Lung MRI

- No radiation !!
- Accurate diagnostic tool for both parenchymal , mediastinal and chest wall diseases !!
- Replacement of routine follow-up chest CT scans with MRI would significantly decrease the radiation exposure in children.

Today Thorax MRI for children

- Infectious and Inflammatory Diseases (e.g. Bacterial/Viral Pneumonia, Fungal Infections, Cyst Hydatid)
- Malignancy (Mediastinal masses, Primary Tumors of Lung and Metastasis, Chest Wall Tumors)
- Congenital Thorax Diseases (e.g. Congenital Diaphragm hernia, CPAM, Pulmonary Sequestration)
- Systemic Diseases (e.g. Cystic Fibrosis, Sarcoidosis)

Lung MRI Protocol

- Patient Preparation**
  - >5-6 years old: Coaching patients on breathing techniques→Breath-holding technique
  - <5-6 years old : intranasal 0.1–0.2 mg/ kg Dormicum Roche, or general anesthesia
    - –Free breathing : Respiratory triggering*
    - –ECG triggering→cardiac pathologies!!

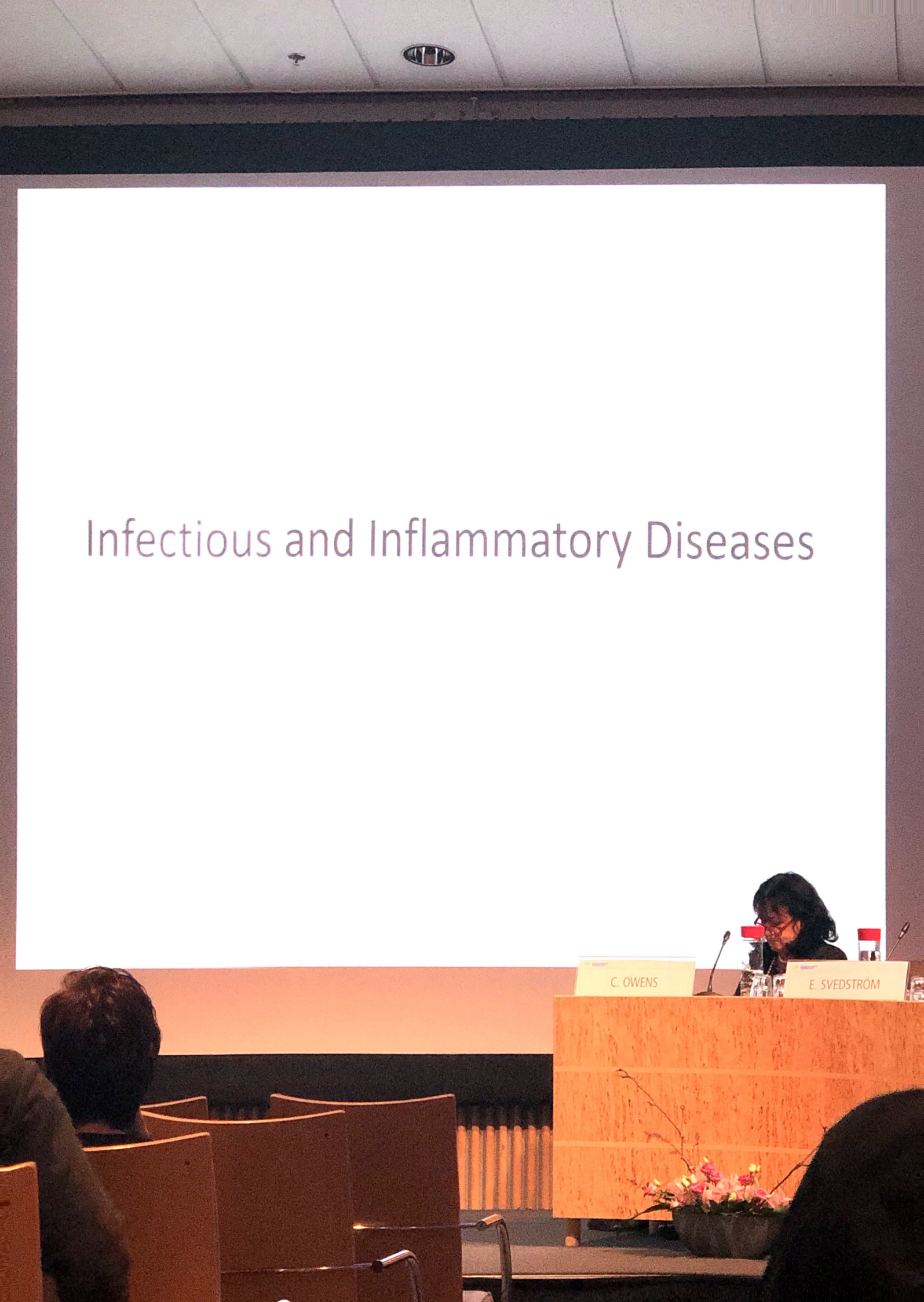
OUR LUNG MRI PROTOCOL

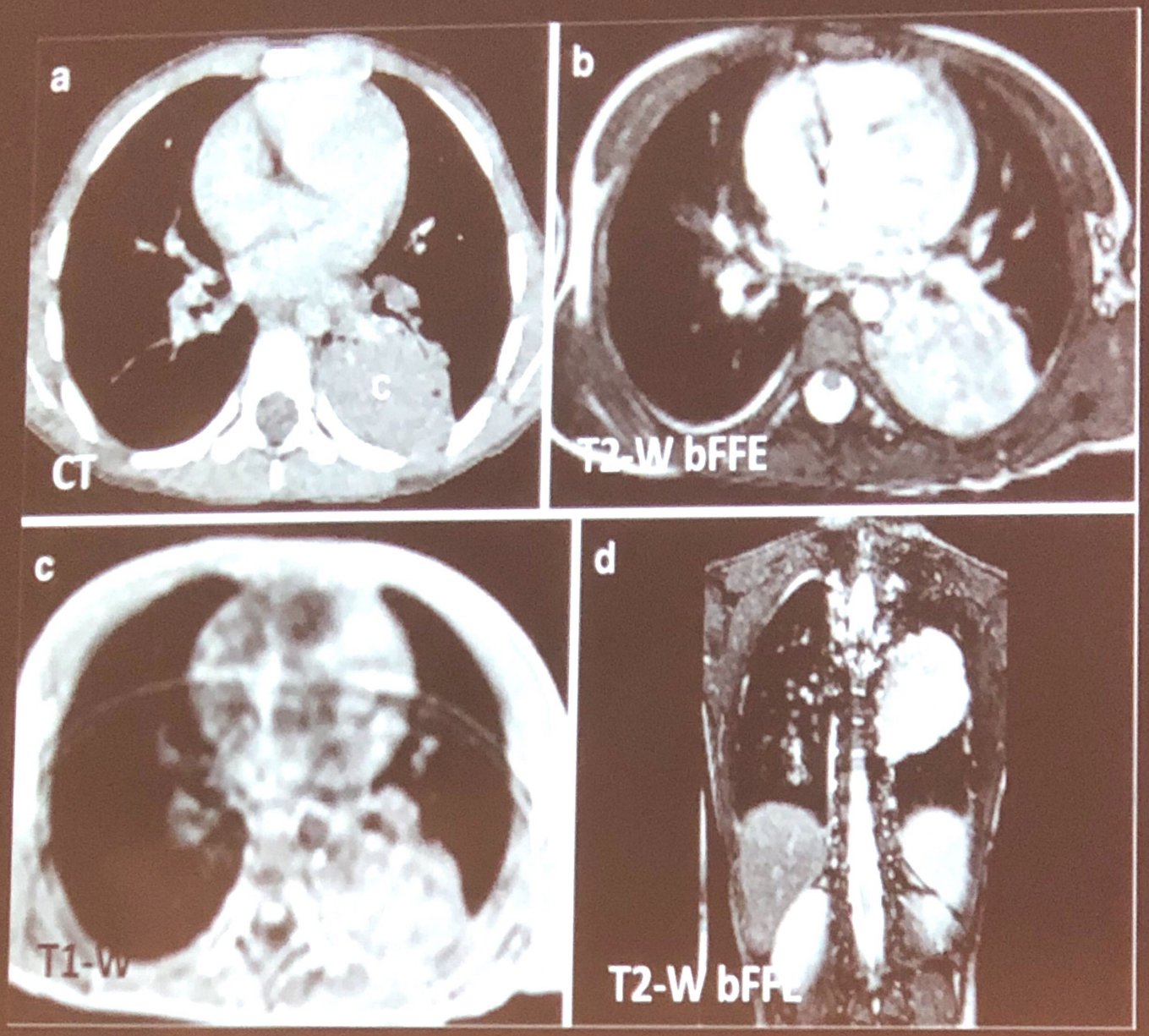
- Chest MRI: 1.5 Tesla MRI unit with a body coil.

