



SMR

SYMPOSIUM MEDISCH
RAMPENMANAGEMENT

26 oktober 2024

Brandwonden

acute opvang en stabilisatie

Dr. Elkana Keersebilck

Anesthesie-Urgentie

Geneesheer Commandant

Brandwondencentrum NOH

Brandwonden – *acute opvang en stabilisatie*

- ***1. Inleiding***
- ***2. Acute opvang verbrande patiënt***
- ***3. Aandachtspunten ICU***
- ***4. Rookinhalatie***
- ***5. Chemische brandwonden***
- ***6. High Voltage Electrocutie***
- ***7. Besluit***

Inleiding

Belgian Burn Units:

Antwerp
Ghent
Leuven
Loverval
Liège
Brussels

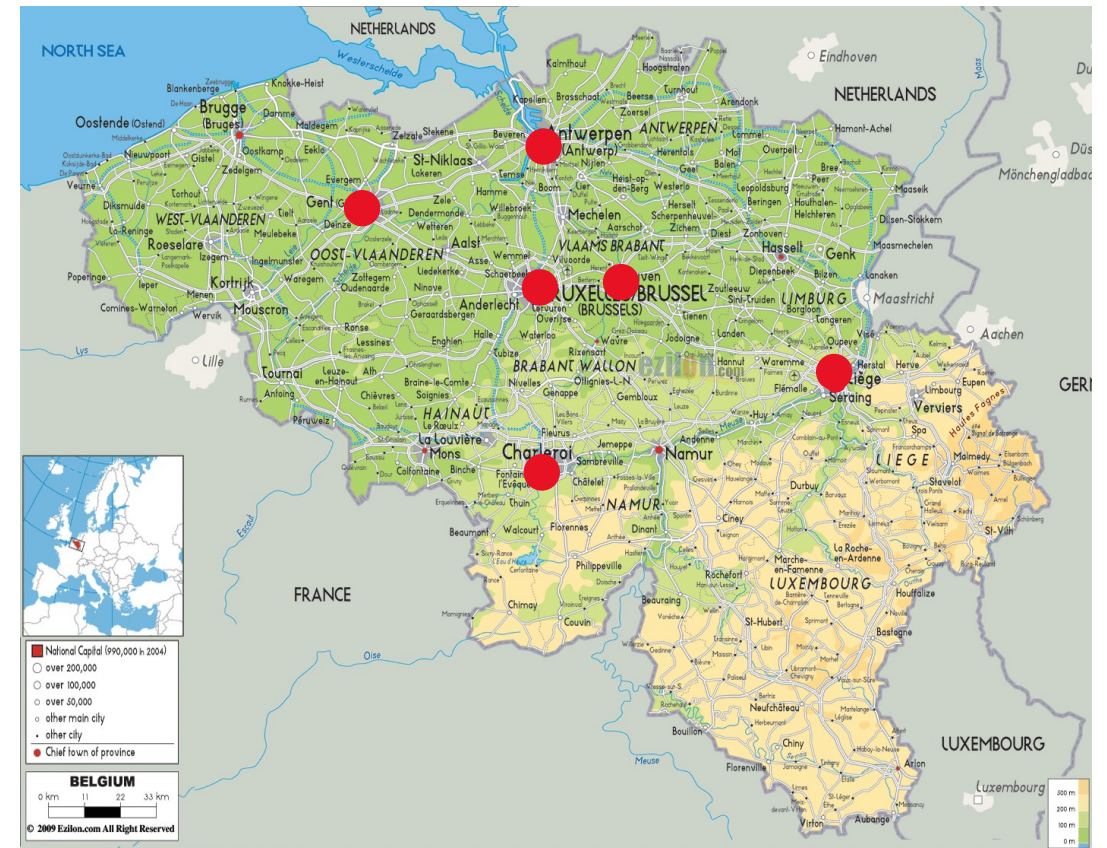
Total capacity: about 70 beds

Brussels 2023:

Total number of admissions: 366

ICU admissions: 72

Paediatric patiënts: 92



“BABI-plan”

- **BABI-plan = *nationaal rampenplan***

 - ** (potentiëel) groot aantal BW patiënten

 - ** via betrokken HC112

- **Centrale dispatching MHKA 02/264.48.48.**

 - ** *onafhankelijk van het BWC NOH* ****

 - 1° up-to-date situatie BW-bedden in BE

 - 2° regulatie patiënten over de BE BWC (NDL/FR/DU)

 - 3° uitsturen B-teams

Criteria opname BWC

- | | | | |
|---|-----------------------|---|---|
| 1. Age 10-50yr: | > 20% TBSA 2°-3°graad | <u>burns</u>
<u>vs</u>
<u>age</u> | <u>burns</u>
<u>related</u>
<u>injuries</u> |
| 2. Age <10yr - > 50yr: | > 10% TBSA 2°-3°graad | | |
| 3. All ages: | > 5% TBSA 3°graad | | |
| 4. Burns face, hands, feet, perineal, major joints | | | |
| 5. Chemical burns, electrical burns, inhalation injury | | | |
| 6. Burns ipw important concomittant diseases | | | |
| 7. Burns ipw important social/psychosocial needs | | | |
| 8. Burns ipw important associated trauma | | | |
| 9. Skin diseases such as TEN (Lyell), SSSS, ... | | | |
| 10. Skin breakdown > 10% TBSA due to medical disease (NF) or trauma (deglovement, Morel-Lavallée) | | | |

****Bij twijfel: neem contact op – eventueel ambulante follow-up**

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Acute opvang verbrande patiënt

Early deaths in burns \neq *burn wounds*

= *associated trauma !*

= *smoke inhalation !*



Early assessment should focus on trauma care

> *ABCDE approach*

> *AMPLE anamnesis*

> *Trauma US, Trauma CT*

+ *smoke inhalation: 100% O2 ± ETT*

± *Cyanokit*

Early assessment

- Stabilisation vitals
- Life threatening injuries: *diagnosis and treatment*



- Focus on the burns:

- > **% TBSA ?**

- > **Depth ?**

- > **Location & Circular ?**

(palm and fingers = 1%; Lund-Browder chart; apps)

(capillary refill; LDI scan)

(=> need for escharotomies ?)

