# TRAUMA

Magdalen Foo, Discipline Lead Oral Maxillofacial Surgery

THE UNIVERSITY OF WESTERN AUSTRALIA

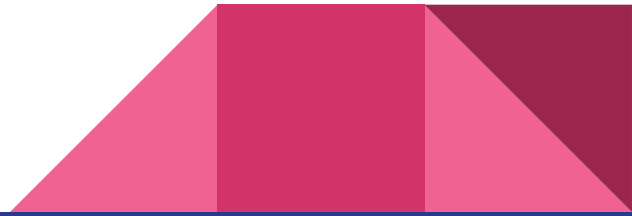
Oral Health Centre of Western Australia

# Learning outcomes

Describe the initial management of a trauma patient

Describe the presentation and management of multiple trauma

Discuss the importance of injury prevention



# Trauma

Injury resulting from the transfer of energy



# Mechanism of injury

- Important in history taking of the trauma patient

e.g. fall from a height, burns, blast, length of time required for vehicle extrication

- Help identify patterns of injury

e.g. whiplash, not wearing a seat belt, ejected from vehicle, assault with instruments



# Energy sources

- Mechanical energy
  - Vehicular accident
  - Falls or crush injury
  - Weapons - gun and knives
  - Machines
  - Assault
- Heat
  - Fire - burns and smoke inhalation
- Drowning

# Energy sources

- Electricity
  - Lighting
  - Wires
- Chemical
  - Drugs
  - Poisons e.g. liquids, gases
  - Insects, snake venom




Single vehicle accident compared to multiple car pile-ups with more serious physical injuries



Vehicle extrication to remove trapped victim



Ejected outside vehicle – increasing risk of injury and fatality



Cyclist and car collide – transfer of kinetic energy



Fall from a height – fatal roof collapse




Crush injury - rhabdomyolysis




# Blast injury

- Primary injury (unique to blast wave) – eardrum rupture, abdominal haemorrhage, blast lung (alveolar haemorrhage)
- Secondary (from debris and fragments) - penetrating or blunt injury, fractures and soft tissue injury
- Tertiary (result of being thrown) - fracture or traumatic amputation, head injury
- Quaternary (not due to primary, secondary or tertiary mechanisms) – e.g. burns or injury from inhalation

# Gunshot

High velocity with greater kinetic energy and consequently potential to destroy tissue



