FIRST AID AND BEYOND

A TEXT DEDICATED TO THOSE PAST
AND
PRESENT THAT RISK THEIR LIVES DAILY

THAT OTHERS MAY LIVE

R DAN WOLFE DC
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INTRODUCTION
This handbook is designed to provide concise information regarding management of patients in austere environments. It is a ‘quick reference’ and is not meant to provide detailed discussions of physiological events.

NOTE: No handbook can anticipate every tactical and/or medical situation that might occur in an emergency. When faced with adverse situations, a first responder and his team will have to improvise, adapt, and overcome. Always keep in mind the mission, your safety, and your patient’s safety.

WHY STUDY EMERGENCY CARE?
We live in a new world, new to me anyway. We are now confronted with a lack of medical care in certain circumstances an it will benefit everyone if they have the knowledge presented in this text. Consider this, what would you do if?:

You were at the site of 911
You were at Boston when the bomber set off his charge
You were in Oklahoma City during the federal building bombing
You were in a city hit by a Category 5 hurricane or tornado
You are in a massive ice or snow storm
You are in the Rocky Mountains on a hunting trip and an emergency arises

No one is available to help

When not to perform life xaving techniques

- Dismembered or body is fragmented
- Open head injury with brain matter exposed and no pulse present
- Injury to the trunk with chest contents exposed and no pulse present
- “Frozen” hypothermia victim, e.g., ice formation in the airway, incompressible chest
- Total body burns or body carbonization and no pulse present
- Suffered massive blunt trauma, e.g., fall of over 100 feet, and has no pulse.
ASSESSING THE AREA AND PATIENT ASSESSMENT
SCENE SIZE UP

PATIENT AFFAIRS

Understand the standards of practice and/or legal requirements regarding patient sensitivity (confidentiality, use of chaperones and gender sensitivity).

RATIONALE

Every patient encounter includes an evaluation of the scene and its components regarding safety, potential hazards, communication and the need for scene control. In an attempt to avoid repetition of the components of the Scene size up, please refer to the following scene size up procedure. Perform scene size up on all patient encounters.

PROCEDURE
A. Scene Safety, consider potential hazards:

Common scene hazards

Environmental
Violence

Animals
Fire and Smoke

Hostile/emotional bystanders
Hazardous materials

Potential building collapse
AND

- Syringes
- Traffic
- Exposed electrical equipment
- Hazardous substances
- Patients
- Family members
- Biological
- Chemical
- Crime scenes
- Rescue
- Motor-vehicle collisions
  a) Extrication hazards
  b) Roadway operation dangers
- Cliffs or steep slopes
- Confined spaces
- Unstable vehicles
- Ice
- Rain
- Wind
- Knives
- Guns

IT DOES NOT TAKE LONG FOR THIS BE BE HABITUAL
2. Addressing hazards
   a. Protect the patient
      • After making the scene safe, the safety of the patient becomes the next priority.
      • If you cannot alleviate the conditions that represent a health or safety threat to the patient, move the patient to a safer environment.
   b. Protect the bystanders
   c. Request resources

3. Violence
   a. DO NOT enter a scene or approach a patient if the threat of violence exists.
   b. Park away from the scene and wait for the appropriate law enforcement officials to minimize the danger.

4. Need for additional or specialized resources
   • A variety of specialized protective equipment and gear is available for specialized situations.
     i. Chemical and biological suits can provide protection against hazardous materials and biological threats of varying degrees.
     ii. Specialized rescue equipment may be necessary for difficult or complicated extrication.
     iii. Ascent or descent gear may be necessary for specialized rescue situations.

5. Standard precautions
   The extent of standard precautions used is determined by the anticipated blood, body fluid, or pathogen exposure.
   1. Hand-washing
   2. Gloves
      • Gowns
      • Masks
      • Protective eye wear
      • Personal Protective Equipment
      • Steel-toe boots
      • Helmets
      • Heat-resistant outerwear
      • Leather gloves
   3. Self-contained breathing apparatus
   4. Remove
   5. Isolate
   6. Barricade
CHAPTER 1
HEALTH CARE PROVIDER CAPABILITIES

EMERGENCY INTERVENTION

The following provides a summary of some commonly required medical skills. It can be used as a general reference or outline for developing adequate privileging credentials.

PATIENT ASSESSMENT

- Management of secondary injuries and wounds
- Continual monitoring of stable and unstable patient
- Preparation of patient for transport to definitive care

BASIC LIFE SUPPORT AND VENTILATION:

- Cardio Pulmonary Recitation (CPR)
- Airway assessment and management, including foreign body airway obstruction, considerations for C-Spine precautions, as appropriate.
- Breathing assessment and management, to include the breathing, non-breathing and inadequately breathing patient.
- Use of airway adjuncts and oxygen administration as appropriate for patient’s condition.

Circulation assessment and management, including CPR and hemorrhage control, as appropriate to patient’s condition. Primary and Secondary Survey:

- Signs and symptoms
- Diagnostic signs
- Pulse
- Respiration’s
- Blood pressure
- Temperature
- Skin color
- Capillary refill
- Pupil size and responding to light
- Level of consciousness
- Scene safety
- Rapid and focused trauma assessment, as appropriate to patient’s condition and/or mechanism of injury (compromised airway, breathing, and/or circulation, etc.)
- Immobilization, to include:
C-spine considerations while securing patient to spinal immobilization device for suspected spinal injury
Joint and long bone splinting
Use of Automatic External Defibrillator (AED).
Shock management

VENTILATION EQUIPMENT AND OXYGEN THERAPY:

Demonstrate knowledge of, and treatment using, the following:
- Pocket mask with oxygen inlet
- Oropharyngeal airway (OPA)
- Nasopharyngeal airway (NPA)
- Bag-Valve Mask System (BVM)
- Portable and hand suctioning devices

HEMORRHAGE AND GENERAL EMERGENCIES:

Demonstrate knowledge and treatment of the following:
- Hemorrhage control by direct pressure and extremity elevation.
- Splinting
- Utilizing air pressure splinting
- Understand indications, use and dangers of the Pneumatic Anti-Shock Garment/PSAG (formerly known as Military Anti-shock Trousers (MAST pants)).
  - Utilization of a tourniquet

SHOCK:

Types of shock: signs, symptoms, treatment and causes to include:
- Cardiogenic shock
- Neurogenic shock
- Psychogenic shock
- Hypovolemic shock
- Metabolic shock
  - Septic shock
- Nonvascular cause of shock: respiratory insufficiency and anaphylactic shock.

GENERAL INJURIES:

Soft Tissue (open and closed injuries):
- Abrasions
  - Lacerations
  - Avulsions
- Puncture wounds
- Impaled objects
FRACTURES, DISLOCATIONS AND SPRAINS:

Demonstrate knowledge of injury management, to include splint application to the upper and lower extremities:

a Fractures (open and closed injuries):
   - Greenstick fracture
   - Comminuted fracture
   - Pathological fracture
   - Epiphyseal fracture

Dislocations: signs and symptoms including treatment

A Dislocation of the shoulder
A Dislocation of the hip joint

Sprains: signs and symptoms including treatment

6 C-Spine injuries and treatment.

HEAD INJURIES AND MEDICAL EMERGENCIES:

Demonstrate knowledge and treatment of the following:

6 Cerebrovascular accident (CVA)
   - Arterial rupture
   - Cerebral embolism
   - Stroke
   - Dyspnea
   - Scalp laceration
   - Fractured skull.
   - Concussion
   - Contusion
   - Intracranial bleed

INJURIES TO THE EYE, EAR AND THROAT:

Demonstrate knowledge and treatment of the following:

A Foreign body, impaled object
b Burns: chemical, thermal and light burns
A Lacerations and blunt trauma
   - Understand the appropriate advanced emergency treatment for a patient suffering from seizures, including status epilepticus.

CHEST INJURIES AND MEDICAL EMERGENCIES:

Demonstrate knowledge and treatment of the following:

a Rib fracture
   - Flail chest
   - Penetrating injury
   - Compression injury
Asthma

D  Pneumothorax
1  Spontaneous pneumothorax
(  Tension pneumothorax
a  Hemothorax
□  Sucking chest wound
m  Subcutaneous emphysema
fi  Pulmonary contusion
m  Acute pulmonary edema
□  Pulmonary Embolism
t  Chronic obstructive pulmonary disease (COPD)
□  Myocardial contusion
m  Pericardial tamponade

ALLERGIES AND ANAPHYLACTIC REACTIONS:

Recognize and respond to an anaphylactic or adverse reaction due to immunization, latex exposure, food or medication ingestion, or an insect sting.
T  Signs, symptoms and treatment of poisons, stings, and bites.
fi  Anaphylactic shock

ABDOMEN AND GENERAL EMERGENCIES:

Demonstrate knowledge and treatment of the following:
□  Closed abdominal injuries (blunt)
a  Open abdominal injuries (penetrating)
□  Evisceration
□  Injuries to the genitourinary system
6  Emergency childbirth procedures
□  Acute abdomen

HEART DISEASE:

Demonstrate knowledge and treatment of the following:
□  Angina Pectoris
□  Acute myocardial infarction (AMI)
6  Congestive heart failure (CHF)
(  Cardiogenic shock

ENVIRONMENTAL EMERGENCIES:

Demonstrate knowledge and treatment of the following:
D  Frostbite
□  Hypothermia
□  Heat exhaustion
(  Heat stroke
Heat cramps

A Drowning and near drowning

PSYCHIATRIC CONDITIONS:

Demonstrate knowledge and treatment of the following:
- Acute psychotic episode/emotional episode
- Know how and when to request critical incident stress debriefing (CISD).

SUBSTANCE ABUSE

Demonstrate knowledge and treatment of the following:
- Alcohol abuse
- Drug abuse

Medical providers should be able to:

- Obtain a history of present illness (hpi), past medical history (pmh), and review of systems (ros), for a patient presenting with the below listed complaints.
- Develop treatment plan. Utilizing the pertinent data, develop a SOAP write-up and be able to provide a verbal case presentation for a patient with these chief complaints.
- Focus on information that enables a medical doctor, or other “higher level” provider, to quickly familiarize themselves with patient's status and provide appropriate follow-on evaluation/treatment, either in person or via telecommunications.

Medical personnel should be able to demonstrate complete knowledge and treatment applications of the following specific conditions:

HEAD:

Establish a differential diagnosis for a patient presenting with a non-traumatic headache. List as possible diagnoses:
- Migraine
- Cluster
- Tension (cervical)
- Sinusitis or sinus congestion
- Temporomandibular Joint (TMJ) induced headache

VISION:

Establish a differential diagnosis for a patient presenting with eye pain, red eye, foreign body or acute altered vision. Use the following list as possible diagnoses:
- Infectious conjunctivitis
- Allergic conjunctivitis
- Hordeolum
- Blepharitis
- Corneal abrasion
Subconjunctival hemorrhage

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a Acute iritis
J Acute retinal detachment
☐ Hyphema
☐ Flash burns
☐ Chemical burns

EAR:

Establish a differential diagnosis for a patient presenting with ear pain. Use the following list as possible diagnoses:
☐ Otitis media with effusion (Serous Otitis Media)
☐ Otitis media, acute
☐ Otitis externa
☐ Cerumen impaction
☐ Perforated/ruptured tympanic membrane due to trauma, including barotrauma
l Perforated/ruptured tympanic membrane due to suppuration
’ Perforated/ruptured tympanic membrane due to retraction
☐ Foreign body
( Mastoiditis
n Temporomandibular joint (TMJ) syndrome

SINUS/NOSE:

Establish a differential diagnosis for a patient presenting with a nosebleed (epistaxis). Use the following list as possible diagnoses:
☐ Hypertension
☐ Digital manipulation
☐ Foreign object
☐ Medicamentosa
☐ Nasal fracture
D Contusion
☐ Sinus infection
y Nasal mucosa infection
y Nasal mucosa desiccation
☐ Fractured skull
☐ Facial injuries
☐ Sinusitis, infections
☐ High blood pressure

THROAT:

Establish a differential diagnosis for a patient presenting with a sore throat. List as possible diagnoses:
 . Epiglottitis
a Influenza
g Peritonsillar abscess
( Toxic shock syndrome
Viral pharyngitis

A Streptococcal pharyngitis
  . Tonsillitis
t Infectious Mononucleosis

NECK:

Establish a differential diagnosis for a patient presenting with neck pain. Use the following list as possible diagnoses:
  □ Meningitis
  □ Trapezius strain
  . Cervical fracture
  □ Tension headache
  □ Dystonic reaction to phenothiazines (extrapyramidal (EPS) reaction to phenothiazines (such as phenergan, compazine) and butyrophenones, commonly used as anti-nauseants and antipsychotics).

RESPIRATORY/THORAX/ CIRCULATORY:

Establish a differential diagnosis for a patient presenting with cough, shortness of breath, and/or difficulty breathing. Use the following list as possible diagnoses:
  □ Asthma
  □ Acute bronchitis
A Upper respiratory infection
A Pneumonia, viral etiology
6 Pneumonia, bacterial etiology
 a Anaphylaxis
( Pulmonary embolism
y Upper airway obstruction

Establish a differential diagnosis for a patient presenting with “cold-like” symptoms (symptoms consistent with possible upper respiratory infection/uri). Use the following list as possible diagnoses:
  □ Sinus congestion
  □ Sinusitis
  □ Influenza
  . Allergic rhinitis

Establish a differential diagnosis for a patient presenting with cough or difficulty breathing. List as possible diagnoses:
  □ Pulmonary edema
  □ Pneumothorax
  □ Status asthmaticus
  □ Influenza
  . Pleuritis
  □ Tuberculosis

Establish a differential diagnosis for a patient presenting with chest pain. Use the following list as possible diagnoses:
Gastroesophageal reflux disease (GERD)

☐ Angina pectoris
A Acute Myocardial Infarction
☐ Costochondritis
☐ Pulmonary Embolism
y Respiratory infection
l Myocardial infarction
☐ Pulmonary embolism
☐ Costochondritis
( Pleuritis
l Spontaneous pneumothorax

SKIN CONDITIONS:

Establish a differential diagnosis for a patient presenting with a papular skin rash. List as possible diagnoses:
a Psoriasis
☐ Seborrhea
D Cellulitis
☐ Folliculitis
6 Insect bites (scabies, fleas)
g Drug reaction/allergies

Establish a differential diagnosis for a patient presenting with a vesicular skin rash. List as possible diagnoses:
. Dyshydrotic eczema
☐ Impetigo
☐ Herpes simplex
t Hand-foot-mouth disease (coxsackie virus)

Perform an examination of a burn patient and know how to diagnose and treat first, second and third degree burns. Know the following:
6 Burns of the respiratory tract
g Circumferential burns
☐ Body Surface Area Percentage (BSA%) partial thickness burns and its application to burn care
☐ Body Surface Area Percentage (BSA%) full thickness burns and its application to burn care
☐ Associated injuries and potential complications

ABDOMEN/REPRODUCTIVE:

State signs, symptoms and describe appropriate emergency treatment for a diabetic patient including:
> Hyperglycemia, including that caused by patient taking insufficient insulin and/or inappropriate diet (i.e. diabetic ketoacidosis)
l Hypoglycemia, including that caused by patient taking too much insulin and/or “skipping” meals (i.e. insulin shock)
Performing blood glucose check using glucose meter (such as Glucometer or Accucheck, or Dextrostix or equivalent reagent strip) with blood sample obtained via a fingerstick
Performing urine reagent test and understand potential significance of positive ketones or sugar

DIABETES:

Demonstrate knowledge and treatment of the following:
- Diabetic coma
- Insulin shock

Establish a differential diagnosis for gynecological conditions. List as possible diagnoses:
- Torsion of ovarian tumor
- Uterine prolapse,
- Endometriosis

Establish a differential diagnosis for male health issues. List as possible diagnoses:
- Incarcerated inguinal hernia
- Testicular cancer
- Testicular torsion

Establish a differential diagnosis for a patient presenting with painful or bloody urination. List as possible diagnoses:
- Chronic asymptomatic hematuria
- Renal cancer
- Renal contusion or laceration
- Urethritis

Establish a differential diagnosis for a female patient presenting with abdominal or pelvic pain. Use the following list as possible diagnoses:
- Food poisoning, bacterial (infectious gastroenteritis)
- Appendicitis
- Normal pregnancy
- Ectopic pregnancy
- Peptic Ulcer disease
- Gastroesophageal reflux disease (GERD)
- Urinary tract infection
- Dysmenorrhea
- Sexually transmitted disease (STD)
- Perforated ulcer
- Bowel obstruction
- Abdominal aneurysm
- Hepatitis
- Pancreatitis
- Ovarian abscess
- Ovarian cyst
- Endometriosis
Upper gastrointestinal (GI) bleeding

A Pelvic inflammatory disease

Colitis (inflammatory bowel disease)
Irritable bowel syndrome
Cholecystitis
Food-borne illness (“food poisoning” type gastroenteritis)

Establish a differential diagnosis for a male patient presenting with abdominal pain. Use the following list as possible diagnoses:
- Hernia
- Irritable bowel syndrome
- Colitis (inflammatory bowel disease)
- Food-borne illness (“food poisoning” type gastroenteritis)
- Pancreatitis
- Cholecystitis
- Hepatitis
- Abdominal aneurysm
- Bowel obstruction
- Perforated ulcer
- Testicular torsion

Establish a differential diagnosis for a female patient presenting with excessive vaginal bleeding or pain. Use the following conditions as possible diagnoses:
- Threatened abortion (miscarriage)
- Ectopic pregnancy
- Dysfunctional uterine bleeding (DUB)
- Metrorrhagia (uterine bleeding at irregular intervals)

Establish a differential diagnosis for a female patient presenting with vaginal irritation. Use the following conditions as possible diagnoses:
- Herpes
- Trichomoniasis
- Candidiasis
- Condyloma acuminata
- Chlamydia
- Gonorrhea
- Syphilis
- Bacterial/gardnerella vaginosis

Establish a differential diagnosis for a patient presenting with an apparent sexually transmitted disease. Use the following conditions as possible diagnoses:
- Herpes simplex virus (HSV), type II
- Condyloma acuminata
- Syphilis
- Gonorrhea
- Chlamydia
Establish a differential diagnosis for a patient presenting with rectal bleeding. Use the following conditions as possible diagnoses:

- External hemorrhoids
- Internal hemorrhoids
- Colon cancer
- Colitis (inflammatory bowel disease)
- Rectal trauma

MUSCULAR SKELETAL:

Establish a differential diagnosis for a patient presenting with low back pain. List as possible diagnoses:

- Aneurysm (such as ruptured abdominal aortic)
- Osteoarthritis (noninflammatory arthritis)
- Trauma

Establish a differential diagnosis for a patient presenting with shoulder pain. Use the following list as possible diagnoses:

- Bursitis, including Subacromial bursitis
- Tendinitis, including Bicipital tendonitis
- Trauma
- Humeral head fracture
- Clavicle fracture
- Rotator cuff impingement
- Rotator cuff tear
- Sternoclavicular joint injury
- Acromioclavicular joint injury (i.e., dislocation, subluxation, sprain)
- Glenohumoral joint injury (i.e., dislocation, subluxation, sprain)

UPPER EXTREMITIES:

Establish a differential diagnosis for a patient presenting with elbow pain. List as possible diagnoses:

- Olecranon bursitis (including septic etiology)
- Lateral or medial epicondylitis
- Radial head fracture
- Dislocation
- Carpal tunnel syndrome

Establish a differential diagnosis for a patient presenting with wrist pain. List as possible diagnoses:

- Carpal tunnel syndrome
- Scaphoid fracture
- Radial/ulna fracture
- Tendinitis
- Degenerative joint disease/noninflammatory arthritis (also known by the misnomer
Establish a differential diagnosis for a patient presenting with a painful nail area. List as possible diagnoses:

2. Paronychia

☐ Subungual hematoma

LOWER EXTREMITIES:

Establish a differential diagnosis for a patient presenting with knee pain. List as possible diagnoses:

☐ Patellofemoral disorders (arthralgia and compression syndrome)

☐ Lateral or medial collateral ligament (LML or MCL) injuries (sprain tear, or avulsion), being sure to use application of varum and valgum stress, with knee at proper degree of flexion, as part of your examination

Anterior or posterior cruciate ligament (ACL or PCL) Injuries (sprain, tear, or avulsion), being sure to use positive and negative drawers, absence/presence of posterior ‘sag,’ and Lachman’s tests as part of your examination

☐ Lateral and medial meniscus injuries, being sure to use McMurray’s Test as part of your examination

☐ Fractures (i.e., tibial plateau, condylar, avulsion type, etc.)

Establish a differential diagnosis for a patient presenting with ankle pain. List as possible diagnoses:

☐ Achilles tendon rupture

☐ Achilles tendinitis

☐ Achilles bursitis

☐ Calcaneal fracture

☐ Plantar fascitis

a. Deltoid ligament tear

PSYCHOLOGICAL CONDITIONS:

Establish a differential diagnosis for a patient presenting with signs of acute depression, consider the following conditions:

☐ Adjustment disorder

☐ Major depression

☐ Suicidal ideation

☐ Substance abuse
CHAPTER 2
CPR

GUIDELINES FOR INITIATION OF RESUSCITATION

Decisions to not initiate resuscitation should be discussed with medical control if possible. If contact with medical control is not possible, the following guidelines should be followed:

**Do not initiate resuscitation if victim is or has:**
1) Obviously dead. Characterized by signs such as:
   - Obvious decomposition
   - Body partially consumed by scavengers
   - Dependent lividity
   - Rigor mortis (CAUTION: In hypothermia victims, severe hypothermia may resemble rigor mortis. Check body core temperature)
2) Decapitated or partially decapitated with no pulse present
3) Dismembered or body is fragmented
4) Open head injury with brain matter exposed and no pulse present
5) Injury to the trunk with chest contents exposed and no pulse present
6) “Frozen” hypothermia victim, e.g., ice formation in the airway, incompressible chest
7) Total body burns or body carbonization and no pulse present
8) Suffered massive blunt trauma, e.g., fall of over 100 feet, and has no pulse
9) Decisions to not initiate resuscitation will be completely documented to include:
   1) Time/Date of decision, 2) Reason for decision, 3) Name of medical control (if able to contact), and 4) location of victim (GPS coordinates if possible).

c. The decision to not initiate resuscitation IS NOT a legal declaration of death, unless a qualified physician declares the patient dead.

REFUSAL OF MEDICAL CARE AND/OR TRANSPORT

1) If the patient is unconscious, or unable to make a rational decision (secondary to head injury or any other cause of altered mental status) the principal of Implied Consent assumes that a normal, rational person would consent to life-saving medical treatment.

2) If the patient is a minor or mentally incompetent adult, permission to treat must be obtained from a parent or guardian before treatment can be rendered. If a life-threatening condition exists, and the parent or guardian is unavailable for consent, treatment shall be rendered under the principal of implied consent, as noted above.

3) If an alert, oriented patient with normal mental status refuses medical care, then care cannot be rendered. Medical control should be contacted (if possible) if such a situation occurs. If a patient refuses medical care the following statement must be written on the medical treatment form and signed by the patient:
I, [Name], THE UNDERSIGNED HAVE BEEN ADVISED THAT MEDICAL ASSISTANCE ON MY BEHALF IS NECESSARY AND THAT REFUSAL OF SAID ASSISTANCE MAY RESULT IN DEATH, PERMANENT INJURY OR IMPERIL MY HEALTH. I REFUSE TO ACCEPT TREATMENT, AND ASSUME ALL RISK AND CONSEQUENCES OF MY DECISION. I RELEASE EVERYONE AND THE FROM ANY LIABILITY ARISING FROM MY REFUSAL TO ACCEPT MEDICAL CARE.

NOTE: The statement must be signed and dated by the patient, and countersigned by a witness. The medical record should completely document that the patient is awake, alert, oriented and has normal mental status. If the patient refuses to sign the form, and still refuses medical care, the patient’s refusal to sign should be documented and signed by the treating person and preferably by at least one other witness.

Before you begin: Care is rendered once the volunteer and casualty are no longer under dangerous conditions. This phase is where the majority of medical care will take place.
- Try to keep yourself from being hurt. It doesn't help the situation to add another casualty to the list.
- Try to keep the victim from sustaining any more injuries
- If the victim is awake and able to function direct him/her to begin first aid treatment
- Address the ABCs, replace tourniquets with pressure dressings as appropriate
- Treat wounds with appropriate dressings/splints.
- Treat pain and administer antibiotics as required.

Cardiopulmonary resuscitation (CPR)

“Remember, the difference between your doing something and doing nothing could be someone's life.”

Cardiopulmonary resuscitation (CPR) is the name for a number of procedures that should be applied if a person stop breathing, or if they suffered from cardiac arrest. These measures are performed to keep up an artificial circulation, so that vital organs still get oxygen. CPR does not start a person's heart again, but it can keep the blood (which carries oxygen) flowing around the body long enough for proper emergency treatment to be given.
- CPR is normally started on a person who is not breathing and is unconscious.
- It is continued until the heart can be restarted or the cause is diagnosed.
- CPR consists of regular compressions (pressing down) of the chest and rescue breathing.
- If a person's heart is working properly but they are not breathing, the aided breathing is called artificial respiration.
- The aim of CPR is to keep a small amount of oxygenated blood flowing to the brain and heart so that, if they are successfully resuscitated, they are not permanently brain damaged.

Here's advice from the American Heart Association:
- Untrained. If you're not trained in CPR, then provide hands-only CPR. That means uninterrupted chest compressions of about 100 a minute until paramedics arrive (described in more detail below). You don't need to try rescue breathing.
- Trained, and ready to go. If you're well trained and confident in your ability, begin with chest compressions instead of first checking the airway and doing rescue breathing. Start CPR with 30 chest compressions before checking the airway and giving rescue breaths.
Trained, but rusty. If you've previously received CPR training but you're not confident in your abilities, then just do chest compressions at a rate of about 100 a minute. (Details described below.)

When the heart stops, the lack of oxygenated blood can cause brain damage in only a few minutes. A person may die within eight to 10 minutes.

**Before you begin**

- Is the person conscious or unconscious?
- If the person appears unconscious, tap or shake his or her shoulder and ask loudly, "Are you OK?"
- If the person doesn't respond and two people are available, one should call 911 or the local emergency number and one should begin CPR.
- If you are alone and have immediate access to a telephone, call 911 before beginning CPR — unless you think the person has become unresponsive because of suffocation (such as from drowning). In this special case, begin CPR for one minute and then call 911 or the local emergency number.
- If an AED [automatic external defibrillator] is immediately available, deliver one shock if instructed by the device, then begin CPR.

**Remember to spell C-A-B**

The American Heart Association uses the acronym of CAB — circulation, airway, breathing — to help people remember the order to perform the steps of CPR.

**Circulation: Restore blood circulation with chest compressions**

1. Put the person on his or her back on a firm surface.
2. Kneel next to the person's neck and shoulders.
3. Place the heel of one hand over the center of the person's chest, between the nipples. Place your other hand on top of the first hand. Keep your elbows straight and position your shoulders directly above your hands.
4. Use your upper body weight (not just your arms) as you push straight down on (compress) the chest at least 2 inches (approximately 5 centimeters). Push hard at a rate of about 100 compressions a minute.
5. If you haven't been trained in CPR, continue chest compressions until there are signs of movement or until emergency medical personnel take over. If you have been trained in CPR, go on to checking the airway and rescue breathing.

**Airway: Clear the airway**

1. If you're trained in CPR and you've performed 30 chest compressions, open the person's airway using the head-tilt, chin-lift maneuver. Put your palm on the person's forehead and gently tilt the head back. Then with the other hand, gently lift the chin forward to open the airway.
2. Check for normal breathing, taking no more than five or 10 seconds. Look for chest motion, listen for normal breath sounds, and feel for the person's breath on your cheek and ear. Gasping is not considered to be normal breathing. If the person isn't breathing normally and you are trained in CPR, begin mouth-to-mouth breathing. If you believe the person is unconscious from a heart attack and you haven't been trained in emergency procedures, skip mouth-to-mouth rescue breathing and continue chest compressions.
Breathing: Breathe for the person

Rescue breathing can be mouth-to-mouth breathing or mouth-to-nose breathing if the mouth is seriously injured or can't be opened.

1. With the airway open (using the head-tilt, chin-lift maneuver), pinch the nostrils shut for mouth-to-mouth breathing and cover the person's mouth with yours, making a seal.
2. Prepare to give two rescue breaths. Give the first rescue breath — lasting one second — and watch to see if the chest rises. If it does rise, give the second breath. If the chest doesn't rise, repeat the head-tilt, chin-lift maneuver and then give the second breath. Thirty chest compressions followed by two rescue breaths is considered one cycle.
3. Resume chest compressions to restore circulation.
4. If the person has not begun moving after five cycles (about two minutes) and an automatic external defibrillator (AED) is available, apply it and follow the prompts. Administer one shock, then resume CPR — starting with chest compressions — for two more minutes before administering a second shock. If you're not trained to use an AED, a 911 or other emergency medical operator may be able to guide you in its use. Use pediatric pads, if available, for children ages 1 through 8. Do not use an AED for babies younger than age 1. If an AED isn't available, go to step 5 below.
5. Continue CPR until there are signs of movement or emergency medical personnel take over.

To perform CPR on a child

The procedure for giving CPR to a child age 1 through 8 is essentially the same as that for an adult. The differences are as follows:

- If you're alone, perform five cycles of compressions and breaths on the child — this should take about two minutes — before calling 911 or your local emergency number or using an AED.
- Use only one hand to perform heart compressions.
- Breathe more gently.
- Use the same compression-breath rate as is used for adults: 30 compressions followed by two breaths. This is one cycle. Following the two breaths, immediately begin the next cycle of compressions and breaths.
- After five cycles (about two minutes) of CPR, if there is no response and an AED is available, apply it and follow the prompts. Use pediatric pads if available. If pediatric pads aren't available, use adult pads.