- Meanwhile

- > *Cool the wound – avoid hypothermia*

- > *Keep the patient comfortable: analgesia and sedation*

- > *Tetanos vaccination*

- > *Fluids*



Laser Doppler Imaging

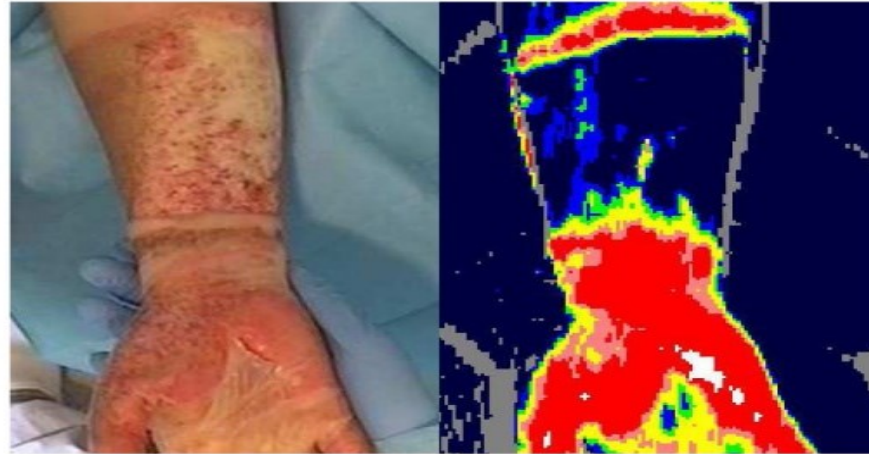


Figure 1

Clinical appearance of a three-days-old flame burn in a woman of 21. The LDI scan shows a burn with a healing potential < 14 days of the right hand palm and a healing potential > 21 days of the right lower arm.
Written consent was obtained from the participant to publish this figure.

