BURN RESUSCITATION
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Graph showing the rate of burn resuscitation per 100,000 population by age group and gender. The graph compares males (blue dots) and females (red squares) across different age groups: 0-4, 5-14, 15-24, 25-34, 35-44, 45-54, 55-64, and 65+. The rate decreases with age for both genders, with a notable peak in the 25-34 age group for males.
Burn Injuries: The Problem

2002 burns responsible for 322,000 deaths worldwide

4th as cause of unintentional child injury death in the USA

3rd leading cause of unintentional death in aboriginal community in NA

Most burns occur in the urban environment

Adverse consequences more common in the rural environment
EARLY ACUTE CARE IMPACTS THE LONG TERM OUTCOME IN BURN PATIENTS

MOST INITIAL CARE IS PROVIDED OUTSIDE THE BURN CENTRE
Burn resuscitation begins at the scene

Stop the burning process
Keep the patient warm
O2
Assess for other injuries
Small burns (partial thickness) < 10% can be cooled
On arrival at hospital

History of the injury
Past medical history
Medications
Allergies
Location, depth and size of the burn

ABC’S
AIRWAY INJURY

Present in 10 – 20 % of burn patients
Identified in 60 – 70 % of patients who die in burn centers

RISK FACTORS:
Extremes of age
Physical disability
Chemically impaired
Loss of consciousness
Large BSA burn
Often present without burn injury

Potential early problem due to edema
Carbon monoxide poisoning

Awake:
Hi flow O2
Until COHgb < 5%

Obtunded:
Intubate & provide
100% O2 via ventilator
Stridor or Respiratory Distress &/OR Deep burns of the head & neck

If Absent:

100% O2
Look for signs of airway Injury
? Laryngoscopy
If edema present
INTUBATE NOW
Upper Airway Management

Stridor or Respiratory Distress &/OR Deep burns of the head & neck

If present:

INTUBATE NOW !!
Ideally before excessive edema develops

Adequate tube size and length
PEEP
Elevate HOB
Transfer to Burn Center
Management of Lower Airway Injury

Asymptomatic:
no treatment

Symptomatic:
Cough, Wheeze, Good Gas Exchange, Bronchorrehea

100% O2, aggressive pulmonary toilet, bronchodilators, monitor O2
CONTINUED REASSESSMENT
Management of Lower Airway:

Symptomatic:

Short of breath, progressive symptoms
impaired gas exchange

Intubate, 100% O2 (maintain Sat > 92%)
Baseline CXR, bronchodilators
chest wall escharotomy if indicated

AS INJURY / RESUSCITATION EVOLVES
MODIFICATIONS WILL BE NECESSARY!!!
Burn Depth:

First Degree Burn
- Sunburn
- Involves epidermis only
- Local pain and erythema
- No blisters
- Heals spontaneously without scarring
- Systemic response is minimal
Burn Depth:

Superficial Partial Thickness Burn

- Involves epidermis and dermis
- Moist appearance
- Blister formation
- Tactile and Pain sensors in tact

Epidermis

Dermis

Subcutaneous Tissue

Full Thickness
Burn Depth:

- Deep Partial Thickness Burn
  - Involves epidermis and dermis
  - Moist appearance
  - Blister formation
  - Tactile and Pain sensors in tact
Burn Depth:

Third Degree Burn

- Involves all layers of skin
- Variable color - white, waxy, red, brown
- Destroys elasticity, dry
- Painless
- Does not heal

Epidermis

Dermis

Subcutaneous Tissue
**Burn Depth:**

Visually deceiving burns
Destroyed epidermis still remains on the wound
Extent/depth of injury is underestimated unless removed
Burn Depth

All burns “progress” over the first 24 – 36 hours

As a result all burns will appear to worsen over the 1st day or 2
Burn Shock:
outcome of a multiple factors including hypovolemia, microcirculation changes, and release of local and systemic inflammatory mediators which result in the body’s ability to meet cellular needs.

