



**GRADUATE
ENTRY
MEDICAL
SCHOOL**

BURNS: Back to Basics



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BURNS

?????

WHO

- Globally 265,000 from fires

St James Hospital

- 200 people per year (>14years)

American Burn Association

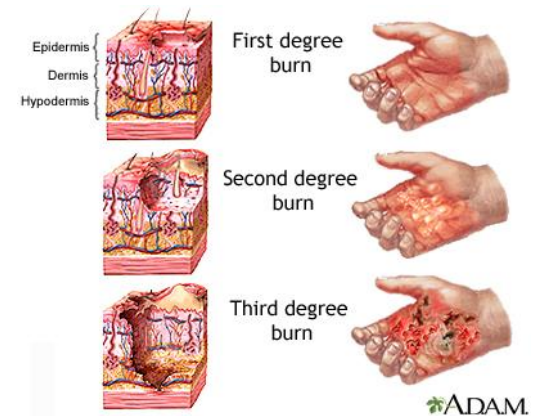
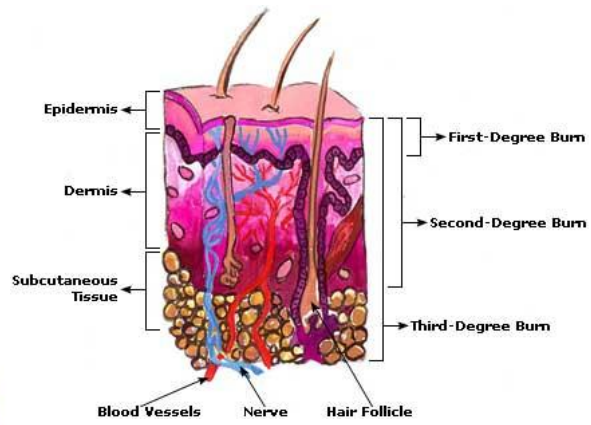
- 486,000 – burn injuries receiving medical treatment

Victoria, Australia

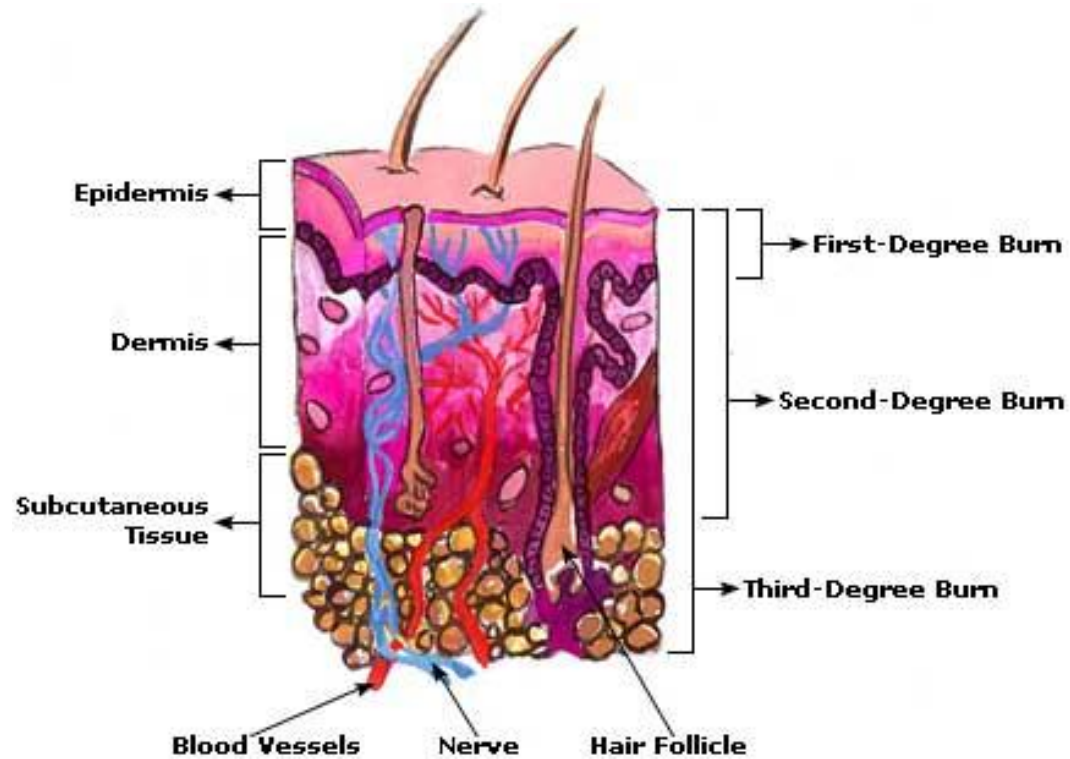
- 5000 to EDs with burn injuries

Objectives

- Anatomy & Physiology of the Skin
- Pathophysiology of Burns
- Burn Shock
- Etiology of Burns
- Burns Depth (Classification)



The Skin



<http://www.home-remedies-for-you.com/remedy/Burns.html>

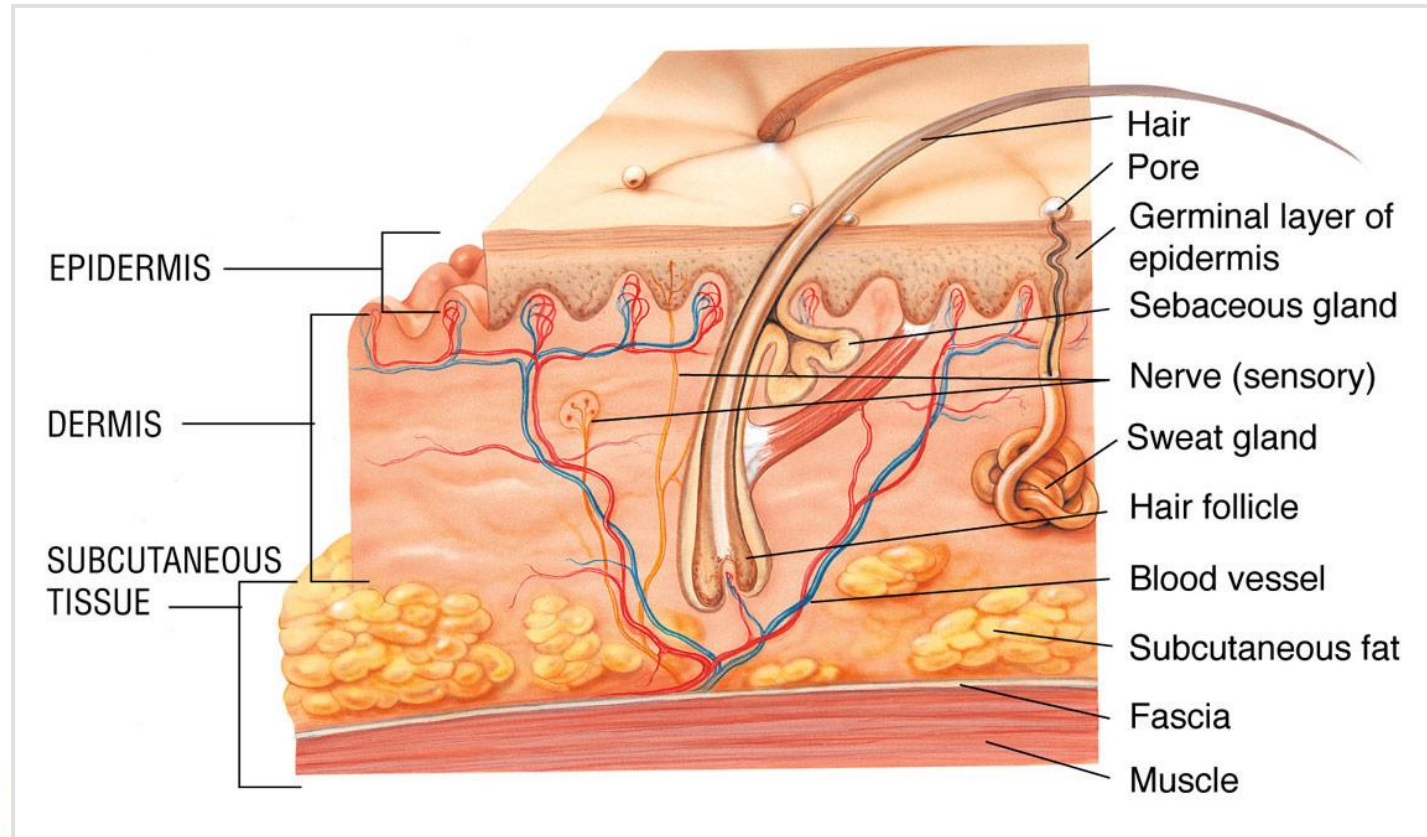
The Skin - Overview

- Integumentary System
- Largest Organ
- Thickness 1cm to 1mm
- Maintain homeostasis

The Skin - Functions

- Protection – physical barrier
- Thermoregulation
- Waterproof
- Sensory Organ
- Vitamin D Synthesis
- Absorption

The Skin



The Skin – Principal Layers

- Epidermis
 - Outer layer
 - Body's first line of defense
 - Composed of several layers

The Skin - Principal Layers

- Dermis
 - Inner layer
 - Composed of:
 - Collagen fibers
 - Elastin fibers
 - Mucopolysaccharide gel
 - Enclosed within the dermis:
 - Nerve endings
 - Blood vessels
 - Sweat glands
 - Hair follicles

The Skin - Principal Layers

- Subcutaneous layer.
- Beneath the subcutaneous layer are the muscles, tendons, bones, and vital organs

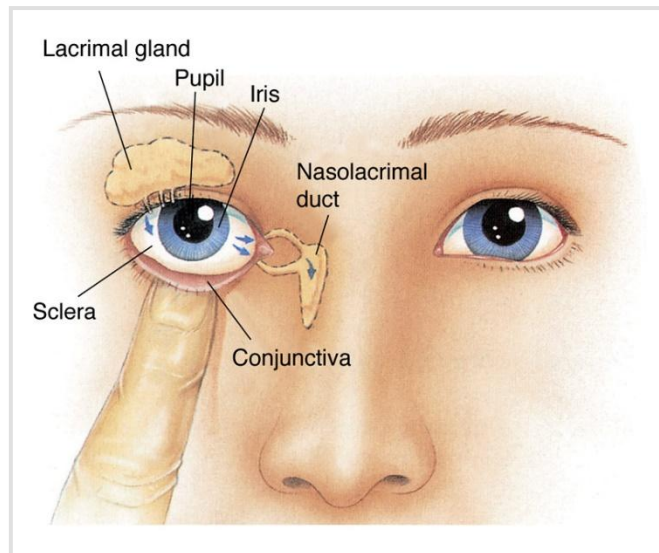
Consequences of burns

- Thermoregulation
- Sweating
- Vasodilation
& vasoconstriction
- Melanin
- Hair growth
- Sensation



The Eye

- Sensitive to burn injuries
- Intense heat, light, or chemical reactions can burn the thin membrane covering the eye.



Pathophysiology - Burns

- Burns are diffuse soft-tissue injuries created by destructive energy transfer
- Skin = barrier between the environment and the body.
- When a person is burned, this barrier is destroyed;
- High risk
 - Infection, hypothermia, hypovolaemia, and shock.

Pathophysiology

- Destructive Energy Transfer
 - Thermal
 - Radiation
 - Electrical
- Chemical Burns

Burn Shock

- Caused by 2 types of injury
 - Fluid loss across damaged skin
 - Series of fluid volume shifts within the rest of the body
- Subsequently intravascular volume oozes into the interstitial spaces as capillaries become leaky
- Cells of normal tissues take in increased amounts of water and salts from fluid around them

Burn Shock

- Involves the entire body
 - Limits distribution of oxygen and glucose
 - Hampers ability to remove waste products
- Adequate fluid resuscitation is essential
- Can occur 6-8 hrs after exposure.....?? Shock at the scene

Etiology of Burns

- Thermal
- Radiation
- Electrical
- Chemical

Thermal Burns

- Can occur when skin is exposed to temperatures higher than 44°C.
- Severity correlates directly with temperature, concentration, or amount of heat energy possessed by the object or substance and the duration of exposure.
- Sometimes known as trauma by fire

Thermal Burns

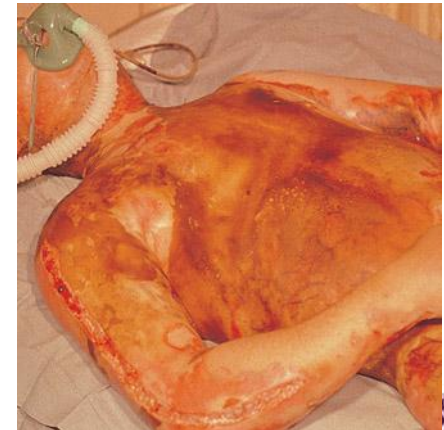
- Flame: most likely to be caused by an open flame
- Scald: hot liquids can produce scald injuries
- Contact: coming in contact with hot objects
- Steam: can produce a topical (scald) burn
- Flash: can be caused by explosions, electrical arc flashes, electricity control panels, and lightning strikes

Burn Depth

- A burn wound is categorised by degree of injury.
- Three pathological progressions or zones.
- Zones of burn
 - Zone of coagulation
 - Zone of stasis
 - Zone of hyperaemia

Burn Depth

- Burn depth is also categorised in terms of severity.
- The traditional labels given to burns were first-, second-, and third-degree burns, but burns classification has evolved and now includes at least five categories.