Continue until the child moves or help arrives.
To perform CPR on a baby

Most cardiac arrests in babies occur from lack of oxygen, such as from drowning or choking. If you know the baby has an airway obstruction, perform first aid for choking. If you don't know why the baby isn't breathing, perform CPR.

To begin, examine the situation. Stroke the baby and watch for a response, such as movement, but don't shake the baby.

If there's no response, follow the CAB procedures below and time the call for help as follows:
- If you're the only rescuer and CPR is needed, do CPR for two minutes — about five cycles — before calling 911 or your local emergency number.
- If another person is available, have that person call for help immediately while you attend to the baby.

Circulation: Restore blood circulation
1. Place the baby on his or her back on a firm, flat surface, such as a table. The floor or ground also will do.
2. Imagine a horizontal line drawn between the baby's nipples. Place two fingers of one hand just below this line, in the center of the chest.
3. Gently compress the chest about 1.5 inches (about 4 cm).
4. Count aloud as you pump in a fairly rapid rhythm. You should pump at a rate of 100 compressions a minute.

Airway: Clear the airway
1. After 30 compressions, gently tip the head back by lifting the chin with one hand and pushing down on the forehead with the other hand.
2. In no more than 10 seconds, put your ear near the baby's mouth and check for breathing: Look for chest motion, listen for breath sounds, and feel for breath on your cheek and ear.

Breathing: Breathe for the infant
1. Cover the baby's mouth and nose with your mouth.
2. Prepare to give two rescue breaths. Use the strength of your cheeks to deliver gentle puffs of air (instead of deep breaths from your lungs) to slowly breathe into the baby's mouth one time, taking one second for the breath. Watch to see if the baby's chest rises. If it does, give a second rescue breath. If the chest does not rise, repeat the head-tilt, chin-lift maneuver and then give the second breath.
3. If the baby's chest still doesn't rise, examine the mouth to make sure no foreign material is inside. If the object is seen, sweep it out with your finger. If the airway seems blocked, perform first aid for a choking baby.
4. Give two breaths after every 30 chest compressions.
5. Perform CPR for about two minutes before calling for help unless someone else can make the call while you attend to the baby.
6. Continue CPR until you see signs of life or until medical personnel arrive.

How to Use an AED

1. Turn on AED
   • AED’s are turned on with:-a button
   • Follow the voice and / or visual commands
2. Place pads on victim
   • Make sure chest is clean and dry
   • Remove any medication patches
   • Remove pads from packet
   • Remove backing, one at a time, from pads,
   • Attach Pads
   • One pad goes on the upper right chest below collarbone.
   • One pad goes on lower left side chest wall.
Make sure nobody, including yourself, is touching the victim.

Say “Everyone stand clear!”
3. Analyze the heart rhythm
   • There are 4 electrical rhythms that the heart can be in when the heart stops beating.
   • Only 2 of these rhythms are shockable.
   • If “shock advised”, shock victim and start CPR
   • The other 2 are non shockable.
   • If “No shock advised” then start CPR
4. Do not turn off AED
   • It is safe to touch Pads and patient
   • Shock if prompted
   • After shock, or if no shock is advised, continue CPR.
   • Every 2 minutes follow the AED prompts

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• Stop CPR if you see signs of life (breathing, movement.)
CHEST PAIN OF CARDIAC ORIGIN

- Classical chest pain of cardiac origin has the following characteristics:
  - Dull, diffuse pain, often described as a ‘weight’ on the chest, a heavy sensation or a squeezing sensation.
  - The pain can radiate to the left arm (or less commonly, right arm), neck or jaw. Sharp, well-localized chest pain, especially when the pain is reproduced by palpation at the painful area, or by taking a deep breath, or twisting the torso is less likely to be cardiac in origin.
  - Chest pain of cardiac origin is frequently accompanied by associated symptoms, such as shortness of breath, diaphoresis, nausea, dizziness, feelings of dread, and verbal denial.
  - Patients with a history of cardiac chest pain (angina) can be asked if this pain is similar to their previous episodes of angina.
    - Angina usually lasts less than 5 minutes. Any angina- like pain that has lasted longer than 5-10 minutes must be treated as a possible heart attack.
    - Don’t be overconfident: Cardiac chest pain can be a subtle, difficult diagnosis, even under ideal conditions. Patients with diabetes are especially prone to having unusual presentations of cardiac pain. When in doubt, treat for a cardiac event, and evacuate the patient.

Acute Myocardial Infarction

- Acute myocardial infarction (AMI) is the leading cause of death in the US and in most of the western world.
- Early aggressive management of AMI can significantly improve mortality and morbidity.
- Approximately 25% of patients with AMI die within one hour of symptom onset
- Another 30-40% of patients with AMI die immediately or within several days.

Symptoms

- Chest pain associated with AMI is generally dull, diffuse, and often described as a pressure sensation.
- Chest pain that lasts for a few seconds is not usually cardiac-related.
- Angina usually lasts less than 5 minutes, while
- AMI chest pain lasts more than 5 minutes.
- Classical angina pain is brought on by exertion and is relieved by rest.

Congestive Heart Failure

- Congestive Heart Failure (CHF), characterized by fluid in the alveoli of the lungs, is defined as the inability of the heart to pump enough blood to meet the demands of the tissues.
- CHF may be seen following any of these conditions:
  1. pulmonary embolism, sepsis
2. anemia
3. thyrotoxicosis in pregnancy
4. arrhythmias
5. myocarditis
6. endocarditis
7. hypertension and myocardial infarction.
8. Other associated causes include fluid overload due to acute renal failure, shock lung due to toxic fumes / smoke / heat inhalation of a fire or blast that causes destruction of the alveolar surfactant, and mountain sickness (high altitude pulmonary edema).

Symptoms
- Shortness of breath (SOB)
- dyspnea on exertion (DOE), dyspnea when lying down (orthopnea), or when awakening from sleep (paroxysmal nocturnal dyspnea, or PND)
- swelling of the ankles and legs (pedal edema)
- fatigue and nausea.

Objective Signs
1. Vitals: Tachycardia >120
2. tachypnea >30
3. low BP or 10mm variation in systolic pressure between inspiration and expiration (pulsus paradoxicus)
4. fever >101 (valvular infection).
5. Jugular venous distension (JVD) with meniscus >5cm above the sternal notch when patient sitting at 30°
6. lip cyanosis.
7. Fine, crepitant rales (bubbling of alveolar fluid) spreading from the bases to all lung fields
8. wheezing
9. productive cough with pink, frothy fluid
10. pleural effusion
11. Heart sounds of horse galloping (all four hoofs striking the ground)
12. Extremities show: Cyanosis, pitting edema of the ankles and legs.

Treatment Primary:
1. Oxygen at 3-5 L/min to raise oxygen saturation above 90%.
2. Furosemide (Lasix) starting at 20 mg IV and doubling every 30 minutes until diuresis ensues, up to 200 mg total. There is no additional benefit above 200 mg if diuresis has not ensued.
3. Nitroglycerin 0.4 mg sublingual, repeating q 5 minutes for a total of 3 doses.
4. Sit patient up with legs dangle to ease dyspnea.
5. Monitor urine output and weight (2.2 pounds, or 1 kilogram, equals a liter of fluid loss).

Alternative: Intubation with positive pressure breathing (bag-valve-tube forced inhalation) if oxygen saturation remains <85%.

Hypertensive Emergency
• Most hypertension does not require intervention in the field but should have further evaluation and treatment upon completion of the mission.
• A hypertensive emergency is defined as acute hypertension with damage resulting to other organs.
• The diastolic BP is usually over 110 mg Hg. Marked hypertension may accompany head trauma.

Symptoms
1. Headache
2. blurred vision
3. neurologic deficits
4. decreased urination
5. shortness of breath while walking or sitting that worsens when lying down
6. fatigue
7. nausea
8. chest pain.

Objective
• BP >220/120
• bounding pulses
• swelling of the legs
• cyanosis
• tachypnea or tachycardia or bradycardia
• blurring of the optic disc or red splotches of hemorrhage on the retina on fundoscopic examination
• lungs may be clear or have rales of CHF or pulmonary edema
• forceful heartbeat on chest wall
• loud bruit just above the umbilicus in renal artery stenosis
• decreased urinary output from renal dysfunction

Treatment
1. Primary: Sedation: diazepam 5 mg; Diuresis: furosemide 20 mg IV (or po) and double every 30 minutes until diuresis occurs.
2. Alternative: Use antihypertensives to lower the diastolic pressure to 100-110, not to under 90, in the first 24 hours: lisinopril 10 mg po or enalapril 5 mg po qid; clonidine 0.1 mg po q 1 hour up to 6 doses.
3. Primitive: Sitting or elevating the head is essential if head trauma is suspected.

Pericarditis
• Acute pericarditis is inflammation of the pericardial sac surrounding the heart that results in chest pain.
• The majority of cases are idiopathic or post-viral.
• Other causes are acute myocardial infarction, uremia, bacterial infection, tuberculosis, collagen-vascular disease, neoplasm (lung, breast, melanoma, lymphoma, leukemia) or trauma.

Symptoms

Precordial chest pain with a pleuritic component (worse when breathing in and out), pain is worse lying down and better sitting up or leaning forward, fever, shortness of breath on exertion or rest, fatigue and malaise.

Objective

• Pericardial friction rub (squeaky leather sound) loudest leaning forward on held expiration
• neck vein distension greater than 5cm above the sternal notch
• possible pleural rub (sound of Velcro).
• A 10 mm or greater difference in the systolic BP between inspiration and expiration (pulsus paradoxicus) suggests tamponade.

Differential Diagnosis
1. Pleurisy - pleural rub without pericardial rub or EKG abnormality
2. Aortic dissection - different pulse pressures between the arms
3. Pulmonary embolism - typically unilateral calf tenderness and swelling consistent with phlebitis
4. Pneumothorax - absence of breath sounds on one side is typical
5. Acute Myocardial Infarction - EKG shows typical ST elevation in 2 or more contiguous leads, not all leads
6. Pericardial tamponade - falling BP with rising neck veins and signs of hypovolemic shock

Treatment

1. Primary: Rest. ASA 650 mg po q 4-6 hours or ibuprofen 800 mg tid or indomethacin 50mg po tid.
2. Alternative: Prednisone 60 mg po qd
3. Primitive: Morphine: Titrate dosage beginning at 2mg IV and repeating q 5 minutes, until pain relief without over-sedation
4. Empiric: If bacterial infection is suspected, the most common cause is staph. Give nafcillin 2 gm q 4 hours plus gentamicin 1mg/kg IV q 8 hours.
5. Inflammation of the pericardial sac is often idiopathic or viral and self-limiting over 5-7 days.
6. Pericarditis is not life threatening unless fluid starts to accumulate in the sac. Exertion, even though it hurts, will not worsen the condition.
7. If the patient is not breathing, give rescue breaths that cause the chest to rise.
8. Check carotid pulses.
9. If no pulse, begin CPR, continue until monitor/defibrillator or AED is available.
10. Intubate and give oxygen if possible
11. If AED arrives first, attach leads to patient and turn on AED as per instructions.
Airway Management
Respiratory distress.

- Airway: Check for airway patency. Open the casualty’s airway and establish the least invasive but most effective airway.
- Breathing: Determine if the casualty is exchanging air sufficiently to maintain oxygen saturation, or requires assisted ventilations.
- Monitor: After checking and correcting the airway and breathing status, monitor to insure no deterioration.
- Perform these procedures without causing further injury to the patient.

What You Need

1. Various sizes of nasal and oropharyngeal airways
2. Gloves
3. Gauze pads
4. Tongue blades
5. Bag-valve-mask (BVM) system
6. Water-soluble lubricant
7. 10cc syringe to inflate the cuff, stylette
8. Laryngoscope with blades
9. Endotracheal tubes (rough size of little finger diameter; 7-9 for adult, 6-7 for adolescents, 4-6 for children [uncuffed], 3.5-4 for infants [uncuffed])
10. and oxygen/suction (if available)
11. and emergency drugs.

What To Do

1. Assess consciousness: does casualty respond to shake and shout, or painful stimuli?
   a. If patient is conscious, go to step 2.
   b. If patient is unconscious, go to step 3.
2. Assess airway and respirations in a conscious casualty.

NOTE:
- Assessing the airway and respirations are two different steps in the trauma sequence, but every time the airway is assessed, the respiratory effort can also be partially assessed.
- However, a clear airway with respiratory effort detected does not fully clear the respiratory system.
- After assessing the airway, assess respiratory effort bilaterally to ensure that both lungs are working and air movement is adequate.

Ask casualty simple questions to determine status of airway
(1) If casualty can talk to you without difficulty, airway is clear.
(2) If the patient answers with difficulty, coughing, pain, hoarseness or other difficulty, manage the airway using the same procedure as if the casualty were unconscious (Step 3).
- Auscultate both lungs to ensure that air is being exchanged equally bilaterally.
• If history does not point to respiratory/airway involvement and there are no signs of respiratory distress present, continue primary assessment.
• Monitor the patient’s airway and respirations.
• Monitor for signs and symptoms of hypoxia.

STEP 2

If signs of respiratory distress develop:

(1) Initiate appropriate treatment immediately.
NOTE: Do not attempt to insert oropharyngeal airways or endotracheal tubes in conscious casualties unless they have a history or signs of inhalation burns/injuries.
(2) Give supplemental oxygen, if available.
NOTE: Failure to notice signs and symptoms of hypoxia or respiratory distress early may have catastrophic effect on the patient.
• If casualty becomes unconscious, manage casualty initiate step 3.

STEP 3

Assess airway and respirations in an unconscious casualty.

NOTE:
• If patient is in a position that makes assessing the airway impossible, move the patient as little as possible to assess the airway.
• Be aware of C-Spine control and other possible injuries when moving patient.
• Remember life has precedent over limb.
• Look, listen and feel for respiratory effort.
(1) Look for bilateral rise and fall of the chest.
(2) Listen for air escaping during exhalation.
(3) Feel for breath exhaling from the casualty’s mouth on the side of your face.
• If respiratory effort is detected, assess the respiratory effort for at least 6 seconds.
• Assess the quality of the respiratory effort as strong, moderate, or weak.
• Assess the rhythm of the respiratory effort as regular or irregular.
• Assess the rate of the respiratory effort: <10 respirations per minute or >20 respirations per minute are indicators for assisted ventilations.

NOTE: Multiply the number of respirations detected in a 6 second period x 10 to get the number of respirations per minute.

• If no respiratory effort is detected, check pulse.
• If the casualty is pulseless:
  (a) In a non-dangerous situation, initiate CPR (see Cardiac Resuscitation).

If the casualty has a pulse, establish an airway immediately.

a. Inspect head, face, and throat for signs of trauma and inhalation injuries. Signs of inhalation
injuries may include reddened face or singed eyebrows and nasal hair.

b. Open the airway using the appropriate technique.
If working on a trauma casualty, use the jaw thrust technique
- Kneel at the top of the casualty’s head.
- Grasp the angles of the casualty’s lower jaw.
- Rest your elbows on the surface on which the casualty is lying.
- Lift with both hands, displacing the lower jaw forward.

STEP 4
If working on a non-trauma casualty, use the head-tilt/chin-lift method.
- Kneel at the level of the casualty’s shoulders.
- Place one hand on the casualty’s forehead and apply firm, backward pressure with the palm of the hand to tilt the head back.
- Place the fingertips of the other hand under the bony part of the casualty’s lower jaw, bringing the chin forward.

CAUTIONS:
1. Do not use the thumb to lift the lower jaw.
2. Do not press deeply into the soft tissue under the chin with the fingers.
3. Do not completely close the casualty’s mouth.

- Inspect the oral cavity for foreign material, blood, vomitus, avulsed teeth, and signs of inhalation injuries. If the casualty has signs of trauma, foreign objects, and/or complications, continue with this step.
- If casualty is breathing with adequate respiratory effort/air exchange and has no signs of trauma, foreign objects, or complications of the upper airway, proceed to step 5.
- If airway is clear but no respiratory effort is detected, see step 6.
- If airway is not clear, regardless of respiratory effort, see step 7.

STEP 5.
Insert an oropharyngeal airway (J tube) if the casualty is breathing, has no history of apnea, and no trauma or complications of the upper airway. Have suction available before attempting.
a. The oropharyngeal airway should be approximately the same length as the distance from the corner of the casualty’s mouth to tip of his ear lobe.
b. Insert the airway inverted until past the tongue and then rotate 180°.
WARNING: It is more traumatic (and contraindicated in children) to use this “corkscrew” technique.
- If a tongue depressor is available, it is preferable to use it to depress the tongue and insert the oral airway under direct vision.
- Check for respiratory effort after J tube is inserted. Respiratory effort should be the same or improved after insertion of J tube. If decreased, remove tube, re-inspect airway, reinsert J tube and reassess.
c. Have assistant provide ventilations and administer oxygen if available.
STEP 6.

If the casualty has no respiratory effort and no apparent obstruction of the airway, attempt to give 2 breaths using the rescue breathing technique.
   a. If the breaths go in, intubate and ventilate the casualty (see Procedure: Intubate a Patient).
   b. If the breaths do not go in, attempt to reopen the airway again and give 2 more breaths.

(1) If the breaths go in, intubate and ventilate the casualty.
(2) If breaths still do not go in, insert laryngoscope and inspect the oropharynx for foreign body, blood, vomitus, swelling or other causes of obstruction.
(3) Using forceps, attempt to remove any foreign objects seen.
   (a) If able to clear airway, attempt 2 breaths and assess for return of spontaneous respirations.

NOTE: If at any time spontaneous respirations return after clearing an airway, the casualty requires assisted ventilations with an oropharyngeal airway or ET tube.

• Casualties who were apnic for any length of time will have an elevated CO2 level. Traumatized casualties who were apneic will have difficulty regaining O2 saturation. They may start off breathing adequately, but their CO2 deficit will cause them to destabilize over time. Failure to assist ventilations in a formerly apneic casualty WILL cause harm and possible death.
• If unable to clear airway, perform surgical cricothyroidotomy (see Procedure: Cricothyroidotomy).

• If the situation makes it impossible to perform an immediate surgical cricothyroidotomy, perform a needle cricothyroidotomy (see Procedure: Cricothyroidotomy)

(4) If no obstruction is seen but vocal cords are visualized, attempt to intubate casualty
   (a) Successful intubation: ventilate casualty (see Procedure: Intubation).
   (b) Unsuccessful intubation: perform surgical or needle cricothyroidotomy (see Procedure: Cricothyroidotomy).

(5) If no obstruction of airway is seen but vocal cords are not visualized, perform surgical cricothyroidotomy.

(6) Clear the airway of a casualty who may or may not be breathing.
   a. Clear any foreign material or vomitus from the mouth as quickly as possible using forceps or the finger sweep method.
   b. If casualty is vomiting, turn head to the side or roll casualty on side to prevent aspiration.

CAUTION: Be aware of C-spine and other injuries.

c. Stem bleeding into the oral cavity with packed gauze, but only after a secure airway is in place.

 ci. After clearing the obstruction, assess the respirations and determine the type of airway required based on the cause of the obstruction and the situation.

NOTE: Casualties who are vomiting or bleeding into their naso-oropharynx need a secured airway, i.e., ET tube, to protect against aspiration.

   (1) If the casualty is breathing on his own with little or no chance of aspiration, insert J tube.
(2) If the casualty is not breathing or has minimal respiratory effort, or there is a chance for aspiration, intubation is preferred.
   e. Secure airway with an oropharyngeal airway or an ET tube.
   f. If blockage cannot be removed or injuries make obtaining a secure oral airway improbable, give casualty a cricothyroidotomy immediately (see Procedure: Cricothyroidotomy).
   g. Assist ventilations with Bag-valve Mask and oxygen if available.

(7) Monitor airway and respiratory effort for at least q 5 min while you continue the primary survey.
   a. After Primary Survey is complete, reassess casualty’s LOC, airway, and respiratory status to determine if additional management is required to further control and protect the airway.
   b. Unconscious casualties require intubation to further control and protect airway (see Procedure: Intubation)
   c. If the casualty is in severe respiratory distress or arrest and cannot be intubated, you must perform a cricothyroidotomy (see Procedure: Cricothyroidotomy)

(8) Monitor and assess casualty on regular basis to determine if ABCs are improving or worsening.

(9) Adjust treatment to compensate for improving or worsening status of the casualty.

(10) Evacuate casualty to nearest appropriate medical treatment facility.

NOTES: Providing oxygen allows time to treat the underlying respiratory problem.

- The nasal cannula is the simplest method suitable for a spontaneously breathing patient. Each additional liter/min of flow adds approximately 4% to the 21% O2 available normally at sea level.
- Facemasks provide higher and more precise levels of inspired oxygen—up to .35-.60 Venturi mask delivers 24%-50% Fi O2
- Non-rebreather delivers 60%-90% Fi O2
- A continuous positive pressure device (CPAP) can deliver up to 100%
- Use a BVM device to assist or control ventilation until a more secure airway can be obtained. If used correctly, 100% oxygen can be delivered this way.

What Not To Do:
- If it takes 2 additional people to hold down a casualty to intubate them, re-evaluate the need for intubation since they have to be exchanging oxygen to maintain muscle strength and resist.
- Do not proceed to directly to intubation in a patient with respiratory disease. Evaluate ways to improve their airway, then assist with respiratory effort. Ambu or bag-valve mask ventilation, timed with a patient’s efforts can help relax and improve their respiratory status, and potentially avoid the risk of intubation.
Intubation

- Establish a temporary emergency airway through the mouth or nose, and pharynx.
- To control the airway during cardiopulmonary resuscitation or respiratory failure, prior to the onset of expected complications (e.g., laryngeal edema from inhalation burns), during complications from surgical anesthesia or other complications.

SUPPLIES
1. Oxygen source and tubing
2. Tonsil-tip suction and source
3. Bag-valve-mask (BVM) device with self-inflating reservoir and oxygen coupling
4. Face masks of different size
5. Oral and nasopharyngeal airways (different sizes)
6. Water-soluble lubricant
7. Straight and curved blade laryngoscopes
8. Endotracheal tubes of different sizes
9. A syringe to inflate the cuff
10. Stylets
11. Tongue blades, nasogastric tube
12. And emergency drugs.

PROCEDURE
First: Patient Evaluation
- Evaluate the airway during the initial injury assessment, and administer supplemental oxygen during this time if possible.
- Continual airway assessment is crucial since subtle changes in mental or respiratory status can occur at any time.
Airway characteristics that can make fitting the mask and tracheal intubation difficult include:

1. Short, thick, muscular or fat neck with full set of teeth;
2. Full beard, facial burns, or facial injuries;
3. Receding or malformed jaw;
4. Protruding maxillary incisors; and
5. Poor mandibular (lower jaw) mobility.

Co-existing injuries such as known or suspected cervical spine injury, thoracic trauma, skull fractures, scalp lacerations, ocular injuries and airway trauma must be included when planning airway management.

Second: Technique

Endotracheal intubation indications include anatomic traits making mask management difficult or impossible, need for frequent suctioning, prevention of aspiration of gastric contents, respiratory failure or insufficiency, disease or trauma to airway, type of surgery or position of patient during surgery, need for postoperative ventilatory support, and traumatic injuries or musculoskeletal malformations making ventilation difficult.

1. Gather and check all previously listed equipment for proper function. Check light on laryngoscope, inflate ET cuff with 5-10cc air and check for leaks, then deflate and leave syringe attached, insert lubricated stylet so it does not protrude beyond distal end of ET and bend into hockey stick form, and have suction on.

2. Hyperventilate with 100% O2 for several minutes using BVM.

3. Have assistant hold cricoid pressure if aspiration is a risk.

4. If orotracheal intubation is planned, hold the laryngoscope in left hand and insert the blade on right side of mouth pushing the tongue to the left and avoiding the lips, teeth and tongue. Holding the left wrist rigid (to avoid using the scope as a fulcrum and damaging the teeth), visualize the epiglottis.

- If a straight (Miller) blade is used, pass the blade tip beneath the laryngeal surface of the epiglottis and lift forward and upward to expose the glottic opening.
If a curved (Macintosh) blade is used, advance the tip of the blade into the space between the base of the tongue and the pharyngeal surface of the epiglottis (the vallecula) to expose the glottic opening.

6. Insert the ET with the right hand through the vocal cords until the cuff disappears. Remove the stylet and advance the tube slightly further.

- Inflate the cuff with air until no leak is heard when ventilated with bag. Adult women use a 7.0mm; men use an 8.0mm ET.

7. Verify correct placement by listening over both lungs for bilateral, equal breath sounds and observe the chest for symmetric, bilateral movements.
   - Listen over the stomach, where you should not hear breath sounds.
   - Note depth of insertion by centimeter markings on the tube at the lips, and tape the tube in place.
   - For nasotracheal intubation when the mouth cannot be opened or the patient cannot be ventilated by another means, or if the patient is conscious and requiring intubation, follow steps 1-3 using a lubricated (water-soluble), size 7-7.5 ET without the stylet.
   - Insert the ET tube straight down into the larger nares until it reaches the posterior pharyngeal wall.
   - If doing a blind nasal intubation, listen for the patient to inhale and insert the ET quickly into the trachea with a single smooth motion.
   - If intubating under direct visualization, now insert the blade as previously described and pass the ET through the cords. Inflate the cuff and verify placement as above.
   - Do not mishandle laryngoscope blade and handle. Teeth can be broken and aspirated, or lips or gums lacerated with resultant bleeding.
   - In addition, cardiac arrhythmias can occur with manipulation of the trachea and esophagus.
   - Do not allow the ET tube to be moved or removed accidentally.

It must be adequately secured after successful placement to avoid compromising respiratory status in order to replace it.

- Never perform a nasal intubation in a patient with a known or suspected basilar skull fracture or cribiform plate fracture. The ET can end up in the brain!
- Never force the ET against tissue resistance. Bleeding and inflammation can result, making future attempts at intubating difficult or impossible.

Cricothyroidotomy, Needle and Surgical

- Consider cricothyroidotomy to establish an airway in casualties having a total upper airway obstruction or inhalation burns preventing intubation.

Two methods are available:
1. Needle penetration of the cricothyroid membrane
2. Surgical placement of an airway tube through the cricothyroid membrane - when a cricothyroidotomy needle is unavailable or performing a needle cricothyroidotomy is not effective.
SUPPLIES

1. Gather pre-assembled cricothyroidotomy kit (every medic should have an easily accessible ‘Cric Kit’ that contains all required items) or minimum essential equipment as below:
   • Cutting instrument: #10 or 11 scalpel, knife blade, 12-14 Gauge catheter-over-needle (e.g., Angiocath) with 10cc syringe attached for needle cricothyroidotomy.
   • Syringe can also be used to inflate cuff on ET tube.
   • Airway tube: IV catheter 12-14 gauge
   • ET tube
   • cannula, or any noncollapsible tube that will allow sufficient airflow to maintain O2 saturation.
   • 2 Hemostats
   • needle holder
   • tissue forceps
   • scissors.
   • Other supplies: Oxygen source and tubing
     • Ambu bag
     • suctioning apparatus
     • Povidone-iodine prep
     • gauze
     • (sterile) gloves
     • blanket
     • silk free ties (for bleeders; size 3-0)
     • 3-0 silk suture material on a cutting needle
     • tape.

PROCEDURE

Needle and Surgical Cricothyroidotomy
1. Place the casualty in the supine position.
2. Place a blanket or poncho rolled up under the casualty’s neck or between the shoulder blades to hyperextend the casualty’s neck and straighten the airway. WARNING: Do not hyperextend the casualty’s neck if a cervical injury is suspected.
3. Locate and prep the cricothyroid membrane.
4. Palpate for the “V” notch of the thyroid cartilage.
5. Slide the index finger down into the depression between the thyroid and cricoid cartilage, the cricothyroid membrane.
6. Prep the skin over the membrane with povidone-iodine.
7. Put on gloves (sterile if available) after assembling equipment and supplies.

Needle Cricothyroidotomy

• Make a small nick in the skin with a #11 blade to open a hole for the IV catheter to slide through the skin
• Using the needle/catheter/syringe, penetrate the skin and fascia over the cricothyroid membrane at a 90° angle to the trachea while applying suction on the syringe.
• Advance the catheter through the cricothyroid membrane.

• Once air freely returns into the syringe, STOP advancement, and direct the needle toward the feet at a 45° angle.
• Hold the syringe in one hand, and use the other hand to advance the catheter off the needle towards the lower trachea.
• Slide the catheter in up to the hub—CAUTION: Do not release the catheter until it is adequately secured into place.

• Check for air movement through the catheter by using the syringe to inject air through it and confirm free airflow. If air does not flow freely, straighten the tube and try again or withdraw the catheter and begin again at step 4b above.

• If air flows freely and the patient is breathing on his own, use the 3-0 suture to make a stitch through the skin beside the catheter.
• Secure the catheter to the stitch with several knots.
• Connect catheter to an oxygen source at a flow rate of 50 psi or 15 L/min. See Step 6 and 7 below for wound care and on-going management.
• If the patient is NOT breathing on his own, attach the syringe to the catheter, remove the plunger and deliver artificial respirations through the syringe and catheter.
• If the patient does not recover spontaneous respirations after several minutes, or if oxygen source is not available, proceed to Surgical Cricothyroidotomy.
Surgical Cricothyroidotomy (If Needle cricothyroidotomy is not possible or is insufficient)

• Proceed through steps 1-3 if not already done.
• Test ET cuff to ensure it holds air.
• Raise the skin to form a tent-like appearance over the cricothyroid space, using the index finger and thumb.
• With a cutting instrument in the dominant hand, make a 1 inch horizontal incision through the raised skin to the cricothyroid space. CAUTION: Do not cut the cricothyroid membrane with this incision.

