Rational use and interpretation of Toxicology tests

Dr SH Tsui, Toxicology Subcommittee

JCM May 2012

Contents

- Ten principles (**commandments**) on use of ancillary tests in Toxicology
- To Illustrate by real cases
- ECG not included in this talk

Commandment 1

- **Rely on your clinical judgment; perform a test only when it is indicated**

- Emergency Physicians: The last fortress to practice **‘Clinical’** Medicine?

Case

- F 3y.o.
- Witnessed by grandma to have overdosed ~ 30ml of Chlorpheniramine (piriton)
- Patient was sleepy on arrival
- Attempted to take blood for paracetamol, salicylates and ethanol levels; but with great difficulty…..

Is blood test indicated in this case?

- Screening for paracetamol, salicylates and ethanol levels only advocated for suicidal patients who may hide or unable to give a reliable history
- Or unexplained liver toxicity, renal toxicity or acidosis
- May pick up potentially treatable poisoning

Acetaminophen and Salicylate Serum Levels in Patients With Suicidal Ingestion or Altered Mental Status

KARL A. SPORER, MD,* HASSAN KHAYAM-BASHI, PHD†

AMERICAN JOURNAL OF EMERGENCY MEDICINE ■ Volume 14, Number 5 ■ September 1996

Case

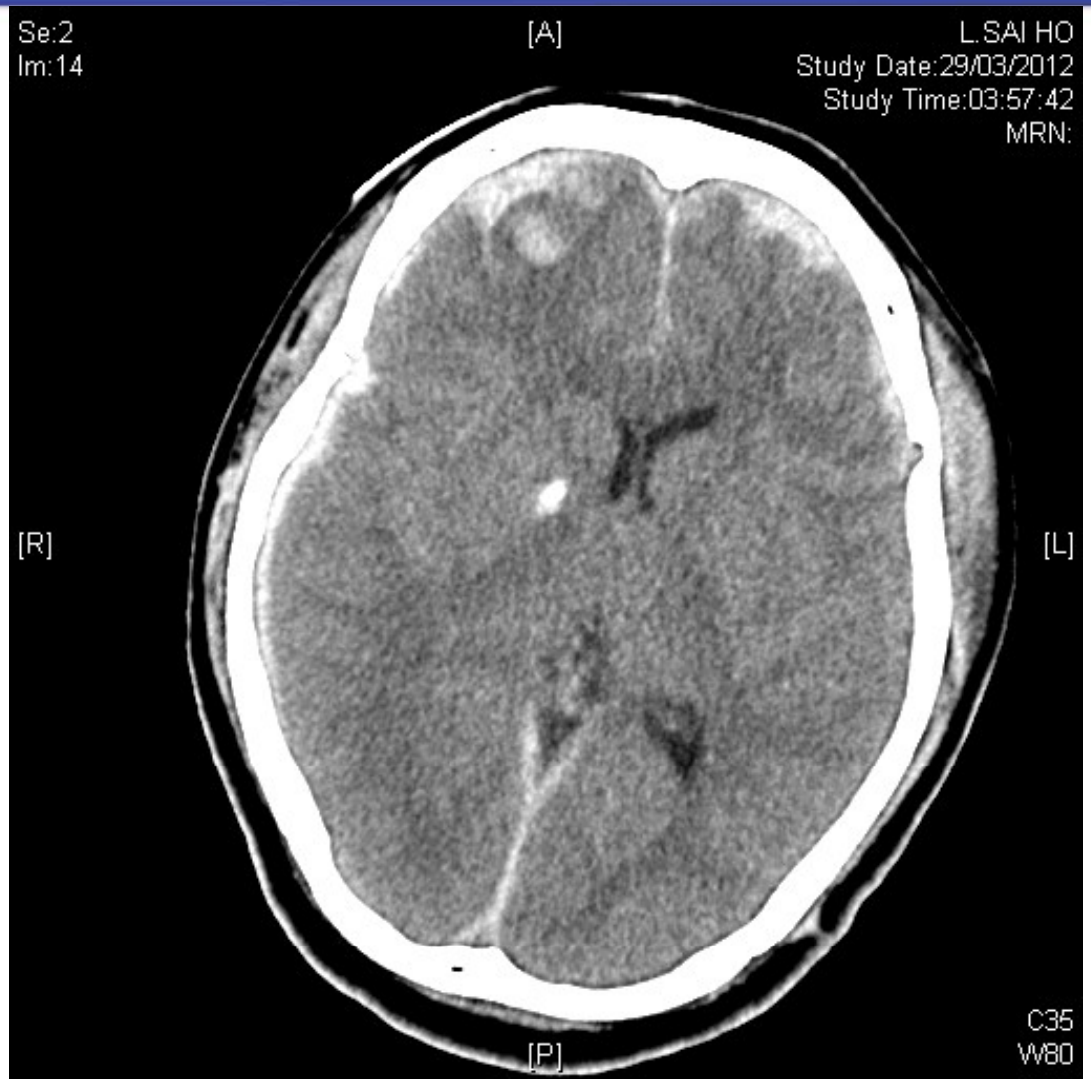
- M51, good past health
- Hit by a private van at unknown speed while pushing a cart (working)
- BP 175/91, P 98 bpm, T 35.9C
- RR 16/min, SpO_2 100%
- GCS: E3 V2 M5
- ‘Confused’
- Pupils 4mm E&R

Case

- Left frontal wound
- Glucose 8.4, Hb 14
- Trauma series: No #
- FAST: -ve
- ECG: SR

- Urine ACON…. Faint line next to ketamine
- Any comment?

Cause of confusion



Commandment 2

- Know the implications and limitations of the tests concerned

- Point-of-care urine test for substance of abuse (ACON®)
- Laboratory Toxicology screening test

Case

- M/ 24, good PH
- Quarreled with girlfriend recent 1 week
- Had dinner with GF and returned home
- Found confused the next morning by relatives
- 2 empty bottles found alongside: ~ 200 tabs of sleeping pills containing valerian and cyproheptadine

Case on arrival

- GCS E4M5V2 (11/15),
- BP 150/97, P 104
- SpO2 100% (High flow O2), RR 22
- Temp 36.1 ˚C, dry skin
- Pupil 3mm, reactive
- Power 3/5
- Bladder distended

Case

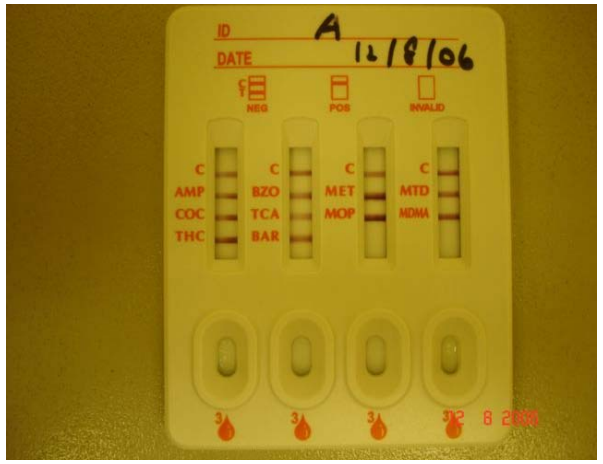
- Glucose 5.6, i-stat normal
- ECG: SR 100/min, QRS 100ms, QTc 412ms
- Foley inserted
- Urine ACON test
  - To do or not to do?
- Urine ACON test: +ve
  - Are you concerned?
  - Will you give physostigmine?

ACON® DOA Kits

- Lateral flow chromatographic immunoassay
- For **qualitative** detection of multiple drugs and its metabolites
- Fast and easy to use
- Presence of drug above cut-off conc:
  - Saturate all the binding sites of Ab
  - No labeled Ab retained in captured zone
  - **No colored line → +ve**

ACON® Kit

- Control (C):
  - A colored line will always appear at the control line region
  - Indicating sufficient specimen volume, adequate membrane wicking and correct procedure technique
- Make sure the Control line appear before you accept the result



- How to interpret this result?
- Only positive or negative
- **Weakly positive NOT exist!!**
- Faint line means negative

ACON® Kit

Test	Calibrator	Cut-off (ng/ml)
Amphetamine **(AMP)**	D-Amphetamine **(P)**	1000
Barbiturates **(BAR)**	Secobarbital **(M)**	300
Benzodiazepines **(BZO)**	Oxazepam **(M)**	300
Cannabinoid **(THC)**	11-nor-THC-9 COOH **(P)**	50
Cocaine **(COC)**	Benzoylecgonine **(M)**	300
Ketamine **(KET)**	Ketamine **(P)**	1000
Methadone **(MTD)**	Methadone **(P)**	300
Methylenedioxymeth-amphetamine **(MDMA)**	D,l Methylenedioxy-Methamphetamine **(P)**	500
Methamphetamine **(MET)**	D-Methamphetamine **(P)**	1000
Opioids/Morphine **(MOP)**	Morphine **(P,M)**	300
Tricyclic Antidepressants **(TCA)**	Nortriptyline **(P,M)**	1000

