Target Audience: Emergency Medicine Residents (junior and senior level postgraduate learners), Medical Students

Primary Learning Objectives:

1. Recognize clinical signs of opioid poisoning
2. Demonstrate appropriate treatment for opioid poisoning

Secondary Learning Objectives: detailed technical/behavioral goals, didactic points

1. Demonstrate professionalism and communication skills when speaking with consultants and working with ED nurse
2. Direct proper disposition/appropriate consultation

Critical actions checklist:

1. Perform primary survey
2. Obtain point-of-care glucose
3. Examine pupils in comatose and presumed poisoned patient
4. Administer naloxone for opiate overdose
5. Order serum acetaminophen
6. Administer N-acetylcysteine for acetaminophen overdose (if case option presented)
7. Consult Psychiatry Service
8. Admit to the MICU

[Critical actions can be changed to address the educational needs of the learner. For example, more senior learners may be required to address acetaminophen toxicity, in addition to the opioid overdose, whereas student learners may only need to manage the opioid overdose.]

Environment: Emergency Department treatment area

Mannequin set up: Simulator mannequin, no moulage, on a stretcher or hospital bed. Mannequin should be male.

Props:
To be displayed on screen or printed out on handouts in scenario room when asked for/return from lab:

- Images (online)
  - ECG with sinus tachycardia
  - Radiology read of normal head CT
  - Radiology preliminary read of normal chest x-ray (CXR)

- Labs (online)
  - CBC
  - BMP
  - Hepatic panel
  - CK, Troponin I
  - Urinalysis
  - Lactic Acid
  - Prothrombin Time, Activated Partial Thromboplastin Radio
  - Digoxin Level

- Urine Tox Screen
- Serum Toxicology

Available in the treatment room:

- Basic airway and code cart
- IVF (NS, D5NS or D5LR labeled liter bags)
- Naloxone vials

Available in the treatment room:

- Basic airway and code cart
- IVF (NS and D5W), D5NS or D5LR labeled liter bags
- Ice bags
- Fan
- Cooling blanket

Distractor: none

Actors:

- Paramedic/s are able to provide information about the scene, including what pill bottles were found, but only if specifically asked. *[Altering input from actors is a good way to increase/decrease scenario difficulty. For example, if EMS did not find the pill bottle, the ingestion becomes unknown.]*
- Coworker. This may be an optional person available to provide additional information either in person or via phone.
- Patient voice is male. Patient should sound somnolent with slurred speech and lethargy.
- ED nurse can start IVs and administer medications/fluids. The nurse does have a medical knowledge base and may cue learners if needed.
- Poison control available via "phone consultation" *[Option: to increase difficulty you can make poison control unavailable]*
- Intensive care unit (ICU) physician can be available via "phone consultation"

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CASE SUMMARY

SYNOPSIS OF HISTORY/ Scenario Background

40-year-old man found unconscious at a bar after work. According to his work colleagues, he was in his usual state of health today. They do not know of any medical problems. He and his colleagues went to a bar to celebrate a new account. He had "a beer" at the bar and went outside. They found him slumped over on the sidewalk. His colleagues put him in the back of their car and drove him to the hospital.

Patient cannot give history until he receives appropriate dose of naloxone. Once he receives naloxone, he admits that every day he takes oxycodone that he bought online and today he took a handful of pills because he felt depressed and wanted to "end it."

[Option: To increase degree of difficulty of case, the patient took a handful of oxycodone/acetaminophen tablets.]

CC: Unresponsive

PMH: Unknown

Meds: Unknown

Allergies: Unknown but presumed none

Family Hx: Unknown

Social Hx: Unknown

SYNOPSIS OF PHYSICAL

Patient drowsy, arouses to noxious stimulus, but quickly falls back asleep
Airway is protected
Noted bradypnea (RR ~ 8) and hypopnea
Skin dry
Bowel sounds hypoactive (if checked)
Pupils miotic

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HISTORY

Your called to see a new patient brought in by paramedics with altered mental status. You see a middle-aged man, appears to be sleeping, on a stretcher.

Onset of symptoms: Today

Background Info: 40-year-old man found unconscious at a bar after work. According to his work colleagues, he was in his usual state of health today. They do not know of any medical problems. He and his colleagues went to a bar to celebrate a new account. He had “a beer” at the bar and went outside. They found him slumped over on the sidewalk. His colleagues put him in the back of their car and drove him to the hospital.

Additional history:

From EMS: If asked, patient was found by coworkers altered. No drug paraphernalia. Due to short transport time, no drugs were given.

From co-worker: Available via phone. No more additional information other than it is thought the patient has a drug problem and has seemed depressed.

Chief Complaint: Altered mental status, somnolent

Past Medical Hx: Unknown

Meds: Unknown (Coworkers may have bottles of oxycodone, for students or junior learners)

Allergies: None

Family Hx: No family history.

Social Hx: “Social drinker, no drugs” (According to friends) “I don’t use drugs” (according to patient.)

ROS: Unable to obtain

CASE CONTINUATION

Vital Signs: BP: 100/60 mmHg P: 60/minute R: 8/minute T: 37C (98.6F) POx: 88% (FiO_2=0.21)

Primary Survey
Airway – Patent
Breathing – Bradypneic (~8/min), hypopneic, 88% RA
Circulation – Borderline bradycardic at 60/minute, normal pulses
Disability – Drowsy and arousable to noxious stimulus, quickly drifts back to sleep. Pupils miotic.
Exposure – No trauma

Required Actions within the First Two Minutes

- Establish safety net (IV, oxygen, cardiac monitor, two large bore IVs, draw blood for labs)
- A/B – Provide supplemental oxygen
- C – Cardiac monitor; NS IV bolus; ECG
- D – Finger stick glucose = 108 mg/dL; diagnostics should be ordered by this time

Branch Points

- **IF NO INTERVENTION OCCURS,** then the patient's blood pressure drops to 80/45 mmHg, and the heart rate and breathing deteriorate further (HR to 45/minute, R to 4/minute).

PHYSICAL EXAMINATION

Appearance: Patient is a somnolent man; arouses to sternal rub (the nurse may comment that he smells like alcohol).

Eyes: Pupils miotic and reactive

Heart: Normal rate, no murmur

Lungs: Equal bilaterally, clear to auscultation, bradypneic and hypopneic

Abdomen: Decreased bowel sounds

Skin: No track marks or needle marks

Neurologic: Arouses to painful stimuli with eyes closed.

[If given appropriate dose of naloxone he becomes sleepy but arouses to voice with eyes open. There are no focal neurological deficits.]

[If given high dose of naloxone he is awake and in mild distress, able to answer questions when pushed but nauseated, and unable to be very cooperative. Neurologic examination is otherwise unremarkable.]

[Physical exam findings not available on your mannequin can be reported verbally if asked for by learners e.g.: If your mannequin does not have reactive pupils you can verbally report the pupillary exam when it is requested]

Required Actions within the Next Two Minutes

- Administer naloxone (0.1-0.4 mg IV, IM, or nasally; ideally, if peripheral venous access has been established, IV administration preferred).
- Reassess patient and obtain further history once opioid toxidrome resolved.
- If dose of naloxone too high (1-2 mg in a single dose) patient will become agitated, psychotic, diaphoretic, and vomiting. When he is psychotic he screams, “They are trying to kill me!”

Branch Points

- **IF NALOXONE IS NOT ADMINISTERED,** then the patient becomes progressively hypoxic, bradypneic, and bradycardic, ultimately suffering PEA arrest.
- **IF GREATER THAN 2 MG NALOXONE IS GIVEN,** then the patient’s vitals will become: HR 120/minute, R 19/minute, BP 130/80 mmHg, and POx 96%.
- **IF PRECIPITATED WITHDRAWAL DEVELOPS FROM NALOXONE OVERDOSE,** then symptoms must be addressed (e.g., give antiemetics and possibly anxiolytics).

Required Actions within the Next Several Minutes

- Patient provides history of suicidal intent
- Diagnostic labs should be obtained and sent if not done so already
- A naloxone infusion (at a rate of two-thirds the rescue dose per hour) should be considered and started at this time

Branch Points

- **IF ADDITIONAL NALOXONE IS NOT PROVIDED,** then the vital signs change and the patient again becomes bradypneic, hypoxic, and bradycardic.
- **AT FACULTY DISCRETION, IF NALOXONE WAS NOT INITIALLY PROVIDED OR HAS NOT BEEN REPEATED,** then the patient could be sent into cardiac arrest (pulseless electrical activity).
- **IF CONTINUOUS NALOXONE INFUSION IS NOT ORDERED,** then the patient will repeatedly develop recrudescent toxicity.
- **IF GREATER THAN 2 MG OF NALOXONE IS GIVEN PER DOSE,** then acute withdrawal develops (**SEE ABOVE**).

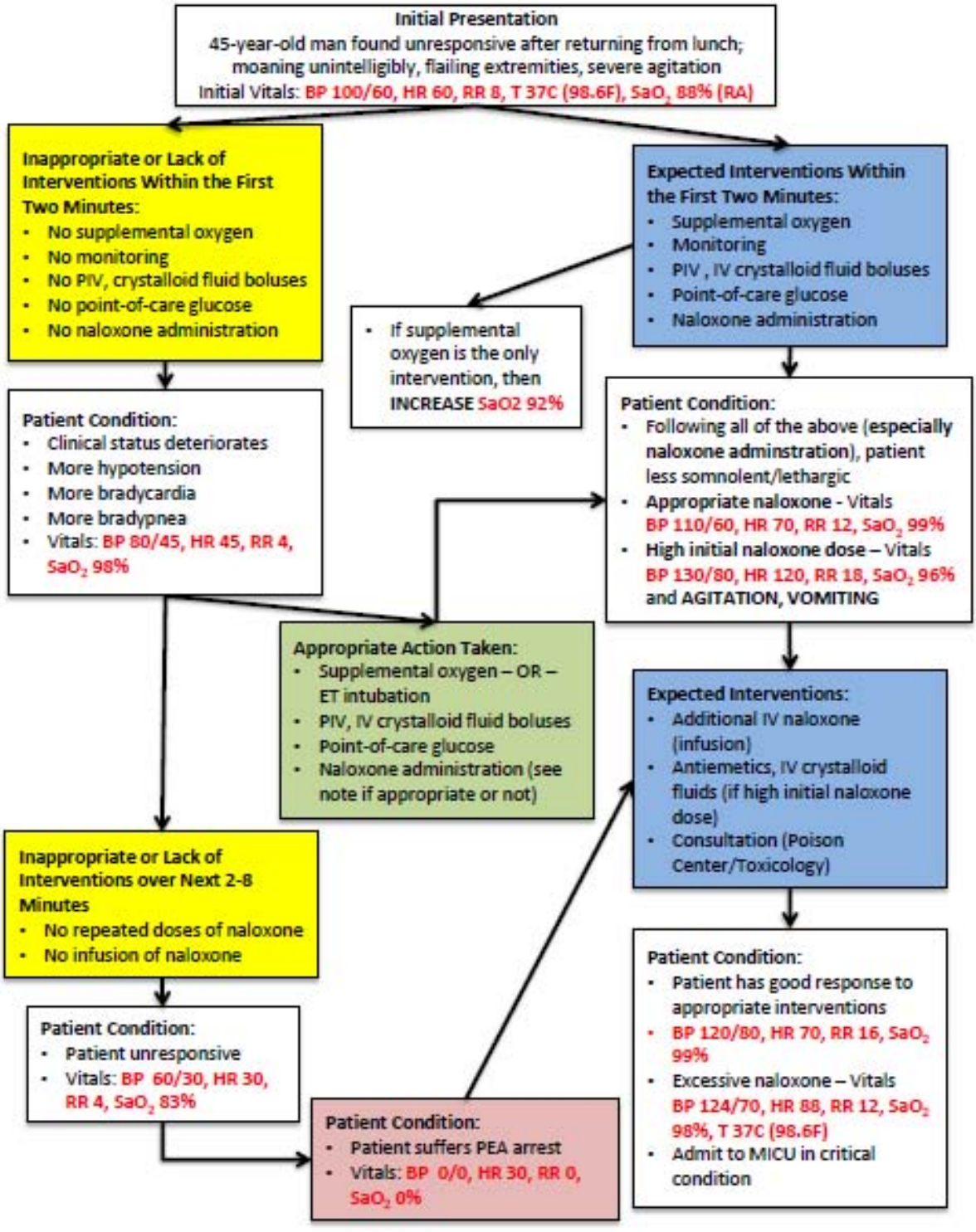
Required Actions Over the Next Several Minutes

- Examinee should contact ICU physician for admission by this time
- Patient should be admitted to ICU
- **For more advanced examinees:** Elevated acetaminophen level should be recognized and NAC started with Poison Center or Toxicology consultation

Branch Points

- **IF ELEVATED ACETAMINOPHEN LEVEL IS NOT ADDRESSED – OR – ACETAMINOPHEN TOXICITY IS NOT RECOGNIZED – OR – N-ACETYLCYSTEINE IS NOT STARTED,** then the MICU attending will balk and request transfer to a liver transplant center

Timeline and Branch Points for This Case



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CRITICAL ACTIONS

1. **Perform primary survey**

   Perform primary survey. To meet this critical action, the participant must evaluate the airway, breathing, circulation (pulses), and disability (specifically, the participant must examine the pupils).
   Cueing Guideline: Nurse can ask how the participant wants to begin evaluating the patient.

2. **Obtain point-of-care glucose**

   Obtain point-of-care glucose. Alternatively, the participant may select to administer empiric dextrose IV for suspected hypoglycemia.
   Cueing Guideline: The nurse may say, “We have a line in place. Would you like anything to reverse this patient’s condition?”

3. **Administer naloxone**

   Administer naloxone. Initially, this may be provided as an IV bolus dose (no greater than 2 mg IV). To meet this critical action, the patient must also start a continuous IV infusion of naloxone to prevent relapse.
   Cueing Guideline: The nurse may say, “We have a line in place. Would you like anything to reverse this patient’s condition?”

4. **Order serum acetaminophen**

   Order serum acetaminophen in patient presenting with symptoms of overdose.
   Cueing Guideline: The nurse may say, “Do you want any special labs in this overdose patient?”

5. **Adminster N-acetylcysteine for acetaminophen overdose (if CASE OPTION presented)**

   Adminster N-acetylcysteine for acetaminophen overdose, if case option presented.
   Cueing Guideline: The nurse may say, “Are there any antidotes we can provide for this patient’s condition?”

6. **Consult Psychiatry**

   Psychiatry should be consulted for evaluation of a patient presenting with a presumed or known intentional ingestion, although the patient’s medical care will always take immediate priority.
   Cueing Guideline: Nurse can ask if the doctor has called the Poison Center/Toxicologist yet.

7. **Consult Poison Center/Toxicologist**

   The Poison Center or Toxicology Service should be consulted for further management recommendations.
   Cueing Guideline: Nurse can ask if the doctor has called the Poison Center/Toxicologist yet.

8. Admit to the MICU

Admit to the MICU for definitive care. Patient will not be stable for any other destination (e.g. telemetry or floor unit). Any attempt to admit elsewhere will be blocked by accepting physician.
Cueing Guideline: The nurse can ask the doctor if anyone has called the intensivist to arrange for a definitive disposition decision.

Critical Actions Checklist[1]

Resident Name	
Case Description	

Skills measured **Core competencies: PC** Patient care, **MK** Medical knowledge, **IC** Interpersonal and communication skills **P** Professionalism, **PB** Practice-based learning and improvement **SB** Systems-based practice	Very Unacceptable		Unacceptable		Acceptable		Very Acceptable	
Data Acquisition (D) PC MK I	1	2	3	4	5	6	7	8
Problem Solving (S) PC MK PB	1	2	3	4	5	6	7	8
Patient Management (M) PC MK IC P PB SB	1	2	3	4	5	6	7	8
Resource Utilization (R) PC PB SB	1	2	3	4	5	6	7	8
Health Care Provided (H) PC SB	1	2	3	4	5	6	7	8
Interpersonal Relations (I) IC P	1	2	3	4	5	6	7	8
Comprehension of Pathophysiology (P) MK PB	1	2	3	4	5	6	7	8
Clinical Competence (C) PC MK IC P PB SB	1	2	3	4	5	6	7	8

Critical Actions

Yes	No		Comments:
		Perform primary survey	
		Obtain point-of-care glucose	
		Administer naloxone	
		Order serum acetaminophen	
		Administer N-acetylcysteine for acetaminophen overdose	
		Consult Psychiatry	
		Consult Poison Center/Toxicologist	
		Admit to the MICU	

Yes	No	
		Dangerous actions

[1] Modified ABEM Oral Certification Examination checklist and scoresheet

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STIMULUS INVENTORY

#1	Complete blood count
#2	Basic metabolic panel
#3	Urinalysis
#4	Liver function tests
#5	Digoxin level
#6	Coagulation studies
#7	Toxicology
#8	Radiology (CXR, CT head)
#9	Lactate
#10	ECG

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LAB DATA & IMAGING RESULTS

Stimulus #1	
Complete Blood Count (CBC)	
WBC	11,700/mm^3
Hemoglobin	14.2 g/dL
Hematocrit	43.2%
Platelets	297,000/mm^3
Differential	
PMNLs	45%
Lymphocytes	55%
Monocytes	2%
Eosinophils	1%

Stimulus #2	
Basic Metabolic Panel (BMP)	
Sodium	142 mEq/L
Potassium	3.9 mEq/L
Chloride	110 mEq/L
Bicarbonate	24 mEq/L
Glucose	122 mg/dL
BUN	18 mg/dL
Creatinine	1.1 mg/dL

Stimulus #3	
Urinalysis	
Color / pH	Yellow / 7.1
Specific gravity	1.020
Glucose	Negative
Protein	Negative
Ketones	Negative
LE/Nitrites	Negative
Blood	1+
WBC/RBC	≤ 5/hpf / ≤ 3/hpf
Crystals/bacteria	Negative

Stimulus #4	
Liver Function Tests	
AST	28 IU/L
ALT	26 IU/L
ALP	109 IU/L
T. Bilirubin	0.8 mg/dL
D. Bilirubin	0.2 mg/dL
Albumin	4.1 mg/dL

Stimulus #5	
Digoxin Level	
Value	Undetectable

Stimulus #6	
Coagulation Studies	
PT/INR	13.1 seconds / 1.1
PTT	18 seconds

Stimulus #7	
Toxicology	
Salicylate	Undetectable
Acetaminophen	170 mcg/mL
Ethanol	Undetectable
Urine drug screen	
Amphetamines	Negative
Benzodiazepines	Negative
Cocaine	Negative
Opiates	Negative
TCAs	Negative
THC	Positive

Stimulus #8	
Radiology	
CXR	Normal
CT head	Normal

Stimulus #9	
Lactate	
Value	2.7 mmol/L

Stimulus #10
ECG Sinus bradycardia, 57, normal intervals and axis, no ischemic changes

Stimulus #1

Complete Blood Count (CBC)

WBC	11,700/mm^3
Hemoglobin	14.2 g/dL
Hematocrit	43.2%
Platelets	297,000/mm^3
Differential	
PMNLs	45%
Lymphocytes	55%
Monocytes	2%
Eosinophils	1%

Stimulus #2

Basic Metabolic Panel (BMP)

Sodium	142 mEq/L
Potassium	3.9 mEq/L
Chloride	110 mEq/L
Bicarbonate	24 mEq/L
Glucose	122 mg/dL
BUN	18 mg/dL
Creatinine	1.1 mg/dL

Stimulus #3

Urinalysis

Color / pH	Yellow / 7.1
Specific gravity	1.020
Glucose	Negative
Protein	Negative
Ketones	Negative
LE/Nitrites	Negative
Blood	1+
WBC/RBC	≤ 5/hpf / ≤ 3/hpf
Crystals/bacteria	Negative

Stimulus #4

Liver Function Tests

AST	28 IU/L
ALT	26 IU/L
ALP	109 IU/L
T. Bilirubin	0.8 mg/dL
D. Bilirubin	0.2 mg/dL
Albumin	4.1 mg/dL

Stimulus #5

Digoxin Level

Value	Undetectable

Stimulus #6

Coagulation Studies

PT/INR	13.1 seconds / 1.1
PTT	18 seconds

Stimulus #7

Toxicology

Salicylate	Undetectable
Acetaminophen	170 mcg/mL
Ethanol	Undetectable
Urine drug screen	
Amphetamines	Negative
Benzodiazepines	Negative
Cocaine	Negative
Opiates	Negative
TCAs	Negative
THC	Positive

Stimulus #8

Radiology

CXR	Normal
CT head	Normal

Stimulus #9

Lactate

Value	2.7 mmol/L

Stimulus #10

ECG: Sinus bradycardia, 57, normal intervals and axis, no ischemic changes

Debriefing Materials – <u>Opioid and Acetaminophen Toxicity</u>

Debriefing Plan
Plan for approximately 30 minutes for discussion

Potential questions for discussion:
- What are opioids?
- What is the opioid toxidrome?
- How is naloxone administered?
- When is a finger stick glucose level performed?
- What are the indications to obtain an acetaminophen concentration?
- Why is the urine toxicology screen negative for opiates in this patient?
- (Optional scenario ending) When do we administer N-acetylcysteine to patients with suspected acetaminophen poisoning?

Pathophysiology
Oxycodone is an opioid with activity at the mu opioid receptor

Clinical Features
- Opioid toxidrome: somnolence, low/normal temperature, low/normal BP, low/normal HR, decreased RR, small pupils, decreased bowel sounds

Diagnosis
- Primarily clinical
- Oxycodone is a semi-synthetic opioid, so it usually does not show up on standard urine toxicology screens

Management
- Activated charcoal should be avoided when patient is somnolent
- Bedside finger stick glucose: Indicated for all patients with change in mental status
- Naloxone
    - Indicated for hypoventilation (bradypnea [RR <12] and/or hypopnea) when opioids are suspected
    - Initial bolus is 0.05-0.1 mg IV or IM, doubled or repeated every minute until ventilation is restored
    - In patients with opioid tolerance, **high doses of naloxone will precipitate opioid withdrawal**
    - Management of withdrawal triggered by naloxone is to administer antiemetics and to help calm patient. After approximately 15 minutes the naloxone effect will diminish and the patient will begin to exhibit the opioid toxidrome again
    - If naloxone is successful AND repeated doses are necessary after initial resolution of opioid toxicity, the clinician can administer a naloxone infusion at 2/3 the total initial successful dose, administered hourly
- IV fluids
- Serum acetaminophen concentration should be obtained in all patients with intentional suicidal overdose
- N-acetylcysteine is indicated for patients with one of the following:
    - Acetaminophen concentration that plots above the treatment line on the Rumack-Matthew nomogram for single, acute ingestions
    - Elevated aminotransferases without known etiology

- Detectable acetaminophen concentration without known time of ingestion
- Acetaminophen poisoning is suspected, the ingestion occurred more than 8 hours prior, and laboratory results are pending

Selected Reading for Learners

1. Nelson LS and Olsen D. Opioids. In: Nelson LS, Lewin NA, Howland MA, Hoffman RS, Goldrank LR, Flomenbaum NE, editors. Goldfrank's Toxicologic Emergencies. Ninth ed. New York: McGraw Hill; 2010 p. 559-74.

2. Aguina CT, et al. OxyContin abuse and overdose. *Postgrad Med*. Mar 2009; 121 (2): 163-7.