

Hot, cold and chemical burns

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Talk outline

Definition

Statistics

Hot burns

Chemical burns

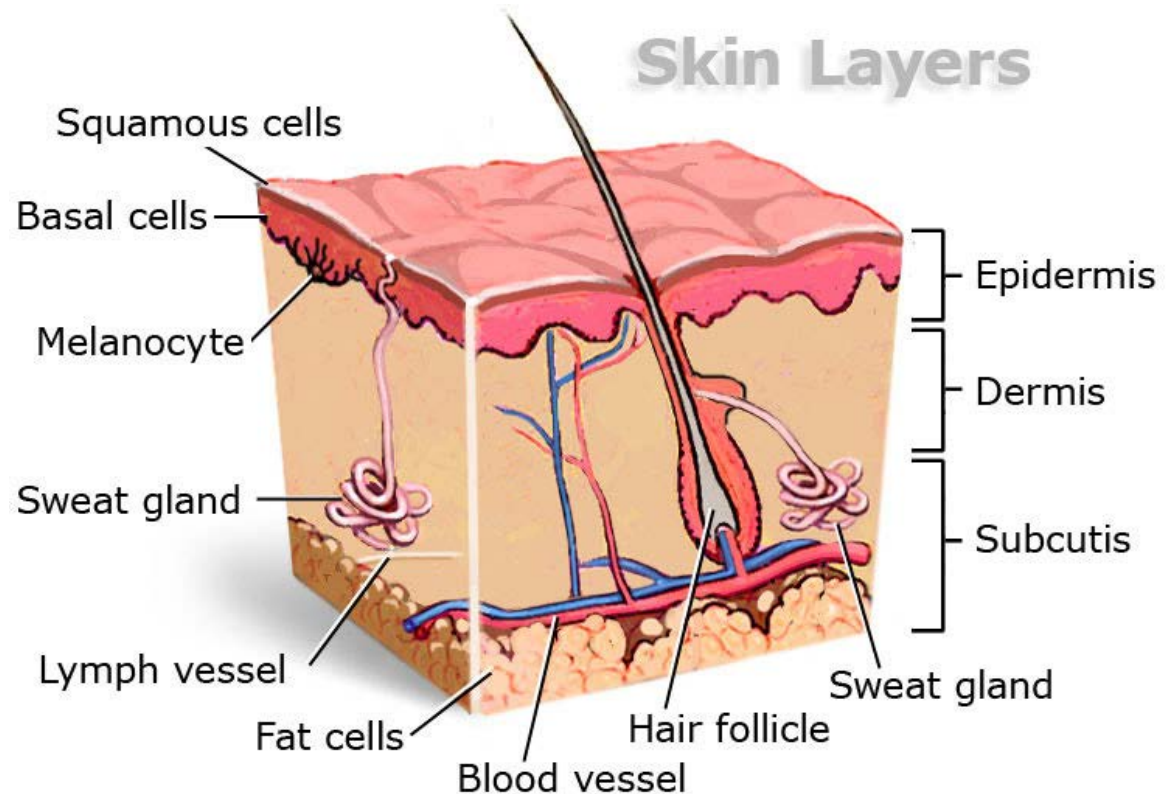
Flash burns

Cold injuries

What is a burn?

A burn is a damage to the skin causing it to no longer function effectively as a natural barrier.

In addition, body fluid may be lost because tiny blood vessels in the skin leak tissue fluid (Serum).



Causes of a burn injury?

A burn is an injury can be caused by thermal, chemical, electrical or radiation energy.

A scald is a burn caused by contact with a hot liquid or steam but the term 'burn' is often used to include scalds.

Most burns heal without any problems but complete healing in terms of cosmetic outcome is often dependent on appropriate care, especially within the first few days after the burn.

Most simple burns can be managed in primary care but complex burns and all major burns warrant a specialist and skilled multidisciplinary approach for a successful clinical outcome.

Epidemiology

- In the UK, it is estimated that each year about 250,000 people with burn injuries present to primary care teams
- The number of burns-related deaths in the UK averages 300 a year.

Risk factors

- Highest rates are seen in children under the age of 5 and the elderly over the age of 75.
- About 50% of burns and scalds occur in the kitchen.
- Infants and toddlers are at high risk of scalds from pulling hot beverages over themselves and at particular risk of burns from touching irons, hair straighteners or oven hobs.

University statistics

Reported (!) number of hot, cold and chemical burns within the University

Year	Hot	Cold	Chemical	Total (burns)	Total Accidents for the year	Frequency
2017	16	0	3	19	536	3.5%

University statistics

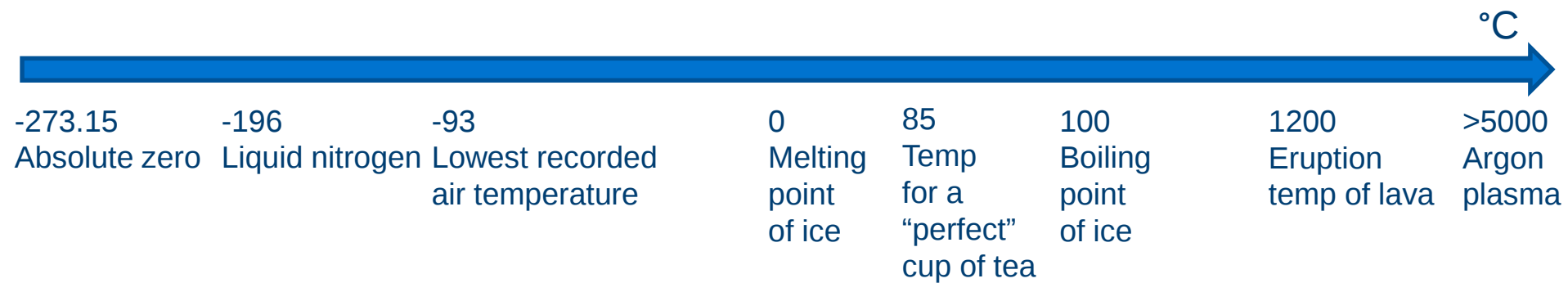
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2018	34	5	6	45	498	9.0%