P: parent compound, M: metabolites

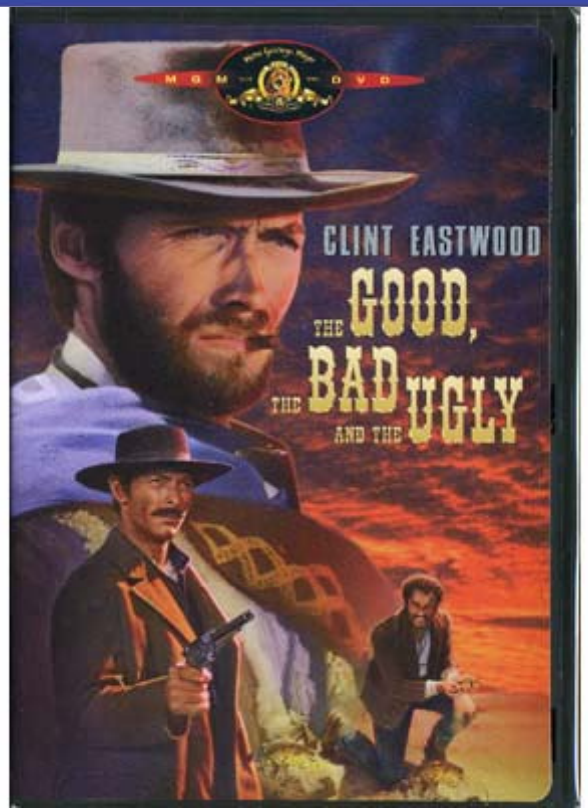
Bedside drug screening

Specific Limitations:

- False positive (cross reactivity)
- False negative

The Good, the Bad and the Ugly (by YC Chan)

The Good:
Cocaine
Cannabinoid
Barbituates
Methadone



The Bad:
Amphetamine
MDMA
Opioids
Benzo
PCP

The Ugly: TCA

General Limitations

- Negative ACON test does not rule out poisoning, it only covers a number of abusive drugs
- True positive only indicates exposure, not necessarily poisoning; and may not be even recent exposure
- Technical error: adulteration of urine by dilution, addition of acids, bases, oxidizing agents (bleach, nitrite, peroxide, peroxidase) etc. may produce erroneous results

Laboratory Toxicology Screening Test

- Usually works on urine, blood and gastric aspirates
- By employing multiple analytic methods: Immunoassay, HPLC, GC, GC/MS, LC/MS/MS
- More comprehensive but still **not exclusive**
- Panels established by **individual laboratory** varies and **performance** also **varies**

TABLE 6–6. Positive and Negative Predictive Values of Toxicology Screens

Sensitivity/ Specificity (%/%)	Prior Probability		
	10%	50%	95%
98/98 (excellent)	84%/99.8%	98%/98%	99.9%/72%
80/95 (mediocre)	64%/98%	94%/83%	99.7%/20%

+ve and –ve predictive values of two hypothetical toxicology screens

Goldfrank's 9th

Laboratory Toxicology Screening Test

Applications

- May provide additional information to confirm an episode of poisoning
- Sometimes may give unexpected results and **shine light on difficult cases**
- But most of the time NO ONE is paying attention to the result when it comes back few days later
- Role of A&E Toxicology Team

Case

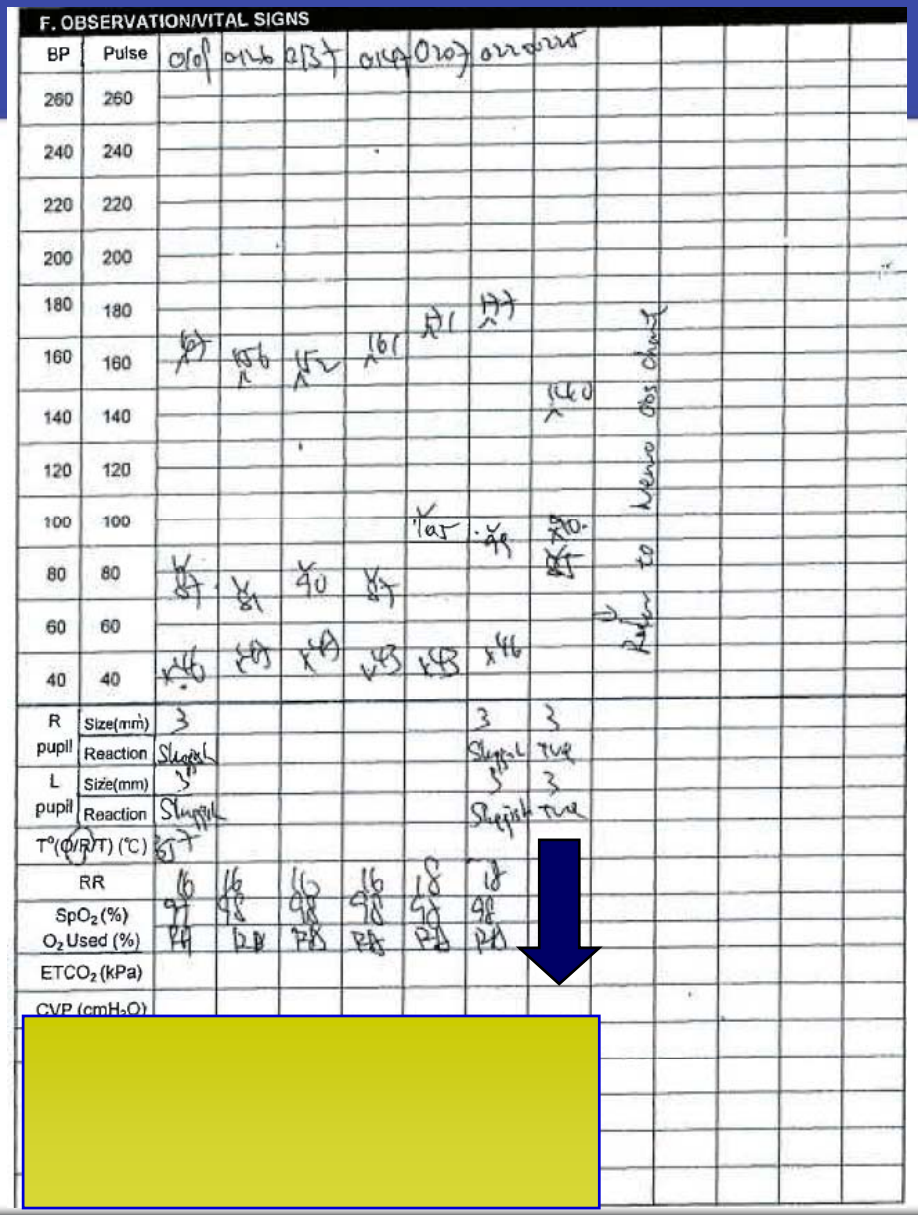
- M/51
- Caucasian living with friend in Central
- Occupation: pilot
- Good past health
- Found vomiting with altered consciousness at home by his friend
- ? Limb twitching
- his friend claimed that patient had gone out to a pub in Wan Chai tonight; unsure if he had taken alcohol or not

Vital sign and P/E on arrival to AED

- BP 167/87mmHg, P 46 bpm
- Temp 35.7C (rectal)
- RR 16
- GCS E1V1M6 (total 8/15)
- SpO2 97% on RA
- Pupil size 3mm bilaterally, reactive
- Resp and CVS: unremarkable
- Abd: soft
- neck soft
- Neurological exam: unremarkable
- small area of abrasion at right forehead

A typical clinical course follows

- You suspect **GHB poisoning**
- Urine sent to laboratory for Toxicology screening



Here is the result

Date Collected: 09/11/08 01:45

Clinical Details: AGITATED

pH	6
Ketones	Negative
Glucose	Negative

Toxicology screening (Urine):

None of the compounds on the following list are detected.

