

Emergency Medicine Clerkship Handbook

1st Edition

Topics

ACLS/CHEST PAIN

TOXICOLOGY

RADIOLOGY

TRAUMA –ONLY USE AS A REFERENCE

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Emergency Medicine Clerkship Seminar Series Objectives

All seminars are small group, case based sessions, with an emphasis on interaction between the students and the instructor

1. Toxicology

Describe the specific components of ABC's as they refer to emergency assessment.

Take a goal directed history in order to identify the offending toxin, and quantifying the amount of toxin ingested and the tempo of symptom progression

Outline the common toxidromes (ASA, Acetaminophen, TCA, Cocaine, Benzodiazepines) with the findings on physical exam . Basic treatment will be outlined, but in not an objective

Describe the indications for charcoal, multi-dose charcoal, gastric lavage, and whole bowel irrigation

Describe the role of the lab and "tox screens" in the assessment of poisoned patients.

2. X-Rays

Develop and organized approach for interpretation of plain x-ray films. Extremity and chest films of common types of injuries will be the focus. Although treatment will be discussed, this is not the emphasis of the seminar

3. Mini ACLS

Develop a differential diagnosis for life threatening causes of chest pain

Discuss various ECG's and the role of 15 lead ECG

Describe the indications and contraindications for thrombolysis

Discuss the ECG and rhythm strip characteristics and treatment of Ventricular Fibrillation

CTAS

Canadian Triage and Acuity Scale (CTAS)

This can be found at the top corner of all charts in emerg – aside from their other uses, you may find these triage designations useful in determining what type of patient presentation awaits you.

Level I - Resuscitation

Conditions that are threats to life or limb (or imminent risk of deterioration) requiring immediate aggressive interventions.

Time to physician IMMEDIATE

Usual presentations:

1. Code / Arrest
2. Major trauma
3. Shock states
4. Unconscious
5. Severe Respiratory Distress

Level II Emergent

Conditions that are a potential threat to life, limb, or function, requiring rapid medical intervention.

Time to physician assessment/interview < 15 min.

Typical presentations include: altered LOC, head injury, severe trauma, chest pain, overdose, stroke, dyspnea, febrile neutropenia.

Level III Urgent

Conditions that could potentially progress to a serious problem, requiring emergency intervention. May be associated with significant discomfort or affecting ability to function at work or activities of daily living.

Time to physician < 30 min.

Presentations include: patients with moderate trauma (ex. fractures, dislocations), moderate asthma, vaginal bleeding, suicidal patients.

Level IV Less Urgent (Semi urgent)

Conditions that related to patient age, distress, or potential for deterioration or complications would benefit from intervention or reassurance within 1-2 hours.

Time to physician < 1 hour

Presentations include: minor head injuries, lacerations, ear ache, chronic low back pain, upper respiratory tract infections, depression.

Level V Non Urgent

Conditions that may be acute but non-urgent as well as conditions which may be part of a chronic problem with or without evidence of deterioration. The investigation or interventions for some of these illnesses or injuries could be delayed or even referred to other areas of the hospital or health care system.

Time to physician < 2 hours.

Presentations include abrasions, minor lacerations, sore throat, chronic mild abdominal pain.

The Primary Survey

Airway maintenance (w/ c-spine control)

Breathing & Ventilation

Circulation (pulses & hemorrhage control)

Disability (neurological status)

Exposure & Environment

Airway (with C-spine protection)

- Assume a cervical spine injury in any pt with multi-system trauma, especially with an altered LOC or blunt injury above the clavicle.
- In a conscious patient, the airway is most easily assessed by patient's ability to speak to you.
- Also note adventitious sounds, cyanosis, agitation, nasal flaring/indrawing in children.

Causes of airway obstruction:

1. decreased LOC
2. airway lumen: foreign body, vomit, secretions
3. airway wall: edema, fractures
4. extrinsic causes: trauma, mass, hematoma

Management: Basic vs. Definitive (intubation or surgical airway)

Basic Airway Management

1. chin lift or jaw thrust
2. suction to clear oropharynx
3. nasopharyngeal or oropharyngeal airway

Indications for intubation

1. unable to protect airway
2. inadequate spontaneous ventilation
3. O₂ saturation < 90% with 100% O₂
4. profound shock
5. GCS < 9
6. anticipate in trauma, overdose, CHF, asthma, COPD
7. anticipate in transfer of critically ill patients

Breathing

Assessed by looking, listening, and feeling...

Look: anxiety / agitation, skin colour, chest movement, respiratory rate & effort

Listen: stridor, wheezing, symmetry of air entry on auscultation

Feel: tracheal shift, crepitus, flail segments, subcutaneous emphysema

Treatment modalities:

- Nasal prongs
 - o Typically 1-6 L/min, provides oxygen concentrations of 24-44%
- Simple face mask
 - o Allows for oxygen concentration of 40-60%
- Mask with oxygen reservoir
 - o Oxygen concentration >60% is possible
- CPAP / BiPAP

Circulation

Management of Severe Hemorrhage:

- secure airway
- control external bleeding: direct pressure, brachial/axillary/femoral pressure points
- immediate surgical consultation for suspected internal bleeding
- infusion of 1-2L RL or NS (14-16 gauge IV)
 - o replace lost fluids at ratio of 3:1

Options for blood transfusions

- cross-matched: ideal, but takes time
- type-specific: often available w/in 10 minutes
- O -- only if above not available
 - o O negative used for children & women of child-bearing age
 - o O positive for everyone else

Disability

Level of consciousness, the quick & dirty method: **AVPU**

Alert

Responds to Verbal stimuli

Responds to Painful stimuli

Unresponsive

Also note:

- o size & reactivity of pupils
- o movement of upper/lower extremities

GCS, the not so quick and dirty method

- reported in three parts: Eyes + Verbal + Motor = Total
- note that, perhaps surprisingly, a dead person still scores 3/15 (there is no 0)

Eyes (4)	Verbal (5)	Motor (6)
Open spontaneously = 4	Appropriate = 5	Obeys commands = 6
Open to voice = 3	Confused / Disoriented = 4	Localizes pain = 5
Open to pain = 2	Inappropriate words = 3	Withdraws to pain = 4
No response = 1	Incomprehensible sounds = 2	Decorticate / flexion = 3
	No verbal response = 1	Decerebrate / extension = 2
		No response = 1

Exposure / Environment

- important to assess all areas of possible injury
- keep patient warm with blanket, heaters to prevent hypothermia

Then What?

The rapid primary survey is often done simultaneously with resuscitation, followed by the more detailed secondary survey, and any definitive care.

The secondary survey includes:

History (AMPLE)

- **A**llegies
- **M**edications
- **P**ast Medical History
- **L**ast Meal
- **E**vents related to injury

Head-to-Toe

- **Head & Neck:** pupils, LOC, facial bones, tympanic membranes
- **Chest:** breath sounds, flail segment, subcutaneous emphysema
- **Abdomen:** bowel sounds, distention, tenderness, etc.
- **MSK:** include log roll, palpation of T and L spine
- **Neurological Exam:** GCS, cranial nerves, focal deficits, papilledema

An Approach to Chest Pain

Differential Diagnosis for Chest Pain

Musculoskeletal	Cardiac	GI	Pulmonary	Other
Rib fracture Costochondritis Muscle strain Malignancy	Aortic dissection Pericarditis Myocarditis Angina MI	Reflux Esoph. Rupture Motility disorder Peptic Ulcer Cholecystitis Pancreatitis	PE Pneumonia Pneumothorax Pleural effusion	Herpes zoster Anxiety Sickle cell disease

Life-Threatening Causes of Chest Pain – consider these first:

- unstable angina / acute MI
- thoracic aortic dissection
- pulmonary embolism
- spontaneous pneumothorax / tension pneumothorax
- esophageal rupture
- cardiac tamponade

History

- Includes:
 - o **Position of Pain**
 - o **Quality of Pain**
 - o **Radiation:** to arm, neck, jaw, back
 - o **Severity**
 - o **Timing:** including onset, as well as aggravating & alleviating factors
- Classic pain of Coronary Artery Disease:
 - o Retrosternal pressure/heaviness
 - o Radiating to arm/neck/jaw
 - o Often with SOB, Nausea, Diaphoresis
- Be aware of atypical presentations in:
 - o Patients with diabetes
 - o Elderly patients
 - o Women
- Always ask about:
 - o Smoking
 - o Diabetes
 - o HTN
 - o Hyperlipidemia
 - o Personal hx of CAD
 - o Family hx of CAD

Physical Exam

- Vitals, including BP in both arms
- Palpate chest wall for tenderness (although a positive finding does not rule out MI, as 25% of patients with an MI have tenderness)
- CVS, Resp, and Abd Exam

Investigations

- ECG
- CXR
- Cardiac Markers
 - o In London currently: CK, Myoglobin, Troponin
 - o Be aware that “routine cardiac markers” vary from city to city

Localization of MI based on ECG findings

ST Changes	Likely Infarct Location
V2-V4	Anterior
II, III, aVF	Inferior
V1-V3	Septal
I, aVL, V4-V6	Lateral
V1-V6	Anterolateral
V4r-V6r	Right Ventricular (often associated with Inferior)

Treatment

- Commonly used medications in MI management:
 - o ASA 160-325mg
 - o Oxygen
 - o B-Blockers
 - o Nitroglycerine
 - o Morphine
 - o Heparin or Low Molecular Weight Heparin (ex Enoxaparin)
 - o Thrombolytics: ex. TPA, TNK, Streptokinase
 - Only used in ST-Elevation MI (STEMI)

Thrombolysis - Indications

- Symptoms consistent with MI, onset within 12 hours, and
- > 1mm ST elevation in 2 or more contiguous limb leads, or
- >2mm ST elevation in 2 or more contiguous chest leads, or
- new LBBB

Thrombolysis – Absolute Contraindications

- Active internal bleeding
- History of CVA < 6 months, or any hemorrhagic CVA
- Intracranial or intraspinal surgery or trauma < 2 months
- Intracranial or intraspinal neoplasm or AVM
- Suspected aortic dissection or pericarditis

Thrombolysis – Relative Contraindications

- Severe HTN (systolic > 200 or diastolic > 120)
- Active PUD
- Pregnancy
- Puncture of noncompressible vessel
- Significant chest trauma from CPR
- Bleeding diathesis

Trauma – A Brief Overview

General

- Usually divided into blunt (ex. MVA, fall, sports injury) vs. penetrating (gunshot, stabbing).
- Always ask about head injury, loss of consciousness, amnesia, headache, vomiting, seizure activity.

Chest Trauma

Life threatening chest injuries

- airway obstruction
- tension pneumothorax
- open pneumothorax
- massive hemothorax
- flail chest
- cardiac tamponade

Potentially Life-Threatening Chest Injuries

- **Contusion:** pulmonary or myocardial
- **Hernia:** traumatic diaphragmatic
- **Esophageal Perforation**
- **Traumatic aortic injury / tracheobronchial disruption**

Management options

- intubation
- chest tube(s)
- oxygen
- positive pressure ventilation
- surgery

Abdominal Trauma

Blunt trauma: more common; typically leads to solid organ injury

Penetrating trauma: often causes hollow organ injury

Physical Exam

- distension, guarding, contusions
- rigidity, tenderness, peritoneal signs
- Note that it is important to have a high clinical suspicion for abd injury in trauma, even in the absence of any immediate physical findings.

Investigations

- X-Ray: free air under diaphragm, diaphragmatic herniation
- FAST (focused abdominal sonogram for trauma) Ultrasound
 - o Looking for free fluid in peritoneal cavity
- IVP
- DPL (diagnostic peritoneal lavage)

- Tests for intra-peritoneal bleed
- CT

Indications for surgical management

- hemodynamically unstable
- hollow organ injury
- evisceration
- free air in abdomen

Patterns of Blunt Abdominal Injury

Direct Injury	Possible Associated Injuries
Right lower rib fractures	Liver, Gallbladder
Left lower rib fractures	Spleen, Left Kidney
Mid epigastric contusion	Duodenum, Pancreas, Small bowel mesentery
Lumbar transverse process fracture	Kidney, Ureter
Anterior pelvic fracture	Bladder, Urethra

Genitourinary trauma

History:

- mechanism of injury
- hematuria
- flank pain
- difficulty voiding

Physical Exam:

- CVA tenderness
- suprapubic tenderness
- blood at urethral meatus
- perineal/scrotal hematoma

Renal: blunt (contusions, hematomas) vs penetrating

Management

- 90% conservative
- 10 % surgical
 - if hemodynamically unstable
 - all penetrating wounds
 - renal pedicle injury

Ureter:

- iatrogenic most common cause
- rarely due to blunt or penetrating trauma

Bladder:

- extraperitoneal vs intraperitoneal
- extraperitoneal: typically rupture due to pelvic fracture fragments
 - often needs only Foley drainage unless major rupture
- intraperitoneal: rupture from trauma in patient with full bladder
 - drain abdomen & repair surgically

Contraindications to foley catheterization:

- blood at the urethral meatus

- ecchymosis of the scrotum or perineum
- high riding prostate on DRE in male patients

C-Spine Injuries

Assessment of a Suspected C-spine injury

Mechanism of Injury

- o MVC, Fall, Sport-related injury

History

- o Midline neck pain
- o Numbness, paresthesias
- o Loss of consciousness

Physical Exam

- o Altered mental state
- o Neck tenderness
- o Neurologic deficits

3-view C-spine X-Ray series

- o AP
- o Lateral C1-T1 (+ swimmer's view if needed)
- o Odontoid

What to look for on the lateral films? (ABCS)

Alignment

- o must see C1 to C7/T1 junction
- o assess 5 lines of contour
 - anterior vertebral line
 - posterior vertebral line
 - posterior border of facets
 - laminar fusion line
 - posterior spinous line

Bones

- o including height, width, shape of vertebral bodies

Cartilage

- o assess intervertebral disc spaces

Soft Tissues

- o widening of retropharyngeal or retrotracheal spaces

Shock

Defined as inadequate end-organ perfusion; ie inadequate transport of oxygen to organs and tissues.

Classified in various different ways, including **SHOCK**:

- **S**epsis & Spinal shock
- **H**emorrhagic / Hypovolemic shock
- **O**bstructive shock (ex. tension pneumothorax, cardiac tamponade)
- **C**ardiogenic shock (ex. MI)
- **A**naphylactic (so it's not a perfect mnemonic)

In a trauma patient, assume shock is **hemorrhagic** unless proven otherwise.

Presentation

Early:

- Incr. HR
- Incr. RR
- Narrow pulse pressure
- Decr. Urine output
- Prolonged Cap Refill
- Pale, cool extremities

Late:

- Hypotension
- Altered LOC

Clinical Signs of Shock

	Blood Loss	BP	HR	RR	Cap Refill	Urine output	CNS	Replacement
Class I	<15% (<750cc)	Normal	<100	20	<2s	30cc/hr	Normal / Mild Anxiety	Crystalloid (NS or RL)
II	15-30% (750cc – 1.5L)	Normal	>100	30	Delayed	20cc/hr	Anxious	Crystalloid
III	30-40% (1.5-2L)	Decreased	>120	35	Delayed	10cc/hr	Confused	Crystalloid + Blood
IV	>40% (>2L)	Decreased	>140	>45	Delayed	None	Lethargic	Crystalloid + Blood

All patients in whom shock is suspected need:

- Full set of vitals
- Rapid assessment of ABCs
- Supplemental oxygen
- Large-bore IV access
- Cardiac monitoring

Management of Hemorrhagic Shock:

- secure airway
- control external bleeding: direct pressure, brachial/axillary/femoral pressure points
- immediate surgical consultation for suspected internal bleeding

- infusion of 1-2L RL or NS (14-16 gauge IV)
 - o replace lost fluids at ratio of 3:1

Additional Trauma Information:

www.trauma.org

www.orthopaedic.ed.ac.uk/trauma.htm

Toxicology – General Principles

ABCs of Toxicology

Airway

Breathing

Circulation

Drugs: ACLS if needed for resuscitation, universal antidotes

Draw Blood

Decontamination: if possible to decrease absorption or increase elimination

Expose / Examine

Full vitals, Foley, monitors

Give specific antidotes, treatments

Universal Antidotes

- These include the following interventions with little chance of harm, but the potential for significant benefit:
 1. Oxygen
 2. Thiamine (vitamin B1)
 - 100 mg IV/IM
 - a necessary cofactor for glucose metabolism
 - may prevent Wernicke-Korsakoff syndrome
 3. Glucose
 - may be given to any pt presenting with altered LOC, though many will check chemstrip glucose at the bedside before administering
 - Adults 1-2ml/kg IV D50
 - Children 2ml/kg IV D25
 4. Naloxone (Narcan)
 - Antidote for opioids
 - Administration of naloxone may be diagnostic as well as therapeutic
 - Adults: 2mg initial bolus IV/IM/SC/ETT (in suspected chronic opioid users, some recommend 0.1-0.4mg every 2 minutes to prevent sudden acute withdrawal)
 - Children: 0.01mg/kg initial bolus IV/IO/ETT
 - may need maintenance dose, as narcotics typically have longer half life than naloxone

Decontamination

- Skin - removal of contaminated clothing, flushing of eyes, etc.