• Relocate the cricothyroid space by touch and sight.
• Stabilize the larynx with one hand and cut or poke a 1 inch incision through the cricothyroid membrane with the scalpel blade. NOTE: A rush of air may be felt through the opening.
• Look for bilateral rise and fall of the chest.
• Insert the ET tube or other airway tube through the opening into the trachea at a 90° angle to the trachea. Once in the trachea, direct the tube toward the feet at a 45° angle.
• Do NOT Insert an ET tube, or other long airway more than 3-4 inches to avoid intubating a single bronchus.
• Inflate the ET cuff if applicable. Do NOT release the airway tube until it is secured.
• Connect the Ambu bag to the tube and inflate the lungs, or have someone perform mouth to tube respirations.
• Auscultate the abdomen and both lung fields while observing for bilateral rise and fall of the chest.
• If there are bilateral breath sounds and bilateral rise and fall of the chest, the tube is properly placed and may be secured.
• If not, reposition the tube as follows until adequate placement is obtained:
  (1) Unilateral breath sounds and unilateral rise or fall of the chest indicate that the tube is past the carina. Deflate the cuff on an ET tube, retract the tube 1-2 inches, inflate the ET cuff and recheck air exchange and placement.
(2) Air coming out of the casualty’s mouth indicates that the tube is pointed away from the lungs.
  • Deflate the cuff on an ET tube, remove the tube, reinsert, inflate the cuff and recheck for air exchange and placement.

(3) Any other problem indicates tube is not in the trachea. Follow the preceding step.
  • If air flows freely, and the patient is breathing on his own, proceed to next step.
  • If the patient is NOT breathing on his own, continue providing respirations via the Ambu bag with oxygen if available, or via mouth to tube assistance at the rate of about 20/min.
  • Secure the airway tube using tape (temporary), or use the 3-0 suture to make a stitch through the skin beside the tube. Secure the tube to the stitch with several knots.
  • Suction the casualty’s airway, as necessary.
  • Insert the suction catheter 4 to 5 inches into the tube.
  • Apply suction only while withdrawing the catheter.
  • Administer 1 cc of saline solution into the airway to loosen secretions and help facilitate suctioning.

NOTE: Ventilate the casualty several times or allow him to take several breaths between suctionings.
  • Apply a dressing to further protect the tube or catheter and incision using one of the techniques below.
    • a. Cut two 4 X 4s or 4 X 8s halfway through. Place them on opposite sides of the tube so that the tube comes up through the cut and the gauze overlaps. Tape securely.
    • b. Apply a sterile dressing under the casualty’s tube by making a V-shaped fold in a 4 X 8 gauze pad and placing it under the edge of the catheter to prevent irritation to the casualty. Tape securely.
  • Monitor casualty’s respirations on a regular basis.
    • a. Reassess air exchange and placement every time the casualty is moved.
    • b. Assist respirations if respiratory rate falls below 12 or rises above 20 per minute.
  • Do not remove needle before advancing the catheter into trachea. (NEEDLE Cricothyroidotomy)
  • Do not forget to insure that the tube is correctly placed, and secured. (SURGICAL Cricothyroidotomy)
  • Do not fail to monitor.
CHAPTER 3
TRAUMA

The following is the conventional approach to a trauma patient. It is NOT an all-inclusive list. Its purpose is as a reminder only.

PRIMARY SURVEY
SCENE SAFETY – Yours? Patients? HAZMAT needed? Universal precautions?
• Treat as needed
• Do not move on to breathing until airway is controlled.
• Treat as needed: O2/BVM/Stabilize chest wall/Thoracentesis/Thoracostomy
• Treat as needed: O2/NS or LR/Direct pressure/Pressure dressings/Elevation/ Tourniquets/MAST
DIAGNOSE & DECIDE - Is pt a Load & Go? Continued decompensation from respiratory & circulatory compromise? Difficulty with circulation (shock)? Decreased or decreasing LOC?
• Do initial Rx/Evacuate ASAP/Continue Rx. enroute
EXPOSE – Examine pt for additional injuries/Unknown etiology/Obtain initial history

SECONDARY SURVEY
VITAL SIGNS - Pulse, Blood Pressure, Respirations, Temperature, O2 Sat, EKG, BGL
PATIENT HISTORY – AMPLE & PQRST

Allergies
Medications
Past medical history (significant)
Last food/fluid intake
Events preceding the injury

Pain: What brought the pain on? How did it start? Is there anything that alleviates/worsens the pain
Quality: How does it feel? Describe it.
Region & Radiation: Where is the pain? Is it local/diffuse/pinpoint? Do you have pain anywhere else? Does it radiate? (Is pain referred?)
Severity: How bad is pain (scale of 1-to-10)? Can you compare it to anything else?
Time: How long have you had the pain? Is it constant or intermittent? Have you had this pain before?
HEAD-TO-TOE EXAMINATION – CSM, AVPU, PERLA, Glasgow Coma Scale

Circulation: Patient have distal pulses? Capillary blanch in finger in and toes?
Sensory: Patient feel touch of fingers and toes? Does unconscious patient respond when you pinch fingers and toes?

Alert: Patient is A & O person/place/date/time
Verbal: Patient responds properly to verbal stimuli
Pain: Patient responds to painful stimuli (withdraws from stimulus)
Unconscious: Patient is unresponsive

Pupils Equal Reactive Light
Accommodating

Perform treatment of findings from secondary exam.

Continuously monitor the patient. Be prepared to correct ABCs if they deteriorate.

GLASGOW COMA SCALE

EYE OPENING
Spontaneous  4
To voice  3
To pain  2
None  1

VERBAL RESPONSE
Oriented  5
Confused  4
Inappropriate sounds  3
Incomprehensible sounds  2
None  1

MOTOR RESPONSE
Obey command  6
Localizes pain  5
Withdraws (pain)  4
Flexion (pain)  3
Extension (pain)  2
None  1

SCORE OF 8 OR LESS, OR DETERIORATING SCORE INDICATES SERIOUS HEAD INJURY.
SHOCK

Shock is defined as tissue perfusion that is not adequate to meet metabolic needs. There are several types of shock; but all are based on the underlying mechanism causing inadequate perfusion. The major types of shock that Pararescuemen are concerned with are: HYPOVOLEMIC, CARDIOGENIC, ANAPHYLACTIC, SEPTIC, AND NEUROGENIC.

HYPOVOLEMIC/HEMORRHAGIC SHOCK

Guidelines & Considerations: The treatment of hemorrhagic shock with large amounts of fluids in the field is controversial. Hemorrhage control takes precedence over starting fluid administration. In cases where bleeding is internal (abdominal or chest wounds), fluid resuscitation prior to surgical control of bleeding may actually make things worse. In cases of internal bleeding, fluid resuscitation should be titrated to a blood pressure between 90-100 mmHg systolic. In cases where the bleeding has been controlled (for example extremity wounds), then fluid resuscitation to higher blood pressures is acceptable.

Signs & Symptoms:
• Apprehensive/restlessness
• Hyperventilation
• Muscle weakness and fatigue
• Decreased level of consciousness
• Cool, pale moist skin
• Weak, rapid, thready pulse
• Decreasing blood pressure
• Narrowing pulse pressure less than 30mmHg

Rapid field estimate of BP:
• Palpable radial pulse = Minimum of 90 mm Hg systolic
• Palpable femoral pulse = Minimum of 60 mm Hg systolic
• Palpable carotid pulse = Minimum of 40 mm Hg systolic

Treatment:
1. Assess Airway, Breathing and Circulation. CONTROL BLEEDING.
2. Start Large Bore IV's with Normal Saline or Ringers Lactate.
• Saline lock with a large bore IV catheter is also acceptable.
3. Administer oxygen 4 to 8 LPM.
4. Place patient in shock position.
5. Keep warm and covered.
6. Monitor V.S. q 5-15 minutes.
7. Adjust IV flow rate to maintain systolic blood pressure between 90-100mmHg and/or minimal BP necessary to maintain a good carotid pulse.
CARDIOGENIC SHOCK

Signs & Symptoms:
• Abnormal pulse: Irregular, rapid and/or weak pulse
• Decrease in blood pressure 30mmHg or more from normal (less than 90mmHg systolic)
• Chest pain
• Nausea and vomiting
• Pallor, cold clammy skin
• Muscular weakness

Treatment:
1. Assess airway and circulation status first, treat appropriately.
2. Complete rest.
3. Administer oxygen 4 to 8 LPM.
4. Start IV and titrate to maintain 90-100 mm Hg systolic BP.
5. Monitor Vital Signs q 15 minutes to 1-4 hours PRN. Auscultate lungs with every 250 cc’s of fluids administered IV.
6. Evacuate ASAP.

ANAPHYLACTIC SHOCK

Signs & Symptoms:
• Hives
• Apprehension
• Hyperventilation
• Laryngeal edema
• Reddened skin or numerous blotchy red areas
• Itching
• Angio-edema
• Tachycardia
• Wheezing
• Respiratory distress
• Hypotension
• Airway obstruction/shock

SEPTIC SHOCK (HYPERDYNAMIC & HYPODYNAMIC)

HYPERDYNAMIC SHOCK (Early, Warm)

Signs & Symptoms:
• Fever
• Altered mentation
• Shaking, chills
• Rapid bounding pulse
• Blood pressure increase-normal-decreases
• Decreased urinary output
HYPODYNAMIC SHOCK (Late, Cool) Signs & Symptoms:
• Skin cold, clammy
• Blood pressure decreases further
• Pulse radi, weak, irregular
• Edema

Treatment: (Septic Shock)
1. Start Large Bore IV with crystalloid solution
2. Administer oxygen 4-8L/min
3. Begin antibiotic therapy
4. Drain abscesses, clean and drain wounds. Debride as required
5. Adjust IV fluid rate to maintain a minimum BP of 90-100 mm Hg systolic

NEUROGENIC SHOCK

NOTE: Isolated head injuries do not cause shock. If shock is present in such a patient, search for other causes of shock.

CAUTION: Neurogenic shock may mask intra-abdominal, pelvic and lower extremity injury. A careful survey of the entire patient is mandatory in patients with this condition.

Signs & Symptoms:
• MOI consistent with probability of spinal cord injury
• Increased pulse (may also have normal pulse or bradycardia)
• Decreased blood pressure less than 80mmHg systolic
• Flaccid, paralysis
• Incontinent of urine and/or feces
• Abnormal reflexes
• Spasticity
• Paralysis and loss of sensation
• Point tenderness/pain, deformity of spine.

Treatment:
2. Start IV with normal saline or ringers lactate, titrate to maintain minimum BP of 100 mm Hg systolic.
3. Administer oxygen 4-8L/min
4. Institute other shock modalities as directed
CHAPTER 4
WOUND CARE

• This section will present basic guidelines in the management of a soft tissue injury.
• Four key areas will be addressed: universal precautions (specifically with regard to wounds) control of bleeding, control of infection, and preservation of function in the injured part.

Universal Precautions

• Care must be taken to prevent the transmission of HIV or other blood-borne pathogens.
• First, wear gloves when touching blood and other body fluids, mucous membranes, or nonintact skin, and when handling items or surfaces soiled with blood or body fluids.
• Masks and protective eyewear or face shields should be worn during procedures that are likely to generate droplets of blood or other body fluids.
• Gowns or aprons should be worn during procedures that are likely to generate splashes of blood or other body fluids.
• Second, any skin surfaces contaminated with blood or other body fluids should be washed immediately. Furthermore, hands should be washed immediately after removing gloves.
• Third, the caregiver must use extraordinary care to prevent injuries to himself/herself with any sharp instrument contaminated with potentially infectious material.
• After use, place all sharp items in a puncture-resistant container for disposal.
• Fourth, avoid handling equipment or devices contaminated with potentially infectious material.
• Fifth, a disinfectant solution such as chlorine bleach should be used to clean spills of blood or body fluids immediately after they occur.
• Last, immediate treatment of accidental exposure to blood or body fluids should include flushing the site well with soap and water and seeking medical attention as soon as possible.

Assessment

1. A quick, but thorough, assessment of the patient and the injury must be done initially.
2. Note the injury site, cause of injury, and degree of injury.
3. It is important to assess the life-threatening potential of the injury, and observe for signs of shock (paleness, rapid and shallow respirations, thirst, nausea and vomiting, weak and rapid pulse, restlessness, excitement and anxiety).
4. Fainting is not uncommon for the injured person during the assessment due to the loss of blood, deformity and pain.
5. It is best to have the individual lie down to prevent a possible fall and further injury.

Control of Bleeding

External Bleeding - APPLY PRESSURE.

1. Place several pieces of sterile gauze or clean cloths directly over the wound.
2. Apply direct pressure on the gauze or cloths with the hands. Hold or maintain the pressure for 4-6 minutes.
3. If bleeding continues, apply a pressure bandage.
   • A pressure bandage is applied in the following manner: keep the first layer of gauze in place; and place a new clean gauze layer on top of the old layers. (prevents losing the original clotting formation)
   • Then, wrap the wound tightly, in a spiral fashion, with continuous bandage or 2" or 3" strip of cloth to continue pressure. It is important to check the nearest pulse most immediately past the wound. DO NOT CUT OFF BLOOD FLOW PAST WOUND.
   • Wrap the entire involved limb further beyond the wound to prevent undue swelling or tissue damage. Wrap in the direction that is furthest from the heart to the area that is closest to the heart, using even pressure throughout.
   • Estimate blood loss and seek medical consultation. After one to two days, with frequent checks for blood flow to the limb, remove the pressure bandage and replace with a smaller bandage.

IF SERIOUS BLEEDING CANNOT BE STOPPED, or if the injury includes loss of a limb, apply a tourniquet, as the last resort.

I __  Wrap a large, broad cloth around the end of the limb on the heart side of the wound; tie a knot; place a stick or other object 6" or so long across the knot, and hold the stick in place with another knot. Then, twist the stick until the bleeding stops, securing the stick to prevent unwinding. Note the date and time applied. EVACUATE THE PATIENT TO THE PHYSICIAN IMMEDIATELY.
I __  NOTE: Tourniquet use is dangerous and may cause unwanted loss of the limb. Keep the area uncovered and the tourniquet tight until ordered to be loosened by a physician.
• In general, if the bandaging was applied to control bleeding, do not remove. Seek medical care.
Principles of Bandaging.

- Thoroughly cleanse wound with sterile saline solution, or clean water. Be sure and remove all visible dirt and foreign material.
- Place sterile gauze on the wound.
- Add extra gauze/cloth to absorb fluid and provide compression to the wound area.
- Wrap with gauze roll or cloth strips, in spiral or a figure 8 fashion to secure.

All dressings should be changed daily.

- When handling dressings, thorough washing of hands with soap and water is extremely important.
- If at all possible, use sterile gloves when handling wounds and removing or reapplying new dressings. If sterile supplies are not available, use clean sheets, towels, or clothing torn into 2" or 3" strips. If linens are used, iron to sanitize before applying to wound, if possible.

Splinting  Splinting is used to decrease mobility and promote wound healing.

Compression Bandages  Some wounds will require a compression bandage. The extra wrapping will prevent swelling. It provides a bulkier style bandage.

Kinds of Wounds

Lacerations: A laceration is a disruption in the tissue where the resultant edges of the wound are left jagged or straight-edged. It is usually caused by either cutting or tearing of the tissue.

Puncture Wounds: A puncture wound occurs when a foreign object pierces the body.
- Bleeding from the wound is encouraged to flush out the foreign material.
- Foreign objects which are protruding from the wound and easily grasped should be removed with a sterile tweezers if removal will not further damage tissues.
- Place a small piece of sterile gauze with sterile tweezers in the wound opening to allow further drainage.
- This is a wound with a high risk potential for infections. (Removing a fish hook generally requires alternate procedures to avoid further tissue damage.)
- **LEAVE OBJECTS STUCK INTO THE SKULL AND BRAIN IN PLACE. SECURE THE FOREIGN OBJECTS WITH A BANDAGE.  EVACUATE THE PATIENT TO THE PHYSICIAN IMMEDIATELY.**
Abrasions: An abrasion occurs when the skin is rubbed or scraped off.

- It can be either deep or superficial.
- It is important to rinse the affected area thoroughly with sterile saline solution or clean water.
- Any large foreign body should be removed with sterile tweezers.
- The area should be covered with sterile gauze or special pads that prevent the gauze from sticking to the wound so the area will not be further traumatized when the gauze is removed.
- The initial layer of gauze is then covered with a bandage. These wounds tend to “ooze”. There is a high risk for infection with abrasions. Small abrasions are often left open to air dry after cleaning.

Avulsion: An avulsion is a tear or separation.

- Small: Cleanse the wound with clean water or sterile saline solution, including small flaps of skin when present.
  - Attempt to place the skin back into place, apply sterile gauze and bandage the wound.
  - If the skin flaps become black and turn necrotic at the edges seek medical care. If medical care is not available trim the area with sterile scissors and re-bandage the wound.
- Large: In a large avulsion, flush the area with clean or sterile water or saline.
  - Place sterile petroleum gauze over the wound base.
  - Attempt to reposition larger skin flaps, apply sterile gauze and bandage the wound.  EVACUATE THE PATIENT TO THE PHYSICIAN IMMEDIATELY.

Contusions: A contusion is a closed, superficial wound usually caused by a blow from a blunt object, a bump against a stationary object, or a crush.

- Blood seeping into soft tissues from injured vessels and capillaries causes swelling and pain that may be severe at the site of the injury. If the injury is over a bone, consider the possibility of a fracture.
- Contusions can also involve hemorrhages of the brain that result from the mechanical forces that move the hemispheres of the brain relative to the skull. Trauma sufficient to cause prolonged loss of consciousness usually produces such lesions.
- Clinically this may present as specific cranial nerve findings such as a gaze preference.
- Dependent on the location, though, this may also present with altered mentation and combativeness, and may even progress to death.  EVACUATE THE PATIENT TO THE PHYSICIAN IMMEDIATELY.

Wounds of Hands and Feet: Cleanse these wounds thoroughly with clean water or sterile saline. Place clean gauze on the wound, separate toes or fingers with gauze, and apply a compression bandage.

Fishhooks

- A fishhook can be removed easily when only the point and not the barb penetrates the skin.
  - If the barb of the hook enters the skin, it must be pushed until it has penetrated through the skin on the opposite side.
  - Then, the barb should be cut off with a wire cutting instrument and the rest of the hook removed.
• After the wound has been cleansed, a bandage should be applied. The wound should be observed for any signs of infection and tetanus toxoid given if required.

DEBRIDEMENT: For removal of devitalized tissue and/or debris.
• In most cases, simple bandaging is all that is required for field management of wounds. If evacuation to a higher level of care is > 12-14 hours
• A grossly contaminated wound with more than 8 hours to a higher level of care, debridement and delayed primary closure may be necessary.

NOTE: Work under adequate local anesthesia and with good exposure.
CAUTION: Work gently, precisely, and methodically. DO NOT cut any structure you cannot positively identify as: Skin, Muscle, or Fat.

Remove dead or devitalized tissue to decrease infection and improve healing.
• It is essential to debride a traumatic wound to prepare it for closure.
• Devitalized tissue inhibits leukocyte phagocytosis, acts as a culture medium for bacteria growth, and provides an anaerobic environment that limits leukocyte function.
• Debridement relieves excess tension, provides drainage, and removes bacteria and devitalized tissue that impair the wound’s ability to ward off infection.
• Whether the wound is secondary to an abrasion, laceration, burn, frostbite or gunshot, debridement should be rational, not radical.

Supplies:
Skin hooks
Iris scissors
Metzenbaum or Mayo scissors
Scalpel with #10, #11, #15 blades
Tissue forceps
35cc syringe, 16 or 18 gauge needle or plastic cannula
Toothbrush or a surgical scrub brush
NaCl for irrigation

1. Improvised: Any type of scissors, scalpel with any type of blade or pocketknife, any type of tissue forceps or hemostats, IV with catheter (any type of clean fluid), any type of brush, tap water (boiled if possible), any type of retractor or pliable object (i.e., SAMS splint)
NOTE: Items should be sterilized with cold sterilization or boiling water if possible.

Procedure

Determine the margin between devitalized and viable tissue.
1. Use clinical judgment.
2. Within 24 hours there is usually a sharp demarcation between devitalized skin and viable skin.
3. Longer time is usually recommended in frostbite and gangrene.
4. Use color, contraction, consistency, and circulation (the 4Cs) as guidelines when excising muscle.
1. Identify devitalized muscle by its dark color, mushy consistency, inability to contract when grasped with forceps and a lack of brisk bleeding when cut.
2. Prep and drape the wound.
3. Irrigate the wound. Use a 35cc syringe with a 16 or 18-gauge cannula and NaCl for irrigation. (This will provide approximately 8 psi, which will dislodge most particles). Irrigate the wound copiously.

Minor wounds not involving muscle

1. Stabilize the skin edges with the skin hooks by retracting the wound at both ends. Use your fingers pull the skin being debrided perpendicular to the laceration (this will prevent the skin from rolling in, providing an even, clean edge).
2. Using the scalpel with a #11 or #15 blade, hold it angled away from the wound edge and excise the devitalized skin. Holding it at an angle will ensure that eversion is achieved when the edges are approximated.
3. After excising the skin edges, inspect subcutaneous tissue. Excise any devitalized tissue with iris scissors.
4. Irrigate the wound once again with copious amounts of NaCl.
5. Close the wound either primarily or secondarily depending on the location, initial debridement, and the level of contamination.

Penetrating wounds

1. Use a scalpel with a #11 or #15 blade to excise the entry and exit wounds. The incisions should be sufficient to allow optimal surgical exposure and drainage. The excised skin should include the underlying subcutaneous tissue, and be incised oriented parallel to the underlying muscle fiber.
2. Incise the fascia parallel to the muscle fiber with Mayo or Metzenbaum scissors in both directions. Open the muscle surrounding the missile tract in the direction of the fibers to allow adequate exposure for inspecting the tract.
3. Inspect the wound tract. Remove any foreign bodies. Excise any muscle that is compromised and nonviable with a scalpel or scissors.
4. Utilize the retractors at this time to help with visualization and debridement. Be careful when using retractors in order to avoid damaging vessels, nerves, and healthy tissue.
5. Perform this procedure at both the entry and exit wounds. Debride the mid-track through extended entry and exit wounds. This prevents cutting across muscle groups to connect the two wounds.
6. Appropriate drainage of the wound may be difficult to achieve. Liberal incisions tend to facilitate drainage from the deep recesses. Remember to excise skin, fascia, vessels, nerves, and bone conservatively, and muscle more liberally. Try to save periosteum and tendons unless severely contaminated or compromised.
7. Irrigate the wound copiously again as above.
8. Do not pack the wound. The additional pressure can cause tissue necrosis, due to its already compromised blood supply. Lightly lay dry sterile gauze in the wound.
9. Leave the wound open with delayed primary closure in 4-10 days.
Do not debride good, viable tissue. Wait until the tissue declares itself, or makes it apparent that it is dead.
Do not close the debrided wounds, but let them drain. They may be closed later (delayed primary closure) if not infected.
Do not pack debrided wounds tightly, but allow them space to expand.

Burns:
- Cool burned tissue immediately with cold water.
- If blisters are present, leave them intact, do not break them.
- For small superficial burns, apply petroleum gauze to the area and bandage.
- It is important to change the bandage daily.
- In case charred white or black tissue is present, remove loose and dead tissue with sterile tweezers.
- Apply petroleum bandage.

Neck Wounds: Treat minor wounds to the neck area as described above.
- When working in the neck area, avoid circular bandaging around the neck.
- Use care not to cut off the carotid arteries or respiration.

Infection Control

The health care provider must scrub hands thoroughly, preferably with an antibacterial soap. If available, use sterile gloves.

Be sure to cleanse the wound thoroughly.

If available, a local anesthetic can help permit adequate cleansing
- The skin area surrounding the wound should be cleansed, and the wound area itself should be flushed with sterile water.
- If antiseptics are used, select one which will not be harmful to surrounding tissue such as 1% silvedene, bacitracin, or neosporin.

Signs of Infection: The wound should be inspected frequently for signs of infection. Wound infection will be characterized by such local signs as pain, swelling, heat, redness, and/or limitation of motion.

Methods Of Wound Closure
- Most wounds, even extensive ones, heal well without suturing.
- Closure should hold the wound edges together continuously to allow healing, normally about ten days, regardless of the method chosen.
- In general, suturing should be avoided if a less invasive method will keep the wound closed during necessary activities.
- Wounds in areas of high use and tension, such as ones that cross joints, require more aggressive closure than wounds in areas where the skin doesn't move and stretch.
- Suturing by an inexperienced person can result in many complications, (including undesirable cosmetic results in visible portions of the body) and should be used only under extreme circumstances.
Surface Closures: (Butterfly strips, steri-strips, skin glue, and medical tape).
- At no time should dirty or infected wounds be closed.
- Wounds that continue to bleed inside, particularly if deep, should not be closed either.
- The area around the skin must be dry for effective taping. Once the wound is cleansed and bleeding has ceased, try to hold the edges together touching or approximate, with butterfly strips or strips of half-inch tape directly over the wound.
- The strips should extend 1 1/2 to 2 inches on either side of the wound, and be placed over the wound with half-inch gaps between tapes.
- Pinch the wound closed and apply the tape to hold it, starting at the ends and working toward the middle of the wound.
- Evaluate the closure by putting the patient through gentle range of motion of the limb or area involved.

Suturing: Suturing of a wound should be considered only if other methods will not close the wound.
- Certain types of wounds should not be closed.
- Wounds that are already infected or dirty should not be sutured.
- Deep wounds with extensive underlying tissue damage, such as major crush wounds, should not be sutured.
- Wounds that are more than twenty-four hours old should not be sutured; in fact, it is advisable to avoid suturing wounds that are more than eight hours old. These wounds need to be incised to fresh skin/flesh.
- Try to avoid suturing animal or human bites because these wounds frequently become infected.
- Do not pull skin together to close a wound particularly if it leaves a large empty space open underneath the skin.

Equipment:
- A well-stocked medical kit (these items will be present in most disposable suture kits) which contains the following:
  - Disinfectant (Betadine or equivalent)
  - Sterile gloves
  - Sterile drapes (available as prepacked disposable items)
  - Needle holder (hemostat could suffice, but not optimal)
  - Forceps (has other uses as well)
  - Surgical scissors
  - Suture material (4-0 Nylon with a curved needle will serve most emergency purposes)
  - Anesthetic (1% Xylocaine)
  - Syringes and needles for anesthetic (several 3 ml syringes and 22 to 27 gauge needles)
  - Gauze pads
Remember, disposable kits of any kind, whether a suture set or any other kind of kit, are DISPOSABLE. DO NOT REUSE ANY ITEM FROM THE KIT. Properly dispose of all items including used needles, other sharp items, dressings and gauze.

Local Anesthesia:

- With the smallest needle available, using proper injection technique with aspiration, inject small volumes (0.5 ml) of xylocaine at the wound edge every 3/4 inch on both sides of the wound.
- Insert the needle just under the skin and parallel to the surface about 1/4-1/2 inch deep from the edge of the wound.
- Wait five minutes for the anesthetic to take effect, then test for feeling by pricking the patient's skin gently with a sterile or other clean, sharp object.
- Add more anesthetic as needed. Xylocaine will be effective for 45-90 minutes.

Suturing Procedure:

- When the wound is well anesthetized, clean it more thoroughly with betadine. Scrub the skin around the wound edge with betadine on a gauze pad at least four inches from all sides of the wound.
- Start at the center of the wound and work outward. Pick and scrub any remaining contaminants and blood clots from the wound before suturing. This will help to prevent microbes on the skin from contaminating the wound further.
- This scrubbing process should be carried on for a period of time, and the golden lather resulting should be allowed to remain on the area for about three to five minutes.
- This cleaning may start fresh bleeding, which should be controlled with direct pressure.
- After cleaning, rinse the area off with sterile gauze saturated with sterile water or sterile normal saline.
- The area around the wound should then be covered with sterile drape material, but the wound itself should be exposed. This will keep the suture material and the suture needle from touching non-sterile areas.
- After cleaning the area with betadine, keep a sterile towel under the area being sutured.
- It is important to plan the closure ahead of time. Sutures once in place will hold wounds closed under tension.
- It is important to keep in mind that tension causes increased scarring and skin breakdown.
- The more sutures used, the less tension on each suture. Usually, sutures work best placed every ½ inch.
- Gaping wounds and wounds over joints will require closer spacing.
- The initial suture is best placed at one end of the wound which gives an opportunity to see how much tension it takes to hold the wound closed. If it is difficult to make the knots stay in place, the sutures can be placed closer together.
- The sutures should be planned so that they bring corresponding parts of the wound back together.
Suture Technique:
Begin by holding the needle holder about 3/4 of the way up the curve from the point.