The following drugs (if present) can be identified by this laboratory:

ANALGESICS	ANTIDEPRESSANTS	ANTIHISTAMINES	Carbamazepine
Mefenamic acid	Amitriptyline	Diphenhydramine	Cimetidine
Meperidine	Amoxapine	Pheniramine	Cyproheptadine
Naproxen	Desipramine		Dextromethorphan
Paracetamol	Doxepin	SYMPATHOMIMETIC AMINES	Haloperidol
Propoxyphene	Imipramine	Amphetamine	Ketamine
Salicylate	Loxapine	MDMA (ecstasy)	Lidocaine
	Maprotline	Methamphetamine	Metoprolol
	Nortriptyline	Ephedrine/Pseudo-	Phenytoin
BARBITURATES	Trazadone	Phentermine	Triamterene
Amobarbital	Trimipramine	Phenylpropanolamine	Trimethoprim
Aprobarbital			Procainamide
Barbital	HYPNOTICS	NARCOTICS	Propranolol
Butabarbital	Glutethimide	Benzoylecgonine/cocaine	Quinine/Quinidine
Pentobarbital	Methaqualone	Codeine	
Phenobarbital		Methadone	PHENOTHIAZINES
Secobarbital	BENZODIAZEPINES	Morphine	

Commandments 3 & 4

3. Has a fair idea what tests are provided by your hospital laboratory, cluster laboratory and Toxicology Reference Laboratory

4. Maintain good communication with your laboratory counterparts

- Every laboratory is different
- Some tests are routinely done
- Some tests cannot be done
- Some tests can be done on special request

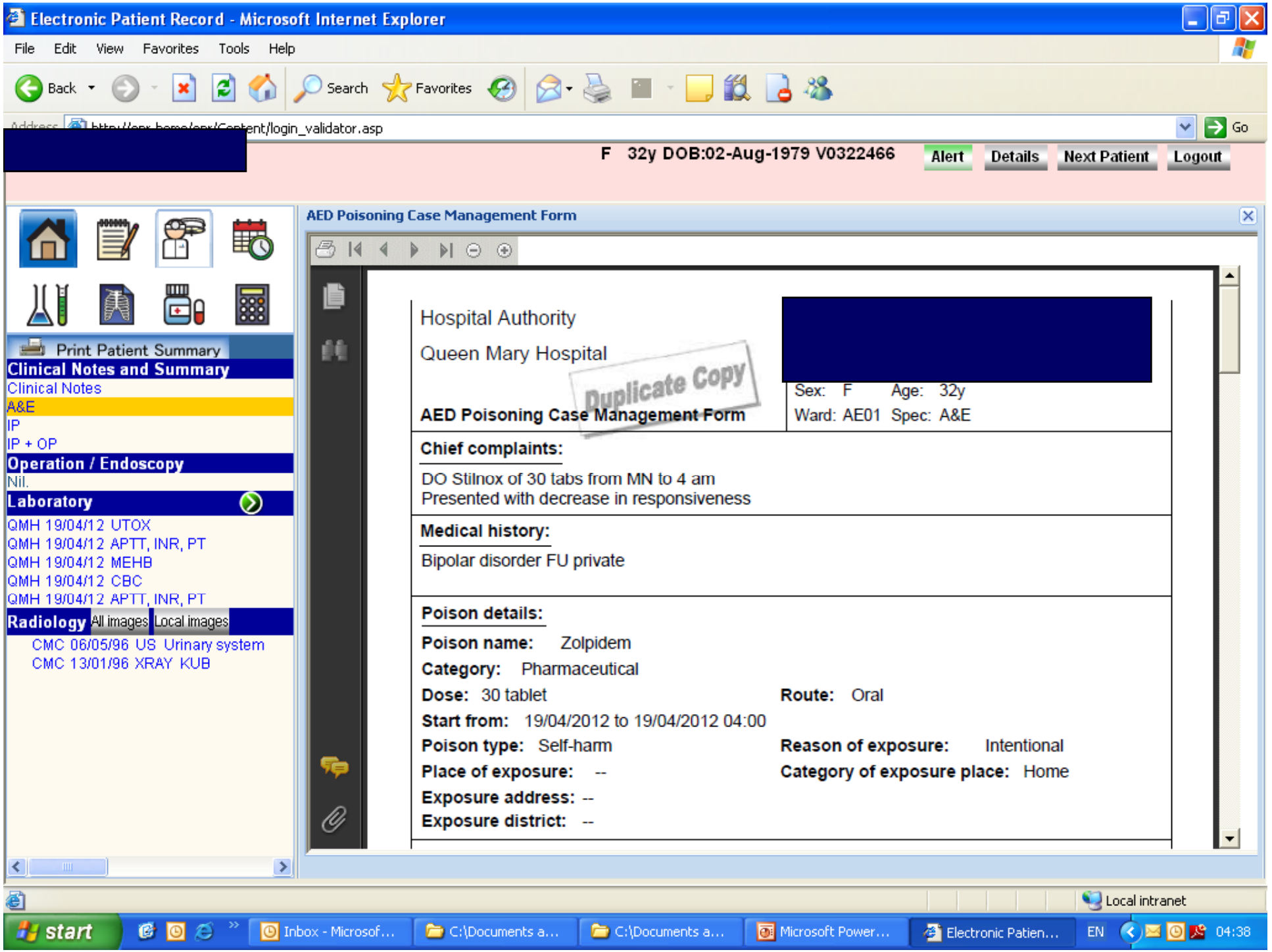
TABLE 6–5. Xenobiotics of Concern that are Often not Detected by Toxicology Screens

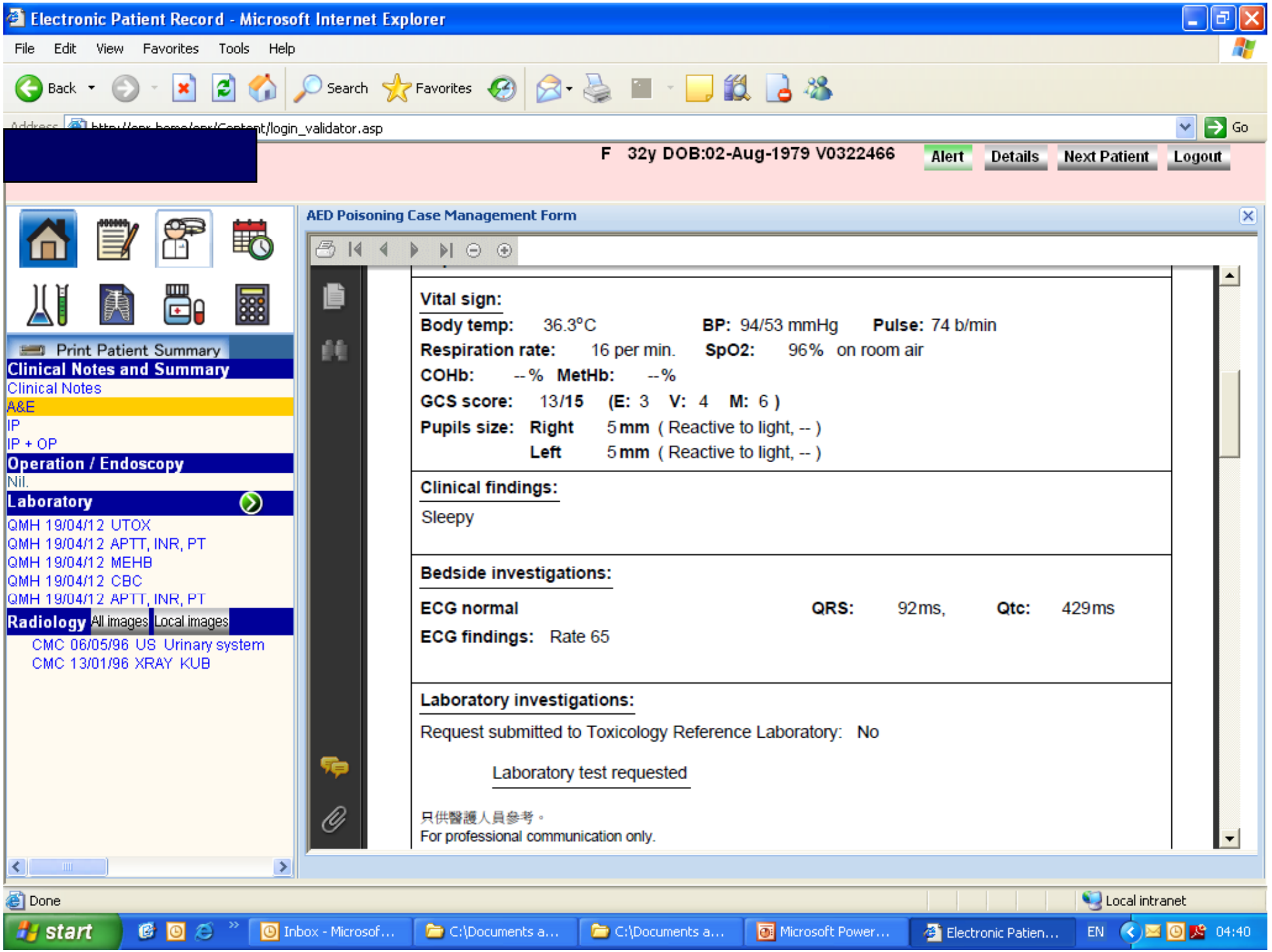
Antidysrhythmics	γ-Hydroxybutyrate ←
Anticholinergics	Herbal preparations
Anticoagulants	Hypoglycemics
Anticonvulsants	Iron
Antipsychotics	Isopropanol
β-Adrenergic agonists and antagonists	Ketamine ←
	Lithium
Calcium channel blockers	Lysergic acid diethylamide
Carbon monoxide	Methylene dioxyamphetamine
Clonidine	Methylene dioxymethamphetamine
Cyanide	Metals
"Designer drugs"	Methanol
Digoxin	Methemoglobin
Diphenhydramine	Solvents
Ethylene glycol	Serotonin reuptake inhibitors
Fentanyl	Strychnine

Goldfrank's 9th

What is meant by good communication?

