

SAFETY

simulation for medical practice

SIMULATION APPROACH FOR
EDUCATION AND TRAINING
IN EMERGENCY

Infant Emergencies & Obstetrics

Philipp Fischer, LMU



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DOCUMENT VERSION 01

AUTHORS

Philipp Fischer

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1 Specifics in anatomy and physiology in terms of Infant Emergencies

1.1 Short Tolerance of Apnoea

Especially when it comes to a reduction or loss of tonicity or a central depression e.g. through the administration of analgetics, sedatives or narcotics, the functional residual capacity of infants decreases so far, that with a parallel increased O₂-Demand, already after 50 sec. the contained oxygen is used up, even after preoxygenation.

1.2 Special anatomy of the airways

The small anatomy of the infants' airways is specific, because when it comes to a swelling of the mucous membrane due to a respiratory virus-infection, we often observe an obstruction of the airways. **Most live-threatening situations are triggered by obstructive respiratory problems.**

1.2 Breathing drive control

Apnoea as an answer to hypoxia or increase of CO₂ and can contribute to the sudden infant death.

Consequences 1.1, 1.2, 1.3

- In emergencies, stabilise the respiratory situation
- The safekeeping of oxygenation has priority. Better, perform a safe mask ventilation than forcing an intubation!
- When performing CPR, stick to five initial ventilations other than recommended in adult CPR.

1.4 Difficult Examination, missing Cooperation

Especially new-born and infants make it difficult when it comes to an examination. They defend themselves when it comes to body-contact and they usually answer with screaming so that an auscultation, measuring BP or applying a pulseoxymeter are not possible.

1.5 Many diagnostics are not performable

Through actions such as measuring BP, applying ECG-Leads or other, you might worsen the actual situation.

Consequences 1.4, 1.5

- Good clinical observation
- Non-invasive measure-methods
- Clinical experience

1.6 Long compensation time, then sudden decompensation

Examples:

Dehydrated infant with enteritis → BP within normal range but mentally reduced, apathetic → sudden Shock

Bronchitis is being compensated with maximum tachydyspnea (SpO₂ within normal range, pCO₂ within normal range) → Apnoea and bradycardia → almost no reversible decompensation

Consequences 1.6

- Clinical observation is often more helpful than physiological measures
- Age-appropriate BP does not exclude shock
- Apply Capillary refill time at forehead or sternum (specific and early recognition of shock)
- Apnoea as warning for impending respiratory exhaustion
- Normalising of tachypnoea without specific therapeutic actions as warning for threatening respiratory decompensation

1.7 Disease spectrum in Emergency-Service

Adults

Cardio-circulatory diseases: Heart Attack, Rhythm Disturbance, Pulmonary Embolism

- Almost unknown in Infant Emergencies

Infant

Obstructive respiratory diseases: viral Krupp, Bronchitis, obstructive Bronchitis, asthmatic

Neurological Problems (infection spasm)

Infections (Enteritis, meningococcal sepsis)

Consequences 1.7

- Knowledge of infant-specific disease spectra, symptoms, therapy is required for acting successful

1.8 Trauma, Intox

Burnings:	way more often scalding than burning
Pattern of injuries:	critical TBI (big head, low muscularly control)
Accident mechanisms:	different (often collision with car) More cranial body parts affected than adult (Femur in spite of tibia/fibula), knocking of hood of car with cranium
Intox:	accidental admission of medication/drugs and household poisons (adults and juvenile: suicidal or reactive medication/drugs admission). Other poisons, other actions.

Think of Child-Abuse!

1.9 Variation of height and weight

3 Kg - 60 Kg → drug-dosing errors

Consequences 1.9.

- Measured dose ranges in mg and ml
- Use of help-devices and Apps

1.10 Variation of height and weight

Position and appearance of larynx impede intubation. Small vanes and adipose tissue impede i.v. cannulas.

Consequences 1.10.

- Alternative breathing aids such as Larynx-ventilation or LMA
- Early use of i.o. needle

1.11 Psychology and interaction

Infants are mostly not cooperative, they cannot locate pain and do not let perform a body examination. Own anamnesis and reassurance not possible by EMS or doctor.

Consequences 1.11

- Foreign anamnesis, observing assessment, guided examination performed by parents
 - Indirect reassurance, explanation of planned actions to parents (silence/calm transfers from parents to infants)
- Infants have another physiology and other problems
→ CPR other than for juveniles and adults (focus on ventilation)

2 Infant Emergencies

2.1 Respiratory Emergencies

Dyspnea = almost always obstructive ventilation disturbance (= constriction of airway (oral to bronchioles))

Crucial question for initial assessment: inspiratory stridor?