Laser Doppler Imaging

Meet perfusie in de wonde

Uitvoeren tussen 48Hr – dag 5

Accuraatheid 95-100%

Rood/roze: genezing < 14 dagen

Geel/groen: genezing 14-21 dagen

Blauw: genezing > 21 dagen

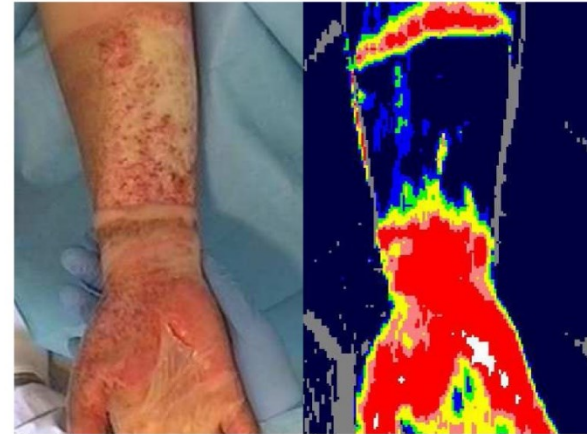


Figure 1

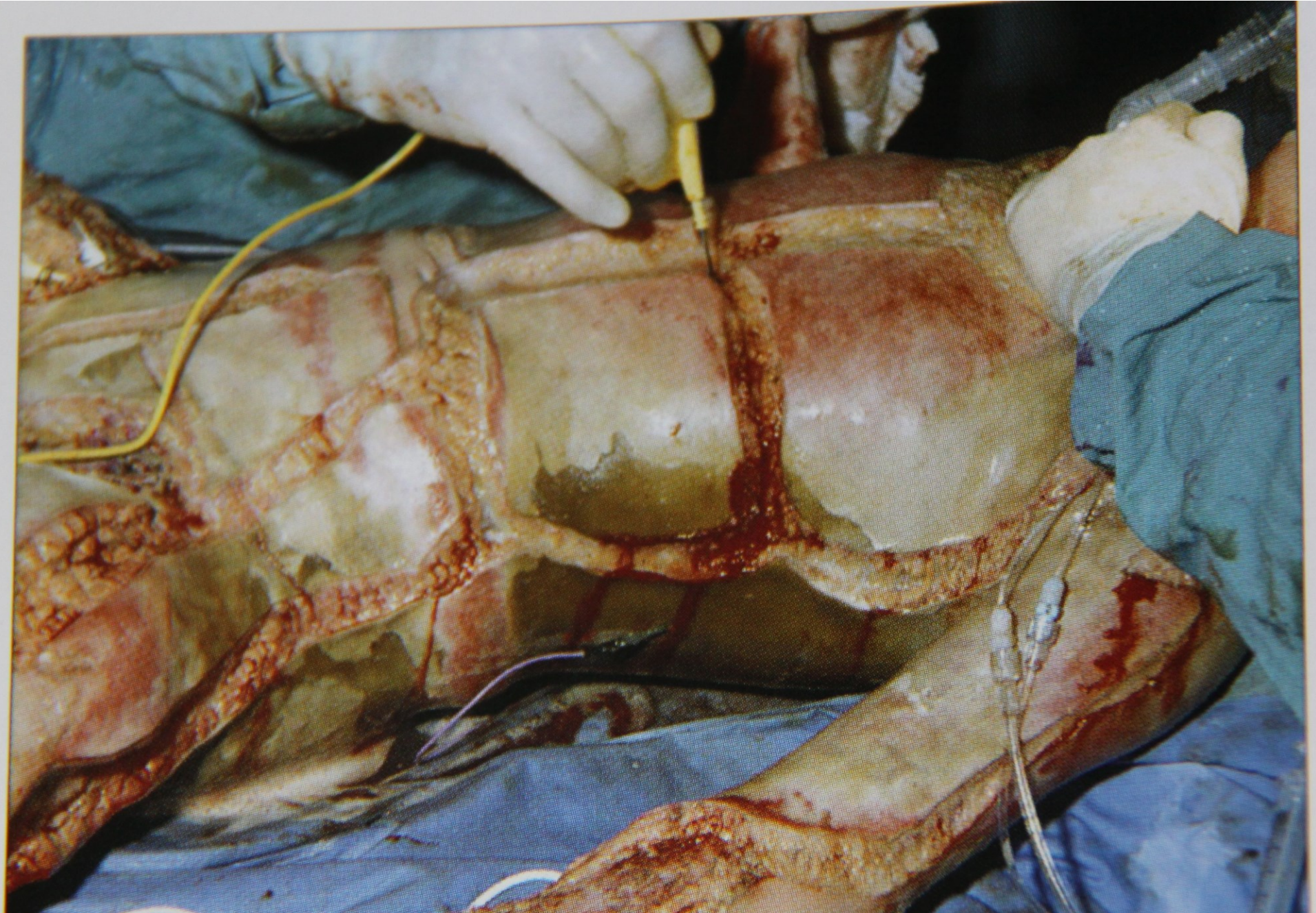
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“Cool the wound – Avoid Hypothermia”

General rule: *luke warm water (20-25°C) , during 20-25 minutes*

Δ T: *still effective within 3Hr*

Avoid hypothermia => **SFAR:** *“TBSA > 15% in children
> 25% in adults
should discourage external cooling “*

Chemical burns: *rinse asap,
during ≥ 1hr,
T° close to body temp*

“extra fluids”

Pathophysiology: *loss of fluids through wound + general (SIRS) capillary leak*

Trigger: **TBSA \geq 15% adults*

**TBSA \geq 10 % ped's*

Type: *balanced crystalloid solution: Ringer's lactate, Hartmann*

Amount: **“Parkland”:** **2 – 4 ml/kg/% over 24 Hr** - half first 8 Hr
- half next 16 Hr

=> Aim at urine output 0,5 – 1 ml/kg/Hr

=> Adjust the infusion rate !!!

Parkland formula

Developed in 1968 by Baxter and Shires in Parkland Memorial Hospital => 4ml/kg/%

→ Anno 2024: rather go for 3 ml/kg/%

→ **ABA june 2024: start with 2 ml/kg/%**

Start to count *at moment of injury*

“%TBSA”: 2° - 3° burns; does not include 1° burns

“body weight”: based on IBW

Balanced crystalloid solutions

If TBSA > 30%: add albumin **(NOH: TBSA > 20%: albumin 20% 3,5ml/kg/24Hr 6Hr after injury)**

Adjust +++ !!!!!!!

Supplemental advice ABA june 2024

Advice to measure IAP *if resus > 6ml/kg/% over 24 Hr (actual or projected)*
if resus > 250ml/kg over 24Hr (actual or projected)
if clinical signs of ACS

IAP > 12 mmHg => measure every 6Hr

IAP > 20mmHg => measure every 4 Hr

Advice to measure IOP *if resus > 6ml/kg/% over 24 Hr (actual or projected)*
if resus > 250ml/kg over 24 Hr (actual or projected)
if deep extensive periorbital burns
if proptosis

