The Rise in Burns: Current Protocols and Trends

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Surgeons for little lives

Background and Epidemiology

Significant local burden

Annual childhood deaths from burns per 100 000:

- USA: 0,3/100 000
- South Africa: 2.8/100 000 – 930% increase

Rode et al, *"attributed largely to urbanisation and urban migration, disorganised development, inaccessible electrical supply, unsafe energy sources, poverty and overcrowding."*

Number of verified paediatric burns units:

- USA: 24
- South Africa: 2

Majority of RSA paediatric burns **aren't** immediately treated by burns surgeons

Background and Epidemiology

CHBAH burns experience (Patel et al)

Annual burns admissions: **523 – 1,43 burns admissions/day**

- Highest single admission diagnosis in department
- 20% of all surgical procedures
- 85% scalds (hot water)

Annual burns patients treated but not admitted: **368**

- Highest single diagnosis of non-admission consults

In total we see and treat **891 emergent paediatric** burn patients per year

Burns OPD: **1936** patients seen per year – 50 patients per clinic day

Background and Epidemiology

CMJAH burns experience

Annual burns admissions: **100 -150**

Across our 3 Wits Paediatric Surgery centres, burns account for **30%** of all mortalities

Significant (and underappreciated) burden

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Significant (and underappreciated) responsibility

Peaks of Mortality

Immediate (hours) – Burns Shock

- Action – fluid resuscitation

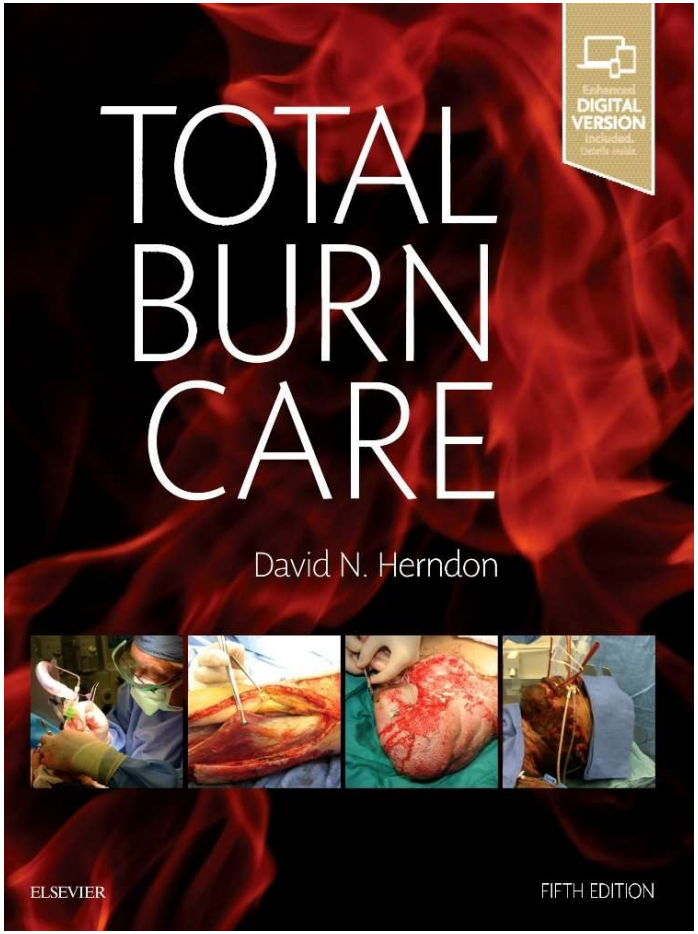
Intermediate (days) – Respiratory Collapse