- Input important **clinical information** into the laboratory request form; esp Toxidrome, suspected culprit drug or class of drugs
- **Electronic poisoning form** in CMS
- **Direct discussion** with laboratory counterparts concerning your worry and see what helps they can offer


Electronic Patient Record - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://epr-home/epr/Content/login_validator.asp
Go
[redacted]
F 32y DOB:02-Aug-1979 V0322466
Alert
Details
Next Patient
Logout
Print Patient Summary
Clinical Notes and Summary
Clinical Notes
A&E
IP
IP + OP
Operation / Endoscopy
Nil.
Laboratory
QMH 19/04/12 UTOX
QMH 19/04/12 APTT, INR, PT
QMH 19/04/12 MEHB
QMH 19/04/12 CBC
QMH 19/04/12 APTT, INR, PT
Radiology
All images
Local images
CMC 06/05/96 US Urinary system
CMC 13/01/96 XRAY KUB
AED Poisoning Case Management Form
Hospital Authority
Queen Mary Hospital
Duplicate Copy
[redacted]
Sex: F Age: 32y
Ward: AE01 Spec: A&E
AED Poisoning Case Management Form
Chief complaints:
DO Stilnox of 30 tabs from MN to 4 am
Presented with decrease in responsiveness
Medical history:
Bipolar disorder FU private
Poison details:
Poison name: Zolpidem
Category: Pharmaceutical
Dose: 30 tablet
Route: Oral
Start from: 19/04/2012 to 19/04/2012 04:00
Poison type: Self-harm
Reason of exposure: Intentional
Place of exposure: --
Category of exposure place: Home
Exposure address: --
Exposure district: --
Local intranet
start
Inbox - Microsof...
C:\Documents a...
C:\Documents a...
Microsoft Power...
Electronic Patien...
EN
04:38


Electronic Patient Record - Microsoft Internet Explorer
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Back Search Favorites
http://epr.home/epr/Content/login_validator.asp
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[redacted]
F 32y DOB:02-Aug-1979 V0322466
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Clinical Notes and Summary
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QMH 19/04/12 UTOX
QMH 19/04/12 APTT, INR, PT
QMH 19/04/12 MEHB
QMH 19/04/12 CBC
QMH 19/04/12 APTT, INR, PT
Radiology
All images
Local images
CMC 06/05/96 US Urinary system
CMC 13/01/96 XRAY KUB
AED Poisoning Case Management Form
Vital sign:
Body temp: 36.3°C
BP: 94/53 mmHg
Pulse: 74 b/min
Respiration rate: 16 per min.
SpO2: 96% on room air
COHb: --%
MetHb: --%
GCS score: 13/15 (E: 3 V: 4 M: 6)
Pupils size: Right 5 mm (Reactive to light, --)
Left 5 mm (Reactive to light, --)
Clinical findings:
Sleepy
Bedside investigations:
ECG normal
QRS: 92ms,
Qtc: 429ms
ECG findings: Rate 65
Laboratory investigations:
Request submitted to Toxicology Reference Laboratory: No
Laboratory test requested
只供醫護人員參考。
For professional communication only.
Done
Local intranet
start
Inbox - Microsof...
C:\Documents a...
C:\Documents a...
Microsoft Power...
Electronic Patien...
EN
04:40

What is meant by good communication?

- Input important **clinical information** into the laboratory request form; esp Toxidrome, suspected culprit drug or class of drugs
- **Electronic poisoning form** in CMS
- **Direct communication** with laboratory counterparts concerning your worry and see if what helps they can offer

GHB

- rapidly absorbed and metabolized
- Mean elimination half-life is 30 to 50 minutes
- Detection period:
  - <6-8 hrs in plasma
  - <10-12 hrs in urine
- Preferred specimen: first catch urine

- In QMH: Targeted analysis with GC-MS is necessary for detection of GHB and must be specifically requested.

- In our case: **Marked excretion of GHB was detected in the urine and diagnosis was confirmed**

Commandment 5

- **Toxicology tests should be performed and interpreted timely**

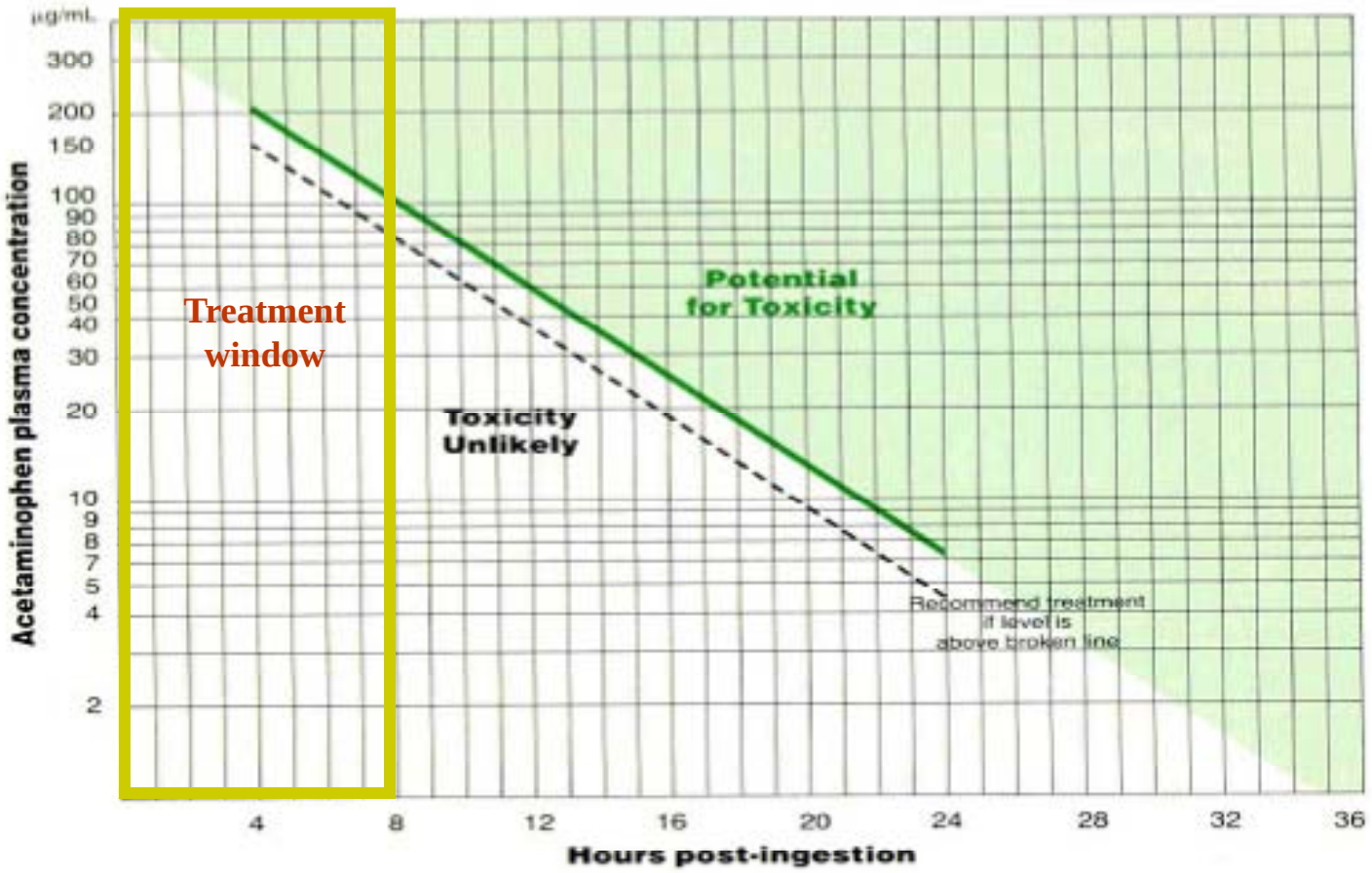
- Have you got some examples in your mind?

Paracetamol poisoning

- F25, DO of paracetamol 20 tabs 5 hours ago before presentation to A&E
- Together with beer, vomited twice
- Paracetamol level checked in A&E (6 hours post ingestion)
- Patient admitted EMW but

- **No one remember to trace the result…**

Paracetamol normogram



Unit conversion : 1mg/L (or μ g/ml) = 6.6 μ mol/L

Rat poison ingestion

- Warfarin or superwafarin: expected delay for prolongation of INR:

  1. Time needed to deplete the existing store of Vit K

  2. Time needed to deplete the existing coagulating factors (VII)

- ~ 3 x $T_{1/2}$ of Factor VII = 15 hours

Rat poison ingestion

- For acute accidental ingestion and symptomatic: repeat INR at 48 hours to clear patient