(Often, additional expiratory stridor)

Leading Symptom in acute dyspnoea:

- Obstruction in the upper airway → inspiratory stridor
- Obstruction in the lower airway → expiratory stridor + Rhonchus, Humming

Often: viral Krupp (insp. Stridor) and asthma/obstructive bronchitis (exp. Stridor)

Rare, but dangerous: Foreign body aspiration

Coughing: activated through trigger on vocal cords downwards

Free movement of head and neck argues against epiglottitis

Crucial question: still able to drink? HiB vaccination? → Rather no epiglottitis

Admitting i.v. access initially almost never necessary

Always primarily inhalation therapy

Inspection of larynx almost never necessary (exception: very likely foreign body aspiration)

Highest priority: calm down the parents → leads to calming the infant → less dyspnea → stabilising the infant (never separate the infant from parents → excitement leads to an increase of O₂-demand and finally to dyspnea)

Never sedate infants with acute dyspnoea because of the depressed breathing drive.

3 Differential Diagnoses

First crucial question in the initial assessment: existence of insp. Stridor?

If yes:

- Viral Krupp (very often)
- Foreign body aspiration, epiglottitis, bacterial tracheitis, allergic larynxoedema (not very often, but dangerous)

Second crucial question: if no insp. Stridor → exp. Stridor?

If yes:

- Asthma, bronchiolitis, obstructive bronchitis (often)
- Foreign body aspiration (not often, but dangerous)
- Anaphylaxis (not often)

Third crucial question: dyspnoea without insp. or ext. stridor?

4 Diagnostic and skills

- Respiratory Frequency (RF)
- Thoracic excursions
- Auscultation
- Nostrils; sternal, subcostal, jugular recoveries
- Oxygenation (cyanoses, paleness)
- SpO₂ (aim: saturation >90 %)
- Neurostatus: AVPU
- Assessment of Circulation (HR, Recap, Pulses)

No inspection of oral cavity/mouth with scoop if viral Krupp or epiglottitis is likely.

5 Severity Assessment

Signs of warning of a respiratory worsening

- Extreme tachypnea
- Normalising of tachypnea with no therapy
- Bradypnea
- Apnoea
- Missing Lung sounds
- Bad thorax movement
- Cyanoses under O₂-supply
- Clouding of consciousness (infant focused on breathing, not able to speak full sentences)
- Biphasic stridor (consider tracheal or laryngeal foreign body)
- **Biphasic stridor with forced expiration (expiratory press breathing + inspiratory contraction = ALERT!)**

6 Respiratory Emergencies by Frequency

6.1 Viral Krupp

6.1.1 Anamnesis and clinical signs

- Mostly during nights, out of sleep
- Barking cough
- Hoarseness
- Insp. stridor
- Occurrence September – March
- Age 6 month – 5 years
- gentle infection upper airway
- good general condition, free movement head & neck
- no ptialism
- Raised temp. (<38,5C)
- No difficulties of swallowing
- Dyspnoea/cyanoses

6.1.2 Therapy and skills

- Calm infant + parents
- Upright position (on lap Parents)
- SpO₂
- Threatening resp. insufficiency □ O₂ supply
- Cold/moist Air (open window, in front of cold shower)

Dose rectal steroids				
	5 Kg	10 Kg	20Kg	30Kg
Prednison/ Prednisolon 100 mg-Supp.	100 mg	100 mg	100 mg	100 mg

Tab. 1

Dose Dexamethasone-liquid					
	Dose	5 Kg	10 Kg	20 Kg	30 Kg
Dexamethasone- liquid 2mg/5ml oral	0,15 mg/kg p.o	0,75 mg	1,5 mg	3,0 mg	4,5 mg
		1,9 ml	3,75 ml	7,5 ml	11 ml

Tab. 2

Dose Adrenaline				
	5 Kg	10 Kg	20Kg	30Kg
Adrenaline 1:1000 p.i. undiluted Per inhalation	3 ml	4 ml	5 ml	4,5 ml

Tab. 3

1. Steroids (Tab. 1)

- Rectal 100 mg Supp. all ages (e. g. Rectodelt, Infectocortikrupp, Klismacort) Takes effect after 20-45 min
- Dexamethasone p.o. 2mg/5ml: (Tab. 2)
0,15mg/kg (0,4ml/kg) as single-dose

2. Adrenaline

Undiluted by inhalation via mask 8-10 l O₂/min

Takes effect within minutes

- Adrenalin 1:1000 pure 3-5 ml p.i. (Tab. 3)

Keep in mind, that concentrations of drugs made by the hospital pharmacy can be different !