- Action – Intubation and ventilation

Late (days – weeks) – Septic Shock

- Action – Antimicrobial therapy and surgical debridement

Outline


TOTAL
BURN
CARE
DIGITAL VERSION
David N. Herndon
ELSEVIER
FIFTH EDITION

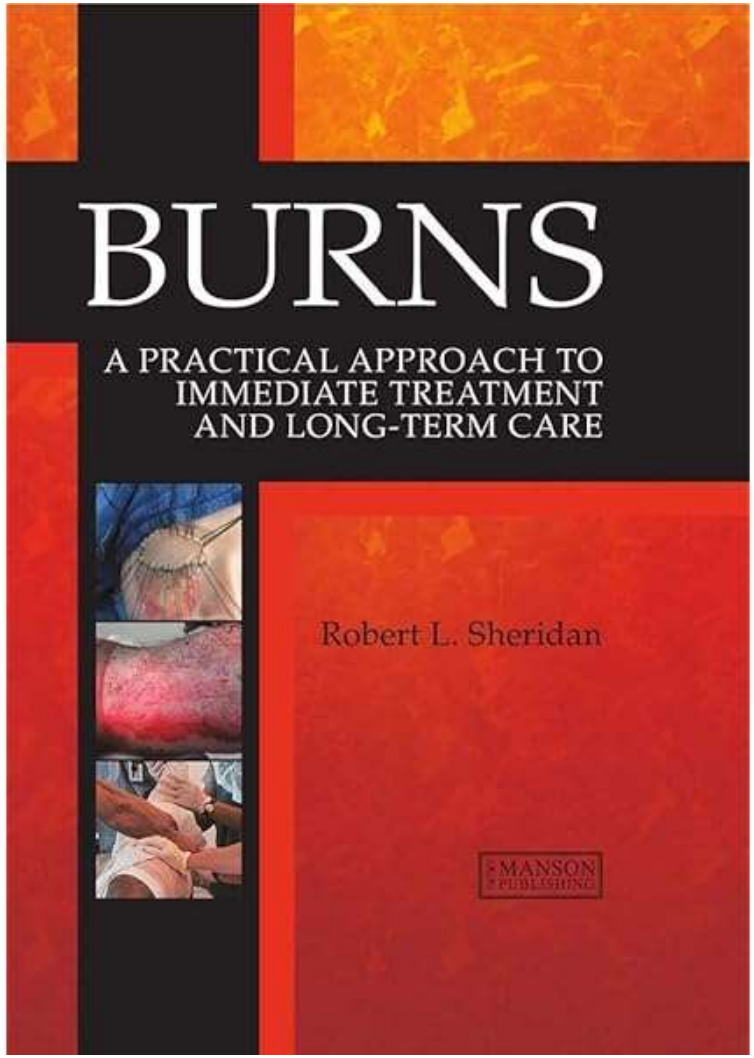
Outline

Primary Paediatric Burns Injury Assessment

Paediatric Burn Resuscitation

Modern Burns Trends

Outline


BURNS
A PRACTICAL APPROACH TO IMMEDIATE TREATMENT AND LONG-TERM CARE
Robert L. Sheridan
MANSON PUBLISHING

Primary Assessment

Primary Assessment

Trauma Primary Survey

Airway

Breathing

Circulation

Disability

Exposure

Primary Assessment

Airway

- Large airway injury - intubation

Breathing

- Small airway injury – difficult ventilation
- Chest wall eschar - escharotomy

Circulation

- Blunt/penetrating injuries

Disability

- Traumatic head injury

Exposure

Wound Size Assessment

Fluid resuscitation is critical in emergent management of burn wounds

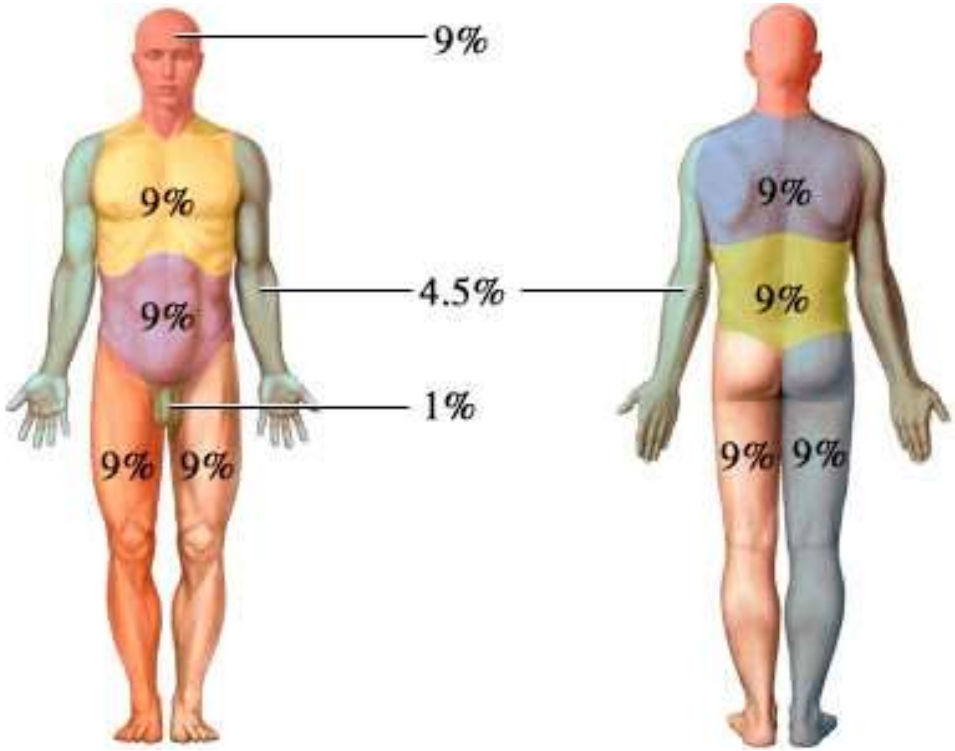
Fluid resuscitation volumes are dictated by *% Total Body Surface Area (TBSA)* involved in the burn