- Activated Charcoal
 - o prevents absorption of many drugs/toxins, with the exception of acids, alkalis, cyanides, alcohols, Fe, Li
 - o dose 1g/kg body weight
- Whole Bowel Irrigation
 - o 500ml (child) to 2000ml (adult) of balanced electrolyte solution by mouth
 - o indications
 - awake, alert patient with recent ingestion (4-6 hours)
 - drug/toxin not bound to charcoal
 - drug packages (body packers)
 - o contraindications
 - suspected ileus, perforation, obstruction

Essential Bloodwork

- CBC, Lytes, Urea, Creatinine, Glucose
- INR, PTT
- Osmolality
- ASA, APAP (acetaminophen)
- Gases, O2 Saturation

Anion Gap

$$AG = Na - (Cl + HCO_3)$$

Normal range 10-14 mmol/L

Differential Dx for Metabolic Acidosis with increased anion gap (MUDPILES CAT)

Methanol

Uremia

DKA

Paraldehyde

Iron / Isoniazid

Lactate

Ethylene glycol

Salicylates

Cyanide

Arsenic

Toluene

Osmolar Gap

Osmolar gap = Measured Osm. – Calculated Osm.

Calculated Osm. Gap = $2Na + BUN + Glucose$ (mmol/L)

Normal Osmolar Gap < 10mOsm/L

Differential Dx for increased osmolar gap

- Methanol, Ethanol, Ethylene Glycol, Isopropyl Alcohol
- Acetone
- Mannitol, Sorbitol, Glycerol

Some Common Toxidromes

Toxidrome	Typical agents	Common findings	Other findings	Specific interventions
Opioid	Heroin Morphine Demerol Codeine	CNS depress. Miosis Resp depress.	Hypothermia Bradycardia Pulm edema	Naloxone (Narcan)
Sympathomimetic	Cocaine Amphetamine PCP LSD Ephedrine	Agitation Mydriasis Diaphoresis Tachycardia Hypertension	Hyperthermia Rhabdomyolysis MI	Benzodiazepines Cooling Hydration
Cholinergic	Insecticides (organophosphate) Mushrooms	Salivation Lacrimation Diaphoresis Vomiting Urination Bronchorrhea	Bradycardia Seizures Weakness Paralysis	Atropine Pralidoxime
Anticholinergic	Atropine TCAs Antipsychotics Antiparkinsonian Scopolamine	Altered LOC Mydriasis Dry/flushed skin Dry MM Urinary retention	Seizures Arrhythmias Rhabdomyolysis	Physostigmine Benzodiazepines
Salicylates	ASA	Altered LOC Resp alkalosis Met acidosis Tinnitus Tachypnea Nausea Vomiting	Low grade fever Ketonuria	Alk of urine K replacement Hemodialysis
Benzodiazepines	Ativan Diazepam Midazolam	Decr. LOC Drowsiness Weakness	Resp. depression Hypotension Agitation	Flumazenil*
Serotonin syndrome	SSRI	Altered LOC Incr. Tone Hyperreflexia Hyperthermia	Tremor	Cooling Sedation Cyproheptadine

*Flumazenil:

- a GABA receptor antagonist
- used as an "antidote" for benzodiazepine overdose
- useful, in theory, as it may reduce the need for intubation in benzodiazepine overdose
- but, increases risk of seizure, specifically in cases of TCA co-ingestion or pre-existing seizure disorder
- also, most patients with a benzodiazepine overdose do well with supportive care
- many therefore limit the use of flumazenil to reversal of therapeutic benzodiazepine sedation in controlled settings

Additional Toxicology Information:
www.emedicine.com/emerg/toxicology.htm
www.acmt.net

Date: _____

Evaluation

Please complete at the end of your rotation and return to the Emergency Medicine office at South Street, Room C21

1. The material in this booklet enhanced my ability to participate in the Emergency Medicine teaching sessions.

1 (strongly disagree) 2 3 4 5 (strongly agree)

2. The material in this booklet was relevant and useful to me during my clerkship Emergency Medicine rotation.

1 (strongly disagree) 2 3 4 5 (strongly agree)

3. I anticipate that the material in this booklet will be useful to me during my future training – ex.during 4th year electives, residency, etc.

1 (strongly disagree) 2 3 4 5 (strongly agree)

Additional Comments:

(Please comment on sections you found particularly helpful, areas in which you'd like more information, and any additional web resources you think others would find useful.)
