Trauma Pharmacology
PFN: SOMRXL0S

Hours: 3.0
Instructor:

Terminal Learning Objective

• Action: Communicate knowledge of trauma pharmacology
• Condition: Given a lecture in a classroom environment
• Standard: Received a minimum score of 75% on the written exam IAW course standards

References

• USSOCOM Tactical Medical Emergency Protocol Drug List
• USSOCOM Tactical Medical Emergency Protocols for ATP’s
• USSOCOM Tactical Trauma Protocols for ATP’s
• Tactical Combat Casualty Care Guidelines
• TCCC Guidelines Comprehensive Review and Update #16-03
Reason

---

Agenda

- Define the schedule of controlled medications
- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of analgesics

---

Agenda

- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of antibiotics
- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of benzodiazepines
Agenda

- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of antagonists
- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of antiemetics

Define the Schedule of Controlled Medications
Schedule I

- Examples: heroin, LSD, mescaline, marijuana
  - High abuse potential
  - No currently accepted medical use
  - Used in research, analysis, or instruction only
  - May lead to severe dependence

Schedule II

- Examples: morphine, meperidine (Demerol®), fentanyl (Actiq®), codeine, cocaine, amphetamines
  - High abuse potential
  - Accepted medical uses
  - May lead to severe physical and/or psychological dependence

Schedule III

- Examples: ketamine (Ketalar®), anabolic steroids, acetaminophen with codeine (Tylenol #3®)
  - Less abuse potential than drugs in Schedules I and II
  - Accepted medical uses
  - May lead to moderate or low physical dependence or high psychological dependence
Schedule IV

- Examples: diazepam (Valium®), lorazepam (Ativan®), zolpidem (Ambien®)
  - Lower abuse potential than drugs in Schedule III
  - Accepted medical uses
  - May lead to limited physical or psychological dependence

Schedule V

- Examples: phenoxylate (Lomotil®), propylhexedrine (Benzedrex®)
  - Lower abuse potential than drugs in Schedule IV
  - Accepted medical uses
  - May lead to limited physical or psychological dependence

Caution with Aviators

WARNING
Identify the Types, Pharmacokinetics, Indications, Contraindications, Side Effects, Dosages and Routes of Administration of Analgesics

---

Acetaminophen (Tylenol®, Ofirmev®)

- **Indications**
  - Mild pain
  - Fever
  - TMEP: Pain Management
  - TTP: Procedural Analgesia

- **Contraindications**
  - Individuals with hypersensitivity to drug
  - Chronic liver damage/histroy of excess alcohol use

- **Description**: Non-narcotic analgesic and antipyretic
Acetaminophen (Tylenol®, Ofirmev®)

- Side Effects
  - Rash
  - Urticaria

Acetaminophen (Tylenol®, Ofirmev®)

- Pharmacokinetics
  - Onset - < 60 minutes
  - Peak - 1 to 3 hours
  - Duration - 4 to 6 hours

- Dose
  - 325 - 650 mg PO, q 4 to 6 hrs
  - 1 gm PO / IV every 6 to 8 hrs

Meloxicam (Mobic®)
Meloxicam (Mobic®)

- Description: NSAID

- Indications
  - Mild to moderate pain relief
  - Relief of signs and symptoms of OA/RA
  - TMEP: Pain Management

- Contraindications
  - Allergy to NSAID class of drugs or Aspirin

Meloxicam (Mobic®)

- Side Effects
  - Allergic reaction
  - Anaphylactic reactions including shock
  - Facial edema
  - Fatigue
  - Fever
  - Hot flashes

  - Malaise
  - Syncope
  - Weight decrease
  - Weight increase
  - Dyspepsia

Meloxicam (Mobic®)

- Pharmacokinetics
  - Onset - 30 minutes
  - Peak - 4 to 5 hours
  - Duration - 15 to 20 hour half life

- Dose
  - 7.5 or 15 mg, PO q D
Fentanyl (Actiq®) Lozenge
“Lollipop”

Indications
- For conscious patients with severe pain
- For patients with morphine allergies
- TMEP: Pain Management

Contraindications
- Hypersensitivity
- Caution in giving to a casualty that has already been given morphine
  - This can increase the chances of respiratory depression and narcotic side effects

Description: Oral transmucosal fentanyl citrate (OTFC)

Side Effects
- Respiratory depression
- Circulatory depression
- Hypotension
- Shock

Special Considerations
- Treatment of overdose should include
  - Ventilatory support
  - Intravenous access
  - Naloxone (Narcan®)
Fentanyl (Actiq\textsuperscript{®}) Lozenge

- **Pharmacokinetics**
  - Onset - 5 to 15 minutes
  - Peak - 20 to 30 minutes
  - Duration - 1 to 2 hours

- **Dosage**
  - 800 mcg
  - Placed between the cheek and lower gum
  - Consumed over 15 minutes

Morphine Sulfate

- **Indications**
  - Severe pain
  - TMEP: Pain Management
  - TTP: Procedural Analgesia

- **Contraindications**
  - Hypersensitivity (Sulfa)
  - Respiratory depression
  - Head injury
  - Hypotension

Description: A CNS depressant and a potent analgesic. It is an opium alkaloid used to relieve pain, to sedate, and to reduce anxiety.
Morphine Sulfate

- **Side Effects**
  - Decreased respiratory rate
  - Hypotension
  - Bradycardia
  - Nausea and vomiting (most common)
  - Dizziness
  - Pruritus
  - Skin flushing

- **Special Considerations**
  - Treatment of overdose should include
    - Ventilatory support
    - Intravenous access
    - Naloxone (Narcan®)

Morphine Sulfate

- **Pharmacokinetics**
  - **IV**
    - Onset - Rapid
    - Peak - 18 minutes
    - Duration - 3 to 5 hours
  - **IM**
    - Onset - 5 to 30 minutes
    - Peak - 30 to 60 minutes
    - Duration - 3 to 5 hours

- **Dose**
  - 5 mg IV or IM, initial dose
    - Slow IV push, over 4 to 5 minutes
    - Titrate to effect, dosing every 10 minutes up to 30 mg

Morphine Sulfate

- **Interactions**
  - The CNS depression associated with morphine can be enhanced when administered with:
    - antihistamines
    - antiemetics
    - sedatives
    - hypnotics
    - barbiturates
    - ETOH
Ketamine (Ketalar®)

- **Indications**
  - TTP: Procedural Analgesia
    - Examples: Fracture reduction and chest tube insertion
- **Contraindications**
  - Hypersensitivity
  - Eye globe injury (FDA/TMEPS ONLY)
  - Head injury (FDA/TMEPS ONLY)
  - Approved by USSOCOM

- **Description:** Ketamine is a rapid-acting general sedative and analgesic

- **Side Effects**
  - Hypertension
  - Respiratory depression
  - Emergence reactions
  - Increased ICP (low risk, benefit outweighs risk)
  - Increased IOP (low risk, benefit outweighs risk)
  - Hypersalivation (only at doses above 2mg/kg)
Ketamine (Ketalar®)

- Pharmacokinetics
  - IV
    - Onset - Rapid
    - Peak - 1 minute
    - Duration - 5 to 10 minutes
  - IM (Alternate)
    - Onset - Rapid
    - Peak - 3 to 4 minutes
    - Duration - 12 to 25 minutes
- Dose
  - Initial dose: 20 mg IV/IO slowly over 1 minute
  - Maintenance: 20 mg every 30 to 60 seconds until nystagmus/maximum dose of 100 mg reached

Ketamine (Ketalar®)

- Tactical Field Care - If unable to fight or there is need for opiate analgesia to control pain without IV access:
  - Ketamine 50 mg intranasal (using nasal atomizer device)
  - Repeat dose every 15-30 minutes as necessary to control severe pain or until the casualty develops nystagmus
  - OR Ketamine 50 mg IM
  - Repeat dose every 15-30 minutes to 1 hour as necessary to control severe pain or until the casualty develops nystagmus

Combat Wound Medication Pack
Battlefield Analgesia (3 options)

1. Mild to Moderate Pain (still able to fight)
   - Combat Wound Medication Pack
     - Tylenol 650mg bilayer caplet, 2 PO every 8 hours
     - Meloxicam 15mg PO once a day

2. Moderate to Severe Pain
   (Patient IS NOT in shock/respiratory distress AND IS NOT at risk of developing either condition)
   - Oral transmucosal fentanyl citrate (OTFC) 800µg
     (IV Morphine is an alternative to OTFC if IV is in)

3. Moderate to Severe Pain
   (Patient IS in hemorrhagic shock/respiratory distress OR IS at risk of developing either condition)
Battlefield Analgesia (3 options)

3. Moderate to Severe Pain
   (Patient IS in hemorrhagic shock/respiratory distress
   OR IS at risk of developing either condition)

   • Ketamine 50mg IM or IN
     – OR –
   • Ketamine 20mg slow IV or IO

   (End points: Control of pain or development of nystagmus)

Identify the Types,
Pharmacokinetics, Indications,
Contraindications, Side Effects,
Dosages and Routes of
Administration of Antibiotics

War Wound Therapy
For Medics to administer (TMEPS)
Ertapenem IV (Invanz®)

- **Description:** Carbapenem antibiotic

- **Indications**
  - Drug of choice for penetrating battlefield trauma
  - Complicated skin infections
  - Pneumonia
  - Complicated UTI, including pyelonephritis
  - TMEPs: Abdominal Pain, Cellulitis, Crush Syndrome, Joint Infection, Sepsis/Septic Shock

- **Contraindications**
  - Hypersensitivity to ertapenem
  - Penicillin allergy with documented severe reaction
  - Hypersensitivity to other carbapenem antibiotics
  - Anaphylactic reactions to other beta-lactam antibiotics
Ertapenem IV (Invanz®)

- **Side Effects**
  - Diarrhea
  - Infused vein phlebitis /thrombophlebitis
  - Nausea and vomiting
  - Headache
  - Vaginitis
  - Seizures with severe reaction

- **Special Considerations**
  - Solutions range from colorless to pale yellow
  - IV and IM administration
  - Must be reconstituted prior to administration
  - Do not give reconstituted IM solution in IV

---

Ertapenem IV (Invanz®)

- **Pharmacokinetics**
  - Half-life: 4 hours
  - High protein binding (85% to 95%)

- **Dose**
  - 1 gm (infused over 30 minutes) once a day
  - May be administered IV up to 14 days or IM injection for up to 7 days

---

“Piggyback” IV Administration
**Ceftriaxone Sodium (Rocephin®)**

- **Description:** 3rd generation cephalosporin, broad spectrum antibiotic for IV and IM use

- **Indications**
  - Serious infections of lower respiratory tract, urinary tract and CNS
  - Serious skin infections
  - Infection with penetrating trauma (abdomen, extremities)
  - TMEPs: Abdominal Pain, Dental Pain, Bronchitis/Pneumonia, Flank Pain, Head/Neck Infection, Joint Infection, Meningitis, Sepsis/Septic Shock, Tactical Trauma, UTI

- **Contraindications**
  - Cephalosporin sensitivity/hemolytic anemia
  - Use caution in patients with a history of
    - Penicillin allergy (10% cross-sensitivity)
    - Hepatic/Liver dysfunction
Ceftriaxone Sodium (Rocephin®)

- **Side Effects**
  - Headaches
  - Dizziness
  - Nausea and vomiting
  - Diarrhea
  - Abdominal cramps
  - Urticaria
  - Increased temperature

- **Special Considerations**
  - Preparation procedure:
    - Withdraw 10 ml NaCl from a 100 ml bag.
    - Inject 10 ml NaCl into 1 gm Rocephin vial. Mix.
    - Withdraw entire contents of vial and inject into original 100 ml NaCl IV bag. Mix.
    - Piggyback with running IV

Ceftriaxone Sodium (Rocephin®)

- **Pharmacokinetics**
  - Widely distributed, including to CSF
  - Half-life: 0.12 to 0.7 hours
  - Elimination half-life: 5.4 to 10.9 hours

- **Dose**
  - 1 to 2 gm IV/IM q 24 hrs
  - Infuse over 30 minutes
  - Must be reconstituted

Moxifloxacin (Avelox®)
### Moxifloxacin (Avelox®)

- **Description:** 4th generation quinolone, broad spectrum antibiotic with broad anaerobic coverage for PO/IV administration, inhibits DNA preventing cellular replication and division
- **Indications**
  - War wound therapy
  - Complicated skin and intra-abdominal infections
  - TMEPs: Barotrauma, Bronchitis/Pneumonia, Cellulitis, Ear Infection, Epistaxis, Flank Pain, Gastroenteritis, Ingrown Toenail, Meningitis, Subungal Hematoma

---

### Moxifloxacin (Avelox®)

- **Description:** 4th generation quinolone, broad spectrum antibiotic with broad anaerobic coverage for PO/IV administration, inhibits DNA preventing cellular replication and division
- **Contraindications**
  - Hypersensitivity to fluoroquinolones
  - Patients < 18 years old
  - Pregnancy and lactation
  - Uncorrected hypokalemia

---

### Moxifloxacin (Avelox®)

- **Side Effects**
  - Headache
  - Nausea
  - Diarrhea
  - Photosensitivity
  - Insomnia
  - Vertigo
- **Special Considerations**
  - IV administration must be reconstituted prior to administration
  - Reconstituted solution must be clear
  - Do not mix or co-infuse with other medications

---
Moxifloxacin (Avelox®)

- Pharmacokinetics
  - Peak: 0.5 to 4 hours
  - Half-life: 11.5 to 15.6 hours (PO)
- Dose
  - 400 mg/day, PO/IV
  - IV infusion should be over 60 minutes
  - Avoid use with antacids
  - Decrease dose in renal impairment
  - Avoid using with antiarrhythmics
    - May cause prolonged QT interval

TCCC Recommendation

- Tactical Field Care
  - Antibiotics: recommended for all open combat wounds
    - a. If able to take PO: (Self aid)
      - Moxifloxacin, 400 mg PO once a day
    - b. If unable to take PO (shock, unconsciousness):
      - Ertapenem, 1 g IV/IM once a day (Medic administration)

Identify the Types, Pharmacokinetics, Indications, Contraindications, Side Effects, Dosages and Routes of Administration of Benzodiazepines
Diazepam (Valium®)

- Description: Benzodiazepine, CNS depressant, anticonvulsant/sedative

- Indications
  - Acute anxiety
  - Seizures/Status epilepticus
  - Relaxation of skeletal muscle
  - Chemical agent/Organophosphate poisoning
  - TMEPs: Back Pain, Behavioral Changes, Hyperthermia, Seizure

- Contraindications
  - Head injury
  - Decreased BP
  - Acute narrow angle glaucoma
Diazepam (Valium®)

- Side Effects
  - Decreased BP
  - Decreased respirations
  - Drowsiness
  - Venous irritation
  - Pain at injection site
  - Nausea and vomiting

Diazepam (Valium®)

- Pharmacokinetics
  - Well absorbed from GI tract
    - Onset: 1 to 5 minutes
    - Duration: 15 to 60 minutes
- Dose
  - Status Epilepticus: 5 to 10 mg, IV slow push
  - Acute anxiety: 5 to 15 mg, PO or IV slow push
  - Relaxation of skeletal muscle: 5 to 15 mg, PO or IV slow push
  - Chemical warfare: 10 mg autoinjector, IM

Midazolam (Versed®)
Midazolam (Versed®)

- **Description:** Benzodiazepine

- **Indications**
  - Sedation in combination with analgesia to perform brief, but painful procedures (i.e. fracture reduction)
  - Treatment of active seizures
  - Sedation of agitated patients
  - TMEP: Seizure
  - TTP: Procedural Analgesia

- **Contraindications**
  - Known sensitivity to midazolam
  - Acute narrow angle glaucoma

- **Side Effects**
  - Respiratory: laryngospasm, bronchospasm, wheezing, shallow respirations
  - Cardiovascular: bradycardia, tachycardia
  - Gastrointestinal: vomiting
  - CNS/neuromuscular: retrograde amnesia, hallucination, confusion
  - Special senses: blurred vision, diplopia, nystagmus, pinpoint pupils
  - Hypersensitivity: anaphylactoid reactions, hives, rash, pruritus
Midazolam (Versed®)

- **Special Considerations**
  - Use with caution when other medications capable of producing CNS depression are used
  - Monitor patients continuously for early signs of hypoventilation, airway obstruction, or apnea
  - Use with caution in patients with severe fluid or electrolyte disturbances
  - Oxygen is desirable, but not absolutely required

- **Pharmacokinetics**
  - Onset: 1 to 5 minutes
  - Peak: 5 to 7 minutes
  - Duration: 20 to 30 minutes