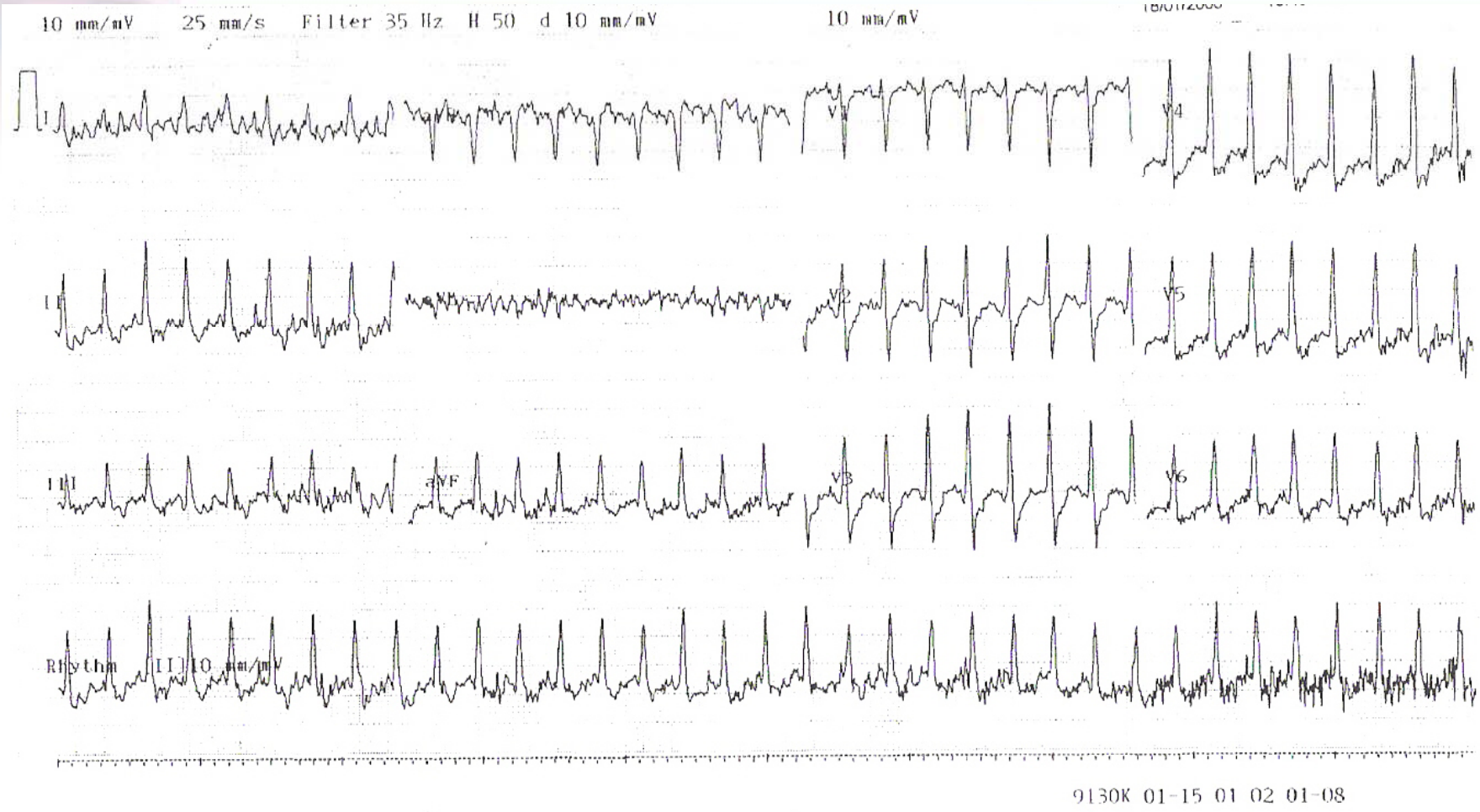
- For intentional overdose: check baseline, then every 12 hours to identify coagulopathy. Increase frequency of monitoring if INR prolongation occurs

Case

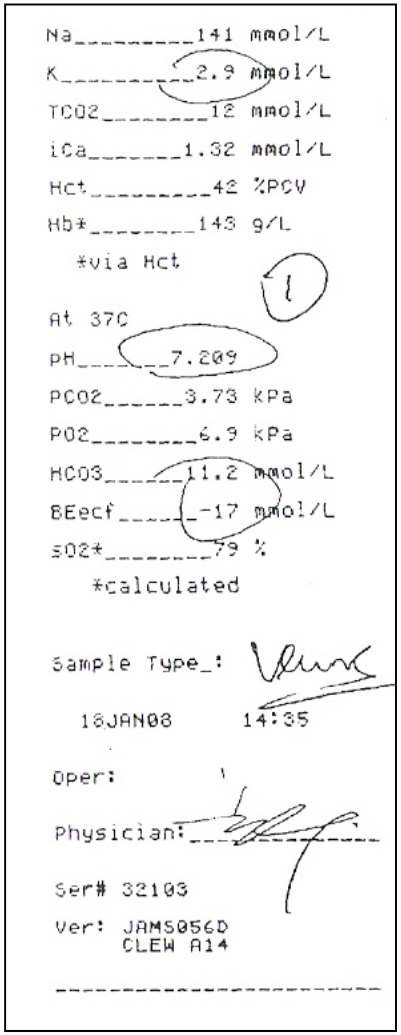
- F/45, asthma FU QMH
- Depression FU Western Psychiatric Centre
  - Venlafaxine
  - Zolpidem
- C/O: Dizziness, vomiting and generalised weakness for 1/7
- BP 111/53 mmHg, P 117 bpm
- Temp 36^{o}C
- RR 16/min, SpO_2 98% R.A.
- Noticed to have intermittent limb twitching in cubicle

- GCS 15/15 all along, restless^{+}, agitated^{+}
- CVS: tachycardia, irregular pulse^{+}, no murmur
- Resp: unremarkable except tachypnoea
- CNS:
  - Tone normal at rest
  - Intermittent 4 limbs twitching and spasm
  - Power full over 4 limbs
  - No neck rigidity, pupils E/R bilaterally
- Abdomen: NAD

ECG


10 mm/mV 25 mm/s Filter 35 Hz H 50 d 10 mm/mV
10 mm/mV
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
Rhythm II 10 mm/mV
9130K 01-15 01 02 01-08

- CXR: normal findings
- H'stix = 15.3mmol/L
- Serum ketone = 0.8 (low)
- Urine tests
  - Acon test all –ve
  - WBC –
  - RBC –
  - Glucose +++
  - Albumen –
  - Ketone +++



Na_____141 mmol/L
K_____2.9 mmol/L
TCO2_____12 mmol/L
iCa_____1.32 mmol/L
Hct_____42 %PCV
Hb*_____143 g/L
*via Hct

At 37C
pH_____7.209
PCO2_____3.73 kPa
PO2_____6.9 kPa
HCO3_____11.2 mmol/L
BEecf_____-17 mmol/L
sO2*_____79 %
*calculated

Sample Type_:

18JAN08 14:35

Oper:

Physician:

Ser# 32103
Ver: JAM5056D
CLEW A14

Causes to consider

- Metabolic cause
  - DKA
  - Thyroid storm
- Cardiovascular cause
  - Myocarditis
  - Cardiomyopathy
- Sepsis
- CNS disease
  - ICH

Poisoning to be considered
•Theophylline
•Salicylates

But patient strongly denies DO

Progress

- Urgent theophylline level arranged with Clinical Biochemist
- They can give us the result in half hour!

Collect Date :	18/01/08	18/01/08	19/01/08	19/01/08	20/01/08		
Collect Time :	16:00	16:00	01:25	06:00	06:00		
Request No. :	C1183095	C1183097	C1196002	C1190123	C1206004	Ref. Range	Units
Remark :	PSY ILLNESS KNOWN ASTHMA	ASTHMA SEIZURE	THEO O.D.	THO OVERDOSE	THO DO		
Theophylline	--	NOTE	229 H	202 H	83	See Below	umol/L
Paracetamol	<30	--	--	--	--	See Below	umol/L
Salicylate	<0.3 L	--	--	--	--	1.4 - 1.8	mmol/L
Ethanol	<3.0	--	--	--	--	Toxic >33	mmol/L

Comment:
08C1206004 Result Faxed.
08C1190123 Result Faxed.
08C1196002 Taken 150mg BC(pm), time & date unknown.
08C1183097 Result Faxed.
Taken 150mg BD (pm), time & date unknown. Theophylline=900 umol/L
08C1183095 Result Faxed.
Footnotes:
Theophylline - Reference Range : Therapeutic 28-111

Commandment 6

- One should know which drug/toxin levels have to be done; which really affect patient management

Drug/Toxin levels that affects management

COHb, MetHb	Paracetamol
Digoxin	Salicylate
Ethanol	Theophylline
Iron	Valproate
Lithium	

- Recommended by COC (Path) to be available round the clock

Ethanol level

- Should we routinely check ethanol level in drunk patients?
- From time to time there are drunk patients dead in A&E because of complications or other missed diagnosis
- Some clinicians recommend checking ethanol levels for all drunk patients
- Practical difficulty in situation in HK

My baseline

- Patient in deep coma
- Patient with prolonged depression of conscious level with no improvement upon observation
- Patient with atypical presentation

Many more drug levels are not useful in patient management

Original Paper

Pharmacology

Pharmacology 2011;88:260–265
DOI: 10.1159/000331867

Received: July 29, 2011
Accepted after revision: August 8, 2011
Published online: October 13, 2011