Accurate TBSA calculation is thus critical

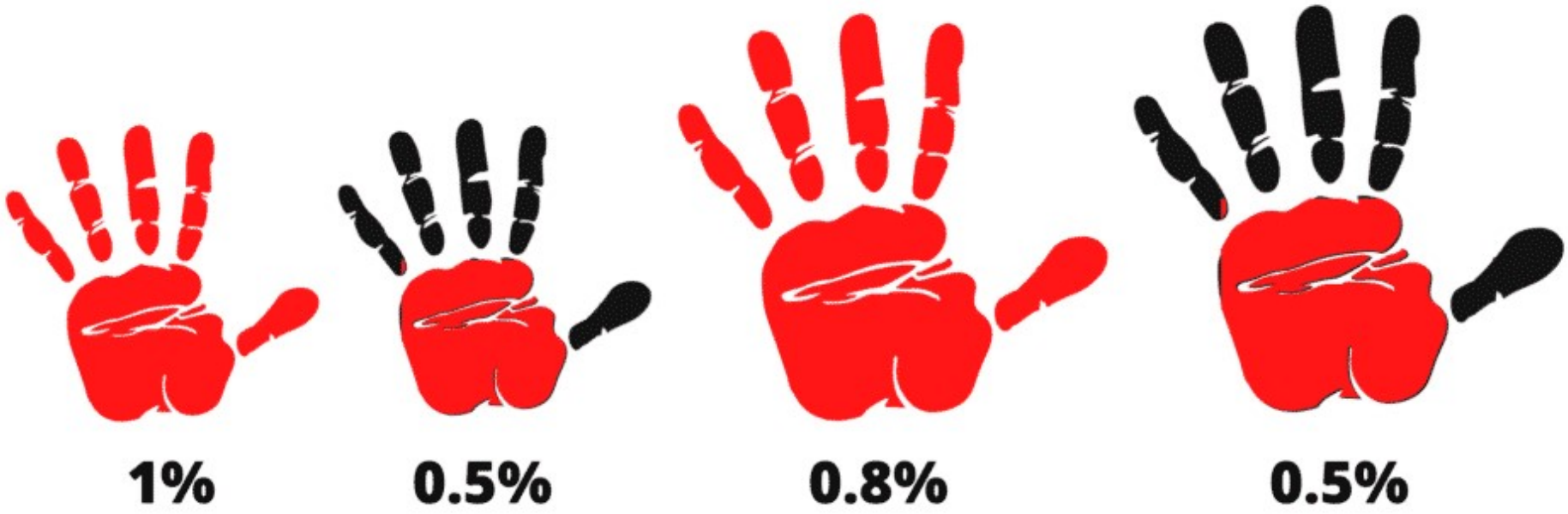
TBSA Assessment

- Rule of Nines
- Palmar Rule
- Lund and Browder Chart
- Digital calculation apps

