PNEUMOLOGY
for Dentistry

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Pediatric Pneumology

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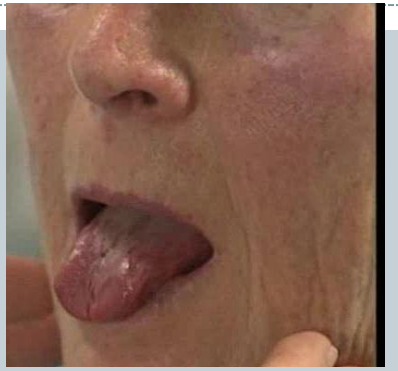
INFANTS	REASONS
• Metabolism↑	Oxygen consumption↑
• Higher risk of apnoe	Immaturity of the Respiratory Centre
• Resistence of upper respiratory tract ↑	Nasal breathing Size of tongue Diameter of airways↓ Colapsibility of airways↑
• Resistence of lower airways ↑	Diameter of airways↓ Compliance of airways ↑ Lower lung elasticityc↓
• Lung volume↓	Number of alveols ↓
• Efficacy of respiratory muscles ↓	Efficacy of diaphragm ↓ – horizontal insertion Compliance of ribcage ↑ Horizontal position of the ribs
• Respiratory muscle endurance ↓	Respiratory rate ↑ Number of fatigue resistance muscle fibers↓

COUGH

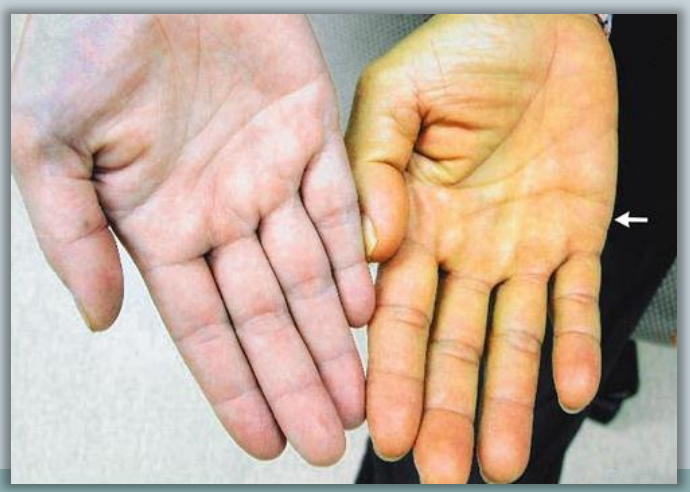
- Symptom = not disease
- Reflex – irritation of tusigennic zones (airways, external ear, esophagus, pericardium)
- DRY (unproductive) x WET (productive)
- ACUTE x CHRONIC < 4 weeks
- CHRONIC COUGH in children

1. Astma bronchiale
2. Gastroesophageal reflux – disease – GERD
3. Postnasal drip syndrom

CYANOSIS



- = reduced hemoglobin above 50 g/l
- Central x peripheral
- Depends on concetration of hemoglobin:
  - Anemia = ↓ incidence of cyanosis
  - Polycythemia= ↑ incidence of cyanosis



CONGENITAL DISORDERS OF THE NOSE

- Nasal hypoplasia
- Arhinia
- Supernumerary teeth
- Congenital nasolacrimal duct obstruction
- Choanal atresia
- Congenital defects of the nasal septum
- Pyriform aperture stenosis
- Congenital midline nasal masses – dermoids, gliomas, encephaloceles

CHOANAL ATRESIA

- 1:7000
- Unilateral x bilateral
- Bony 90 % x membranous
- 50-70% association with other anomalies
- 10-20% → the CHARGE syndrome

  Coloboma Heart disease Atresia choanae Retarded growth Genital anomalies Ear anomalies
- Clin. manif. – variable, cyanosis relieved by crying pláčem x during sucking
- Dg – catheter, fiberoptic rhinoscopy, HRCT
- Therapy – intubation, oral airway

Congenital facial anomalies

- Mandibular hypoplasia (Pierre-Robin syndrome)