# Stab wound

Penetrating injury



# Machinery - cutting disc

Penetrating injury



# Assault



# Rescue from a burning building

Burns,
Inhalation of smoke and toxic gases

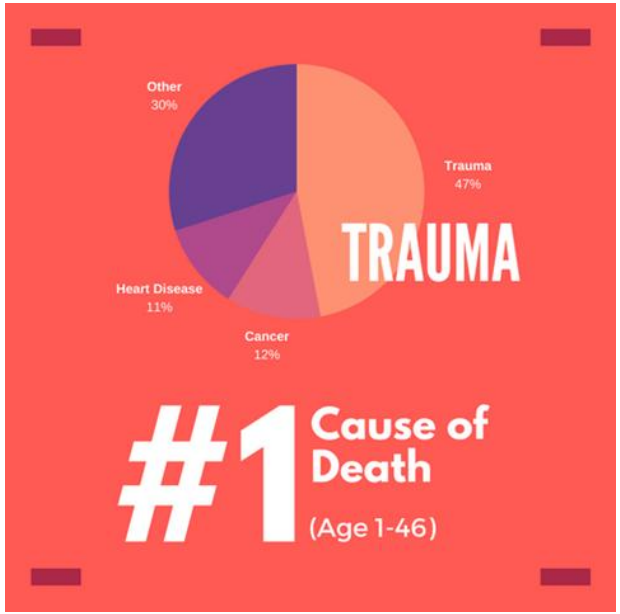


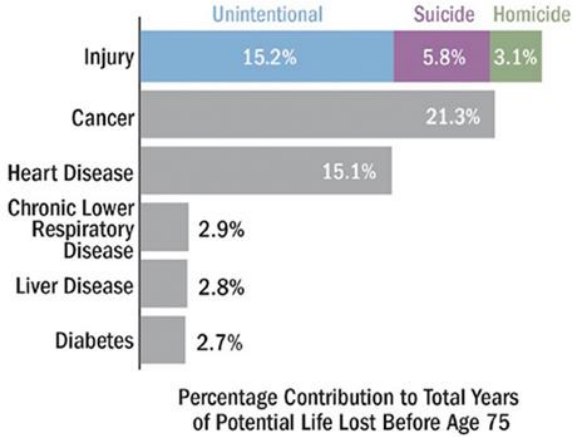
# Drowning

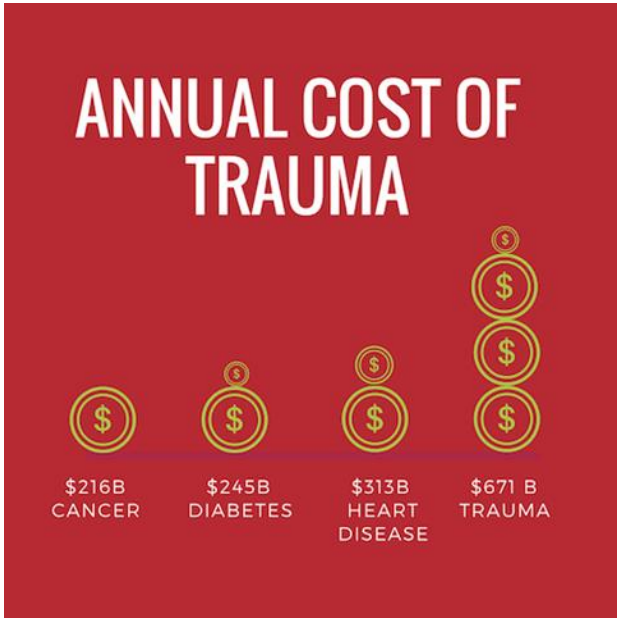


# Trauma statistics and facts

- Almost half a million hospitalised, and almost 12,000 deaths
- Males made up 59% of cases
- Indigenous people twice as likely to be admitted to hospital as a result of injury or die of injury
- Most injuries requiring hospitalisation happen as a result of transport accidents, falls, self-harm and assault
- Most deaths from injuries happen as a result of falls, suicide and transport accidents
- Significant public health problem in Australia – major cause of death and disability in young people and many survivors have long-lasting disabilities
- Huge human, social and economic costs –annual healthcare costs (> $3.4 billion )