Metformin-Associated Lactic Acidosis in Chinese Patients with Type II Diabetes

Chun Wing Yeung[a] Ho Yin Chung[b] Bonnie Mei Wah Fong[a] Nga Wing Tsai[c]
Wai Ming Chan[c] Tak Shing Siu[a] Sidney Tam[a] Sik Hon Tsui[b]

[a]Division of Clinical Biochemistry, [b]Department of Accident and Emergency, and [c]Adult Intensive Care Unit, Queen Mary Hospital, Hong Kong, SAR, China

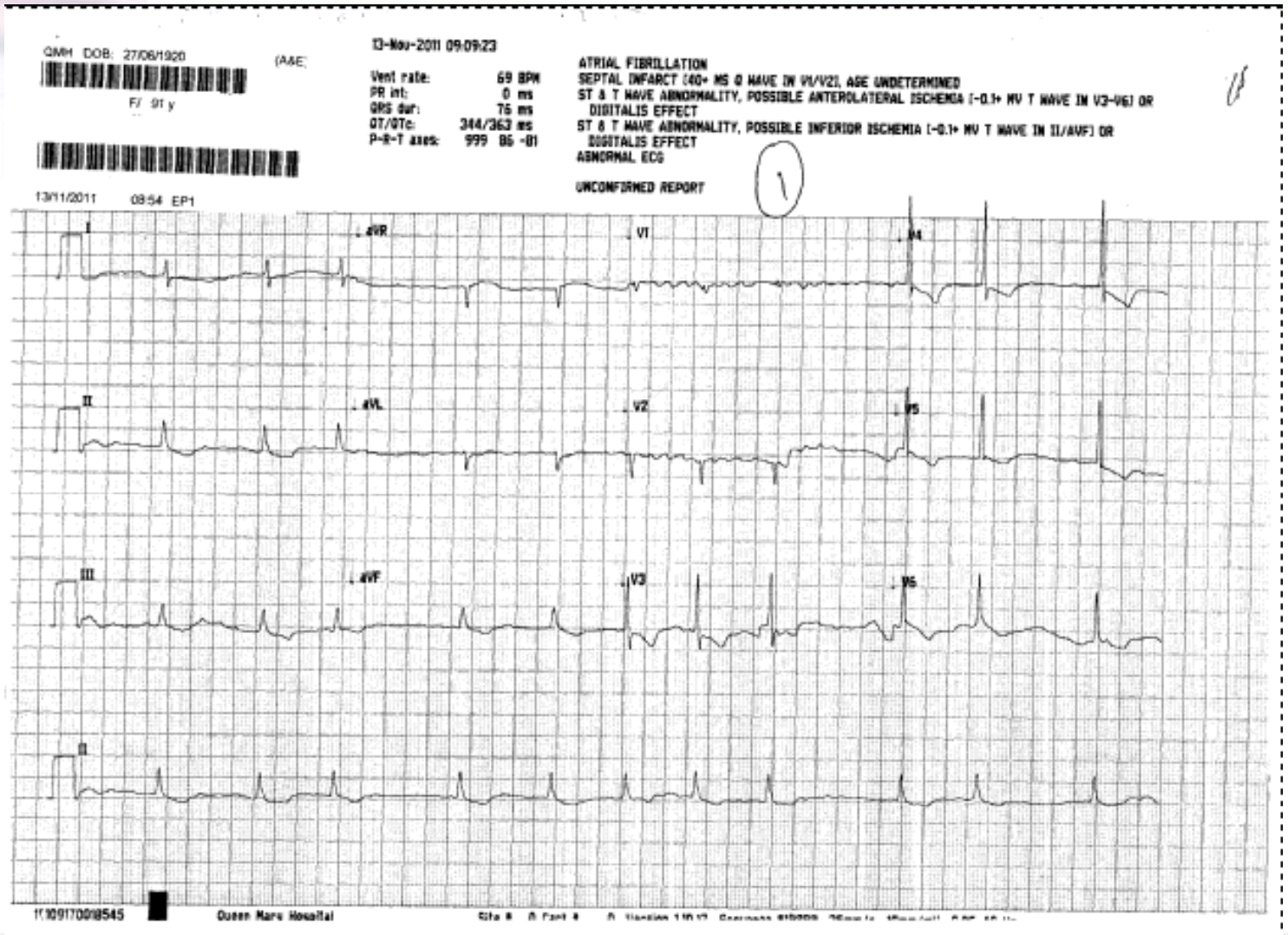
Risk factors of mortality were identified as shock and high plasma lactate levels. The majority of patients were found to have significantly raised creatinine versus a normal baseline value before the acute illness. Concomitant illnesses taking place alongside MALA were common. With a high utility rate of renal replacement therapy (82.6%) in the study group, the mortality rate was 30.4%.

Case

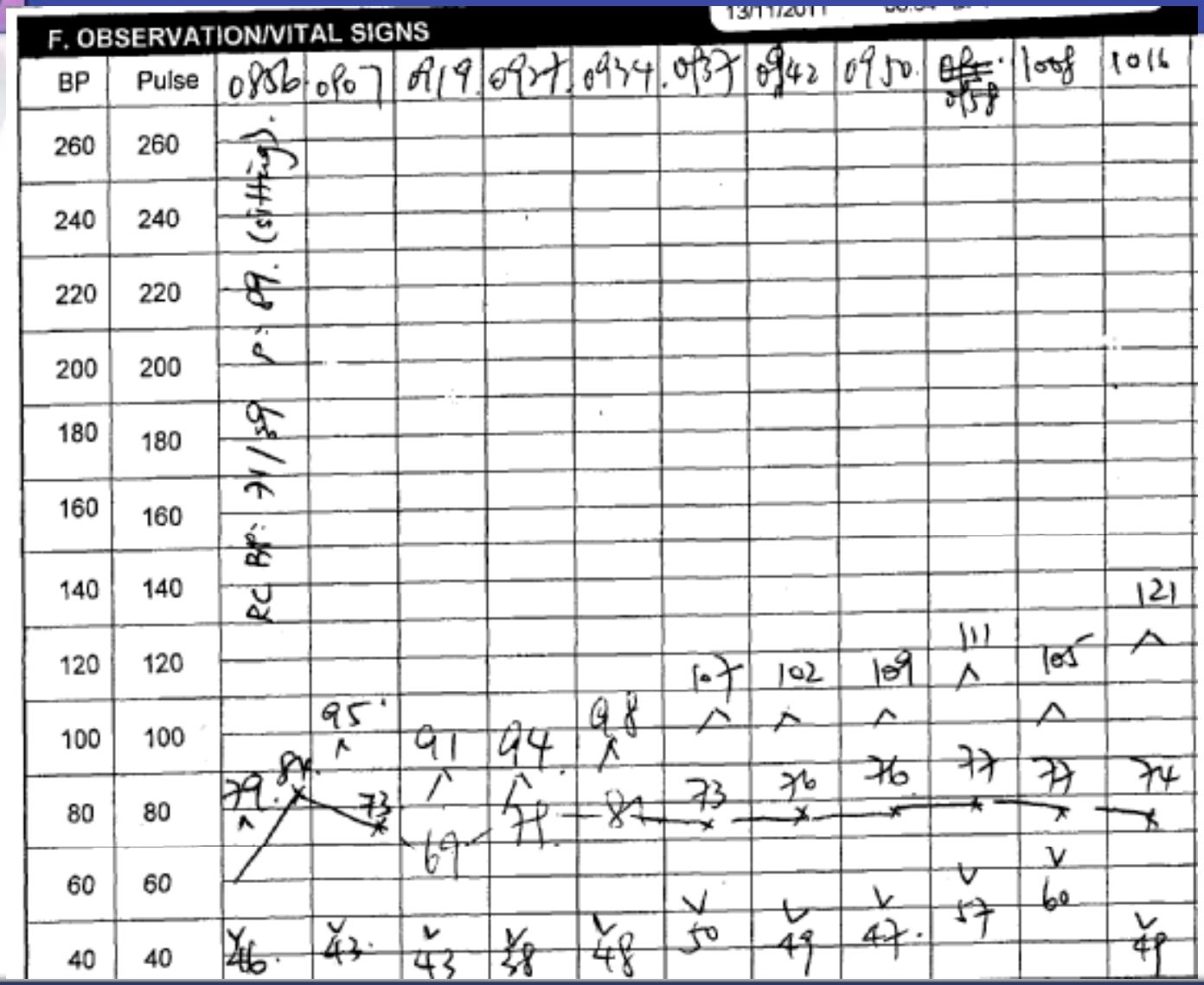
- F / 91yo
- HT, AF with VVIR, dementia
- Accidentally took **8 times** the normal dose of medications
  - Aspirin (x80mg)
  - Digoxin (x62.5mcg)
  - Lisinopril (x2.5mg)
  - Adalat Retard (x20mg)
- Last dose 30min before admission

Case

- Alert
- BP 79/39 P 89
- Temp. 36.1°C
- GCS 15/15
- Glucose 8.4
- Hb 10.9
- Na/K 140/4.1


QMH DOB: 27/06/1920
(A&E:
F/ 91 y
13-Nov-2011 09:09:23
Vent rate: 69 BPM
PR int: 0 ms
QRS dur: 76 ms
QT/QTc: 344/363 ms
P-R-T axes: 999 86 -81
ATRIAL FIBRILLATION
SEPTAL INFARCT (40+ MS Q WAVE IN V1/V2), AGE UNDETERMINED
ST & T WAVE ABNORMALITY, POSSIBLE ANTEROLATERAL ISCHEMIA (-0.1+ MV T WAVE IN V2-V6) OR
DIGITALIS EFFECT
ST & T WAVE ABNORMALITY, POSSIBLE INFERIOR ISCHEMIA (-0.1+ MV T WAVE IN II/AVF) OR
DIGITALIS EFFECT
ABNORMAL ECG
UNCONFIRMED REPORT
13/11/2011 08:54 EP1
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Queen Mary Hospital

Calcium and IV fluid given



- Digoxin level came back soon: **11.2 nmol/L**
- Reference level: 1.3 – 2.6 nmol/L
- Digitalis antibody was given

- Was the treatment indicated?