- The needle should enter the skin about 1/4 inch from the wound edge, or more, depending upon the thickness of the skin and tension of the wound.
- Deeper and higher-tension wounds require wider sutures.
- Pass into the tissue about as deep as the distance from the wound edge to the suture, then arc under to come out in the wound itself. Then pass into the other side of the wound at the same level exited from the first side, passing up to the skin surface at the same distance entered initially, and grasp the needle with the forceps and lead it through the skin.
- Use the forceps gently, trying not to damage more tissue by crushing skin edges.
- Pull the suture through until 3 inches remain above the skin, tie a surgeon's knot or a square knot to finish the suture, and cut the suture ends ½ inch above the knot. Repeat the steps over and over until the wound is closed.
- Cover the sutures with a dry dressing and keep the wound covered and dry for 24 hours.
- After 24 hours, depending upon the injury, the sutures may be either left exposed or covered. It may be more comfortable to cover them, especially if the sutures snag on clothing or other material.
- The wound area should be protected from water, bathing and swimming, for at least seven days.
Over and over sutures (interrupted and continuous)

Subcuticular suture (interrupted and continuous)

Horizontal mattress sutures (interrupted and continuous)

Vertical mattress sutures (interrupted and continuous)

Lambert sutures (interrupted and continuous)

Cushing suture

Evertling suture

Lock-stitch suture

Halsted suture

Connell suture

Purse-string suture
Suture Removal:
- Skin sutures may be left in place between seven to 14 days, depending on the amount of strain on the sutures.
- Less time minimizes scarring, so remove facial and hand sutures early. More time maximizes strength.
- If a wound becomes infected, remove the sutures immediately with sterile instruments. Pull one end of the suture with forceps until the knot rises free from the wound.
- Cut the loop of the suture on one side of the knot only, and continue to pull until the entire suture comes out.
- If there are any doubts about the strength of the wound after the sutures are removed, it is best to reinforce the closure with butterfly closures or tapes as previously described.
CHAPTER 5
SPINAL ANATOMY

123 pairs of peripheral nerves (spinal nerves)
8 cervical
12 Thoracic
5 Lumbar
5 Sacral
1 Coccygeal
Blood supply to the spinal cord: horizontal distribution

Posterior spinal artery

Peripheral Central

Anterior spinal artery

Anterior

The central area supplied only by the anterior spinal artery is predominantly a motor area
GUIDELINES AND CONSIDERATIONS:

NOTE: If patient is unconscious, assume spinal injury. The spine-injured patient, even if awake, may not complain of pain. Use correct technique (in-line stabilization) and enough people to move the patient without manipulating the C spine.

There are Five Basic Groups of Spinal Injuries:
1. Muscular or ligamentous strains or contusions (e.g., lumbosacral strain or cervical whiplash)
2. Intervertebral disc injuries
3. Vertebral fracture/dislocation without any involvement of the spinal cord
4. Vertebral fracture/dislocation with injury to the spinal cord
5. Penetrating injuries to the spinal cord and its surrounding tissue

Mechanism of Injuries (MOI):
• Direct trauma to head, neck, face
• Falls or dives into shallow water
• Acceleration/deceleration injuries
• Ejections
• Blunt trauma
• Penetrating injury
• Blast Injury

Treatment:
1. Maintain Airway.
2. Immobilize Neck - C-collar, spine board (do not restrict breathing).
3. Perform primary and secondary surveys.
4. Palpate entire spine for point tenderness.
5. Perform sensory/motor function check.
6. Oxygen 8 liters per minute.
7. IV normal saline or ringers lactate and titrate, or saline lock.
8. Clean and dress open wounds.
9. Urethral catheterization, monitor urine output.
10. Place NG tube if patient is unconscious. Consider NG even if patient is awake. CAUTION: Be prepared for vomiting, prevent aspiration.
11. Check neurological function q 15-30 min and record.
12. NOTE: Consider antibiotics if open wounds are associated with the injury and evacuation is delayed.

SOLU-MEDROL PROTOCOL FOR BLUNT (NON-PENETRATING) SPINAL CORD TRAUMA.

Guidelines and Considerations: To be used only in cases of blunt trauma with signs and symptoms of spinal cord injury. It is most effective when started as soon as possible after the injury occurs.

Initial dose: 30 mg/Kg Solu-Medrol IV push, give over 1-2 minutes.
Maintenance dose: 5.4 mg/Kg/hour by continuous IV drip for 23 hours.
• If the protocol is started more than 6 hours after the original injury, continue the IV drip for 48 hours.
All persons started on the Solu-Medrol protocol should also receive ulcer prophylaxis: Zantac, 50 Mg IV or IM every 6-8 hours, or 150 Mg orally every 12 hours.

Example Solu-Medrol Protocol Calculation: A 100 Kg person requires an initial bolus of 3 GRAMS of Solu-Medrol, followed by an IV drip giving 540 mg of Solu-Medrol per hour for the next 23-48 hours.

1. DANGEROUS SITUATION: NOTE: Accomplished when C-spine precautions will adversely affect the ability to accomplish the treatment AND all of the following conditions are met and documented:

   a) The patient is fully awake and alert with no alcohol or medications on board that might alter his sensorium or level of consciousness.

   b) The patient has no painful ‘distracting’ injuries (such as femur fracture, pelvic fracture, and long bone fracture or significant chest/abdominal injury). No significant head or facial trauma.

   c) The patient has a completely normal motor and sensory neurological examination, and does not have any significant neck pain or any midline or paraspinous muscle spasm.

   d) There is no pain or tenderness to palpation of the posterior cervical spine, and no palpable step-offs of the cervical spine. No muscle spasm in midline or paraspinous muscles.

   e) The patient has no other injury that might require long-board immobilization (thoracic or lumbar spine injury, pelvic fracture).

   f) The patient has no pain on unassisted range of motion of the neck.

   g) Low suspicion of cervical spine injury based on mechanism of injury.

NOTE: This protocol does not fully clear the cervical spine. However, if properly done, this protocol will insure that the chance of missing a clinically significant cervical spine injury is minimal.

CAUTION: If in doubt, immobilize the cervical spine.

DANGEROUS SITUATIONS ONLY: Penetrating trauma to the neck alone does not absolutely require C-spine immobilization. However, minimize motion of the neck as much as possible.

SENSORY LEVEL DETERMINATION: BY DEMATOMES

MOTOR LEVEL DETERMINATION:

DECORTICATE POSTURING: Arms flexed, Legs extended = lesion at or above upper brainstem.

DECEREBRATE POSTURING: Arms and legs extended = lesion in the brainstem

FLACCID PARALYSIS: Usually indicates spinal cord injury.
SPINAL CORD TRANSECTION (COMPLETE)

Definition: No preservation of any motor or sensory function more than 3 segments below the level of lesion. Complete

Cervical Spine
- Quadriplegia
- Incontinence
- Respiratory paralysis

Below T-1
- Incontinence
- Paraplegia

Note: If sacral sensation around the anus, voluntary rectal sphincter contraction and voluntary toe flexion are intact than the injury is incomplete.
Crush Injury or compression from a hematology
Compression of the Anterior Spinal artery
Paraplegia below the lesion
Pain and temperature loss below the lesion
Sparing of dorsal column sensation

Central Cord Syndrome

Most common of the partial cord syndromes
Hyperextension injury in athletes
Ligamentum flavum buckles and increases pressure on the cord
Bilateral motor paresis greater in the upper than lower extremities
Shawl distribution pain and temperature loss
Sparing of light touch and proprioception
Good prognosis
Bladder dysfunction

Figure 2-28: Anterior Spinal Artery Infarction.

Figure 2-29: Central cord syndrome.
BABINSKI TEST

Stroke lateral aspect of the bottom of the foot
Evaluate for movement of the toes
Fanning and Flexing (lifting)
Positive sign
Injury along the pyramidal (descending spinal) tract

Managing injuries of the cervical spine

If a patient has injured his spine, the important factor in caring for him is whether his injury is stable or not. The diagnosis of stability is partly clinical and partly radiological, and is critically important in his neck. An injury of any part of the spine is unstable if any of the following conditions hold:

- The patient has any neurological signs (the only exception is an acute extension injury of his neck.
- He has any signs of instability on clinical examination. These are: (a) some break in the continuous line of spinous processes from his neck to his sacrum, or (b) any soft doughy areas between his spinous processes into which your finger can sink. Such an area shows that the ligaments between the spines of his vertebrae have been ruptured, and that his spine is unstable at this point.
- He has X–ray signs of instability, in normal or flexion and extension views. Don’t be misled by a normal X–ray, because his bones may have moved out of place at the time of the injury, and now be back in place again. So, if a routine X–ray is normal, he can still have an unstable spine. You may need flexion and extension views to show instability.

If a patient has had no neurological signs at any time, no clinical signs of instability, and his X–rays are normal, treatment depends on his pain and stiffness. If this is mild, persuade him to ignore his injury and move his neck. If pain and stiffness are severe, put him to bed. If you cannot X–ray him or interpret his films, be safe and fit him with a collar.

If he has a stable injury radiologically and no neurological signs, fit a collar. Stable injuries are:

- all anterior wedge fractures, (2) minor burst fractures (major ones are unstable), (3) fractures in which there is an anterior gap between two vertebral bodies in an extension film.
- If he has an unstable injury and no neurological signs, put him in cuirasse. Traction is a preferable alternative, but if you are not expert and nursing care is less than perfect, he may be safer in a cuirasse. These injuries include all dislocations. These are rare precious patients.

If a patient has or has had neurological signs, his injury must be unstable, even if his X–ray looks normal. Treatment depends on their severity. If his neurological signs have now gone, give him a cuirasse, or better, apply traction. If his quadriplegia is only partial, apply traction. If his quadriplegia is complete, apply traction for a week. If it shows no sign of improving in a week, there is no point in continuing it, because it will hinder nursing care. Complete or partial recovery is more likely to occur with cervical than with thoraco–lumbar injuries.
If you are in doubt as to what to do, treat the injury as if it is unstable. Overtreat an injury of the cervical spine rather than undertreat it. This is the reverse of the advice for the lumbar spine. For example, if a patient has a painful neck after an injury, and you are not sure what to do, fit a collar. If you think traction might help, apply it.

PARTICULAR CERVICAL SPINE INJURIES

Wedge fractures Ignore these, but fit the patient with a collar for comfort. Burst fractures if he has no neurological signs, apply traction for 6 weeks, followed by a collar for 12 weeks. Extension injuries don’t usually cause fractures, but they may injure the anterior longitudinal ligament. Fit a collar for 2 to 3 months. If he has a collar and if there are no other reasons for keeping him in bed, encourage him to get up.

A NORMAL X–RAY DOES NOT NECESSARILY MEAN A STABLE SPINE
Hangman’s fracture (C-2 fracture)

It’s the fracture of pedicle of C-2 vertebra

5-10% injuries are caused by Hyperextension of spine.
Its very fatal injury.
Odontoid fr: / C-2 Fr:/ Axis Fr:

Most commonly missed cervical spine fracture.
It constitutes 10% of cervical injuries.
Failure to diagnose this fracture can lead to lethal complications and even Death.
3 types
Treatment : mainly Halo jacke
Bilateral Facet Dislocation

Hyperflexion with Rotation (MVA/Diving)
Disruption of all the spinal ligamentous columns
Highly unstable
Almost always quadriplegic (Poor prognosis)
Back Pain, Low

- Low back pain is an extremely common affliction.
- Most low back pain results from strain or mechanical stress, is self-limited and resolves in 4-6 weeks.
- Identification of worrisome signs or symptoms (e.g., pain over 6-8 weeks, night pain, weight loss, neurological injury including loss of bowel and bladder control) will determine which patients require additional testing or treatment.
- Evaluate trauma causing low back pain for the presence of a fracture.
- Although very common in adults, low back pain is unusual in children and adolescents and warrants investigation.

Symptoms

**Worrisome** symptoms include persistent fever, night pain, weight loss and progressive neurological symptoms such as progressing weakness or saddle anesthesia.

Loss of bowel or bladder control in a non-trauma patient suggests cauda equina syndrome, a rare condition that is a surgical emergency to prevent chronic neurologic damage.

**Location:**
Low back pain may be midline, one-sided, radiate into the hip or buttock. Numbness or tingling radiating past the knee, and/or lower extremity weakness suggests a herniated disc pushing on a nerve.

**Objective:** Acute traumatic low back pain – screen for signs of fracture.

**Inspection:** Obvious deformities – acute trauma (think fracture) or chronic pain (look for scoliosis).

Any mass – tumor. Skin erythema – infection or tumor.

**Palpation:** Step-off on spinous processes – sign of fracture. Palpable spasm—sign of trauma.

Palpable mass—tumor. Abnormal neuro exam including motor function (extensor hallucis longus [great toe pulled up], peroneals [feet held up and out/inverted], and quadriceps extension), sensation (first metatarsal to anus), or deep tendon reflexes (Achilles and patellar tendon) indicates a possible CNS lesion or trauma. If there is loss of sensation in the anal area, check the anal sphincter tone. Loss of sphincter tone and sensation about the anus suggests neurologic damage to the sacral nerves, such as in cauda equina syndrome or serious damage to the spinal cord. Unless other red flags are present, initial evaluation of low back pain does not require X-rays. Manual muscle test scale is 0-5 with 0 being absent and 5 normal. Deep tendon reflexes are 0-4 scale, with 0 being absent, 2 normal, and 4 being hyperactive with clonus.

**Differential Diagnosis**

The differential diagnosis of low back pain is extensive and includes:

- mechanical low back pain
- sciatica, herniated disc with or without nerve impingement
- spondylolysis with or without spondylolisthesis
- scoliosis, sacroiliac joint dysfunction
- infection
- ankylosing spondylitis
- spinal stenosis
- abdominal aortic aneurysm in elderly patient
- various benign and malignant tumors
- fracture
- cauda equina syndrome.
• prostate
• strain/sprain
• kidney stones
• pelvic inflammatory conditions
• Urological conditions
• pyelonephritis
• labor
• and pancreatitis

Treatment

Primary: Usual treatment of mechanical low back pain includes
• Chiropractic
• ice
• anti-inflammatories such as ibuprofen (800 mg tid with food)
• progressive range of motion exercises and trunk strengthening.
• Bed rest is not indicated unless absolutely essential, as it merely causes deconditioning
• Epidural steroids are sometimes used; oral steroids are not recommended.
• Cauda equina syndrome, a rare complication where there is compression of the cauda equina in the spinal column causing neurological impairment, may become permanent if not surgically repaired in 12-24 hours.

Fractures of the thoracic and lumbar spine

• The spinal cord ends at L1.
• A patient with a fracture at or above this level is usually either grossly injured and paraplegic, or has a stable fracture.
• Below this level he can have an unstable fracture and a normal cauda equina.
• If a patient has no cord injury, you can easily miss these fractures.
• His spine can be injured by a force which compresses or flexes it, usually at T7–T8
• the apex of his thoracic kyposis, at T12–L1
• the thoraco-lumbar junction
• or at L4–L5.

If a patient has a fracture especially a wedge fracture, after only a minor injury, suspect that it may be pathological, and the result of a secondary tumour or osteoporosis.

If all you can see is a widened disc space, count his spinous processes, and see if they match his vertebral bodies. The widened disc space may be all that remains of a vertebral body.

If his fracture is stable, the active movements regime described below will give better results than a plaster cast and be cheaper.

If his fracture is unstable his accompanying paraplegia dominates his management.
4. Fixation with interspinous plates is not established as better than conservative management which almost always leads to stable union in 6 to 10 weeks.

Assess whether the patient’s fracture is stable or not by the criteria already described. If you are in doubt, treat his injury as unstable.

STABLE FRACTURES Treat wedge fractures, minor burst fractures, and laminar fractures in the same way.
• Treat conservatively as you wound for a strain/sprain.

UNSTABLE FRACTURES are usually fractures of the posterior elements with subluxation. These need to be treated by an Orthopedist or Neurosurgeon.
CHAPTER 6
HEAD INJURIES

GUIDELINES AND CONSIDERATIONS:

• All patients with significant Head/Face injuries have a spinal injury until proven otherwise.
• Use in-line stabilization & enough people to move pt w/out manipulating C -Spine.
• Maintain airway. Do not obstruct breathing
• Maintain a high index of suspicion for cerebral insult until proven otherwise.
• The most important element in assessment of head injury is LOC and noted changes.
• Serial Glasgow Coma Scale readings should be accomplished on all head injury patients.
NOTE: Isolated head injuries do not cause shock. If shock is present in such a patient, search for other causes of shock.

PHYSICAL FINDINGS AND INDICATIONS

Primary Survey:
ABCs: An open and secure airway is critical.
• Patients with head injuries commonly vomit or patients tongue blocks airway.

Vital Signs: Observe and record every 5 minutes.
• Observe Blood Pressure for: Increasing Intracranial Pressure (ICP); Increasing BP; Widening pulse pressure. If possible, maintain BP between 100-140 mmHg systolic.
• Pain and fear can also increase BP
• Observe Pulse for: ICP intracranial pressure] with decreasing pulse rate; slowing of pulse rate (strong/steady/bounding)
• Observe Respirations for: Increasing, decreasing and/or become irregular; Cheyne-Stokes: An abnormal type of breathing seen especially in comatose patients, characterized by alternating periods of shallow and deep breathing.
• Fear, hysteria, chest injuries, etc. also affect respiratory rate (not as reliable as other VS)
• Observe for Cushing’s Reflex: Slowing pulse rate, deep erratic respirations, and increasing blood pressure.

Secondary Survey:
1. Obtain a history if possible to determine the MOI [method of injury].
3. Examine the scalp for evidence of bleeding, swelling and deformity.
4. Examine the nose and ears for blood and cerebral spinal fluid.
5. Gently palpate the skull (don't press on depressed areas or explore open wounds.)
6. Observe pupillary reaction
7. Record all findings and continue with remainder of secondary assessment.
Treatment:

1. Secure airway, ensure breathing and circulation
2. Maintain cervical spinal immobilization
3. Oxygen 4-8L/min (If evidence of increased intracranial pressure, see next section)
4. IV normal saline, titrate appropriately (If shock develops give adequate fluid volume to maintain systolic blood pressure at 100). Saline lock is an excellent alternative to having a running IV in place.
5. Gently dress all scalp wounds (If there is concern of underlying fracture, do not apply pressure)
6. Transport ASAP. If possible, elevate the head of the patient by raising the head end of the litter 1-2 feet higher than the foot end of the litter.
7. If bleeding from scalp wounds is not controlled by pressure, consider suturing with 0-nylon or use skin staples to close. CAUTION: If brain tissue is seen in the wound, DO NOT irrigate with dilute betadine solution: Irrigate with normal saline only.

INCREASED INTRACRANIAL PRESSURE (ICP): Increased ICP can be the result of several different types of intracranial processes. Some, such as subdural or epidural hematoma [blood clots] can only be managed definitively by surgical intervention. Diffuse brain injury causing swelling of the brain itself can be treated to some extent in the field. As the brain swells, a herniation syndrome can result, where the intracranial contents shift and herniate through the cranial foramen.

Signs & Symptoms:

• Asymmetric Pupils:
  • Classically a large, fixed pupil suggests herniation, usually with the expanding mass on the same side as the fixed & dilated pupil. Typically, changes progress from sluggish pupil → odd-shaped pupil → fixed/dilated pupil. Asymmetrical pupil size, responsiveness or size differences of 1.5 mm are considered pathological until proven otherwise.
  
  NOTE: Approximately 3% of the population have asymmetric pupils normally (anisocoria) and that some eye surgery can result in odd-shaped and fixed pupils.
• Motor examination showing decreased strength, localized weakness or abnormal motor posturing.
• Abnormal cranial nerve examination (especially decreasing gag reflex), pupillary response or corneal reflexes.

Treatment:

1. Hypotension is rarely caused by isolated head injury. Regardless of cause, hypotension must be treated aggressively in the setting of acute head injury. Keep systolic BP above 95 mmHg by stopping bleeding and appropriate fluid resuscitation.
2. CAUTION: Vasoconstriction resulting from hyperventilation can INCREASE cerebral damage by reducing cerebral blood flow.
3. Elevate the patient’s head higher than his feet by 1-2 feet. The patient should be kept flat: Elevate the head of the stretcher/stokes litter to accomplish this.
4. NOTE: Steroids are ineffective in treating traumatically induced cerebral edema, and should NOT be used in the setting of trauma-induced increased ICP.
5. Seizure in the setting of acute head injury is a serious sign, and should be treated aggressively. Insure the patient is being adequately oxygenated, and give Diazepam, 0.1 mg/Kg up to 5 mg IV every 5 minutes (up to a max dose total of 20 mg).
FACIAL AND EYE TRAUMA

AIRWAY OBSTRUCTION FROM:
Posterior Tongue Displacement:
• Unconscious patient: Jaw thrust or chin lift.
• Conscious patient: Most common cause is bilateral mandible fracture. Have patient bend forward (CAUTION: C-SPINE CONTROL) and pull tongue forward or insert airway adjunct.
Oropharyngeal Bleeding:
• Rotate supine patient to the side. Allow for drainage. (CAUTION: C-SPINE CONTROL)
• Suction & direct pressure if possible.

Edema:
• Early intubation if possible
• If unable to intubate, cricothyroidotomy may be needed

Blood Loss from Facial Trauma:
• Pressure dressing to most areas of face.
• Specific locations:
  • Severe Tongue Laceration: If pressure unsuccessful, a few sutures may be needed.
  • Gingiva, Floor of Mouth, Buccal Mucosa: Pressure dressing with roll of sterile gauze.
Have patient bite on roll or hold in place with pressure.

Nasal Bleeding:
1. Direct pressure: Pinch anterior portion of nose between fingers for a minimum of 5 minutes.
2. Packing: Anterior or Posterior. NOTE: All patients who have had nasal packing should be given antibiotics (Keflex, 500 mg q. 6 hours or Cefotan, 1 gram IV or IM q. 12 hours). CAUTION: DO NOT attempt to pack a nose if a cerebral spinal fluid (CSF) leak is suspected.
• Anterior Pack: Layer strips of petrolatum gauze in one or both nostrils.
• Posterior Pack: Used if bleeding persists in the nasopharynx after the anterior packing.
NOTE: Observe patient closely. If the pack becomes loose it can easily obstruct the airway.

OCULAR TRAUMA:

Guidelines and Considerations:
1. Obtain history of injury, pre-existing conditions, i.e. contact lens use. If chemically induced, type of chemical, treatment, visual disturbance, pain, any other associated injuries.
2. Time of injury.
3. Obtain gross visual acuity and record. Visual acuity can be as simple as light perception, count fingers at three feet, read this book at 2 feet, etc.
NOTE: Always obtain a visual acuity with ocular injuries! (Before and after treatment, if possible)
CAUTION: In cases of chemical splash injury to the eye, begin irrigation immediately!
SOME EYE INJURIES

Rupture of the globe

Rupture of the choroid
black uveal tissue herniating through a wound in the sclera

retinal vessels

A

rupture

macula

anterior chamber

d

C

Hyphaema

fluid level

iris

lens

pupil

blood

cornea
Physical Examination and Treatment

Eyelids: Assess for: Edema, bruising, burns, movement and strength, ptosis, foreign bodies impacting the globe.
Foreign bodies. Invert lid to examine globe for laceration, penetrating injury, and impaled object.
Treatment: Apply dressing and transport. DO NOT suture laceration.

Orbital rim: Gently palpate for: Depressed fractures or loss of sensation to the skin above and below the globe.

Globe: Retract lids without applying pressure to globe. Examine for: Forward or retro displacement of the globe. Assess for: Normal movement and double vision at the extremes of gaze and integrity of the globe. Examine for: Foreign body or obvious damage.
Conjunctiva: Assess for: Signs of infection, evidence of subconjunctival air, hemorrhage, or foreign bodies.

Cornea: Assess for: Tears, abrasions and clarity.

Foreign Body:
Examine for: Pain, foreign body sensation. Treatment: Irrigate eye and treat as for corneal abrasion. If foreign body is still present instill antibiotic ointment. Patch both eyes to prevent eye movement. Transport.
CAUTION: If it appears the foreign body has penetrated into the anterior or posterior chamber: DO NOT patch and do not use ointment. Shield eye and transport.

Blood in Anterior Chamber (Hyphema): A sign of possibly severe eye injury.
Treatment: Keep patient as still as possible, maintain sitting position and immediate transport.

<table>
<thead>
<tr>
<th>Anterior blood layer</th>
<th>Torn iris</th>
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Iritis: May present as: Constricted, dilated or irregular pupil; swelling or severe photophobia.
Treatment: Rest and transport.
Lens: About the only lens injury you may be able to assess will be anterior dislocation. Treatment: Rest and transport.

Vitreous: Blood in the posterior chamber, interfering with light transfer through the vitreous may be assessed with a black rather than a red fundoscopic reflex. Treatment: Rest and transport.

Globe: Possible ruptured globe; Possible marked visual impairment. Vitreous may be seen extruding from the globe. Globe may be soft and anterior chamber flat or shallow. CAUTION: Palpation of globe may cause increased loss of vitreous. Treatment: Eye shield (no pressure applied to globe) and moist dressing. Immediate transport.

Chemical Injuries: Treatment: Copious irrigation for at least 30 minutes prior to or during transport. Use water, normal saline or lactated ringers. NOTE: Any water will do in a pinch. CAUTION: If the victim has had an alkali compound (such as lye or ammonia) splashed into the eye, irrigation must begin AT ONCE. This is the only time you do not take the time to evaluate the visual acuity prior to starting treatment. Continue irrigation for a minimum of 60 minutes or until directed to stop by medical control.

Traumatic Enucleation: Globe displaced from orbit. Treatment: Protect globe with moist sterile gauze, shield globe and immediate transport.

Convulsions after a head injury

These can occur following a head injury at any time, and can be of almost infinite variety, either focal or general. They are usually associated with sudden deterioration of consciousness. Prevent them with phenobarbitone. Treat them promptly in the hope of preventing status epilepticus, which may be fatal.

CONVULSIONS

Make sure the patient has a good airway. This may stop them.

If improving his airway fails, give him:
1. diazepam (A 2-4) intravenously for its immediate effect.
2. Follow this with phenytoin sodium (‘Epanutin’), first 250 mg intramuscularly, and then 50 mg, 6 hourly by mouth or tube.
3. Phenytoin causes very little depression of consciousness, so it will not mask the signs of clot compression.

If these fail to stop convulsions, give him paraldehyde into the outer side of his thigh.

If even these methods fail, give the patient:
• 10% paraldehyde in 0.9% saline (50 ml in 500 ml of saline) by Intravenous drip slowly, as necessary.
COMMON EAR PROBLEMS

Eustachian Tube Dysfunction
Overview:
- Eustachian tube is a structure connecting the nasopharynx and middle ear cavity.
- Normally it is closed but it opens when we swallow or yawn.
- It serves to equalize the middle ear air pressure to the outside.
- Moreover during diving, elevating or landing of flight, there is also change of pressure.
- If the tube does not work, the pressure in the ear will be different to that outside.
- Thus affecting our hearing.
- It is known to be a predisposing factor to infection of the middle ear.

symptoms
- ear blockage
- hearing one's own voice (autophony)
- intermittent ear discomfort
- tinnitus (ringing)
Common causes:
- allergic rhinitis i.e. hay fever
- upper respiratory infection
- adenoid enlargement
- nasopharyngeal cancer including the primary disease and post-radiotherapy
- drugs: such as oral contraceptive pills
- hormonal change
- significant weight loss
- stress and fatigue
- congenital cleft palate

Treatment:
- Perform microscopic examination of ear to rule out middle ear infection with fluid.
- Perform nasoendoscopy to exclude rhinosinusitis and nasopharyngeal cancer.
- drugs to enhance the opening of eustachian tube
- If severe, may need trial of grommet insertion.

Barotrauma
- Diving and flight elevation or landing, the pressure is changing
  - To adapt to it, pressure of middle ear should be changed accordingly by opening up the eustachian tube. Besides swallowing or chewing action, sometimes Valsava maneuver may be needed.
  - However if the eustachian tube function is impaired or the change of depth or height level is too fast,
    - pressure of middle ear cavity cannot be equalized and barotrauma may resulting in perforation,
    - middle ear cavity mucosa resulting in bleeding and fluid collection, even the inner ear through the round window causing severe sensorineural hearing loss.
- Diving and flight elevation or landing, the pressure is changing
  - To adapt to it, pressure of middle ear should be changed accordingly by opening up the eustachian tube. Besides swallowing or chewing action, sometimes Valsava maneuver may be needed.
  - However if the eustachian tube function is impaired or the change of depth or height level is too fast, pressure of middle ear cavity cannot be equalized and barotrauma may resulting in perforation, middle ear cavity mucosa resulting in bleeding and fluid collection, even the inner ear through the round window causing severe sensorineural hearing loss.
Simple nosebleed is usually caused by a burst capillary near the opening on the inside of the nose. The larger the blood vessel, the more severe the bleeding. As with any bleeding point, to prevent further blood loss pressure is required at the injury site. Here, we are concerned with the floppy, fleshy bits of the face and once you have examined the extent of the blood flow by lifting the handkerchief, etc., from the upper lip end, proceed as follow:

1. Using your thumb and forefinger, hold a clean pad against either side of the tip of the nose and pinch your fingers together.
2. Whenever possible, involve your casualty by letting them hold the pad in place. This will allow you to clean the person up.
3. Make sure that the head is tilted forward as swallowed blood causes vomiting.
4. Apply pressure for some ten minutes by which time the clotting process should have started. If on examination there is still bleeding, continue pressure for a further ten minutes.
5. Should bleeding continue beyond half an hour, the casualty will have to attend Hospital for more intensive treatment.