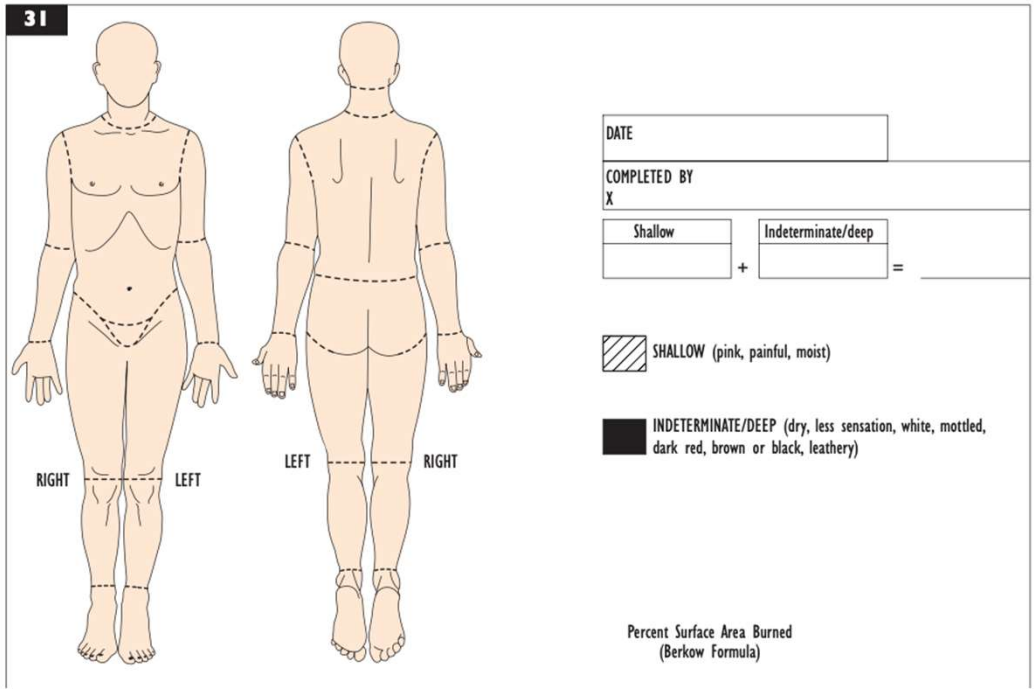
Rule of Nines



Palmar Rule

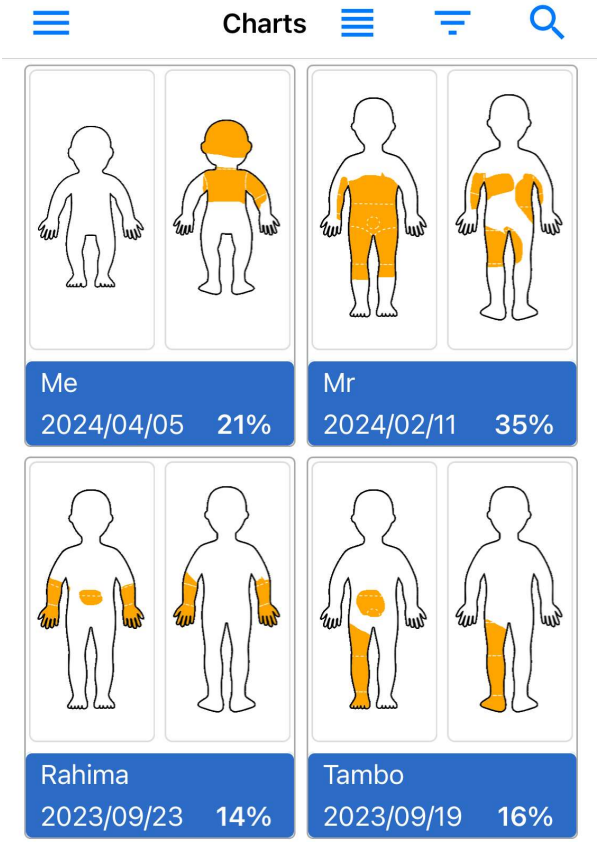


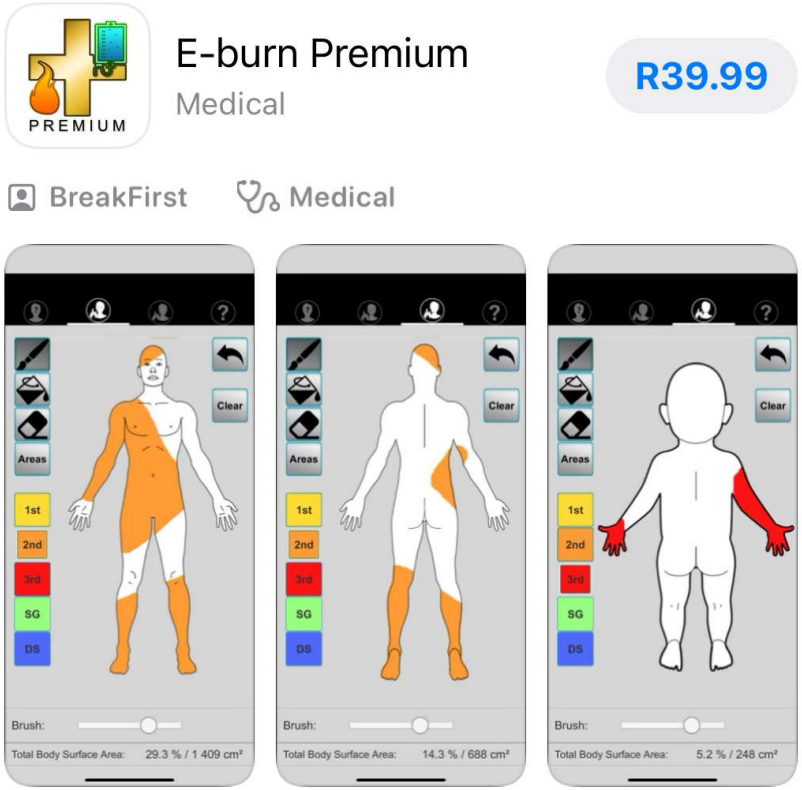
Lund and Browder Chart



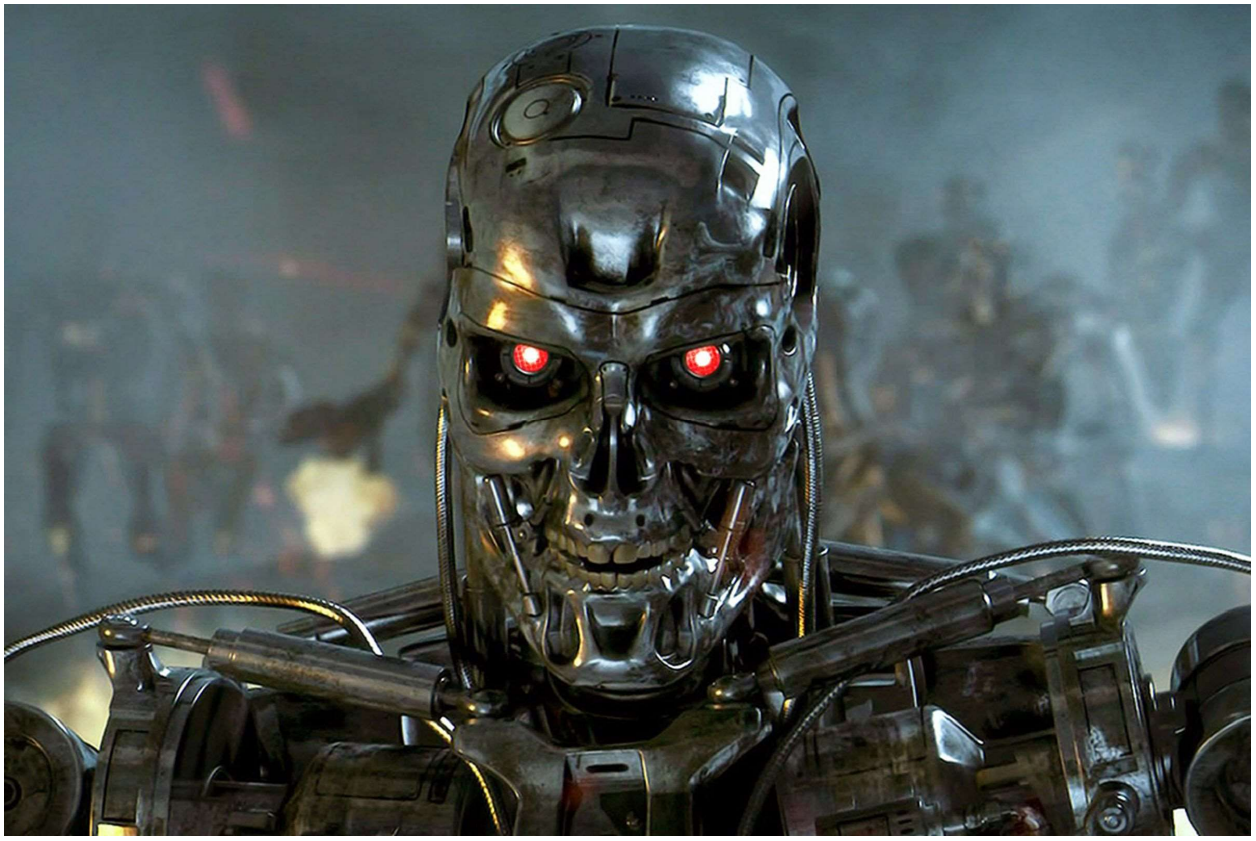
AREA	1 year	1–4 years	5–9 years	10–14 years	15 years	Adult	Shallow	Indeterminate/ deep
Head	19	17	13	11	9	7		
Neck	2	2	2	2	2	2		
Ant. Trunk	13	13	13	13	13	13		
Post. Trunk	13	13	13	13	13	13		
R. Buttock	2.5	2.5	2.5	2.5	2.5	2.5		
L. Buttock	2.5	2.5	2.5	2.5	2.5	2.5		
Genitalia	1	1	1	1	1	1		
R. U. Arm	4	4	4	4	4	4		
L. U. Arm	4	4	4	4	4	4		
R. L. Arm	3	3	3	3	3	3		
L. L. Arm	3	3	3	3	3	3		
R. Hand	2.5	2.5	2.5	2.5	2.5	2.5		
L. Hand	2.5	2.5	2.5	2.5	2.5	2.5		
R. Thigh	5.5	6.5	8	8.5	9	9.5		
L. Thigh	5.5	6.5	8	8.5	9	9.5		
R. Leg	5	5	5.5	6	6.5	7		
L. Leg	5	5	5.5	6	6.5	7		
R. Foot	3.5	3.5	3.5	3.5	3.5	3.5		
L. Foot	3.5	3.5	3.5	3.5	3.5	3.5		
TOTAL								

Digital Calculation Apps





Can the Machines help us?