- **Dose**
  - Seizure Control: 5 to 10 mg IM/IV/IO
  - Sedation: 1 mg IV slowly, q 2 to 3 minutes to effect or maximum adult dose of 10 mg
Identify the Types, Pharmacokinetics, Indications, Contraindications, Side Effects, Dosages and Routes of Administration of Antagonists

---

Naloxone (Narcan®)

- **Indications**
  - Known or suspected narcotic induced respiratory depression
  - TMEPs: Pain Management, Loss of Consciousness (without seizures)

- **Contraindications**
  - Known allergy to medication

---

Naloxone (Narcan®)

- Description: Narcotic antagonist

---

---
Naloxone (Narcan®)

- **Side Effects**
  - In narcotic dependent patient, withdrawal symptoms may be precipitated

---

Naloxone (Narcan®)

- **Pharmacokinetics**
  - Onset - 1 to 2 minutes
  - Duration - 20 to 40 minutes

- **Dose**
  - 0.4 to 2 mg IV (IM or ETT optional)
  - Repeat q 2 to 3 min PRN
    - Repeat doses may be needed after 20 to 30 minutes

---

Flumazenil (Romazicon®)
Flumazenil (Romazicon®)

- **Description:** Benzodiazepine antagonist

- **Indications**
  - Known or suspected benzodiazepine overdose; reversal of sedation/anesthesia

- **Contraindications**
  - Known allergy to medication
  - Patients who have been given benzodiazepines to control status epilepticus
  - Patients with a cyclic antidepressant overdose

- **Side Effects**
  - In benzodiazepine dependent patient, may trigger withdrawal symptoms and seizures

- **Pharmacokinetics**
  - Onset - 30 seconds
  - Duration - 30 to 60 minutes

- **Dose**
  - 0.2 mg IV initial dose (over 30 seconds)
  - May increase to 0.5 mg for additional doses
  - Repeat q 30 seconds PRN to desired effect, or to max dose of 3 mg
Identify the Types, Pharmacokinetics, Indications, Contraindications, Side Effects, Dosages and Routes of Administration of Antiemetics

Promethazine (Phenergan®)

- Description: Phenothiazine class drug, an H1 receptor blocking agent
- Indications
  - Sedative
  - Antihistamine for allergies
  - Anaphylactic reactions in addition to epinephrine
  - Nausea and vomiting
  - Motion sickness
  - TMEPs: Nausea and Vomiting, Pain Management

Promethazine HCl (Phenergan®)
Promethazine HCl (Phenergan®)

- Description: Phenothiazine class drug, an H1 receptor blocking agent
- Contraindications
  - Children < 2 years old
  - Comatose states
  - Asthma

Promethazine HCl (Phenergan®)

- Side Effects
  - Drowsiness, sedation, sleepiness
  - Anticholinergic effects
  - Photosensitivity
  - Bradycardia
  - Urticaria
  - Respiratory depression
  - Hypotension
  - Chest pain
- Special Considerations
  - Store at room temperature, between 15° to 25° C (59° to 77° F)
  - Protect from light
  - Do not use if solution is discolored or contains a precipitate
  - Can use IV as a last resort
  - Subcutaneous or IV infiltration may result in tissue necrosis

Promethazine HCl (Phenergan®)

- Oral Dose
  - Nausea/vomiting: 25 mg q 4 hrs
  - Motion sickness: 25 mg bid
    - 30 - 60 min before travel; repeat in 8 - 12 hrs if needed
- Parenteral (deep IM injection)
  - Nausea/vomiting: 12.5 - 25 mg, q 4 - 6 hrs PRN
  - Motion sickness: 12.5 - 25 mg; repeat PRN up to 4 times/day
- Pharmacokinetics
  - Onset: 3 to 5 minutes
  - Duration: 2 to 8 hours
Ondansetron (Zofran®)

- **Indications**
  - Prevention of nausea and vomiting
  - TMEP: Nausea and Vomiting

- **Contraindications**
  - Hypersensitivity to any component of product

- **Description:** Antiemetic

- **Side Effects**
  - Anxiety
  - Dizziness
  - Sedation/drowsiness
  - Headache
  - Malaise/fatigue
  - Chills/shivering
  - Constipation or diarrhea
  - Fever
  - Pruritus
  - Urinary retention
  - Musculoskeletal pain
  - Extrapyramidal symptoms
  - Arrhythmias
  - Hypotension
  - Chest pain
Ondansetron (Zofran®)