  CAVE ! inspiratory airway obstruction
  - Micrognatia, retrognatia
  - High arched or cleft palate
  - Glossoptosis – with foreshortened floor of the mouth

- Cleft lip and palate
- High arched palate – common association with limited nasal breathing

CLEFT LIP and PALATE

- Typical – cleft lip, palate or cleft lip and palate
- Atypical – facial – oblique, medial, lateral
  - Incidence - 1:750 – 2500, boys > girls
  - Sporadically > possible association with 1 of 400 syndrome
- Cleft unilateral x bilateral
- Manifestation variable from small notch in the uvula to complete separation

Congenital anomalies of the Larynx

- Pharyngeal x Laryngeal obstruction

  obstruction worse during sleep worse with activity

- Manifestation – <u>inspiratory stridor:</u>

1. Laryngomalacia – inspiratory stridor worse during crying or activity (feeding)

   usually appear within first 2 weeks

   15-60 % synchronous airways anomalies – complete bronchscopy in case of moderate to severe obstruction

   common gradual improvement

2. Congenital subglottic stenosis

   – recurent or persistent croup

   - usually cartilaginous

Congenital anomalies of the Larynx

Vocal Cord Paralysis

Unilateral – aspiration, coughing and choking, wek and breathy crying

Bilateral – airway obstruction - stridor

Congenital laryngeal web – glottic with subglottic extension = subglottic stenosis

Congenital subglottic hemangioma – hoarseness, stridor, barking cough

Posterior laryngeal cleft– symptoms of aspiration

laryngotracheoesophageal cleft

Congential tracheal and bronchial anomalies

- Vascular and cardiac anomalies:

  Vascular ring or sling

  = coughing, stridor, dyspnoea
- Tracheal stenoses, webs and atresia

- Tracheomalacia

TRACHEOESOPHAGEAL FISTULA

- 1:3500, common assoc. with esophageal atresia
- 84 % trachea connected with distal esophagus
- 50% syndromic, other anomalies (Charge sy…)

Distal fistula

- early after birth - frothing
- cough, cyanosis,
- stomach distension
- aspirations

H- type fistula 4 %

- later onset
- chronic respiratory problems (bronchospasms, pneumonias)
- respiratory symptoms during feeding
- recurrent pneumonia

Congenital disorders of the lung

- Pulmonary agenesis x pulmonary aplasia
- Unilateral left x right
- Pulmonary hypoplasia – limited space in thorax – limited breathing movements and/or ↓pressure of amnial fluid
  - Cystic adenomatoid malformation
  - Diaphragmatic hernia
  - Oligohydramnion – maternal disease, congenital renal anomaly
  - Congenital neuromuscular disease

  Lower number of alveoli and airway generations
- Pulmonary sequestration – extrapulmonary or intrapulmonary
  - Lung tissue withou connection with bronchus, arterial supply from the systemic arteries
  - Repeated infections, expansion

Congential disease of the lungs

- Congenital lobar emphysema – neonatal period – respiratory distress, congenital overdistension of affected lobe – shift of mediastinus, atelectasis of normal lung tissue
  - Immediative surgery x conservative treatment
- Cystic adenomatoid malformation – cystic dysplastic lung tissue of one lobe – different types with variable prognosis
  - Respiratory distress in early infancy
  - Recurrent pneumonia, pneumothorax
  - Surgery for symptomatic patients

CONGENITAL DIAPHRAGMATIC HERNIA

- 1:2000-1:5000
- Pulmonary hypoplasia, pulmonary hypertension
- Prenatal diagnosis
- Early respiratory distress of neonates
- Manifestation – weak breathing sounds, niveau of abdominal wall bellow – scaphoid abdomen, shift of heart sounds (mediastinum) bowel sounds in the chest

X- RAY

- transport in utero – specialized centrum
- Orotracheal intubation + ventilatory support
  x avoid resuscitation with ambuvac with mask
- Nasogastric tube - stomach air bubble

DYSPNEA

- **Dyspnea** =*shortness of breath* or air hunger, subjective symptom of *breathlessness*
  - small children – according to objective symptoms and clinical signs

- **Division: acute** x chronic> 3 weeks

  obstructive x non - obstructive

  inspiratory x exspiratory x mixed

DYSPNEA – clinical manifestation

- **Alar flaring of the nose, retractions of jugulum, supraclavicular and intercostal retractions**, g**runting**
- **Gasping**
- **Orthopnea –** vertical position, often with upper arms fixation
- **Different respiratory rate and breath volume:tachypnea, hyperpnea** (low airways obstruction), rapid and deep breathing pattern – extrapulmonary – Kussmaul´s during diabetic ketoacidosis or renal tubular acidosis or stimulation of respiratory centrum (encefalitis, psychostimulancia)
- **Apnea – arrest > 20s, bradypnea-** intoxication with sedatives
- Different ration inspiration/exspiration
- **Inspiratory stridor** – airwax obstruction above middle trachea

  x lower part of trachea nad distal airways – **exspiratory breathing sounds** (wheezing, rackles)
- **Cyanosis** – concentration of reduced hemoglobin >50 g/liter, CAVE – depends on global hemoglobin – anemia or polyglobulia
- Chronic hypoxia – **digital clubbing**
- Irritability or **apathy, hypercapnia a imminent respiratory failure**

DYSPNEA IN INFANCY

- Infants – inability increase tidal volume
  - Horizontal position of diaphragma and ribs, lower efficacy of respiratory muscles
- Tachypnea
- Retraction of low ribs (Hoover´s sign) = intensive contraction of horizontal diaphragma during inspiration
- Parents usually recognize difficult feeding (intemitent sucking) or tireness, intolerance prone position

PHYSIOLOGIC RATES

	Respiratory rate per minute	Heart rate (beats/min)	Minimal systolic blood pressure (mmHg)
Immature neonates	**60-100**	100-180	*
Mature neonates	**40-60**	100-160	*
1 year	**30-60**	100-160	>60
Toddler	**24-40**	90-150	>70
Preschool age	**22-34**	80-140	>75
School age	**18-30**	70-120	>80
Adolescent	**12-20**	60-100	>90

Lung and airways	**Etiology – differential diagnosis**
Infection	Laryngitis
	Laryngotracheobronchitis (croup)
	Epiglotitis
	Absces - retropharyngeal, retrotonsilar etc., tonzilitis acuta
	Bronchitis obstructiva
	Bronchiolitis
	Pneumonia
Central airways obstruction	Choanal atresia, bronchomalacia, tracheomalacia, vocal cord paralysis, mediastinal tumour, vascular ring etc.
Periferal airways obstruction	Asthma bronchiale, cystic fibrosis, α1 antitrypsin deficit
Alveoli – lung intersticium damage	ARDS, pulmonar hemoragia
Thorax	Kyphoscoliosis, diaphragmatic hernia or eventration etc.
Decreased lung mechanics	Pneumothorax
Extrapulmonar	
Cardiovascular	Left right shunt, insuficiency, pulmonary veins stenosis
Central	Encephalitis, trauma, intracranial hypertension, drugs
Metabolic	Ketoacidosis, renal tubular acidosis, hereditary metabolic disorder
Shock	Sepsis, anafylaxis, hypotension
Neuromuscular	Myopathy, Guillain-Barré syndrome, poliomyelitis, …

UPPER AIRWAYS OBSTRUCTION

- inspiratory stridor, severe obstruction or in case of narrowing of middle trachea - mixed stridor
- Prolonged inspirium, activity of accessory muscles – retractions, orthopnoic position

1. Acute laryngitis
2. Acute epiglottitis
3. Foreign body aspiration
4. Foreign body in Killian´s space in esophagus

5. Allergic swelling – anaphylaxis – laryngeal edema, tongue and throat swelling, afebrile without signs of infection, dysphagia
6. Peritonsillar abscess - fever, odynophagia, dysphagia, trismus, asymmetric tonsillar bulge with shifted uvula
6. Retropharyngeal abscess – commonly <3-4 y (boys, fever, dysphagia, drooling, decreased oral intake, muffled voice, stridor, torticollis or nech stiffness, bulging of posterior pharyngeal wall, dg. CT
7. Bacterial laryngotracheobronchitis – mixed dyspnea, signs of bacterial infection