- The protocol included (*contrast-enhanced) free breathing fast four sequences :
  - 1) T2-HASTE in coronal plane ;
  - 2) T2-BLADE (or STIR) in axial and coronal planes;
  - 3) T2-TRUFI in sagittal or coronal plane;
  - 4) T1-VIBE fat saturated or non fs in axial plane;
  - 5) DWI *(b=600-800 mm2/sec)* in axial plane
  - 6) *Contrast-enhanced T1-VIBE fat saturated in axial plane (0.1 mmol/kg gadolinium)
  - Slice thickness= 4 mm
  - The duration= 6 min.10 sec ± 1.5 min. The average total time on the MRI table=10 ± 5 min.

Why fast sequences?

- High spatial resolution
- Short echo time (TE)
- Preferably for breath hold imaging
- To reduce the need for sedation
- Comparable with MDCT


Infectious and Inflammatory Diseases
C. OWENS
E. SVEDSTRÖM



Lung magnetic resonance imaging for pneumonia in children.
Liszewski MC, Görkem S, Sodhi KS, Lee EY . Pediatr Radiol. 2017 Oct;47(11):1420-1430.

C. OWENS

INFECTIOUS/INFLAMMATORY DISEASES

IF INITIALLY DIAGNOSED

+C LUNG CT

FOLLOW-UP

+/-C LUNG MRI

DIAGNOSTIC AND FOLLOW-UP

+/-C LUNG MRI

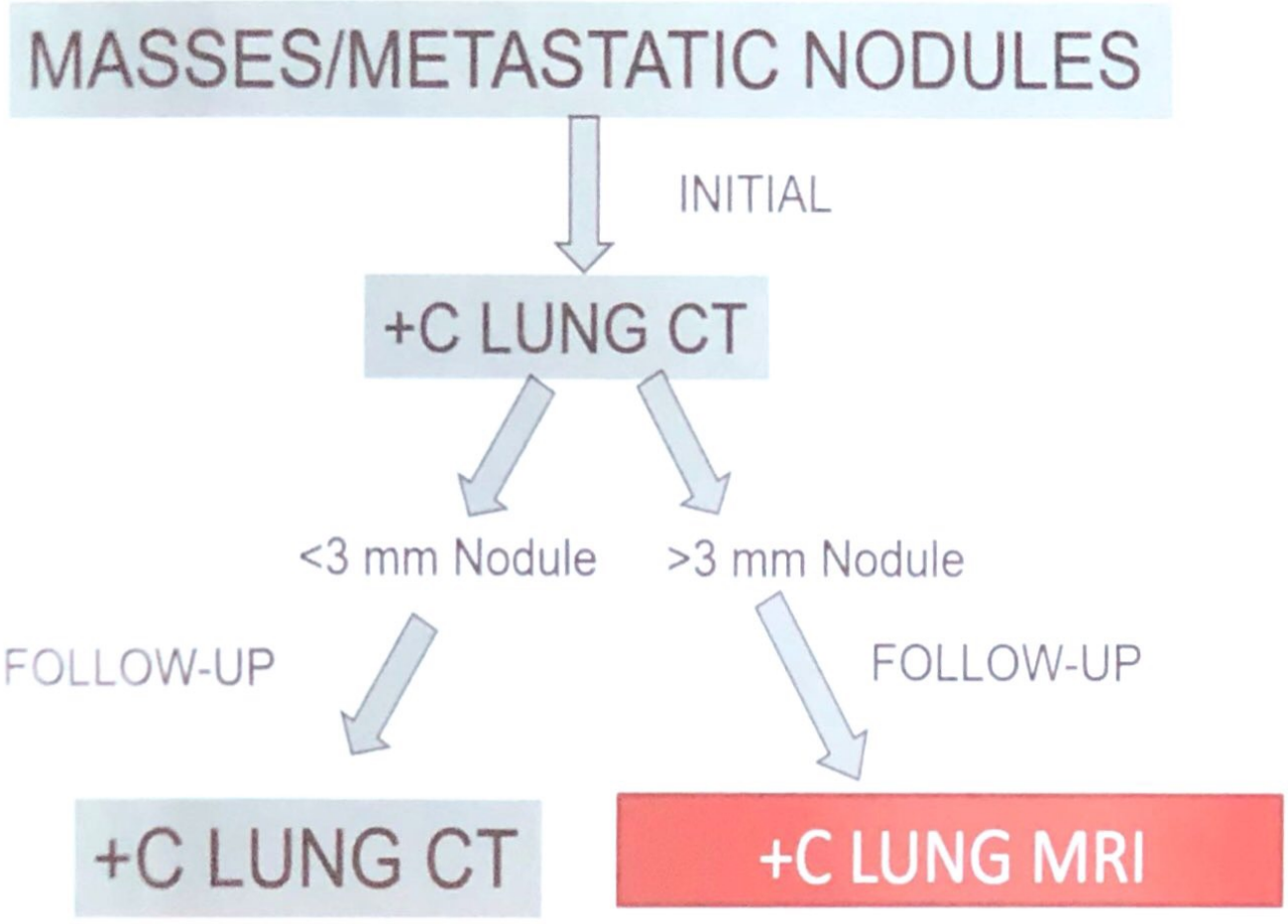
Malignancy

- Mediastinal
  - * Lymphoma, Leukemia, Germ cell tumors, Neurogenic tumors
- Chest Wall Tumors
- Parenchymal tumors
  - Metastatic disease
    - Osteosarcoma, Wilms tumor, neuroblastoma and Ewing's sarcoma
  - Primary lung tumors
    - Pleuropulmonary blastoma*** most common primary lung tumor

Nodule Detection

- **Gorkem et al.**; Two undiagnosed findings with MRI that were detected with MDCT were mild bronchiectasis and small pulmonary nodule (<3 mm).
- **Sodhi et al.** ; MRI can emerge as the first line modality for the detection of pulmonary nodules (≤ 3cm) in children with leukemia and persistent febrile neutropenia.
- **Sodhi et al.;** MRI with a new rapid MRI protocol demonstrated sensitivity, specificity, PPV, and NPV of 100% for detecting pulmonary consolidation, nodules (>3 mm), cyst/cavity, hyperinflation, pleural effusion, and lymph nodes.

- *Gorkem SB et al. Evaluation of pediatric thoracic disorders: comparison of unenhanced fast-imaging-sequence 1.5- T MRI and contrast-enhanced MDCT. AJR 2013 Jun;200(6):1352-7.
- *Sodhi KS et al. Rapid lung MRI - paradigm shift in evaluation of febrile neutropenia in children with leukemia: a pilot study. Leuk Lymphoma. 2016 Jan;57(1) 70-5
- *Sodhi KS et al Rapid lung MRI in children with pulmonary infections: Time to change our diagnostic algorithms. J Magn Reson Imaging. 2015 Nov 6.


MASSES/METASTATIC NODULES
INITIAL
+C LUNG CT
<3 mm Nodule
>3 mm Nodule
FOLLOW-UP
FOLLOW-UP
+C LUNG CT
+C LUNG MRI

Congenital Thorax Malformations

- Pulmonary sequestration
- CPAM
- Congenital lobar emphysema
- Bronchogenic cyst, Duplication cyst of esophagus
- Congenital diaphragmatic hernia
- Diaphragmatic eventration
- Pulmonary vascular malformations
- Bronchial atresia
- Pulmonary hypoplasia
- Pulmonary agenesis

Key Points to Image Effectively

- Fast (Use Fast T2 sequences to reduce sedation need, examination time)
- Clear (Avoid breath-motion artefacts)
- Coverage (Axial, Coronal or Sagittal)
- Definitive (Add sequences: FS,STIR, DWI or contrast)