New Paramedic Level Skills: Chest Tube Management, Paralytic Administration, and Eye Irrigation with the Morgan® Lens

2011 Georgia Office of EMS
Paramedic Level Updates

Special Thanks

- **Chest Tube Management**
  - Gina Solomon RN CCRN
  - Trauma Program Manager
  - Gwinnett Medical Center
- **Paralytic Administration/Morgan Lens**
  - Rob Andrews, EMT-P, CCP-C
  - Training Officer
  - Gwinnett County Fire Academy

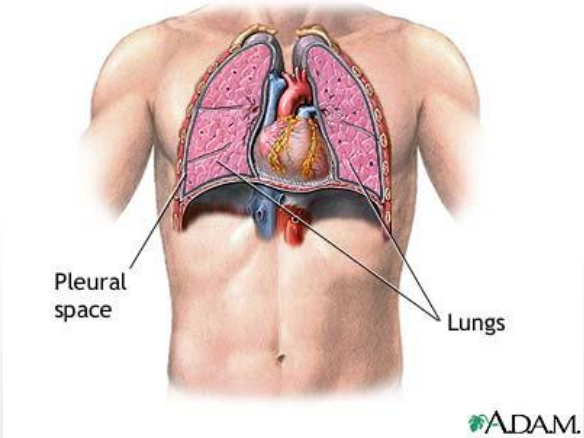
Objectives

- Describe purpose of a chest tube
- List indications for a chest tube
- Explain care for a chest tube drainage system
- List possible complications and troubleshooting for chest tubes

Indications for a Chest Tube

- Pneumothorax
- Hemothorax
- Pleural effusion

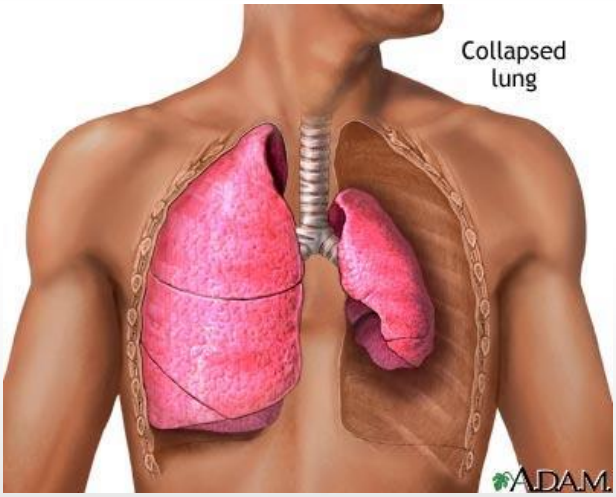
Anatomy & Physiology



Anatomy & Physiology

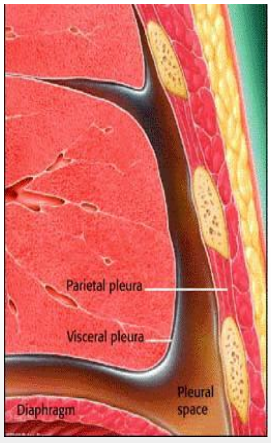
- Under normal circumstances there is always negative pressure in the pleural cavity
- When air or fluid enters the pleural space it disrupts the negative pressure and compresses the lung

Pneumothorax



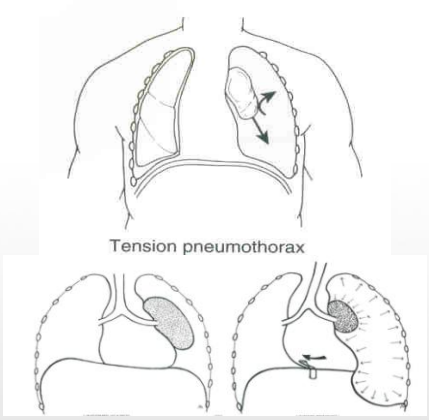
Chest (Thoracic Cavity)

- Parietal Pleura
  - Membrane lining the thoracic cavity
- Visceral Pleura
  - Membrane covering the lungs
- Pleural Space/Cavity
  - A potential space between the pleurae
- Parietal Space/Cavity
  - Space encapsulated by visceral pleura making up intrapulmonary area
- Pleural Fluid
  - Lubricant that allows pleurae to move with breathing