Lower airways obstruction

- Exspiratory dyspnea - prolonged forced acive exspiration with activity of accessory muscle, exspiratory noises (wheezing, rhonchi) and ev. inspiratory position of thorax (hyperinflation)
- CAVE – silent thorax – weak lung sounds
- Infants and toddlers - obstructive bronchitis (virus induced wheezing), bronchiolitis and acute exacerbation of asthma - dif dg in children > 5 y difficult
- Foreign body aspiration – distal position

NON- OBSTRUCTIVE DYSPNEA

- Infants and toddlers – pneumonia or sepsis, premature infants with RDS or bronchopulmonary dysplasia (chronic lung disease=CLD)
- Congenital anomalies of respiratory system
- Extrapulmonar etiology – congenital heart disease or diaphragmatic hernia
- **Cardiac etiology** – cyanosis without effect of oxygenotherapy, fatigue, tachycardia or specific findings (heart murmurs, arrythmia, weakened pulsation etc.).
- **Sepsis in neonates** - tachypnea or apneic pauses, fever or hypothermia, worsened perfussion, tachycardia, bradycardia or organ dysfunction
- **Pneumonia** – signs of infection, fever, cough, chest pain, typical auscultation (diminished lung sounds, bronchial breathing, asymetric ausculation, rarely fine crackles), atypical pneumonia (radiology>clinical manifestation)
- **Pneumothorax –** dry cough, diffuse chest pain or sharp lokalised pleural pain, limited thoracical movements, tachypnea, ev. cyanosis, diminished lung sounds and hypersonoric percussion, mediastinal shift, rarely subcutaneous emphysema palpable or abdominal distension with pneumoperitoneum

DYSPNEA - Therapy

- **Generally**
- Immediately assess vital function, airways patency and ev. initiation of cardiopulmonary resuscitation according to current guidelines
- Symptoms of severe respiratory insufficiency (cyanosis, „silent thorax“, severe tachycardia with tachypnea, ev. bradycardia, hypotension etc) - urgent transpport by emergency, vital function monitoring, moistened warm oxygen by nostrils or mask

UPPER AIRWAYS OBSTRUCTION

- Nasopharyngitis acuta
- Tonzilitis acuta
- Sinusitis acuta
- Epiglottitis acuta
- Laryngitis acuta
- Tracheitis acuta
- Bronchitis acuta
- Bronchiolitis acuta
- Bronchopneumonia

PHARYNGITIS, TONSILLITIS ACUTE

- Viral x bacterial x mycotic
- Streptococ. pyog. - risk of poststreptococcal complications – antibiotics apply till 9 days from first symptoms

  - clinical incertainty – CULTIVATION
- Exudative tonsillitis – viral – EBV, CMV , adenovirus..

  - mycotic

Complications:

early – peritonsilar abscess

late – poststreptococ. glomerulonephritis, rheumatic fever

TONSILLITIS acuta

- Therapy: 1. Penicillin 50.000-100.000 IU/kg/day
  every 6 to 8 hours for 10-14 days
  phenoxymethylpenicillin
  2. ev. macrolides as alternative for allergy

SINUSITIS ac.

- Sinuses - development:
  - neonates – ethmoid
  - Maxillar from 2 years
  - Frontal after 6th year
  - Sphenoid sinus about 10 years
- Limited form during any acute rhinitis
- Commonly follows upper respiratory infection
  x up to 13 % odontogennic origin

Sinusitis acuta

- Bacterial sinusitis:

1. biphasic course of respiratory infection
2. Acute respiraotry infection > 10 days, progressive worsening

- Fever, purulent nasal secretion, frontal headache, toothache, muffled voice, dysosmia, anosmia, malaise
- COUGH = sinobronchial syndrome – typically nocturnal
- Complications – neuroinfections, orbitocellulitis

SINUSITIS ACUTA - TERAPIE

- Therapy:
  - Antibiotics
  - Mucolytics
  - Nasoconstrictive nasal drops
  - Ev. intranasal cortico steroids (allergy)
- Punction, surgery

INSPIRATORY DYSPNEA – dif. dg.