Classification	Other Names	Example Cause	Appearance	Sensation	Healing Time	Scarring
Epidermal	Superficial, first degree	Ultraviolet light, very short flash	Dry and red, blanches with pressure, not blisters	May be painful	Less than 7 days	None
Superficial dermal	Superficial partial thickness, second degree	Scald (spill or splash)	Pale pink, fine blisters, blanches with pressure	Very painful	Less than 14 days	Colour match defect, low risk for hypertrophic scarring
Mid-dermal	Superficial partial thickness, second degree	Scald (spill), flame	Dark pink with large blisters, delayed capillary refill	May be painful	14-21 days	Moderate risk of hypertrophic scarring
Deep dermal	Deep partial thickness, second degree	Scald (spill) flame	Blotchy red, may blister, no capillary refill; children: may be dark lobster red with mottling	No sensation	Over 21 days	Grafting probably required, high risk of hypertrophic scarring
Full thickness	Third degree	Scald (immersion), flame, steam, high-volt electricity	White, waxy or charred, no blister, no capillary refill, children: may be dark lobster red with mottling	No sensation	Does not heal spontaneously	Grafting required if greater than 1 cm, scarring inevitable



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Burn Depth

- Superficial burns
 - Involves the epidermis only
 - Skin is red and swollen.
 - Patients experience pain.
 - Will heal spontaneously in 3 to 7 days

Burn Depth

- Partial-thickness burns
 - Involves the epidermis and dermis
 - Usually painful

Burn Depth

- Full-thickness burns
 - Involves destruction of both layers of the skin
 - Incapable of self-regeneration
 - Skin may appear white and waxy, brown and leathery, or charred.
 - Sensory nerves are destroyed.

Inhalation Burns and Intoxication

- Can cause serious airway compromise
 - Steam/hot particulate matter associated with damage to:
 - Vocal cords and larynx
 - Lower airway
 - Superheated gases associated with damage to:
 - Upper airway

Inhalation Burns and Intoxication

- Smoke inhalation
 - Causes the majority of deaths from fires
 - Exposure to smoke from a fire may cause:
 - Thermal burns to the airway
 - Hypoxia from lack of oxygen
 - Tissue damage and toxic effects

Inhalation Burns and Intoxication

- Carbon monoxide intoxication
 - CO evolves from incomplete combustion of carbon compounds.
 - CO can displace oxygen.
 - Being exposed to relatively small concentrations will result in higher blood levels of CO.

Inhalation Burns and Intoxication

- Carbon monoxide intoxication
 - Patients usually present with an O_2 saturation of normal or better.
 - Never trust a pulse oximeter.



Summary

- ❖ Reviewed the A&P, physiology of integumentary system
- ❖ Described the pathophysiology of burns
- ❖ Explained Burn Shock and how it affects homeostasis
- ❖ Outlined the etiology and classification of burns

References

1. Caroline N. Burns. *Emergency Care in the Streets*. 7th ed. London. Jones and Bartlett Publishers Inc.; 2008.
2. Sanders MJ. Endocrinology. *Mosby's Paramedic Textbook*. 3rd ed. Canada: Elsevier Mosby; 2007.

Links:

<http://www.stjames.ie/Departments/WardsA-Z/B/BurnsUnit/>

<http://www.hse.ie/eng/health/az/B/Burns-and-scalds/Treating-burns-and-scalds.html>

<http://www.mayoclinic.org/diseases-conditions/burns/basics/definition/con-20035028>

<https://www.vicburns.org.au/about.html>

<http://lifeinthefastlane.com/ccs/burns/>





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BURNS:

**Prehospital Assessment &
Management**



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- Ability to treat burns has improved due to:
 - Better understanding of “burn shock”
 - Advances in fluid therapy and antibiotics
 - Improved ability to excise dead tissue
 - Use of biologic dressings
 - Formation of specialized teams

Objectives

- Scene Assessment
- Patient Assessment
 - Primary Survey
 - Burn Severity
 - Secondary Survey
- Prehospital Management & Treatment
 - General Management
 - Fluid Resuscitation
 - Pain Management
 - CPG's: Adult/Paeds
 - Thermal/Chemical/Inhalation/ Electrical

Scene

- Do not run into a burning building if you are not trained and properly equipped.
- Stage yourself in a safe place to provide patient care.

Scene

- When a burned patient comes to you:
 - Extinguish the flame and cool the burn.
 - Do not permit a person on fire to run.
 - Have the patient stop, drop, and roll.
 - If smoldering cloth adheres to the skin, cut it away.

Scene

- If possible, determine the mechanism of injury (MOI).
 - Consider and examine other mechanisms associated with the burn.
- Wear appropriate personal protective equipment and follow standard precautions.

Primary Assessment

- Airway and breathing
 - Signs of airway involvement include:
 - Hoarseness
 - Cough
 - Singed nasal or facial hair
 - Facial burns
 - Carbon in the sputum
 - History of burn in an enclosed space

Primary Assessment

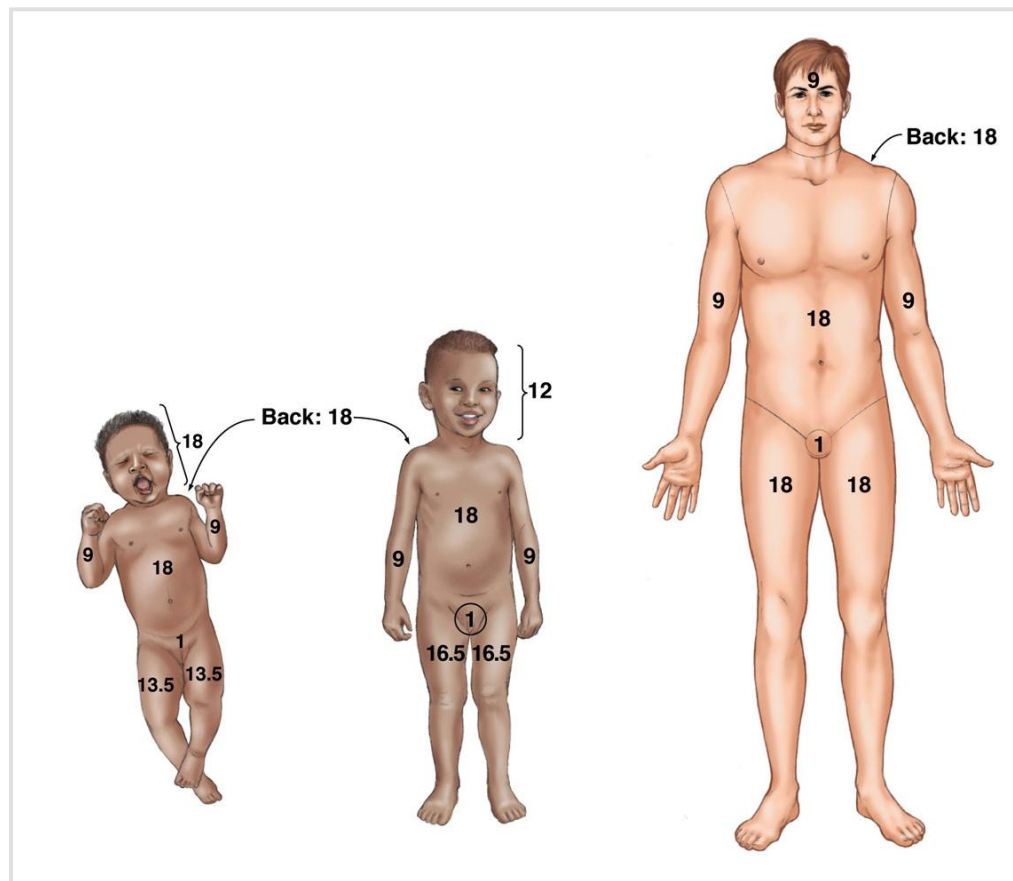
- Airway and breathing
 - Early ET intubation could be lifesaving.
 - Listen to lung sounds.
 - Note if signs and symptoms of edema are present.
 - Anyone suspected of having a burn to the upper airway may benefit from humidified, cool O₂.

Primary Assessment

- Circulation
 - During the first 24 to 48 hours, fluid resuscitation is emphasized to prevent burn shock.
 - Do not delay transport by making multiple attempts at vascular access.

Primary Assessment

- Assess burn severity.
 - Rule of nines
 - Divide the body into 9% segments.
 - Add portions to obtain total of area affected.

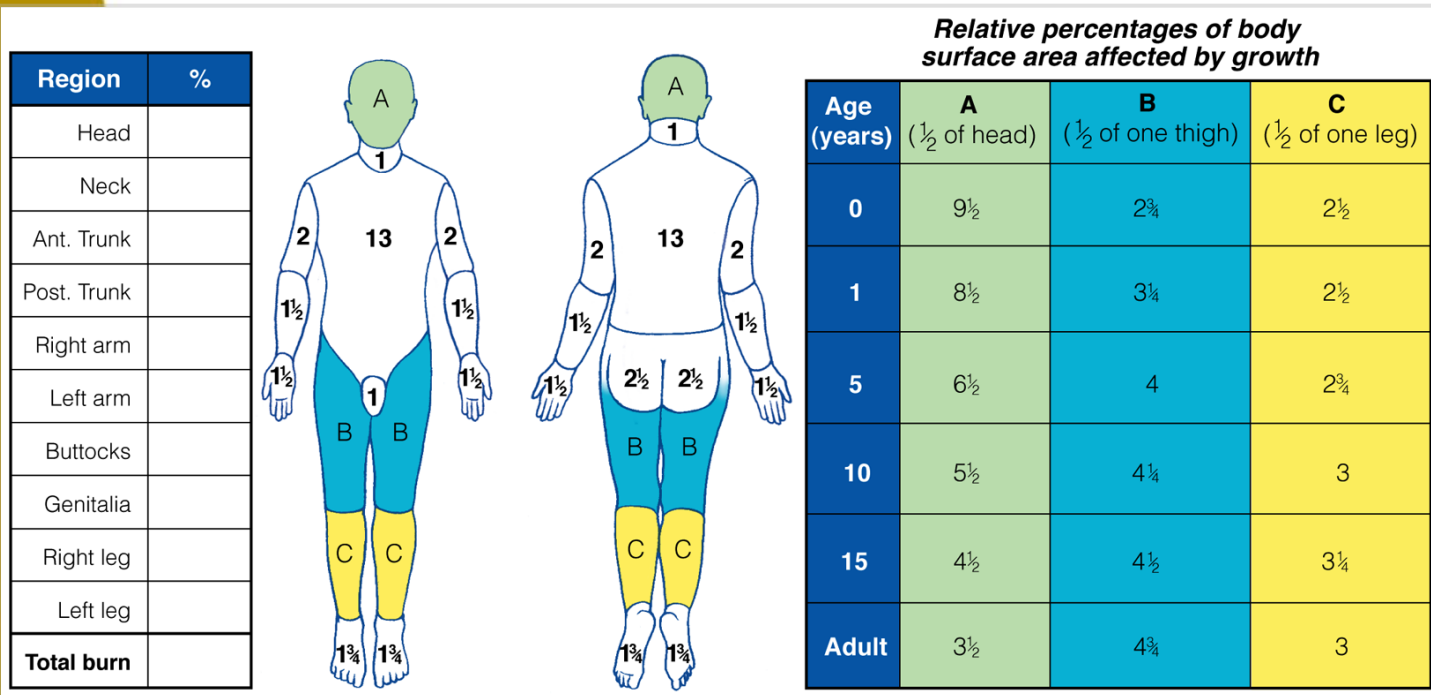


Primary Assessment

- Assess burn severity
 - Rule of palms (rule of ones)
 - Use the patient's palm to represent 1% of the body surface area.
 - Helpful when the burn covers less than 15% of the body surface area.