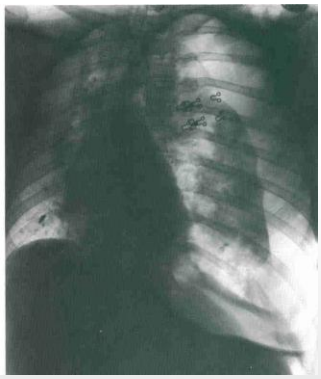


Tension Pneumothorax Illustrated

- Tension Pneumothorax

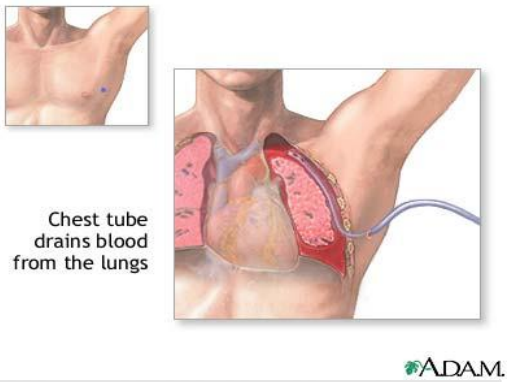


- CXR of Tension Pneumothorax



Chest Tube Insertion

- Chest tubes are inserted into the pleural space to drain blood, air or fluid and allow expansion of the lung.



Chest Tube Insertion

- The chest tube is then connected to a chest drainage system such as a Pleur-evac
- This allows the air and fluid to drain out of the pleural space and prevents air from re-entering the space

Chest Drainage System

Types of Collection Devices

- Water Seal Drain

- Dry Suction Drain

- Mobile Drains


- Autotransfusion Drain

Types of Tubes

- Plastic catheter

- Pigtail catheter

- Pleurx catheter

Chest Tube Characteristics

- Multiple eyelets that functions as drainage holes (fenestrations)
- Radiopaque line on tubing will show up on x-ray
- Diameters: 6-40 French
- General guidelines:

  6 to 12 French - Infants and young children

  16 to 20 French - Children and young adults

  24 to 40 French -Most Adults

With pneumothorax smaller French gauges are adequate, even in the adult.

Drainage System; how does it work?

- Expiratory positive pressure from the thorax helps push air and fluid out of the chest
- Gravity helps fluid to drain
- Suction improves speed that air and fluid are evacuated from chest resulting in the restoration of expanded lung fields

Care of Chest Tube and Drainage System

- Secure dry dressing should be intact to insertion site
- Connections should be taped securely
- Drainage system should remain upright
- Drainage system should remain below chest tube insertion site
- Tubing should never be clamped

FOCA

- The pneumonic FOCA can be used to asses the chest tube drainage system
  - **F** = fluctuation
    - fluctuation should be noted in the water chamber
  - **O** = output
    - how much?
  - **C**= color
    - what is the color of the output?
  - **A** = air leak
    - is there bubbling in the water seal chamber that could indicate an air leak?

Tidaling in Water Seal Chamber

- Check regularly to see that the water seal is filled to the proper level, and that the water level moves as the patient breaths (tidaling/fluctuation).
- If there is no tidaling, it could mean that:
  1. Tubing is kinked or clamped
  2. Patient is lying on the tubing
  3. A fluid–filled, dependent loop is in the tubing
  4. Catheter eyelets are blocked by lung tissue or adhesions
  5. No air is leaking into the pleural cavity and lung has re-expanded

Assessing for Air Leak

- Constant or intermittent bubbling during exhalation
- Continuous bubbling – confirms persistent air leak
- Intermittent bubbling with float ball oscillation – presence of an intermittent air leak
- No bubbling with minimal float ball oscillation at the bottom of the water seal - no air leak

Patient Assessment

- Assessment of a chest tube patient should include the following:
  - Breath sounds
  - Trachea position
  - Respiratory rate and pattern
  - Dressing
  - Suction setting
  - Drainage

Troubleshooting

- If tubing becomes disconnected, reconnect tubing immediately
- If chest tube comes out, cover site with loose dressing
- If drainage system turns over, return to proper position and have patient take a few deep breaths
- If air leak is noted, check connections and assure dressing is secure.

