# Real-time MRI for thoracic and lung evaluation in children: Highway to future MRI or dead end road?

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# Problem of lung MRI in small children

- motion artifacts caused by respiration and heart movements

# Up to date - triggering

- very long examination time, sedation in small infants
- still: in about 10% lung MR is affected by artifacts

## New approach: Real-time MRI?

- time for each image faster than any physiological motion

Objective

M&M



# Lung MRI until now in young children

# Triggered T2-TSE sequence Akquisition time ~ 4:45 min



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Objective

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Volume coverage

## **Real-Time-MRI**

Only 30 ms per image No artefacts due to movements No sedation

Standard image reconstruction unit T2-TSE

Bypass



 Objective

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Volume coverage

## **Real-Time-MRI**

Only 30 ms per image No artefacts due to movements No sedation

Standard image reconstruction unit T2-TSE

MR operating console

Bypass

# real-time-T2

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Real-time MRI is available in two weightings: proton (pd) and T2-weighting Example of pd-weighting: 16 y girl with **lung metastases of a rhabdomyosarcoma** 



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Example of T2-weighting RT-MRI: a two-day-old neonate with a **bronchocele** 



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Example of T2-weighting RT-MRI: Three-day-old neonate with **multiple pneumonic nodules** 



Example of T2-weighting RT-MRI: Three-day-old neonate with **multiple pneumonic nodules** 



Three-year-old boy with **Ewing's sarcoma of the 5th rib** 



Three-year-old boy with **Ewing's sarcoma of the 5th rib** 



## Which types of lung lesions and which minimal size

## of lung lesions that can be identified with RT-MRI?

## What are the current limitations of RT-MRI of the lungs?

### 87 children 0-16 years, 87 lung lesions

Only one finding per child (= index lesion) to avoid accentuation of multiple occurring entities such as pulmonary metastases

### Definition of six subgroups, detected on conventional lung MRI

- 1. Metastases and tumors
- 2. Consolidation
- 3. Scars
- 4. Hyperinflation
- 5. Interstitial pathology
- 6. Bronchiectasis

### **Classified lesions grouped into 3 categories according to size**

4–6 mm, 7–9 mm, and ≥ 10 mm

### Visual delineation of the findings (each for PD- and T2-weighting)

Score 0 = not visible Score 1 = hardly visible Score 2 = well visible Objective

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Results

**Consolidation (pneumonia and atelectasis)** Lesions detected with high reliability 100% 100% 100% 88% 75% 80% 64% 60% 40% 24% 20% 0% 4-6 mm 7-9mm ≥10 mm Size of lesion T2w VC PDw VC



Objective

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Results

**Metastases and tumor** 100% 100% 100% 83% 80% 60% 50% 40% 18% 20% 0% 0% 4-6 mm ≥10 mm 7-9mm Size of lesion PDw VC T2w VC

## Real-time examination is a significant innovation for pediatric radiology

- A) Fast examination even in small neonates and children
- B) Artifact free technique regarding physiological movements

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### However, it is still a work in progress

RT-MR must become more sensitive with respect to small lesions



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Results

# Thanks for your attention!