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2019 (so far)	3	0	2	5		



Types of Burns and Possible Causes

Type of Burn	Causes
Dry Burn	Contact with hot objects such as domestic appliances or cigarettes, Flames, Friction.
Scald	• Steam, Hot liquids such as tea/coffee/hot fats.
Electrical Burn	▪ Low voltage current, as used by domestic appliances, ▪ High voltage currents, as carried in over head cables, ▪ Lightning strikes.
Cold Injury	Frostbite, Contact with freezing metals, Contact with freezing vapours (Liquid oxygen, liquid nitrogen).
Chemical Burn	Industrial chemical , including inhaled fumes/ corrosive gases, Domestic chemicals and agents – paint stripper, caustic soda, weed killers, bleach, oven cleaner.
Radiation Burn	Sunburn, Over exposure to UV rays, exposure to a radioactive source such as X-ray, lasers.

What happens when you burn yourself

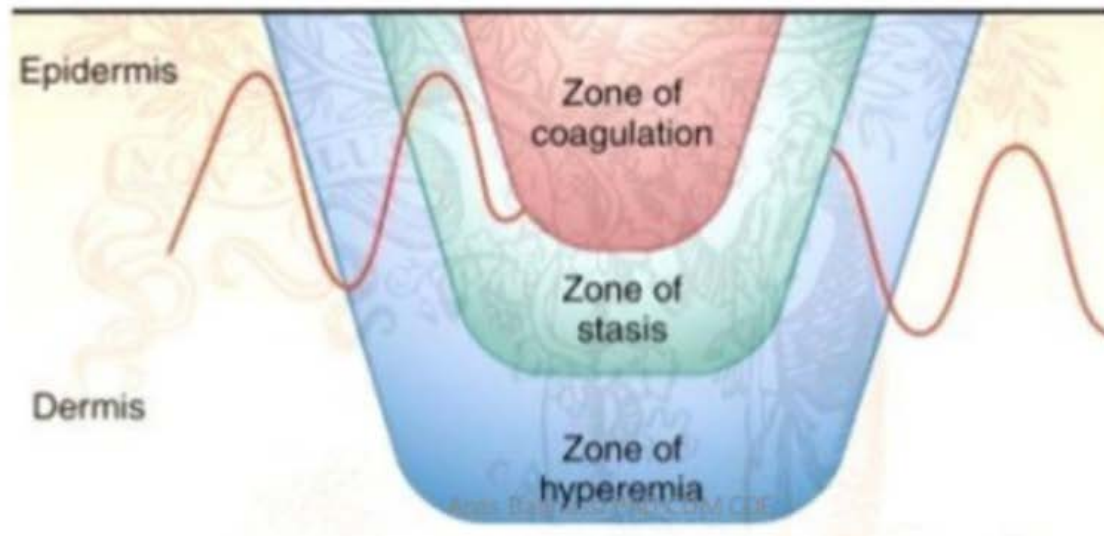
Skin is the largest organ in the body and isolates chemically, thermally, biologically and mechanically the inside from the outside

A burn destroys these functions.

A burn is three-dimensional, it opens up a surface and leads to

- Loss of water, electrolytes, proteins and heat due to vascular permeability, which results in the formation of edema

What happens when you burn yourself



3

Zone of coagulation/necrosis

- At the centre of the wound
- No tissue perfusion
- Irreversible tissue damage due to coagulation of proteins

Zone of hyperaemia

- At the periphery of the wound
- Good tissue perfusion
- Tissue recovery likely.

Zone of stasis

- Surrounds the central zone of coagulation
- Decreased tissue perfusion
- Some chance of tissue recovery with optimal management

What does cooling with water do?

Experimental models show that intradermal temperatures return rapidly to normal – independent of cooling with water

Cooling with water does have an analgesic effect

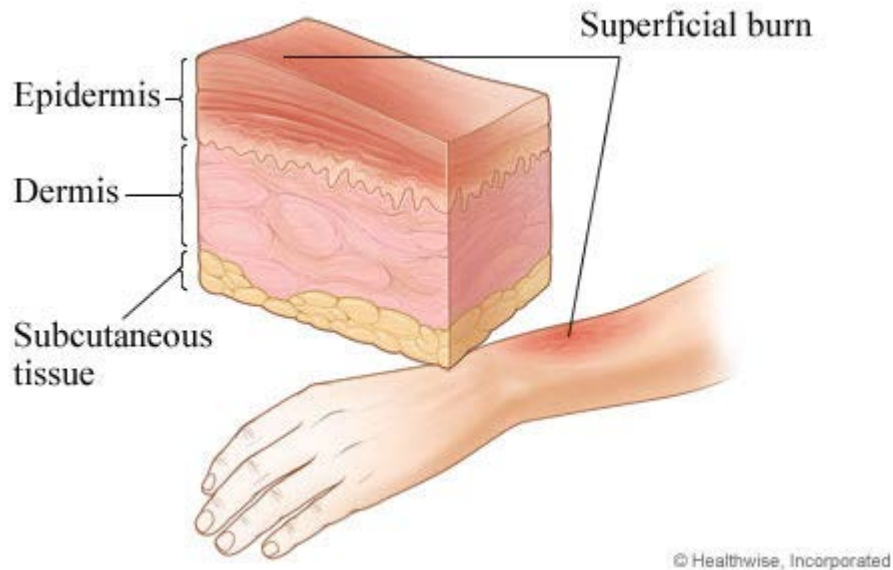
Cooling with water even after 30min delay has beneficial effect