Dystonia

- Pharmacokinetics
  - Rapidly absorbed from GI tract

- Dose
  - Oral: 4 to 8 mg, PO tid up to 48 hours
  - Parenteral: 4 mg IV over 2 to 5 minutes or 4 mg IM tid

Identify the Types, Pharmacokinetics, Indications, Contraindications, Side Effects, Dosages and Routes of Administration of Miscellaneous Trauma Medications
Dexamethasone (Decadron®)

- **Description:** Parenteral steroid (glucocorticoid)
- **Indications**
  - Emergency treatment of AMS, HACE, HAPE, when tactical conditions preclude descent or acclimatization
  - Inflammatory conditions
  - Allergic conditions
  - TMEPs: Altitude Illness, Anaphylaxis, Blast Injury, Sepsis/septic Shock, Smoke Inhalation
*Use of Decadron does not preclude the need for an emergency descent. (Administer Decadron every 6 hours until descent is accomplished)*

Dexamethasone (Decadron®)

- **Contraindications**
  - Use caution in patients with a history of diabetes, hypertension, and ulcers
Dexamethasone (Decadron®)

- Side Effects
  - Delayed wound healing
  - Acne
  - Various skin eruptions
  - Edema

Dexamethasone (Decadron®)

- Pharmacokinetics
  - Rapidly, completely absorbed form GI tract after PO administration

- Dose
  - Blast injury - 10 mg IV/IO/IM/PO QD x 5 days for hearing loss if not contraindicated by other injuries
  - All other conditions - 4 mg IV/IM/PO q 6 hours

Mannitol (Osmotrol®)
Mannitol (Osmotrol®)

- Description: Osmotic diuretic
- Indications
  - Crush injury
  - TMEP: Crush Syndrome
- Contraindications
  - Anuria
  - Pulmonary edema
  - Dehydration
  - Congestive heart failure
  - Hypovolemia
  - Hypotension
  - Hypersensitivity

Mannitol (Osmotrol®)

- Side Effects
  - Sodium depletion
  - Transient volume overload
  - Hypotension (excessive diuresis)
  - Angina like chest pain
  - Headache and dizziness
  - Nausea and vomiting
  - Chills

Mannitol (Osmotrol®)

- Pharmacokinetics
  - Onset - 1 to 3 hours
  - Duration - 1.5 to 6 hours
- Dose
  - 1 to 2 gm/kg at the rate of 5 gm/hr
    - Always use an in-line filter
    - Drug will crystallize at 45 degrees F or lower
**Diphenhydramine HCl (Benadryl®)**

- **Indications**
  - Mild to moderate allergic symptoms and/or allergic reactions
  - Dystonic reaction
  - TMEPs: Allergic Rhinitis/Hay Fever/Cold Like Symptoms, Anaphylactic Reaction, Contact Dermatitis, Envenomation, Nausea and Vomiting

- **Contraindications**
  - None in the emergent setting
  - Consideration with asthma

- **Description:** Antihistamine, prevents (but does not reverse) histamine-mediated responses, H1 blocker
Diphenhydramine HCl (Benadryl®)

- **Side Effects**
  - Sedation
  - Blurred vision
  - Nausea
  - Vomiting
  - Diarrhea
  - Headache

- **Pharmacokinetics**
  - Onset - < 15 minutes
  - Peak - 1 to 4 hours
  - Duration - 4 to 6 hours

- **Dose**
  - 25 to 50 mg IM/IV/PO, q 6 hours
  - Maximum dose is 400 mg/day

Epinephrine (Adrenaline®)
Epinephrine (Adrenaline®)

- **Description:** Alpha and beta adrenergic sympathomimetic

- **Indications**
  - Anaphylaxis
  - Allergic reactions
  - Asthma
  - TMEPs: Anaphylactic Reaction, Asthma (Reactive Airway Disease), Sepsis/Septic Shock, Neurogenic/Spinal Shock

- **Dosage:**
  - 1:1,000 dilution epinephrine (1 mg in 1 ml) is standard issue and dosage for anaphylaxis
  - 1:10,000 dilution (1 mg in 10 ml) is the standard ‘Cardiac’ dosage form for IV use

- **Contraindications**
  - 1:1,000 Epinephrine is not given IV
  - Use caution in patients with a history of heart disease or those over the age of 40
  - Do not inject epinephrine (or solutions containing epinephrine) into/near the fingers, toes, nose, ears or penis

- **Side Effects**
  - Cardiac arrhythmias
  - Ventricular tachycardia
  - Ventricular fibrillation
  - Angina
  - Hypertension
  - Increased BP
  - Nausea and vomiting
  - Vasoconstriction
Epinephrine (Adrenaline®)

- Pharmacokinetics
  - Onset - 5 to 10 minutes
  - Peak - 20 minutes
  - Duration - 1 to 4 hours

Epinephrine (Adrenaline®)

- Dose
  - Anaphylaxis:
    - 0.3 to 0.5 mg (0.3 to 0.5 ml of 1:1,000 dilution) IM
    - 0.3 to 0.5 mg (3 to 5 ml of 1:10,000 dilution) IV
  - Allergic reaction:
    - 0.3 to 0.5 mg (0.3 to 0.5 ml of 1:1,000 dilution) SQ/IM
  - Asthma:
    - 0.3 to 0.5 mg (0.3 to 0.5 ml of 1:1,000 dilution) SQ/IM

Epinephrine (Adrenaline®)

- Dose for hypotension in Neurogenic/Spinal Shock or Sepsis/Septic Shock
  - Take a 10 ml syringe and draw up 1 ml of 1:1,000 epinephrine
  - Then draw up 9 ml of normal saline into this syringe
  - Waste 9 ml of this mixture, then draw up 9 ml more of normal saline into the same syringe
Epinephrine (Adrenaline®)

- Dose for hypotension in Neurogenic/Spinal Shock or Sepsis/Septic Shock (cont.)
  - Final concentration is 10 ml of 1:100,000 epinephrine, 10 mcg/ml
  - Administer 0.5 to 2 ml (5 to 20 mcg) IV/IO to maintain radial pulse or SBP > 90 mm Hg

Tranexamic Acid (TXA)

- Indications
  - Combat casualties at high risk for requiring massive blood transfusion
  - Combat casualties presenting with hemorrhagic shock, penetrating torso trauma, multiple major amputation, or clinical evidence of severe blood loss

- Description: Antifibrinolytic agent
Tranexamic Acid (TXA)

- Description: Antifibrinolytic agent

- Contraindications
  - Subarachnoid hemorrhage
  - Active intravascular clotting
  - Known hypersensitivity

Tranexamic Acid (TXA)

- Side Effects
  - Ophthalmologic
    - Blurred vision, conjunctivitis, eye pain
  - Digestive
    - Dose related nausea, vomiting, diarrhea
  - Cardiovascular
    - Angina/chest pain, hypotension, postural hypotension, myocardial infarction, tachycardia

Tranexamic Acid (TXA)

- Pharmacokinetics
  - Duration - 7 to 8 hours in serum, 17 hours in tissues

- Dose
  - Give 1 gram TXA in 100 ml of normal saline or Lactated Ringer’s IV/IO over 10 minutes as soon as possible after injury but no later than 3 hours after injury
  - Give second dose of 1 gram after Hextend or other fluid treatment
Tranexamic Acid (TXA)

- After first dose, write on chest wall
  - "1 gm TXA given"
- After second dose, change marking to
  - "2 x 1 gm TXA given"
- Warnings
  - Do not administer TXA IV push
  - Do not administer through same IV line as blood, blood products or Hextend

Questions?

Agenda

- Define the schedule of controlled medications
- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of analgesics
Agenda

- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of antibiotics
- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of benzodiazepines

Agenda

- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of antagonists
- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of antiemetics

Agenda

- Identify the types, pharmacokinetics, indications, contraindications, side effects, dosages and routes of administration of miscellaneous trauma medications
Reason

References

- USSOCOM Tactical Medical Emergency Protocol Drug List
- USSOCOM Tactical Medical Emergency Protocols for ATP’s
- USSOCOM Tactical Trauma Protocols for ATP’s
- Tactical Combat Casualty Care Guidelines
- TCCC Guidelines Comprehensive Review and Update #16-03

Terminal Learning Objective

- Action: Communicate knowledge of trauma pharmacology
- Condition: Given a lecture in a classroom environment
- Standard: Received a minimum score of 75% on the written exam IAW course standards
Trauma Pharmacology
PFN: SOMRXL0S

Hours: 3.0
Instructor: