

Severely Poisoned Patients Requiring Critical Care



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Disclaimer

- I am not a toxicologist !
- Non-evidence based

Background

- Tertiary referral teaching hospital
- A 23-bed unit with 1700 admission per year
- Both surgical and medical patients
- Resp/Renal /CVS support including VA and VV ECMO



Poisoning / Overdose

- Jun 2014 – Jun 2016
- 1430 Hospital admission
- 32 ICU admission
- *Admission rate 2.2%*

No	Sex/Age	Reason	Intervention
1	F/84	Bamboo snake bite	Observation
2	M/55	Aconitine poisoning	Observation
3	F/56	CO poisoning, delayed presentation	Observation
4	F/46	Metoprolol overdose	Observation
5	F/65	Multiple drug overdose include Propanolol	Observation
6	F/30	Overdose of psychotropic drugs	Observation
7	F/71	Hypnotics overdose	Observation
8	F/33	Snake bite with compartment syndrome	Observation
9	F/84	Panadol + Benzodiazepine	Observation
10	F/16	Paracetamol overdose, underlying asthma	Observation
11	M/37	Zopiclone overdose with MetHb	Observation

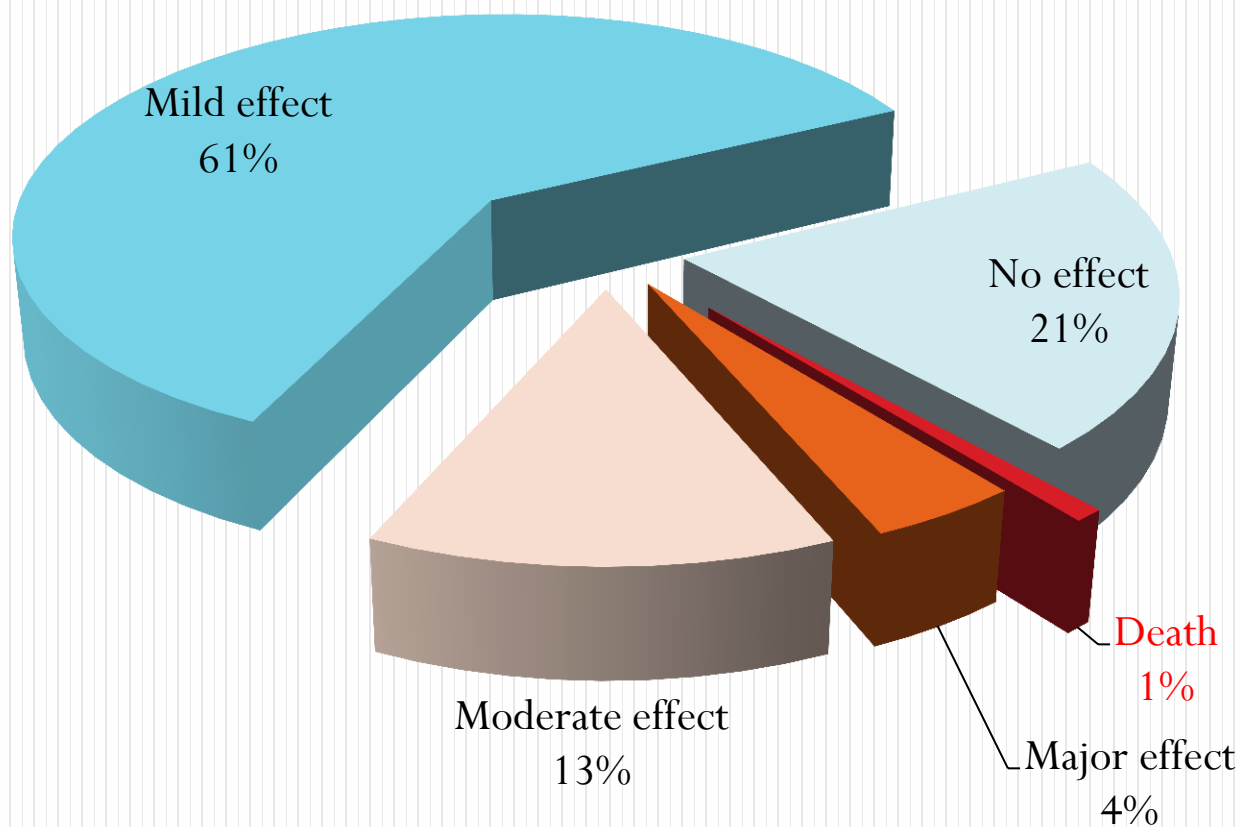
No	Sex/Age	Reason	Intervention
12	F/45	Overdose of psychotropic drugs	Intubate for airway protection
13	F/37	Overdose of psychotropic drugs	Intubate for airway protection
14	F/27	Hypnotics overdose	Intubate for airway protection
15	M/56	Benzodiazepine overdose	Intubate for airway protection
16	M/28	CO + Hypnotics toxicity	Intubate for airway protection
17	F/32	CO + Burn wound to Right leg	Intubate for airway protection
18	M/18	Alcohol intoxication	Intubate for airway protection
19	F/32	Alcohol intoxication	Intubate for airway protection
20	M/79	Orange swipe, delayed laryngeal edema	Intubate for airway protection
21	F/46	Diuretics with hypoK	Electrolyte replacement
22	F/46	Diuretics with hypoK	Electrolyte replacement

No	Sex/Age	Reason	Intervention
23	M/72	Diltiazem overdose	CVS
24	F/48	Propranolol overdose	CVS
25	F/60	Lithium with neurotoxicity	Renal
26	M/39	Zopiclone overdose with ARF	Renal
27	F/64	Welsch toxicity, delayed laryngeal edema	Resp
28	M/44	Opioid overdose with aspiration pneumonia	Resp
29	M/53	Opioid overdose with aspiration pneumonia and shock	Resp + CVS
30	M/56	Amlodipine and methyldopa overdose	Resp + CVS
31	M/54	Thinner and Methanol toxicity	Resp + CVS + Renal
32	M/29	Isopropylalcohol and Methanol toxicity	Resp + CVS + Renal

ICU Admission

- F:M = 1.46:1
- Median age 46 (range 16-84)
- Length of hospital stay
 - Average 9.1 day
 - Median 5 day (range 1 – 55)
- *Mortality 0%*

Clinical outcome HKPIC 2013



Main Challenges

- Represent a small but unique and diverse group of patients
- Non-standard drug therapies which is unfamiliar to most of the involved staffs
- Diagnosis can be difficult and time-pressing

First encounter

- 'Look well'
- Impaired conscious state
- Hemodynamic instability
- Respiratory failure
- Severe metabolic or electrolyte derangement

Initial Approach

- Airway protection
- Support of respiration and circulation
- Rapid assessment
- Clinical context / Toxidrome
- Toxicology laboratory testing virtually never available in a time frame that supports early resuscitation decisions
- Early consultation with regional poison center
 - Poisoned patients could deteriorate rapidly
 - Benefit from a thorough understanding of the toxic agent

Challenges and Difficulties

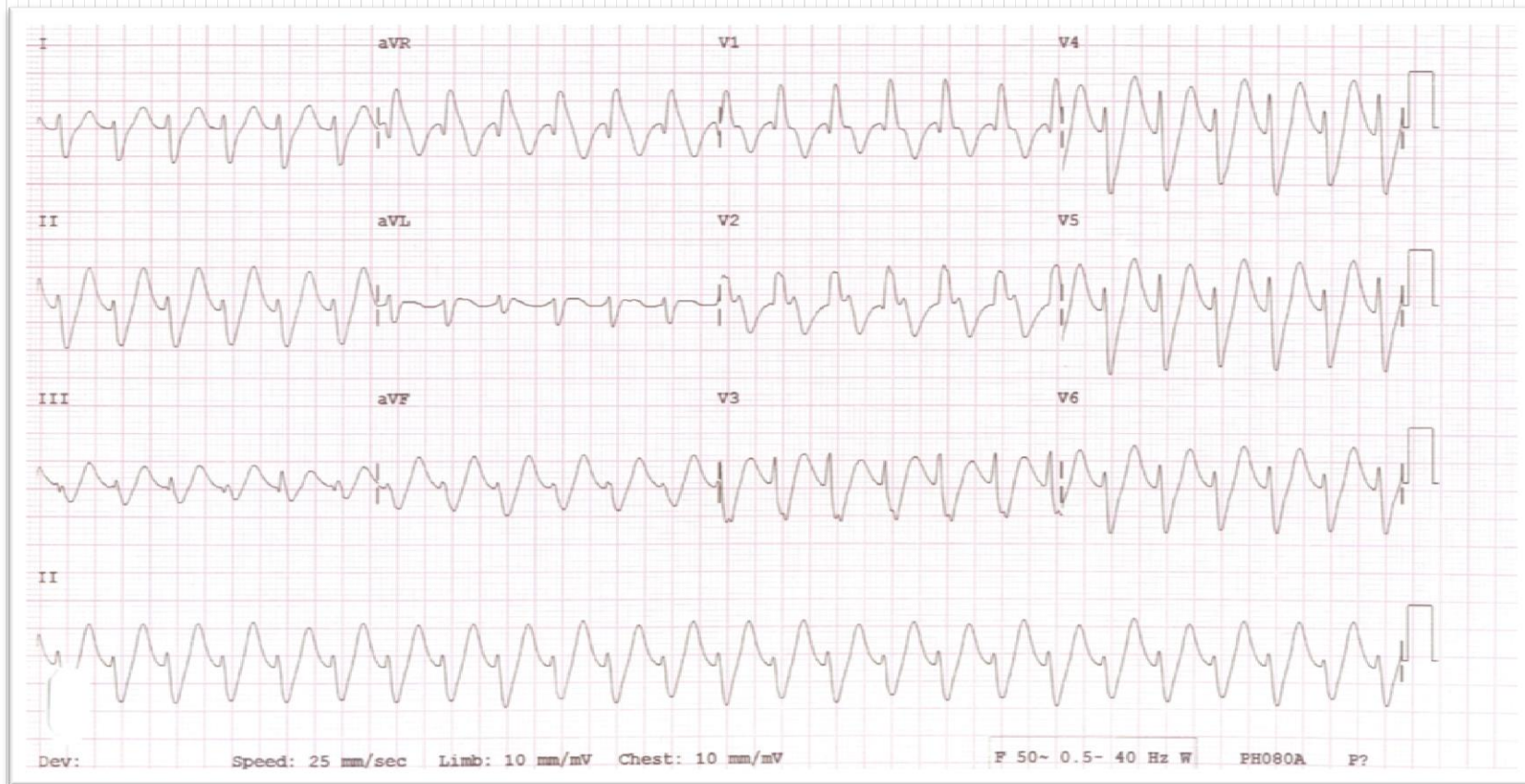
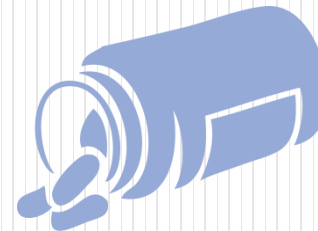


Case 1

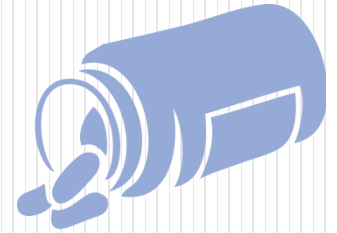


- F/54 on *mirtazapine*, *zopiclone* and *diazepam* for depressive disorder
- At 0min, called ambulance herself for drug overdose
- At 37min, door opened by the patient
- At 65min, arrived at AED with GCS7 with hypotension
- At 108min, VT arrest and seizure
- ROSC after 20mins

Case 1



TCA Overdose



- Secure Airway and Breathing
- Circulatory support and control of arrhythmia
- Management of refractory seizure

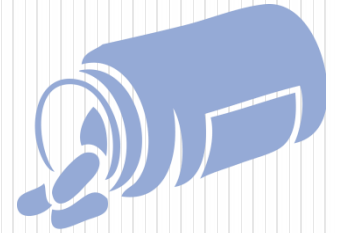
- Specific treatment
 - GI decontamination – Activated charcoal
 - Use of antidote
 - Use of Intralipid

Circulatory support



- Fluid and Vasopressor
 - Noradrenaline and Adrenaline
- Early use of NaHCO_3 during resuscitation and as treatment for hypotension and arrhythmia
 - Increase the sodium load
 - Plasma alkalinization
- Hypertonic saline infusion

Refractory seizure



- American Epilepsy Society (AES) Guidelines 2016
 - Benzodiazepine (midazolam, lorazepam, or diazepam)
 - Phenytoin, valproic acid, or levetiracetam
 - Anesthetic doses of thiopental, midazolam or propofol.
- Avoid phenytoin for concern of exacerbating cardiotoxicity
- Only thiopental and propofol can achieve isoelectric EEG

Refractory seizure



- *15mg midazolam and 15mg valium*
- *-> Propofol 200mg/h*
- *-> Thiopentone 350mg/h*

- Propofol – unexplained metabolic acidosis
- Thiopental – can cause severe hypokalemia and increase rate of nosocomial infection

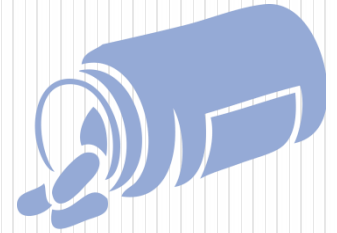
GI Decontamination



- Time dependent and effectiveness is questionable
- Insertion of nasogastric tube could be difficult
- Logistic reason – Xray to confirm position, blocked tube etc

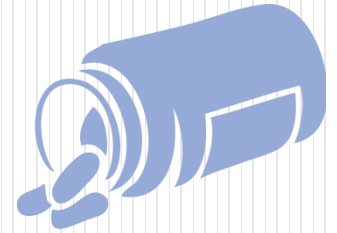
- Life saving measures take precedence
- Decontamination if sufficient time and manpower
 - Gastric emptying always delay in critically ill patient

GI Decontamination



- *After stabilization, attempted nasogastric tube insertion for activated charcoal but failed*
- *GI team consulted for OGD guided insertion*
- *Activated charcoal given at ~4 hours after ICU admission*

Use of Intralipid



- ‘Lipid sink’ mechanism
- Rescue therapy when standard resuscitative measures fail
- Logistic reason
- Concern of interfere with the VA ECMO circuit

Our patient



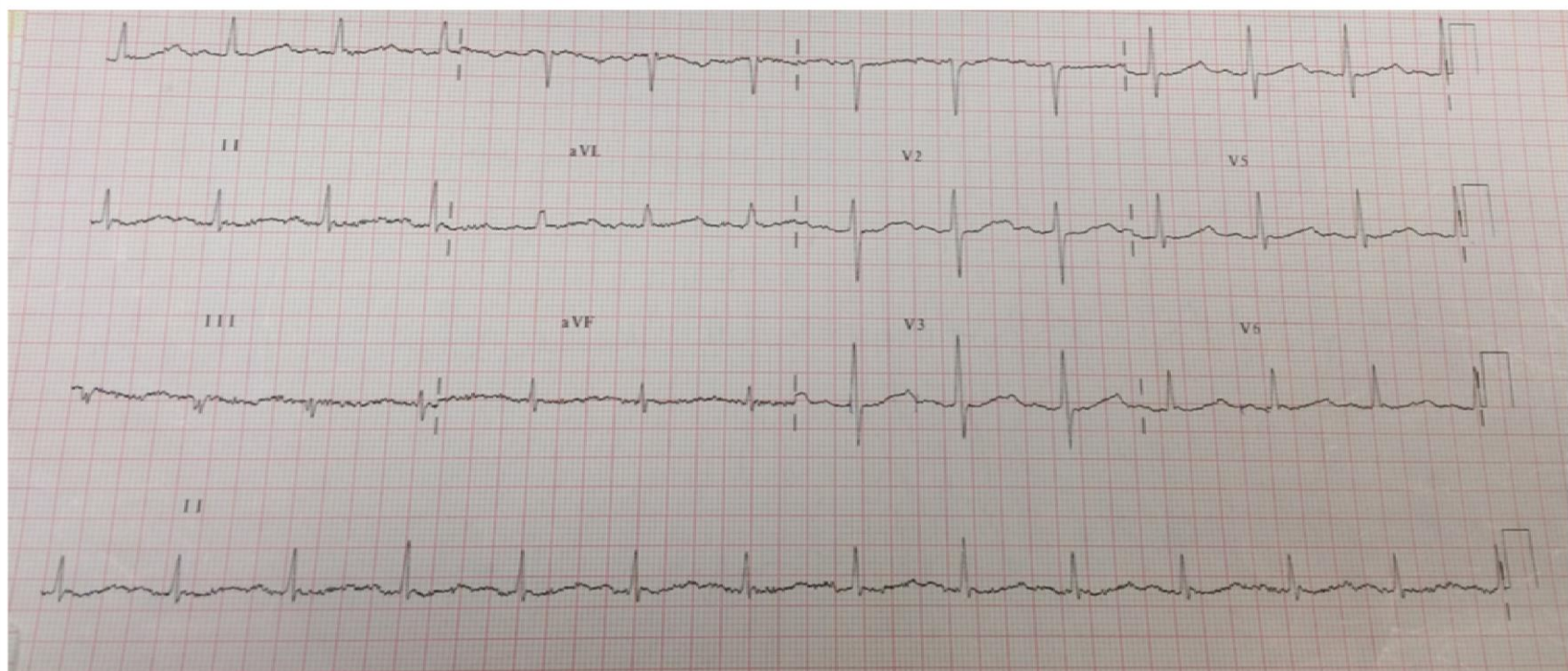
- Improved after 24 hours
- Management of complications
 - Tight temperature control for cerebral protection
 - Treatment of aspiration pneumonia
- Woke up on Day 4
- Extubated on Day 5
- Discharged to general ward on Day 6
- Home on Day 22

Case 2



- F/69
- Hypertension on *nifedipine extended released* and *lisinopril*
- Schizophrenia on *imipramine*, *sulpiride* and *lorazepam*
- In a cold winter, found collapse at home with empty drug bags nearby
- Last seen well by family 12 hours ago
- On arrival at AED GCS 3, hypothermia with temp 31.6C
- BP 112/71mmHg, P78/min

Case 2



Case 2



- Intubated for airway protection
- CT scan to exclude intracranial cause
- One dose of activated charcoal given and started rewarming
- At 5th hours, temperature came up to 34C
- Patient developed bradycardia with hypotension

Delay presentation of Calcium-channel blocker toxicity

Calcium channel blocker



- Circulatory support
 - Atropine for symptomatic bradycardia
 - Adrenaline or dobutamine
 - Fluid and noradrenaline for hypotension
 - IV calcium in form of Ca gluconate or Ca chloride
- *0.9mg Atropine*
- *30ml 10% Ca gluconate*
- *Noradrenaline up to 15mcg/min*

Calcium channel blocker



- HDI therapy
 - Improve myocardial contractility and improve systemic perfusion
 - Initial bolus of 1 U/kg followed by infusion 0.5–2 U/kg/h
 - Noradrenaline sparing effect
- Problems of hypoglycemia and hypokalemia
- Regular blood monitoring every 30mins to 1 hour
- *Insulin 25u/hr + D20 60ml/h*