In case of an injury on the bony part of the bridge of the nose, there may well be a fracture which can be identified by bruising and swelling in this case pressure must, of course, not be applied. Care must be taken to prevent any blood being swallowed; a person with a nose fracture can least afford to vomit as well. Removal to hospital is vital and, while waiting for the ambulance, take the following steps:
1. Do not pinch the nose since the injury is much higher up than the tip. In any case, it is very doubtful whether the casualty will permit you to touch any part of their face.
2. No one has died from a nosebleed yet, unless there was other evidence of a more sinister injury.
3. Tilt the casualty’s head forward, give them a large towel and ask them to hold it to their face. They will know by feel how near to the face the towel should be held.
4. Make sure that person remains stable and reassure them as much as possible.

Nose fracture

A nose fracture is a break in the bone or cartilage over the bridge, or in the sidewall or septum (structure that divides the nostrils) of the nose.

Considerations

- A fractured nose is the most common fracture of the face. It usually occurs after an injury and often occurs with other fractures of the face.
- Sometimes a blunt injury can cause the wall dividing the nostrils (septum) to separate.
- Nose injuries and neck injuries are often seen together because a blow that is forceful enough to injure the nose may be hard enough to injure the neck.
- Serious nose injuries cause problems that need a health care provider's attention right away. For example, damage to the cartilage can cause a collection of blood to form inside the nose. If this blood is not drained right away, it can cause an abscess or a permanent deformity that blocks the nose. It may lead to tissue death and cause the nose to collapse.

Occasionally, surgery may be needed to correct a nose or septum that has been bent out of shape by an injury.
Symptoms
• Blood coming from the nose
• Bruising around the eyes
• Difficulty breathing through the nose
• Misshapen appearance (may not be obvious until the swelling goes down)
• Pain
• Swelling
The bruised appearance usually disappears after 2 weeks.

First Aid
- Try to stay calm.
- Breathe through your mouth and lean forward in a sitting position to keep blood from going down the back of your throat.
- Apply cold compresses to your nose to reduce swelling. If possible, hold the compress so that there isn't too much pressure on the nose.
- To help relieve pain, acetaminophen (Tylenol) is recommended.
- Do NOT try to straighten a broken nose.
- Do NOT move the person if there is reason to suspect a head or neck injury.

Get medical help right away if:
• Bleeding will not stop
• Clear fluid keeps draining from the nose
• You suspect a blood clot in the septum
• You suspect a neck or head injury
• The nose looks deformed or out of its usual shape

- Serious injuries should be treated, then nasal inspection and palpation may be performed to assess for airway patency, mucosal laceration, and septal deformity.
- A thorough examination of the nose and surrounding structures, including the orbits, mandible, and cervical spine, should be completed.
- Imaging studies are necessary for facial or mandibular fractures.
- Patients with septal hematomas, cerebrospinal fluid rhinorrhea, malocclusion, or extraocular movement defects should be referred to a subspecialist.

Anatomy
The nose is easily exposed to trauma because it is the most prominent and anterior feature of the face. The nose is supported by cartilage anteriorly and inferiorly, and by bone posteriorly and superiorly (Figure 1). The paired nasal bones, the nasal process of the frontal bone, and the maxilla form a framework to support the cartilaginous skeleton. Although most of the nasal structures are cartilaginous, the nasal bones usually are fractured in an injury.

Overlying this framework are soft tissues, mucous glands, muscles, and nerves responsible for sensation and function of the nose. By virtue of its natural taper, the supporting nasal septum becomes increasingly thin and is therefore subject to fracture toward the tip of the nose.
The relative ease by which epistaxis can occur with minor trauma is explained by the dense and redundant vascular network that supplies the nose. This plexus, known as Kiesselbach’s area, is responsible for the vast majority of normal epistaxis.

Bleeding as a result of nasal fracture usually originates from other locations within the nose. For example, profuse anterior bleeding may originate from the anterior ethmoid artery (a branch of the ophthalmic artery), while posterior bleeding is more likely to arise from a branch of the sphenopalatine artery.

Arterial ligation may be necessary if packing fails to control bleeding. In such cases, early consultation with an otolaryngologist is indicated.

PHYSICAL EXAMINATION

● Most nasal fractures are the result of minor trauma such as being punched or elbowed.

● When assessing a patient with an acute nasal injury, the physician should avoid focusing solely on the obviously traumatized nose.

● A substantial direct blow to the mid-face area can result in cervical spine injury, therefore exercise clinical judgment in using appropriate precautions until a cervical spine injury is ruled out.

● Be certain that the patient has an adequate airway and is ventilating appropriately.

● Given the close proximity of the nose to other facial structures, the physician must consider the possibility of an associated facial or mandibular fracture.

● All bony structures of the face, including the malar eminences, orbital rims, zygomatic arches, mandible, and teeth, should be carefully inspected and palpated for irregularity or tenderness.

● All facial lacerations, swellings, and deformities should be noted, and the eyes should be examined for symmetry and mobility of gaze.

● If a facial or mandibular fracture is suspected, radiologic assessment with computed tomography (CT) is indicated.

● Edema and bruising of the nose and periorbital structures ordinarily will be present, particularly if examination is performed more than several hours after the injury.

● Palpation of the nasal structures should be done to elicit any crepitus, indentation, or irregularity of the nasal bone.

● A patient with an uncomplicated acute nasal fracture, it is appropriate to prescribe pain medication and release the patient with instructions to rest, apply ice, and maintain head elevation.

Figure 2
Bilateral septal hematomas associated with a nasal fracture.

● The initial internal inspection usually will reveal the presence of large blood clots, which should be removed with warm saline irrigation, suction, and cotton-tipped applicators.

● Adequate anesthesia and vasoconstriction should be obtained before the complete internal examination. This is best achieved with topical agents administered as sprays, impregnated cotton-tipped applicators, or local injections.
Alternatives for anesthesia include intranasal topical lidocaine (Xylocaine), bupivacaine (Marcaine), and pontocaine (Opticaine) spray.

Topical vasoconstrictors, such as oxymetazoline (Afrin) and phenylephrine hydrochloride (Neo-Synephrine) are useful adjuncts for controlling bleeding and decreasing intranasal edema.

Some experts report that a 1:1 mixture of the topical decongestant oxymetazoline or phenylephrine and 4 percent topical lidocaine (liquid) is as effective as cocaine.

Assess nasal airway patency and should determine if ongoing epistaxis or septal deformities are present. The turbinates and inferior meatus should be visualized bilaterally, and the septum must be carefully inspected for septal hematomas.

Finally, any mucosal lacerations should be noted because they may suggest an underlying fracture.

Management

After ensuring airway patency, adequate ventilation, and overall stability of the patient, the physician can devote attention to the nasal fracture itself.

Treatment begins with management of external soft tissue injuries. If an open wound is present and appears to be contaminated with foreign matter, copious irrigation will be required. Some debridement also may be necessary. However, debridement should be done judiciously because tissue will be needed to cover any exposed cartilage.

Reduction of acute nasal fractures in the primary care setting is confined largely to the closed reduction of mild unilateral fractures. However, on rare occasions, open reduction in an operating room is necessary. It is worthwhile for family physicians to understand how closed reduction of a nasal fracture is performed, although it is not considered a standard family medicine procedure.

Manual realignment is the easiest method of closed reduction.

The Boies elevator offers more precision than forceps.

When used correctly, the Boies elevator is inserted into the nostril deeply to an internally or externally displaced fracture. The blade of the elevator opposes the physician’s thumb on the outside of the nose. The physician then gently attempts to raise or depress the misaligned bones to their original configuration. The reduction may be felt as the fractured bone returns to its proper alignment.

A septal hematoma is a blood-filled cavity between the cartilage and the supporting perichondrium. If left untreated, these pockets of blood easily become infected. The resulting necrosis of the underlying cartilaginous support may result in permanent saddle nose deformity. When a septal hematoma is identified, it should be aspirated immediately or incised with the aid of local anesthesia. To prevent reaccumulation of blood, a sterile drain may be left in place. However, there is conflicting evidence regarding the benefit of using a drain. Splints or sutures may be applied to both sides of the septum to provide pressure and support, or anterior nasal packing also may be used. If improperly managed, a septal hematoma may have a disastrous outcome. Therefore, the treating physician should consult with an otolaryngologist or plastic surgeon when feasible.

Figure 4
Management of septal hematoma. (A) Cross-sectional view of a septal hematoma, showing blood accumulation between the septum and perichondrium. Treatment involves anesthesia, followed by (B) incision using a hemostat, (C) drainage of the hematoma, and (D) insertion of sterile gauze to prevent the reaccumulation of blood.
The physician should complete a final external and internal (endoscopic, if possible) examination before releasing a patient who has undergone manipulation and reduction of a nasal fracture. This examination should ensure alignment of the nose and the absence of significant epistaxis or hematomas. When completed, an external splint or cast should be applied to the nasal dorsum for about one week. If nasal packing is required, the physician should remember that nasal packing rarely has been associated with toxic shock syndrome. Accordingly, packing material should be impregnated with an antistaphylococcal ointment.

The tetanus status of all patients should be determined and managed appropriately; prophylactic antibiotics may be prescribed when indicated, such as in a grossly contaminated open fracture. Although most family physicians routinely will not perform closed reduction of nasal fractures, it is still important to understand the preliminary assessment and basic management principles. Furthermore, because of the uncertainty of functional and cosmetic outcomes following a nasal fracture reduction, referral to an otolaryngologist or plastic surgeon within three to five days post-reduction, while not absolutely necessary, usually is appropriate. Ideally, the referral should be arranged before the family physician releases the patient.

INJURIES OF THE LIPS, THE GUMS, AND THE TONGUE

LIP INJURIES

Tears of a patient’s lips are often caused by his teeth. If a piece of tooth is missing, feel for it inside his lip. Small tears on the inner surfaces of his lips don’t need suturing. Suture larger lacerations in layers. Close his mucosa as a separate layer.

ADVANCED

If a laceration crosses his skin–vermilion border, mark it with a felt pen before you inject the local anaesthetic because the anaesthetic will blanch it and make accurate alignment difficult. Use the first fine monofilament stitch to draw his skin–vermilion border together, as in D, and E, Fig. 61-4. Traction on this will cause the other structures to fall into line. If a laceration involves his labial sulcus, put your second suture into this, so as to align it. If you don’t, it may be obliterated later. If his orbicularis oris muscle is divided, suture it first with 3/0 catgut. Then bring his skin-vermilion border together. Finally, suture his mucosa with fine catgut. CAUTION! Preserve the line of his skin–vermilion border. If up to one quarter of his lip is missing, you can repair it by primary suture without great deformity. If so much of his lip is missing that you cannot close it by primary repair, suture skin to mucous membrane and apply a vaseline gauze pack held by adhesive strapping. Refer him.

GUM INJURIES

If a laceration of a patient’s gum retracts and exposes the margin of his alveolus, suture it. Dressings are not required. Remove skin sutures on day 4, and sutures in the mucous membrane on day 8.

TONGUE INJURIES
If a laceration does not involve the edge of a patient’s tongue, or leave a free flap, you may not need to do anything to it. Otherwise, suture it with catgut. If it is on the tip, suture it using ketamine and suction, or use local anaesthesia. If it is on the dorsum, he may need a general anaesthetic with nasotracheal intubation.

If the anterior two thirds of an injured tongue bleeds, hold it in a piece of gauze and pinch it between your finger and thumb behind the tear. Put in a mouth gag and repair it with fine silk. If deeper sutures are needed, use catgut.

If the tip of a patient’s tongue is almost completely avulsed, try to repair it. It will probably live.
If the posterior third of his tongue is bleeding, put your index finger over it, and press it down against his mandible.
If you cannot reach a severe tongue wound, do a tracheostomy under local anaesthesia. Pack the patient’s pharynx and repair his wound with deep stitches.

INJURIES INSIDE THE CHEEK: Repair these with catgut.

REPLACING A DISLOCATED JAW

CLINICAL CONSIDERATIONS

RECENT DISLOCATIONS Most patients need no anaesthetic.

Dislocations occur when two bones that originally met at the joint detach.
- Dislocations should not be confused with Subluxation. Subluxation is when the joint is still partially attached to the bone.
When a person has a dislocated jaw it is difficult to open and close the mouth.

If the pain remains constant, it may require surgery to realign the jaw.

The joint involved with jaw dislocation is the (TMJ). This joint is located where the mandibular condyles and the temporal bone meet.

There are four different positions of jaw dislocation: posterior, anterior, superior and lateral.

- The most common position is anterior. Anterior dislocation shifts the lower jaw forward if the mouth excessively opens. This type of dislocation may happen bilaterally or unilaterally after yawning. The muscles that are affected during anterior jaw dislocation are the masseter and temporalis which pull up on the mandible and the lateral pterygoid which relaxes the mandibular condyle.
- Posterior dislocation is common for people who get injured after being punched in the chin. This dislocation will push the jaw back affecting the alignment of the mandibular condyle and mastoid.

Superior dislocations occur after being punched as the mouth remains open. Since great force occurs in a punch, the angle of the jaw will be forced upward moving towards the condylar head.
Lateral dislocations move the jaw away from the skull and are likely to happen with other jaw
fractures.

Symptoms

• The symptoms can be numerous depending on the severity of the dislocation injury and how long the person is inflicted with the injury. Symptoms of a dislocated jaw include a bite that feels “off” or abnormal, hard time talking or moving jaw, not able to close mouth completely, drooling due to not being able to shut mouth completely, teeth feel they are out of alignment, and a pain that becomes unbearable.

• The immediate symptom can be a loud crunch noise occurring right up against the ear drum. This is instantly followed by excruciating pain, particularly in the side where the dislocation occurred.

• Short-term symptoms can range from mild to chronic headaches, muscle tension or pain in the face, jaw and neck.

In contrast, symptoms of a fractured jaw include bleeding coming from the mouth, unable to open the mouth wide without pain, bruising and swelling of the face, difficulty eating due to the constant pain, loss of feeling in the face (more specifically the lower lip) and lacks full range of motion of the jaw.

Most temporomandibular disorders (TMDs) are self-limiting and do not get worse.

Simple treatment, involving self-care practices, rehabilitation aimed at eliminating muscle spasms, and restoring correct coordination, is all that is required.

Nonsteroidal anti inflammatory analgesics (NSAIDs) should be used on a short-term, regular basis and not on an as needed basis. On the other hand, treatment of chronic TMD can be difficult and the condition is best managed by a team approach; the team consists of a primary care physician.

As with most dislocated joints, a dislocated jaw can usually be successfully positioned into its normal position by a trained medical professional. Attempts to readjust the jaw without the assistance of a medical professional could result in worsening of the injury.

Treatment

1. Sit the patient forward in a chair.
2. Ask an assistant to stand behind him and hold his head.
3. Put some gauze over his lower posterior teeth on each side.
4. Press his premolar teeth downwards.
5. At the same time press the underneath of his chin upwards and backwards.

If he opens his mouth too wide again, the dislocation may recur. So bandage his jaw to keep his mouth shut for 3 days. Allow him to open it just a little for eating.
There are two TMJs, one on either side, working in unison. The unique feature of the TMJs is the **articular disc**. The disc is composed of fibrocartilagenous tissue which is positioned between the two bones that form the joint. The disc divides each joint into two.

The **lower joint** compartment formed by the mandible and the articular disc is involved in **rotational** movement—this is the initial movement of the jaw when the mouth opens.
CONTROLLING BLEEDING IN HEAD INJURIES

GENERAL METHOD FOR LESSER FACE WOUNDS

PREP

If necessary, shave the patient’s scalp, moustache, and beard, but leave his eyebrows. A wound can be
difficult to align without them. Do a social and, when necessary, a surgical toilet. Clean his wound
adequately, irrigate it copiously, and explore it. You may find a fracture, or foreign bodies, such as glass
from a broken windscreeneen, or grit from the road.

Treatment: see general wound care

The prognosis in head injuries

During the first few hours following an injury you can seldom forecast what is going to happen to a
patient with a head injury.

- If he has fixed dilated pupils and does not respond to any stimuli, his prognosis is not good.
- If he is alert, he is going to live
- Although a patient may seem normal after a head injury, he may not be fully aware of what has
  happened, or be fit to drive a car.
- Subdural or extradural haemorrhage may occur later, so warn him and his relatives that he must
  return immediately, if he becomes drowsy or his headache gets worse.

ADVANCED

BLEEDING FROM THE SCALP and BRAIN INJURY

Bleeding scalp vessels are difficult to pick up in haemostats, because they are held by the fibro–fatty
tissue. Instead, use stitches, and control bleeding like this:

1. Ask one, or even two assistants, to press on the patient’s scalp close to the edges of the wound.
2. Pick up the cut edge of his galea with haemostats 1 cm apart along the incision. Then evert them so
   that they compress the bleeding vessels in the edge of his scalp. Keep them together in bundles with
   rubber bands round their handles, out the way of the operation.
3. Add adrenaline to the local anaesthetic solution. If the patient is having a general anaesthetic,
   infiltrate his scalp and temporalis muscle with adrenaline and saline.

Try to control all bleeding before you stitch up his scalp. If you don’t, a large haematoma may form
under it, become infected, and need opening later.

BLEEDING VEINS AND VENOUS SINUSES

When you operate, prevent venous bleeding by taking the following precautions before you start:

- Use methods of anaesthesia which minimize bleeding. It will be worse if the patient strains.
  Ideally, give him a general anaesthetic, intubate him under relaxants, and hyperventilate him. This will
  reduce his intracranial pressure and minimize bleeding. If general anaesthesia is unlikely to be perfect,
  local anaesthesia may be better.
(2) Make sure that nothing obstructs the veins of the patient’s neck. If necessary, raise his shoulders on sandbags.
(3) Reduce the venous pressure in his wound. Arrange the position of his head so that his wound lies uppermost. Give the table just enough head up tilt, about 10, to raise his head above his heart and minimize venous bleeding. Don’t raise it too much because air may be sucked in and cause an air embolus. The first sign of this will be sudden weakening of his pulse and an increase in its rate. Embolism will be less likely if there is fluid over the surface of his wound, so keep syringing it with saline.
Elevating the head of the table will also help to control bleeding from his dura or his brain, but is less useful on the more superficial tissues. If a sinus bleeds during an intracranial operation, apply the above measures. But:
Don’t: (1) Apply haemostats to the patient’s bleeding sinus, because they will tear out and make bleeding worse. (2) Don’t try to sew up a torn sinus. This can increase bleeding, especially if you cannot get at it adequately.
Instead: (1) Tie any smaller sinuses on either side of the tear, or fix them with a silver clip. (2) Push muscle grafts or pieces of surgical gauze between his dura and his skull. Then keep them in place by passing a few interrupted sutures between his epicranium and his dura over the nibbled edge of the bone. These sutures will hitch up his dura, and help to keep the muscle grafts in place. (3) Plug his bleeding sinus with a piece of muscle. If necessary, hold it in place with a deep suture passed under the sinus with a big curved needle.
If blood pours out as a dark venous stream from his sagittal sinus, controlling it can be very difficult. This sinus runs in the midline on the inner surface of the skull from the forehead to the occiput. Several irregular venous spaces (lacunae) join it on the top of the head (63-6). Fortunately, it is rarely injured, because the skull is more often hit from the side than directly from on top. The transverse sinuses in the occipital region are still less vulnerable, but when they are injured, bleeding is even harder to control.
Plug the patient’s torn sagittal sinus with haemostatic gauze. Suture his scalp over it, apply a tight bandage, and refer him. If you don’t have any haemostatic gauze, or cannot refer him, use ordinary gauze and remove it cautiously in the theatre 48 hours later. If necessary, replace it with a muscle graft or a patch. Or, cover the gap with a thin piece of bone wax, and close his scalp over this. You can safely obstruct the superior sagittal sinus in the first quarter of its length. Obstructing it further back will probably kill him.
Often, a sinus does not bleed until you begin raising a depressed fracture near it—don’t!—treat it conservatively! These fractures are for real experts.
BLEEDING FROM THE BRANCHES OF THE MIDDLE MENINGEAL ARTERY
These vessels lie between the dura and the inner table of the skull. Underrun them with silk or cotton on a fine curved needle. This is easier than trying to coagulate them with diathermy.
BLEEDING FROM THE DIPLOE
Push Horsley’s bone wax into the bleeding cut surface of the patient’s skull. Or, use Bismuth and iodoform paste BPC. Or, use autoclaved beeswax or paraffin (candle) wax. If an artery spurts from the bone, push the sharpened point of a sterile match stick into it.
BLEEDING FROM THE VESSELS OF THE DURA
These tear so easily that you cannot grasp them with haemostats and tie them in the usual way. Instead, control bleeding like this.

Place the wound uppermost, as described above.
Press gently on the patient’s injured sinus for about a minute. When you let go, the bleeding will probably have stopped. Pressing too hard may injure the smaller veins joining the sinus and make bleeding worse.

Grasp the bleeding vessels with fine dissecting forceps and touch these with the diathermy electrode.

Grasp the bleeding vessel with fine dissecting forceps, ask your assistant to hold them very still, while you underrun the vessel with 3/0 silk on a small curved atraumatic needle. When the suture is complete, apply a muscle patch, as described below.

USING A MUSCLE PATCH If a piece of some suitable material is pressed over the bleeding area for a few minutes, blood will clot around it and seal it. Synthetic absorbable gauze is best, but if you don’t have that, use a piece of muscle, or muscle and fascia squeezed flat. The temporalis muscle is close at hand, so use it. Although these patches will not stop an obviously bleeding vessel, they will stop a steady ooze.

Take a piece of the patient’s temporalis muscle, and squeeze it flat between artery forceps until it is a thin sheet, the size of a postage stamp. The muscle will now be dead, but it will readily promote clotting. Press it onto the bleeding vessel, cover it with moist gauze, hold it in place with the sucker and drip saline onto it. The saline will keep the surrounding brain wet, and you will see through the gauze when bleeding has stopped. Leave it for five minutes.

If the flap you have reflected does not contain temporalis muscle, extend it so that you can take some. If you have already prepared the patient’s thigh, you can take some muscle from that.

Alternatively, scrape off a piece of the patient’s epicranium exposed by the wound, or take a piece from his mastoid process and hammer this flat to make the patch.

WAYS TO CONTROL BLEEDING IN A HEAD INJURY. A, evert the edges of the patient’s scalp with haemostats, or press on them. B, press a flattened muscle patch on his bleeding brain, cover it with gauze, drip saline onto it, and suck. C, when you excise a ragged head wound ask your assistants to press on its edge. D, tack the patient’s pericranium to his dura. E, fill his diploe with bone wax. By kind permission of Hugh Dudley and Gerishom Sande.

BLEEDING FROM THE BRAIN

Diathermy or silver clips will usually stop venous or arterial bleeding from any size of vessel. Use the lowest diathermy current that will cause coagulation, and the finest forceps. If don’t have diathermy, or silver clips, avoid using haemostats, because the bleeding vessel too easily pulls out of the brain. Instead, apply a muscle patch, as described above, or soak a pad of cotton wool in hydrogen peroxide and put this on the patient’s bleeding brain.

If his brain is bleeding, a warm pack will almost always control it. If necessary, put a piece of haemostatic gauze between his brain and his dura before closing it, and then place more gauze outside this. Don’t pack or plug head wounds with ordinary gauze.

ALWAYS OPERATE WITH THE PATIENT’S HEAD ABOVE HIS HEART
CHAPTER 7
CHEST TRAUMA

TRAUMA

GUIDELINES AND CONSIDERATIONS

General Evaluation of Chest:
• Get history of breathing difficulties
• Expose chest and abdomen. Observe for: Respiratory rate, depth and symmetry.
• Examine anterior and posterior chest for injuries.
• Auscultate breath sounds in all lung fields to include axillae.
• Listen for: Symmetry, wheezes, rales and rhonchi
• If breath sounds are not equal: Percuss to determine different tones (hyperresonance-vs-hyporesonance).

NOTE: All severe chest injuries require urgent evaluation with special consideration for aeromedical evacuation.

CAUTION: In cases of abdominal and chest trauma, the role of fluid resuscitation in the pre-hospital environment is controversial. In cases of uncontrolled internal hemorrhage, administering large amounts of IV fluids prior to surgical control of bleeding may make things worse. In these cases, fluid resuscitation should be rendered with great care. Monitor the patient closely: A patient with suspected internal hemorrhage that is awake, alert and oriented, and producing urine does not necessarily need fluid resuscitation to a higher BP. If the patient is unconscious: Titrate the BP to between 90-100 systolic.
SPECIFIC INJURIES AND TREATMENT

Fractured Ribs or Sternum
Signs and Symptoms: Localized chest pain aggravated by breathing or coughing. Often there is decreased motion on the affected side. May be ecchymosis, localized tenderness to palpation; crepitus. Normal symmetrical breath sounds bilaterally.
Treatment: Semi-Fowler's (Semi-reclining position with head and torso inclined to 45-60 degrees, legs/knees extended).

Treatment

- Encourage deep breathing and coughing.
- Pain medication PRN. O2 if condition deteriorates (suspect more serious problem).
- Evacuate.

CAUTION 1: Do not tape or strap fractured ribs in absence of paradoxical motion (flail chest). This contributes to pooling of secretions, atelectasis and pneumonia.

CAUTION 2: Fractures of lower three ribs may accompany splenic or hepatic injury with subsequent internal bleeding.

CAUTION 3: Numerous complications can accompany chest injury. Continuous re-evaluation is imperative.
Flail Chest

Signs and Symptoms:

- Localized chest pain aggravated by breathing or coughing.
- Rapid shallow respirations with compromised air exchange.
- Localized area of paradoxical chest movement. Treatment:
  - Immediately immobilize flail segment by placing hand over area to prevent further motion.
  - Immobilize flail segment with tape (midline to midline).

NOTE: If tape does not stick, immobilize flail segment with hand, sandbags, etc. or roll patient onto affected side. Semi-Fowler's position if there are no contraindications (Semi-reclining position, with head and torso inclined to 45-60 degrees, legs/knees extended). Oxygen and pain medication as required.

NOTE: Definitive treatment is usually intubation with mechanical ventilation.

CAUTION 1: Monitor respirations closely. Monitor for underlying problems: Pulmonary contusion, cardiac contusion, abdominal injuries or hemopneumothorax.

CAUTION 2. May need to assist ventilations with BVM. Intubation may be required.

CAUTION 3. Limit hydration. Over hydration may increase the incidence/severity of pulmonary contusion.

Pulmonary Contusion

Signs and Symptoms:
- MOI usually within last 24 hours (e.g., steering wheel trauma, deceleration injury, concussion waves following explosion) and history of progressive respiratory distress.
- Decreased breath sounds.
- Dullness to percussion over affected area.
- Hypoxia can occur leading to coma and death.


Pneumothorax


Treatment: In absence of severe symptoms, observe and O2 only. O2. Evacuate.

NOTE: In the presence of severe symptoms a thoracentesis or chest tube insertion is indicated.
Open Pneumothorax

Signs and Symptoms: History of penetrating injury. Rapid and/or gasping respirations. May hear sucking sound or see blood froth escaping from wound.
Treatment: Immediately seal wound with hand or available material. Replace temporary seal with a saline gauze dressing or Ascherman Chest Seal. Sterile saran wrap is an excellent material for making an occlusive chest dressing.
NOTE: When taping dressing, leave one edge undone to function as a flap valve. Semi-Fowler’s position. Oxygen. Evacuate.
NOTE: An alternative treatment is to apply an occlusive dressing without a flap, then IMMEDIATELY perform a needle thoracentesis followed by chest tube insertion.

Tension Pneumothorax

Signs and Symptoms: May or may not be from penetrating trauma. Chest pain. Difficulty breathing. Extreme dyspnea. Cyanosis. Hypotension. Diminished or absent breath sounds on affected side. Hyperresonance on affected side. Affected side may appear more prominent and move less with respiration. The following may or may not be found:
• Distended jugular veins
• Subcutaneous emphysema
• Tracheal shift
• Displaced apex beat of heart
Treatment: Needle thoracentesis. High flow oxygen. Evacuate while monitoring ventilation closely.

Massive Hemothorax

Signs and Symptoms: May or may not be due to penetrating trauma. Patient may be anxious and confused. S/S of hypovolemic shock. Respiratory distress. Decreased breath sounds on affected side. Dull to percussion on affected side.
Treatment: Secure airway. High concentration oxygen. IV x NS or NS. (hypovolemic shock). Close observation for developing tension hemopneumothorax. Decompress only if tension hemopneumothorax is suspected. Evacuate.
CHAPTER 8
ABDOMINAL TRAUMA

GUIDELINES AND CONSIDERATIONS

Physical Exam:
- Examine for wounds, bruises, abrasions and abdominal distention (late finding).
- Any penetrating wound from the neck to the knees may involve the abdomen (dependant on trajectory, ricochet, missile fragmentation, etc.).
- Any chest or groin injury may involve abdominal contents.
- Auscultate all four quadrants for bowel sounds.
- Listen to chest during this exam (bowel sounds in the chest are indicative of ruptured diaphragm).
- Palpate for tenderness and rigidity.
- Perform genital and rectal examination.

CAUTION: In cases of abdominal and chest trauma, the role of fluid resuscitation in the pre-hospital environment is controversial. In cases of uncontrolled internal hemorrhage, administering large amounts of IV fluids prior to surgical control of bleeding may make things worse. In these cases, fluid resuscitation should be administered with great care. Monitor the patient closely: A patient with suspected internal hemorrhage who is awake, alert and oriented; and producing urine does not necessarily need fluid resuscitation to a higher BP. If the patient is unconscious: Titrate BP to between
SPECIFIC INJURIES

Penetrating Abdominal Injury

Signs and Symptoms:
Patient may have multiple complaints or no complaints.
May see very small to very large penetrating wound.
Remember to look for additional wounds (such as exit wounds).
Treatment: Control external bleeding. Large-bore IV's NS or LR

NOTE: Large bore saline lock is an excellent alternative to an IV. Keep patient N.P.O. Insert an NG tube. Urinary catheterization (proceed gently due to possible bladder trauma, but only if rectal exam is normal, there is no blood at urethral meatus and no scrotal hematoma). ASAP evacuation. If evacuation is delayed greater than 2-4 hours, initiate antibiotic therapy.

Blunt Trauma & Blast Injury

Signs and Symptoms: Patient may have any number of physical complaints. May or may not see evidence of trauma. Do full abdominal exam. Much of the time you will have no idea the extent of damage, only that something is wrong.
Treatment: Monitor patient closely and treat symptomatically. Evacuate ASAP
Evisceration

Signs and Symptoms: Any protrusion of abdominal contents through a wound.
Treatment:
- Control hemorrhage.
- Large bore IV's NS or LR Saline lock is acceptable.
- Sterile wet (saline) dressing, then cover with saran wrap.
- Urinary catheterization if rectal/penile/scrotal exam is negative.
- ASAP transport.
- If wound is grossly contaminated and evacuation delayed, dilute (1:10 dilution with normal saline) betadine solution may be used to soak the wound for 20 minutes, then replace with saline/saran wrap dressing.
- Initiate antibiotic therapy.

Gastrointestinal (GI)

Appendicitis

Introduction: Appendicitis is the most common abdominal surgical emergency. Between 5-10% of people develop this condition in life (lower percentage in developing world). Appendicitis can occur at ANY AGE, but is most common during from 20-40. Consider the diagnosis of appendicitis in anyone with an appendix that develops acute abdominal pain..

Symptoms
Classic sequence:
1. generalized abdominal pain
2. anorexia, nausea or vomiting
3. localized pain over the appendix
4. fever (Low-grade).
5. Initially, the pain is usually colicky, vague and not severe. It reaches a peak at 4 hours only to gradually subside, and then reappear as a severe pain localized to the right lower quadrant.
6. The shift in pain from generalized to the RLQ (McBurney’s March) is a diagnostic clue. About 95% of patients have anorexia, nausea or vomiting. Hunger or persistent eating is atypical in appendicitis.

7. The sensation of constipation or “gas stoppage” is common, but defecation does not bring relief of symptoms.

8. With time the pain gradually increases, but may then subside for a period after the appendix perforates, and resume with greater intensity and generalization.

Signs
• Temperature: Fever (101-102°F) frequently develops over 24 hrs.
• Higher fever is atypical.

Inspection: Guarding, abdominal pain with cough

Palpation: Abdominal tenderness: more common in RLQ, may be localized over the appendix at McBurney’s Point (2 inches from the anterior superior iliac spine along a line that intersects with the umbilicus); rebound tenderness; costovertebral angle tenderness (CVAT) in retrocecal appendicitis; positive psoas sign: pain extending the right hip while patient lies on his left side; positive obturator sign: With the patient supine and the right hip and knee flexed, pain when right leg passively crosses over left (internal rotation).

Perform pelvic and rectal exams.

Lab: WBC with differential (>10,000/ml, in over 90% of appendicitis), pregnancy test, urinalysis.

Differential Diagnosis: Quite extensive

Treatment
1. IV fluids (see Shock: Fluid Resuscitation)
2. Antibiotics: Cefotetan 2 grams q 12 hours.
3. Evacuation: Elevate head and flex knees.
4. If evacuation is not possible or imminent, consider appendectomy (see following Appendectomy procedure guide). Perforation rate climbs steeply after 24 hours of pain. Evaluate abdominal pain expeditiously and explore promptly before perforation occurs.

Acute Cholecystitis

Introduction:
• Gallbladder stones are common in the United States, seen in 10-15% of adults.
• They are 2-3 times more common in women (4 Fs: fat, forty, female, and fertile).
• Cholecystitis (gall bladder inflammation) occurs more commonly in certain diseases such as malaria, sickle cell, and ascariis infestations.
• When gallstones become symptomatic, cholecystectomy is indicated.

Symptoms

Biliary colic pain: usually located in the upper abdomen, frequently in the right upper quadrant (RUQ), may radiate to the right scapula; may be precipitated by a meal, but more commonly there is no inciting event; gradually increases over 15-60 min., plateaus for 1 or 2 hrs before slowly going away; if persists longer than 4 hrs it is unlikely to spontaneously resolve. 75% of patients have a history of previous attacks of biliary colic before acute cholecystitis. May include nausea and
vomiting.

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Signs

Inspection: Patients with acute cholecystitis appear uncomfortable and ill. Febrile but < 102°F. Mild jaundice/icterus seen in 20%.

Auscultation: Bowel sounds should be present, unless gangrenous gallbladder or gallstone pancreatitis. Palpation: Murphy’s Sign - During palpation of the right subcostal region, pain and inspiratory arrest may occur when the patient takes a deep breath, bringing the examiner’s hand in contact with the inflamed gallbladder. The obstructed and swollen gallbladder is palpable in 1/3 of acute cholecystitis.

Lab: WBC with differential will demonstrate infection.

Differential Diagnosis

- Ascending cholangitis - fever, RUQ pain and jaundice (Charcot’s Triad) - a surgical emergency!
- Obstruction of the common bile duct (gall stone or tumor) - marked jaundice, dark urine, clay-colored stools
- Pancreatitis - diffuse abdominal pain with ileus and vomiting
- Peptic Ulcer Disease - vomiting, hematemesis or melena if bleeding
- Cardiac Pain - angina, heart attack
- Esophageal reflux, hiatal hernia - acid taste, pain relieved with antacid
- Pleurisy/pneumonia - respiratory complaints, pain with deep inspiration
- Liver Mass (abscess, tumor, cirrhosis) - jaundice, RUQ pain, no fever, no relationship to meals

Treatment

1. IV fluids (see Shock Fluid Resuscitation)
2. Antibiotics (ticarcillin 4 gm IV q 6 hr plus metronidazole 500 mg IV q 6 hr, or aztreonam 2 gm IV q 8 hr plus clindamycin 450 mg IV q 8 hr).
3. Pain control (see Procedure: Pain Assessment and Control)
4. Antipyretics (Tylenol, etc.)
5. Antiemetic medications should be given as needed (e.g., Compazine 5-10 mg IM q 3-4 hours, max 40 mg/day)
6. Evacuate: High fever > 102°F, the presence of jaundice, persistent pain or vomiting—evacuate immediately; otherwise, worsening symptoms or failure to improve over 24 hours should prompt medical evacuation.

Remember — cholangitis (pus in the biliary tree) is a surgical emergency.

Acute Bacterial Food Poisoning

Introduction:

- Bacterial food poisoning is any illness caused by the consumption of food contaminating bacteria or bacterial toxins.
- The major recognized causes of bacterial food poisoning are limited to 12 bacteria: Clostridium perfringens, Staphylococcus aureus, Vibrio cholera & parahaemolyticus, Bacillus cereus, Salmonella, Clostridium botulinum, Shigella, toxigenic E. coli, certain species of Campylobacter, Yersinia, Listeria, and Aeromonas.
- Most cases arise from ingesting contaminated food. The attack rates are high, with most persons ingesting the food becoming afflicted. Rapid onset of symptoms indicates the presence of
pre-formed toxins liberated from contaminated food.

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Symptoms
Nausea, vomiting, crampy abdominal pain, fever, myalgias, headache, diarrhea (sometimes bloody).

Signs
Inspection: Patients appear ill and dehydrated.
Auscultation: Abdominal bowel sounds are often hyperactive.
Palpation: Mild to moderate abdominal tenderness. Peritoneal signs (rebound, guarding, point tenderness) are atypical.
Lab: Elevated WBC with differential may indicate systemic infection; stool cultures, blood cultures.

Treatment
1. Rest
2. Rehydration (oral or intravenous) correction of electrolyte disturbances (see Shock Fluid Resuscitation)
3. Anti-emetics as necessary (e.g., Compazine 5-10 mg IM q 3-4 hours, max 40 mg/day)
4. Antibiotics are unusually NOT necessary, in fact may promote increased carrier rates for Salmonella.

Acute Gastritis

Inflammation of the stomach lining or acute gastritis, is common. The causes of gastritis are numerous, but it is most commonly caused by consumption of alcohol, aspirin, non-steroidal anti-inflammatory drugs (NSAIDs) or by acute infections.

Symptoms
Dyspepsia (epigastric discomfort or burning), nausea, vomiting, postprandial fullness/bloating and occasional GI bleeding; history of excess alcohol consumption or ingestion of aspirin, NSAIDs, corrosives or poorly prepared or preserved food.

Signs
Inspection: Nausea, vomiting and epigastric pain; appear pale and dehydrated; no fever.
Palpation: Abdomen is usually soft but may have some mild to moderate tenderness in the epigastric region.
Lab: CBC for evidence of infection or anemia; and urinalysis (elevated bilirubin).

Treatment
Primary: Discontinue gastric irritants such as alcohol and/or medications (aspirin/NSAIDs).
Rehydrate with oral or IV fluids. Give short course (4 weeks) of H2-blocker (e.g., Pepcid 40 mg q hs) to promote healing of gastritis.

Acute Pancreatitis

Introduction: Acute pancreatitis is an inflammatory process of the pancreas usually associated with severe pain in the upper abdomen. Gallstones and alcohol cause about 80-90% of acute pancreatitis. Most acute cases will spontaneously resolve, but severe, chronic pancreatitis has a 50% mortality rate.

Symptoms
Pain: located primarily in the epigastrium; may be localized to the right upper quadrant and radiate to the back; pain reaches a maximum intensity rapidly over 10-20 minutes; described as unbearable, with little relief offered by position. Patients frequently assume a fetal position. Nausea and vomiting are common.
Signs
Inspection: Appears acutely ill; mental status may be depressed, especially if associated with acute alcohol ingestion; fever, tachycardia and hypotension; ecchymosis along the flanks (Grey Turner's sign) or around the umbilicus (Cullen's sign) grave prognosis; jaundiced sclera (icterus); distended abdomen.
Auscultation: Decreased breath sounds from effusions or rales (ARDS)—grave prognosis; abdominal pain may cause splinting and shallow respirations; absent bowel sounds.
Percussion: The abdomen is tympanic and diffusely tender.
Lab: CBC with differential for evidence of anemia and infection; save the red top tube for future analysis for milky layer seen in hypertriglyceridemia.

Treatment - treat aggressively
1. NPO [nothing by mouth] until pain resolved.
2. Pain control (avoid morphine - it may cause sphincter of oddi spasm, worsening pancreatitis).
3. Aggressive IV fluid resuscitation (D5-Lactated Ringer's solution)
4. NG decompression if vomiting or distended
5. Antibiotic (cefotaxime 2 gm q 8 h IV) if patient appears septic (fever > 102° F, rigors, or jaundice)
6. Evacuation to hospital.

Acute Peritonitis

Acute peritonitis is a potentially catastrophic illness caused by infectious organisms attacking the peritoneum. It is usually characterized by rapid onset of symptoms and rapid medical deterioration. The five most common causes of acute peritonitis are appendicitis, cholecystitis, diverticulitis, pancreatitis, and bowel perforation. Each has a characteristic pattern of symptoms to suggest the etiology. When abscess or perforation complicates any of these causes, generalized peritonitis ensues. Generalized peritonitis requiring surgical intervention is caused by perforated peptic ulcer (40%), appendicitis (20%), gangrene of bowel/gallbladder (15%), post-op complications (10%) or other causes (15%).

Exact details of the onset of the pain, and associated symptoms (e.g., change in bowel or menstrual habits) are helpful in drawing attention to the affected organ. Mortality is high in many groups, especially in the elderly and patients suffering organ failure before development of peritonitis. Peritonitis secondary to appendicitis or perforated duodenal ulcer is associated with >90% survival, whereas peritonitis from other causes, including postoperative peritonitis, has only approximately 50% survival.

Symptoms
Pain and fever: Generalized abdominal pain that becomes localized to the right lower quadrant (and eventually McBurney’s Point); anorexia; sensation of “gas blockage” and need for bowel movement, but no improvement after enema or defecation.

Signs
Vital Signs: Fever 100-101°F, tachycardia
Inspection: Patient in fetal position, because any movement worsens pain; visible peristalsis suggests
bowel obstruction.

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Auscultation: Absence of bowel sounds in all four quadrants suggests peritonitis. Always auscultate before doing percussion or palpation.

Percussion: Absence of dullness over the liver suggests free air and perforation.

Palpation: Begin with very gentle palpation away from the area of maximal symptoms; board-like abdomen is unmistakable and indicates obvious peritonitis; shake the pelvis to assess rebound tenderness; ileopsoas and obturator signs (see Appendicitis section) are suggestive for retroperitoneal inflammation.

Serial examinations: Diminishing bowel sounds with increasing tenderness and the development of rebound indicates peritonitis.

Lab: CBC with differential, urinalysis, blood cultures for infection.

Abdominal X-ray (if available): free air, dilated loops of bowel, air-fluid levels, calcified gallstones (1/3) or pancreas.

Treatment

1. Intravenous antibiotics must cover both aerobic and anaerobic bacteria:
   Single Agents: Cefoxitin 2 gm IV q 8 hr, cefotetam 2 gm IV q 12 hr, or cefmetazole 2 gm IV q 8-12 hr
   Combination Agents: Aztreonam 2 gm q 8 hr plus metronidazole 500 mg IV q 8 hr

2. IV fluids to compensate for respiratory and third space losses (see Fluid Resuscitation section). Use pressor agents at lowest dose needed to maintain adequate perfusion pressure, such as Dopamine 5 mcg/kg/min.

3. Pain control (see Procedure: Pain Assessment and Control) and antiemetic (e.g., Phenergan 25 mg IV, IM, or po) of choice.

4. Nasogastric tube decompression for significant abdominal distention or vomiting, and keep NPO.


Peptic Ulcer Disease

Introduction: Peptic ulcers are defects in either the gastric or duodenal mucosa.

- Almost all ulcers are caused by infection with Helicobacter pylori, consumption of aspirin or NSAIDs (Motrin, Advil, Aleve, Clinoril, Feldene, etc.) or severe physiologic stress (extensive trauma, burns or CNS injury).
- Some ulcers are related to ingestion of fish parasites.
- Most ulcers cause mid-epigastric pain, often associated with nausea or vomiting.
- Complications of ulcers include bleeding, perforation and obstruction.
- Generally, pain will herald the presence of an ulcer before complications occur.
- Ulcer pain is decreased by ingestion of alkali and patients often give a history of self-medication with bicarbonate of soda, antacids or over-the-counter acid blocking medicines.

Symptoms

Gnawing epigastric pain between the umbilicus and the xiphoid, increased by food and relieved by alkali (gastric ulcer); awakening from sleep with pain, that radiated to the mid back (duodenal ulcer); anorexia, nausea and vomiting.

Signs

Tender epigastric area; vomiting bright red blood (hematemesis) or coffee grounds suggests active or recent bleeding from the upper GI tract; melena (“tarry” black, oily and odiferous stool that suggests upper GI tract bleeding); weight loss.
Vital Signs: Pulse > 100 bpm, systolic BP < 90: probable hypovolemia. Orthostatic change in VS (systolic BP drop of 20 mm Hg or pulse rise 20 bpm): significant hypovolemia.
Appearance: Pallor of anemia, diaphoresis: suggests significant blood loss.

Gastric Contents (check if melena or hematemesis): NG aspirate – bile, no blood or coffee grounds suggests no active bleeding. Coffee grounds: recent bleeding, bright red blood: active bleeding.

Abdomen: Absent bowel sounds, rigid exam, peritoneal signs: perforated or penetrating ulcer
Rectal Exam: Melena: recent UGI bleeding
Lab: Hematocrit.
Differential Diagnosis - dyspepsia, gallstones, pancreatitis, angina and malignancy.
Treatment
1. Treat the uncomplicated ulcer:
   a. Stop aspirin or NSAIDs.
   b. Suppress acid secretion with oral therapy, or IV therapy until stable, then switch to oral therapy.
      IV therapy: Cimetidine 300 mg q 6 hr, famotidine 20 mg q 12 hr, or ranitidine 50 mg q 6-8 hr;
      Oral therapy: Cimetidine 400 mg bid, famotidine 20 mg bid, or ranitidine 150 mg bid for 8-12 weeks;
      Alternative antacids: Omeprazole 20 mg qd or lansoprazole 30 mg qd for 8-12 weeks
2. Manage bleeding ulcer
   a. Place 2 large bore IVs (>18 gauge) and give Lactated Ringers or Normal Saline to resuscitate and normalize blood pressure.
   b. Suppress acid with IV therapy.
   c. Evacuate and be prepared to perform blood transfusion.
3. Eradicate Helicobacter pylori: “triple therapy” includes many choices, but most treat for 10-14 day po course with: omeprazole 20 mg bid or lansoprazole 30 mg bid, plus clarithromycin 500 mg bid or amoxicillin 500 mg tid, plus metronidazole 500 mg bid

Acute Organic Intestinal Obstruction

Introduction: Acute organic obstructions, which are partial or complete blockages in the bowels, are divided into small and large intestinal causes.
Symptoms
Acute onset of severe, crampy abdominal pain with associated vomiting (usually feculent due to increased bacteria in the gut) and abdominal distention; pain: in paroxysmal waves every 4-5 minutes for proximal obstructions (less frequent for distal obstructions), and continuously for strangulated bowel; rectal bleeding is consistent with mucosal ulceration from intestinal ischemia, inflammatory bowel disease or malignancy.
Signs
Inspection: Febrile, toxic, dehydrated from vomiting, distended abdomen with visible peristaltic waves in small bowel obstruction.
Auscultation: Frequent, high-pitched bowel sounds occur in waves early, but the bowel may be silent later due to peritonitis or bowel infarction. Borborygmi (loud bowel rumblings audible without stethoscope) correspond to paroxysms of pain.
Percussion: Obstructed and dilated, gas-filled loops of bowel are often tympanic.
Palpation: A mass suggests the cause of obstruction. Check for hernias (inguinal, femoral, or umbilical), surgical scars (adhesions).
Lab: CBC with differential and urinalysis for infection.

Abdominal X-ray (if available): free air, dilated loops of bowel, air-fluid levels demonstrating obstruction.

Differential Diagnosis - causes of peritonitis (see section on Peritonitis), including appendicitis, cholecystitis, peptic ulcer disease, and diverticulitis; various types of food poisoning and gastroenteritis; large neoplasms; labor (pregnancy)

Treatment
1. Place NG tube to decompress and keep NPO.
2. IV fluids to restore fluid and electrolyte losses caused by vomiting
3. Give antiemetic (e.g., Phenergan 25 mg IV, IM, or po) of choice, but no pain meds until sure of diagnosis and awaiting evacuation. Narcotics paralyze the bowel and can mask worsening symptoms that may precede perforation.
4. Prepare for medical evacuation if symptoms persist for > 12 hours or if fever or peritoneal signs develop.
5. IV antibiotics should be administered if peritoneal signs arise (must cover both aerobic and anaerobic bacteria)
   Single Agents: Cefoxitin 2 gm IV q 8 hr, cefotetam 2 gm IV q 12 hr, or cefmetazole 2 gm IV q 8-12 hr
   Combination Agents: Aztreonam 2 gm IV q 8 hr plus metronidazole 500 mg IV q 8 hr
CHAPTER 9
Genitourinary (GU)

Urinary Tract Problems: This section will provide tips for the assessment and disposition of major symptoms associated with the urinary tract, excluding trauma.

Examination Tips
1) Assessing a flank pain:
   Lightly tap or push with fingers on right or left lower chest wall. If there is significant kidney irritation, this will elicit increased pain.
2) Abdominal exam:
   a) Percuss the region superior to the pubic bone. A dull tap suggests a distended bladder holding a large volume of urine. In the female, the pubis is much lower and a smaller volume of urine can be appreciated on percussion or bimanual exam.
   b) Look for peritoneal signs: increased pain with light tapping on the abdomen, pain with shaking of the abdomen and hips, pain when suddenly releasing pressure on the abdomen (rebound).
3) Scrotal exam:
   a) If possible, always exam the patient in both the standing and supine positions.
   b) Testis position and varicoceles can only be appreciated in the standing position.
   c) Examine the testis of a patient complaining of pain in the scrotum while he is lying down. Increased pain in the testis may cause the patient to faint.
   d) If a bright light such as for an otoscope is available, transilluminate all scrotal masses to determine cystic (bright, diffuse glow) or solid nature of the mass.
4) Rectal Exam
   a) Prostates are generally the size of a walnut and no more than 2 finger breadths wide.
   b) With the patient standing and bending over the top of the prostate should be easy to reach. In young men, the presence of a large soft mass on rectal exam usually is the bladder. Some prostates in young men are difficult to palpate.

Urinalysis
1) Dilute urine with a specific gravity of 1.005 or less, or concentrated urine (dehydration, first morning void, etc.) of 1.015 or higher suggests normal renal function.
2) When there is visible blood in the urine, the protein from the blood can raise the urine dipstick protein value to 2+.
3) Nitrite positive urine can be from skin bacteria if the person (male or female) voided a small amount without doing a clean catch. (Avoid this problem by starting to void, then sliding the cup into the stream).
4) Infections can be nitrite negative.
5) Trace heme on a urine dipstick can be normal.
6) Trace leukocyte urine can look significantly positive when viewed under the microscope.
7) Cloudy urine in specimens with an alkaline pH (6 or higher) can be amorphous phosphate and be normal in young individuals.
8) The presence of crystals in the urine does not automatically mean that the person has kidney stones.
Normal voiding

1) Normal first urge to urinate occurs with about 5 ounces in the bladder.
2) Normal bladder capacity in an adult is 10-15 ounces.
3) Normal time between voiding averages greater than every 2 hours.
4) Average total 24-hour urine volume for adults is about 1 quart. Ideal would be 2 quarts/day. This translates to 40-80 ml of urine per hour.

Blood in the urine (hematuria)

1. Trauma and visible blood in the urine suggests possibility of major injury. Stabilize and transfer for evaluation. If patient is able to void, severe injury to bladder and urethra is much less likely.
2. Hematuria with irritative voiding symptoms should be treated initially as an infection. Exposure to bodies of fresh water in Africa or the Middle East may lead to schistosomiasis as a cause of blood in the urine.
3. Hematuria with flank pain and:
   • No fever, no drug exposure and no trauma suggests a kidney stone.
   • Fever, but no trauma should be treated for a possible kidney infection.
   • High proteinuria, but no fever or drug or chemical exposure suggests nephritis.
4) Hematuria with painful scrotum should be treated initially as an infection.

I Gross hematuria (visible blood) without any other symptoms can be a sign of cancer at any age.

Blood in the semen (hematospermia)

If there are no difficulties voiding, the physical exam (including rectal exam) is normal and the urinalysis several days after the event is negative, then this is a benign condition and no further workup is indicated.

Cannot control urine (leaking, incontinence)

Cannot urinate (anuria)

Catheterization (see Procedure: Bladder Catheterization) is the best method of determining if there is an obstruction versus poor urine production as an explanation for anuria. In a patient with a very large bladder by palpation (dome of bladder extends more than half the distance between the umbilicus and the top of the pubic bone), rapid drainage of the bladder can result in the patient fainting.

Discharge from the penis. Refer to section on STDs

Lumps in the genital region or swollen scrotum. Refer to section on Testis Mass and to STDs.

Pain in the side (flank). Refer to section on Urolithiasis

Pain in the scrotum

1) Tenderness located primarily in the testis: consider torsion, epididymitis.
2) Point tenderness on upper pole of testis: consider torsed appendix testis or cyst.
3) Tenderness primarily in cord above testis: consider varicocele.
4) Mass in testis: consider tumor.
5) Mass above testis or around testis that glows when a strong light is placed against it: hydrocele or spermatocele.
6) Large mass with history of direct blow to testis: fractured testis vs. hematoma.

Pain with urination

In most cases, it is safer to initially assume a urinary tract infection (UTI) and treat with antibiotics (see UTI section). Treat vaginitis if found.

Persistent erections (Priapism)

1) A tender, painful erection with no history of trauma is low flow priapism. This is an emergent condition best treated by a urologist. Although this condition may resolve spontaneously, cold water immersion and manual compression of the penis may be successful. A persistent erection greater than 4 hours may result in increasing tissue injury that may result in the loss of erectile function after the penis is decompressed.
2) A painless partial or full erection especially with history of pelvic trauma can be observed. Similar treatment can be used.

Skin lesions in the genital region

Ulcers (see Sexually Transmitted Diseases):
1) Ulcers that form immediately after intercourse are from trauma.
2) If always associated with the ingestion of one particular medication, the ulcer represents a fixed drug reaction.
3) Painful - chancroid, herpes
4) Painless - syphilis (hard or firm induration, chancre), granuloma inguinale, or LGV

Blisters and nodules
1) If there is any question of the diagnosis, assume it may be sexually transmitted (herpes) and avoid further sexual contact.
2) Persistent lesions should be evaluated electively to r/o cancer.
3) Most causes are benign and/or self-limited.

Generalized edema
1) Generalized swelling of the penile shaft skin with itching is usually either a contact allergic reaction or idiopathic. If an offending agent can be identified (or suspected), treat with antihistamines and avoid the chemical irritant.
2) Suspect a skin infection if there is significant erythema and pain, which may also involve the scrotum.
In a sick individual with fever, this can represent a life threatening condition called Fournier’s gangrene (see Symptom: Male Genital Inflammation).

Cannot Move Foreskin (Phimosis/Paraphimosis)

Inability to retract the foreskin (phimosis) or to pull it forward to its normal position (paraphimosis). Often the foreskin is edematous from irritation or infection. Monitor this condition for excessive circumferential swelling which could compromise blood flow in the penis. Anti-inflammatory medications, ice water and lubricants may be helpful. If there are signs of systemic infection (fever, nausea, fatigue, etc.), and prompt evacuation is not available, a dorsal slit should be performed. Most patients require circumcision later.

ADVANCED

Dorsal Slit: Prepare the penis as with any surgical procedure (sterile scrub, Betadine, drape), and attempt to clean between the head and the foreskin especially on the dorsal side. Anesthetize the dorsum of the foreskin with lidocaine (NO EPINEPHRINE!) using the smallest gauge needle (25-26) available. Use forceps or needle to ensure dorsal foreskin is numb. Clamp the dorsal foreskin tightly beginning at the tip and working back to where the foreskin meets the shaft. Leave the clamp in place for several minutes, as this will compromise blood flow in the area to be incised. Remove the clamp, and using sterile scissors or scalpel, carefully incise the dorsum of the foreskin through its entire thickness, through the line of devascularized tissue formed by the clamp.

Do not incise the head of the penis. Fold the two sides of the incised foreskin back and away from the penis. Clean the penis with sterile prep solution between the head and foreskin, then again with alcohol. Allow to air dry and apply a sterile dressing.

Urinary Incontinence

Incontinence, the inability to voluntarily control the flow of urine, is only a social nuisance in most cases. If the incontinence is not due to infection, and a physical exam including gross motor and sensory (numbness or muscle weakness) exam is normal, serious complications are unlikely. Incontinence is fairly common in women. Daytime incontinence in men is highly abnormal and suggests significant underlying disease.

Symptoms: Uncontrollable loss of urine.

Signs
Wet clothing; trauma or irritation to the vagina; neurologic deficits: difficulty walking, numbness in the perineum or increased deep tendon reflexes.

Lab: Urinalysis: moderately to strongly positive leukoesterase should be considered an infection. Moderate to strongly positive heme should be considered an infection initially, but may be cancer, urinary tract stone or other condition. Urinary catheterization for suspected retention.

Differential Diagnosis - stress incontinence, urge incontinence, mixed incontinence, and retention as described above.

Trauma, with or without fistula - continuous leakage in the setting of trauma suggests laceration of the vagina and bladder either from a foreign body or bone fragment. Trauma frequently causes fistula formation. Compression of the spinal cord from disk disease, spinal tumors and brain disease (e.g., stroke).
Multiple sclerosis or other neural tissue disease. Renal obstruction with overflow incontinence.

Treatment Primary:
Treat any urinary tract infection
Treat specific type of incontinence:
Stress Incontinence: Empty bladder frequently. Wear diaper or tampon. Practice Kegel exercises (tighten the muscles around the vagina 40-160 times per day).
Urge Incontinence: Mild: Hyoscyamine 0.375 mg po bid, Urised 1 po qid or Flavoxate 1 po bid
Moderate/Severe: Ditropan 5 mg 3-4x/day
Mixed Stress and Urge Incontinence: Imipramine 10-25 mg po q hs
Retention with Overflow Incontinence: Patients with significant symptoms, especially those suspected to have overflow incontinence, should have a catheter passed into the bladder per urethra to determine if there is significant residual urine. If there is greater than 200-300 cc, leave the catheter in place and monitor urine output. If urine output is greater than 200 cc/hour, suspect renal obstruction. Start an IV placed with NS running at a maintenance level with boluses for resting pulse rate greater than 100/min.
Decrease prostate resistance with alpha-blockers: Hytrin (terazosin) 1-5 mg po q hs (start at low dose and titrate up over several weeks), Cardura (doxazosin) 1-4 mg po q hs, Flomax (tamsulosin) 1 po qd or Minipress 1-5 mg po q hs
After removing urethral catheter, perform intermittent (self-) catheterization (see Procedures: Bladder Catheterization) q 4-6 hours to keep bladder volume under 300 cc.
For those patients in whom it is too difficult to pass a Foley catheter, use a straight or suprapubic catheter.

Alternative: For frequency and urgency, diazepam (Valium) 5-10 mg po q 6h can be very helpful.
Empiric: Antibiotics for chronic suppression of infection, such as nitrofurantoin 50 mg po bid, Septra 1 po q hs. Cipro 250 mg po q hs or Keflex 250 mg po q hs.

Medications: Cold medications and antihistamines for sinus problems will counteract alpha-blockers and vice versa. Side effects of Ditropan include dry mouth, dry eyes and constipation.

**Urolithiasis (Kidney Stones)**

Introduction: Ureteral stone pain is generally acknowledged as one of the worst pains a person can suffer. The majority of stones can be managed with hydration and pain control. Fever, vomiting and severe pain not controlled by oral medication requires intravenous treatment. Evacuate these patients with persistent symptoms beyond 24 hours.

Symptoms
Intense, intermittent flank or inguinal pain radiating into the scrotum and not related to activity; nausea and vomiting; urinary frequency and burning (if stone at ureter/bladder junction); fever.

Signs
Fever, severe costovertebral angle (CVA) tenderness which waxes and wanes, vomiting.
1. Examine the patient between the lower chest and scrotum/pelvis.
2. Check for a tender liver by pushing under the anterior right ribs while the patient takes a large breath.
3. Check for a hernia.
4. Examine the scrotum for epididymitis or torsion.
5. Examine the prostate on the rectal exam for any fullness on the side of symptoms.
6. Do a bimanual pelvic exam to check for adnexal tenderness.
7. Check for costovertebral angle (CVA) tenderness. Lightly thump the right and left lower ribs in the back. Increased tenderness suggests kidney pain.
8. Check for peritoneal signs. If pain increases with light tapping on the abdomen, shaking the abdomen, striking the heel of the foot, or there is significant irritation of the abdominal contents, then bowel inflammation/perforation (appendicitis, etc.) is suggested.
9. Light thumping over the right lower anterior chest wall would suggest gallbladder irritation. This, combined with increased pain on eating, especially in young, overweight women is suggestive of gallbladder disease.

Lab: Urinalysis may reveal casts, blood. Abdominal X-ray to assess for presence of stones.

Assessment:
Severe side pain not related to position, which waxes and wanes, without evidence of an abnormal genital exam or peritoneal signs strongly suggests ureteral stone.

Differential Diagnosis - any disease process between the lower chest and upper thigh can be considered. Lower lobe pneumonia or pulmonary process - abnormal breath sounds.
Abdominal causes - liver disease; cholecystitis/cholelithiasis (gallbladder) diverticulitis including Meckel’s; appendicitis; mesenteric adenitis; abdominal aortic aneurysm. Renal - waxing and waning pain excludes pyelonephritis, cysts, tumor or ischemic injury.
Musculoskeletal pain - this includes aches due to viral illness. Inguinal hernia - distinguish by exam.
Urologic - Epididymitis - tender epididymis; testicular torsion - tender testis; congenital ureteropelvic junction obstruction.
Gynecologic - abnormal pelvic exam (see GYN Problems section): ectopic pregnancy, pelvic inflammatory disease, torsion of ovary, ovarian cyst, tubo-ovarian abscess.

Treatment Primary:
1. Pain control (in order of preference): Ketorolac (Toradol) 30 mg IM q 6 h is highly effective in relieving stone pain. Narcotics such as morphine sulfate 5-10 mg IM, Demerol 50-100 mg IM q3-4 h prn (can combine with ketorolac) Tylox 1-2 po q 4 h prn or Demerol 50-100 mg po q 4 h prn.
If above are not available, NSAIDs such as ibuprofen 800 mg po tid or indomethacin 25-50 mg po tid can help.

2. Hydration

3. Antibiotics when fever is present in a suspected urinary stone patient: Either levofloxacin or IV ampicillin plus IV gentamicin are acceptable (see pyelonephritis in UTI section).

4. Anti-emetics as needed

Urinary Tract Infection

Introduction: The causative organisms of cystitis, acute prostatitis and pyelonephritis are the same. or the vast majority of infections, the fluoroquinolone antibiotics are highly effective. Bladder infections (cystitis) are treated for 3 days, kidney (pyelonephritis) for 14 days and prostate (prostatitis) for 30 days. In the male, it is practical to assume that any leukoesterase positive or culture positive bacterial urinary tract infection involves the prostate so treat for 30 days.
Prostatitis and epididymitis are covered in separate sections. Urethral discharge suggests urethritis, usually sexually transmitted. Therefore, primary treatment is different, although the fluoroquinolones are a good alternative. Urethral discharge is covered in the STD chapter.

Symptoms: Burning, frequency, urgency, fever, flank pain.

Signs
Fever, flank tenderness, fatigue, nausea, vomiting, suprapubic tenderness.

Urinalysis: Pyuria (leukoesterase +) and nitrite positive indicates infection (some gram-positive organisms may be nitrite negative). Nitrite + and leukoesterase negative specimen is contaminated with skin; Gram stain: identify and quantify WBCs, gram-positive or gram-negative rods and epithelial contamination.

Differential Diagnosis:
Cystitis - burning or frequency, and leukoesterase-positive urine in a female.
Pyelonephritis - fever or flank pain, and leukoesterase-positive urine in a female. Microhematuria without pyuria - pyelonephritis is less likely; patient may have other reasons for microhematuria (tumor, stone, etc.).
Peri-ureteral inflammation - inflammation around the ureter (e.g., appendicitis, PID) can result in an abnormal urinalysis.
Contamination - positive nitrite, negative leukoesterase and negative heme is likely skin contamination of the urine specimen.
Prostatitis - UTI symptoms in a male with leukoesterase-positive urine.

Treatment Cystitis
Septra DS 1 po bid, nitrofurantoin 100 mg po qid or Macrodvid 100 mg po bid, Cipro 250 mg po bid or Levaquin 250 mg po qd, Keflex 250 mg po qid, or Augmentin 875/125 po bid or 500/125 po tid x 3 days. Nitrofurantoin is the safest drug in women since it is acceptable to give throughout a pregnancy.

If symptoms do not improve in 2 days, treat patient for 2 weeks. If Augmentin is used, candidal yeast infections frequently develop. Be prepared to treat with fluconazole 150 mg po single dose or terconazole vaginal suppositories qd x3 days.
Alternative: 1/3 of woman can clear their cystitis by increased hydration. Doxycycline 100 mg po bid Cystitis with complicating factors
If patient has history of infections every 1-2 months, place on suppression (see below) until seen by urology. Women who are postmenopausal, especially greater than 60 years old, frequently take longer to eradicate cystitis. In such patients, treat for 7-10 days.

Pyelonephritis
Moderately ill:
Fluoroquinolones (Levaquin 500 mg po qd or Cipro 500 mg po bid or Floxin 400 mg po bid) x 2 weeks. Alternative: Augmentin 875/125 mg po q12h or 500/125 mg po tid x 2 weeks or Keflex 500 mg po qd x 2 weeks.

Moderately ill but unable to tolerate po medications: Ampicillin 1-2 gm IV q 6-8h and gentamicin. Gentamicin, q d dosing at 5 mg/kg is preferred or 1.5 mg/kg loading and 1.0 mg/kg IV/IM q 8 h. Alternative: cefotaxime 1.0 gm q12h IV up to 2.0 gm q4h IV or ceftriaxone 2.0 gm qd IV. Once patient is clinically improved, treat with quinolones (as above) x 2 weeks.
Severely ill: Treat 2-3 weeks with same IV regimen as above. Do not progress to oral dosing. Give IV fluids if there is dehydration and nausea.
Of the quinolones, Levaquin has a broader spectrum of coverage for UTI.
If quinolones are not available, use Septra DS tid until afebrile, then bid for 2 weeks. Nitrofurantoin is not useful for deep tissue infections such as pyelonephritis.
Patients who are penicillin allergic should be treated with vancomycin 15 mg/kg q12h IV when ampicillin is indicated.
Pyelonephritis with complicating factors (recurrent UTIs or post-menopausal)
After initial treatment, begin suppression regimen until seen by urology: Macrodantin 50 mg po bid, Septra DS 1/2 po qhs, Cipro 250 mg po q hs or Keflex 250 mg po q hs.
Empiric:
- Failure of symptoms and urinalysis to improve suggests resistance to the antibiotic being used. Antibiotics should be changed if there is no improvement after 3-4 days. Patients with a fever can be expected to take several days to become afebrile.
- Recurrence of urinary tract infection within weeks of completing the initial course of antibiotics suggests an inadequate duration of treatment or reinfection. A longer course of antibiotics, possibly with the addition of 2-3 months of suppression is indicated.
Urine culture data is extremely valuable in both cases.
CHAPTER 10
EXTREMITY TRAUMA
GUIDELINES AND CONSIDERATIONS

General Treatment: A hazardous environment or situation may alter or prevent any of these steps.
1. Control hemorrhage and treat for shock.
2. Remove tight clothing, jewelry and footgear prior to splinting. NOTE: Femur fractures require a traction splint.
3. Unless fracture is significantly angulated, do not manipulate if good circulation and nerve supply is present.
4. If there is neurovascular compromise of the limb or significant angulation of the fracture:
   • Stabilize the proximal portion of the fracture and use gentle long-axis traction to align the fracture (exact anatomic reduction is not necessary at this stage). Perform CSM check after any manipulation or splinting
5. If evacuation is delayed: Debride wounds by irrigation and scrubbing.
6. Pack and dress wounds with bulky sterile dressing. Immobilize joint above and joint below fracture.
7. Neurovascular check: Perform neurovascular check before splint application, after application and q. 15-30 min thereafter.
8. Consider analgesics for pain if not contraindicated.
9. Elevate and apply cool compresses during the first 12 hours (if able).
10. Consider antibiotics for open wounds if evacuation delayed over 4 hours.

NOTE: Open fractures have a high incidence of infection and must be treated aggressively in the field. In all cases of open fracture or suspected open fracture the use of IV antibiotics should be considered:

IN CASES WHERE EVACUATION TO HIGHER LEVEL CARE WILL TAKE 4 HOURS OR LONGER, TREAT AS ABOVE, PLUS:
• Administer antibiotics. Rocephin, Cefotan or Mefoxin are acceptable antibiotics.
• If the skin over a fracture is abraded, clean the abrasion with betadine solution, irrigate with saline and dress the wound.
• If bone is visible in the wound and there is neurovascular compromise, re-alignment of the fracture in the field may be required. Irrigate the bone ends with a minimum of 1 liter of normal saline before re-alignment. Do not delay re-alignment for more than 5 minutes for irrigation. If normal saline is not available, use any other sterile fluid for irrigation.

IN CASES WHERE EVACUATION TO HIGHER LEVEL CARE WILL TAKE 12 HOURS OR LONGER, TREAT AS ABOVE, PLUS:
• If there is a laceration with no bone visible: Irrigate the wound with medium-pressure technique, using a minimum of 1 liter of normal saline (preferably 2-3 liters).
• If bone is visible in the wound: Irrigate as above and cover with a moist sterile dressing.
• If dirt or other debris is impacted into the bone: Clean out as best as possible before irrigation.
_types of bone fracture (anatomical overview)_

open fracture:
when the bony fragments are exposed to external environment by means of wound

closed fracture:
the fracture fragments are not exposed to outside

complications of fractures:

<table>
<thead>
<tr>
<th>early</th>
<th>late</th>
</tr>
</thead>
<tbody>
<tr>
<td>visceral injury</td>
<td>delayed union</td>
</tr>
<tr>
<td>vascular injury</td>
<td>non-union</td>
</tr>
<tr>
<td>compartment</td>
<td>mal-union</td>
</tr>
<tr>
<td>syndrome (later)</td>
<td>tendon rupture</td>
</tr>
<tr>
<td>volkmann contracture</td>
<td>myositis ossificans</td>
</tr>
<tr>
<td>nerve injury</td>
<td>osteonecrosis</td>
</tr>
<tr>
<td>haemarthrosis</td>
<td>algodystrophy</td>
</tr>
<tr>
<td>infection</td>
<td>osteoarthritis and joint stiffness</td>
</tr>
</tbody>
</table>
Open (compound) fractures

While contacting orthopaedic team for definitive surgical treatment
Irrigate wound with N. saline, if not available with tap water. Cover wound with sterile moist dressing.
Immobilise limb preferable with external fixator if not possible, by cast (including joint above & below)
Remove obvious contaminants with meticulous effort IV antibiotics (e.g. cefuroxime +/- metronidazole or gentamicin)
Tetanus prophylaxis.
Check distal neurovascular status
Re-assess
Types of fracture healing

Primary : healing of the bone occur by interstitial growth of bone in rigid fixation by plate or nail
Secondary : healing occurs with adequate callus formation both interstitial & surrounding, when micro movement occur in stable fixation by POP, cast, locking plate, external fixator.
Modern concept is … secondary healing is preferable except intra-articular fracture

PHISIOLOGY OF FRACTURE
Components of Bone Formation

Note: Periosteum has 2 layers: an outer fibrous layer
inner more cellular and vascular cambium layer

It covers the external surface of bone and participates in healing of many types of fractures. The thicker more cellular periostium of infants and children has more extensive vascular supply therefore more active in fracture healing than adults.

STAGING OF FRACTURE HEALING

Last for less than 7 days

Tissue disruption results in hematoma at the fracture site

Local vessels thrombose causing bony necrosis at the edges of the fracture

Increased capillary permeability results in a local inflammatory milieu

Osteoinductive growth factors stimulate the proliferation and differentiation of mesenchymal stem cells
Cellular Formation Phase (2nd)
- 2-3 weeks
- Acidic environment but turning neutral
- Influx of endosteal cells from cambium layer produce a fibrous callus (environment has high oxygen tension) then cartilage (has a low oxygen tension environment)

Callus Formation Phase (3rd)
1. 4-12 weeks
2. Fibroblast deposit collagen in the granulation tissue
3. Soft Callus is formed (Unorganized network of woven bone); 4-12 weeks
4. Fibroblast deposit collagen in the granulation tissue
5. Soft Callus is formed (Unorganized network of woven bone); 4-12 weeks
6. Fibroblast deposit collagen in the granulation tissue
7. Soft Callus is formed (Unorganized network of woven bone);
• Periosteal callus forms along the periphery of the fracture site
• Intramembranous ossification initiated by preosteoblasts
• Intramedullary callus forms in the center of the fracture site
• Endochondral ossification at the site of the fracture hematoma
• Chemical and mechanical factors stimulate callus formation and mineralization

Ossification Phase (4th)

● 1-4 Years

● It will occur with adequate immobilization

● Bone ends become crossed with a new Haversian system that will eventually lead to the laying down of primary bone

● Fracture is bridged and united
Remodeling Phase (5th)

- Remodeling hard callus to compact bone or woven bone is gradually converted to lamellar bone.
- May take a few years
- Medullary cavity is reconstituted
- Bone is restructured in response to stress and strain (Wolff’s Law)

Osteon with bone-resorbing osteoclasts (left) that drill a tunnel into the bone and osteoblasts that lay down new bone (osteoid) and fill the tunnel with a new bone layer (original magnification 100×)
CHAPTER 11
SPECIFIC INJURIES

Clavicle

A broken collarbone is also known as a clavicle fracture. This is a very common fracture that occurs in people of all ages.

Anatomy

The collarbone (clavicle) is located between the ribcage (sternum) and the shoulder blade (scapula), and it connects the arm to the body.

The clavicle lies above several important nerves and blood vessels. However, these vital structures are rarely injured when the clavicle breaks, even though the bone ends can shift when they are fractured.

Description

The clavicle is a long bone and most breaks occur in the middle of it. Occasionally, the bone will break where it attaches at the ribcage or shoulder blade.

Symptoms

Clavicle fractures can be very painful and may make it hard to move your arm. Additional symptoms include:

- Sagging shoulder (down and forward)
- Inability to lift the arm because of pain
- A grinding sensation if an attempt is made to raise the arm
- A deformity or "bump" over the break
- Bruising, swelling, and/or tenderness over the collarbone
Examination

There is usually an obvious deformity, or "bump," at the fracture site. Gentle pressure over the break will bring about pain. Although a fragment of bone rarely breaks through the skin, it may push the skin into a "tent" formation.

Examine the shoulder to make sure that no nerves or blood vessels were damaged.

In order to pinpoint the location and severity of the break order an x-ray. X-rays of the entire shoulder will often be done to check for additional injuries.

Nonsurgical Treatment

If the broken ends of the bones have not shifted out of place and line up correctly, you may not need surgery. Broken collarbones can heal without surgery.

Arm Support

A simple arm sling or figure-of-eight wrap is usually used for comfort immediately after the break. These are worn to support your arm and help keep it in position while it heals.

Medication

Pain medication, including acetaminophen, can help relieve pain as the fracture heals.

Complications

If the fracture fragments do move out of place and the bones heal in that position, it is called a "malunion." Treatment for this is determined by how far out of place the bones are and how much this affects your arm movement.

A large bump over the fracture site may develop as the fracture heals. This usually gets smaller over time, but a small bump may remain permanently.

Surgical Treatment

Surgery can align the bones exactly and hold them in good position while they heal. This can improve shoulder strength when you have recovered.

Plates and Screws

During this operation, the bone fragments are first repositioned into their normal alignment, and then held in place with special screws and/or by attaching metal plates to the outer surface of the bone.

A small patch of numb skin below the incision. This numbness will become less noticeable with time. Because there is not a lot of fat over the collarbone, you may be able to feel the plate through your skin.

Plates and screws are usually not removed after the bone has healed, unless they are causing discomfort. Problems with the hardware are not common, but sometimes, seatbelts and backpacks can irritate the collarbone area. If this happens, the hardware can be removed after the fracture has healed.

Pins

Pins are also used to hold the fracture in good position after the bone ends have been put back in place. The incisions for pin placement are usually smaller than those used for plates. Pins often irritate the skin where they have been inserted and are usually removed once the fracture has healed.
**Surgical Complications** People who use any kind of tobacco product, have diabetes, or are elderly are at a higher risk for complications during and after surgery. They are also more likely to have problems with wound and bone healing. Be sure to talk with your doctor about the risks and benefits of surgery for your clavicle fracture.

There are risks associated with any surgery, including:
- Infection
- Bleeding
- Pain
- Blood clots in your leg
- Damage to blood vessels or nerves
- Nausea

The risks specific to surgery for collarbone fractures include:
- Difficulty with bone healing
- Lung injury
- Hardware irritation

**Humerus (Proximal, Middle and Distal Shaft)**

Proximal Fractures of the Humerus: Pain of upper arm and shoulder. Swelling and ecchymosis may be present. Angulation may be noted. May have appearance of dislocation or shoulder may appear normal with arm hanging loosely at side or held across the chest. Shortening of upper arm may be evident. Virtually the entire length of the humerus can be palpated by palpating from the axilla to the medial aspect of the elbow. Significant pain and/or crepitation on palpation is strongly suggestive of fracture. Treatment: Loose sling and swathe (with no pressure under the elbow). Keep patient in seated position, if practical. NOTE: Fractures of the neck of the humerus can accompany shoulder dislocations.

Mid-Shaft Fractures of the Humerus: May have damage to the radial nerve, which spirals around the bone. Damage to the nerve is indicated by inability to lift the hand (wrist drop) and loss of sensation on the back of the hand. Treatment: Loose sling and swathe (with no pressure under the elbow). Keep patient in seated position, if practical.

Fractures of the Distal Humerus: Fractures of the lower humerus can be difficult to differentiate from fracture/dislocations of the elbow in the field. If there is swelling, pain and crepitation on palpation around the elbow, it is best to assume a fracture and splint, sling and swathe the arm with the elbow in 90 degrees of flexion.
Elbow Dislocation
When the joint surfaces of an elbow are separated, the elbow is dislocated. Elbow dislocations can be complete or partial. In a complete dislocation, the joint surfaces are completely separated. In a partial dislocation, the joint surfaces are only partly separated. A partial dislocation is also called a subluxation.

The elbow is stable because of the combined stabilizing effects of bone surfaces, ligaments, and muscles. When an elbow dislocates, any or all of these structures can be injured to different degrees.

A simple dislocation does not have any major bone injury.
A complex dislocation can have severe bone and ligament injuries.
In the most severe dislocations, the blood vessels and nerves that travel across the elbow may be injured. If this happens, there is a risk of losing the arm.
Some people are born with greater laxity or looseness in their ligaments. These people are at greater risk for dislocating their elbows. Some people are born with an ulna bone that has a shallow groove for the elbow hinge joint. They have a slightly higher risk for dislocation.

Symptoms
A complete elbow dislocation is extremely painful and very obvious. The arm will look deformed and may have an odd twist at the elbow.
A partial elbow dislocation or subluxation can be harder to detect. Typically, it happens after an accident. Because the elbow is only partially dislocated, the bones can spontaneously relocate and the joint may appear fairly normal. The elbow will usually move fairly well, but there may be pain. There may be bruising on the inside and outside of the elbow where ligaments may have been stretched or torn. Partial dislocations can continue to recur over time if the ligaments never heal.

**Diagnosis**

The doctor will examine the arm. He will check for tenderness, swelling, and deformity. He will evaluate the skin and circulation to the arm. Pulses at the wrist will be checked. If the artery is injured at the time of dislocation, the hand will be cool to touch and may have a white or purple hue. This is caused by the lack of warm blood reaching the hand.

It is also important to check the nerve supply to the hand. If nerves have been injured during the dislocation, some or all of the hand may be numb and not able to move.

An X-ray is necessary to determine if there is a bone injury. X-rays can also help show the direction of the dislocation.

**Treatment**

An elbow dislocation should be considered an emergency injury. The goal of immediate treatment of a dislocated elbow is to return the elbow to its normal alignment. The long-term goal is to restore function to the arm.

**Nonsurgical Treatment**

The act of restoring alignment to the elbow is called a reduction maneuver. It is done gently and slowly. Two people are usually required to perform this maneuver.

Simple elbow dislocations are treated by keeping the elbow immobile in a splint or sling for two to three weeks, followed by early motion exercises. If the elbow is kept immobile for a long time, the ability to move the elbow fully (range of motion) may be affected. Physical therapy can be helpful during this period of recovery.

Some people will never be able to fully open (extend) the arm, even after physical therapy. Fortunately, the elbow can work very well even without full range of motion. Once the elbow's range of motion improves, the doctor or physical therapist may add a strengthening program. X-rays may be taken periodically while the elbow recovers to ensure that the bones of the elbow joint remains well aligned.
**Surgical Treatment**

In a complex elbow dislocation, surgery may be necessary to restore bone alignment and repair ligaments. It can be difficult to realign a complex elbow dislocation and to keep the joint in line.

After surgery, the elbow may be protected with an external hinge. This device protects the elbow from dislocating again. If blood vessel or nerve injuries are associated with the elbow dislocation, additional surgery may be needed to repair the blood vessels and nerves and repair bone and ligament injuries.

Late reconstructive surgery can successfully restore motion to some stiff elbows. This surgery removes scar tissue and extra bone growth. It also removes obstacles to movement.

Over time, there is an increased risk for arthritis in the elbow joint if the alignment of the bones is not good; the elbow does not move and rotate normally; or the elbow continues to dislocate.

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**Shoulder Dislocations**

Signs and Symptoms: Anterior/Inferior dislocations are most common (95% of shoulder dislocations). Pain to shoulder region. Loss of contour of deltoid muscle when compared to unaffected side. Palpable defect where the humeral head should be. Test for loss of sensation in the deltoid region: This indicates injury to the axillary nerve and needs to be documented prior to any treatment. Patient will usually hold the affected arm away from the body and supported by the unaffected arm. Recurrent dislocations are common. Frequently the victim will be able to tell you what the problem is.

Treatment:
1. If within easy transport time/range to higher-level care, splint in the most comfortable position and transport.
2. If higher-level care is distant, early reduction can be attempted:
   a) Palpate the entire length of the humerus. The entire shaft of the humerus can be palpated from the inner aspect of the upper arm. Presence of any significant point tenderness to palpation or crepitation indicates a fracture-dislocation. Fracture-dislocations are more common in high-speed injuries and in older persons. NOTE: DO NOT attempt field reduction if there is any suspicion of a fracture-dislocation: Splint in position of comfort and transport.
   b) Test for sensation over the deltoid area, checking for injury to the axillary nerve. Document prior to any attempt at reduction.
   c) Check circulation and neurological function of the affected arm and hand. There are multiple methods of reducing shoulder dislocations. The key to reduction is to perform it early before significant muscle spasms can develop, and to do any required manipulation
   d) SLOWLY and GENTLY. It is NEVER appropriate to attempt to ‘jerk’ a shoulder back into place.
   e) The patient may have to be sedated prior any procedure. Valium, 5-10 mg slow IV is usually effective and is also a good muscle relaxant.
   f) Successful reduction is usually obvious with a sudden return of the shoulder external anatomy to normal, and significant reduction of pain.
g) Reassess the neuro/vascular status of the arm and hand, then sling/swath.

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SCAPULAR MANIPULATION METHOD: Have the patient sit upright or lay face down. If sitting, the affected arm is supported straight out from the body. If lying prone the arm will be straight down. Apply 5-10 pounds of long-axis traction to the arm. The operator stands behind the patient and grasps the tip (inferior portion) of the scapula rotating it inward (towards the spine) and superior (towards the head). Slow, gentle and continuous motion is maintained.

Hand Fractures
Fractures of the hand can occur in either the small bones of the fingers (phalanges) or the long bones (metacarpals). They can result from a twisting injury, a fall, a crush injury, or direct contact in sports.

Symptoms
Signs and symptoms of a broken bone in the hand include:

- Swelling
- Tenderness
- Deformity
- Inability to move the finger
- Shortened finger
- Finger crosses over its neighbor when making a partial fist
- Depressed knuckle

A depressed knuckle is often seen in a "boxer's fracture." This is a fracture of the fifth metacarpal, the long bone below the little finger.

**Diagnosis**

A physical examination is done to check the position of the fingers and the condition of the skin. The examination may include some range of motion tests and an assessment of feeling in the fingers. This will ensure that there is no damage to the nerves. X-rays identify the location and extent of the fracture.

**Treatment**

**Nonsurgical Treatment**

Most of the time, the bones can be realigned by manipulating them without surgery. A cast, splint or fracture-brace is applied to immobilize the bones and hold them in place. The cast will probably extend from the fingertips down past the wrist almost to the elbow. This ensures that the bones remain fixed in place.

A second set of X-rays will probably be needed about a week later. These X-rays are used to ensure that the bones have remained in the proper position.

The cast will be worn for three to six weeks. Gentle hand exercises can probably be started after three weeks. Afterward, the finger may be slightly shorter, but this should not affect the ability to use the hand and fingers.

**Surgical Treatment**

Some hand fractures require surgery to stabilize and align the bones. These fractures usually break through the skin or result from a crushing accident. An orthopaedic surgeon can implant wires, screws, or plates in the broken bone to hold the pieces of the fractured bone in place.
If the bone changes position while healing, the finger may lose some function.  
After the bone has healed, the surgeon may remove the implants or may leave them in place.  
The physician may want to examine the hand periodically to ensure that the joint doesn't tighten (contract) during healing.  
Joint stiffness may be experienced because of the long immobilization period. Exercises can help restore strength and range of motion. A physical therapist may be able to help with this.  

**Thumb/Finger Dislocations**

**Signs and Symptoms:** Usually obvious from deformity of the thumb/finger at the joint.  
**Treatment:** Reduction of phalange dislocation is accomplished by traction applied to the partially-flexed digit while pushing the base of the dislocated phalanx back into place. Reduction of a dislocated metacarpophalangeal joint (knuckle) of an index finger is usually unsuccessful, frequently requiring surgery. After reduction buddy-tape or splint the affected finger. If reduction is unsuccessful, splint the hand in position of function (beer-can or duckbill splint) and transport. 

**Pelvis**

**Signs and Symptoms:** Pain in the pelvis, hips, groin or back. Pain is elicited when applying pressure to iliac crests or suprapubic area. Patient may be unable to lift legs while supine. The foot on the injured side may be turned outward.  
**Treatment:** Place patient on a long board. MAST will help in stabilizing pelvic fractures and may help tamponade bleeding from pelvic structures. Initiate 2 x LB IV LR/NS or start large-bore saline lock.
Pain medication as needed and evacuate.

NOTE: Foley catheter is contraindicated due to risk of damage to GU structures. It is recommended not to use the log roll technique to move a patient with a suspected pelvic injury.

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Hip Fractures

A hip fracture is a break in the upper quarter of the femur (thigh) bone. The extent of the break depends on the forces that are involved. The type of surgery used to treat a hip fracture is primarily based on the bones and soft tissues affected or on the level of the fracture.

Symptoms
The patient with a hip fracture will have pain over the outer upper thigh or in the groin. There will be significant discomfort with any attempt to flex or rotate the hip.

If the bone has been weakened by disease (such as a stress injury or cancer), the patient may notice aching in the groin or thigh area for a period of time before the break. If the bone is completely broken, the leg may appear to be shorter than the noninjured leg. The patient will often hold the injured leg in a still position with the foot and knee turned outward (external rotation).

Examination imaging

The diagnosis of a hip fracture is generally made by an X-ray of the hip and femur. Hip fractures occur at the upper end of the thigh bone (femur).

Types of Fractures

In general, there are three different types of hip fractures. The type of fracture depends on what area of the upper femur is involved.

Intracapsular Fracture

These fractures occur at the level of the neck and the head of the femur, and are generally within the capsule. The capsule is the soft-tissue envelope that contains the lubricating and nourishing fluid of the
Intertrochanteric Fracture

This fracture occurs between the neck of the femur and a lower bony prominence called the lesser trochanter. The lesser trochanter is an attachment point for one of the major muscles of the hip. Intertrochanteric fractures generally cross in the area between the lesser trochanter and the greater trochanter. The greater trochanter is the bump you can feel under the skin on the outside of the hip. It acts as another muscle attachment point.

Subtrochanteric Fracture

This fracture occurs below the lesser trochanter, in a region that is between the lesser trochanter and an area approximately 2 1/2 inches below. In more complicated cases, the amount of breakage of the bone can involve more than one of these zones. This is taken into consideration when surgical repair is considered.

Treatment Considerations

Nonsurgical Treatment

Certain types of fractures may be considered stable enough to be managed with nonsurgical treatment. Because there is some risk that these "stable" fractures may instead prove unstable and displace (change position), the doctor will need to follow with periodic X-rays of the area. If patients are confined to bed rest as part of the management for these fractures, they will need to be closely monitored for complications that can occur from prolonged immobilization. These include infections, bed sores, pneumonia, the formation of blood clots, and nutritional wasting.

Surgical Treatment

The surgeon's decision as to how to best fix a fracture will be based on the area of the hip that is broken and the surgeon's familiarity with the different systems that are available to manage these injuries.

Intracapsular Fracture

If the head of the femur ("ball") alone is broken, management will be aimed at fixing the cartilage on the ball that has been injured or displaced. Frequently with these injuries, the socket, or acetabulum, may also be broken.

Intertrochanteric Fracture

Most intertrochanteric fractures are managed with either a compression hip screw or an intramedullary nail, which also allows for impaction at the fracture site. The compression hip screw is fixed to the outer side of the bone with bone screws and has a large secondary screw (lag screw) that is placed through the plate into the neck and head of the hip.
Subtrochanteric Fracture

At the subtrochanteric level, most fractures are managed with a long intramedullary nail together with a large lag screw or they are managed with screws that capture the neck and head of the femur or the area immediately underneath it, if it has remained intact.

Femur

Signs and Symptoms: Pain in the upper leg and/or deformity. Foot may be rotated inward or outward. NOTE: Serious bleeding may occur into the thigh compartments without any visible blood loss. Treatment: Apply traction splint. A properly applied traction splint will significantly decrease the patient’s pain and help control bleeding. LB IV LR/NS or saline lock, pain control and evacuate.

Knee Dislocations

Signs/Symptoms: Usually obvious, with the tibia/fibula either anterior or posterior to the distal femur. Treatment: This is a devastating injury, frequently accompanied by vascular damage to the popliteal artery. Assume vascular damage in all knee dislocations even if pulses are present. Knee dislocations will frequently reduce themselves. If it has not, reduce by steady, gentle long-axis traction. Splint carefully and monitor distal pulses frequently. A dislocation of the kneecap occurs when the patella comes completely out of its groove on the end of the thigh bone (femur), and comes to rest on the outside of the knee joint. Kneecap dislocations usually occur as a significant injury the first time the
injury occurs, but the kneecap may dislocate much more easily thereafter.

**Signs of a Kneecap Dislocation**
A kneecap dislocation causes significant pain and deformity of the knee joint. The kneecap always dislocates to the outside of the joint. Pain and swelling are common symptoms of a kneecap dislocation. Over time, bruising may also develop around and below the knee joint.

A kneecap dislocation should not be confused with a knee dislocation. A knee dislocation occurs when the thigh bone (femur) and shin bone (tibia) lose contact. A kneecap dislocation occurs with the kneecap dislodges from its groove on the thigh bone. Sometimes people use the words knee dislocation to describe a kneecap dislocation; this is incorrect.

**Recurrent Kneecap Dislocations**
When the kneecap comes out of joint the first time, ligaments that were holding the kneecap in position are torn. The most important torn structure is called the medial patellofemoral ligament, or MPFL. This ligament secures the patella to the inside (medial) of the knee. When a kneecap dislocation occurs, the MPFL must be torn.

Once the MPFL is torn, it often does not heal with proper tension, and the kneecap can subsequently dislocate more easily. That is why recurrent dislocation of the kneecap occurs in a high percentage of patients who have this injury.

**Treatment of a Kneecap Dislocation**
- Most kneecap dislocations are initially with prompt reduction (repositioning) of the kneecap.
- Most patients will go to emergency room, and while repositioning the kneecap is relatively straightforward, pain and muscle spasm can prevent this from being easily accomplished.
- Anesthesia (either local or general) may be administered to help reposition the bone.
- After repositioning the kneecap, treatment usually begins with R.I.C.E. treatment to control pain and help with swelling.
- Crutches and a knee brace are usually offered to help control pain.
- By strengthening the muscles around the joint, and with the use of specialized knee braces, the hope is to help prevent recurrent injury.
• Posterolateral dislocations are particularly difficult and often require operative reduction. This is especially true when the medial femoral condyle button-holes through the medial aspect of the joint capsule and/or MCL — an occurrence that is often accompanied by a "dimple sign" overlying the medial aspect of the knee.

• After reduction, splint the lower extremity in approximately 20 degrees of flexion to avoid postreduction re-dislocation, apply ice, and keep the knee elevated.

• Postreduction radiographs should be obtained, preferably before further ligamentous stressing/assessment.

• Postreduction hard signs of arterial injury should prompt emergent vascular surgical intervention that should not be delayed for arteriography. In this setting, arteriograms may indeed be contributory to the surgical decision matrix but can be performed in the operating room by the vascular surgeon with less contrast administration than traditional arteriography tends to use.

• All reduced knee dislocations without hard signs of arterial injury should be assessed with ABI/API measurements. Any reading of less than 0.90 should prompt further imaging (i.e., arteriography vs CT angiography vs duplex sonography), which should be decided upon in conjunction with the vascular consult.

• All knee dislocations, regardless of emergent revascularization needs, should be admitted for serial perfusion checks.
Ankle Fracture-Dislocations
Signs/Symptoms: Usually obvious, with the foot shifted anterior or posterior on the distal tibia/fibula. Skin over the dislocation is frequently tented. Pulses in the foot may be absent and is a grave sign, requiring immediate reduction of the dislocation. Virtually all ankle dislocations involve fractures.
Treatment: Ankle dislocations should be reduced as soon as possible. Apply gentle and steady traction to the foot while supporting the heel and lower leg until the alignment of the ankle is approximately normal. Exact anatomic reduction is not necessary. No skin should be tented or tight over bone if the ankle has been properly reduced. Splint the ankle with a well-padded posterior and U-splint. Do not allow the patient to put any weight on the ankle or leg.

Ankle Sprains

- Grade 1 sprain:
  Slight stretching and some damage to the fibers (fibrils) of the ligament.
- Grade 2 sprain:
  Partial tearing of the ligament. If the ankle joint is examined and moved in certain ways, abnormal looseness (laxity) of the ankle joint occurs.
- Grade 3 sprain:
  Complete tear of the ligament. If the examiner pulls or pushes on the ankle joint in certain movements, gross instability occurs.

Treatment
Nonsurgical Treatment
Walking may be difficult because of the swelling and pain. You may need to use crutches if walking causes pain. Usually swelling and pain will last two days to three days. Depending upon the grade of injury, the doctor may tell you to use removable plastic devices such as castboots or air splints. Most ankle sprains need only a period of protection to heal. The healing process takes about four weeks to six weeks. The doctor may tell you to incorporate motion early in the healing process to prevent stiffness. Motion may also aid in being able to sense position, location, orientation and movement of the ankle (proprioception). Even a complete ligament tear can heal without surgical repair if it is immobilized appropriately. Even if an ankle has a chronic tear, it can still be highly functional because overlying tendons help with stability and motion.

For a Grade 1 sprain, use R.I.C.E (rest, ice, compression and elevation):
- Rest your ankle by not walking on it.
- Ice should be immediately applied. It keeps the swelling down. It can be used for 20 minutes to 30 minutes, three or four times daily. Combine ice with wrapping to decrease swelling, pain and dysfunction.
- Compression dressings, bandages or ace-wraps immobilize and support the injured ankle.
- Elevate your ankle above your heart level for 48 hours.
- For a Grade 2 sprain, the RICE guidelines can also be used. Allow more time for healing to occur. The doctor may also use a device to immobilize or splint the ankle.

A Grade 3 sprain can be associated with permanent instability. Surgery is rarely needed. A short leg cast or a cast-brace may be used for two weeks to three weeks.

Rehabilitation is used to help to decrease pain and swelling and to prevent chronic ankle problems. Ultrasound and electrical stimulation may also be used as needed to help with pain and swelling. At first, rehabilitation exercises may involve active range of motion or controlled movements of the ankle joint without resistance. Water exercises may be used if land-based strengthening exercises, such as toe-raising, are too painful. Lower extremity exercises and endurance activities are added as tolerated. Proprioception training is very important, as poor propriception is a major cause of repeat sprain and an unstable ankle joint. Once you are pain-free, other exercises may be added, such as agility drills. The goal is to increase strength and range of motion as balance improves over time.

All ankle sprains recover through three phases:
- Phase 1 includes resting, protecting the ankle and reducing the swelling (one week).
- Phase 2 includes restoring range of motion, strength and flexibility (one week to two weeks).
- Phase 3 includes gradually returning to activities that do not require turning or twisting the ankle and doing maintenance exercises. This will be followed later by being able to do activities that require sharp, sudden turns (cutting activities) such as tennis, basketball or football (weeks to months).

Medication
Nonsteroidal anti-inflammatory drugs (NSAIDs) may be used to control pain and inflammation.

Long-term outcome
If an ankle sprain is not recognized, and is not treated with the necessary attention and care, chronic problems of pain and instability may result.
Surgical Treatment
Surgical treatment for ankle sprains is rare. Surgery is reserved for injuries that fail to respond to nonsurgical treatment, and for persistent instability after months of rehabilitation and non-surgical treatment.
Surgical options include:
• Arthroscopy
  A surgeon looks inside the joint to see if there are any loose fragments of bone or cartilage, or part of the ligament caught in the joint.
• Reconstruction
  A surgeon repairs the torn ligament with stitches or suture, or uses other ligaments and/or tendons found in the foot and around the ankle to repair the damaged ligaments.

ANKLE SPRAINS (MILD, MODERATE, SEVERE): Injury to the lateral (outer) aspect of the ankle caused by inversion of the foot. Ligaments are damaged, but usually no fracture is involved. MOI is usually a result of rolling the foot inward at the ankle and stretching/tearing the ligaments of the lateral aspect of the ankle.
Signs & Symptoms: Pain and swelling of the lateral aspect of the affected ankle.
• Moderate to severe sprains frequently show bruising and ecchymosis of the ankle.
• Palpate the entire lower leg as part of the physical exam. Any tenderness in the knee or middle section of the lower leg may indicate a complicated injury. Treat as a severe sprain.
• Mild sprains can usually be walked on immediately after injury, but become painful and swollen within a few minutes to hours after injury.
• If the patient has significant pain upon attempting weight bearing, the ankle should be treated as a severe sprain or a fracture.
• If the patient is able to bear weight on the ankle, perform an anterior drawer test of the ankle:
  a) With the patient supine, cup the heel of the affected foot in one hand and grasp the leg just above the ankle with the other.
  b) Attempt to pull the foot forward while holding the leg stable. If there is any motion of the foot forward on the ankle, the ankle is unstable (grade 3 sprain).
• Any tenderness/swelling of the anterior or the medial aspect of the ankle may indicate a complicated injury. This must be treated as a severe sprain.
• Point tenderness of the lateral malleolus at the inferior tip or posterior aspect may indicate a chip fracture of the lateral malleolus. Treat as a severe sprain.

Treatment (Minor, Moderate and Severe Sprains):
• Minor Sprains (minimal swelling, no bruising/ecchymosis, able to bear weight): R.I.C.E. – Rest, Ice, Compression, Elevate. Limit weight bearing if possible. Motrin or Toradol prn. NOTE: An ace wrap around the ankle may help control swelling, but does nothing to stabilize the ankle. A ‘stirrup tape’ or ‘basket tape’ (see below) of the ankle will help provide stability to an injured ankle. If the ankle becomes seriously painful during ambulation, treat as a moderate/severe sprain.
• Moderate to Severe Sprains (any evidence of fracture, unable to bear weight without significant pain): R.I.C.E. – Rest, Ice, Compression, Elevate. Ace wrap and splint the ankle. Do not allow weight bearing. Give Motrin or Toradol prn. Evacuate ASAP.

Stirrup Taping of the Ankle:
1. Clean the foot, ankle and lower leg. Benzoin tincture (if available) may be used as a skin adherent, however this will make it difficult to remove the tape.
2. Using 1-inch silk tape, apply anchor strips about 4 inches above the ankle, and the instep of the foot. Anchor strips should not be circumferential, leave a 2-inch gap on the lower leg, and a 1-inch gap on top of the foot.
3. Hold the foot at a 90 degree angle in relation to the leg.
4. Apply a long strip of tape from one side of the ankle under the heel to the other side in stirrup manner.
5. Apply a short strip of tape from one side of the foot around the posterior heel to the other side of the foot.
6. Alternate long and short strips as above, overlapping the previous strips by 50-75%. Use about 5-6 strips of tape in each direction.
7. No tape strip should be circumferential around the foot or leg: There should be at least a 1-2 inch gap on the foot and leg to allow for swelling.
8. If the taping is done properly, it will be difficult to passively invert the ankle.
9. Check the taping every 30 minutes for two hours, and hourly after that. Remove the taping if any neurovascular compromise to the foot or ankle occurs.

**SPLINTING EXTREMITY**

Rationale: Careful management of the extremity may prevent exacerbation of the existing injury and help preserve future function.
- Isolated extremity trauma itself is rarely life threatening, however, complications of poorly managed injuries may result in significant loss of function and disability.
- The development of hemorrhagic shock is also a concern and the most important and immediate danger.
- When performed correctly, the fracture site, along with the joint above and below, will be
immobilized.
• This should prevent further injury, help control bleeding and reduce pain.

Indications:
1. Injury to the extremity with associated pain, swelling, numbness, tingling, deformity, or loss of function.
2. Amputation, if not completely severed.
3. Stabilize IV sites.

Procedure:
1. Manually stabilize injured extremity.
2. Cut or remove clothing to expose injury.
3. Check distal circulation, pulse, and neurological status.
4. Select and prepare appropriate splint.
5. Apply splint without moving fracture site regularly during transport.
6. Pad where applicable.
7. Immobilize above and below injury.
8. Re-check distal circulation, pulse, and neurological status.
Note: A traction splint can be used with no traction applied and used as a rigid splint.

SPLINTING TRACTION SPLINT

Rationale:
The use of traction on a mid-shaft fracture of the femur helps in relieving spasms or tension to the muscles, stabilizes the fractured bone ends, and prevents additional damage to the surrounding arteries, veins and tissues. Relief of tension and spasms also assists in alleviating pain.

Indications: Mid-shaft fracture to the femur.

Contraindications:
1. Fractures to the head of the femur.
2. Fractures to the lower third of the femur.
3. Associated fractures to the pelvis, patella, tibia, fibula.
4. Partial amputation of the extremity.
5. Critical patients should not have the device applied on scene.

Procedure:
1. Manually stabilize injured extremity.
2. Remove clothing to expose injury.
3. Remove shoe and sock.
4. Check distal circulation and neurological status
5. Adjust splint to proper length beside uninjured leg.
6. Apply the splint according to manufacturer's instructions.
7. Pull traction on the injured extremity.
8. Secure extremity to splint.
9. Recheck distal circulatory status, pulse, movement, and sensation.

SPECIAL CONSIDERATION: Application of a traction splint to an open fracture of the femur with protruding bone ends may lead to further damage and infection.

Compartment Syndrome

Occurs when bleeding in a closed space exerts pressure in surrounding non-elastic membranes. This pressure is transmitted to blood vessels and nerves, compressing them to the point of circulatory impairment and neurological compromise. This condition is usually found in either the forearm or the lower leg resulting from crushing injuries or fractures, but can manifest itself in the hand, forearm and foot.

NOTE: Compartment syndrome is addressed here as a complication of extremity trauma.

Signs & Symptoms
• Pain that is out of proportion to the injury or physical findings. Pain is usually described as: Deep, excruciating, burning and unrelenting. Pain is usually difficult to localize and difficult to control with the normal analgesic regimen.
• Pain increased with passive stretching of the muscle group involved or with active flexion of involved muscles.
• Hyperesthesia or paresthesias of nerves that cross through the affected area.
• Tenderness, tenseness, or sensation of tightness of the compartment.

CAUTION: Some of the ‘classic signs’ of compartment syndrome (delayed capillary refill, lack of sensation distal to the injury site, paralysis, pallor and puselessness) occur late in the course of the syndrome and are not reliable for early diagnosis. If compartment syndrome is suspected immediate evacuation is required.

Treatment: Treat causative factor. Immobilize extremity. Closely monitor extremity and transport ASAP. Fasciotomy

NOTE: Fasciotomy should only be performed under direct supervision of a physician.

CAUTION: Elevation of a limb above heart level, wrapping with ace wraps or compression dressings or application of cold packs are NOT an acceptable treatments for compartment syndrome. These procedures may actually exacerbate the situation.

SPECIALTY AREAS
Heel Spur Syndrome
(heel spur, heel bursitis, plantar fasciitis)

Introduction: The term "heel spur syndrome" refers to any to heel pain with or without a spur that
typically develops from excessive repetitive strain on the plantar fascia. The plantar fascia is loaded when weight is applied (standing), causing pain along the plantar fascia, particularly where the fascia connects to the heel tubercle. This condition is often a tolerable nuisance but it may be painful enough to make ambulation difficult. Chronic conditions may last for years if not properly treated.

Symptoms

Insidious onset of heel pain, most severe in the morning or when standing up; may acutely follow an injury; pain can be bilateral.

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Signs

- Using Basis Tools: Point tenderness over medial tubercle of the calcaneus at the level of the plantar fascial attachment, which may radiate distally causing pain and swelling in the arch; more common in pronated foot type but heel pain can present in a high-arch foot type; distant symptoms due to compensatory gait changes; tight Achilles tendon.
  
  X-rays: Spur presents 60% of the time; fracture, bone cyst or arthritic changes may be noted to explain symptoms.

Differential Diagnosis

- Bursitis - palpate tenderness (inflamed bursa) directly below the calcaneal tubercle.
- Nerve entrapment - point tenderness over nerve; pain radiating into heel; positive Tinel’s sign*. Tarsal tunnel syndrome - compression of the posterior tibial nerve; positive Tinel’s sign*.
- Referred pain from low back - L-4 L-5 extends to the heel as part of the area of distribution for this nerve root level; EMG/nerve conduction studies are helpful for diagnosis of nerve related heel pain.
- Stress fracture - diagnose on x-ray; not common in calcaneous
- Foreign body - usually an entrance portal visible
- Arthritis (Reiter’s, psoriatic, ankylosing spondylitis, rheumatoid) - See Symptom: Joint Pain section.

*Tinel’s sign is pain radiating distally along the course of a nerve.

Treatment

1. Conservative: Ice (not heat) massage, Achilles stretching, heel pad (foreign body, bursitis, arthritides).
   a. Ice massage: Use ice directly on heel and arch but limit to 8-10 minutes 4-6 x day; use Dixie cup technique or frozen plastic water bottle or gel pack if available.
   b. Dixie cup technique when freezer available: Fill cup with water and freeze. Keep several ice cups on hand. Tear cup down to expose ice and use as an applicator to heel area.
   c. Achilles tendon stretching: Any limitation in ankle dorsiflexion increases force on plantar fascia.

2. Rest strap: Tape the foot to support the arch

3. Remove any splinter, glass or metal when the operational tempo permits.
4. Anti-inflammatories: Motrin 800 mg po tid with food; arthritides may need steroid injection. Cortisone injection for acute pain: Injection mixture: 1/2 cc long acting steroid i.e., Celestone, dexamethasone acetate, and 1cc Marcaine 0.5% plain. (See video on CD-ROM)  
5. Consider a Marcaine block to the posterior tibial nerve if previous training and experience.  
6. Rest is mandatory to allow healing. 
Alternative:  
• Arch supports, injection (2cc of Marclaine 0.5% mixed with 1/2cc of dexamethasone acetate or other long acting steroid could prove helpful for short mission if pain significant).  
• Place soft, supportive material under boot insole arch area. (Ex. eye patch, 4x4 gauze cut to fit)

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Ingrown Toenail

An ingrown nail occurs when the nail border or corner presses on the surrounding soft tissue. This condition is painful and often results in an infection once the skin is broken, with the offending nail corner acting like a foreign body introducing pathogens. An ingrown nail may result from improper trimming of nails, injury, tight shoes, genetic predisposition and fungal nail infections.

Symptoms
Toe pain, especially in shoes; history of recurrent ingrown nails and infections, and previous procedures to remove the nail.

Signs: Most commonly involves great toe; soft tissue penetration and secondary infection, with purulence, tenderness, erythema and edema; excessive granulation tissue in more chronic cases; malodorous wound when gram-negative bacteria involved.

Differential Diagnosis
• Subungual exostosis - spur on the distal phalanx which pushes upward causing the nail to incurvate.  
• Fungal nail infection, subungual hematoma, foreign body reaction (granuloma)

Treatment
Partial nail avulsion
1. Perform digital block using Xylocaine 1% or Marcaine 0.5% plain (no epinephrine for digits)
2. Use elevator to free nail from bed along border. Also free nail from overlying soft tissue.
3. Use an English nail anvil or nail clipper to remove the offending nail border. Scissors will also work.
4. Use curette to remove infected necrotic tissue or excessive granulation tissue (proud flesh) from the nail groove.
5. Dress with Betadine gauze and Kling. Coban or Elastoplast helps hold dressing in place.
6. Elevate foot and apply warm soaks or compresses tid.

7. Antibiotics for 7 days: Dicloxacillin 500mg po qid or Keflex 500mg po qid for broader coverage. Erythromycin 500mg po qid for penicillin allergic. ONLY if INFECTED

Plantar Warts

Introduction: Warts are caused by human papillomavirus viruses and can be found anywhere on the skin when the virus is introduced through a crack in the skin of a susceptible individual. A wart has tiny dots in the center which are small vascular elements. These dots are often black (dried blood) due to irritation, when located on the plantar aspect of the foot. Warts are often ignored until they become painful.

Symptoms

Pain, especially if wart is on prominent plantar area; may have tried over-the-counter preparations, other family or team members may have warts as well.

Signs

Lesions tender to palpation and squeezing especially if located on weight-bearing area; callus may form over the wart, increasing pain.

Differential Diagnosis:

Corn, callus, pyogenic granuloma, other lesions. Corns and Callus.
A wart may bleed (pinpoint) with debridement but callus will not.
Pyogenic granuloma bleeds easily.

Treatment
1. Debride overlying callus with #15 or 10 blade to allow medicine to reach wart.
2. Apply aperture pad to keep topical preparation isolated over the wart. 1/8“ felt padding with sticky back works well. Precut felt pads are available, but if material is in sheets, cut and size to fit.
3. Apply 60% salicylic acid paste (or monochloroacetic acid) to wart. Tape to cover and hold in place for 3 days.
4. Repeat treatment in one week.
5. Curettage reduces the chance of plantar scarring since the procedure does not involve penetration below the dermis when done correctly.
6. A surgical excision of a wart using two semi-elliptical incisions is a consideration for a wart in a non-weight bearing area. Surgical excision should never be performed on weight bearing areas because of the risk of scarring and subsequent pain with ambulation. Alternative: Liquid nitrogen (LN2), trichloroacetic acid, many over-the-counter preparations.

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Bunion

Introduction: A bunion is an enlargement at the 1st metatarsal head of the great toe, which deviates laterally. Often there is no bump, but rather an angulation of the first metatarsal (hallux abductor valgus) that makes the head of this bone more prominent. Pain is a result of cartilage erosion, bursitis and neuritis in the effected joints.

Symptoms: Pain near first metatarsal head, history of a progressive deformity over time.

Signs: Bump, erythema and tenderness medially (tibial aspect) over the first metatarsal head; joint stiffness in more chronic cases, especially with excessive pronation (flat feet).

Differential Diagnosis - rigid toe due to traumatic osteoarthritis (hallux rigidus or limitus). Toe joint displacement/swelling (metatarsalgia, sesamoiditis). Local toe irritation (shoe irritation in absence of deformity)

Treatment

1. Change to a wider shoe or soft sneaker if operationally permissible.
2. Use bunion pads. Over-the-counter bunion pads come in all shapes and sizes. A doughnut hole cut in felt or several layers of moleskin will work as a substitute for a bunion pad.
3. NSAIDs for pain relief. Ice massage if acute presentation.
4. Arch supports and orthotics in severely pronated feet.

Corns and Calluses

Introduction: A callus is a thickening of the outer layer of skin, in response to pressure or friction, that serves as a protective mechanism to prevent skin breakdown. The hyperkeratotic change for corns and calluses is similar except a corn involves a discrete pressure spot, typically over a bone.

Symptoms: Pain history of a corn or callus in the same areas.

Signs: Thickened, dry skin over prominent bones (corn); larger patches of thickened, dry skin over friction areas from walking (calluses); tenderness, blisters, breakdown and infection after continued irritation.
Differential Diagnosis  Wart, foreign body

Treatment

Trim areas with #15 blade or beaver blade. Trim with #10 blade for larger callus areas. Place felt with a doughnut-shaped hole cut in the middle (or precut felt available over the counter) around area to relieve pressure and friction. Medicated pads are not recommended.

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Stress Fractures of the Foot

Introduction: A stress fracture may affect any bone. The most common stress fracture in the foot, known in the military as a march fracture, is the second metatarsal. Stress fractures are often seen when bone absorption exceeds bone-building activity.

Symptoms: Pain in a specific area that persists during and after exercise; history of increased activity such as a long run which significantly exceeds previous training.

Signs

• Point tenderness with palpation; (i.e., tibial stress fracture most common at junction of middle and lower thirds or middle and upper thirds of the bone); significant edema in the dorsum of the foot over metatarsal fracture; compensatory antalgic gait.
• X-rays (if available) Initially normal but repeat study at 3-4 weeks after onset will often show slight callus formation.

Differential Diagnosis - metatarsal stress fracture: metatarsalgia, neuroma, capsulitis

Treatment

1. Conservative: Rest until point tenderness subsides; ice and NSAIDs.
2. Alternate exercise: Swimming or biking in place of running to maintain cardiovascular fitness. Gradually resume a running program once pain free.

3. Identify biomechanical and structural predisposing factors (i.e., tibial varum, cavus foot, flatfoot, long 2nd or short 1st metatarsal) and treat with appropriate custom foot orthotics.
4. Arch supports, padding to decrease weight on specific area. A metatarsal pad or doughnut cutout will decrease weight on the metatarsal when correctly placed.

Friction Foot Blisters

Introduction:
Footwear is often new and sometimes ill fitting. Hyperhidrosis (excessive sweating) of the feet may increase friction over pressure areas in the shoe. A high arch or cavus foot may be more
susceptible to shoe rub and blister formation on the top of the foot as well as over the metatarsal head area.

Symptoms: Sore feet, blister, history of high-level training or running

Signs: Obvious blisters over involved areas.
Assessment: Diagnosis is based on clinical presentation.

Differential Diagnosis
Genetic blister disease, epidermolysis bullosa (inherited disease in which bullae form from slight trauma), insect bite, or burn.

Treatment
1. Prevent additional and future blisters.
2. Aspirate blister with a sterile needle.
3. Cleanse with Betadine and cover
4. Leave the “roof” of the blister in place to act as a biological dressing. This will decrease tenderness until new skin forms and matures in a few days.
5. If infected, the blistered skin covering should be removed using a scalpel or scissors. Cleanse the area and apply a thin layer of Neosporin or Bacitracin followed by a thin non-adherent dressing. Then apply moleskin over the dressing and adjacent skin to hold everything in place.
6. Coban and Elastoplast also work well for holding dressings in place on the foot.
7. Wear heavier socks, if sweating is not a problem, or two pairs of socks to act as a buffer.

Crush Injuries
Introduction
Result from a patient being trapped under heavy object and either crushing part of the body or cutting off circulation (usually of the extremities). Crush injuries are usually the result of a structural collapse. Crush injuries of the head, neck and chest are usually rapidly fatal. Crush injuries/entrapment of the extremities, lower abdomen and pelvis can result in an awake, alert victim trapped in a collapsed structure.

Signs and Symptoms: Patient trapped with a section of the body caught under a heavy object. The patient can be awake, alert and in remarkably little pain, even though damage to the trapped portion is serious. If accessible, the trapped part of the body may be blue, cold and pulseless. Hyperkalemia and rhabdomyolysis can result from this syndrome resulting in cardiovascular collapse or renal failure minutes to hours after extraction.

Treatment: This syndrome has a high mortality. Even though the patient may appear stable while trapped, once the entrapment has been released, the victim may go into complete cardiovascular collapse, from both the sudden flow of blood to the formerly entrapped part of the body and from accumulated metabolic waste products being shunted back into the central circulation. If an IV can be started prior to extrication, it is best to give the patient a fluid bolus just prior to release of the entrapped part of the body. If cardiovascular collapse occurs, standard resuscitation should be started. Crushed extremities should be irrigated with normal saline, dressings applied and splinted. Minimal or no debridement should be done at this stage. Rhabdomyolysis (breakdown of muscle
tissue) can result from crush injury. The release of myoglobin can cause acute renal failure. Hydration with normal saline to insure brisk urine flow can help avoid this complication. Urine flow can be increased by use of Mannitol, 0.5-1.0 mg/Kg. This may be used if approved by medical control. Compartment syndrome (see above) can also result from crush injury.