Mild form → Cold/moist Air, Steroids rectal/p.o., inhalation → ambulant assessment in Hospital

Medium-heavy form → Steroids rectal/p.o., Adrenaline 1:1000 pure p.i. → in-patient to hospital, upright position on lap parents, O₂supply if necessary

Severe form → Steroids, rectal/p.o., Adrenaline per inhalation 1:1000 pure, inhalation Adrenaline → **Life-Threatening! ICU! SpO₂**

- Think of:
- intubation (0,5-1 mm ID smaller)
- i.v. access
- non-invasive ventilation
- O₂-supply

6.1.3 Differential Diagnosis

- Retropharyngeal abscess
- Epiglottitis
- Think of Diphtheria
- Foreign body
- Larynx oedema
- Tracheitis

6.1.4 Tips

- Use adrenaline undiluted for inhalation
- Rebound-Effect after 2-4 hrs. □ inpatient when adrenaline inhalation is needed
- consequent use of inhalation and early steroids □ rarely need of intubation
- But if needed: i.v. access, Tube 0,5-1 mm ID smaller
- Use leading mandrin for intubation
- Oro-tracheal intubation!
- Ultima Ratio: tracheotomy, cricothrotomy

6.2 Asthma, Status Asthmaticus, obstructive bronchitis

6.2.1 Anamnesis and clinical signs

- Extended expiration, pressed expiration
- Exp. Stridor (Rhonchus)
- Dyspnoea
- Upright position
- Tachypnea
- Tussive irritation
- Tachycardia
- Centralisation

Warning signs

- Difficulties speaking
- No lung sounds (silent lung)
- Cyanosis
- Loss of consciousness

6.2.2 Therapy and skills

- Asthma in history
- Long-term medication
- SpO₂ before and after inhalation of betamimetics

When SpO₂ is <94 % after 20 min after inhalation with betamimetics → Evidence of severe progression!

1. Initial therapy

- Immediate O₂-supply 1-4 l (face-mask or nasal cannula ask parents to hold) aim for SpO₂ >94 %
- Calm infant and child

No sedation (resp. depression)!

- Upright position
- **Salbutamol** per inhalation (Tab.4)
 - 0,5% 8 drops ad 2 ml NaCl 0,9% inhalation
 - Ready-to-use inhalant Salbutamol 1,25 mg = 2,5 ml for all ages

Dose Salbutamol				
	5 Kg	10 Kg	20Kg	30Kg
Inhalation solution 0,5% 8 drops=2 mg)	8 drops ad 2 ml NaCl 0,9%			
Ready-to-use Vial (2,5 ml=1,25 mg)	1 vial	1-2 vials	2 vials	2-3 vials

Tab. 4

- If available, 3 x 4-6 strokes metered-dose inhaler, 10 min gap between repetition
- Prednison/Prednisolon 2 mg/kg i.v./p.o. or SUp. 100 mg
 - Alternative: Dexamethasone oral juice 2mg/5 ml as single-dose

Dose Prednison/Prednisolon				
	5 Kg	10 Kg	20Kg	30Kg
2mg/kg i.v.	10 mg	20 mg	40 mg	60 mg
Rectal	100 mg	100 mg	100 mg	-

Tab. 5

- Ipratropiumbromid p.i.: Atrovent (1ml=20 drops=0,25 mg), 2 ml undissolved per inhalation repeat after 20 min once
 - If available 2-4 strokes metered-dose inhaler

If no recovery on betamimetic-inhalation:

- Try Adrenaline 1:1000, 3-5 ml pure p.i.

2. Intensify therapy in case of resp. insufficiency

- Stick to inhalation with salbutamol

When inhalation is unsuccessful, try:

- Terbutaline (Tab 6) s.c. 0,005 mg/kg, repeat after 10-15 min
or
- Adrenaline (Tab.7) 0,01 ml/kg i.m., repeat after 15 min
or
- Theophylline 4-6 mg/kg “loading-dose” over 20 i.v.

Dose Terbutaline (0,5 mg/ml)				
	5 Kg	10 Kg	20Kg	30Kg
2 mg/kg i.v.	10 mg	20 mg	40 mg	60 mg
Rectal	100 mg	100 mg	100 mg	-

Tab. 6

Dose Adrenaline 1:1000				
	5 Kg	10 Kg	20Kg	30Kg
0,01 mg/kg i.m.	0,05 ml	0,1 ml	0,2 ml	0,3 ml

Tab. 7

Keep in mind, that concentrations of drugs made by the hospital pharmacy can be different !

Intubation

- Use Ketamine (bronchio dilatation!)
- Use Succinylcholine or Rocuronium for Relaxation
- When using consequent inhalation, not often necessary
- When having difficulties in ventilation
 - Use low frequency (5-10/min)
 - Long expiration (I:E1:4)
 - Manual thorax compression in expiration
 - Use blocked tube
 - Accept high ventilation pressure

ICU → sudden Asthma death!

6.2.3 Differential Diagnosis

- Foreign body
- Allergenic reaction
- Broncho pulmonary Dysplasia
- RSV-bronchiolitis
- Pneumothorax

6.2.4 Tips

- It is crucial, when faced with severe course/bad therapy reaction, to stick to a continuous inhalation therapy using betamimetics
- When breathing spontaneously, use pursed lip breathing
- When intubated, mostly use low ventilation frequency and use thorax compression in expiration, if needed

6.3 Foreign Body Aspiration

Rare, but dangerous!