IOP should be < 20mmHg



Brandwonden – acute opvang en stabilisatie

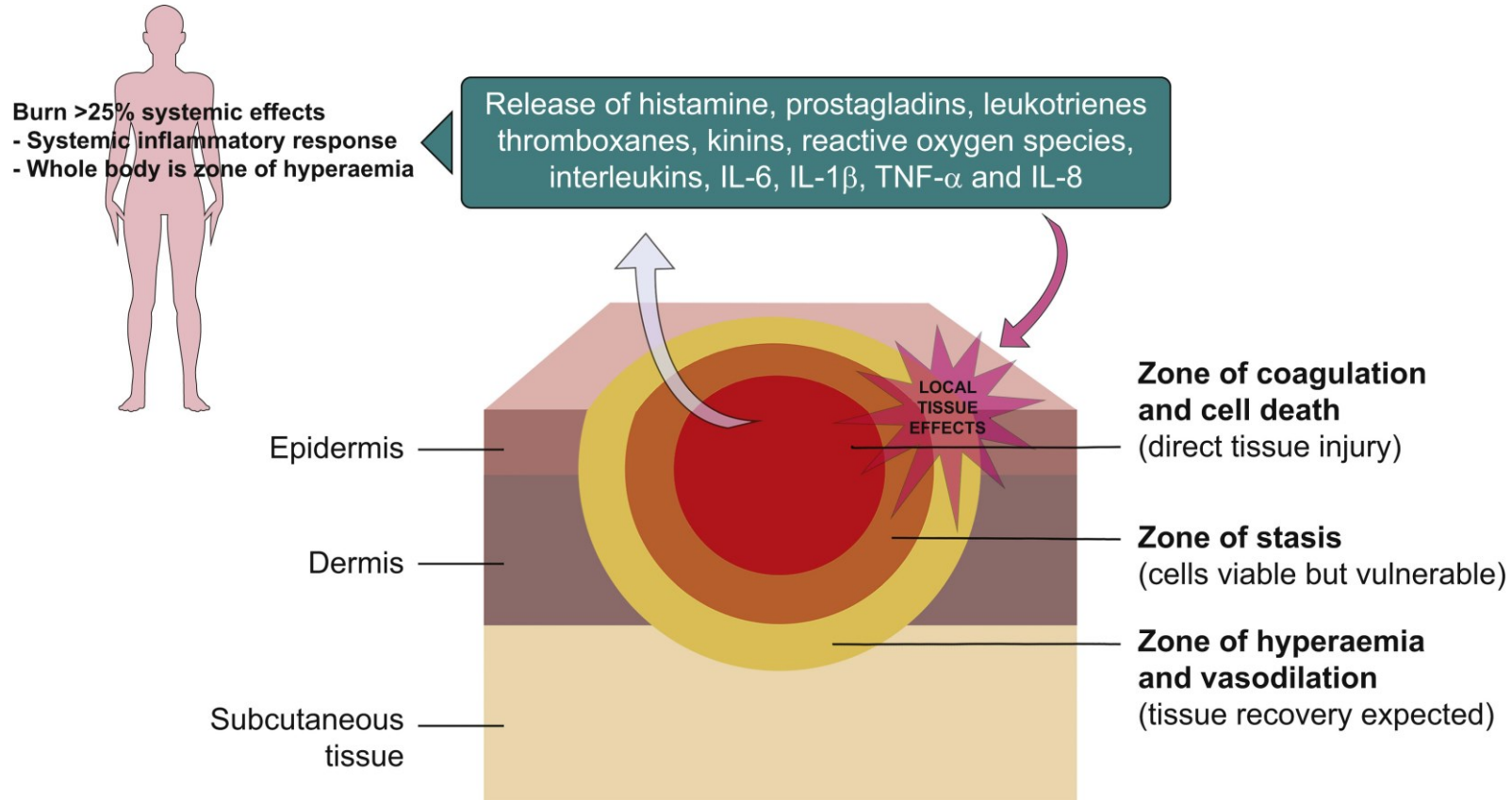
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Aandachtspunten ICU

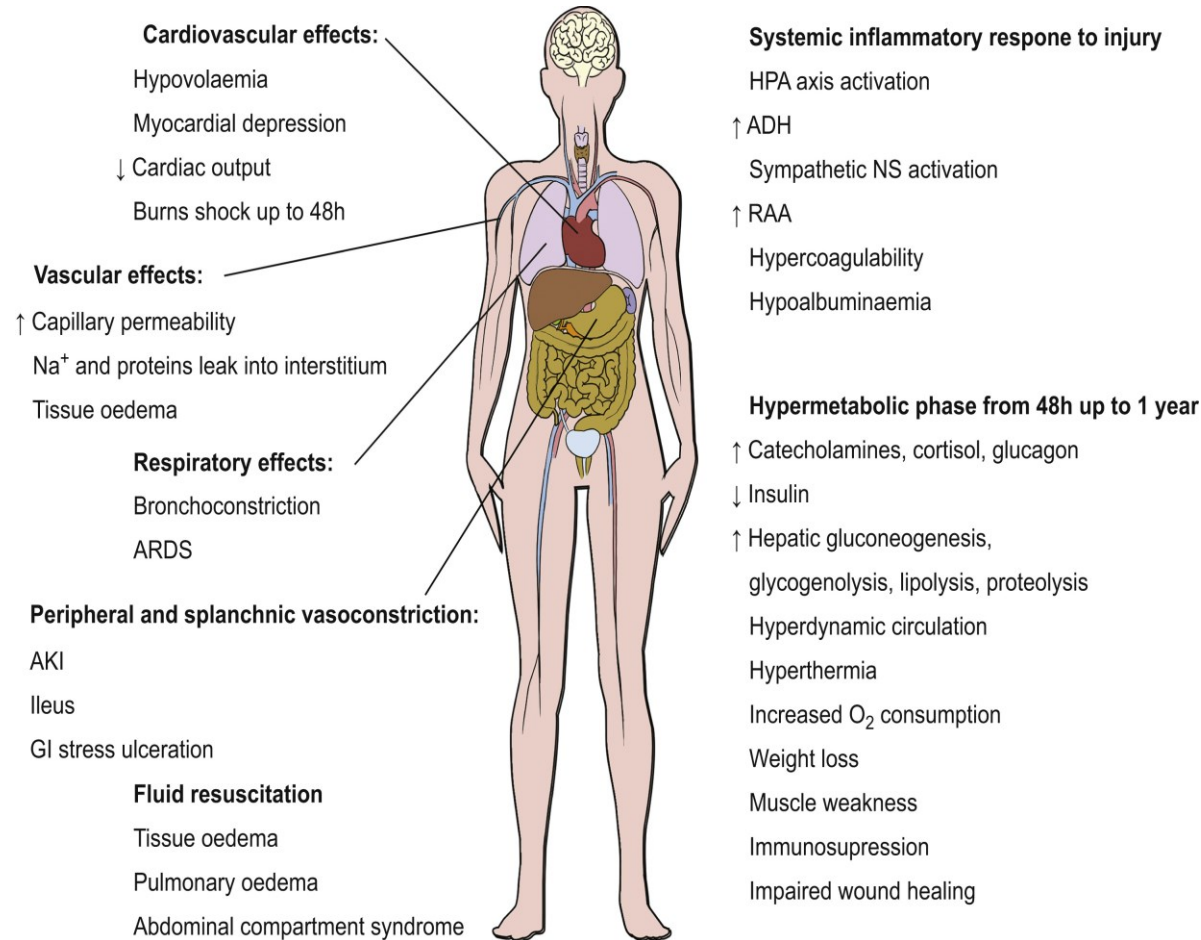
ER – level: major burn = (potential) major trauma

