

## Case Conference

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2012/01/07

## Patient Data

- Case :張XX
- 44 y/o, male
  - Date: 2011/xx/XX, 11:44
  - E1V1M1
  - TPR: 34.4/55/18BP:55/35
  - SpO2:90
  - 檢傷主訴：意識程度改變
  - Triage: 1

## History

- Conscious change found by colleague just now
- 工地同事:約11:20發現P't軟倒在椅子上、叫不醒。
- 早上說有diarrhea for several times
- 之前有因為低血糖去三重H
- EMT車上F/S是Hi

## Past History

- Allergy: NKA
- DM(+)
- No HTN
- No history of heart disease

## Physical Examination

- E1V1M1
- Pupil size:4/4 mm
- Light reflex:+/+
- Chest: bil coarse breath sound
- Abdomen: soft
- Extremity:cold,no pitting edema

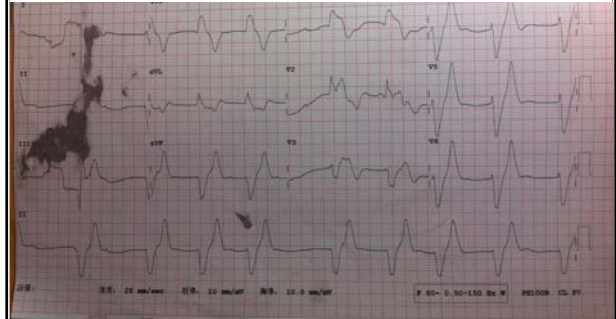
## Tentative diagnosis

- Conscious change
  - ✓ r/o HHS or DKA
  - ✓ r/o ICH
  - ✓ r/o hyperkalemia

### Order

- On monitor
- On nasal airway /ambu bagging
- F/S (Hi)
- ABG(6)
- EKG
- On ETT & MV
- CBC/DC/PLT
- RI 15 U IV st
- PT/aPTT
- BUN/Cr/Cl/Ketone/Osmo
- Lactate
- Cardiac enzyme
- N/S 1000ml challenge
- B/C x II
- CXR(p)
- Dopamine 40ml/hr
- Brain CT s contrast

### EKG 11:43



### ABG6

- PH=6.897
- PCO2=30.1mmHg
- PO2=285 mmHg
- BE=-27 mmol/L
- HCO3=5.9 mmol/L
- TCO2=7 mmol/L
- SO2=100 %
- NA=105 mmol/L
- K=>9.0 mmol/L
- HCT=43 %PCV
- HB=14.6 g/dL

### Bedside echo

- No pericardial effusion
- Fair LV contractility
- No visible liver abscess
- No ascites noted

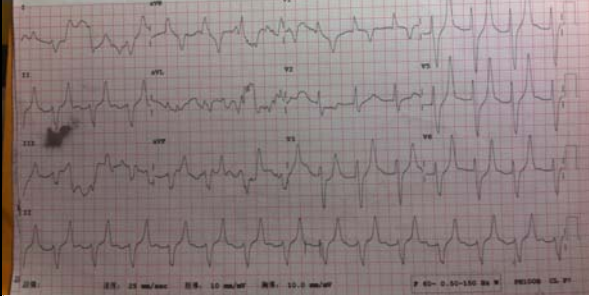
### Further management

- Calcium gluconate 1 amp IV st
- NaHCO<sub>3</sub> 6 amp + 6 amp IV st
- F/S Q1H
- DC brain CT (Patient con's sluggish& no focal neurologic sign)
- 電聯Nephro
- On NG / Foley
- F/u ABG(6) and F/S at 12:30
  - ✓ 1 line N/S 100ml/hr
  - ✓ 2 line Dopamine 40 ml/hr
  - ✓ 3 line RI 50U in N/S 500ml run 60ml/hr

### CXR



## EKG 12:06



## Lab 12:33

| PT             | 9.0  | second | 9.400  | 12.500 |
|----------------|------|--------|--------|--------|
| Normal control | 10.6 | second |        |        |
| INR            | 0.86 | Ratio  | 0.800  | 1.200  |
| APTT           | 33.3 | second | 28.600 | 38.600 |
| Normal control | 32.8 | second |        |        |

## 12:36

- PH=7.079
- PCO2=33.3
- PO2=349 mmHg
- BE=-20 mmol/L
- HCO3=9.9 mmol/L
- TCO2=11 mmol/L
- SO2=100 %
- NA=115 mmol/L
- K=6.6 mmol/L
- HCT=39 %PCV
- HB=13.3 g/dL

F/S : High

- N/S 500ml 續challenge
- On critical
- RI 15U IV st

## Lab 12:42

| Lactate | 13.0 | mg/dL | 4.500 | 19.800 |
|---------|------|-------|-------|--------|

## Lab 12:44

| CBC/Platelet/DC    | ***** |          |         |         |
|--------------------|-------|----------|---------|---------|
| WBC                | 19.8  | X1000/uL | 3.800   | 10.000  |
| RBC                | 4.87  | million  | 4.500   | 5.700   |
| Hb                 | 11.9  | gm/dl    | 13.000  | 18.000  |
| Ht                 | 38.5  | %        | 40.000  | 54.000  |
| MCV                | 79.1  | fL       | 81.000  | 98.000  |
| RDW                | 13.6  | %        | 11.500  | 14.500  |
| Platelet           | 167   | x1000/uL | 140.000 | 450.000 |
| Differential count | ***** |          |         |         |
| Segmented Neutro.  | 88.0  | %        | 37.000  | 75.000  |
| Lymphocyte         | 4.0   | %        | 20.000  | 55.000  |
| Monocyte           | 5.0   | %        | 4.000   | 10.000  |
| Band               | 1.0   | %        | 0.000   | 5.000   |
| Metamyelocyte      | 2.0   | %        | 0.000   | 0.000   |

## Lab 13:15

| CPK          | 134   | U/L     | 39.000  | 308.000 |
|--------------|-------|---------|---------|---------|
| BUN          | 47    | mg/dL   | 8.000   | 20.000  |
| Creatinine   | 2.4   | mg/dL   | 0.500   | 1.300   |
| eGFR         | 29.42 |         |         |         |
| Cl           | 72    | meq/L   | 96.000  | 108.000 |
| Blood Ketone | 4+    |         |         |         |
| Osmolarity   | 328   | mOsm/kg | 278.000 | 305.000 |
| Troponin I   | <0.01 | ug/L    | 0.000   | 0.500   |
| CK-MB        | 21    | U/L     | 7.000   | 25.000  |

### Anion gap

- Anion gap =  $[\text{Na}^+] - ([\text{Cl}^-] + [\text{HCO}_3^-])$
- $105 - (72 + 5.9) = 27$

13:40

- U/A
- U/C
- Stool culture
- Rocephin 2g v st
- On CVP

### VBG 13:52

- PH=7.093
  - PCO2=33.4
  - PO2=83 mmHg
  - BE=-22 mmol/L
  - HCO3=9.0 mmol/L
  - TCO2=10 mmol/L
  - SO2=90 %
  - NA=121 mmol/L
  - K=4.5 mmol/L
  - HCT=42 %PCV
  - HB=14.3 g/dL
- F/S: High  
BP:92/58  
HR:124
- RI:15U sc st
  - NaHCO3 3 amp v st
  - N/S 500 ml Challenge

### U/A

| Sediment        | *****     |      |       |       |
|-----------------|-----------|------|-------|-------|
| RBC             | 1-2       | /HPF | 0.000 | 2.000 |
| WBC             | 3-5       | /HPF | 0.000 | 5.000 |
| Epithelial cell | 1-2       | /HPF | 0.000 | 5.000 |
| Cast            | Not Found | /LPF |       |       |
| .cast-amount    | -         |      |       |       |
|                 | Not Found | /HPF |       |       |
| .Cry-amount     | -         |      |       |       |

### Diagnosis

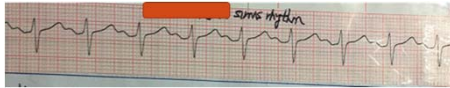
- 1. Conscious change
- 2. DKA
- 3. AKF
  - ✓ Hyperkalemia & hyponatremia
  - ✓ Hypovolemic shock

### Initial Medication at ER

- NaHCO3 15amp
- N/S 2000 ml
- Calcium gluconate 1 amp
- Dopamine
- RI
- Rocephin

## RICU course day 1

- Start CVVH
- Rocephin 2gm q12h
- Dopamine 40 ml/hr
- RI pump(100U+N/S 100ml ) 5ml/hr
- N/S 120 ml/hr



## U/A

| Urine routine | *****    |       |       |       |
|---------------|----------|-------|-------|-------|
| Color         | Yellow   |       |       |       |
| Clarity       | Negative |       |       |       |
| Sp.gr.        | 1.022    |       | 1.002 | 1.022 |
| pH            | 5.0      |       | 5.500 | 8.000 |
|               | 2+       |       |       |       |
| protein       | 30(+)    | mg/dl |       |       |
| glucose       | 1.0(3+)  | gm/dl |       |       |
| Ketone        | 3+       |       |       |       |
| Bilirubin     | +        |       |       |       |
| Urobilinogen  | 0.1      | EU/dl | 0.100 | 1.000 |
| Nitrite       | Negative |       |       |       |

## ABG 18:13

- PH=7.380
- PCO2=29.8
- PO2=395.8 mmHg
- Hct =43
- BE=-5.5 mmol/L
- HCO3=17.8 mmol/L
- SO2=100 %

## Lab 18:30 (CVVH)

| BUN        | 38    | mg/dL | 8.000   | 20.000  |
|------------|-------|-------|---------|---------|
| Creatinine | 1.5   | mg/dL | 0.500   | 1.300   |
| eGFR       | 50.61 |       |         |         |
| Na         | 133   | meq/L | 133.000 | 145.000 |
| K          | 3.7   | meq/L | 3.300   | 5.100   |
| Cl         | 89    | meq/L | 96.000  | 108.000 |
|            | 4.39  | mg/dL | 3.680   | 5.600   |
| P          | 4.00  | mg/dL | 2.500   | 4.500   |

## Urine

| BUN                | ***  | g/day   | 10.000  | 20.000  |
|--------------------|------|---------|---------|---------|
| Creatinine         | 41.5 | mg/dL   |         |         |
| TP/Cr              | ***  |         |         |         |
| Na                 | 50   | meq/L   | 40.000  | 220.000 |
| K                  | 19   | meq/L   | 25.000  | 120.000 |
| Osmolality (Urine) | 448  | mOsm/kg | 300.000 | 900.000 |

## Lab

| LDL-C             | 31    | mg/dL | 0.000   | 130.000 |
|-------------------|-------|-------|---------|---------|
| Total cholesterol | 145   | mg/dL | 0.000   | 220.000 |
| Triglyceride      | 589   | mg/dL | 50.000  | 130.000 |
| Uric acid         | 10.8  | mg/dL | 3.400   | 7.000   |
| Amylase           | 36    | U/L   | 28.000  | 100.000 |
| Lipase            | 38    | U/L   | 13.000  | 60.000  |
| Serum Iron/TIBC   | ***** |       |         |         |
| Iron              | 60    | ug/dL | 45.000  | 160.000 |
| TIBC              | 235   | ug/dL | 228.000 | 428.000 |
| Ferritin          | 357   | ng/mL | 30.000  | 400.000 |

## Day2

| BUN        | 25    | mg/dL | 8.000   | 20.000  | *H | 38    |
|------------|-------|-------|---------|---------|----|-------|
| Creatinine | 1.1   | mg/dL | 0.500   | 1.300   |    | 1.5   |
| eGFR       | 72.39 |       |         |         |    | 50.61 |
| Na         | 138   | meq/L | 133.000 | 145.000 |    | 133   |
| K          | 3.6   | meq/L | 3.300   | 5.100   |    | 3.7   |
| Cl         | 102   | meq/L | 96.000  | 108.000 |    | 89    |
|            | 4.11  | mg/dL | 3.680   | 5.600   |    | 4.39  |
| P          | 2.20  | mg/dL | 2.500   | 4.500   | *L | 4.00  |

## HbA1C

| HbA1C | 9.10 | % | 4.000 | 6.000 |
|-------|------|---|-------|-------|

## Day 2

- DC CVVH
- DC RI pump
- DC dopamine

## Day 3Extubation

- 轉一般病房
- ABX 改 Cefmetazone

## Day 5

| BUN        | 12     | mg/dL | 8.000   | 20.000  |
|------------|--------|-------|---------|---------|
| Creatinine | 0.7    | mg/dL | 0.500   | 1.300   |
| eGFR       | 121.95 |       |         |         |
| Na         | 138    | meq/L | 133.000 | 145.000 |
| K          | 4.4    | meq/L | 3.300   | 5.100   |
| Cl         | 101    | meq/L | 96.000  | 108.000 |
|            | 4.79   | mg/dL | 3.680   | 5.600   |
| P          | 3.60   | mg/dL | 2.500   | 4.500   |

## Day 9 MBD final diagnosis

- Diabetic ketoacidosis
- Acute kidney failure with hyperkalemia
- Shock caused by acidosis
- Anemia , susp Thalassemia
- Type 2 DM
- HTN

## Discussion

- 1. Conscious change
- 2. Hyperkalemia & ECG
- 3. DKA

## ALTERED LEVEL OF CONSCIOUSNESS

**A** Acidosis, Alcohol intoxication  
**E** Epilepsy  
**I** Infection  
**O** Overdose (Drug or Alcohol)  
**U** Uremia  
**T** Trauma, Tumor  
**I** Insulin (low BLOOD SUGAR)  
**P** Psychosis  
**S** Stroke