Primary Assessment

- Assess burn severity
 - The Lund and Browder chart



Adapted from Lund, C. C., and Browder, N. C. Surg. Gynecol. Obstet. 1944. 79: 352-358

Primary Assessment

- Assess burn severity
 - The American Burn Association has published classifications.

Table 1 Classification of Burns in Adults

Burn Classification	Criteria
Critical (severe) burns	<ul style="list-style-type: none">■ Full-thickness burns involving hands, feet, face, upper airway, or genitalia or circumferential burns of other areas■ Full-thickness burns covering more than 10% of the body's total surface area■ Partial-thickness burns covering more than 30% of the body's total surface area■ Burns associated with respiratory injury (smoke inhalation or inhalation injury)■ Burns complicated by fractures■ Burns on patients younger than 5 years or older than 55 years that would be classified as "moderate" in young adults
Moderate burns	<ul style="list-style-type: none">■ Full-thickness burns involving 2% to 10% of the body's total surface area (excluding hands, feet, face, genitalia, and upper airway)■ Partial-thickness burns covering 15% to 30% of the body's total surface area■ Superficial burns covering more than 50% of the body's total surface area
Minor burns	<ul style="list-style-type: none">■ Full-thickness burns covering less than 2% of the body's total surface area■ Partial-thickness burns covering less than 15% of the body's total surface area■ Superficial burns covering less than 50% of the body's total surface area

Technology!!!!

- Mersey Burns App

Primary Assessment

Transport Decision (Burns Unit??)

- More than 10% of body involved
- Face, hands, feet, genitalia, perineum, or joints involved
- Full-thickness burns
- Electrical burns
- Chemical burns
- Inhalation burns
- Burns in conjunction with preexisting medical conditions
- Risk of morbidity or mortality

Burns Units - Ireland



- National Burns Unit – St James Hospital, Dublin
- Our Lady's Hospital for Sick Children, Crumlin
- Cork University Hospital
- University Hospital, Galway

History Taking

- Get a brief history from the patient.
- Patients with preexisting diseases may be triaged as critical even if the injury is small.

Secondary Assessment

- Pay attention to the circumstances of the burn and the possible MOI.
- Look for injuries to the eyes.
- Check for circumferential burns.
- Check and document distal pulses often.

General Management



- Only turn your attention to the burn itself when the ABCs are under control.
 - Have all resuscitative equipment ready for use.

General Management

- Patient with an acutely decompensating airway who requires field intubation
 - Includes:
 - Burn patients in cardiac or respiratory arrest
 - Responsive patients whose airways are swelling
 - Surgical airways or rescue devices may be necessary.

General Management



- Patient with deteriorating airway who might require intubation
 - Better to defer treatment to hospital teams.
 - Attempt to intubate only if the airway continues to swell and intubation will become impossible.

General Management



- Patient whose airway is patent but who has a history consistent with risk factors for airway compromise
 - Use cool, humidified O₂ from a high-output nebulizer or an aerosol nebulizer with saline.
 - Report the patient's history to hospital personnel.

General Management



- Patient with no signs of or risk factors for airway compromise who is in no distress
 - Provide supplemental O₂.

Fluid Resuscitation

- Needed for patients with burns covering more than 25% of the body's surface
 - If delayed more than 2 hours, mortality increases.
 - Our CPG if >1hr to ED
 - Begin to deliver as soon as is reasonable.

Fluid Resuscitation

- Approximate the amount of fluid needed by using the Consensus formula.
 - During the first 24 hours, the patient will need:
 - $4 \text{ mL} \times \text{body weight (in kg)} \times \text{percentage of body surface burned}$
 - Half is given during first 8 hours.
 - Half is given over the subsequent 16 hours.

Fluid Resuscitation

- Our CPGs
- Adult
 - 25%TBSA +/-or time to ED >1hr,
then administer 1000mL IV/IO
 - If not consider 500mL IV/IO
- Paeds
 - > 10%TBSA+/-or time to ED >1hr,
then administer IV/IO
 - 5-10yrs = 250mL
 - >10yrs = 500mL

Pain Management

- Assess pain before administering analgesia.
 - Burn patients may require higher doses.
- CPG – 2/10 pain score
- Pain medication is best given via IV route.
- Narcotics remain the drugs of choice.

Burn Shock

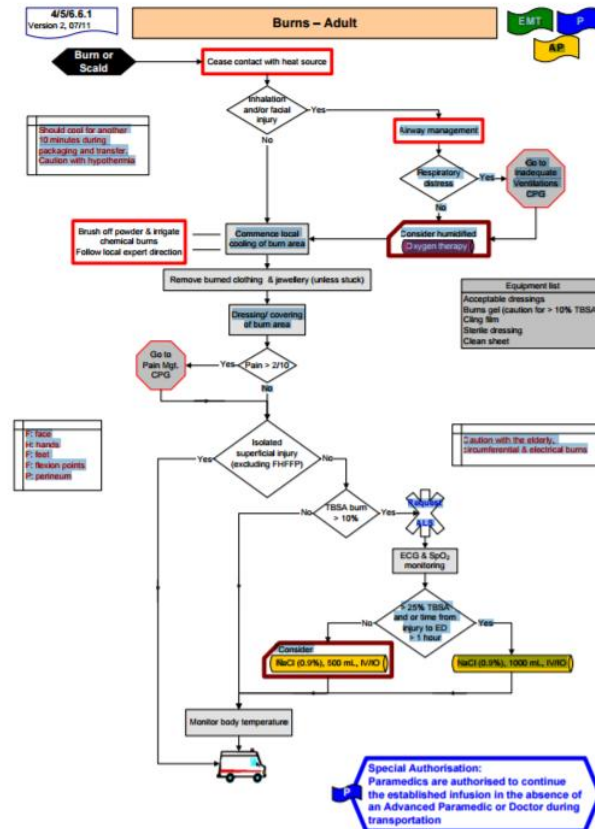
- Sets in during a 6- to 8-hour period
- Mortality increases if fluid resuscitation is delayed longer than 2 hours.
- Obtain vascular access and begin fluid resuscitation in the field.

Clinical Practice Guidelines

PARAMEDIC



SECTION 6 TRAUMA



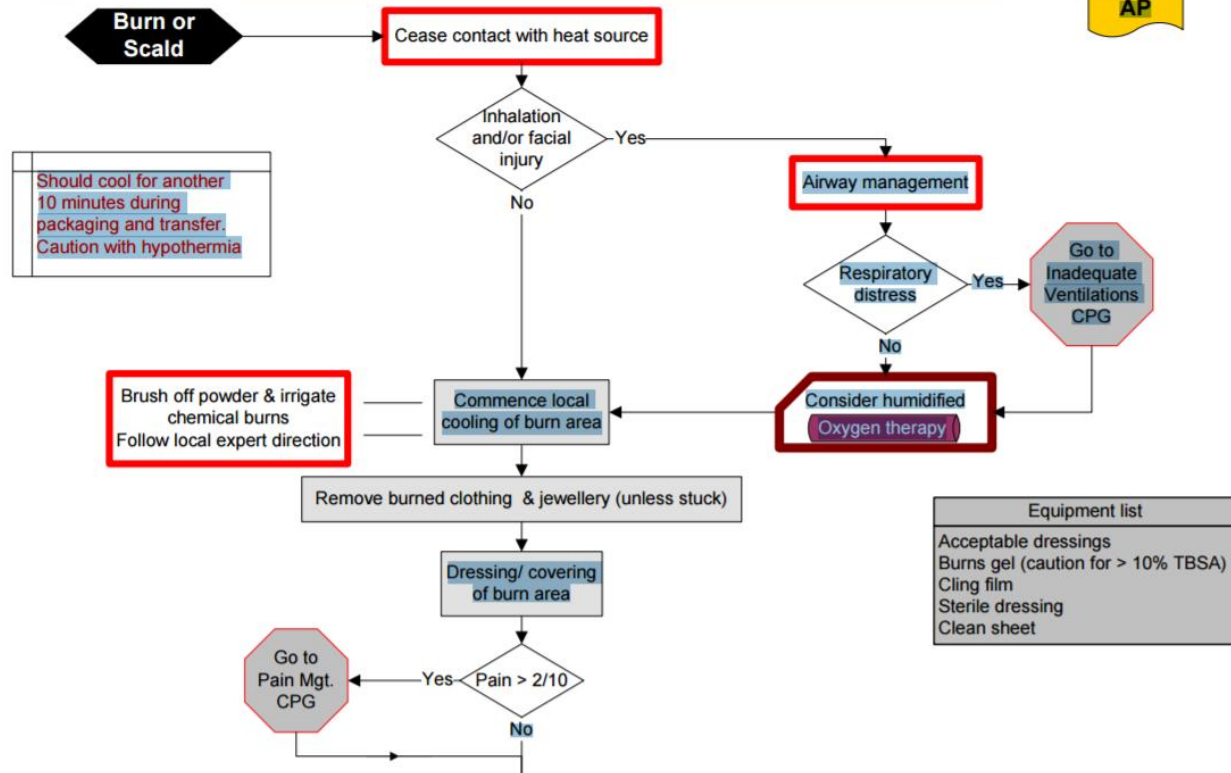
Reference: Allison, K. et al, 2004, Consensus on the prehospital approach to burns patient management, Emerg Med J 2004; 21:112-114
Sanders, M, 2001, Paramedic Textbook 2nd Edition, Mosby

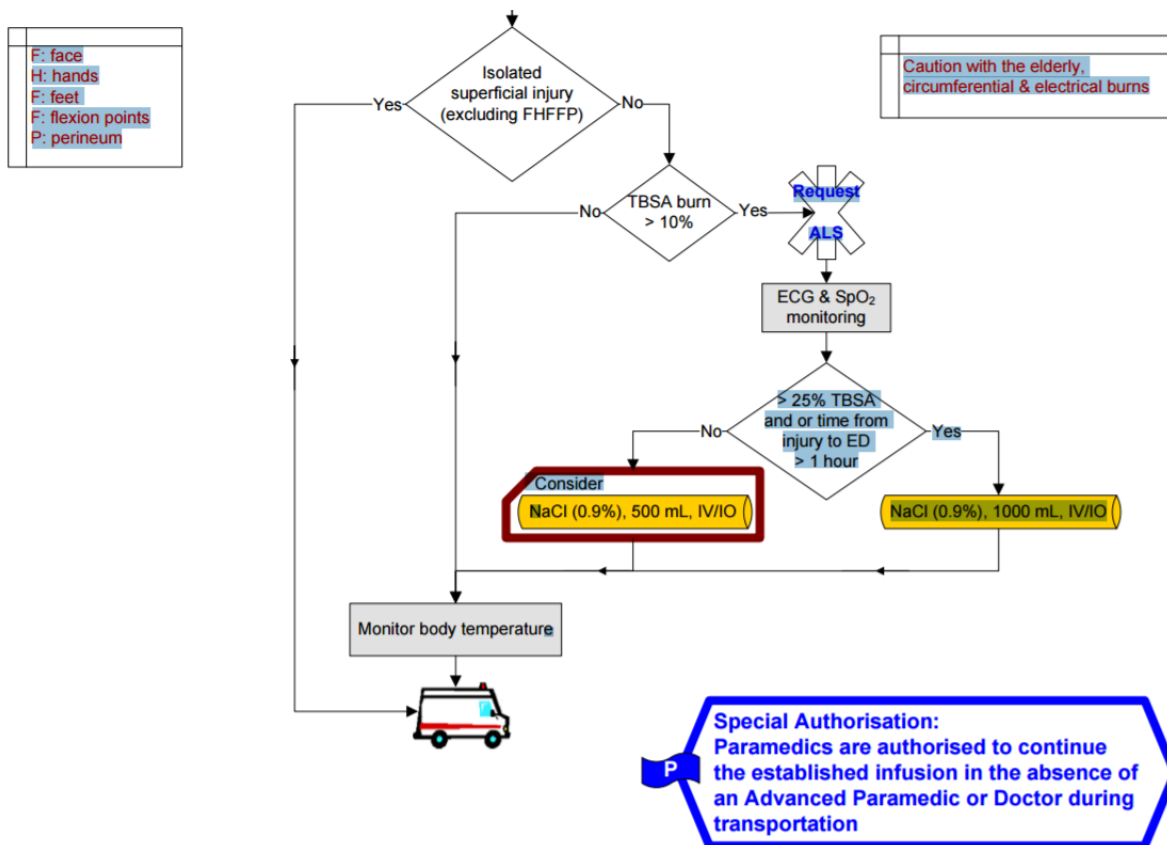
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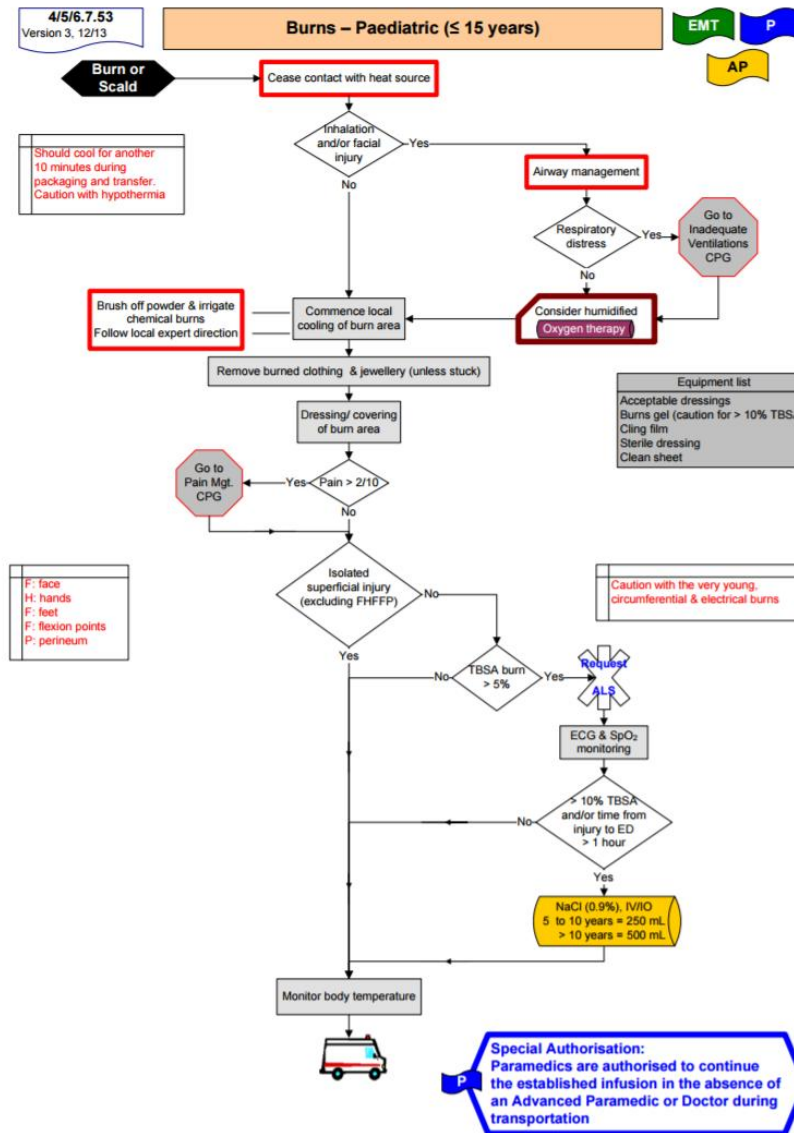
4/5/6.6.1
Version 2, 07/11