Wound Size Assessment

%TBSA = 18

Next step: calculating resuscitation fluids

Fluid Resuscitation Categories

%TBSA < 10% - nil fluid resuscitation needed

- Encourage oral fluid and food intake

%TBSA 10 – 15% - require fluid supplementation, but not formal resuscitation

- 150% maintenance fluid IVI (5% dextrose Balsol cocktail)

%TBSA > 15% - require formal fluid resuscitation

- Formula derived resuscitation fluid infusion (centre specific)
- 100% maintenance fluid IVI (5% dextrose Balsol cocktail)

Fluid Resuscitation

Cornerstone of immediate large burns management

- Capillary leak
- Third spacing
- Cardiac depression

Requires significant fluid replacement

23 Clifford Johnson, celebrated survivor of the Cocoanut Grove Fire, towards the end of his hospitalization.

Cocoanut Grove fire (1942) – Clifford Johnson (45% flame burns) – revolutionised immediate burns care

Fluid Resuscitation Formulae

Parkland's Formula

- 4 x body weight (kg) x %TBSA = ml of crystalloid fluid to be administered over 24 hours
- First half in the first 8 hours, second half over remaining 16 hours

Brook's Formula

- 2 x body weight (kg) x %TBSA = ml of crystalloid fluid to be administered over 24 hours
- First half in the first 8 hours, second half over remaining 16 hours

Fluid Resuscitation Formulae

- No formula predicts how much volume a patient will need to complete resuscitation
- Formulae **only** determine starting point of fluid resuscitation
- Patients require regular, repeated assessment of end points and titration of fluids

Sheridan et al – "*very few children should be reaching the end of their Parkland's if resuscitated appropriately*"

Emergent Management for Large Burns

Emergent Management for Large Burns

Primary trauma survey – ABCDE

- Address life threatening issues as discovered

Reliable vascular access is essential

- Peripheral access often challenging
- Intraosseous access – emergent option
- Central Venous Access – gold standard in serious burn injury
- Place transurethral catheter concomitantly

Prevent Hypothermia

- Cover with plastic/blankets
- Warm fluids
- Minimise “open time”

Emergent Management for Large Burns

Scrubbing and Assessment of Wound

Warm Fluids

- 50% sterile water
- 50% chlorhexidine soap

Aseptic Technique

- Clean drapes/packs
- Sterile gloves

Temperature is critical

- Warm room
- Warm fluids
- Speed of wash and dressing
- Teamwork

Emergent Management for Large Burns

Scrubbing and Assessment of Wound

Sedation

- Ketamine IVI/IMI
- O2 support
- Vitals monitoring

Emergent Management for Large Burns

Wash

- Bullae removed
- Brown staining washed off
- Pink wound bed (superficial)

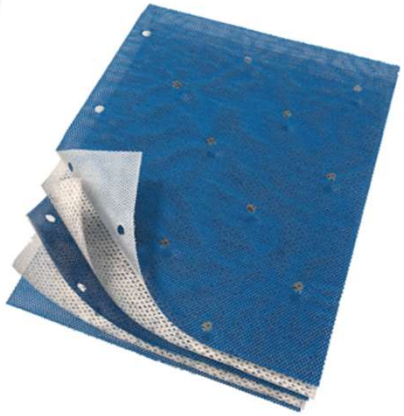
Scalp – shave hair back to 1cm rim of healthy skin

Don't forget to take pictures

Emergent Management for Large Burns

Immediate Dressing

- Often dictated by availability, not choice
- Discuss Burns Referral Centre



Good (safe) choices

- Paraffin-impregnated gauze
- Paraffin-impregnated gauze & gentle chemical debridement
- Acticoat (even better with **intrasite**)

Burnshield is first aid, not a dressing

Emergent Management for Large Burns

Fluid Resuscitation – Starting Points

***Modified* Parkland Formula**

- **3** x body weight (kg) x %TBSA = ml of crystalloid fluid to be administered over 24 hours
- Infusion divided equally over 24 hours
- Ringer's Lactate/Plasmalyte

Maintenance Fluids (patients <20kg)