ICU – level: major burn = (potential) multi-organ condition

Burn wound = source of cytokines



multi-organ involvement



ICU topics

Lung protective ventilation

Hemodynamic support

Renal support

Thrombosis prophylaxis (+ consider measurement of antiXa activity)

Stress ulcer prophylaxis

Feeding +++

➤ *Calories*

➤ *Vitamins & Traces*

Infections:

> *susceptibility +++*

> *MDR organisms !!!*

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4. Smoke inhalation

(Acute) Killer !!!

1. Inhalation of hot air => edema and airway obstruction

2. Inhalation of soot, carbonaceous particles

=> atelectasis, bronchospasms, pneumonia, ARDS

=> inhibition of hypoxic pulmonary vasoconstriction....

3. Inhalation of toxics: CO, CN, ...

4. Hypoxia through oxygen consumption: FiO_2 10-13%...

4.1. Inhalation of hot air

Inhalation of hot air => edema, airway obstruction

*mostly supraglottic/glottic edema

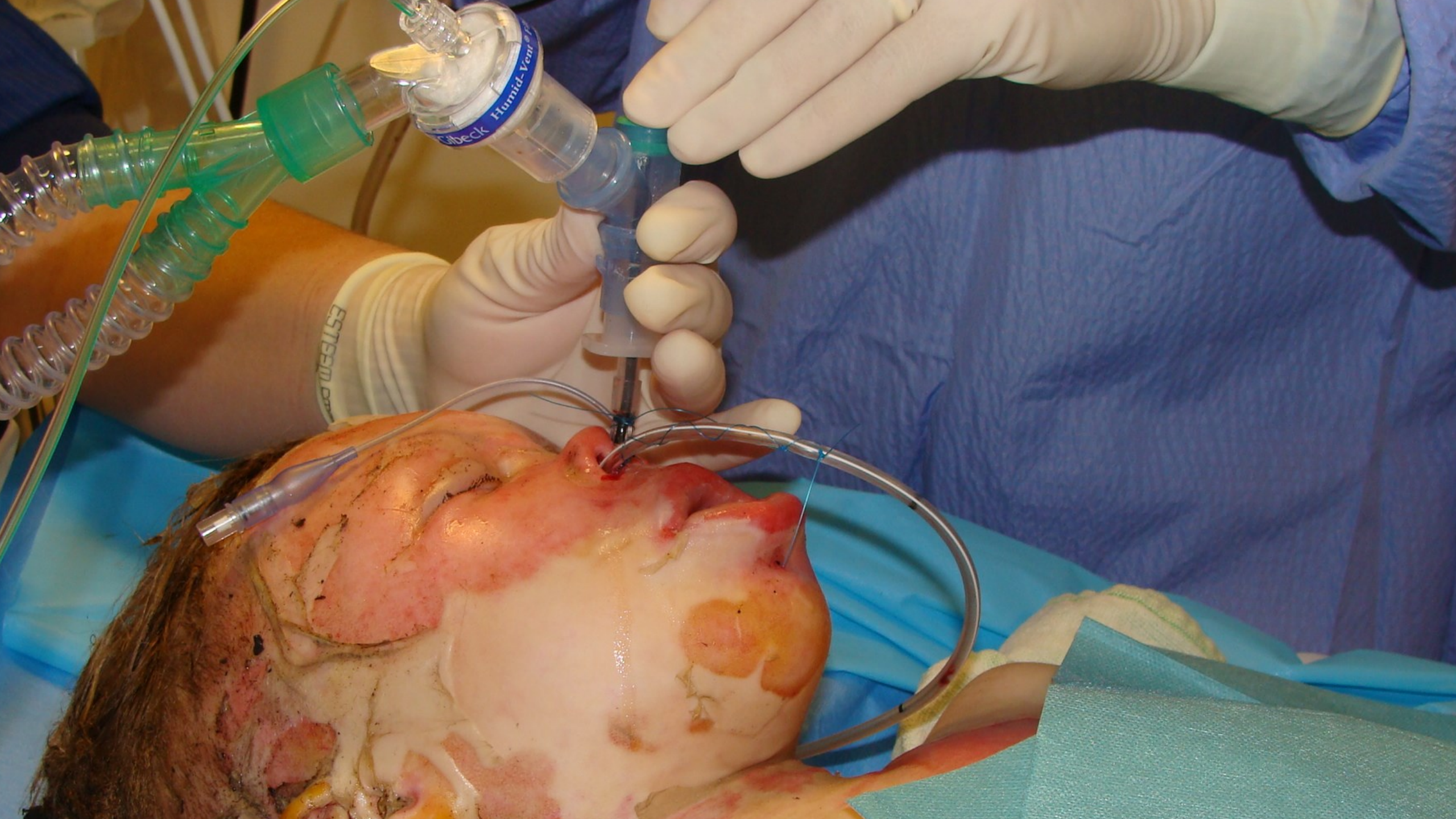
*exception of steam and explosions

If in doubt: intubate !

*gain time by aerosol with adrenaline

(+ corticosteroids ivi)

(+ sitting position)





4.2. Inhalation of smoke

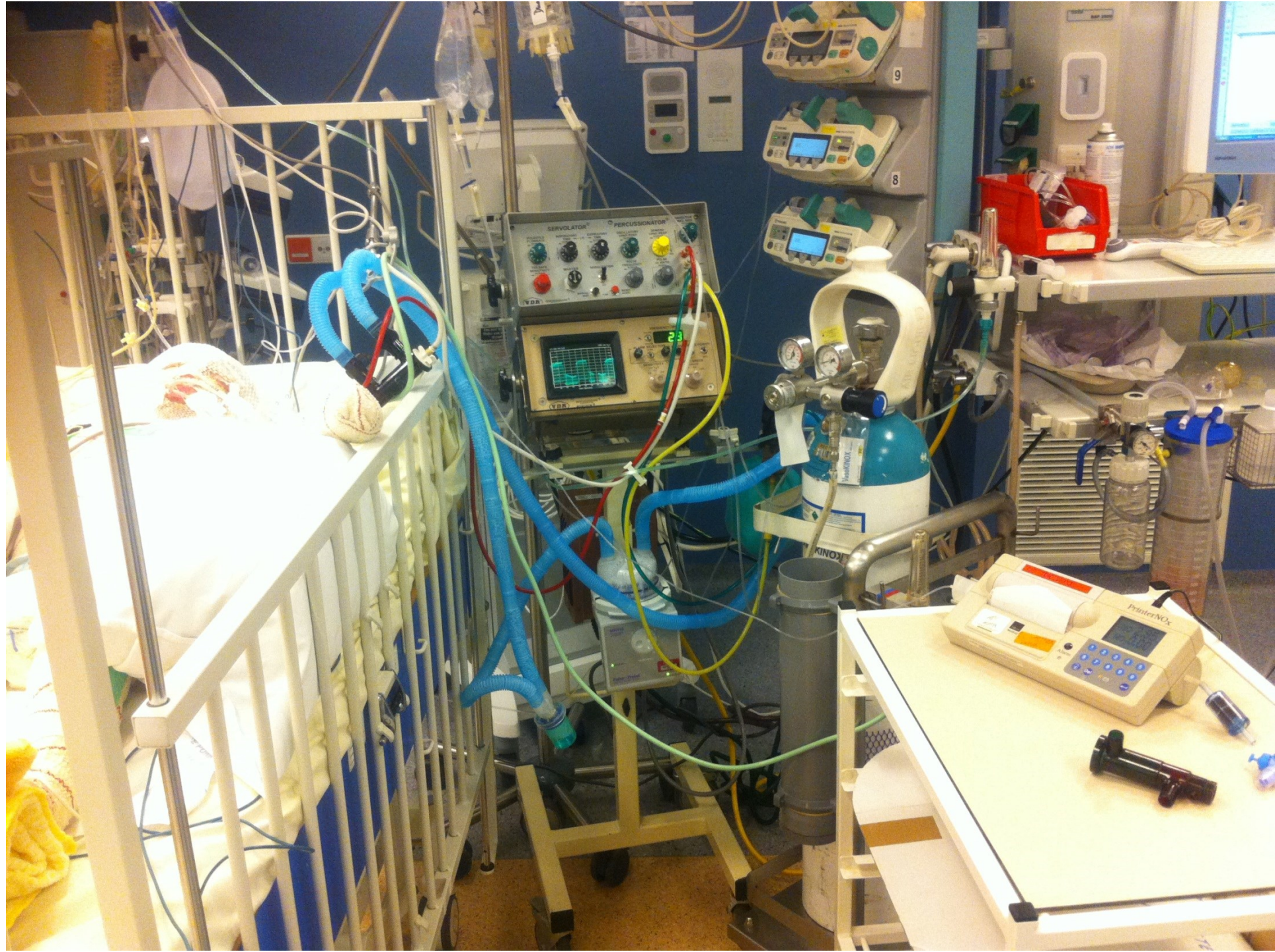
Inhalation of soot, carbonaceous particles



Bronchospasm, atelectasis, pneumonia, ARDS

R/

- > ***Aerosols with heparine*** (*=> thrombine inactivation => √ formation airway casts*)
- > ***Aerosols with acetylcysteine*** (*=> mucolytic => √ formation airway casts*)
- > ***Aerosols with salbutamol***
- > ***Lung protective ventilation***
- > ***Bronchoscopic cleaning***
- > ***High Frequency Percussive Ventilation if expertise***
- > ***ECMO as ultimate rescue***



4.3. Inhalation of toxic substances: CO

PF:

- > *Affinity for Hg = 250x affinity O₂-Hg*
- > *Shift O₂-dissociation curve to the left*
- > *Competitive inhibition binding O₂ – cytochrome oxidase A => √ √ √ cellular utilization of O₂*

R/

- > *oxygen 100% during 6Hr- 12Hr (vs till carboxyHg level ≤ 3% CO ???)*
- > *hyperbaric oxygen: debate still going on....*

www.achobel.be

4.3. Inhalation of toxic substances: CN

Kleurloos gas met de geur van amandelen

Komt vrij bij de verbranding van plastics, PVC's

Extreem cytotoxisch: inhibitie cytochroom oxydase -> cel kan geen zuurstof meer verbruiken

