Department of Trauma and
Emergency Medicine
Phramongkutklao Hospital

Special Consideration of Pre-Hospital Trauma Patient Care

Thanananan Isarangura na Ayutthaya MD EP
Nat Krairojananan MD FRCST

Scope

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- Traumatic brain injury
- Burn
- Confined space medicine

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Traumatic Brain Injury

Pathophysiology of CNS Injury

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Primary injury

- Direct damage to the brain

Secondary injury

- Systemic causes
- Intrinsic causes

Pathophysiology of secondary CNS injury

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Systemic causes	Intrinsic causes
Hypoxia Hypotension Anemia (blood loss) Increased or decreased CO_2 Increased or decreased blood glucose	Increased intracranial pressure (ICP) Edema Hematomas Seizures

CNS Injury Management

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- A-B-C
- Spinal motion restriction
- D-E
- Transport and destination decisions

Airway

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- Open AW under spinal motion restriction: Jaw thrust or chin lift
- Clear AW: suction
- Maintain AW: need of definitive AW
  - Protection: tongue, FB
  - Ventilation

Breathing

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Provide 100% oxygen

- Goal → 95% oxygen saturation or higher

Assist ventilations (as needed)

- Maintain normal $ETCO_2$ at 35 to 40 mm Hg
- Ventilation rates
  - Adults : 10 to 12 breaths/min
  - Pediatric : 12 to 20 breaths/min

No routine hyperventilation

Hyperventilation

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Hyperventilation indicated for:

- Bilateral dilated and unresponsive pupils or Unequal pupils (with altered LOC)
- Abnormal posturing
- Neurologic deterioration → Decreased GCS ≥ 2 points in patient with initial GCS < 9

Ventilatory rate

- Adult : 20 breaths/min
- Child : 25 breaths/min
- Infant : 30 breaths/min

Hyperventilation target

$ETCO_2$ 30–35 mm Hg

Circulation

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- Control hemorrhage
- Prevent secondary brain injury
- Maintain adequate BP by hypotensive resuscitation, maintain SBP 90-100 mmHg

Neurologic assessment for disability

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Conduct in the ambulance

The complete neurologic examinations

- Level of consciousness
- Pupillary reaction
- Motor function
- Sensory function

Level of Conscious Assessment

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AVPU

- Alert
- Responds to Verbal stimulus
- Responds to Painful stimulus
- Unresponsive

Glasgow Coma Scale (GCS)

- scored after the A-B-C assess and correct
- Mild-Moderate-Severe
- modified GCS for pediatrics

Pupils Assessment

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- Determine increasing of intracranial pressure
- Normally equal, round, and 3 to 5 mm in size
- Light in one pupil should constrict both
- Consensual light reflex tests CNs II and III

Motor Function

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upper extremities

- Move the hands and arms
- Squeeze your fingers

lower extremities

- Wiggle the toes
- Push and pull their feet against resistance

Sensory Function

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in conscious patient:

- light touch perception in both upper and lower extremities

in unconscious patient

- deep pain response
  - Forehead rub
  - Nailbed compression

Transport and destination

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- Minimal scene time < 10 minutes
- Supine position
- Appropriate receiving facility
- Reassessment

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Burn

Spectrum of disease

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- All severity of burns are not related in size
- Large burns might cause multiple organ systems
- Smoke inhalation can be life-threatening