Burns – Adult





Reference: Allison, K et al, 2004, Consensus on the prehospital approach to burns patient management, Emerg Med J 2004; 21:112-114
Sanders, M, 2001, Paramedic Textbook 2nd Edition, Mosby



Reference: Allison, K et al. 2004, Consensus on the prehospital approach to burns patient management, Emerg Med J 2004; 21:112-114
Sanders, M. 2001, Paramedic Textbook 2nd Edition, Mosby

Thermal Burns

- While assessing burns, consider:
 - Pain
 - Swelling
 - Skin color
 - Capillary refill time
 - Moisture and blisters
 - Appearance of wound edges
 - Foreign bodies, debris, contaminants
 - Bleeding
 - Circulatory adequacy
 - Concomitant soft-tissue injury

Thermal Burns

- Superficial burns
 - If patient is reached within the first hour, immerse the burn in cool water or apply cold compresses.
 - Transport the patient in a comfortable position.



Courtesy of Water-Jel® Technologies

Thermal Burns

- Partial-thickness
 - Cool burn with water or apply wet dressings.
 - Elevate extremities.
 - Establish IV fluids.
 - Administer pain medication.

Thermal Burns

- Full-thickness
 - Assess pain and administer pain medication.
 - Dry dressings are often used.
 - Begin fluid resuscitation

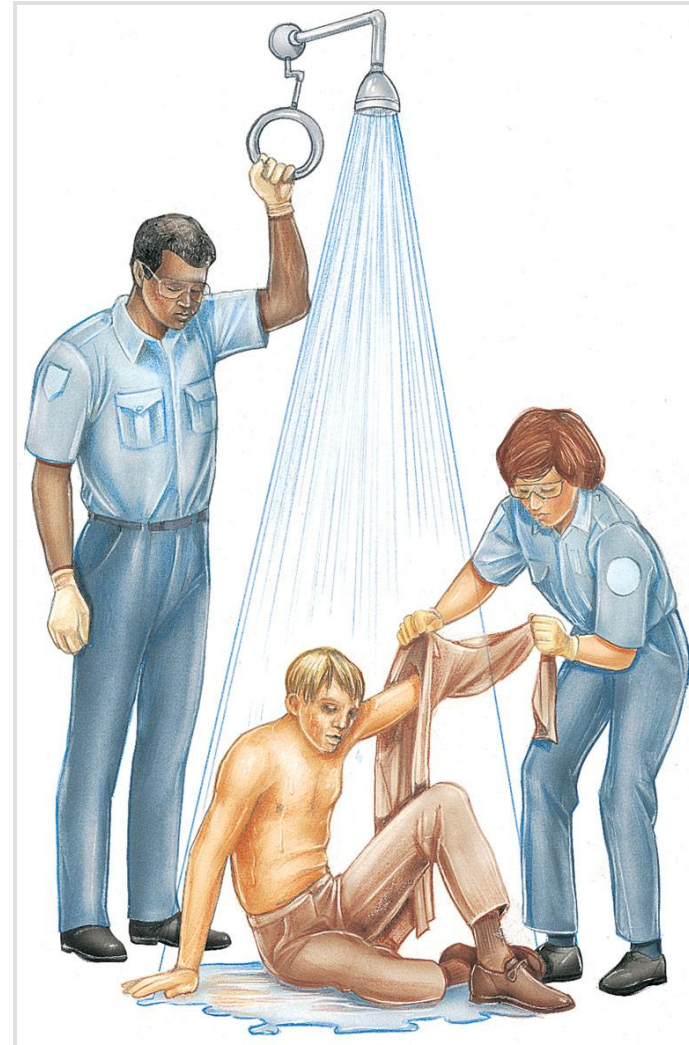
Chemical Burns of the Skin



- Assessment
 - Ensure your own safety.
 - Follow with decontamination of the patient.

Chemical Burns of the Skin

- Management
 - Flush with copious amounts of water.
 - Rapidly remove the patient's clothing.
 - Wash skin folds.
 - Once washing is complete, wash again.



Inhalation Burns

- Assessment
 - Signs of upper airway swelling:
 - Stridor
 - Signs of lower airway involvement:
 - Wheezing and desaturation
 - Pulmonary edema

Inhalation Burns

- Management
 - Maintain an acceptable O₂ saturation level.
 - Monitor for signs of airway compromise.

Electrical Burns and Associated Injuries

- Electrical burns may produce internal injuries with little external evidence.
- May result in two injury sites:
 - Entrance wound
 - Exit wound



Electrical Burns and Associated Injuries

- Electrical burns have a strong possibility of severe internal injury.
 - Two common causes of death from electrical injury are asphyxia and cardiac arrest.
 - Electricity can disrupt the nervous system.

- Lightning Related Injuries
- Radiation Burns

Long-Term Consequences

- Patient
 - Average of 1 day of inpatient treatment for each 1% of TBSA
 - May be left with problems with:
 - Thermoregulation
 - Motor function
 - Sensory function

Long-Term Consequences



- Provider
 - Caring for patients with severe burn emergencies can be horrifying.
 - Proper training, confidence, and courage can have a large impact.

Summary

- ❖ Outlined prehospital burns patient assessment
- ❖ Described the management of a burns patient prehospital
- ❖ PHECC Education & Training Standard
- ❖ Paramedic CPG 4/5/6.6.1, Version 2, 07/11
- ❖ Paramedic CPG 4/5/6.7.53, Version 3, 12/13

References

1. Caroline N. Endocrine Emergencies. *Emergency Care in the Streets*. 6th ed. London. Jones and Bartlett Publishers Inc.; 2008.
2. Pre-hospital Emergency Care Council. *Clinical Practice Guidelines for Pre-hospital Emergency Care*. 2014 Version. Dublin. Pre-hospital Emergency Care Council; 2014.





Head and Maxillofacial Injuries

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Skull and Facial Bones

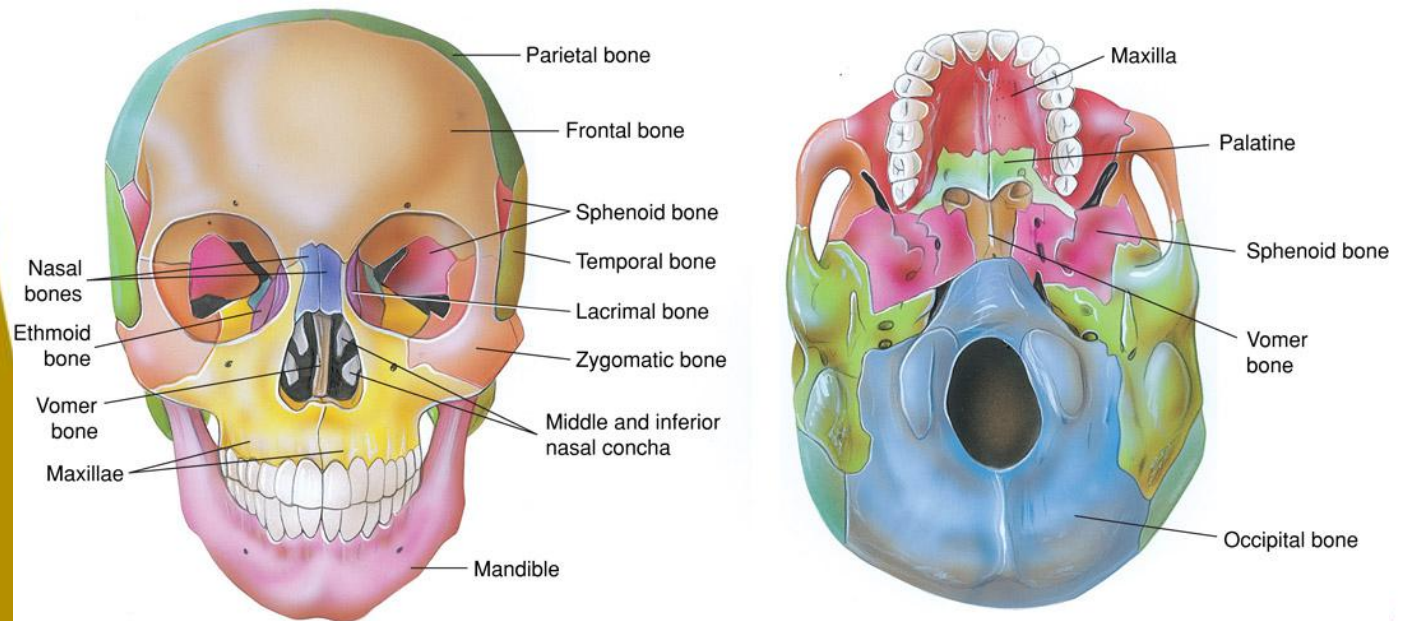
- The brain
 - Requires maximum protection from injury
 - Housed within soft and hard wrappings

The Scalp

- Scalp layers
 - Skin and hair
 - Subcutaneous tissue
 - Galea aponeurotica
 - Loose connective tissue (alveolar tissue)
 - Periosteum