Troubleshooting

- The pneumonic DOPE can be helpful in troubleshooting chest tubes
  - **D** = dislodgement of tube
  - **O** = obstruction – is tubing kinked
  - **P** = pneumothorax
  - **E** = equipment

PARALYTIC ADMINISTRATION

Objectives

- Paramedic Scope of Practice: Paralytic Administration
- Neuromuscular Junction (NMJ) Physiology
- Neuromuscular Blocking Agents (NMBAs) and Indications
- Depolarizing (noncompetitive agonist) NMBA
  - Pharmacodynamics
  - Example
- Non-depolarizing (competitive antagonist) NMBAs
  - Pharmacodynamics
  - Examples
- Summary

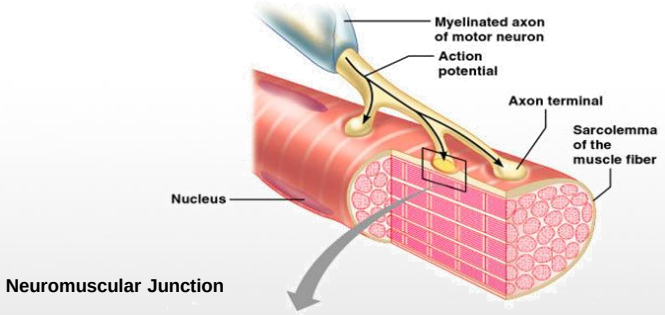
Scope of Practice: Paralytic Administration

"Administration of paralytics for the purposes of RSI (Rapid Sequence Induction/Intubation) **IS NOT PERMITTED**, *unless the EMS Agency has met RSI requirements promulgated by the OEMST, and has received approval for RSI use from the OEMST.* Paramedics **ARE ALLOWED** to use paralytics to maintain the paralysis of an already intubated patient, if approved by medical direction."

R-P11A (2011): Scope of Practice - Became Effective on 7/1/2011

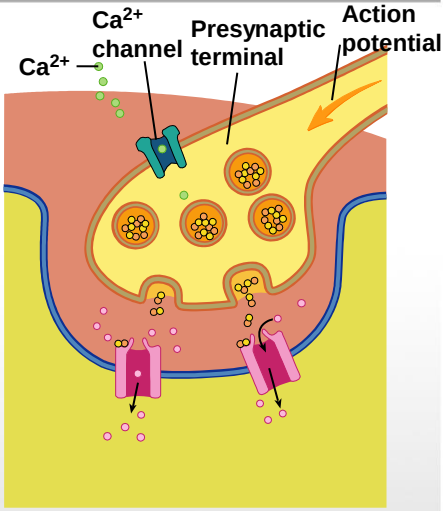
Neuromuscular Junction Physiology

- Understanding skeletal muscle physiology is essential to learning paralytic pharmacology.



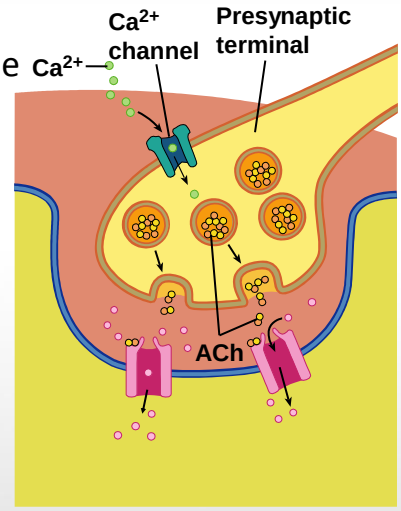
Neuromuscular Junction Physiology

- An action potential arrives at the presynaptic terminal causing voltage gated Ca^{2+} channels to open.
- This increases the Ca^{2+} permeability of the presynaptic terminal.



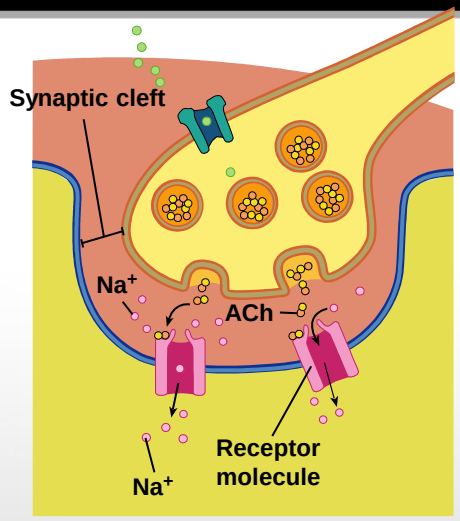
Neuromuscular Junction Physiology

- Ca^{2+} enters the presynaptic terminal and initiates release of the neurotransmitter, acetylcholine(ACh), from synaptic vesicles in the presynaptic terminal.