LARYNGITIS ac.

- ACUTE onset
- Subfebrilia
- Viral (rhinitis, cough)
- Barking (rough) cough
- Swallowing OK
- Dysphonia
- Tolerance of horizontal position, usually restlessness

EPIGLOTTITIS ac.

- Progressive deterioration
- Febrilia
- Bact. – Haemophilus infl
- Careful cough
- Drooling, odynophagia
- Silent speech or refuse
- Refuse horizontal position, markedly calm

INSPIRATORY DYSPNEA- therapy

Laryngitis acuta

- Downes score

therapy amb x admission (> 2) x ICU

(> 7 – intubation)

- Calm moistened neulisation
- Nebulized adrenalin
- Corticosteroids

	1	2 points
Auscultation	Wheezing,rhonchi	Weak sound
Stridor	Inspir.	Insp-exsp
Cough	Rough	Barking
Retractions, alar	Jug+ Supraclav.	+subcostal +intercostal
Cyanosis	Fi02 0,21	0,4

Epiglottitis ac.

- High risk of suffocation!!!!
- Emergency – transport to ICU with doctor, no laboratory examination, calm
- Acute suffocation – open airways (intubation, mask with lateral position, coniopunction)

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- Antibiotics
- Endotracheal intubation, ev. tracheostomy

INFECTION OF LOWER AIRWAYS

- Bronchitis acuta
- Bronchitis obstructiva – therapy similat to asthma bronchiale
- Bronchiolitis acuta
- Repeated infections:
  - Cystic fibrosis
  - Primary ciliary dyskinesia (ev Kartagener syndrome)
  - Imunodeficiency

BRONCHIOLITIS ACUTA

- Age < 2 y, mainly < 6 mo
- RSV, ADV, influenza, parainfluenza, HMPV, B. pertussi, parapertussis, H. influenzae, Mycoplazma etc.

- Obstruction of bronchiols :

  atelectasis + hyperinflation

- Clinical manifestation:
  1. Mixed dyspnea with insufficient effect of bronchodilators
  2. Tachypnea, grunting, alar flaring, retractions
  3. Hyposaturation, low Pa02
  4. Increased respiratory effort
  5. Hypoventilation, cyanosis
  6. Respiratory insufficiency

BRONCHIOLITIS ACUTA

- X RAY – microatelectasis, emphysematic loci, peribronchial infiltration
- Monitoration: sat 02, RR, HR, repeated Astrup
- THERAPY:
  - Oxygenotherapy – warm moistened oxygen
  - Bronchodilatation – possible effect
  - Severe dyspnea – nasogastric tube or parenteral nutrition
  - Corticosteroids in high risk patinets, with ventilatory support

  ……
  - Early tracheal intubation
  - Mechanical ventilation – high risk of barotrauma - high rezistence
  - Suction of secretions

BRONCHIOLITIS ACUTA

- RISK FACTORS:
  - Age below 6 weeks
  - Immaturity <35.gt
  - Bronchopulmonar dysplasia
  - Cystic fibrosis
  - Imunodeficiency
  - Congenital heart disease
- PREVENTION: vaccination – PALIVIZUMAB – monoclon. antibody against RSV
  - High risk neonates < 35.week, age < 6 mo in autumn
  - BPD - age<2 y

CYSTIC FIBROSIS

- AR, 1: 2700-4000, neonatal. screening (till r. 2009)
- Multiorgan disease:
  - Chronic progres. damage of airways and lungs
  - Pancreatic insufficiency – failure to thrive
  - High concentration of chlorides in sweat
  - Reproduction
  - Hepatic disfucntion, diabetes, osteoporosis etc
- Mutation gene CFTR – chlorine cannal apical membrane – worsened mucocil. clearance, chron. bact. infection

CF - NEONATES

NEONATES:

- meconium ileus
- protracted icterus
- failure to thrive (till 1 mouth child below birth weight)
- hypoproteinemia with edema
- metabolic failure with hypoelectrolytemia and metabolic alkalosis

INFANTS:

- Failure to thrive with good appetite
- steatorhea – fatty stools X diarrhea (milk allergy, celiac disease)
- rectal prolapse

CF – OLDER CHILDREN

- Growth retardation, weight/height ration< 3. perc.
- Repeated sinusitis, nasal polypes, chronic cough, recid. bronchitis
- digital clubbing

ADULTS:

- obstructive azoospermia as simple simptom or associated with chornic sinusitis or mild respiratory symptoms in mild forms

Respiratory complications CF

- recid. sinusitis
- Nasal poylpes
- Alerg. bronchopulm. aspergilosis
- pneumothorax
- Hemoptysis
- Resp. insuficiency parc. – cor pulmonale
- Resp. insuficiency global – during exacerbations

Cystic Fibrosis

- INHALATION of MUCOLYTICS
- RESPIRATORY PHYSIOTHERAPY – daily
- Prevention of infection – vaccination, antibiotics administration – inhalations, preventive application, longterm

PNEUMONIA

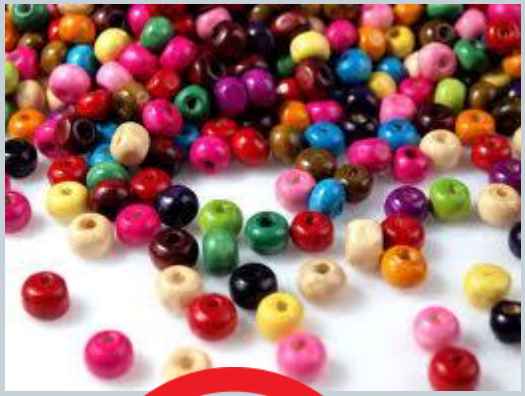
- CAP =community acquired x nosocomial

RISK FACTORS :

1. Imunodeficiency
2. Chronic lung disease (asthma, cystic fibrosis, anomalies, bronchopulmonary dysplasia, alfa1-antitrypsine deficiency)
3. Immaturity
4. Severe course of pneumonia – hyposaturation,extrapulmonary symptoms – meningitis, arthritis..., severe X RAY- pleural effusion, infiltrates bilateral
5. Renal failure
6. Severe leucocytosis, leukopenia
7. Non – compliance of family