The mainstay of treatment is fluid resuscitation.
FLUID RESUSCITATION:
Rule of Nines
quick and easy method to estimate BSA burned

*most people forget the differences adult and infant

* most burn sizes are GROSSLY over estimated
FLUID RESUSCITATION:

Lund Bowder Chart

more complicated and time consuming

method to estimate BSA burned

BUT MORE ACCURATE!!
Parkland (Baxter) Formula:
most commonly used formula today

4cc/Kg/%BSA burn
  1/2 in the first 8 hrs
  1/2 in the next 16 hrs
Lactated Ringers
Using urine output as a clinical guide
GOAL: 30-50 cc’s/hr
  1cc/kg in patients less than 30 kgs
Accurate in about 70% burn patients
  12% require more, 18% require less
Plasma can be given at any time but is most effective after
  24 – 36 hrs
Can be of benefit in patients who do not respond to initial
  predicted fluid needs
Not all burn patients require INTRAVENOUS fluid resuscitation

LESS THAN 10 – 15 %

if patient cooperative, no nausea and vomiting

DO NOT allow unrestricted access to plain water, especially in children
New Problem: FLUID CREEP

Patients frequently receive fluid in excess of the predicted requirements!!

up to 48% MORE !!

Problems: compartment syndrome
(extremity & abd.)
ARDS / pulmonary edema

ARDS / pulmonary edema

ARDS / pulmonary edema
cerebral edema
multiple organ failure
Most burn resuscitation fails to meet the standard set forth by the **PARKLAND** formula.

Emphasis needs to be placed on **MONITORING** the response to fluid resuscitation rather than following the formula.

Best monitor is **URINE OUTPUT**
- 1 ml/kg/hr
- CBC – hemoconcentration
- ABG’s - acidosis
Other monitoring:

Pulse - young patient - < 120 reasonable
  > 130 ↑fluid
- elderly / heart disease - pulse not a good reflection of perfusion

ECG - > 40 yo
Blood pressure – only useful if low
Electrolytes
PTT / INR
Protein / Albumin
CVP / Central pressures only if patient not responding to predicted requirements
RISK FACTORS FOR REQUIRING INCREASED RESUSCITATION FLUID VOLUMES

- 80% BSA burn
- Extremes of age
- Electrical injury – current flow
- Associated inhalation injury
- Associated trauma
- Delayed resuscitation
- Myoglobinuria
Myoglobinuria

If present requires increased volumes to flush the pigment from the system.

If persists > 12 hours ↑ risk of renal failure.

u/o of 100 – 200 cc’s /hour

Alkalinate the urine

Use mannitol to force diuresis.

May need to use central pressure monitoring to assess response to fluids as urine output no longer useful.
Management of the burn wound:

Tetanus Prophlaxis
Analgesia
Debride the wound
  chlorhexidine, hydrotherapy
Topical antibiotics - ointments
  - flamazine cream
Consider closed dressings except for the face & perineum
  Dressings protect the injured skin, reduce heat loss & provide comfort

NEW OPTIONS:
silver containing dressings
  acticoat
  aquacel Ag

IF IN DOUBT STERILE NON-ADHERENT DRESSING LIKE JELONET OR ADAPTIC UNTIL DEFINITIVE DEPTH CAN BE DETERMINED!
THINGS WE CAN DO BETTER!

- Assessment of Airway
- Accurate assessment of BSA Burns
- Accurate assessment of burn depth
- More careful monitoring of the response to fluids administered
THANK YOU

QUESTIONS ?????
BURN RESUSCITATION
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Burn Depth:
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Burn Shock:
Circulatory collapse when blood pressure is too low to maintain tissue perfusion

The magnitude of intravascular fluid loss can be easily underestimated much of the fluid accumulates beneath the burn
Burn Resuscitation & Cholera

Dr. O’Shaughnessy 1831 analyzed cholera patients noting diarrhea leads to dehydration, electrolyte depletion, acidosis and Nitrogen retention.

Treatment depended on IV fluid replacement of deficient salt and water.

1854 Ludwig von Buhl correlated the hemoconcentration seen in both burns and cholera patients due to fluid loss.

Recommended saline either orally, subcutaneously or intravenously.
Burns and the Theatre??

Dr. Frank Underhil: The Rialto Theatre fire 1921 New Haven Conn. Rudolph Valentino in the Shiek
Showed blister fluid was similar to plasma
Concluded burn shock was due to fluid shifts
Recommended replacement of fluid with salt and protein using Hgb as a guide

Coconut Grove Fire Boston Mass. 1942 Drs. Cope & Moore
Patients treated with IV fluid resuscitation based on body surface area
Monitored Hct, U/O, BUN
Patients with inhalation injury required more fluid
BUDGET FORMULA resuscitation was not based on patient size