What happens when you burn a large Total Burn Surface Area (TBSA)

- In burns, >20%TBSA, effects on the whole body are
 - Hypovolemia (=shock phase = first 48 hours)
 - Immunosuppression leading to infection
 - Impairment of barrier function of the gut leading to translocation of bacteria (it is therefore important to start enteral feeding early)
 - System inflammatory response post burn affects the lungs resulting in Adult Respiratory Distress Syndrom (ARDS), even in the absence of inhalation injury
 - Metabolic stress response
 - Hypermetabolism, metabolic dysfunction, stress-

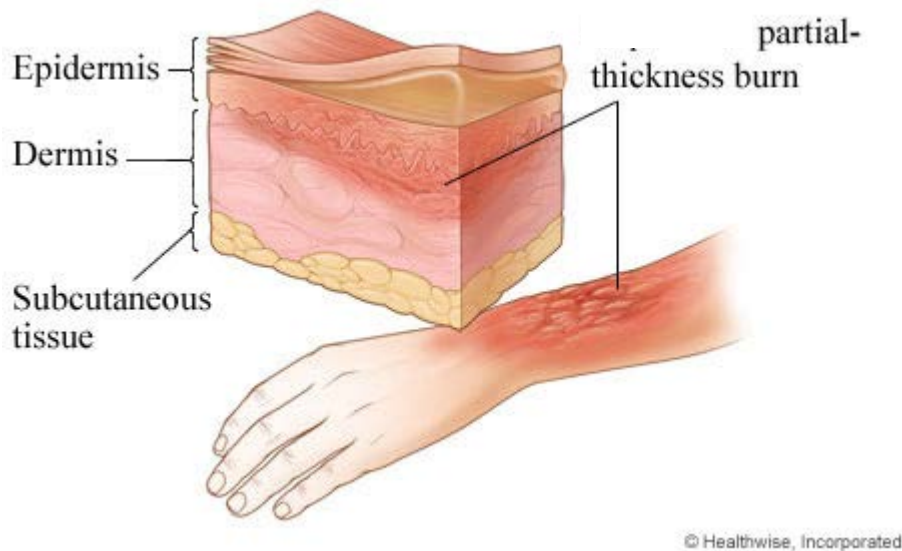
Superficial Burn (First Degree)

- Only involves the outermost layer of skin
- Redness, swelling, tenderness of the skin



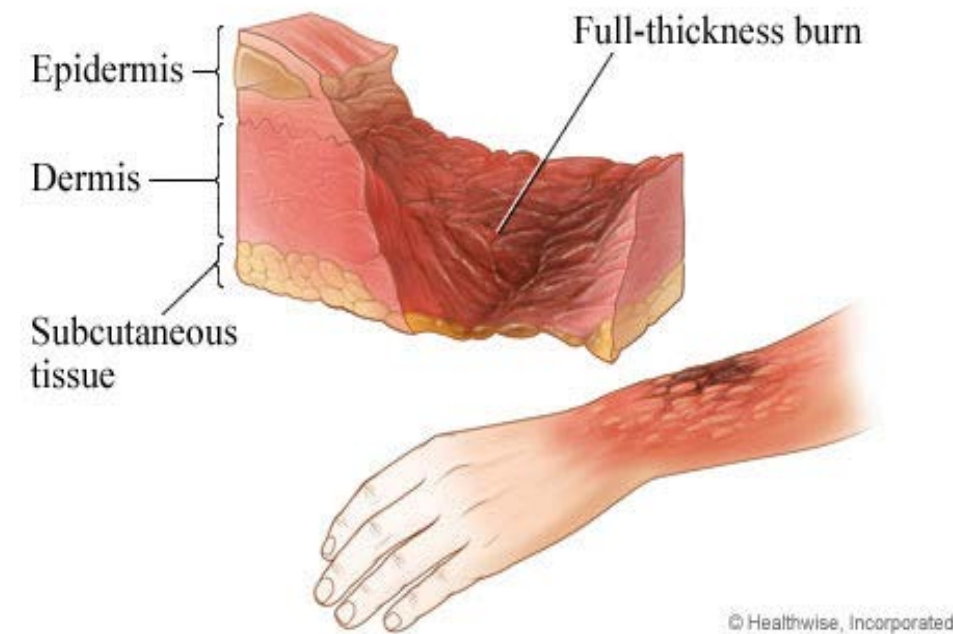
Partial-thickness Burn (Second Degree)

- Affects the epidermis and parts of the dermis
- Skin becomes red and raw
- Blisters form over the skin



Full-thickness Burn (Third Degree)

- All layers affected. May be damage to nerves, fat, muscles, blood vessels
- Skin may look waxy, pale or charred
- Likely to be areas of superficial and partial thickness burns around