# Trauma statistics and facts

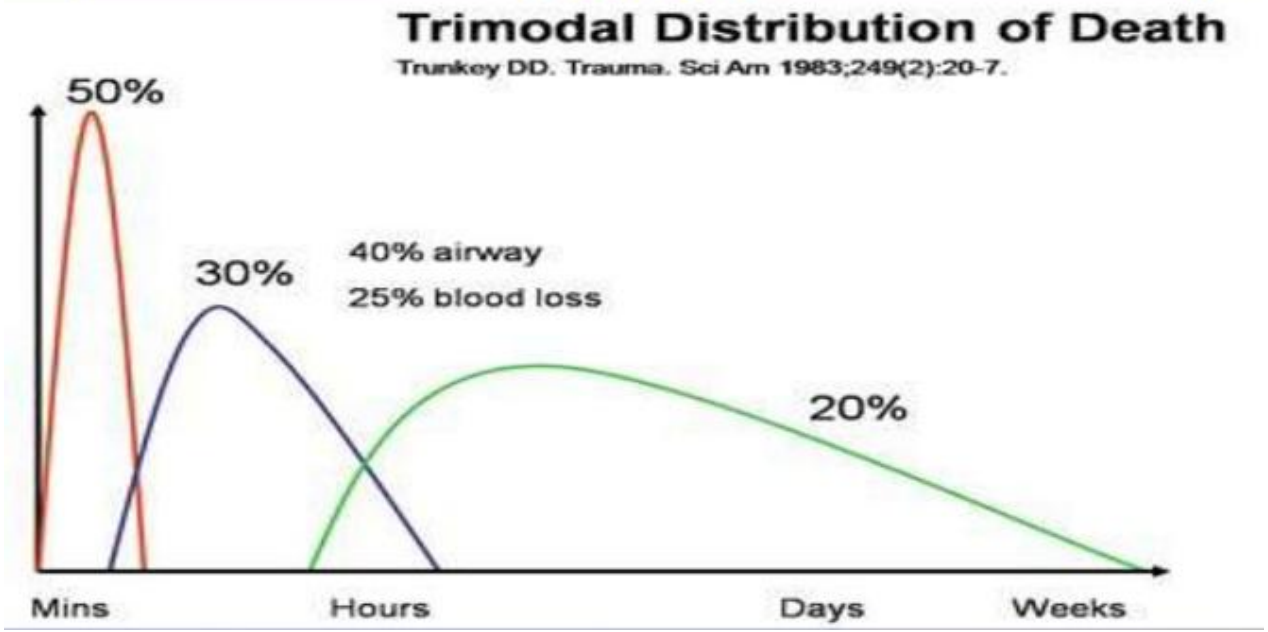
# Trauma patient

- Person who has suffered a serious or life-threatening injury as a result of an event such as a car accident, gunshot wound or fall
- Traumatic injuries may affect many parts of the body, including the brain, the extremities and internal organs

# Trauma

- Large spectrum of injury severity may result, ranging from minor injuries which require little medical intervention to severe multisystem trauma, requiring definitive management by an experienced multidisciplinary team
- Integrated systems of care allows the best chance of survival and recovery
- A systematic approach to management in order to maximize outcomes and reduce the risk of undiscovered injuries

# Trimodal distribution of death



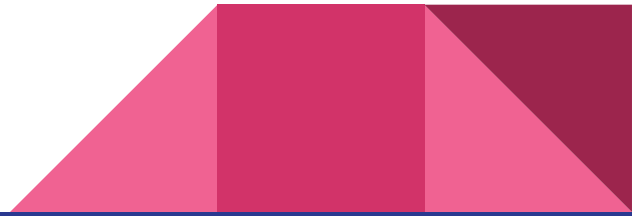
# Immediate deaths

- caused by fatal injury of the great vessels, heart, brain, brainstem, upper spinal cord



# Early deaths

- Occur minutes to hours after the injury
- Results from failed oxygenation of vital organs or central nervous system injury
- Injuries occur in predictable patterns based on mechanism of injury, patient , environmental conditions



# Golden Hour

- First hour after a traumatic injury, when emergency treatment is most likely to be successful
- Can have significant impact on morbidity and mortality



# Late trauma mortality

- occurs days to weeks after injury
- primarily due to sepsis and multi-organ failure



# ATLS (Advanced trauma life support)

- Training program for medical providers in the management of acute trauma cases, developed by the American College of Surgeons
- Standard of care built around a consistent approach to patient evaluation
- Ensures that the most life-threatening conditions are quickly identified and addressed in the order of risk potential

- "co-ordinates and prioritizes patients ! "

# Transfer to a trauma centre



# Royal Perth Trauma Unit



- The receiving facility should be designated to receive seriously injured patients and the resources and expertise to adequately manage their injuries
- To avoid any delay and to have a best initial management of poly trauma, patient triage is important

# Triage

- Prioritize patients according to the severity and urgency of their injuries and the availability of care
- Considers vital signs and prehospital clinical course, mechanism of injury, patient’s age, comorbid conditions

# Tools to predict outcomes

- Glasgow Coma Scale (GCS) - quantify the severity of head injury
- Revised Trauma Score – characterizing the physiological status of injured patient, and predicting mortality using the Revised Trauma Score
- Injury Severity Score – deals with multiple traumatic injuries, rate the severity of injury in each of the 3 most severely injured organ system

# Glasgow Coma Scale (GCS)

Quantify the head injury

* Best = 15

* Comatose if 8 or less (3)

**TABLE 38-2**

**Glasgow Coma Scale**

| BEHAVIOR | RESPONSE | SCORE |
|---|---|---|
| Eye opening response | Spontaneously | 4 |
| | To speech | 3 |
| | To pain | 2 |
| | No response | 1 |
| Best verbal response | Oriented to time, place, and person | 5 |
| | Confused | 4 |
| | Inappropriate words | 3 |
| | Incomprehensible sounds | 2 |
| | No response | 1 |
| Best motor response | Obeys commands | 6 |
| | Moves to localized pain | 5 |
| | Flexion withdrawal from pain | 4 |
| | Abnormal flexion (decorticate) | 3 |
| | Abnormal extension (decerebrate) | 2 |
| | No response | 1 |
| Total score: | *Best response* | 15 |
| | *Comatose client* | 8 or less |
| | *Totally unresponsive* | 3 |

