hepatic failure 需打 QD x 3days

3. HUS 禁輸 FFP, 只可輸 wash RBC, LPP

4. 大量輸血(成人 > 1000ml, 小孩 > 25ml/kg), 要小心 Electrolyte 大亂 (K ↑, Ca ↓) and TRALI (transfusion related acute lung injury)

## Diamox (Acetazolamide) 功能 (口訣 2A2D)

1. AED ~ catamenial epilepsy 的第一線用藥

2. Alkalinization urine ~ 當 blood  $\text{HCO}_3^- > 40$ , **Dose: 10mg/kg/dose Q12H\*2 days**

3. Diuretics

4. Decreased IICP (高山症)

**其餘 dose: 5mg/kg/dose Q12H**

## Milrinone

BW \* 0.3 in D5W/ NS, total 20ml, **Loading 3ml/hr \* 30mins = 0.75mcg/kg/min**

**Maintain 1ml/hr = 0.25mcg/kg/min**

## Fentanyl

**1ml dilute 到 total 5ml, run BW/10 ml/hr = 1mcg/kg/hr**

## Intoxication (口訣 CLEAN+HD)

Charcoal (四小時內)

Lavage (一小時內)

Emesis (不建議)

Anti-dote

Hydration + Alkalosis

Diuretics / HD

那些 Charcol 沒用? (記法: 小藥罐)

PHIALS, Vials 字頭改成 "PH")

Pesticide 農藥

Hydrocarbon

Iron

Acid and alkalosis

Lithium

Solven 溶劑

## Traffic accident

1. Liver: hematoma (有 capsule 包住, 可稍微抑制出血量)

2. Pancreas: 斷裂 (因為橫跨在 spine 前)

3. Spleen hematoma, rupture: 無 capsule, 容易大量出血造成 shock