Criticism

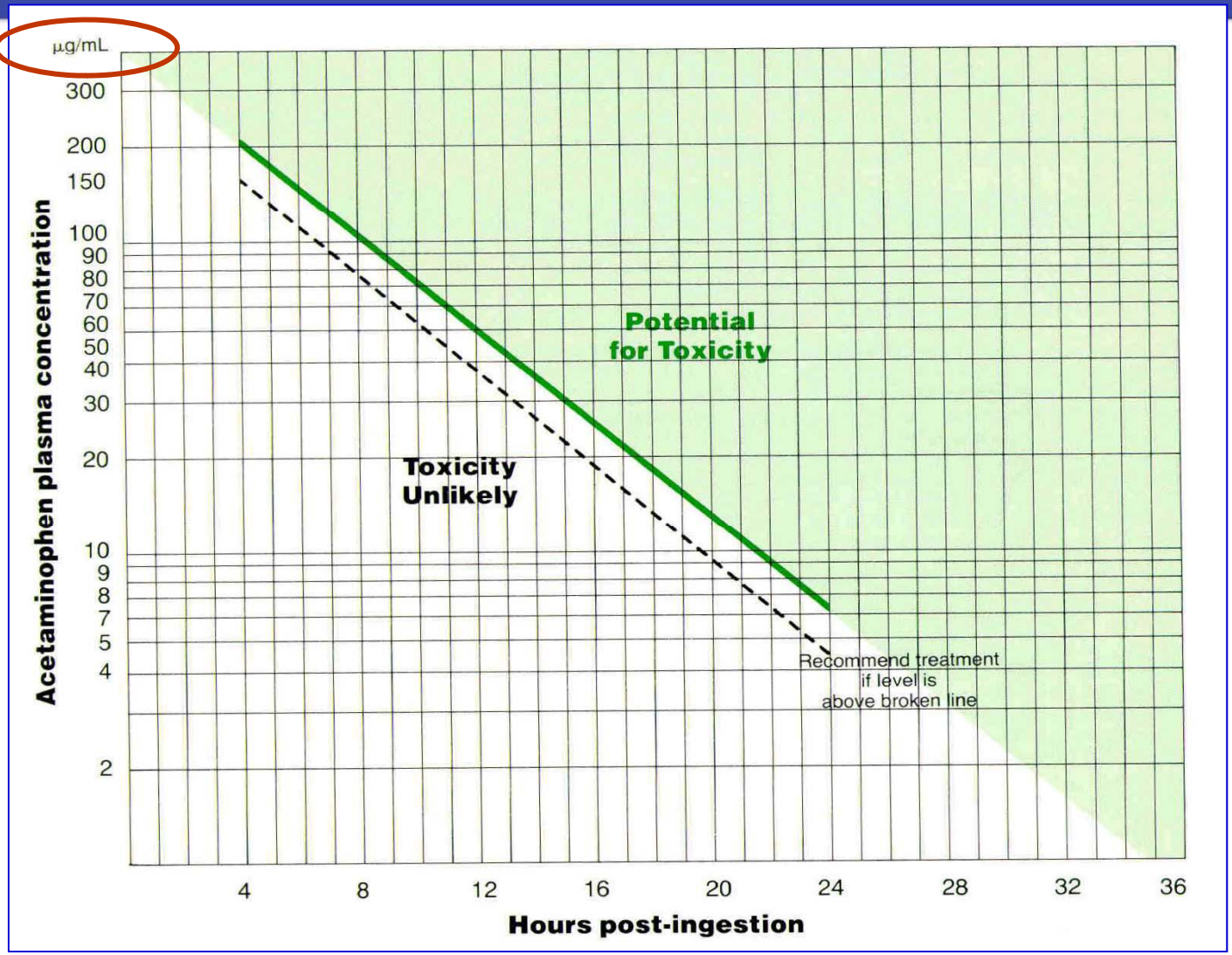
- Patient was stable at that juncture; no clinical indication
- Action level quoted by HKPIC was **>12nmol/L** for acute toxicity
- However it refers to post distribution, i.e. >6 hours post ingestion

Commandment 7

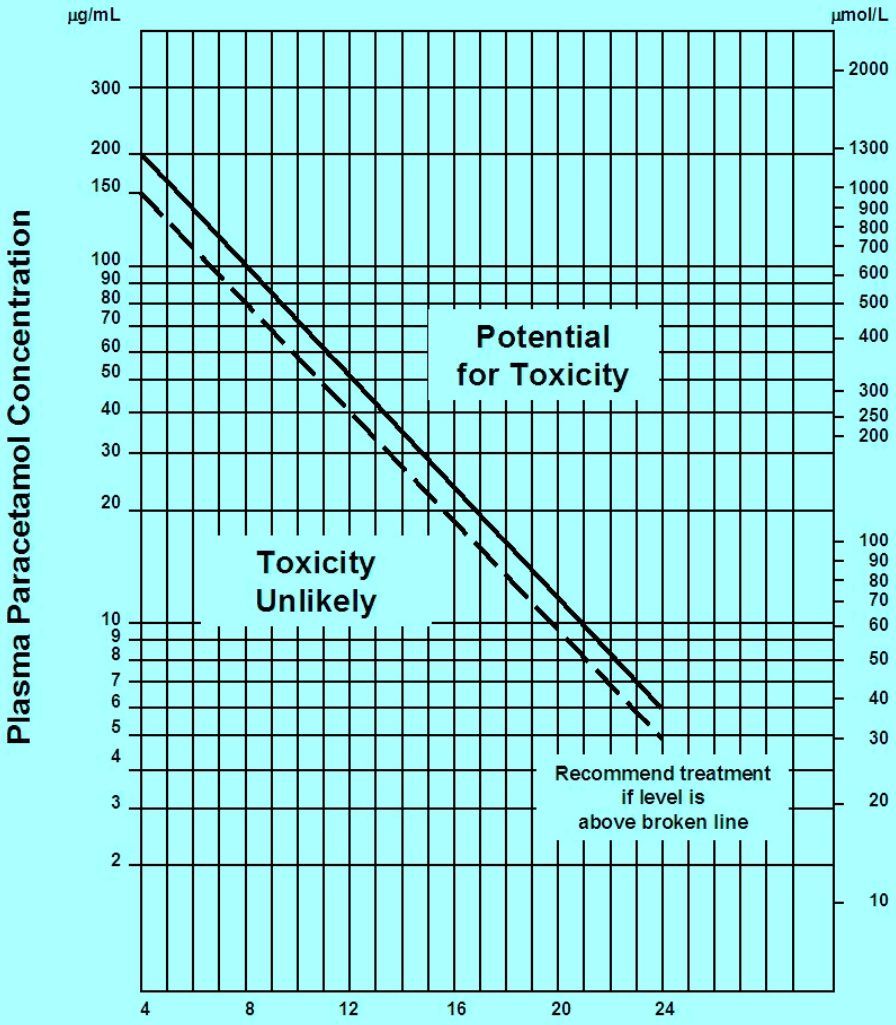
- Treat the patient, not the laboratory result

- Be careful with the Units (Conventional vs SI) for laboratory results and take reference to individual laboratory reference levels when making clinical decisions

Paracetamol normogram



Nomogram for Paracetamol Poisoning



Unit conversion : 1mg/L (or µg/mL) = 6.6 µmol/L

(adapted from the HKPIC Nomogram)

Commandment 8

- Be familiar with the use and interpretation of common tests that are very useful for poisoning diagnosis and management

Examples include

- COHb, MetHb levels
- RFT
- Blood gas analysis
- Lactate
- Anion Gap
- Osmolar Gap (serum osmolarity)

Case

- M/45, chronic alcoholic
- c/o palpitation, chest & epigastric discomfort, SOB for 1/52
- Poor oral intake, vomiting +
- GCS 15, BP 115/73, P 141, RR 28, SpO_2 100% in RA, Temp 36.7C
- P/E: mild dehydration, chest clear, no abd. sign

Case

	Not Specified 15/11/06 18:22 CT753564 URGENT	Reference Range	Units
Blood pH	7.09 L	7.35 - 7.45	
Blood pCO2	1.42 L	4.70 - 6.00	kPa
Blood pO2	18.25 H	10.60-13.30$	kPa
Base Excess(vt)	-24.3 L	-3.0 - 3.0	mmol/L
Bicarbonate(act)	3.1 L	20.0 - 26.0	mmol/L
O2 Saturation	98	>95	%

- How to interpret?
- What additional information do you need?