# Revised Trauma Score

- physiological status predicting mortality

* considers other factors like blood pressure or respiratory rate

## REVISED TRAUMA SCORE

RTS = 0.9368 GCS + 0.7326 SBP + 0.2908 RR

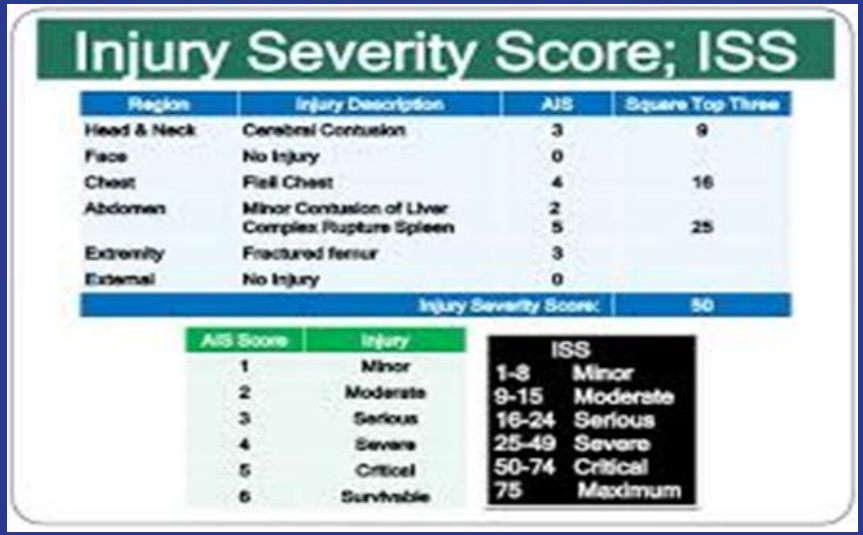
| GCS | SBP | RR | Coded Value |
|---|---|---|---|
| 13-15 | >89 | 10-29 | 4 |
| 9-12 | 76-89 | >29 | 3 |
| 6-8 | 50-75 | 6-9 | 2 |
| 4-5 | 1-49 | 1-5 | 1 |
| 3 | 0 | 0 | 0 |




Krongdai.unh@mahidol.ac.th

# Injury Severity Score

ISS = sum of 3 highest squared AIS (abbreviated injury score)



## Injury Severity Score; ISS

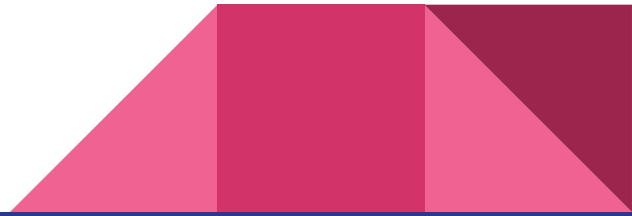
| Region | Injury Description | AIS | Square Top Three |
|---|---|---|---|
| Head & Neck | Cerebral Contusion | 3 | 9 |
| Face | No Injury | 0 | |
| Chest | Flail Chest | 4 | 16 |
| Abdomen | Minor Contusion of Liver<br>Complex Rupture Spleen | 2<br>5 | 25 |
| Extremity | Fractured femur | 3 | |
| External | No Injury | 0 | |
| | | Injury Severity Score: | 50 |

| AIS Score | Injury |
|---|---|
| 1 | Minor |
| 2 | Moderate |
| 3 | Serious |
| 4 | Severe |
| 5 | Critical |
| 6 | Survivable |

| ISS | |
|---|---|
| 1-8 | Minor |
| 9-15 | Moderate |
| 16-24 | Serious |
| 25-49 | Severe |
| 50-74 | Critical |
| 75 | Maximum |

# Primary survey ABC

- Crucial in the Initial Assessment of a seriously injured patient
- Patients assessed and treatment priorities are established based on their injuries, the stability of their vitals, and the injury mechanism
- Patient's vital functions must be assessed quickly and efficiently