6.3.1 Anamnesis and clinical signs

Lead: Aspiration = sudden coughing/dyspnoea

- Ask for characteristics such as, nuts, small plastic parts, pearls, etc.
- Think of aspiration of powders
- Happening not always to be identified surely
- Age, mostly 1-3 years
- Cyanoses, dyspnoea, apnoea
- Rhonchus, one-sided lung sounds

**Insp & exp. Stridor, dyspnoea, low breathing, bad air inlet → suspicion of tracheal/laryngeal foreign body
→ DANGER!**

6.3.2 Instant Diagnostics

- Point 4
- Different lung sound left vs right
- Biphasic stridor (insp. + exp.) → ALERT!
- Changing insp. and exp. Rhonchus (valve mechanism)

6.3.3 Therapy and skills

Depending on size and position of foreign body, it comes to a different pathology and therefore different procedure

Good general condition, no heavy dyspnoea, no cough

- After short, acute choking fit, no relevant dyspnoea or cyanosis → obstruction of main bronchus after foreign body sliding deeper
- Possible, one-sided lung sound
- No immediate action necessary
- No manipulation
- Don't let cough
- Let sober

Immediate worsening possible!

Infant is coughing effectively with sufficient inspiration, no relevant dyspnea/cyanosis

- Partial trachea obstruction
- Supply O₂ (hold mask in front of face)
- Biphasic stridor? → ALERT!
- Keep infant coughing

Warning signs of worsening

- Decreasing cough
- Increasing dyspnoea
- Loss of consciousness

No manipulation or trying to remove foreign body → danger of secondary position change and a total obstruction!

If necessary, i.v. access when resp. exhaustion

Anticipate total trachea obstruction (anaesthesia bag + mask, laryngoscope, et. tube)

Ineffective breathing and ineffective coughing, dyspnoea, cyanosis, still conscious

No effective coughing

- Total tracheal obstruction
- O2 supply
- Clear airway
- Avoid blinded buccal cavity cleaning (secondary dislocation)
- Inspection of buccal cavity: if foreign body is in sight, use magill's forceps
- Use suction for eliminating liquids

If not successful: increase intrathoracic pressure for imitation of coughing fit!

Infant (<1 year)

- Put with belly on forearm and head-low, keep mouth open with fingers, apply 5 hits on back with palm between bladebones check buccal cavity if foreign body is in sight

If not successful:

- in dorsal and lower head position, apply 5 compressions of thorax in lower sternum (pressure point as in CPR) → check buccal cavity if foreign body is in sight

No Heimlich-Manoeuvre <1 year (organ rupture)

Child (>1 year)

- apply up to 5 hits on back with palm between bladebones → check buccal cavity if foreign body is in sight

If not successful:

- Heimlich-Manoeuvre, apply up to 5 hits on back with palm between bladebones check buccal cavity if foreign body is in sight

If not successful:

- Repeat, 5 backblows, 5 Heimlich-Manouvres
- When Heimlich-Manouvres applied, check for intra-abdominal injuries → in-patient

Also check: Print (hlr-experten.se) <https://www.hlr-experten.se/wp-content/uploads/CPR-Poster-ckoking-first-aid-A4.pdf>

Child unconscious

If all mentioned actions were not successful and the child loses consciousness due to asphyxiation/hypoxia:

- Insufficient breathing → assisted ventilation (high insp. pressure)

If cardiovascular arrest:

- Perform CPR (5 initial ventilations)
- 15 compressions: 2 ventilations, with every mouth opening for ventilation, check if foreign body comes to sight

If no cardiovascular arrest, but no breathing:

- Clear airway (lift chin, Esmarch)
- Avoid blinded buccal cavity cleaning (secondary dislocation)
- Inspection of buccal cavity: if foreign body is in sight, use magill's forceps
- Use suction for eliminating liquids
- If missing air inlet, perform mask ventilation → try to blow foreign body further down

CAVE: Laryngospasm, vomiting, bradycardia, heart arrest when using laryngoscope

Mask ventilation not possible → laryngoscopy

- Laryngoscopy with parallel use of magill's forceps
- Try to eliminate foreign body if located in larynx, pharynx or supraglottic with use of magill's forceps

Ultima Ratio: orotracheal intubation → try to ventilate

- Try to push down foreign body to one of main bronchus (accept injuries of trachea, bifurcation, main bronchus)
- Then, pull back tube, eliminate leading mandrin and ventilate
- If not successful: tracheostomy, only makes sense if located above canula

No transverse incision!