Gevolg 1: anaeroob metabolisme = **lactaat acidose +++**

Gevolg 2: **PaO₂ = PvO₂**

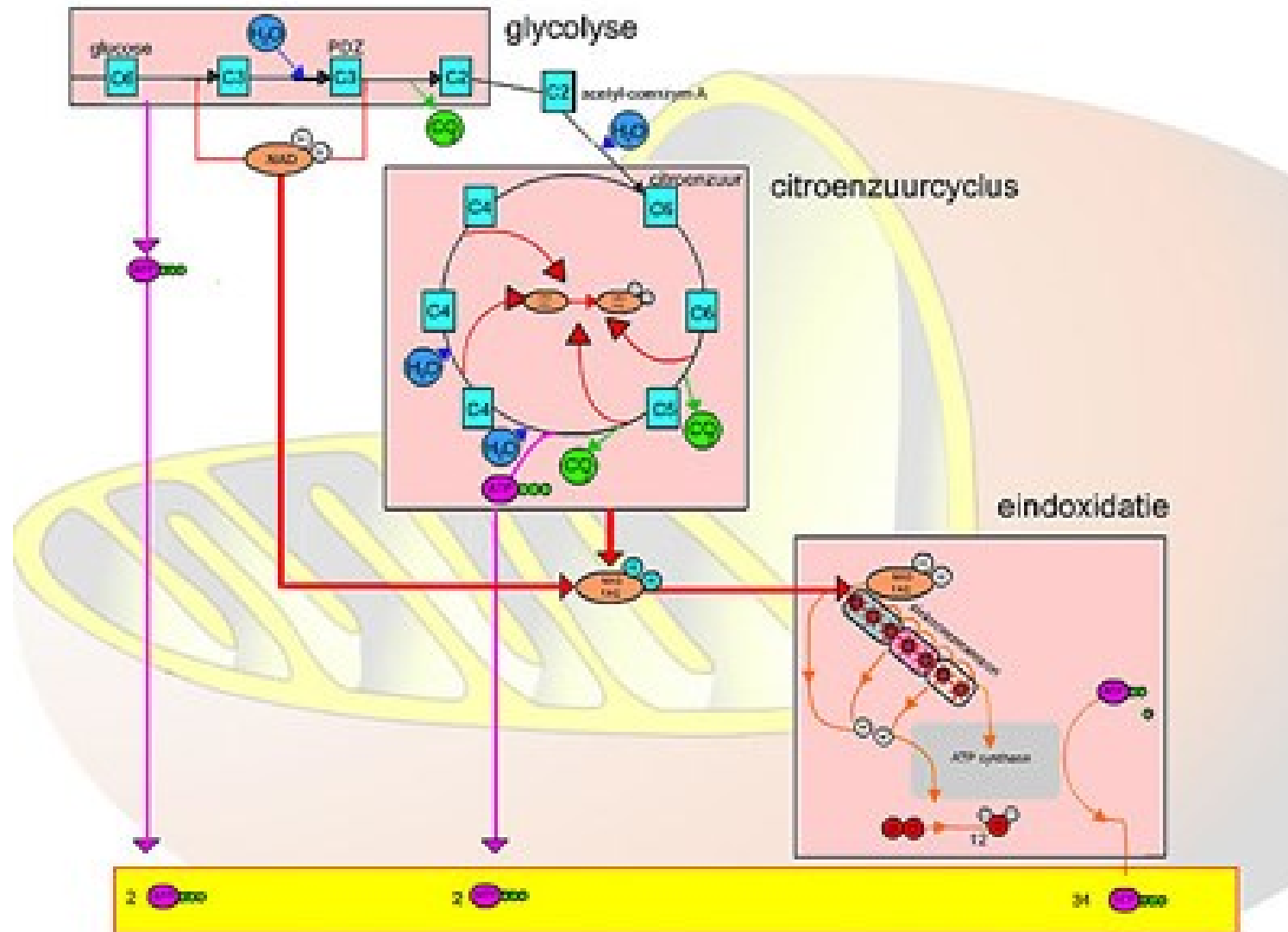
Gevolg 3: ***Cerebraal:** C-C-C

***Cardiaal:** aritmie-ischemie-shock

***Exitus**

Dit allemaal bij slachtoffer van 'binnenhuisbrand'

4.3. Cyanide intoxicatie



4.3. Inhalation of toxic substances: CN

PF: *binds to cytochrome oxidase A => √√√ cellular utilization O₂*

20x more toxic than CO

R/Hydroxycobalamine – Cyanokit 5g (ped's: 70mg/kg)

****Only on indication: obvious smoke inhalation + severe neuro/CV symptoms*

****Repeat once if cardiac arrest*

****Cfr concerns about renal toxicity (oxalate nephropathy)*



Lot - Lotto - Ch.-B. - Παρτίδα - LOTT : 7012-0042

EXP - Scad. - Verwendbar bis - AHEH - JIS: 05/2016

CYANOKIT® 5g

Merck Santé s.a.s.
37, rue Saint-Romain

A SCANNER

CYANOKIT 5g
6505-14-563-0793

Merck Serono

CYANOKIT® 5g

Cyanokit 5 g poudre pour solution pour perfusion 

Cyanokit 5 g powder for solution for infusion 

Hydroxocobalamine
Le flacon Cyanokit 5 g d'hydroxocobalamine. Après reconstitution avec 200 ml de diluant, chaque ml de la solution reconstituée contient 26 mg d'hydroxocobalamine.
Excipient: acide chlorhydrique (pour l'ajustement du pH).
Poudre pour solution pour perfusion.
• Un sac.
• Un dispositif de transfert.
• Un kit de perfusion intraveineuse.
Ce kit doit être utilisé pour l'administration à des enfants.
A conserver à une température ne dépassant pas 25°C.
Lire le mode d'emploi avant utilisation.
Tenir hors de la portée et de la vue des enfants.
Lire le mode d'emploi des conditions de conservation en cas d'utilisation en ambulatoire.
Medicament soumis à prescription médicale.

Hydroxocobalamin
The kit contains 5 g of hydroxocobalamin. After reconstitution with 200 ml of diluent, each ml of the reconstituted solution contains 26 mg of hydroxocobalamin.
Excipient: Hydrochloric acid (for pH adjustment).
Powder for solution for infusion.
• One vial.
• One transfer device.
• One intravenous infusion set.
• One short catheter for administration to children.
This kit does not contain diluent.
Do not store above 25°C.
Read the package leaflet before use.
Keep out of the reach and sight of children.
Read the leaflet for storage conditions in ambulatory use.
Medicinal product subject to medical prescription.

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05/2016

Ah

NEI

Cyanokit 5 g
polvere per soluzione per infusione
Idrossicobalamina

Il flacone contiene 5 g di idrossicobalamina.
Dopo la reidratazione con 200 ml di diluente, ogni ml di soluzione ricostituita contiene 26 mg di idrossicobalamina.
Excipienti: acido cloridrico (per regolare il pH).

Polvere per soluzione per infusione.

- Un flaconcino.
- Un dispositivo di trasferimento.
- Un set per infusione endovenosa.
- Un catetere corto per la somministrazione a pazienti pediatrici.

Questo kit non contiene diluente.
Non conservare a temperatura superiore a 25°C.
Leggere il foglio illustrativo prima dell'uso.
Tenere fuori dalla portata e dalla vista dei bambini.
Leggere il foglio illustrativo per le condizioni di conservazione per uso ambulatoriale.
Medicinale soggetto a prescrizione medica.

Cyanokit 5 g
polvere per soluzione per infusione
Idrossicobalamina

Cyanokit 5 g
Pulver zur Herstellung
Infusionslösung
Hydroxocobalamin

Cyanokit 5 g
Pulver zur Herstellung
Infusionslösung
Hydroxocobalamin

Intravenöse Anwendung.
Die Durchstechflasche enthält 5 g Hydroxocobalamin.
Nach Rekonstitution mit 200 ml Verdünnungsmittel enthält die rekonstituierte Lösung 26 mg Hydroxocobalamin pro ml.
Sonstiger Bestandteil: Salzbun pH-Wert Anpassung.
Pulver zur Herstellung einer Infusionslösung.

- Eine Durchstechflasche.
- Eine Überleitungskanüle.
- Ein intravenöses Infusionsset.
- Ein kurzer Katheter für die Anwendung bei Kindern.

Diese Packung enthält kein Verdünnungsmittel.
Nicht über 25°C lagern.
Packungsbeilage beachten.
Anzeigemittel für Kinder unzugänglich aufbewahren.
Zu Lagerungsbedingungen bei ambulanter Anwendung, Packungsbeilage beachten.
Verschreibepflichtig.

05/2016

Merck Serono

IT 5g

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5. Chemical burns

Be aware: *local damage + potential systemic toxicity*

Bases vs Acids:

> ***acids***: *coagulation necrosis => limited penetration*

> ***alkali burns***: *liquefaction necrosis => deeper penetration*

First measure: rinse with water

* as soon as possible !

*during $\geq 1\text{Hr}$

*with temp as close to body temp as possible

Eventually measure pH of the wound with litmus paper

5. Chemical burns

Alternative for H2O might be Diphoterine

Diphoterine:

- *amphoteric

- *chelating

- *hypertonic

- >> Application as soon as possible

- >> Should not replace rinsing with water if not immediately available

- >> Delayed application still beneficial

Further studies needed to prove clinical benefit

Working on a protocol within the BABI



“Destop” NaOH pH 13



5. Chemical burns: not to rinse with water

Elemental metals:

- > will ignite with water (Na, K, Li)
- > should be covered with oil ?

Phenol: *insoluble > needs to be wiped off with sponges soaked with 50%PEG*

Ca O₂: *exotherm reaction +++ with water*

Sulphuric acid: *exotherm reaction +++ with water*

Phosphorus burns: *coppersulphate ?*

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6. High Voltage Electrocution

1. Definition “High Voltage” – “Low Voltage”: 800-1000 Volt

2. High Voltage: soft tissue trauma +++

-> **rhabdomyolysis** +++ CK's ↗↗↗

-> pt will need extensive *fasciotomies*

-> pt will need repetitive *débridements*

-> **Fluid resuscitation** . More than expected based on TBSA (“iceberg phenomena”)

. Aim at UO > 1ml/kg/Hr

-> **Consider bicarbonate** in case of myoglobinuria (ccc)

-> **Consider mannitol** (rincing the kidneys)

-> **Consider dialysis/CVVH**



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7. Besluit

- **Acute burn care = Trauma care**
- **Smoke inhalation: 100% O₂ (+ cyanokit)**
- **If in doubt: intubate**
- **Burns specific actions:**
 - *> cooling (but avoid hypothermia)*
 - *> fluids (TBSA \geq 15%)*
 - *> analgesia*
 - *> tetanos prevention*