# Airway

Airway maintenance with C-spine control



# Breathing

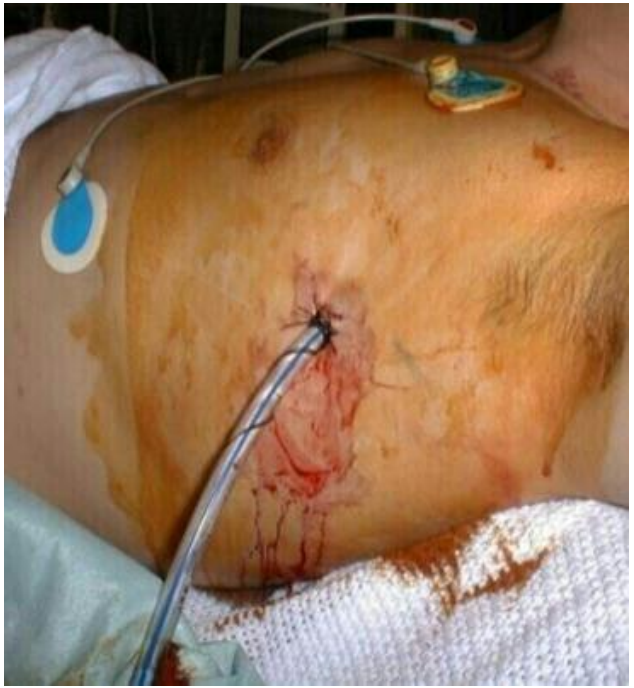
- Chest wall of patient with pneumothorax, flail chest  or haemothorax may move but not ventilate effectively
- Pneumothorax - air leaks out and gets trapped in pleural space, it can cause complete or partial collapse of a lung
- Flail chest – multiple rib fractures resulting in unstable segment of chest wall, affecting respiratory ability
- Haemothorax – collection of blood in the pleural cavity

# Breathing

Chest radiograph - Right pneumothorax



Chest drain



# Breathing

Endotracheal intubation helps to protect the airway and facilitates adequate lung inflation with high Fi02



# Circulation

- Control bleeding and restore circulation to the tissues
- Most common cause of shock in the traumatized patient is hypovolemia caused by haemorrhage





# Circulation

Hypovolemic shock in patients with multisystem injuries

| Class of haemorrhagic shock | | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| Blood loss (mL) | Up to 750 | 750–1500 | 1500–2000 | > 2000 |
| Blood loss (% blood volume) | Up to 15 | 15–30 | 30–40 | > 40 |
| Pulse rate (per minute) | < 100 | 100–120 | 120–140 | > 140 |
| Blood pressure | Normal | Normal | Decreased | Decreased |
| Pulse pressure (mm Hg) | Normal or increased | Decreased | Decreased | Decreased |
| Respiratory rate (per minute) | 14–20 | 20–30 | 30–40 | > 35 |
| Urine output (mL/hour) | > 30 | 20–30 | 5–15 | Negligible |
| Central nervous system / mental status | Slightly anxious | Mildly anxious | Anxious, confused | Confused, lethargic |