6.3.4 Differential Diagnosis

Asthma, bronchiolitis, Krupp, epiglottitis, diphtheria, oesophageal foreign body

6.4 Epiglottitis

6.4.1 Anamnesis and clinical signs

- Main question: HiB vaccination?
- Main age: 3-7 years
- Acute illness
- Insp. stridor
- No cough
- No voice, maybe silent voice
- Shock
- Upright, sitting position, bended forward
- Typical head position; pushing lower jaw forward, tilt/overstretch cervical spine
- Pyrexia (>39° C)
- Dysphagia
- Ptyalism

- Bad air inlet
- Last oral ingestion? Child eats and drinks → rather no epiglottitis

No invasive actions, don't inspect larynx, no injection → sudden cardiac arrest

6.4.2 Instant Diagnostics

- Check
- Criteria: air inlet? Cyanoses? Paleness? Resp. exhaustion?

6.4.3 Therapy and skills

- Calm down child + parents
- Preclinical Therapy:
 - O₂-supply
 - If stable: reduce manipulations + quick transport to hospital, upright position
 - Don't let lay down (epiglottis falls back)
 - No scoop inspection
 - When resp. instable → assisted mask ventilation
 - Preclinical intubation difficult and dangerous, better quick transport to hospital
- Worst case: tracheostomy

6.4.4 Differential Diagnosis

- Krupp
- Tracheitis
- Diphtheria

6.4.5 Tips

- Assisted mask ventilation basically always possible
- Don't use supraglottic airway devices (don't make sense)
- After first try of intubation, swelling of epiglottis very likely → if mask ventilation is not successful → tracheostomy

7 Cardiac emergencies

Reason for Alarm:

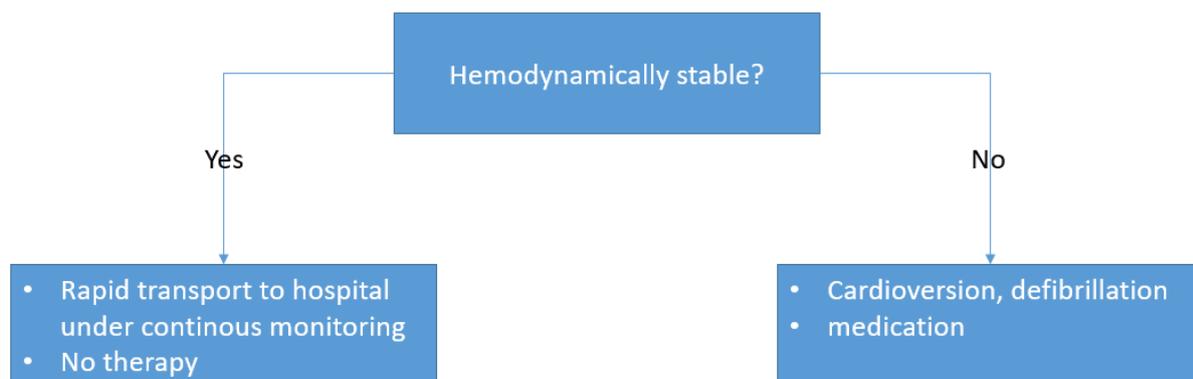
- Newborn with tachycardia, grey, pale, doesn't drink for hours/days
- Older child with sudden collapse (e.g. Long-QT, Romano-Ward-Syndrom) → CPR or spontaneous improvement
- Child, teenager with sudden palpitation

General:

- Age-related standard vital signs hard to remember and individually very different
- In contrast to adult, dysrhythmia is tolerated for a long time
- Children mostly have a healthy heart □ rare dysrhythmia such as VF or PVT
- Crucial Question:
 - Palpable pulses?
 - Bad Perfusion: Recap. Time >3 sec, paleness □ beginning shock
 - Reduced consciousness?
 - **Signs of heart failure?**

Apply ECG-monitor or defibrillator

General Procedure



8 Shock

8.1 Breathing drive control

- Saggy child (often after trauma or infection)
- Loss of consciousness (often after trauma or infection)

8.2 Diagnostics

- Recap Time >3 sec. at forehead
- warm-cold-boarder at limbs
- tachycardia
- decreased SpO₂
- not wakeable
- disorientated
- low BP

New-born and little children have normal systolic blood pressure (long compensation) despite in heavy shock. Measuring RR mostly difficult □ Use Recap-time at forehead as early shock parameter/indicator.

Reasons for Shock:

- hypovolemia e.g. trauma (splenic rupture, burnings, ketoacidosis)
- septic shock
- cardiogenic shock
- distributive shock

8.3 Instant Therapy

- follow ABCDE
- quick correction of hypovolemia
 - passive leg-raising
 - i.v. access, consider i.o. access
- Aim
 - Recap time <3 sec
 - Regaining consciousness

Apply volume

- Crystalloid, isotone e.g. Ringer-Acetate, VEL, NaCl 0,9%
- Amount: 20ml/kg bolus, repeat until recap time is normal

Signs of success

- Recap Time ↓
- Heart rate ↓

- Warm-cold-boarder moves distal
- Better neurostatus
- Better SpO₂
- RR ↑

Dose Volume Shock					
	Dose	5 Kg	10 Kg	20Kg	30Kg
Ringer-Acetat NaCl 0,9%	20ml/kg	100 ml	200 ml	400 ml	600 ml
VEL					

Tab. 8

Keep in mind, that concentrations of drugs made by the hospital pharmacy can be different !

Problems

- Volume overload → moist rale, O₂ ↓
- If necessary Intubation, adrenergics

Further Therapy

- Think of Prednisone 1 mg/kg, if septic shock is resistant to volume and adrenergics and no other reason is suitable
- Think of
 - Respiration
 - O₂
 - Ventilation: following clinical indication, but rather early (indication (SpO₂ ↓, coma)
 - Blood glucose
 - Think of Dobutamine 5-15 µg/kg/min

9 Anaphylaxis

9.1 Reason for alarm:

- Known allergy and definitive exposition (e.g. nitration, insect sting) circulatory reaction
- Known allergy and assumed exposition (unknown part of nutrition) observed reaction with systemic symptoms
- No known allergy but unspecific circulatory reaction, maybe with skin involvement, shock → supposed allergy

9.2 Symptoms

- Anxiety
- Tachypnea
- Skin
 - Cyanosis
 - Urticaria
 - Pruritus
- Upper airway
 - Stridor (larynx oedema)
 - Airway obstruction
 - Sneezing
 - Rhinorrhea
- Lower airway
 - Coughing
 - Rhonchus
- Circulation
 - Tachycardia
 - Hypotension
 - Shock
- Other
 - Nausea
 - Emesis
 - Diarrhoea
 - Abdominal cramping

Decision Criteria

- Only urticarial is no anaphylaxis!
- Anaphylaxis = supposed allergic reaction + systemic reaction
 - Signs of shock
 - Dyspnea
 - Heavy GI symptoms

When anaphylaxis, early indication for Adrenaline i.m.

9.3 Tips

- When having parts of shock (dizziness, cramp attack) think of anaphylaxis
- Often time shift with urticaria → resp. symptoms → shock
- Standard therapy → Adrenaline i.m.

9.4 Differential diagnosis

- Vasovagal syncope
- Septic shock (mostly fever, no urticaria, no airway obstruction, less sudden begin, mostly no allergic anamneses)
- Hypovolemic shock
- Side effect of medication

Instant Therapy/Emergency therapy when dyspnoea or circulation reaction

- ➔ Adrenaline i.m.
- Don't hesitate too long
- Preferred way of admitting is i.m.
- Dose: Adrenaline undiluted 1:1000 0,1ml/10 kg i.m., max. 0,5 ml i.m.

9.5 Therapy

- Stop allergen intake
- Lay patient on floor
- Apply i.v. access
- Be aware of progression

Dyspnea

- Adrenaline (1:1000) 0,01 mg/kg i.m. (repeat after 5-min intervals when no effect)
- If available, Emerade®, Fastjekt® i.m.
- Apply oxygen

Dose Adrenaline i.m.					
	Dose	5 Kg	10 Kg	20Kg	30Kg
Adrenaline 1:1000 undiluted i.m.	0,01 mg/kg i.m.	0,05 ml	0,1 ml	0,2 ml	0,03 ml

Tab. 9

Bronchial Spasm

- Treat like asthma, before inhalation always apply Adrenaline i.m.
- Sultanol-inhalation

Dose Salbutamol				
	5 Kg	10 Kg	20Kg	30Kg
Inhalation solution 0,5% 8 drops=2 mg)	8 drops ad 2 ml NaCl 0,9%			
Ready-to-use Vial (2,5 ml=1,25 mg)	1 vial	1-2 vials	2 vials	2-3 vials

Tab. 10

- Or If available, 4-6 strokes metered-dose inhaler
- If inhalation does not show effect
 - Adrenaline undiluted, 3-5 ml inhalation mask
 - Assume Terbutaline (Bricanyl) 0,01 ml/kg s.c. if inhalation is not tolerated

Dose Terbutaline					
	Dose	5 Kg	10 Kg	20Kg	30Kg
Adrenaline 1:1000 undiluted i.m.	0,01 mg/kg s.c.	0,1 ml	0,2 ml	0,4 ml	0,6 ml

- Or Reproterol 1,2 µg/kg over 5–10 min

Dose Reproterol					
	Dose	5 Kg	10 Kg	20Kg	30Kg
Status asthmatics	1,2 µg/kg i.v. (Bolus 30–60 sec)	1,0 ml	2,0 ml	4,0 ml	6,0 ml

Tab. 11

Insp Stridor

- Adrenaline undiluted (1:1000) 0,01 mg/kg i.m.
- Adrenaline undiluted, 3-5 ml inhalation mask
- If tongue swell occurs after insect stich, apply/drop Adrenaline (1:10) on tongue