Calcium channel blocker

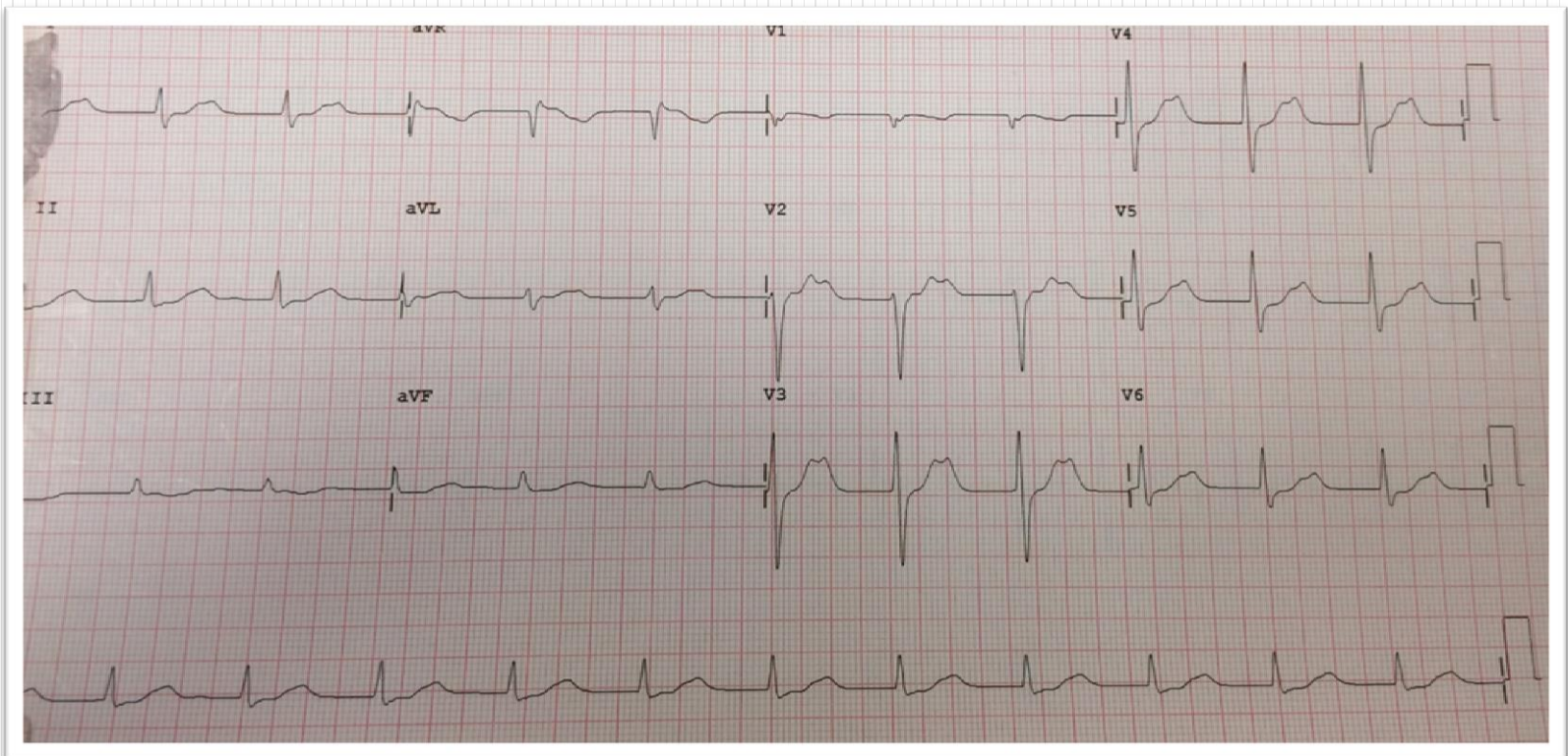


- GI decontamination
 - Multi-dose activated charcoal
 - Whole bowel irrigation technically difficult in critically ill patients and usually not tolerated well
- *At 21st hour, wean off inotropes*
- *HDI therapy slowly tapered off*

Calcium channel blocker



- At 24th hour, developed recurrent VT / VF required repeated defibrillation



Calcium channel blocker



- ECG – prolonged QTc 540ms, R on T phenomenon
 - ? CCB toxicity
 - ? Sulpiride/Imipramine toxicity

Prolonged QTc



- Correct electrolytes
- Administration of Magnesium
- At 46th hour, decided for insertion of trans-venous pacing wire for overdrive pacing
- Pacing rate set at 100/min and patient stabilized
- Day 5, pacing stopped
- Day 8, patient extubated and discharge from ICU

Case 3



- M/52, Anxiety disorder
- Found lying on street with strong smell of 'thinner'
- Had been spoken to son for low mood and suicidal idea
- GCS 8 (E2V2M4)
- BP 194/99mmHg, P147/min
- ABG – pH 7.09, BE -17

Case 3



- Intubated for airway protection
- Runs of SVT aborted with IV propranolol
- One dose of activated charcoal given
- Metabolic acidosis improved with rehydration
 - Lactate is normal
 - Anion gap 14 mEq/l
 - Toxicology screen for ethanol, salicylate and paracetamol negative

Hydrocarbon



- Common ingredients of thinner are toluene and xylene
- Management of systemic toxicity – CNS depression, cardiac arrhythmia and aspiration pneumonitis
 - Arrhythmia precipitated via catecholamine surge
 - Proper sedation, treated with B-blocker
- Activated charcoal not indicated for aliphatic hydrocarbons
- For aromatic hydrocarbon, one dose of activated charcoal can be given

Hydrocarbon



- Serum osmolarity as screening test
- Osmolarity gap 71mOsm/l
- Serum methanol screening test came back positive
- **Methanol Toxicity**
 - Specific treatment available, Early treatment is crucial
 - Toxic metabolite formic acid
 - Alcohol dehydrogenase inhibition – Fomepizole and ethanol