Burn Assessment: Depth

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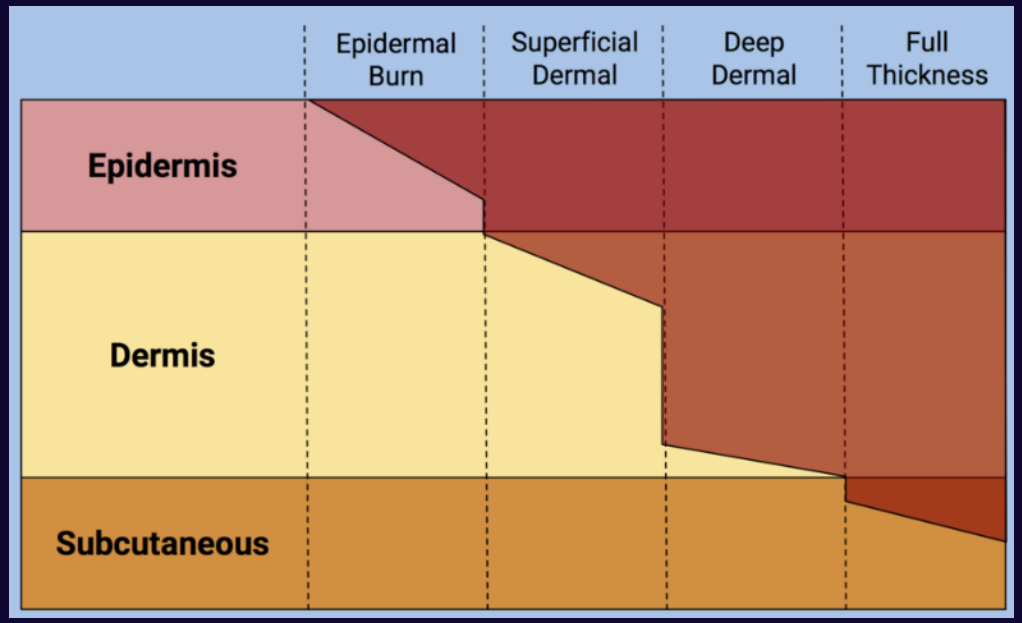
- Superficial (first-degree)
- Partial-thickness (second-degree)
  - Superficial
  - Deep
- Full-thickness (third- and fourth-degree)



Burn depth may progress over time

Burn Assessment: extension

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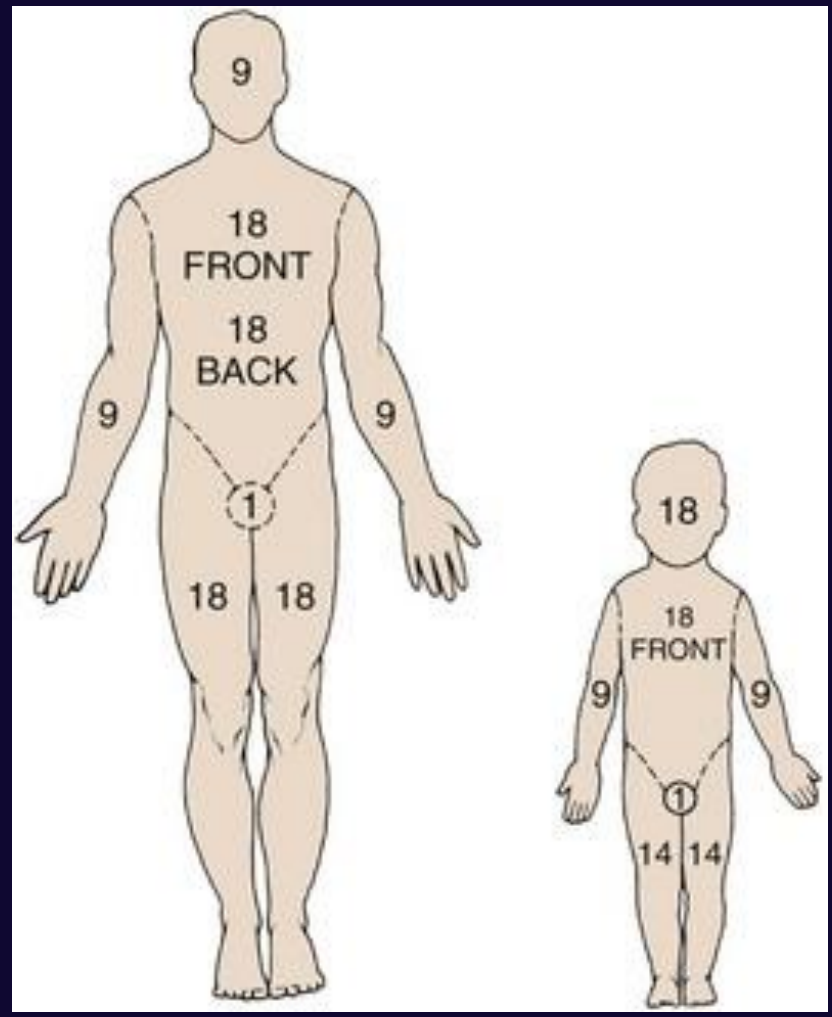
Burn size estimation

- Percent of body surface area (BSA)
- Rule of nines



Primary Assessment in : A & B

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Airway

- swelling in smoke inhalation
- Consider early intubation / surgical airway

Breathing

- compromised from chest wall eschar
- toxic pulmonary injury
- Monitor ventilatory rate, SpO_2, and $ETCO_2$

Primary Assessment in Burn: C

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Circulatory

- fluid leaks into damaged tissue causing swelling
- Hypotension
- Concomitant injury
- IV access and fluid replacement by Parkland’s formula

Primary Assessment in Burn: D & E

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Disability

- Altered mentation indicated hypotension or hypoxia

Expose

- loss of body temperature
- Cover patient upon completion of assessment

Burn Management: Specific burn therapy

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- Stop ongoing burning: remove cloth
- Cover with dry, sterile dressing
- Do not apply ice
- Do not use any ointments or topical antibiotic

Burn Management: fluid administration

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Parkland formula

Total fluid in 1st 24 hrs = (2–4 ml)(body weight: kg)(% BSA burned)

- First ½ given in the first 8 hours after burn
- Second ½ given in the next 16 hours after burn
- Adults: RLS
- Pediatric: 5% dextrose in RLS

Burn Management: transfer to definitive care

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- Analgesia
- Transport to burn center as indicated
- Monitor for hyperventilation, fluid overload, heat loss
- Reassess the patient

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Confined Space Medicine

Confined space

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Cause

- Natural: earthquake, storm, flood
- Manmade: explosion, accident

- Collapsed structure / building
- Rocks, trees
- Trapped in vehicle

Confined Space Medicine (CSM)

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- To rescue casualties trapped in confine space
- 35% of casualties are still alive

Factors influence CSM

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- Low lighting
- Bad ventilation
- Temperature
- Tight space
- Hazardous material
- Risk for exposure to body fluids

Scene sized up in CSM

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Environment

- O2 deficit
- CO2 and other toxic gas from fire

Risk of secondary collapse

Principle of care in CSM

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- Might spend hours in limited space along with patient
- Preventing sudden death from hyperkalemia and metabolic acidosis
- Prevent morbidity from infection and compartment syndrome

Prolonged management in CSM

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- Decubitus ulcer
- Infection from contaminating own urine and feces
- Animals and insects bite
- Hypothermia
- Dehydration
- Bleeding

Limited access

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- ‘Remote assessment’
- Assess and treat only exposed/ accessible part

Increase patient outcome in CSM

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- Rapid stabilize and extricate
- Immobilize as necessary
- Pain control
- Restrain for incorporate / unmovable patient

Spectrum of symptoms

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- Airway obstruction from impacted dust
- Crush syndrome
- Traumatic amputation
- Hypothermia / burn
- HAZMAT and blast injury

Airway obstruction

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- Mostly from impacted dust
- #1 cause of death in Kobe earthquake
- Building components: plaster, tiles, silica
- Block ventilation and gas exchange

- Rarely from blood, vomitus or tooth

Blast injuries in CSM

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Increased mortality due to explosion in close space

- Primary blast injury: PTX, PE, ruptured TM, ARDS (sequelae)
- Secondary blast injury: rare
- Tertiary blast injury: crush injury, blunt injury, traumatic asphyxia
- Quaternary blast injury: burn
- Quinary blast injury: toxic

Infection

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- Open wound with delayed treatment → wound infection
- Contamination with dirty water, own urine and stool
- Animals and insects bite

- Decontamination, wound cleansing
- Prophylaxis antibiotics

Extremities injury

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- Clean and cover all wounds
- Immobilize all fractures / dislocation with non-compressive splint
- High index of suspicious for compartment syndrome, neurovascular injuries
- Adequate pain control
- Field amputation only for entrapped extremity with sign of ischemia

Crush and Reperfusion Syndrome

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- Initiate treatment before extrication / lifting the overlay object

Cause of death

- Early: cardiac arrhythmia and hypovolemia
- Late: renal failure and infection

Prevention of EARLY death from crush syndrome

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- Before extrication / lifting the overlay object
- Initiate IV fluid: NSS load
- connected with T-way
- Syringe filled with calcium gluconate, Sodium bicarbonate, RI and glucose
- ECG monitoring

Prevention of LATE death from crush syndrome

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- Treatment of traumatic rhabdomyolysis
- IV fluid load
- Alkalinizing urine?

Question