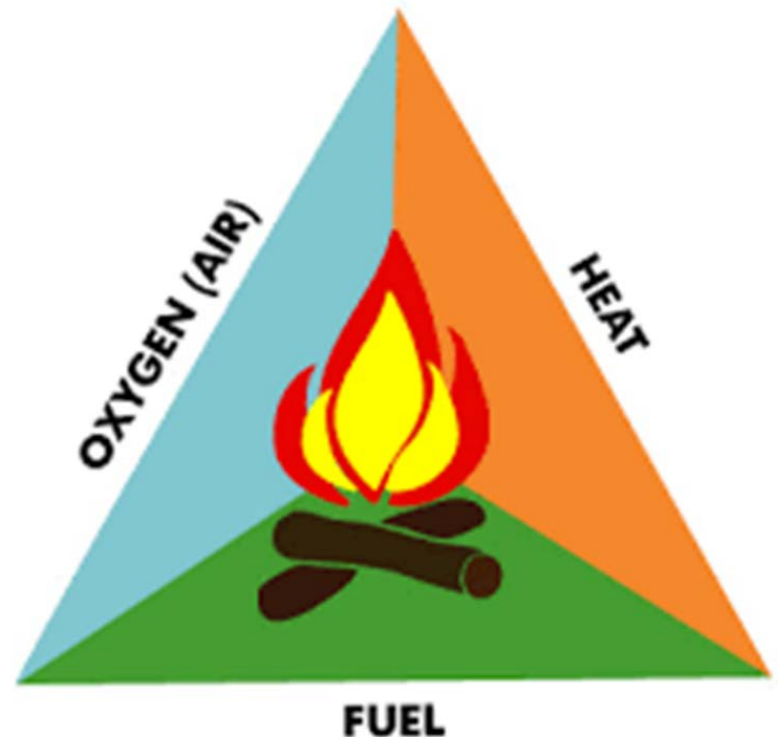


What body areas can be burnt

- Skin
- Eyes
- Ears
- Mouth
- Nose
- Genitalia

What to Assess.

- Consider the circumstances in which the burn occurred
- DANGER
- Remove the heat source from the patient, or the patient from the heat source, whichever is easiest and safest.



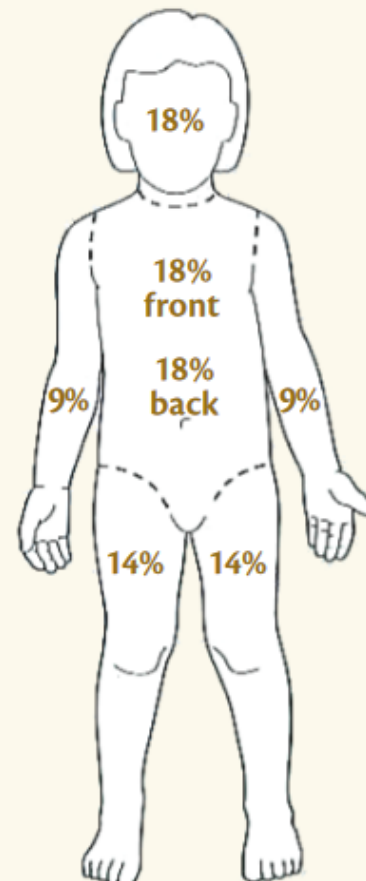
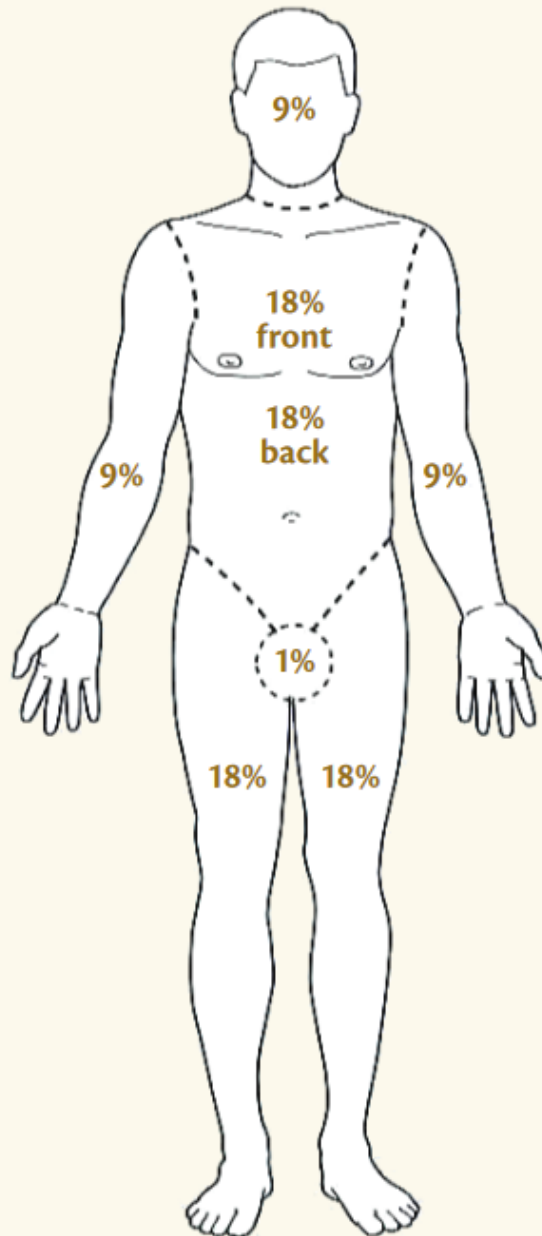
What to Assess.

- Consider the circumstances in which the burn occurred
 - Does it affect the airway?
 - Location of the burn on the body
 - The depth of the burn
 - Is the casualty going into shock?
 - Does the casualty require hospital treatment?
-
- By establishing the cause of the burn, you may be able to identify any other potential problems that may occur.

Burns that need Hospital Treatment

- If the casualty is a child – always seek medical advice.
- Adults:
- All full thickness burns
- All burns involving face, hands, feet or genital area
- All burns that extend right around an arm or leg
- All partial thickness burns larger than 1% of casualty's body surface
- All superficial burns larger than 5% of casualty's body surface
- Burns comprising a mixed pattern of varying depths.

RULE OF NINES for adult and child



Hand surface area (HSA) or palm surface area (PSA) represents 1% of the total body surface area (TBSA).



Br J Dermatol. 2013 Jul;169(1):76-84.

...results in an overestimate for adults (particularly women) and an underestimate for children

PSA equating to 0.5% TBSA appears to be suitable for adults.



Treatment

- Priority is to cool the burn down as soon as possible.
- For at least 10 minutes – may need additional time/until it feels better
USE TEPID WATER.
- Cool the burn but warm the patient
- Treat for shock if the casualty has a severe burn or scald – due to possible fluid loss.
- Remove any jewellery or clothing near the burn
- Try to minimise the risk of infection.
- Get medical attention, as required.
- Reassure the casualty.





Cool

cover with sheets of
Cling film



DON'T'S

- Do-not remove anything sticking to the burn
- Do-not burst blisters
- Do-not apply lotions, ointments or creams
- Do-not use adhesive dressings or apply tape to the skin around the burn.



Facial Burns



<http://www.bbc.co.uk>

Burns to the Airways

- Any burn to the face, mouth or throat is very serious because the airways rapidly become swollen.
- Always suspect damage to the airway if the casualty sustains burns in a confined space since they are likely to have inhaled hot air or gases.
- Singeing of the eyebrows and around the nose
- Carbon particles seen in sputum.
- There is no specific first aid treatment for an extreme case of burns to the airways
- Serious risk of Hypoxia – need emergency treatment.

Burns to the Airway - Treatment

- Call 999/112 for emergency help
- Take steps where possible to improve casualties air supply such as loosening clothing around the neck
- Offer casualty sips of cold water or an ice cube
- Reassure the casualty.



Electrical Burns



- Burns may occur when electricity passes through the body.
- There may be damage at point of entry and exit – this may alert you to extent of hidden injury.
- Low Voltage
- High Voltage
- Lightning Strike
- Electrical shock can cause cardiac arrest.
- Always make the area safe before approaching casualty.

Chemical Burns



- Certain chemicals may irritate, burn or penetrate the skin causing widespread and sometimes fatal damage.
- Domestic chemical burns i.e. dishwasher products, oven cleaners, pesticides and paint stripper
- Industrial chemical burns i.e. Hydrofluoric acid used in several industries- dental work, tyre cleaning, glass etching.



Treatment – Chemical Burns

- Make sure area around the casualty is safe. Ventilate the area to disperse fumes. Wear protective gloves to prevent you coming into contact with the chemical.
- Move casualty if necessary.
- Flood the burn with water for at least 20 minutes.
- If casualty laying on the floor, ensure that contaminated water doesn't collect underneath them.
- Gently remove any contaminated clothing whilst flooding the injury.
- Emergency 999/112 help.



Chemical Burns to the Eyes

- Splashes of chemicals in the eye can cause serious injury if not treated quickly.
- Some chemicals damage the surface of the eye, resulting in scarring and even blindness.
- Priority to wash out (irrigate) the eye(s)
- Ensure you wear gloves
- When irrigating an eye, be careful of the contaminated rinse doesn't splash the good eye your to yourself.





Hydrofluoric acid

Special safety training available

- Corrosive
- Contact poison
- Burns might not be immediately visible and exposure might go unnoticed

Treatment

- Wash off for 1min with water
- Apply Calcium gluconate gel
- Call emergency services



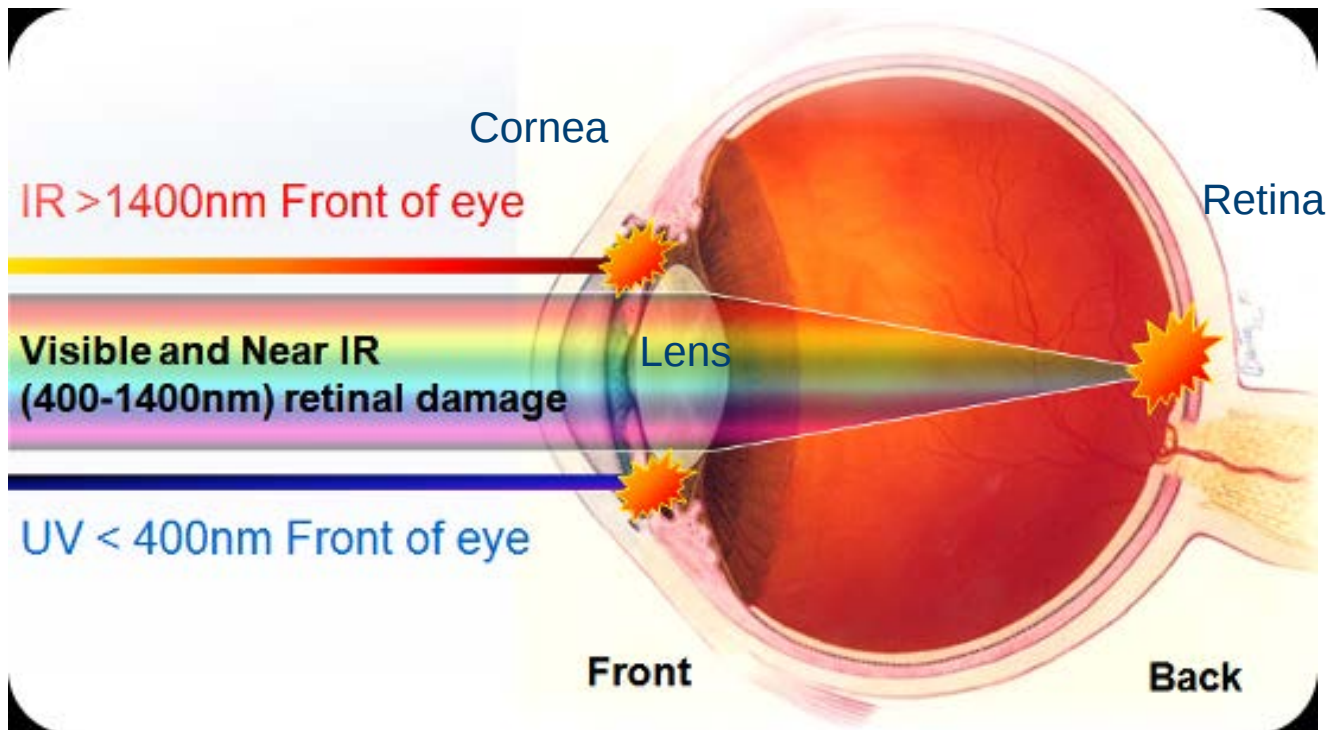
Eye splashes

- Wash 15min with Hexafluonine solution



Flash Burn to the Eye

- This condition occurs when the surface (Cornea) of the eye is damaged by exposure to ultraviolet light, such as a prolonged glare from a welder's torch or laser beam



Flash Burn to the Eye



Focusable 648nm 650nm 100mW Red Laser Line Module Mitsubishi Diode 16MM*68MM

£15.70

From China

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14 watching



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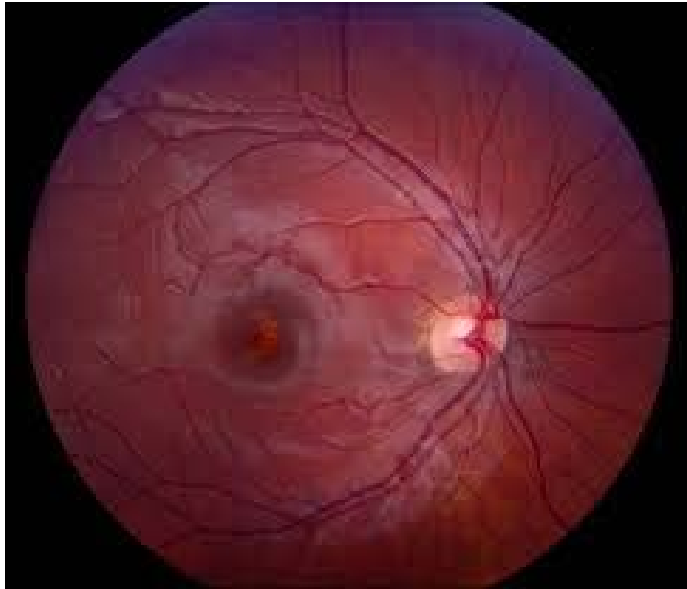
£30.39 Was: ~~£31.99~~

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Flash Burn to the Eye



Flash Burn to the Eye

- The casualty will possibly feel:
- Intense pain in the effected eye
- A gritty feeling in the eye
- Sensitivity to light
- Redness & watering of the eye

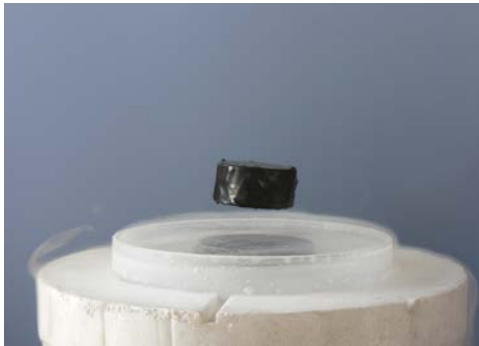
Treatment:

- Reassure the casualty.
- Ask casualty to hold an eye pad against the injured eye
- Arrange to take/send the casualty to hospital.
- Give information about the equipment that burnt the eye



°C

-273.15 -196 -93 0
Absolute zero Liquid nitrogen Lowest recorded
air temperature Melting
point
of ice



Aim of this part

- How can cold injuries happen?
- Identify:
 - Hypothermia
 - Frostnip
 - Frostbite
 - Trenchfoot



How we loose heat

Radiation – loss of heat to the environment due to temperature gradient

Conduction – through direct contact between objects

- Water conducts heat away 25 times faster than air
→ Stay dry = stay alive!

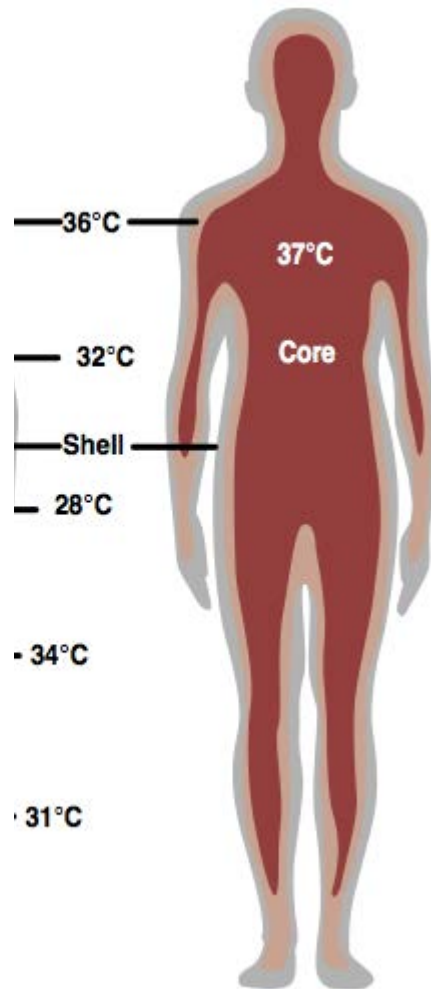
Convection – contact with something that is in motion

- Wind Chill – the air is moving around you and causes greater heat loss

Evaporation – heat loss from converting water from a liquid to a gas

- Sweating or breathing

Normothermic



ction

Hypothermia

Decrease in the core body temperature to a level at which normal muscular and cerebral functions are impaired

Heat Retention + Heat Production - Cold Challenge = Hypothermia

Insulation
Body Fat
Surface to
Volume Ratio
("Bergmann's
rule")

Exercise
Shivering

Temperature
Wetness
Wind

How to regulate the core temperature?

- Vasodilation/ Vasoconstriction
- Sweating/ Shivering
- Increasing/ Decreasing Activity
- Behavioural Responses – removing or applying layers of clothing

Hypothermia

Conditions leading to hypothermia

- Cold temperature
- Improper clothing and equipment
- Wetness
- Fatigue, exhaustion
- Dehydration
- Poor food intake
- Alcohol intake – causes vasodilation and heat loss
- Medication
- Underlying medical condition

Signs and Symptoms

Shivering, cold, pale, and dry skin

Tiredness, confusion, and irrational behaviour

Slow and shallow breathing

Slow and weakening pulse

Levels of Hypothermia

Mild

Moderate

Severe

Mild Hypothermia

- Core temperature 37°C - 35°C
 - Shivering
 - Unable to perform complex motor functions

Moderate Hypothermia

- Core temperature 35°C - 34°C
 - Dazed consciousness
 - Loss of fine motor coordination – zipping a coat
 - Slurred speech
 - Violent shivering
 - Irrational behaviour – taking off clothing
 - “I don’t care attitude”

Severe Hypothermia

- Core temperature 33°C - 30°C
 - Shivering occurs in waves – less to conserve energy
 - No motor functions, can't walk, fetal position
 - Muscle rigidity
 - Skin is pale
 - Pupils dilate
 - Pulse increases