Methanol



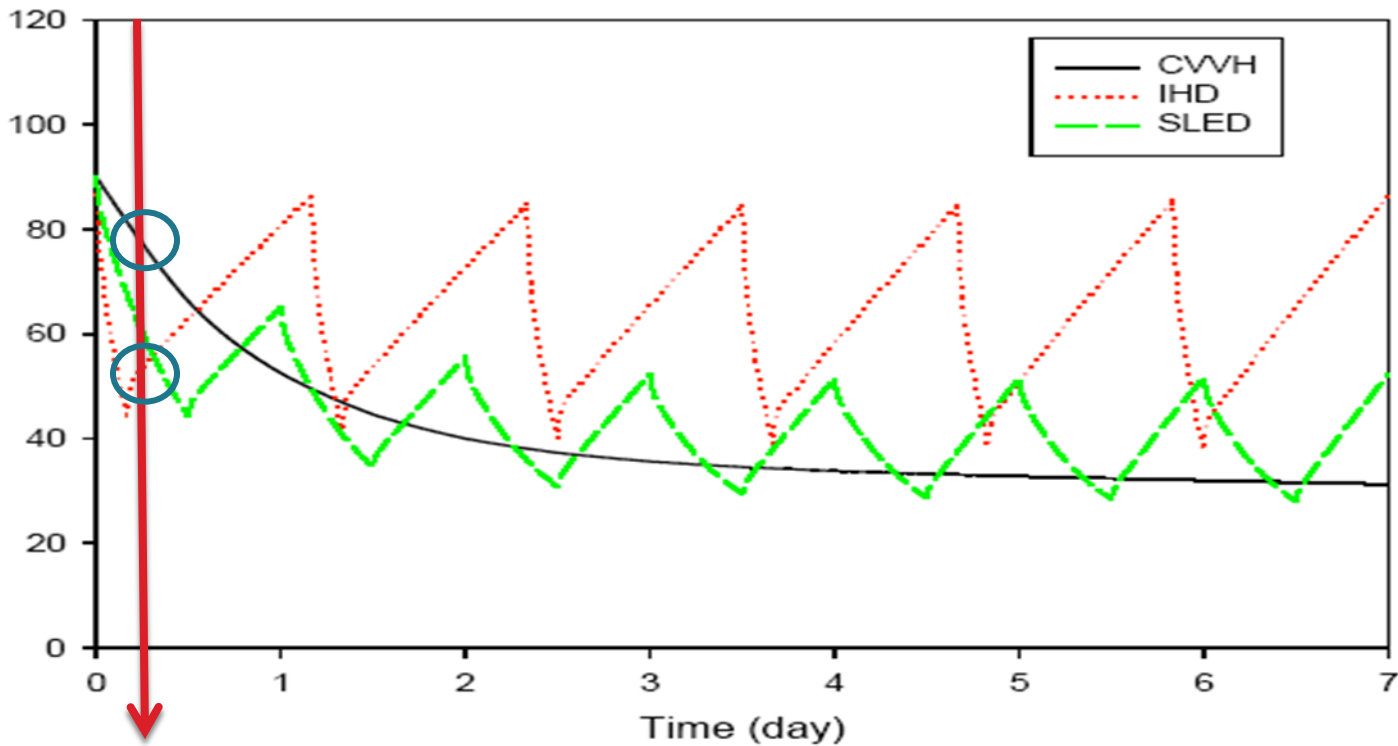
- Fomepizole was not stocked in our hospital
- IV Ethanol
 - 1ml/kg 100% ethanol, infusion 10% ethanol at 2-4ml/kg/h
 - Monitoring every 2 hour, target serum ethanol level 22mmol/l
 - Stock is limited, after the loading dose, infusion could only commenced three hours later
- Decided to start on dialysis
 - *2h section of haemodialysis (HD) followed by continuous haemofiltration (CVVH)*

HD vs CVVH



- MW < 500D – **Diffusion** - Hemodialysis
- MW > 1000D – **Convection** - Hemofiltration

HD vs CVVH



Kinetic Comparison of Different Acute Dialysis Therapies

Bill Liao et al; Artificial Organs 27(9):802-7 · October 2003

HD vs CVVH



- HD is preferred because of its efficacy within a given time period
 - Clearance by HD is 3 fold greater than CVVH
- Disadvantages
 - More cardiovascular instability and electrolyte disequilibrium
 - Rebound phenomenon in drug overdose



Our patient

- At 22nd hour, patient wake up to obey command
- Methanol level
 - 29.4mmol/l → 10.4mmol/l → 1.2 mmol/l in 26 hours
- 30th hour Ethanol and Dialysis stopped
- 32th hour patient extubated
- 50th hour patient discharged from ICU

Summary

- Severely poisoned patients requiring critical care represent a small but unique and diverse group of patients
- Presentation could be delayed and diagnosis could be difficult
- Most patients recover with appropriate treatment.
- Overall mortality from acute poisoning <1%



Thank you