Analysis

- pH 7.09 → **Acidaemia**
- Acidaemia with low HCO_3 level 3.1 (20 – 26) → **metabolic acidosis**
- Metabolic acidosis with low pCO_2 1.42

(4.7 – 6) → **respiratory compensation** occurs

- Is the respiratory compensation appropriate /adequate or in fact hyperventilation occurring?

Winter's equation

- Predicts the degree of respiratory compensation in the setting of metabolic acidosis
- PCO_2 (mmHg) = (**1.5** x HCO_3) + 8 +/- 2
- In our case: calculated PCO_2 = 1.5 x 3.1 + 8 +/- 2 = **12.65 +/- 2 mmHg**
- Measured blood PCO_2 = 1.42 kPal = 1.42 x **7.5** = **10.65 mmHg**

- **Conclusion: Metabolic acidosis with respiratory compensation**

A case of severe metabolic acidosis

More information that may help your case analysis

- Na 147, Cl 91
- Glucose 3.3
- Urea 3.3, ethanol level 38
- Serum osmolarity 355
- Serum lactate: 6.3mmol/L (0.5-2.2)

- Anion gap
  - **Na – Cl - HCO3** = 147 – 91 - 3.1 = 52.9 (normal 12+/-4)
- Osmolar gap = Measured osmolality – calculated osmolarity
  - Calculated osmolarity
  - **Na x 2 + urea + glucose + ethanol (all in mmol/L)**
  - 147 x 2 + 3.3 + 3.3 + 38 = 338.6
- OG = 16.4 (normal -10 to 14)

Measured serum osmol 355

High AG metabolic acidosis (52.9)

- Lactate: 6.3
- Urine ketostix® **negative**
- Urine ketones by laboratory (acetoacetate and β-hydroxybutyrate) : **50mg/dL ++**
- Consider **KULT**

- **Dx: Alcoholic ketoacidosis**

Commandment 9

- **Do no harm!**

- E.g. Multi-panel metal testing on hair or mobilized urine samples
- For children with eczema, autism, hyper-activity, poor academic performance…
- Result bound to be positive for some panels

Case

- F36, good PH
- Paracetamol overdose, claimed 20 tabs
- Delayed presentation at 12 hours
- Epigastric pain and vomiting
- NAC given

Mx in EMW

Collect Date :	13/10/09	**13/02/11**	
Collect Time :	17:12	**14:48**	
Request No. :	CA130761	**C2131662**	
Remark :	left neck mass	Panadol overdose	
Na	140	140	
K	4.4	3.4	L
Chloride	106	110	H
Urea	4.3	3.7	
Creatinine	57	59	
R Glucose	--	7.3	
Calcium	--	2.23	
Adjusted Calcium	--	2.21	
Phosphate	--	0.87	L
Total Protein	80	72	
Albumin	42	43	
Globulin	38	29	
Total Bili	4	14	
ALP	64	55	
ALT	28	49	H
AST	36 H	35	H
GGT	--	38	H
LDH	--	152	
CK	--	65	
Urate	--	252	

Collect Date :	**13/02/11**	
Collect Time :	**14:48**	
Request No. :	**C2133026**	
Remark :	Panadol overdose. Therapeutic	
Paracetamol	240	
Salicylate	<0.3	L
Ethanol	<3.0	

Serial LFT

Collect Date :	13/02/11	14/02/11	15/02/11	15/02/11	**15/02/11**		
Collect Time :	14:48	07:14	05:40	14:54	**21:52**		
Request No. :	C2131662	C2141428	C2151397	C2152771	**C2161259**	Ref. Range	Units
Remark :	Panadol overdose	panadol overdose	panadol overdose	panadol overdose	panadol overdose. panadol overdose		
Comment		Below	Below	Below	Below		
Na	140	136	137	--	142	136 - 148	mmol/L
K	3.4 L	3.0 L	3.7	--	3.6	3.6 - 5.0	mmol/L
Chloride	110 H	107	107	--	107	100 - 109	mmol/L
Urea	3.7	2.2 L	2.4 L	--	2.2 L	2.5 - 6.4	mmol/L
Creatinine	59	50	41 L	--	46 L	49 - 82	umol/L
R Glucose	7.3	--	4.9	--	8.4 H	2hr pp < 7.8	mmol/L
Calcium	2.23	--	--	--	--	2.11 - 2.55	mmol/L
Adjusted Calcium	2.21	--	--	--	--	2.11 - 2.55	mmol/L
Phosphate	0.87 L	--	--	--	--	0.88 - 1.45	mmol/L
Total Protein	72	62 L	61 L	59 L	64 L	67 - 87	g/L
Albumin	43	36 L	37 L	33 L	37 L	39 - 50	g/L
Globulin	29	26	24 L	26	27	26 - 40	g/L
Total Bili	14	13	11	11	12	4 - 23	umol/L
ALP	55	50	46	48	51	32 - 93	U/L
ALT	49 H	279 H	639 H	2596 H	>3000 H	7 - 36	U/L
AST	35 H	331 H	511 H	2210 H	2643 H	14 - 30	U/L
GGT	38 H	--	--	--	55 H	up to 35	U/L
LDH	152	--	--	--	--	107 - 218	U/L
CK	65	--	--	--	--	40 - 161	U/L
Amylase	--	--	--	--	140 H	25 - 124	U/L
Urate	252	--	--	--	--	177 - 400	umol/L

Commandment 10

- Don’t hesitate to consult the experts if needed

Suggested Management

- Frequent clinical evaluation and monitoring
- Check prognostic markers: ABG, RFT, PT, Lactate, PO_4, αFP
- Continue NAC
- Monitor LFT

When to stop NAC?

Textbook guideline:

- Asymptomatic
- AST / ALT <1000
- Negligible paracetamol level

When to stop NAC?

Collect Date :	15/02/11	16/02/11	16/02/11	16/02/11	**17/02/11**		
Collect Time :	21:52	07:01	07:01	15:30	**05:11**		
Request No. :	C2161259	C2160120	C2161370	C2162817	**C2170735**	Ref. Range	Units
Remark :	panadol overdose. panadol overdose	panadol overdose. liver damage	panadol overdose. liver damage	panadol overdose	panadol overdose		
Comment	Below		Below	Below	Below		
Na	142	--	139	143	145	136 - 148	mmol/L
K	3.6	--	3.7	3.6	4.0	3.6 - 5.0	mmol/L
Chloride	107	--	105	109	112 H	100 - 109	mmol/L
Urea	2.2 L	--	2.0 L	1.8 L	2.0 L	2.5 - 6.4	mmol/L
Creatinine	46 L	--	40 L	44 L	46 L	49 - 82	umol/L
R Glucose	8.4 H	--	5.3	5.4	4.3	2hr pp < 7.8	mmol/L
Calcium	--	--	2.13	1.99 L	2.15	2.11 - 2.55	mmol/L
Adjusted Calcium	--	--	2.27	2.15	2.25	2.11 - 2.55	mmol/L
Phosphate	--	--	0.89	0.78 L	0.91	0.88 - 1.45	mmol/L
Total Protein	64 L	--	61 L	60 L	63 L	67 - 87	g/L
Albumin	37 L	--	35 L	34 L	37 L	39 - 50	g/L
Globulin	27	--	26		26	26 - 40	g/L
Total Bili	12	--	11		10	4 - 23	umol/L
ALP	51	--	45	47	43	32 - 93	U/L
ALT	>3000 H	--	>3000 H	2824 H	2296 H	7 - 36	U/L
AST	2643 H	--	1604 H	982 H	418 H	14 - 30	U/L
GGT	55 H	--	55 H	57 H	61 H	up to 35	U/L
Amylase	140 H	--	105	--	--	25 - 124	U/L
Lactate	--	0.9	--	--	--	0.7 - 2.1	mmol/L

Expert opinion

- AST (cytosolic and mitochondrial) vs. ALT (cytosolic)
  - AST higher intracellular abundance
  - AST shorter half-life
  - AST initially higher than ALT
  - **AST declines more rapidly due to shorter $T_{1/2}$**
- **AST the better marker to gauge the clinical course**

Take home message

1. **Rely on your clinical judgment; perform a test only when it is indicated**

2. **Know the implications and limitations of the tests concerned**

3. **Have a fair idea what tests are provided by your hospital laboratory, cluster laboratory and Toxicology Reference Laboratory**

Take Home Message

4. **Maintain good communication with your laboratory counterparts**

5. **Toxicology tests should be performed and interpreted timely**

6. **Know which drug/toxin levels that will affect your patient management**

Take Home Message

7. **Treat the patient, not the laboratory result; and beware of the units**

8. **Be familiar with other common tests that are very useful for poisoning management**

9. **Do no harm!**

10. **Consult the experts**

Thank you!