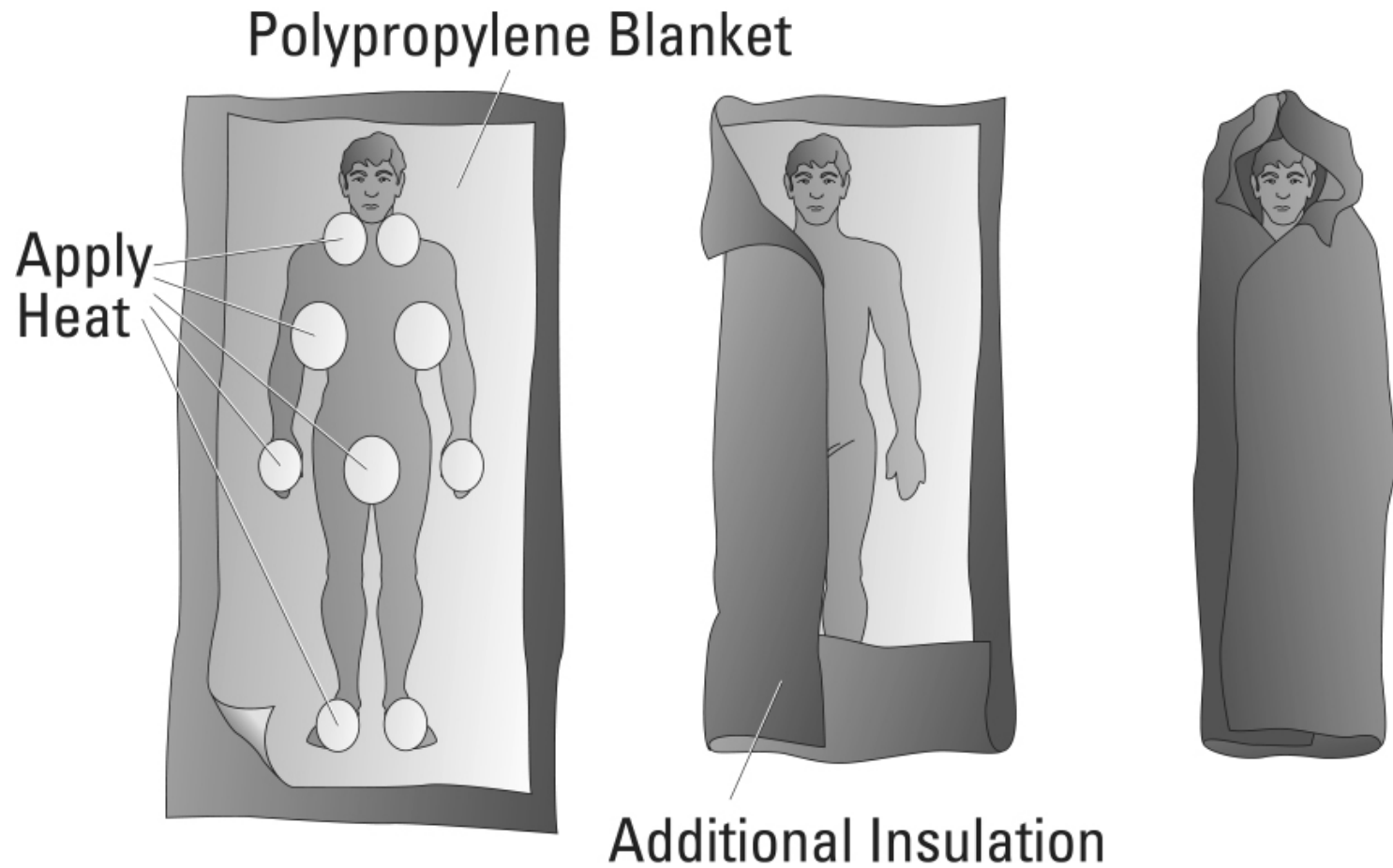
How to assess

- Shivering can be stopped voluntarily = mild hypothermia
- If it can't be stopped = moderate hypothermia
- Curled in fetal position

How to treat

- Reduce heat loss
 - More layers
 - Dry clothing
 - Shelter
 - Increase physical activity
(Mild to moderate hypothermia)
- Add fuel and food
(Mild to moderate hypothermia)
 - Hot liquids (soup, tea)
 - Sugars (chocolate)
- Allow to urinate
- Avoid
 - Alcohol - vasodilator
 - Caffeine - diuretic
 - Tobacco – vasoconstrictor
increased risk of frostbite
- Add heat
 - Fire
 - Body to body contact

Hypothermia Wrap



Cold Injuries

- Frostnip
- Frostbite
- Trench Foot

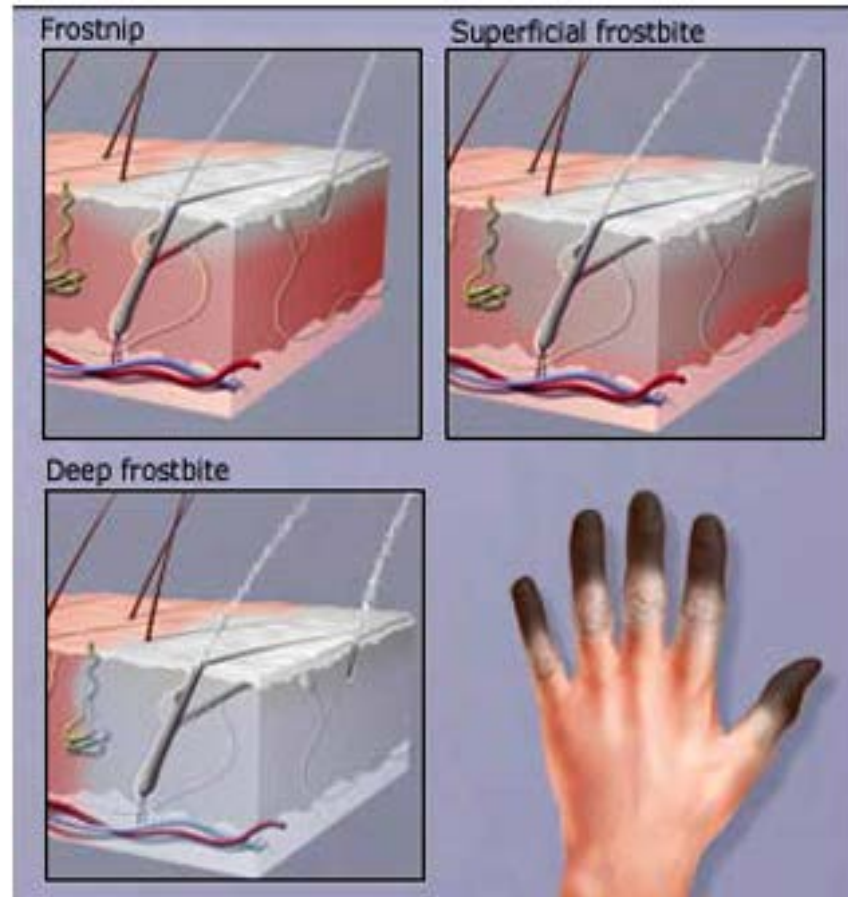


Image taken from <http://www.medscape.com/>

Frostnip – Signs and symptoms

- ‘Pins and needles’ to begin with
- Paleness, followed by numbness
- Hardening and stiffening of the top layer of skin
- Change in skin colour: first white, then blotchy and blue
- On recovery, the skin may be red, hot, painful and blistered.
- If they get gangrene, the tissue may become black due to the loss of blood supply and death of tissue.



Warning: Further on this presentation
contains some graphic images



Frostbite – Signs and symptoms

- Paleness, followed by numbness or no feeling
- Includes
- Blisters
- C



Treatment of Frostnip and Frostbite

- Encourage patient to put hands in his/her armpits. Then help move them indoors or to somewhere warm.
- Once inside, gently remove anything constricting like rings, gloves or boots.
- Warm the body part with your hands on your lap, or under their armpits. Don't rub it though because this could damage their skin tissue.
- (If there is a danger of it refreezing then don't warm it up yet as this can cause more damage).
- Place the body part in warm (not hot) water at around 40°C and be careful not to put it near direct heat as this can cause more damage. Dry it carefully and put on a light dressing, ideally a gauze bandage
- Raise their limb to reduce swelling, with cushions or a sling for instance.
- Take or send them to hospital, keeping their limb raised.

Trench Foot

- Prolonged exposure of the feet to cool, wet conditions
- Wet feet lose heat 25x faster than dry





Thank you for listening