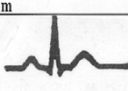
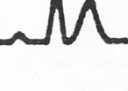
## MIDSO

- 代謝性(Metabolic)
- 感染(Infection)
- 藥物(Drugs)
- 構造性(Structural)
- 其他(Others)

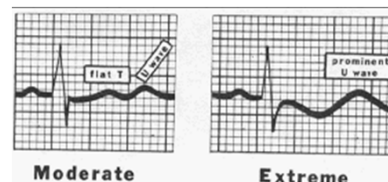
## Metabolic

- (一) 代謝性(M)：1.低血糖，2.高血糖，3.尿毒病，4.電解質不平衡，5.內分泌異常等。
- (二) 感染(I)：如腦膜炎，腦炎，敗血性休克等。
- (三) 藥物(D)：如1.酒精 2.藥物 3.毒物(一氧化碳、有機磷殺蟲劑等)。
- (四) 構造性(S)：1.腦出血(包括硬腦膜下、硬腦膜上、蜘蛛膜下、腦內和腦幹出血)，2.腦腫塊/膿瘍，3.癲癇發作，4.中風。
- (五) 其他(O)：精神病、偽病。

## Hyperkalemia

| Serum Potassium | EKG Effects                                                                                                                               |  |
|-----------------|-------------------------------------------------------------------------------------------------------------------------------------------|--|
| Normal          |                                                        |  |
| >6.0meq/L       |  Tall T waves                                          |  |
| >7.5meq/L       |  Long PR interval<br>Wide QRS duration<br>Tall T waves |  |
| >9.0meq/L       |  Absent P waves<br>Sinusoidal wave                     |  |

## Hypokalemia



## Treatment of hyperkalemia

### Antagonism of membrane actions of potassium

Calcium

### Drive extracellular potassium into the cells

Insulin and glucose

Sodium bicarbonate, primarily if metabolic acidosis

$\beta_2$ -adrenergic agonists

### Removal of potassium from the body

Loop or thiazide diuretics

Cation exchange resin

Dialysis, preferably hemodialysis if severe

## RAPIDLY ACTING TRANSIENT THERAPIES

### • Administration

- ✓ Calcium
- ✓ Insulin with glucose
- ✓ Beta-2-adrenergic agonists
- ✓  $\text{NaHCO}_3$

## RAPIDLY ACTING TRANSIENT THERAPIES

- Patients with hyperkalemia and **electrocardiographic changes**.
- Patients with a serum potassium greater than **6.5 to 7.0 meq/L**
- A lesser degree of hyperkalemia in patients with a serum potassium that is **rapidly increasing**.

## DKA vs HHS

|                                              | DKA       |              |             | HHS         |
|----------------------------------------------|-----------|--------------|-------------|-------------|
|                                              | Mild      | Moderate     | Severe      |             |
| Plasma glucose (mg/dL)                       | >250      | >250         | >250        | >600        |
| Arterial pH                                  | 7.25-7.30 | 7.00-7.24    | <7.00       | >7.30       |
| Serum bicarbonate (mEq/L)                    | 15-18     | 10 to <15    | <10         | >18         |
| Urine ketones*                               | Positive  | Positive     | Positive    | Small       |
| Serum ketones*                               | Positive  | Positive     | Positive    | Small       |
| Effective serum osmolality (mOsm/kg)*        | Variable  | Variable     | Variable    | >320        |
| Anion gap $\Delta$                           | >10       | >12          | >12         | Variable    |
| Alteration in sensoria or mental obtundation | Alert     | Alert/drowsy | Stupor/coma | Stupor/coma |

## Clinical features

- DKA usually evolves rapidly over a 24-hour period.
- Hyperglycemia: polyuria, polydipsia, and weight loss  $\rightarrow$  lethargy, focal deficits, obtundation, seizure, and coma.
- Ketoacidosis: nausea, vomiting, abdominal pain, and hyperventilation.
- Common causes of DKA include: infection; noncompliance, inappropriate adjustment, or cessation of insulin; new onset DM; and AMI.

## Management key point

- A B C + large bore IV ( $\geq 16$  gauge) access + Monitor
- Replete fluid deficits
- Replete potassium ( $\text{K}^+$ ) deficits if  $< 3.3$
- Give insulin if  $\text{K}^+ > 3.3$
- Give sodium bicarbonate to patients with pH below 7.00 (add KCl slow drip over two hours)