* Memory tip: Like a game of tennis 15/30/40

The first clue is when respiratory rate goes up first

15:
↑ most people Compensate

30:
↑↑ respiration

40:
↓ Pulse ↑↑ respiration
↓ BP
↓ Urine

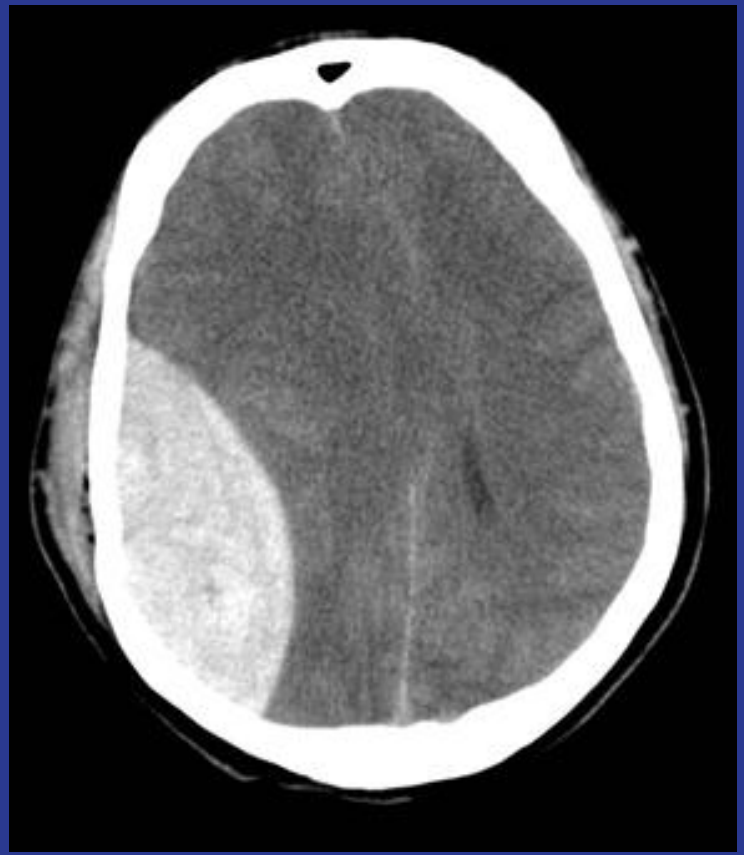
# Disability

Neurological exam AVPU
A = awake
V = voice stimulation
P = pain stimulation
U = unresponsive



# Disability

Neurological exam identifies any CNS problem that require immediate intervention or additional diagnostic evaluation



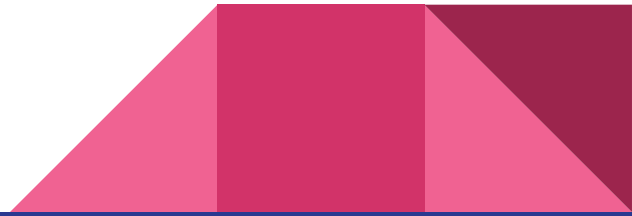
# Exposure



- All of the body need to be visualized, palpated and examined for injuries and bleeding sites
- Frequent re-evaluation of the patient's vital signs is important to monitor the patient's ability to maintain an adequate airway, breathing and circulation

# ABCDE

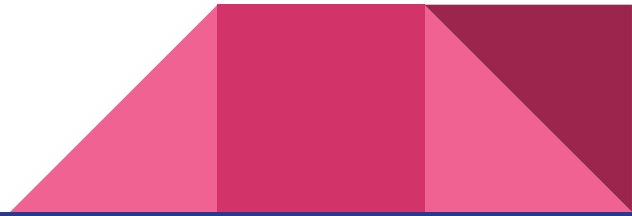
- Airway, Breathing, Circulation, Disability, Exposure (ABCDE) approach to assess and treat the patient
- Do a complete initial assessment and re-assess regularly
- Treat life-threatening problems before moving to the next part of assessment
- Assess the effects of treatment



# Secondary survey

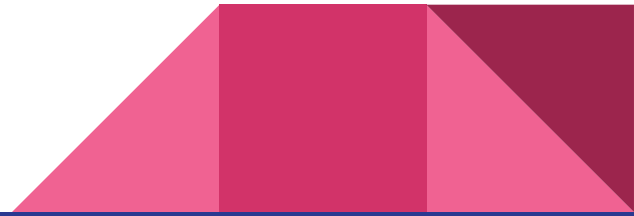
Does not begin until primary assessment has been completed

- Head and skull
- Chest
- Maxillofacial and neck
- Spinal cord
- Abdomen
- Genitourinary tract
- Extremities



# Special injuries

- Patient with burns, cold injuries and electrical injuries have special considerations that must be addressed during the initial assessment and resuscitation



# Burns

Full thickness burns of the thorax or extremity, may require escharotomies to prevent impaired ventilation and compartment syndrome, respectively