Shock

- Hypotension → Trendelenburg-positioning → Shock Therapy as described
- Adrenaline (Tab. 9)
 - If no reaction to Adrenaline i.m. repeat Adrenaline in 5-min-intervalls
 - If available, Emerade®, Fastjekt® i.m.
- If manifested shock (recap >3 sec) think of Adrenaline i.v. 1 µg/kg
 - Adrenaline (1:10.000=1:10 solved) 0,001 mg/kg i.v.
- Volume
 - NaCl 0,9%, Ringer-Acetat
 - Repeat to 100 ml/kg until RR and Recap are within normal ranges

- If necessary Noradrenaline: 0,1-0,5 µg/kg/min
- Intubation if loss of consciousness
- If paradox bradycardia (insect) → Atropine 0,02 mg/kg i.m/i.v

Dose Adrenaline					
	Dose	5 Kg	10 Kg	20Kg	30Kg
Adrenaline 1:10.000 (=1:10 solved) i.v.	0,001 mg/kg i.v.	0,05 ml	0,1 ml	0,2ml	0,3ml

Tab. 12

Keep in mind, that concentrations of drugs made by the hospital pharmacy can be different !

9.6 Tips

- Immediate apply Volume and Adrenaline i.m. = crucial therapy
- Secure airway and breathing
- Intubation (asses if intubation is necessary in prehospital setting)
- Be aware of bradycardia if insect stich (Apply Atropine)

10 Epileptic seizure

10.1 Main Points

- Most reason: febrile convulsions
- Document type and beginning (generalised, focal, absence, eye position)
- Exclude dangerous differential diagnosis
 - Hypoglycaemia
 - Hypocalcemia
 - Meningitis
 - Encephalitis
 - Electrolyte disturbances
 - Intracranial bleeding
 - Common initial symptom of stroke
 - Tumour
 - Intoxication

Epileptic seizure >3 min. → burst with medication but think of side-effects

- Apnea
- Airway obstruction through loss of muscular tone
- Difficult assessment of neurological status
- Aspiration hazard

10.2 Therapy

- Child is still convulsing
 - Care for position, reduce self-harm, protect head
 - Check glucose → hypoglycaemia → Glucose 20% 2,5 ml/kg or Glucose 10% 5ml/kg i.v.
 - No/less breathing or cyanosis: apply O₂
 - Support with mask ventilation if necessary
1. Early admission of Benzodiazepine, i.v. as epileptic seizure lasts longer than 5 min
 2. Use sufficient dose
 3. Use step-by-step therapy with escalation

Initial therapy

- Midazolam buccal (5mg/ml in jowl pouch)
- Midazolam nasal (5mg/ml) using MAD
- Lorazepam sublingual, buccal
- Diazepam rectal

If i.v. access is available

- Midazolam/Lorazepam i.v.
- If not, apply i.o. access → Midazolam/Lorazepam

Be aware of Apnea and Airway obstruction → prepare ventilation and suction.

Think of side effects! If epileptic seizure is witnessed, start therapy after >3 Min.

“Time is brain” ongoing epileptic seizure leads to a damage of brain structure.

Check glucose

10.3 Tips

- Midazolam intranasal or buccal as initial therapy
- No intubation in post ictal phase

11 Poisoning

Frequent causes

- Infant: accidental intake
- Juvenile: suicidal or experimental intake

11.1 Main Points

- Focus on vital signs, specific poison-therapy rarely possible
- Save substance (pill box, bottles, mushrooms, etc.)

Anticipate early and acute symptoms

- Apnea
- Airway obstruction
- Coma
- Epileptic seizure
- Cramp fit
- Hyperthermia

Dangerous Poisonings

- Antiarrhythmics
- Opioids
- Paracetamol
- Beta-Blockers
- Alcohol
- Cocaine, Ecstasy
- Acid fluids
- Mushrooms
- Some plants

Stop poison supply!

- Skin
 - Eliminate affected clothes, clean skin with running water and soap
- Eyes
 - Clean with running water
- Gastrointestinal tract
 - Eliminate “upwards”
- Call poison emergency number, if available
- Use antidotes, if necessary (Anticholinium, Atropin, Toluidinblau, Cynokit, Naloxon, Anexate, etc.)

Ingestion/Chemical burn

- Lye/Brine: Ammoniac, bleach, laundry detergent, go-devil
- Acidness: acid sulphur, WC-cleaner

11.2 Main Points

Take ingested solution to hospital. Measure pH! Note time and amount of ingestion. Leave sober, don't let drink water or milk, avoid vomiting, apply i.v. access.

12 Trauma

12.1 Specifics in child-trauma

- Fast body cooling → go to ambulance quickly
- TBI often without visible bounce mark
- Always think of injury of cervical spine
- Chest trauma often lung contusion without rib fracture
- Exposed upper abdominal organs

12.2 Accident mechanism

- Traffic accident (pedestrian, cyclist, co-driver)
- Fall from big heights (Fall outside window, treehouse, etc.)