- 100% IVI – Balsol Cocktail (5% solution)

Emergent Management for Large Burns

Fluid Resuscitation – Starting Points

Austere Environment Challenges

- Single intravenous access point
- Limited variability of crystalloids available
- No infusion pumps for various infusion rates

"***Double Maintenance***" – 200% maintenance rate IVI crystalloid infusion

Balsol/Ringer's Lactate/Plasmalyte – mixed to 5% solution

Emergent Management for Large Burns

Fluid Resuscitation – Monitoring

Regular (2-4 hourly) patient and endpoint review

Table 8 Typical resuscitation targets

- **Sensorium:** arouseable and comfortable
- **Temperature:** warm centrally and peripherally
- **Systolic blood pressure:** for infants, 60 mmHg systolic; for older children, 70–90 + 2× age in years mmHg; for adults, mean arterial pressure >60 mmHg
- **Pulse:** 80–180/min (age dependent), easily palpable peripherally
- **Urine output:** 0.5–1 ml/kg/hr (glucose negative)
- **Base deficit:** <2

Emergent Management for Large Burns

Fluid Resuscitation – Adjustments

Well patient, urine output >1ml/kg/hour, improving blood gas (BE, lactate)

- Decrease **Resuscitation Fluid** infusion by 20-30%

Well patient, urine output 0,5-1ml/kg/hr, static blood gas

- No changes to fluid infusions

Endpoints not met, urine output <1ml/kg/hr, worsening blood gas

- Increase **Resuscitation Fluid** infusion by 20%
- Consider a crystalloid fluid bolus (10ml/kg)
- Increase frequency of review
- Discuss with Intensive Care

Emergent Management for Large Burns

Intensive Care Criteria (Emergent)

- Airway injury/ventilated patient
- %TBSA > 20%
- Age < 1 year
- Multisystem injury
- Haemodynamic support

Concerning clinical findings

1. Decreased GCS
2. Poor perfusion
3. Hypothermic

'The wise man avoids evil by anticipating it.'
Publilius Syrus (circa 100 BCE), Roman actor and author, a former slave.

Intensive Care support is an "embedded component" of any valid burn service

Emergent Management for Large Burns

Definitive Admission/Transfer to Appropriate Unit

- Ongoing review of patient condition and endpoints
- Fluid adjustments
- Escalation/weaning of supportive care

Sheridan, "*essential to have an interested presence by the bedside throughout these often inconvenient hours, adjusting volume infusions frequently, if one is to achieve reliably optimal outcomes*."

Willie Sutton (1901–1980), bank robber, *"Success in any endeavor requires single-minded attention to detail."*

Peaks of Mortality

Immediate (hours) – Burns Shock

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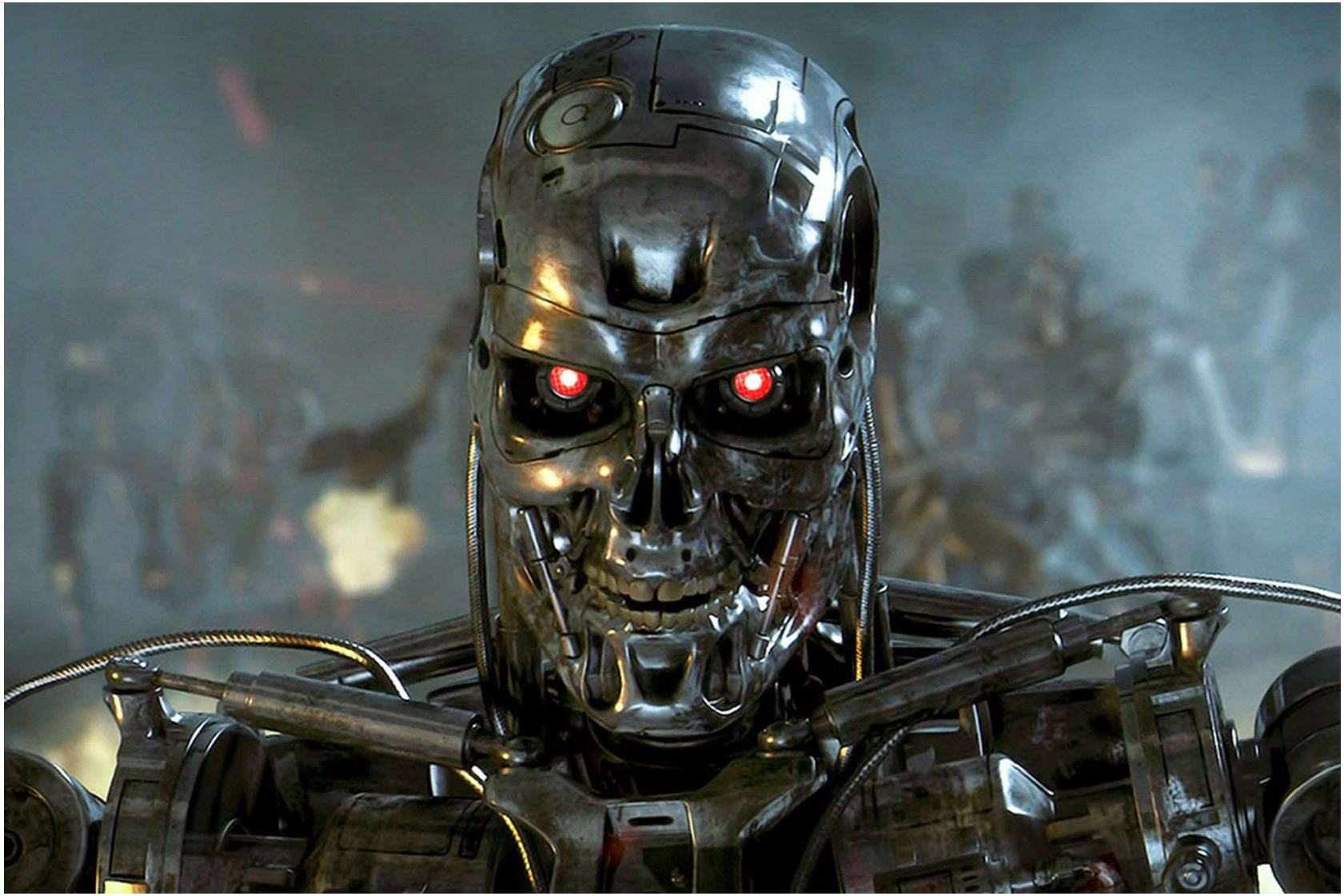