ASPIRATION OF FOREIGN BODY

- Subject ?
- Size?
- Amount?
- Age

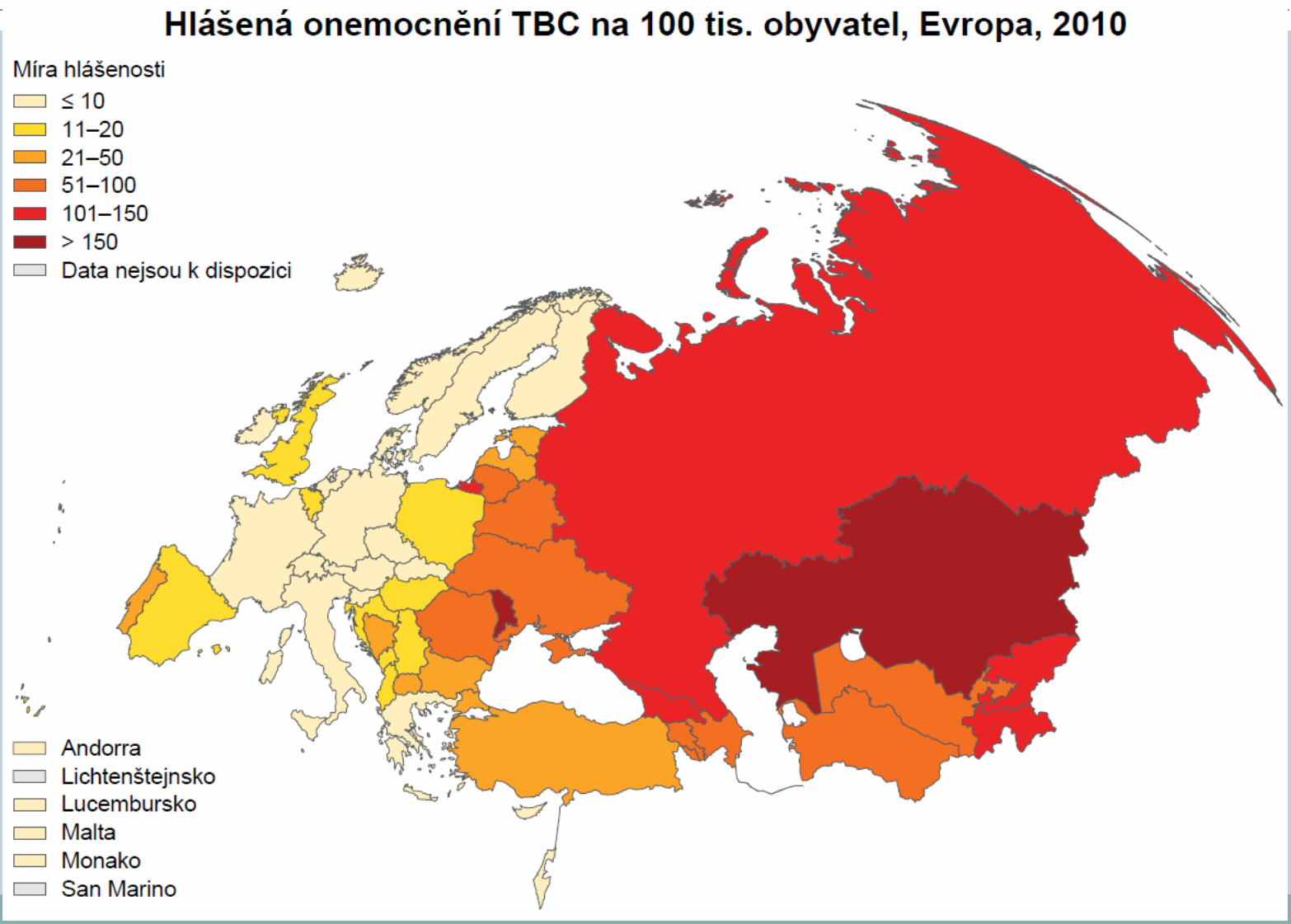


RECURRENT PNEUMONIA

- Same localizations:
  1. Congenital anomaly of airways
  2. External or internal obstruction of airways
  3. Intralobar pulmonary sequestration

- Different localizations:
  1. Immunodeficiency
  2. Microaspirations, aspirations, GERD
  3. Primary ciliary dyskinezia

TUBERCULOSIS



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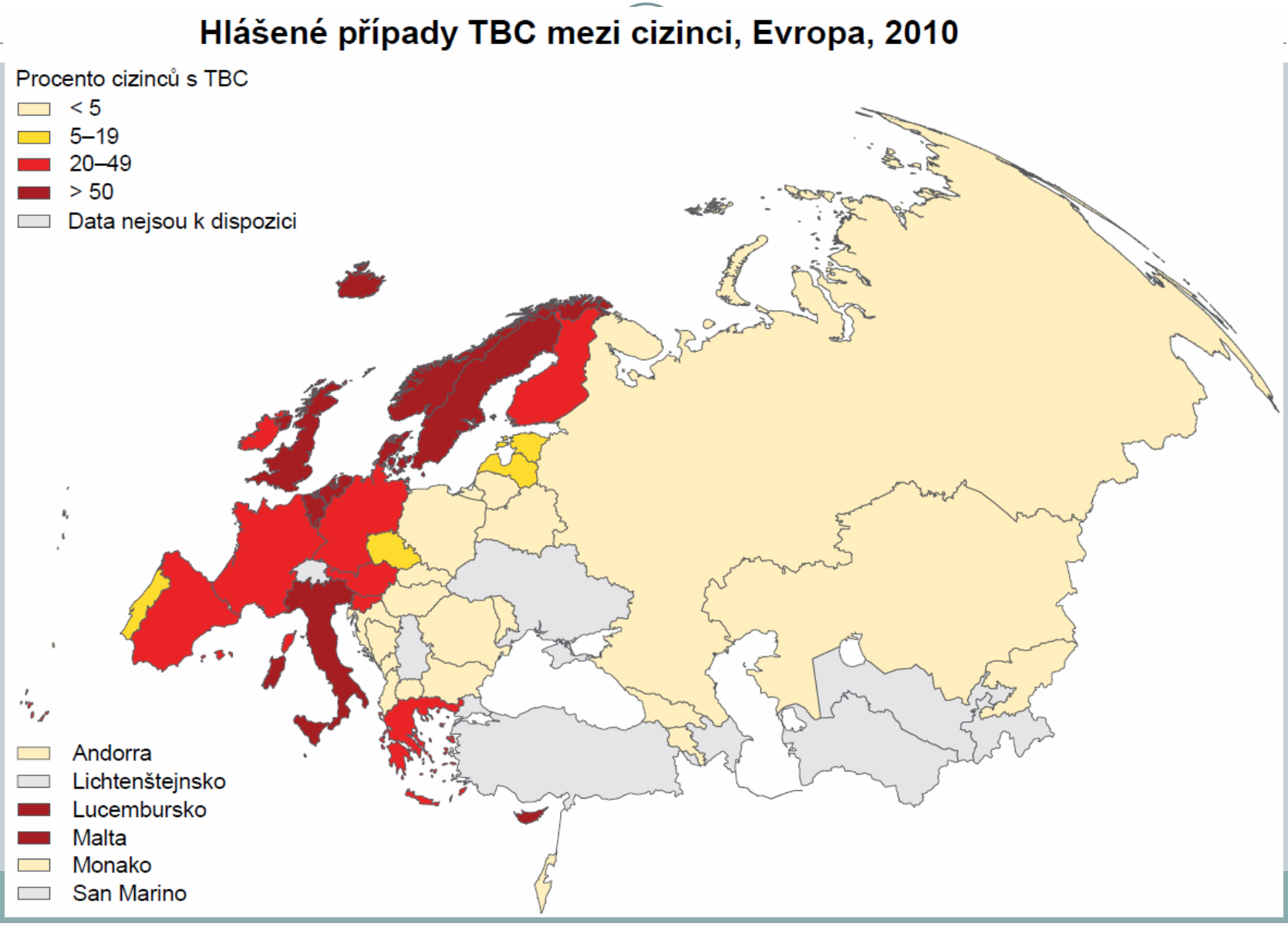

ASTHMA BRONCHIALE

- Obstruction of lower airways – mucus, spasm, swelling of lining

- SYMPTOMS:
  - COUGH
  - WHEEZING
  - TIGHT CHEST
  - DYSPNOEA, breathing troubles druig exspiration

ASTHMA BRONCHIALE

- AIM of therapy :
  - Allow sufficient longterm physical activity = necessary for appropriate development of child
  - To fully control the disease
- Modern drugs:
  - Treatment should be titrated to minimal drug dose/combination = allow children sufficient physical activity with asthma below full control

ASTHMA BRONCHIALE

- TREATMENT:
  1. Bronchodilatators = quick-relief medicines (“relievers”) – effect within 10-15 minutes, puffs by inhalation, preferably with aerochamber, everyone with asthma
  2. Preventive medicines (“controllers”) – daily, not all asthmatic people, lower risk of asthma exacerbation

BRONCHITIS OBSTRUCTIVA

- Exspiratory obstruction during URI
- Similar symptoms as asthma – wheezing, cough, dyspnea
- Infants, toddler, preschool children
- Difficult to distingish persistent wheezer (asthma) from transient wheezer
- Same management of acute dyspnea