12.3 Injury pattern

- TBI 70-90%
- Thorax trauma 30-44%
- Abdominal trauma 19-33%
- Limb trauma 26-63%
- Spine trauma 5%

Common combination trauma

- Fall from big height: TBI + bone fracture
- RTA: TBI, Lung contusion and Femur fracture
- Bicycle accident: injury of pancreas, duodenum and liver
- Injuries caused by being run over: pelvis fracture, gastrointestinal injuries, bladder ruptures

12.4 Primary Survey

- A = open airway and keep clear (and C-spine)
- B = breathing (supply O₂, mask ventilation, tension pneumothorax)
- C = Circulation (check circulation and treat shock, Recap >3 sec, HF↑, RR↓)
- D = Disability (check neuro status) -> AVPU + GCS children, Check pupils, Glucose
- E = Environment (plan transport)

Aim of primary survey:

- Early recognition of life threatening injuries
- Launching immediate measures

Aim of initial therapy:

- Secure gas exchange with sufficient oxygenation + stable hemodynamics

After stabilizing: Re-assess, bodycheck in extenso, record and detect every injury, void hypothermia, look for bounce marks.

13 Burnings

90% scalding, mostly 1-3 years

- Especially dangerous: Boiling oil and fat
- Typical mechanism: pulling down hot water/oil from cooking plate, or table → scalding face and thorax

10% burning

- Think of inhalation trauma when exposed to flat burning and CO-intoxication
- BBQ accident with methylated spirit

5 classes of burning:

I° = redness

IIa° = redness + blistering

IIb° = paleness + blistering

III° = no pain and leathery

IV° = carbonization

13.1 Initial Therapy

- Normalize vital signs
- Fluid therapy
- Analgesia
- When face or throat is involved, consider intubation
- Treat wounds with sterile compresses
- Use “Hand Principal” for assessment of affected body surface
- When signs of shock, apply i.v. or i.o. access
- Cool smaller wounds with hand warm water for max. 10 min.
- Keep warm (hypothermia increases lethality)
- Remove wet clothes
- Leave stick parts of cloths in place
- Check for other injuries
- Quick transport to hospital

14 Obstetrics/new-born care

14.1 Key points

- Unexpected birth at home/public area
- Unexpected problems after house birth
- Mostly breathing support necessary
- 1% need CPR
- Only 0,2% need intubation

14.2 Immediate Therapy

1. Free airway, lift chin, suction only if airway is obstructed with blood or mucus
2. Support with mask ventilation (21% oxygen!)
3. When not successful, that means bradycardia or asystole because of preceded hypoxia! VENTILATE!
Rarely chest compression or adrenaline.

14.3 First Aid Procedure of new-born

Primary assessment

- **Breathing** → spontaneous? Frequency, bilaterally equal lung excursions, skin colour
- **Heart rate** → feel umbilical cord pulse, >100bpm or apply SpO₂ on right hand → use APGAR (Tab. 13)
- **Cyanosis** <30 sec after birth is normal
- **Muscle tone** → equal?

SIGN	0	1	2
Heart rate	Absent	Below 100	Over 100
Respiratory effort	Absent	Slow, irregular	Good, crying
Muscle tone	Limp	Some flexion	Active motion
Reflex*	No response	Grimace	Cough or sneeze
Color	Blue, Pale	Body pink, Extremities blue	Completely pink
➤ 7 to 10 is normal ➤ 4 to 6 is moderately depressed ➤ 0 to 3 needs immediate resuscitation			

Tab. 13

Using APGAR is crucial for assessing the clinical condition of a new-born.

- Note the time
- Care for heat retention

Healthy new-born: strong crying, sufficient breathing, good muscle tone, heart rate >100 bpm

- Dry with towel and wrap in warm towels
- Nibble after earliest of 1-2 min. use 2 clamps, place 2-3 cm above abdomen. Cut in between, use 70% alcohol for disinfection, wrap compress around end-part
- Put new-born to mother, keep warm, care for continuous observation of new-born
- Transport to hospital

Unhealthy new-born: no strong crying, insufficient breathing, loose muscle tone, heart rate <100bpm

- Dry with towel and wrap in warm towels
- Nibble as fast as possible to begin CPR (use 2 clamps, place 2-3 cm above abdomen. Cut in between, use 70% alcohol for disinfection, wrap compress around end-part)
- CAVE: if there is a knot in the umbilical cord, scratch out toward new-born, than nibble (Volume!)

15 Infant CPR

Madar et al. – 2021 – European Resuscitation Council Guidelines 2021

Barn HLR (engelska) (hlr-experten.se) <https://www.hlr-experten.se/wp-content/uploads/CPR-poster-infant-child-50X70.pdf>