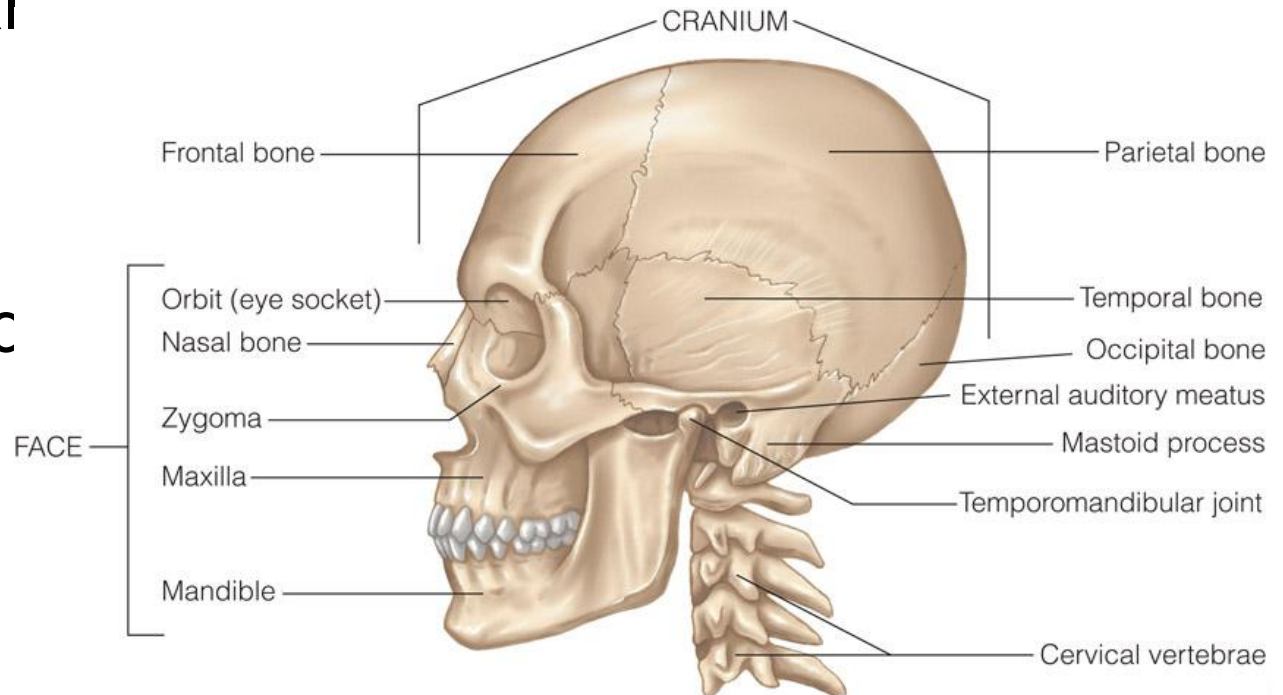
The Skull

- 28 bones in three anatomical groups
 - Auditory ossicles
 - Cranium
 - Face



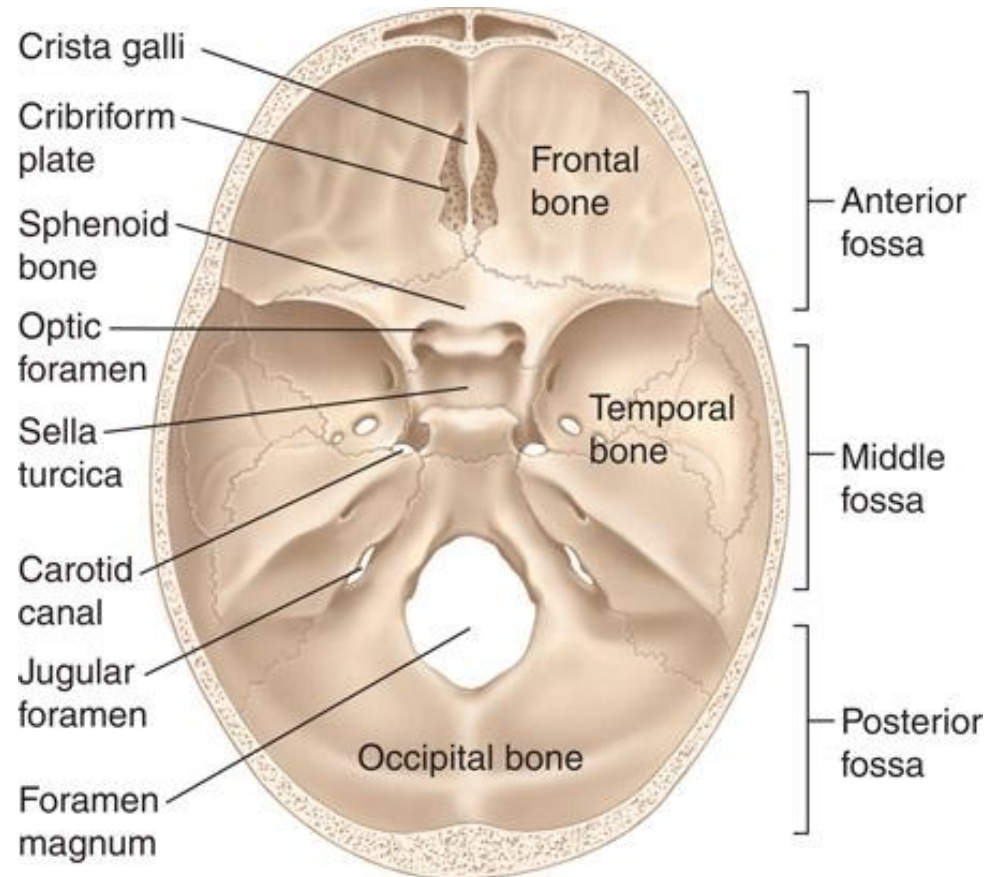
Cranial Vault

- Eight bones
 - Parietal
 - Temporal
 - Frontal
 - Occipital
 - Sphenoic
 - Ethmoid



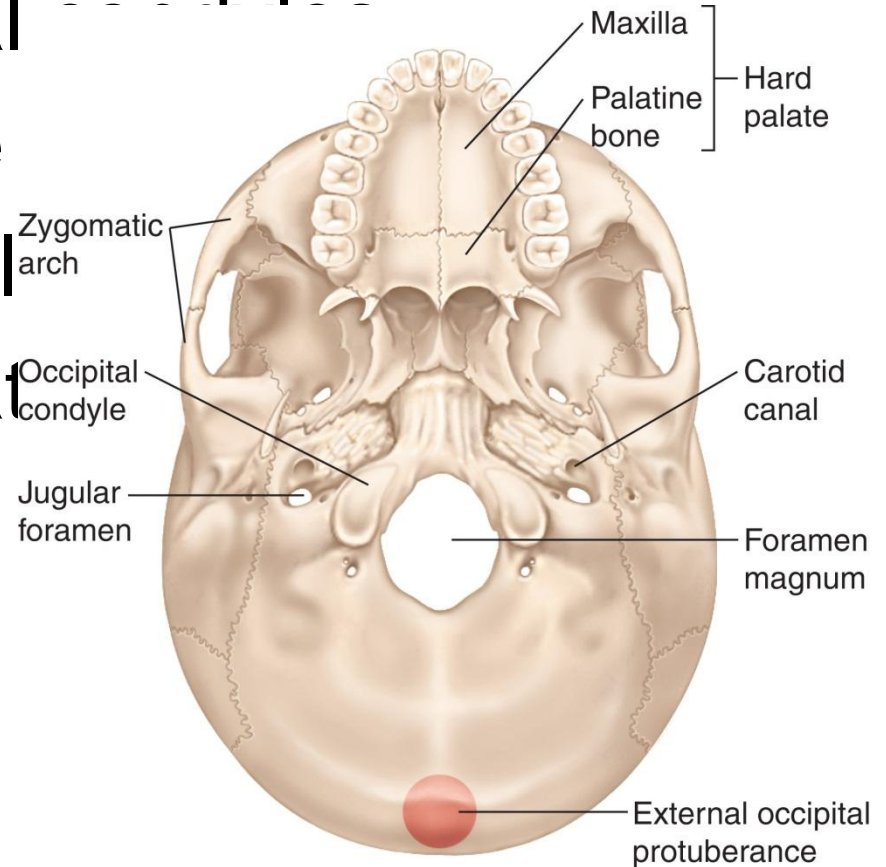
Floor of Cranial Vault

- Compartments
 - Anterior fossa
 - Crista galli
 - Cribriform plate
 - Middle fossa
 - Posterior fossa



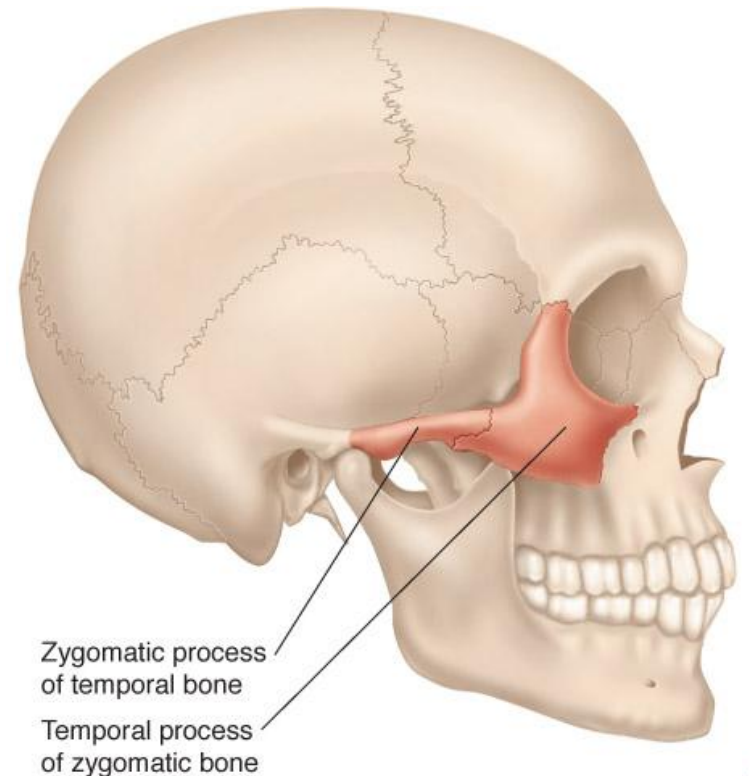
Base of the Skull

- Occipital
- Palatine
- Hard pal
- Zygomat



Facial Bones (1 of 2)

- 14 bones form the structure of the face without contributing to the cranial vault
 - Maxillae
 - Vomer
 - Inferior nasal concha
 - Zygoma
 - Palatine bone
 - Nasal bone
 - Lacrimal bones

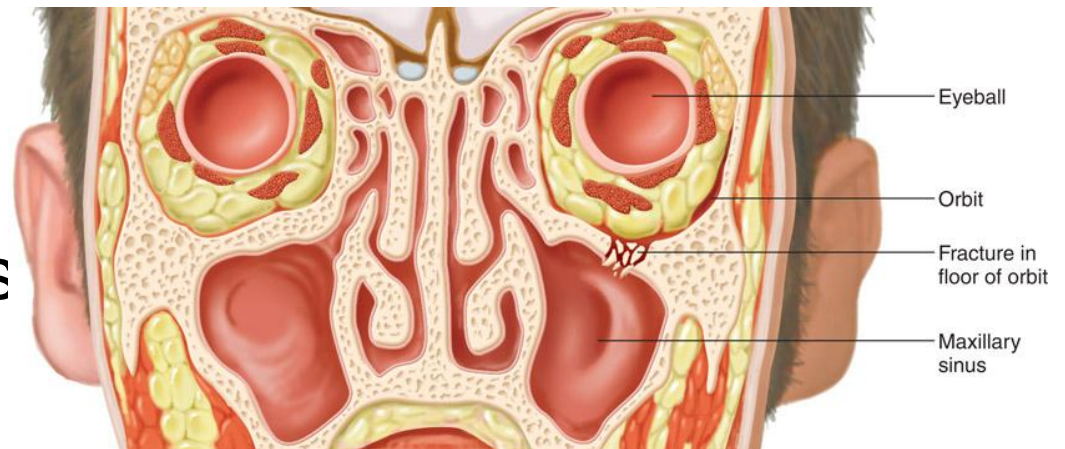


Facial Bones (2 of 2)

- Function
 - Protect the eyes, nose, and tongue
 - Provide attachment points for the muscles that allow chewing
 - Lend shape to the cheeks

The Orbits

- Cone-shaped fossa
- Enclose and protect the eyes
- Contains:
 - Blood vessels
 - Nerves
 - Fat
- Extremely thin and break easily
- Blowout fracture