Current Advances in Burns Care

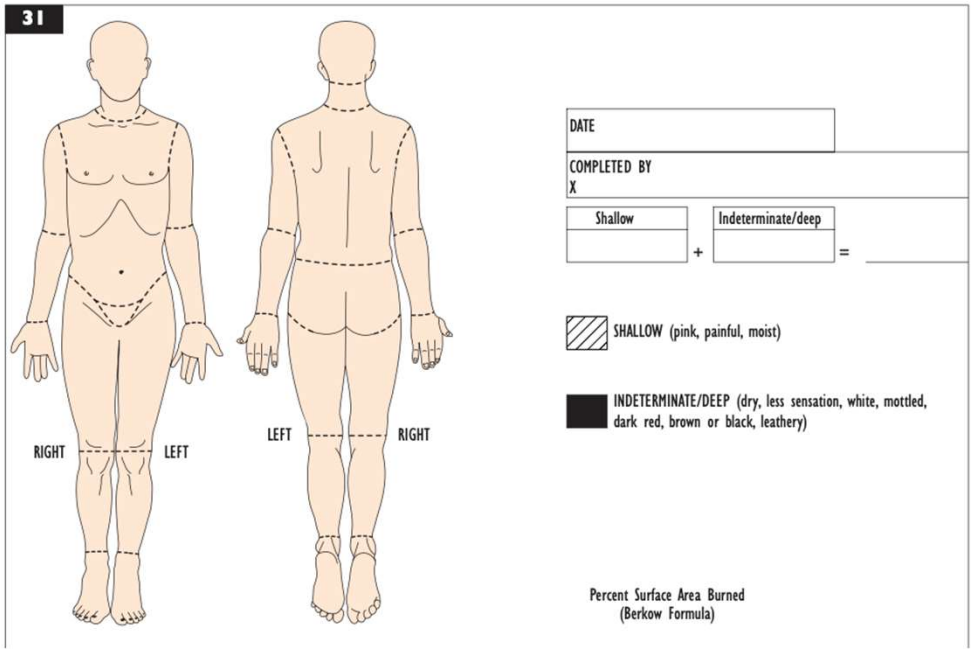
University of the Witwatersrand, Johannesburg

Department of Paediatric Surgery & Child Health

Surgeons for little lives

Advances are NO USE if basics are neglected!!

Artificial Intelligence/Machine Learning



Artificial Intelligence/Machine Learning

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/burns

Application of multiple deep learning models for automatic burn wound assessment

Che Wei Chang[a,b,*], *Chun Yee Ho*[b], *Feipei Lai*[a,c], *Mesakh Christian*[c], *Shih Chen Huang*[b], *Dun Hao Chang*[b,d], *Yo Shen Chen*[b]

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