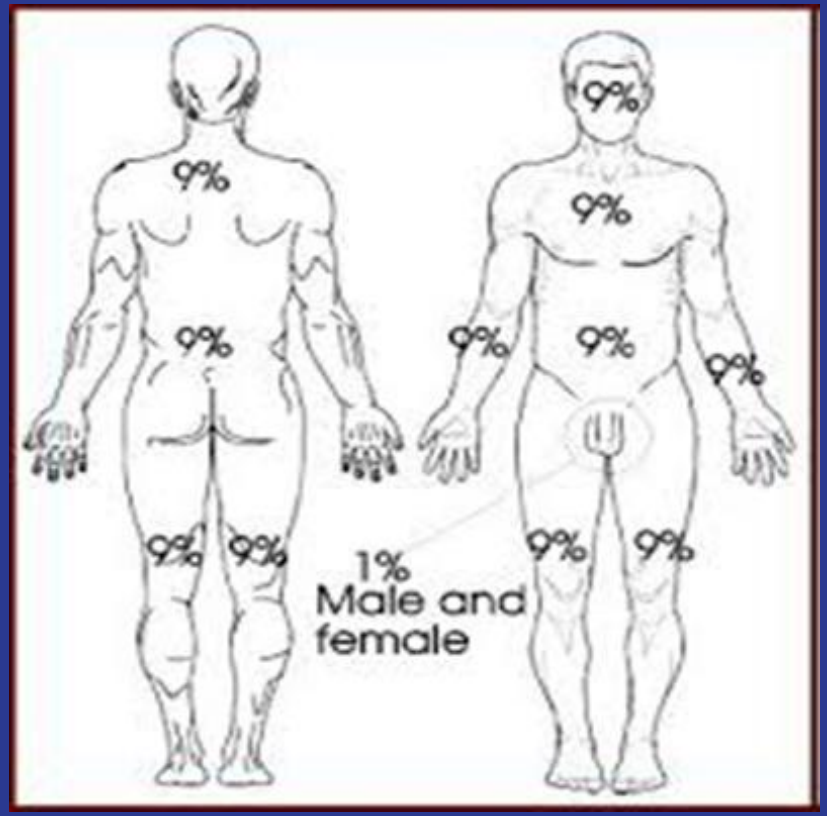
# Burns



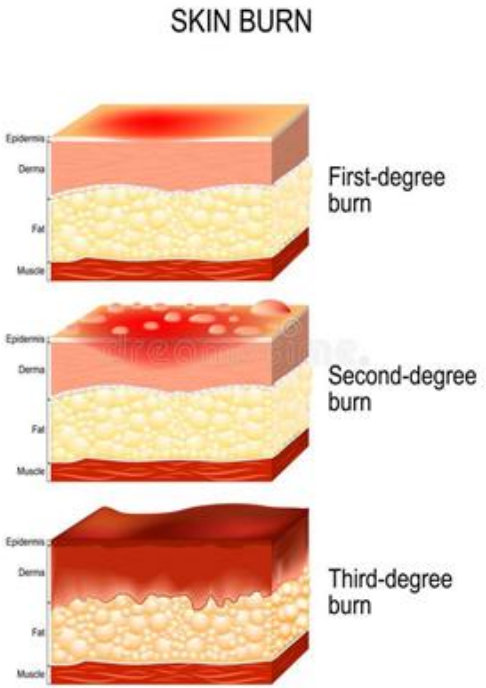
- Early intubation and mechanical ventilation indicated if upper airway burns or inhalation injury
- Patient with large burns require large volumes of crystalloid resuscitation fluids

# Burns

*Rules of nines* – tool used to estimate the total body surface area affected by burn



# Burns


SKIN BURN
Epidermis
Derma
Fat
Muscle
First-degree burn
Second-degree burn
Third-degree burn

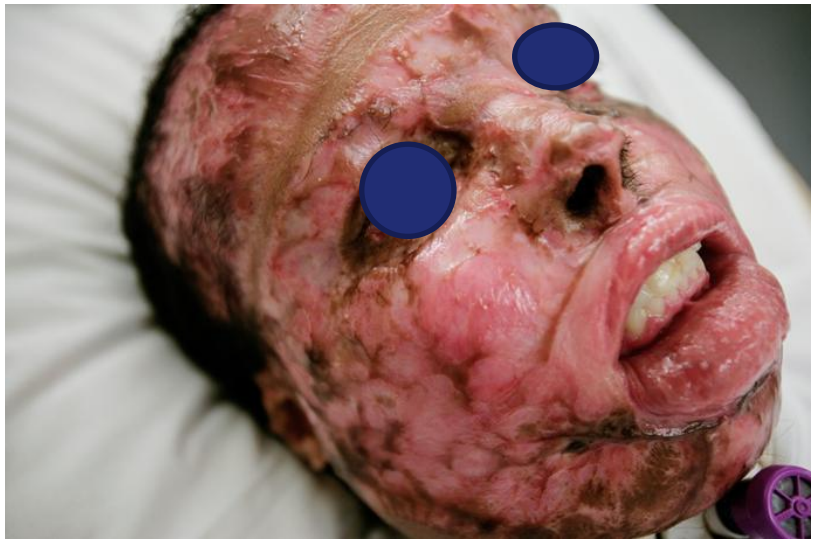


# Second-degree burns



- partial thickness burns involve the epidermis and part of the dermis
- burn site appears red and blistered, and maybe swollen and painful

# Third-degree burns



- Severe **burn** characterized b y destruction of the skin through its deeper layers and possibly into underlying tissues, loss of fluid, and sometimes shock
- Skin is white and without sensation , or may be blackened or burned away

# Electrical burns

-results from electricity passing though the body causing rapid injury
-burns on skin are largely superficial and cover a large area
- patients require debridement of eschar and skin grafts



# High-voltage electrical injuries

- Tissue injury may not be apparent; massive myonecrosis and damage to soft tissue and bone may be concealed beneath normal-appearing skin between entrance and exit wounds
- Measurement of compartment pressures and performing decompressive fasciotomies
- Monitor urine output for evidence of myoglobinuria
- Continual cardiac monitoring as risk of direct myocardial injury and hyperkalemia arising from myonecrosis



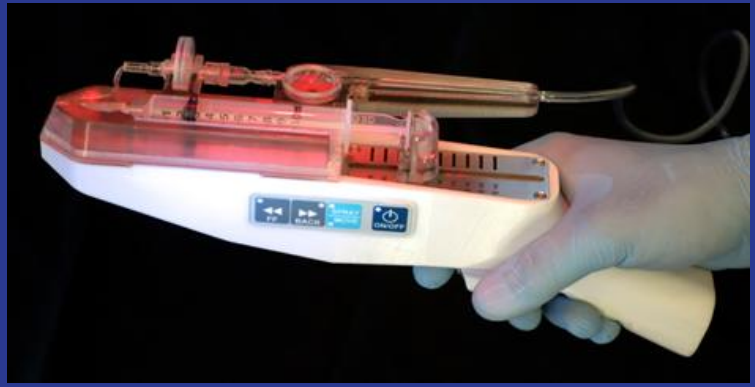
Split-thickness skin grafts are usually harvested from the front or outer thigh, abdomen, buttocks or back and used to cover large areas

# Skin grafting



# Spray-on skin

- Technology for treatment of burn victims
- Involves taking small samples of the patient's skin and spraying them on the wound





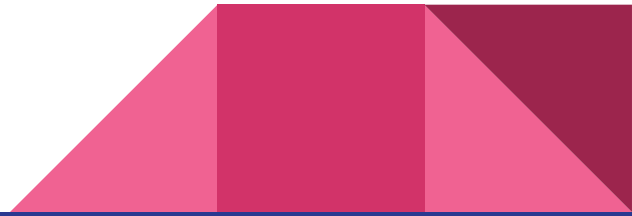
# Severe hypothermia

Treat with  rewarming



# Cold injuries

- Immersion in water warmed to 40 degrees centigrade
- In case of severe hypothermia with cardiac arrest, do not stop resuscitation efforts until patient is rewarmed thoroughly



# Frequent and thorough reassessment

# Tertiary trauma survey

- As a result, a tertiary trauma survey (TTS) is increasingly being implemented to avoid missed injuries
- The tertiary trauma survey is defined by the American College of Surgeons as a patient evaluation that identifies and catalogues all injuries after the initial resuscitation and operative intervention
- Decreases morbidity and mortality by earlier identification and treatment

# Injury prevention & control

- Injury prevention

- enhance research of biomechanics
- enhance trauma care
- develop national policy








# Injury prevention & control

- Injury control

- engineering and technology
- enforcement and legislative
- education and behavioural