Mandible and Temporomandibular Joint

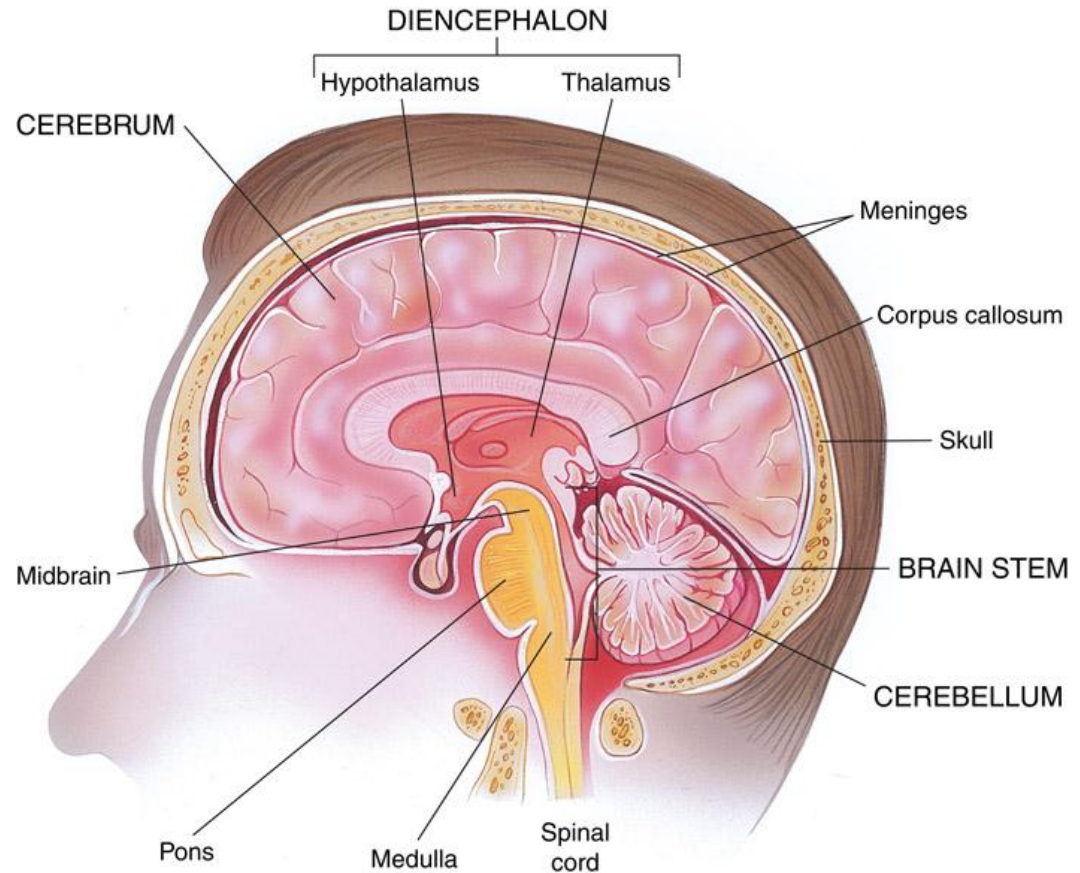
- Mandible
 - large moveable bone forming the lower jaw and containing the lower teeth
- Temporomandibular joint (TMJ)
 - allows movement of the mandible

The Brain

- Cranial vault
 - Brain: 80%
 - Cerebral blood: 12%
 - Cerebrospinal fluid: 8%
- The brain accounts for 2% of total body weight.
 - Most metabolically active and perfusion-sensitive organ in the body
 - Totally dependent on a constant source of both fuels (oxygen and glucose) via cerebral blood flow

Major Brain Regions

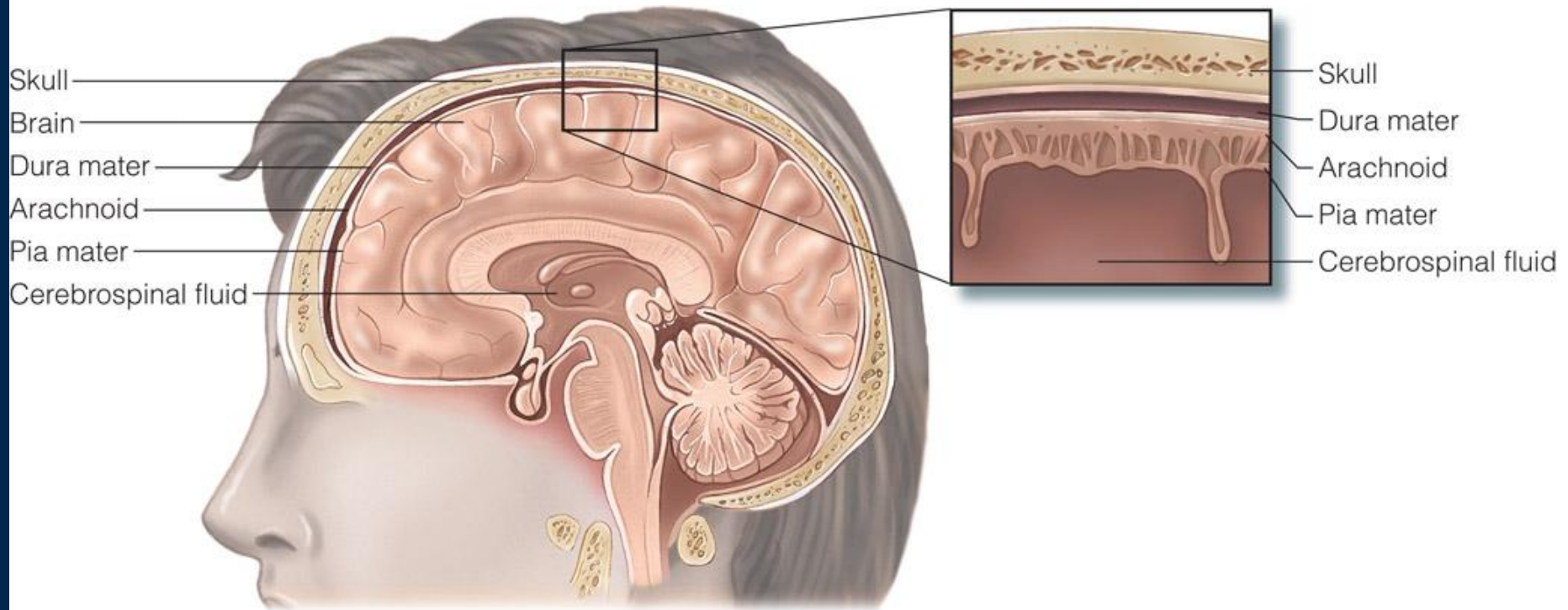
- Cerebrum
- Diencephalon
- Cerebellum
- Brainstem
- Meninges



Brainstem: Meninges

- Protective layers around central nervous system
 - Dura mater: the outermost layer; a strong, fibrous wrapping that covers the entire brain
 - Arachnoid: delicate, transparent membrane (blood vessels resemble a spider's web)
 - Pia mater: third meningeal layer; thin, translucent, highly vascular membrane that firmly adheres to the surface of the brain

Brainstem: Meninges



Nerves

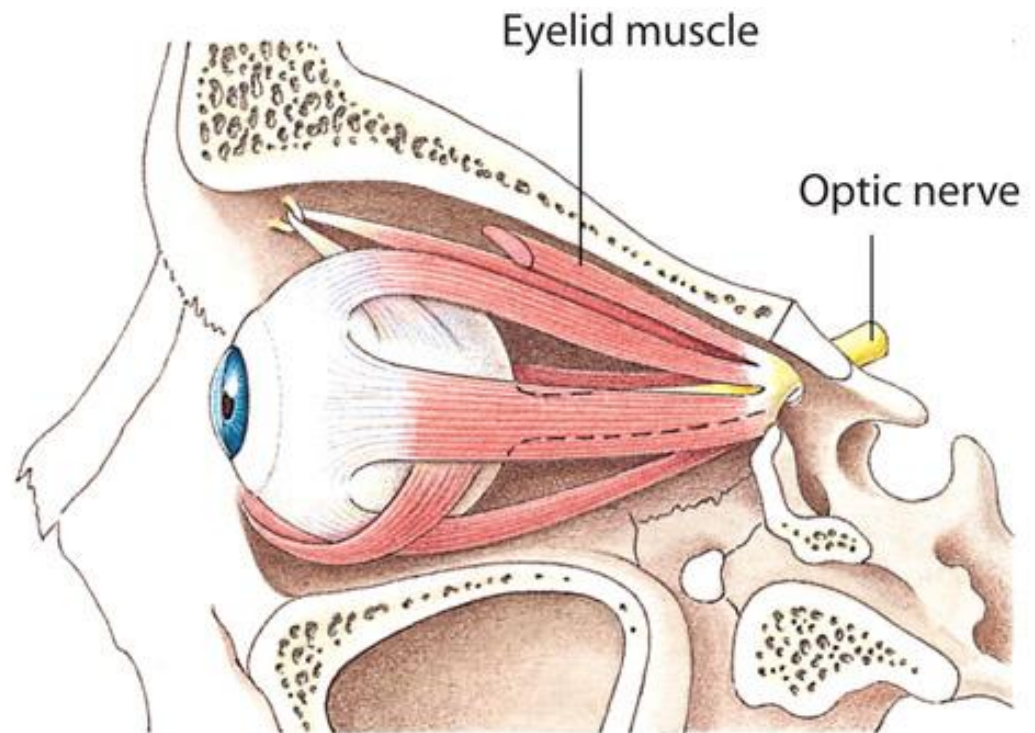
Cranial Nerves—Learning-Laboratory.com

Cram CNs into your cranium!

CN#	Name	Function
I	Olfactory	Sense of smell
II	Optic	Sense of sight
III	Oculomotor	Extraocular eye movements, lid elevation, pupil contraction, lens shape
IV	Trochlear	Downward and inward eye movement
V	Trigeminal	Mastication, touch, pain, and temperature
VI	Abducens	Eyeball movement
VII	Facial	Facial expression, lip articulation, taste on anterior tongue, secretion of saliva & tears
VIII	Vestibulocochlear (Acoustic)	Hearing, equilibrium
IX	Glossopharyngeal	Taste on posterior tongue, gag reflex, swallowing and phonation of the pharynx
X	Vagus	Visceral muscle movement (heart, lungs, intestines, etc)
XI	Spinal Accessory	Trapezius and sternocleidomastoid movement
XII	Hypoglossal	Speech movements of the tongue, swallowing

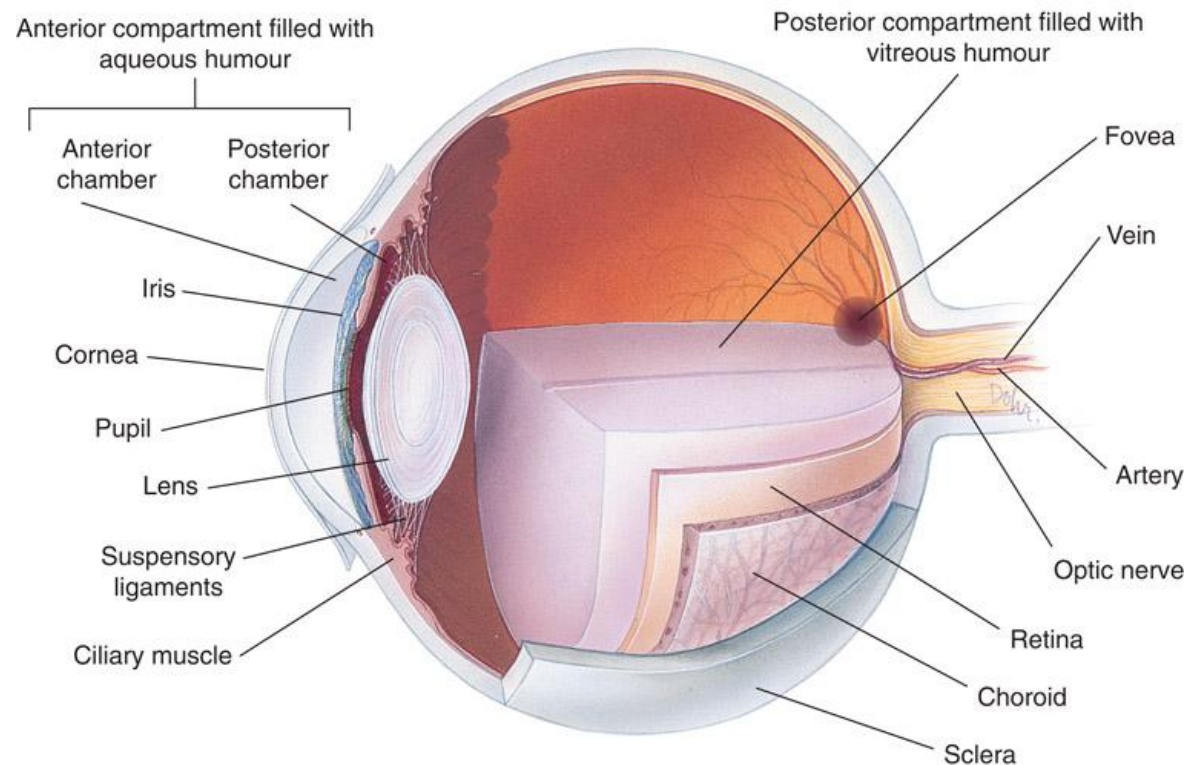
The Eye

- Globe (eyeball)
- Oculomotor nerve
 - 3rd cranial nerve
- Optic nerve
 - 2nd cranial nerve



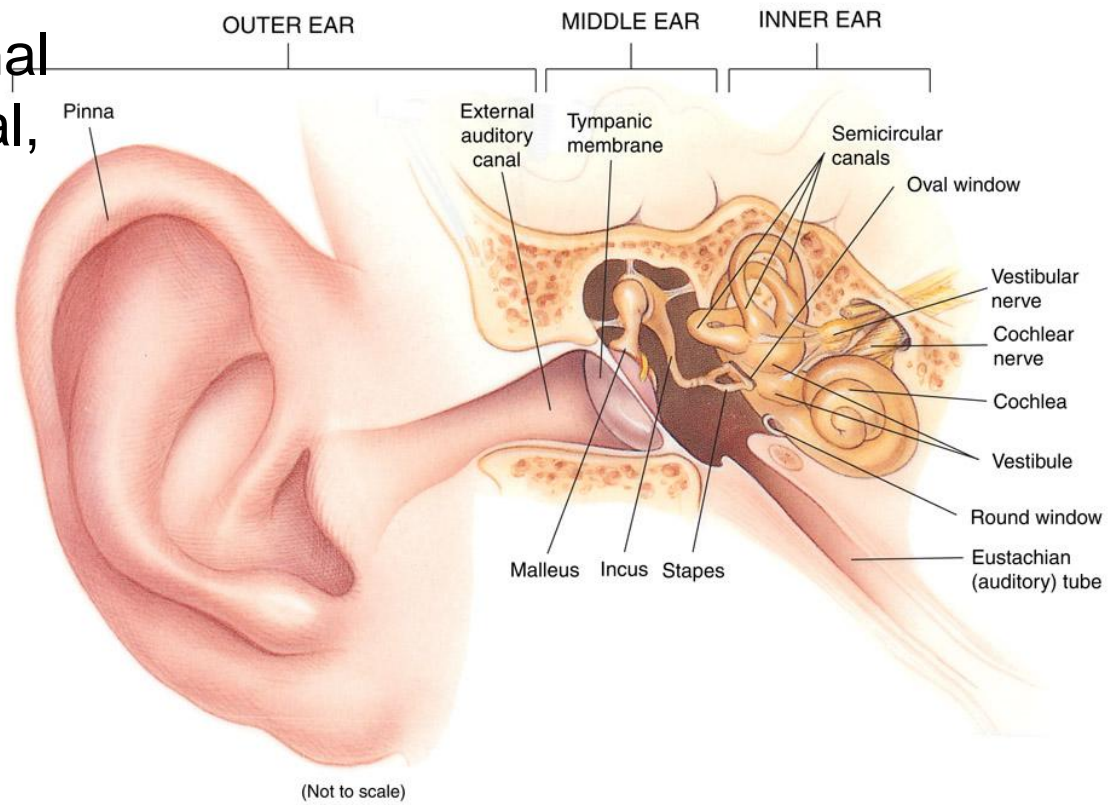
Structures of the Eye

- Sclera
- Cornea
- Conjunctiva
- Iris
- Pupil



The Ear

- External ear
 - Pinna, external auditory canal, eardrum
- Middle ear
 - Tympanic membrane, ossicles
- Inner ear
 - Cochlea, semicircular canals



The Mouth: Nerves (1 of 2)

- Hypoglossal (12th cranial)
 - Motor function of the tongue
- Glossopharyngeal (9th cranial)
 - Taste sensation of the posterior tongue
 - Salivary gland function

The Mouth: Nerves (2 of 2)

- Trigeminal (5th cranial)
 - Motor chewing function
- Facial (7th cranial)
 - Motor activity of all muscles providing facial expression
 - Sensation of taste to anterior 2/3 of the tongue
 - Cutaneous sensations of the tongue and palate

Patient Assessment (1 of 4)



- Scene Assessment
 - Initial step of any assessment should be a determination of scene safety.
- Primary Assessment
 - Severity of the injury
 - Patient's level of consciousness
 - General impression
 - Catastrophic haemorrhage
 - Airway and breathing

Patient Assessment (2 of 4)



- Primary Assessment (cont.)
 - Circulation
 - Disability
 - Expose/Environment
 - Transport Priority
- History Taking
 - SAMPLE
 - Exact Time of initial injury

Patient Assessment (3 of 4)

- Secondary Assessment
 - Level of Consciousness (LOC)
 - Glasgow Scale
- Pupillary Assessment
 - Frequently monitor the size, equality, and reactivity of the patient's pupils.
 - Nerves that control dilation and constriction are very sensitive to ICP.

GLASGOW COMA SCALE

Eye Opening

Spontaneous	4	
To Voice	3	
To Pain	2	
None	1	

Verbal Response

Oriented	5	
Confused	4	
Inappropriate Words	3	
Incomprehensible Words	2	
None	1	

Motor Response

Obeys Command	6	
Localises Pain	5	
Withdraws (pain)	4	
Flexion (pain)	3	
Extension (pain)	2	
None	1	

Glasgow Coma Score Total 15

Patient Assessment (4 of 4)

- Assessing Intracranial Pressure (ICP)
 - severity of increase can be estimated based on the patient's clinical presentation.
 - Critical treatment decisions
- Reassessment
 - Vital signs
 - Repeat the physical examination
 - Reprioritise patient as necessary



Management of Head Injuries (1 of 2)

- Traumatic insult to the head that may result in injury to soft tissue, bony structures, or the brain
- More than 50% of all traumatic deaths result from a head injury.
- Road traffic collisions are the most common mechanism of injury.
 - Also in victims of assault, when elderly people fall, sports-related incidents, and a variety of incidents involving children

Management of Head Injuries (2 of 2)

- Two general types
 - Closed (most common type): usually associated with blunt trauma; skull fractures, focal brain injuries, or diffuse brain injuries and ICP
 - Open: dura mater and cranial contents are penetrated, and brain tissue is open to the environment
- Gunshot wounds have a high mortality rate with almost always a significant neurological deficit and a decreased quality of life

Scalp Lacerations

- Minor or very serious
 - Rich blood supply
 - Quickly lead to significant blood loss
- Hypovolaemia
- Often result from direct blows to the head
 - Indicates deeper, more severe injury



Skull Fractures

- Significance
 - Directly related to the type of fracture, the amount of force applied, and the area of the head that suffered the blow
 - Most commonly seen following road traffic collisions and significant falls
 - May be associated with soft-tissue scalp injuries
- Potential complications
 - Intracranial haemorrhage
 - Cerebral damage
 - Cranial nerve damage

Linear Skull Fractures

- Linear skull fractures
 - Nondisplaced skull fractures
 - 80% of all fractures.
 - 50% occur in the temporal-parietal region of the skull.
 - Radiographic evaluation is required to diagnose
 - If the brain is uninjured and the scalp is intact, linear fractures are relatively benign.
 - Open: risk of infection
 - Potential injury to the middle meningeal artery (extradural bleeding)

Depressed Skull Fractures

- Result from high-energy direct trauma to a small surface area of the head with a blunt object
- Frontal and parietal regions are most susceptible (bones relatively thin).
- Bony fragments may be driven into the brain.
- Overlying scalp may be intact.
- Often present with neurological signs

Basilar Skull Fractures (1 of 2)

- Associated with high-energy trauma with diffuse impact to the head
- Generally result from extension of a linear fracture to the base of the skull
- Difficult to diagnose with radiography



Basilar Skull Fractures (2 of 2)

- Signs: CSF drainage from the ears, periorbital bruising (panda eyes), or bruising behind the ear over the mastoid process (Battle's sign)



Courtesy of AAOS

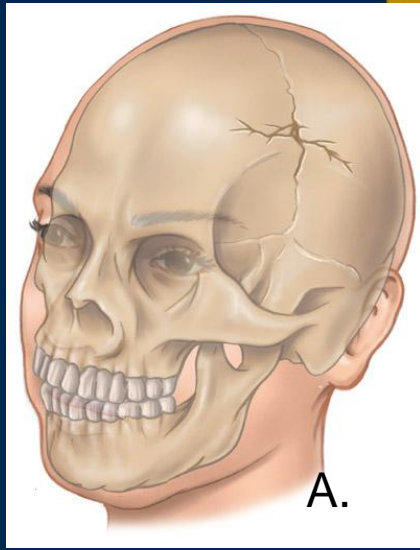


Courtesy of AAOS
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HEALTHCARE TRAINING

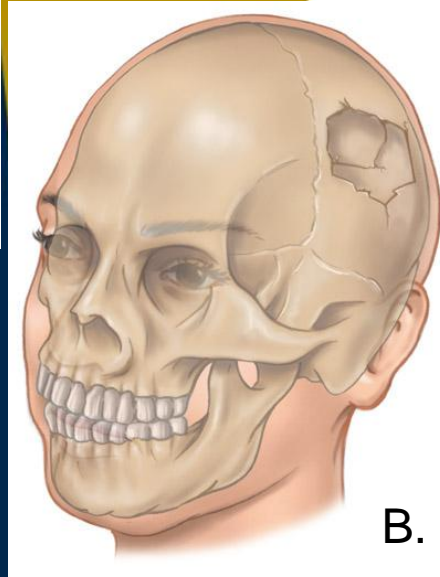
Open Skull Fractures

- Severe forces applied to the head
- Associated with trauma to multiple body systems
- Brain tissue may be exposed to the environment.
- High mortality rate

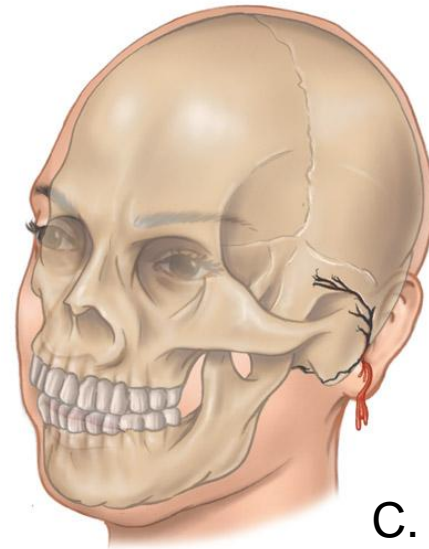
Skull Fractures



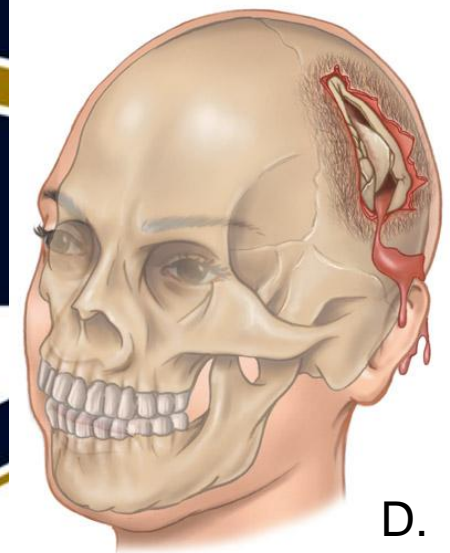
A.



B.



C.

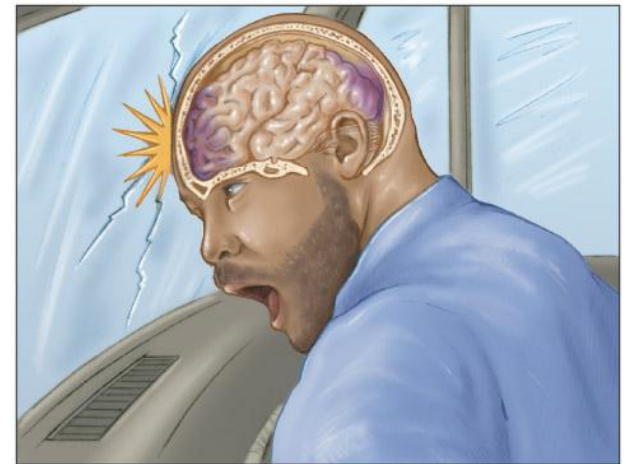


D.

Types of skull fractures. A. Linear B. Depressed. C. Basilar. D. Open.

Traumatic Brain Injury

- Primary (direct) brain injury
- Secondary (indirect) brain injury
- Coup-contrecoup injury
- Swelling
 - Initially because of cerebral vasodilation
 - Increase of cerebral water (cerebral oedema)



Intracranial Pressure

(1 of 2)

- Accumulations of blood within the skull or swelling of the brain can lead to an increase of pressure within the cranial vault.
 - Squeezes the brain against bony prominences within the cranium



Intracranial Pressure

(2 of 2)

- Increase in ICP
 - Decreases cerebral perfusion pressure and cerebral blood flow
 - Critical minimum threshold (60 mm Hg)
 - The body responds to a decrease in CPP by increasing mean arterial pressure (autoregulation), causing further increase in ICP.
 - CPP cannot be calculated in the prehospital setting.
 - Cerebral herniation can occur.
 - Early signs and symptoms
 - Ominous signs

Diffuse Brain Injury (1 of 3)

- Cerebral concussion
 - Brain is jarred around in the skull.
 - Caused by rapid acceleration-deceleration forces.
 - Results in transient dysfunction of the cerebral cortex
 - Resolution is usually spontaneous and rapid
 - Signs range from transient confusion and disorientation to confusion for several minutes.
 - Loss of consciousness may occur.
 - Retrograde or anterograde amnesia

Diffuse Brain Injury (2 of 3)

- Diffuse axonal injury (DAI)
 - Associated with or similar to a concussion
 - More severe diffuse brain injury
 - Poor prognosis
 - Involves stretching, shearing, or tearing of nerve fibres with subsequent axonal damage
 - Most often results from high-speed, rapid acceleration-deceleration forces
 - Severity depends on the degree of axonal damage.
 - Mild, moderate, or severe

Diffuse Brain Injury (3 of 3)



Table 32-4 Diffuse Axonal Injury (DAI)

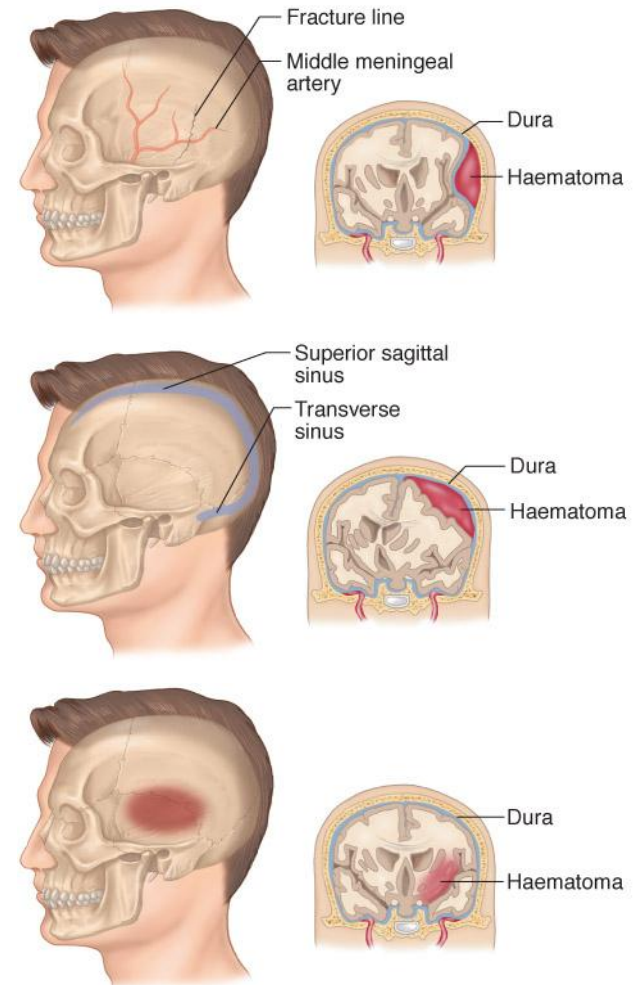
Pathophysiology	Incidence	Signs and Symptoms	Prognosis
Mild DAI			
Temporary neuroneal dysfunction; minimal axonal damage	Usually the result of blunt head trauma; concussion is an example	Loss of consciousness (brief, if present); confusion, disorientation, amnesia (retrograde and/or anterograde)	Minimal or no permanent neurological impairment
Moderate DAI			
Axonal damage and minute petechial bruising of brain tissue; often associated with a basilar skull fracture	20% of all severe head injuries; 45% of all diffuse axonal injuries	Immediate loss of consciousness: secondary to involvement of the cerebral cortex or the reticular activating system of the brainstem; residual effects: persistent confusion and disorientation; cognitive impairment (eg, inability to concentrate); frequent periods of anxiety; uncharacteristic mood swings; sensory/motor deficits (such as altered sense of taste or smell)	Survival likely, but permanent neurological impairment common
Severe DAI			
Severe mechanical disruption of many axons in both cerebral hemispheres with extension into the brainstem; formerly called "brainstem injury"	16% of all severe head injuries; 36% of all diffuse axonal injuries	Immediate and prolonged loss of consciousness; posturing and other signs of increased ICP	Survival unlikely; most patients who survive never regain consciousness but remain in a persistent vegetative state

Focal Brain Injury (1 of 2)

- Cerebral contusion
 - Brain tissue is bruised and damaged in a local area.
 - Greater neurological deficits
 - Acceleration-deceleration forces and direct blunt head trauma
 - Frontal lobe is most commonly affected.
 - The reaction of the injured tissue will be to swell, leading to increased ICP.

Focal Brain Injury (2 of 2)

- Intracranial haemorrhage
 - ICP increases
 - Bleeding can occur between the skull and dura mater, beneath the dura mater but outside the brain, within the parenchyma of the brain itself, or into the CSF.
 - Extradural haematoma
 - Subdural haematoma
 - Intracerebral haematoma
 - Subarachnoid haemorrhage



Maxillofacial Fractures (1 of 6)

- Commonly occur when the facial bones absorb the energy of a strong impact
 - A force of up to 150 g is required to fracture the maxilla
 - Likely to produce closed head injuries and cervical spine injuries as well
 - The first clue is bruising.
 - A black-and-blue mark on the face
 - Deep facial laceration

Maxillofacial Fractures (2 of 6)

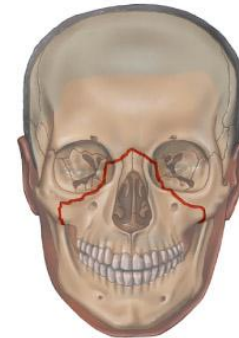
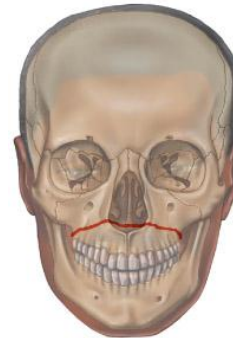
- Nasal fractures
 - Not as structurally sound as other bones of the face
 - Most common facial fracture
 - Characterised by swelling, tenderness, and crepitus
 - Deformity usually appears as a lateral displacement.
 - Epistaxis

Maxillofacial Fractures (3 of 6)

- Mandibular fractures and dislocations
 - Second only to nasal fractures in frequency
 - Massive blunt force trauma to the lower third of the face
 - Fracture is most commonly located at the angle of the jaw.
 - Malocclusion: misalignment of the teeth
 - Mandibular dislocations are most often the result of yawning extravagantly or otherwise opening the mouth very widely.

Maxillofacial Fractures (4 of 6)

- Maxillary fractures
 - Massive blunt facial trauma (road traffic collision, falls, and assaults)
 - Produce massive facial swelling
 - Le Fort I fracture
 - Le Fort II fracture
 - Le Fort III fracture



Maxillofacial Fractures (5 of 6)

- Orbital fractures
 - May complain of double vision and lose sensation above the eyebrow or over the cheek secondary to associated nerve damage
 - Inferior orbit fractures are the most common and can cause paralysis of upward gaze.

Maxillofacial Fractures (6 of 6)

- Zygomatic fractures (cheek bone)
 - Blunt trauma secondary to motor vehicle crashes and assaults
 - Side of the patient's face appears flattened
 - Loss of sensation over the cheek, nose, and upper lip
 - Paralysis of upward gaze may be present.
 - Orbital fractures, ocular injury, and epistaxis.

Assessment of Face Injuries (1 of 2)

- It is not important to distinguish among the various maxillofacial fractures in the prehospital setting
 - Requires radiographic evaluation in the accident and emergency department
 - Rapid patient assessment, management of life-threatening conditions, full spinal precautions and prompt transport

Assessment of Face Injuries (2 of 2)

Table 32-5 Summary of Maxillofacial Fractures

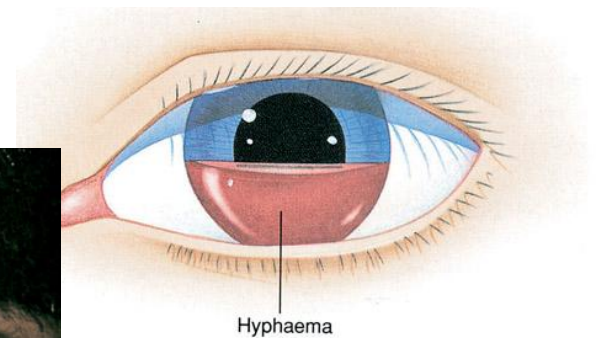
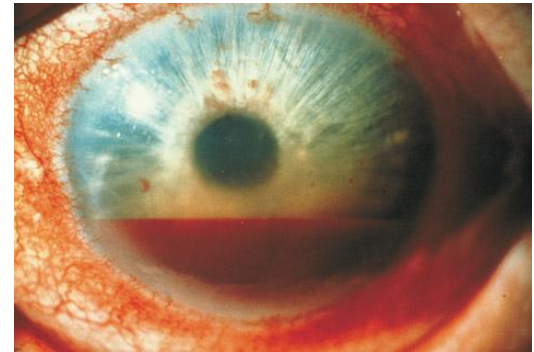
Injury	Signs and Symptoms
Multiple facial bone fractures	<ul style="list-style-type: none">■ Massive facial swelling■ Dental malocclusion■ Palpable deformities■ Anterior or posterior epistaxis
Zygomatic and orbital fractures	<ul style="list-style-type: none">■ Loss of sensation below the orbit■ Flattening of the patient's cheek■ Paralysis of upward gaze
Nasal fractures	<ul style="list-style-type: none">■ Crepitus and instability■ Swelling, tenderness, lateral displacement■ Anterior or posterior epistaxis
Maxillary (Le Fort) fractures	<ul style="list-style-type: none">■ Mobility of the facial skeleton■ Dental malocclusion■ Facial swelling
Mandibular fractures	<ul style="list-style-type: none">■ Dental malocclusion■ Mandibular instability

Management of Face Injuries

- Begins with protecting the cervical spine
- Open the airway
- Treat as you would any other soft-tissue injury
- Epistaxis following facial trauma can be severe
- Swelling and bruising

Blunt Eye Injuries

- Range from swelling and bruising to rupture of the globe
 - Hyphaema
 - Orbital blowout fractures
 - Retinal detachment



Assessment of Eye Injuries

- Variety of symptoms
 - Vision loss that doesn't improve
 - Double vision
 - Severe eye pain
 - Foreign body sensation
 - Obvious ocular damage



Evaluate Visible Ocular Structures and Functions (1 of 2)



- Orbital rim: bruising, swelling, lacerations, and tenderness
- Eyelids: bruising, swelling, and lacerations
- Corneas: foreign bodies
- Conjunctivae: redness, pus, inflammation, and foreign bodies

Evaluate Visible Ocular Structures and Functions (2 of 2)

- Globes: redness, abnormal pigmentation, and lacerations
- Pupils: size, shape, equality, and reaction to light
- Eye movement in all directions: paralysis of gaze or uncoordinated eye movements
- Visual acuity: test each eye separately.

Oral and Dental Injuries (1 of 2)

- Soft-tissue Injuries
 - Lacerations and avulsions in and around the mouth
 - Associate with a risk of intraoral haemorrhage and subsequent airway compromise
 - Fractured or avulsed teeth and lacerations of the tongue
 - May cause profuse bleeding into the upper airway
 - Patients may swallow blood.
 - Bleeding may not be grossly evident.



Oral and Dental Injuries (2 of 2)

- Dental Injuries
 - Fractured and avulsed teeth
 - Common following facial trauma
 - May be associated with mechanisms that cause severe maxillofacial trauma
 - Always assess the patient's mouth following a facial injury.
 - Teeth fragments can become an airway obstruction.

Summary

- Anatomy of the head and face
- Assessment and management of general injuries
- Assessment and management of specific injuries