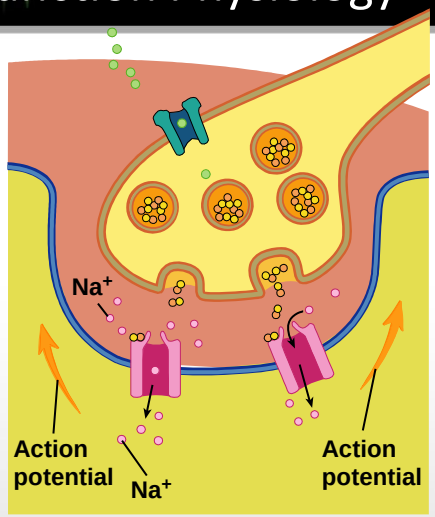
Neuromuscular Junction Physiology

- ACh diffuses across the synaptic cleft and binds to Ach receptors on the postsynaptic muscle fiber membrane.
- This results in an increase in the permeability of ligand-gated Na^+ channels.



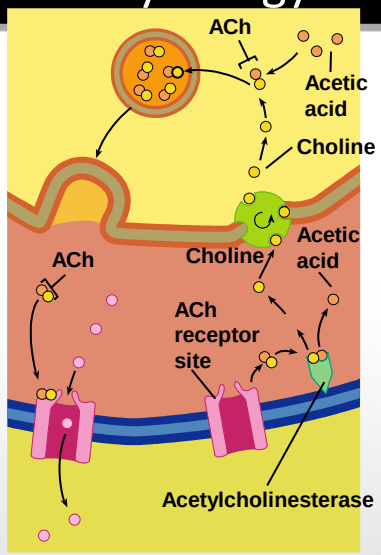
Neuromuscular Junction Physiology

- The increase in Na^+ permeability results in depolarization of the postsynaptic membrane
- Once a threshold has been reached a postsynaptic action potential results, i.e., muscle contraction.



Neuromuscular Junction Physiology

- ACh is rapidly broken down in the synaptic cleft by acetylcholinesterase to acetic acid and choline.
- Choline is reabsorbed by the presynaptic terminal and combined with acetic acid to form more Ach.
- Acetic acid is taken up by many cell types.



Neuromuscular Blocking Agents

- NMBAs are medications that result in the chemical paralysis of skeletal muscle. *(CANNOT move, breathe, or speak)*
- NMBAs **DO NOT** provide: *(CAN hear, think, and feel)*
  - **Sedation;** The patient's LOC and perception remain intact!
  - **Analgesia;** The patient's ability to perceive pain remains intact!
  - **Amnesia;** The patient's memory remains intact!
- Therefore, NMBAs should always be used in conjunction with sedative-induction agents
  - Benzodiazepines, Anesthetics, and/or Opiate Analgesics

Neuromuscular Blocking Agents

- **Indications**
  - Rapid Sequence Intubation (RSI)
    - Inducing temporary paralysis to facilitate endotracheal intubation

***Unless a service has met the Georgia requirements for RSI and has been granted permission from the OEMST, NMBA administration will be reserved for patients that are intubated ***

  - Continued paralysis of intubated, ventilator-dependent, patients during interfacility transfer
  - Paralysis of intubated ROSC patients to prevent shivering associated with induction of therapeutic hypothermia
  - To facilitate needed ventilatory support for intubated patients that combat their endotracheal tube or ventilator

Neuromuscular Blocking Agents

- NMBAs are divided into two classifications base on their mechanisms of action.
  - Depolarizing (noncompetitive agonist)
    - Rapid onset of action and short duration of paralysis
  - Non-depolarizing (competitive antagonist)
    - Slower onset and moderate to long duration of paralysis

Depolarizing (noncompetitive agonist)

- Succinylcholine (SCh), (Anectine)
- This NMBA is chemically similar to ACh.
- When it reaches the NMJ, it binds tightly to the ACh receptors, initiating depolarization.
  - Resulting muscle twitches are referred to as fasciculations
  - SCh is resistant to acetylcholinesterase and remains bound to the ACh receptors for several minutes.
  - Paralysis is achieved because ACh receptors are occupied and cannot be stimulated again

Depolarizing (noncompetitive agonist)

- SCh is the only depolarizing NMBA utilized in the United States.
- It is the preferred NMBA for emergency RSI, due to its rapid onset and brief duration.
- SCh administration has several contraindications and numerous adverse effects.
- Utilization of SCh for paralysis other than emergency RSI is not indicated.

Non-depolarizing (competitive antagonist)

- Non-depolarizing NMBAs block ACh receptors
- For this reason, no fasciculations are observed
- Their onset of action is slower than SCh and their duration of paralysis is much longer
- Indicated for post-intubation management when intermediated or prolonged paralysis is desired
- Depending upon the agent utilized, paralysis may persist for 30-75 minutes

Non-depolarizing (competitive antagonist)

- The most frequently utilized non-depolarizing agents:
  - Pancuronium (Pavulon)
  - Vecuronium (Norcuron)
  - Rocuronium (Zemuron)
  - Cisatracurium (Nimbex)

Summary

- This update presentation is intended to provide a brief overview of NMBAs.
- Utilization of these medications without proper pharmacological education, training, and guidance from medical direction may result in catastrophic patient outcomes.

Miscellaneous Skills: Eye Irrigation with the Morgan® Lens

2011 Georgia Office of EMS Updates

Objectives

Step-by-step instructions for complex eye irrigation utilizing

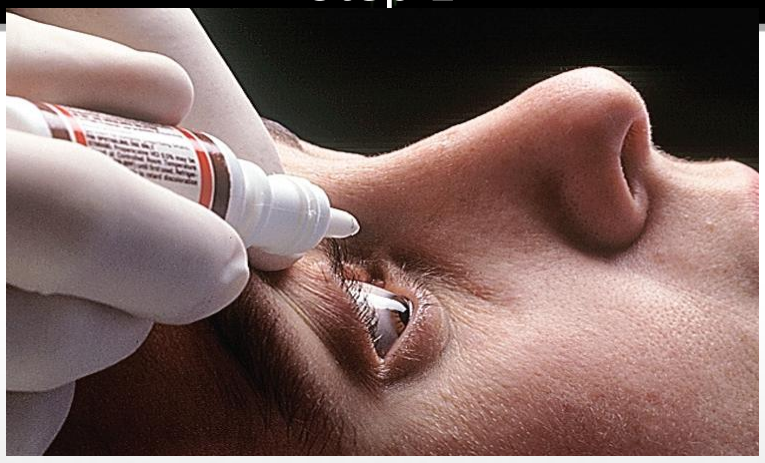
The Morgan® Lens

MorTan® Inc.

Indications

- Ocular injury due to acid burns, solvents, gasoline, detergents, etc.
- Alkali burns
- Non-embedded foreign bodies
- Foreign body sensation with no visible foreign body

Step 1

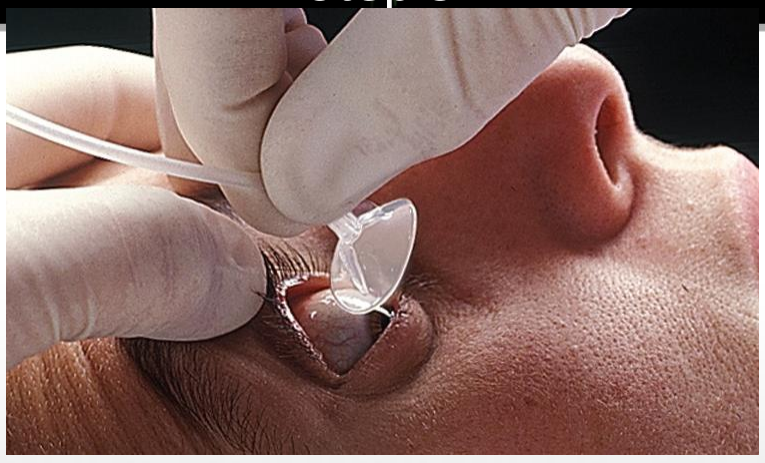


INSERTION: Instill topical ocular anesthetic, if available.

Step 2

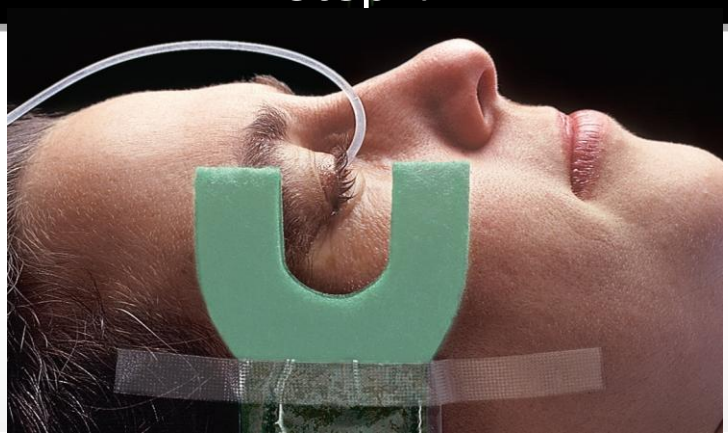
Attach Morgan Lens Delivery Set, I.V., set-up or syringe using solution and rate of choice; **START FLOW.***

Step 3



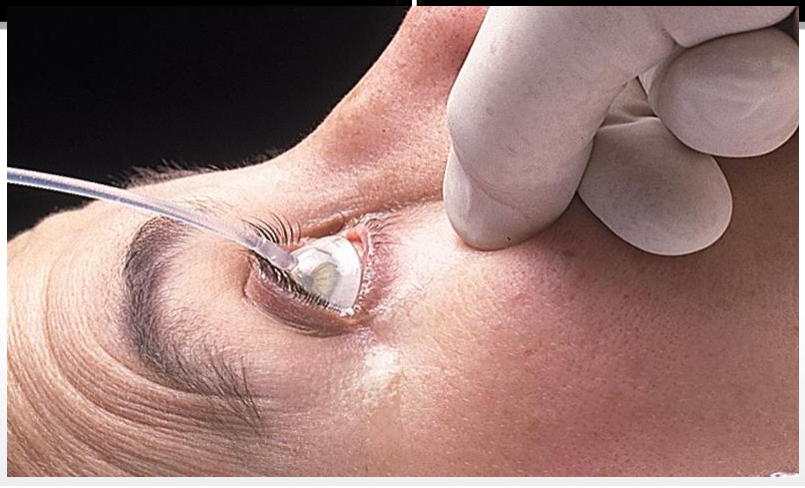
Have patient look down, insert Morgan Lens under upper lid. Have patient look up, retract lower lid, drop lens in place.

Step 4



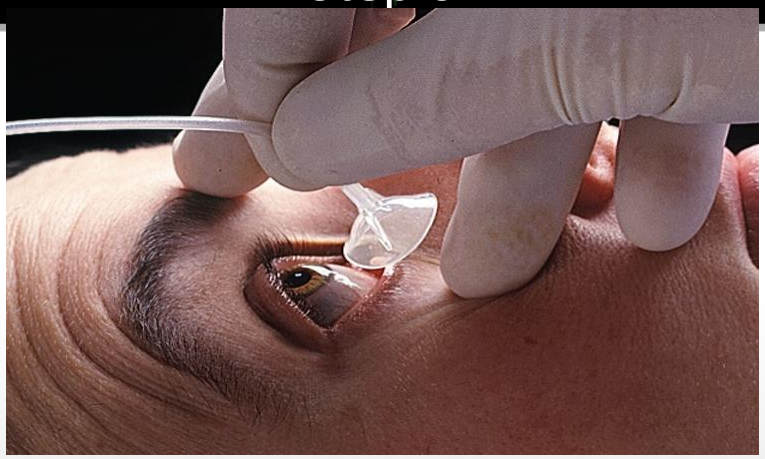
Release the lower lid over Morgan Lens and adjust flow. Tape tubing to patient's forehead to prevent accidental lens removal. Absorb outflow with the Medi-Duct. **DO NOT RUN DRY.**

Step 5



REMOVAL: **CONTINUE FLOW,** have patient look up, retract lower lid—hold position.

Step 6



Slide MorganLens out; **TERMINATE FLOW.**

Solution and Flow Rates

Ocular injury due to acid burns or solvents, gasoline, detergents, etc.	Solution: Lactated Ringer's** I.V. Solution Rate: 500 ml rapid/free flow. Reassess and continue at slower rate.	Mode: Morgan Lens Delivery Set or I.V. set-up Frequency: Once. Repeat as necessary.
Alkali burns	Solution: Lactated Ringer's** I.V. Solution Rate: 2000 ml rapid/free flow. Reassess. Continue at 50 ml/hour or 15 drops/minute.	Mode: Morgan Lens Delivery Set or I.V. set-up Frequency: Continuous until pH of cul-de-sac is returned to neutrality.
Non-embedded foreign bodies	Solution: Lactated Ringer's** I.V. Solution Rate: 500 ml rapid/free flow. Reassess and continue at slower rate.	Mode: Morgan Lens Delivery Set or I.V. set-up Frequency: Once. Repeat as necessary.
Foreign body sensation with no visible foreign body	Solution: 20 cc sterile solution Rate:	Mode: 20 cc syringe Frequency: