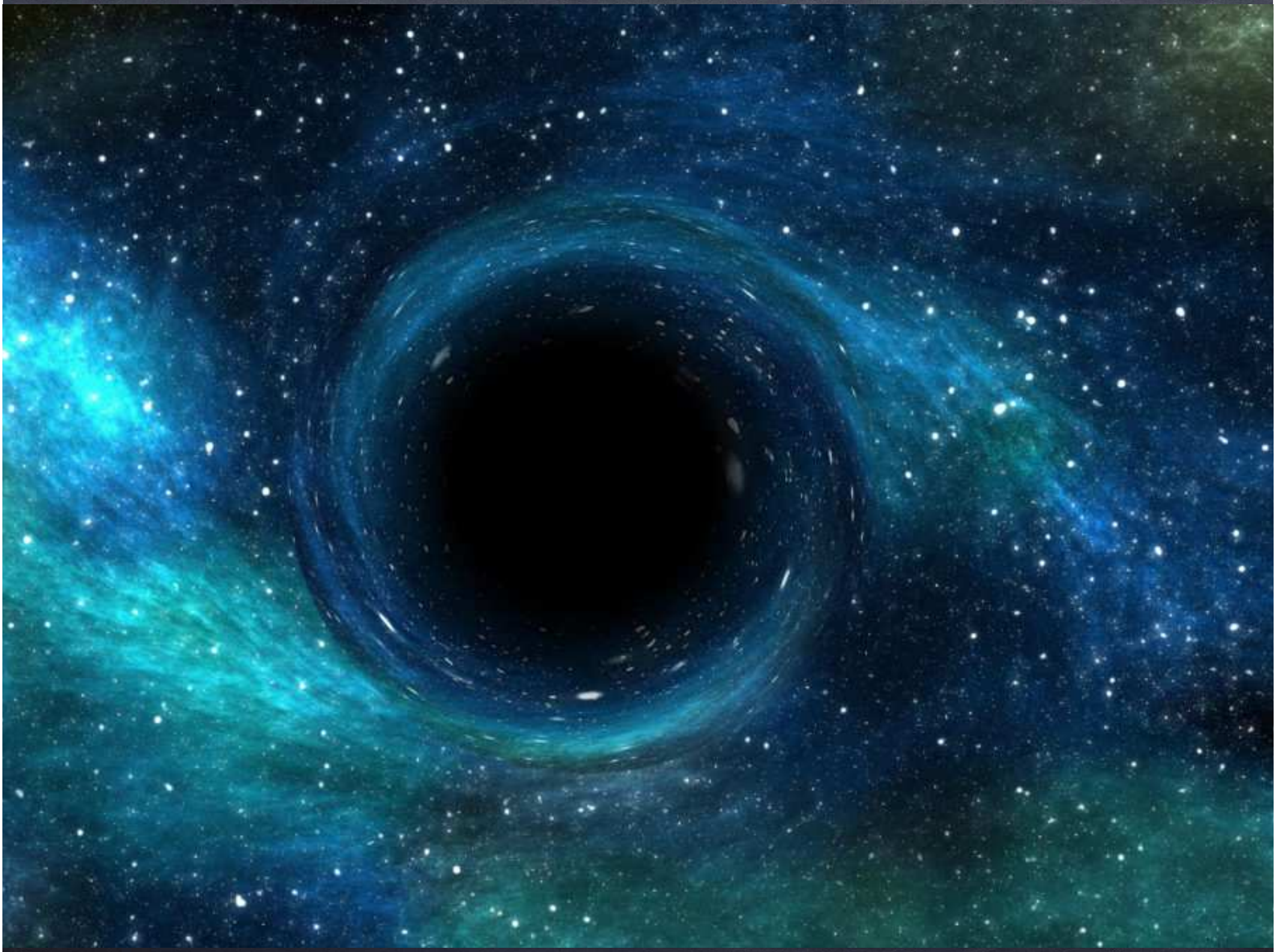
ELEMENTI DI APPROPRIATEZZA APPLICATI: RM TORACE E MEDIASTINO

Dott.ssa Elisabetta Cattaruzzi



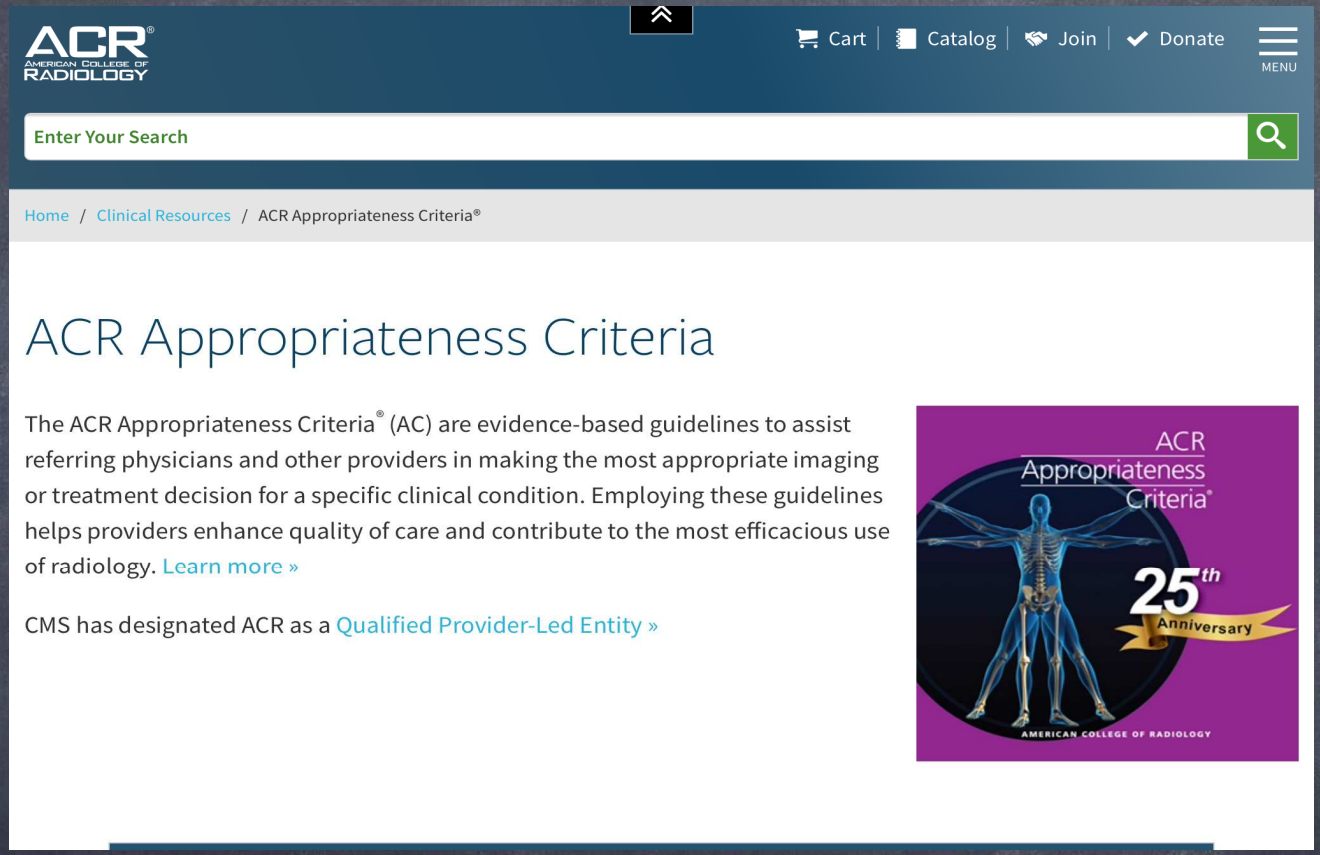

la RM del polmone è un buco nero?


La RM è stata poco utilizzata per lo studio del polmone per una serie di limiti intrinseci alla tecnica

La qualità del segnale (e quindi dell’immagine) dipende dalla densità dei protoni nel tessuto analizzato: il polmone ha una bassa densità fisica e quindi una bassa densità di protoni, perciò il segnale generato risulta basso

- La RM è suscettibile agli artefatti dovuti alle molteplici interfacce aria-tessuto del polmone, cosicché il poco segnale generato decade rapidamente cosi’ da avere tipicamente il polmone nero
- gli artefatti legati al battito cardiaco e ai movimenti respiratori costituiscono ulteriore causa di riduzione del segnale
- la risoluzione spaziale del polmone è nettamente inferiore a quella della TC

ELEMENTI DI APPROPRIATEZZA APPLICATI: RM TORACE E MEDIASTINO



LINEE GUIDA ACR

Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate	*Relative Radiation Level

Linee Guida ACR: RM del torace con Rating Scale basso (2 e 3) citata solo nell'Imaging della tubercolosi e del nodulo polmonare solitario

Imaging of Possible Tuberculosis 3

Documents: Narrative & Rating Table | Evidence Table | Lit Search

1 Suspect active tuberculosis. 6

Name	Rating	Adult RRL	Peds RRL	Comments

2 Newly positive PPD or IGRA OR positive PPD or IGRA with unknown prior status. No clinical symptoms. 6

Name	Rating	Adult RRL	Peds RRL	Comments
X-ray chest	9	<0.1	<0.03	

3 PPD not available. Placement in group home or skilled nursing facility. No clinical symptoms. 6

Name	Rating	Adult RRL	Peds RRL	Comments
X-ray chest	9	<0.1 mSv	<0.03 mSv [ped]	
CT chest with IV contrast	2	1-10 mSv	3-10 mSv [ped]	
CT chest without IV contrast	2	1-10 mSv	3-10 mSv [ped]	
MRI chest without IV contrast	2	O 0 mSv	O 0 mSv [ped]	
CT chest without and with IV contrast	1	1-10 mSv	3-10 mSv [ped]	
MRI chest without and with IV contrast	1	O 0 mSv	O 0 mSv [ped]	

Radiographically Detected Solitary Pulmonary Nodule 4

Documents: Narrative & Rating Table | Evidence Table

1 Solid nodule > or = 1 cm, low clinical suspicion for cancer. 8

Name	Rating	Adult RRL	Peds RRL	Comments

2 Solid nodule > or = 1 cm, moderate to high clinical suspicion for cancer. 8

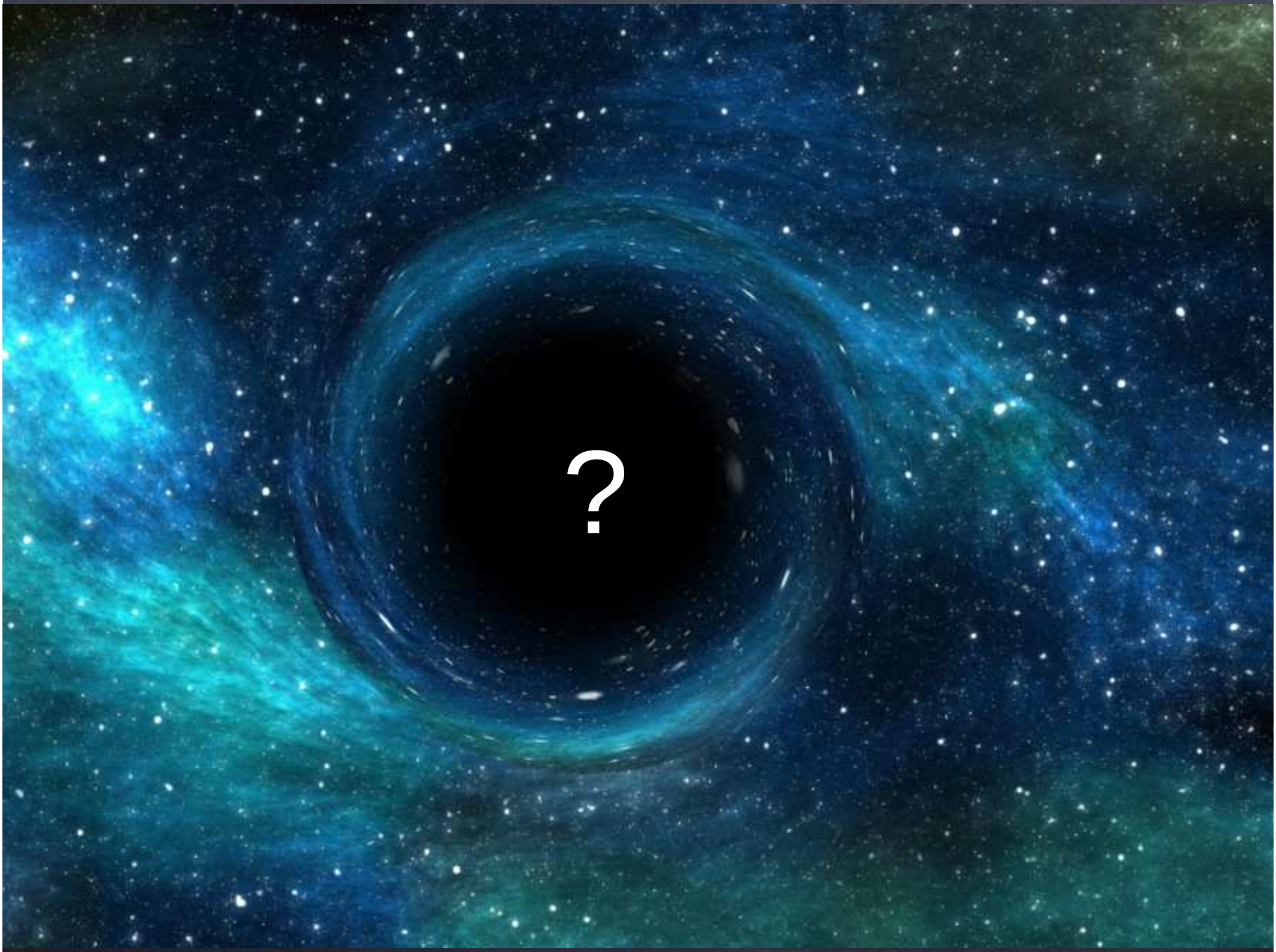
Name	Rating	Adult RRL	Peds RRL	Comments
CT chest without IV contrast	8	1-		To detect occult calcifications, fat, bronchus sign

3 Solid nodule <1 cm, low clinical suspicion for cancer. 8

Name	Rating	Adult RRL	Peds RRL	Comments
Watchful waiting with CT follow-up	8	Varies Varies		
CT chest without IV contrast	7	1-		

4 Solid nodule <1 cm, moderate to high clinical suspicion for cancer. 8

Name	Rating	Adult RRL	Peds RRL	Comments
CT chest without IV contrast	8	1-10 mSv	3-10 mSv [ped]	
Transthoracic needle biopsy	6	Varies Varies		
Watchful waiting with CT follow-up	5	Varies Varies		
CT chest without and with IV contrast	5	1-10 mSv	3-10 mSv [ped]	Depends on size (washout study).
CT chest with IV contrast	4	1-10 mSv	3-10 mSv [ped]	
FDG-PET/CT whole body	2	10-30 mSv		
MRI chest without IV contrast	2	O 0 mSv	O 0 mSv [ped]	Limited data.
MRI chest without and with IV contrast	2	O 0 mSv	O 0 mSv [ped]	Limited data.



VALUTAZIONE CON RM DELLE LESIONI MEDIASTINICHE e DELLA PARETE TORACICA

Table 3. Mediastinal Masses by Compartment (as classified by ITMIG)[4]

Prevascular Compartment (Anterior)	Visceral Compartment (Middle)	Paravertebral Compartment (Posterior)
Lymphadenopathy	Lymphadenopathy	Lymphadenopathy
Thyroid lesions	Thyroid lesions Aortic aneurysm Dilated pulmonary artery Aberrant subclavian arteries	Extramedullary hematopoiesis
Thymic lesions	Neurogenic tumors	Neurogenic tumors Lateral meningoceles
Germ cell tumors Pleuropericardial or mesothelial cysts	Mesothelial cysts Tracheal lesions Esophageal lesions	Mesothelial cysts
Morgagni hernia	Hiatal hernia Bronchogenic cysts Esophageal duplication cysts	Bochdalek hernia Neuroenteric cysts
Abscess	Abscess	Abscess
Hematoma	Hematoma	Hematoma
Fibrosing mediastinitis	Fibrosing mediastinitis	Fibrosing mediastinitis
Hemangioma	Hemangioma	Hemangioma
Lymphangioma	Lymphar	
Sarcoma	Sarcoma	

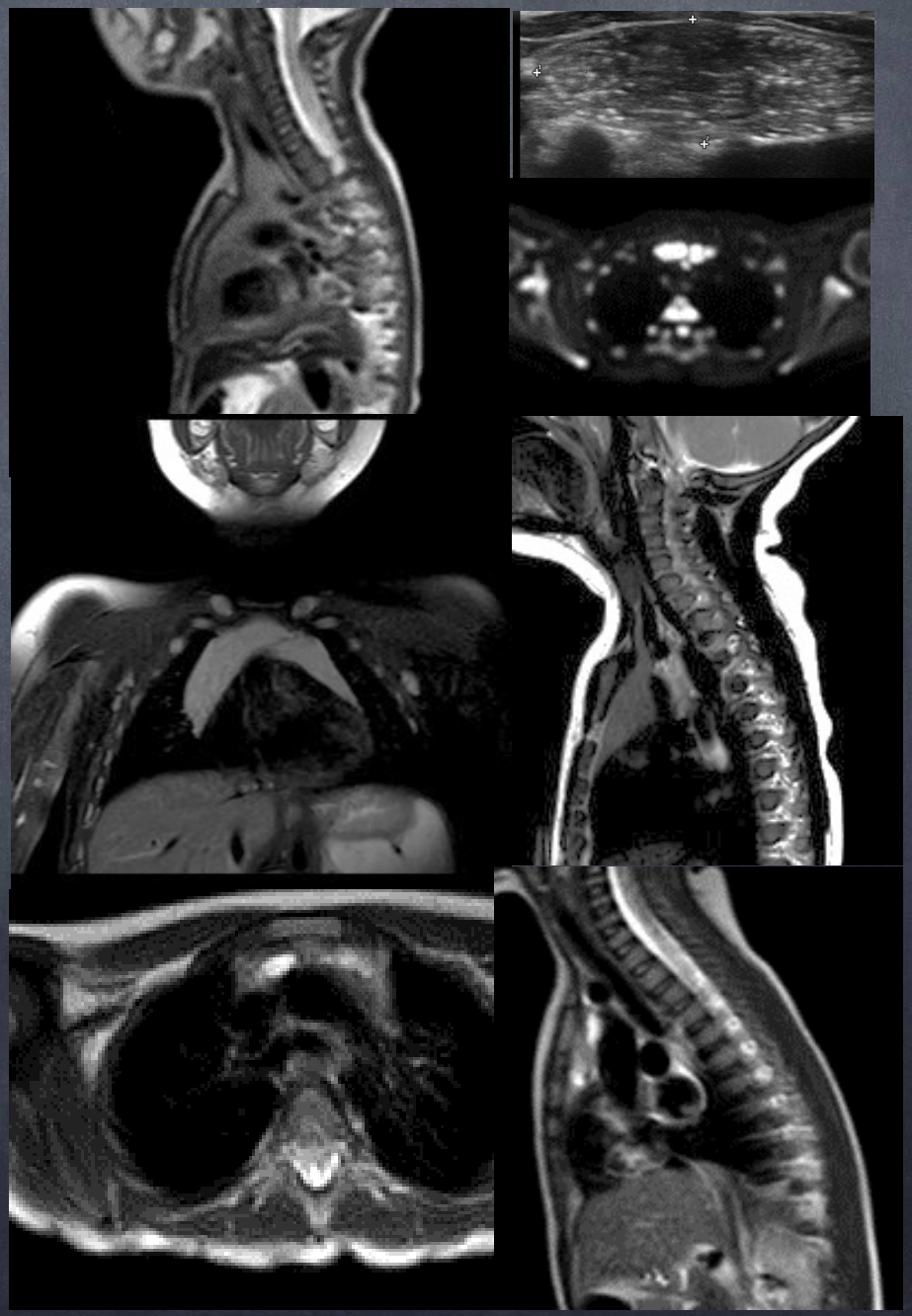
Table 1 Guidelines and MR sequences for chest imaging in children

Mediastinum (25 min)	Chest wall (30 min)
• Use thin sections and if possible surface coil, encoding right-left/ suppress heart/gate	• Use thin sections and if possible surface coil
• Cor STIR	• Cor or Sag STIR
• Ax B-TFE/TruFISP/BH FIESTA	• Cor or Sag T1-W TSE
• Cor B-TFE/TruFISP/BH FIESTA	• Ax T2-W TSE FS
• Ax T2-W FSE	• Ax T1-W TSE (6 NEX)
• Ax T1-W FSE	• Post contrast
• Cor BH VIBE/THRIVE/LAVA	- Ax T1-W TSE FS (6 NEX)
• Post contrast	- Cor or Sag T1-W FS
- Ax T1-W FSE FS	
- Cor BH VIBE/THRIVE/LAVA	

Ax axial, *BH* breath held, *Cor* coronal, *FIESTA* fast imaging employing steady-state acquisition, *FS* fat saturation, *FSE* fast spin echo, *LAVA* liver acquisition with volume acceleration, *NEX* number of excitations, *Sag* sagittal, *STIR* short tau inversion recovery, *TFE* turbo field echo, *THRIVE* T1-W high-resolution isotropic volume excitation, *TruFISP* true fast imaging with steady-state precession, *TSE* turbo spin echo, *VIBE* volume interpolated breath-hold examination

MEDIASTINO ANTERIORE: TIMO

- In I istanza RX ed Ecografia, ma nel bambino piu' grande ossificazione dello sterno
- T1 (=muscolo) e T2 fat sat (>iper muscolo): timo omogeneo in tutte le sequenze
- Restrizione in diffusione
- Il timo e' nel mediastino anteriore, ma anche piu' posteriormente e nel collo
- Timo ectopico, cisti timiche, timoma (non comune nel bambino)
- Valutazione del timo, del suo sviluppo e riconversione post terapie

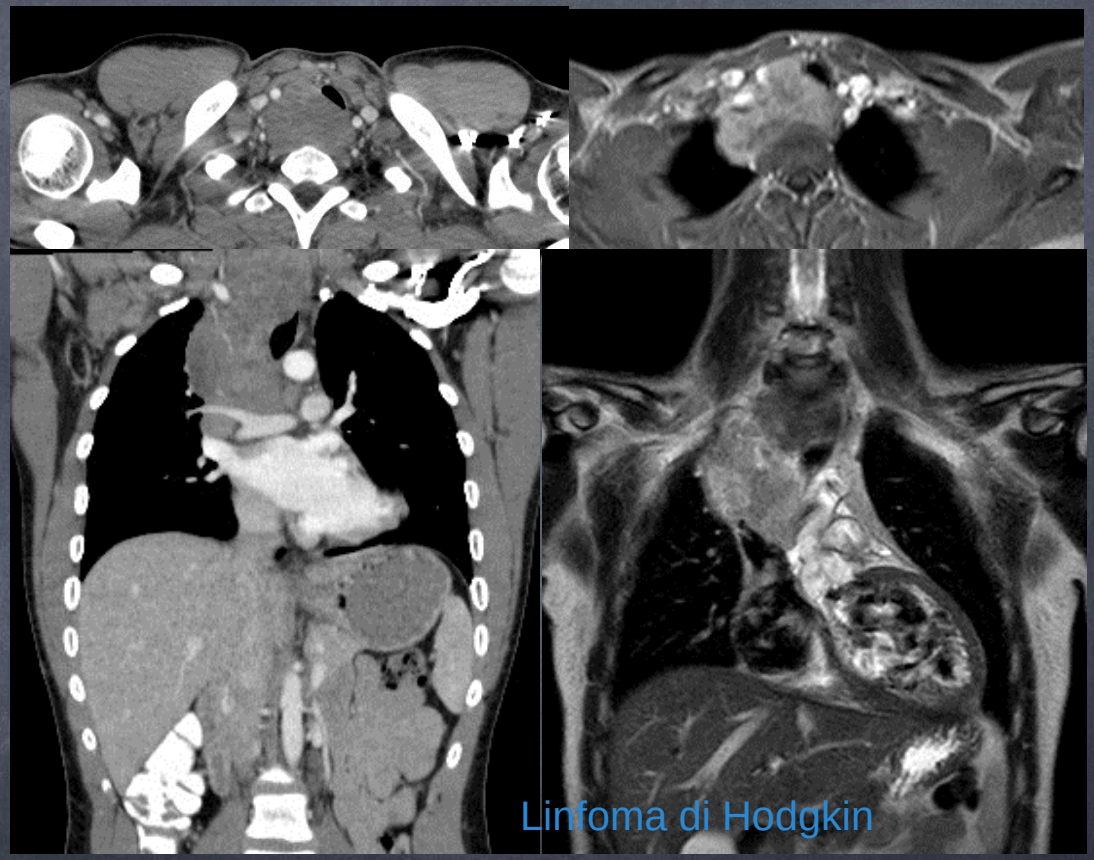


Office1

Office [3]1

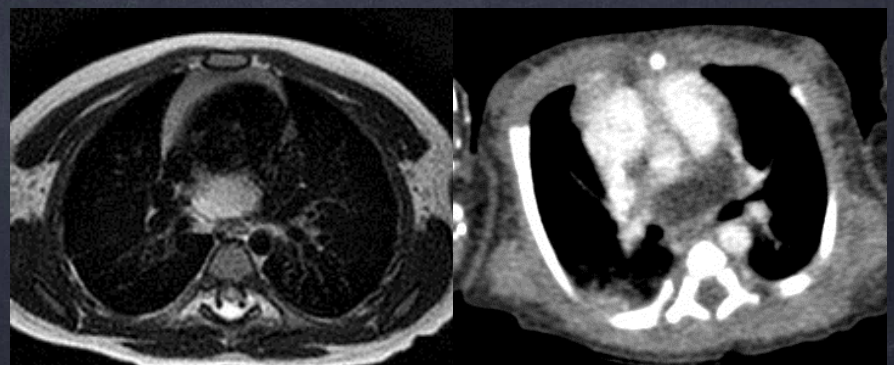
MEDIASTINO MEDIO: LINFOADENOPATIE e CISTI MEDIASTINICHE

- LINFOMA: per lo staging iniziale è preferibile la TC (il linfoma cresce rapidamente, compromissione respiratoria, compressione vena cava aggravata dall'anestesia e dalla posizione supina, il tunnel della RM è un posto difficile per un bambino instabile, limitata risoluzione spaziale per le lesioni parenchimali)
- LINFONODI: T1 =muscolo, T2 leggermente + iper del muscolo, restrizione in DWI
- Successivamente in RM per valutare:
  - Recidive tumorali DD necrosi e fibrosi
  - Rebound timico



Linfoma di Hodgkin

Office [2]1



Cisti broncogena

Diapositiva 12

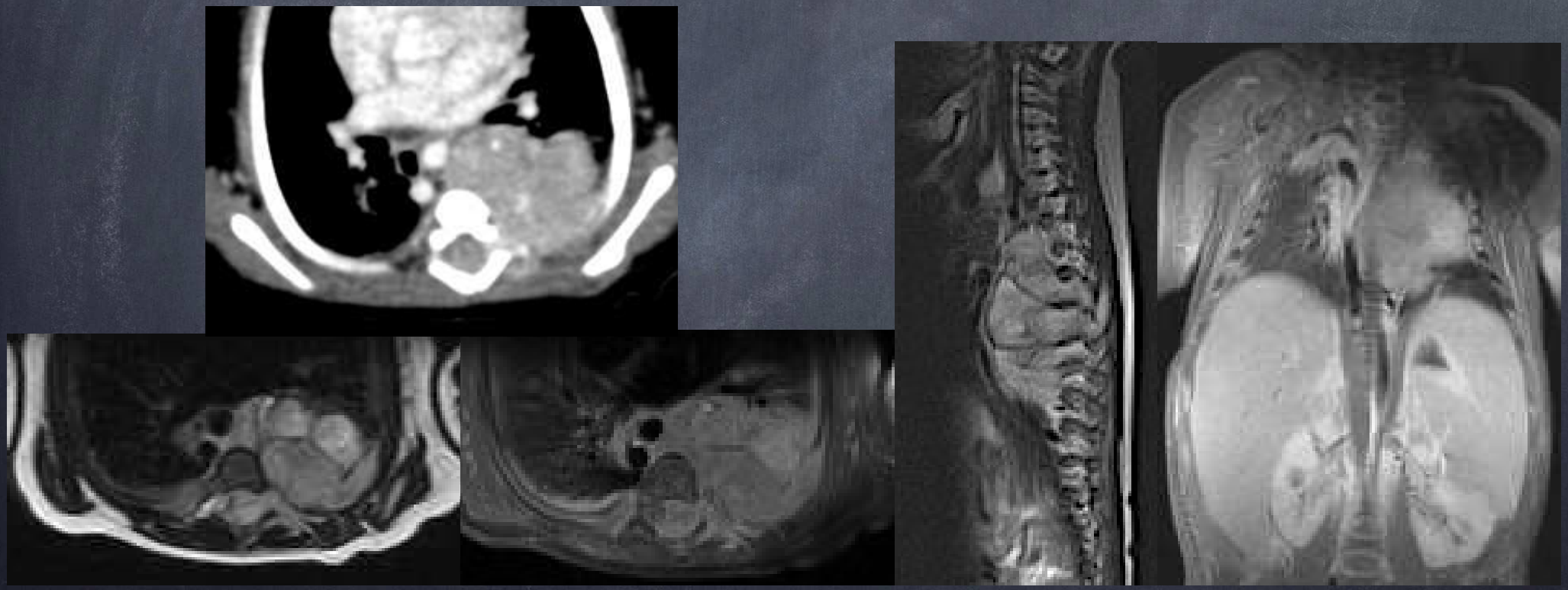
Office1 Utente di Microsoft Office; 23/03/2018

Office [2]1 Utente di Microsoft Office; 23/03/2018

Office [3]1 Utente di Microsoft Office; 23/03/2018

LESIONI MEDIASTINICHE POSTERIORI

Uniformemente accettato il ruolo critico della RM nell'iniziale valutazione delle masse del mediastino posteriore nei bambini, la maggior parte sono di origine neurogenica (NEUROBLASTOMA) e invadono il canale spinale: RM urgente per la valutazione del contenuto intraspinale



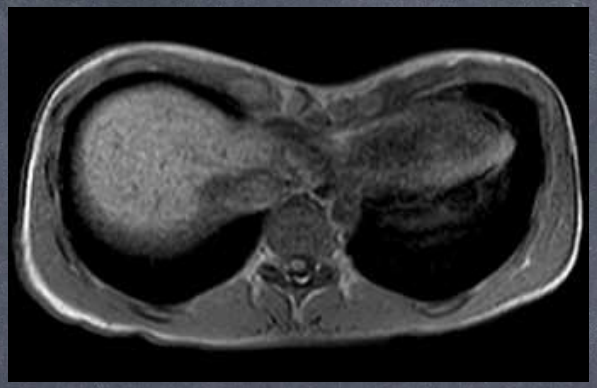
Neuroblastoma

Office3
Office4

PARETE TORACICA e PLEURA

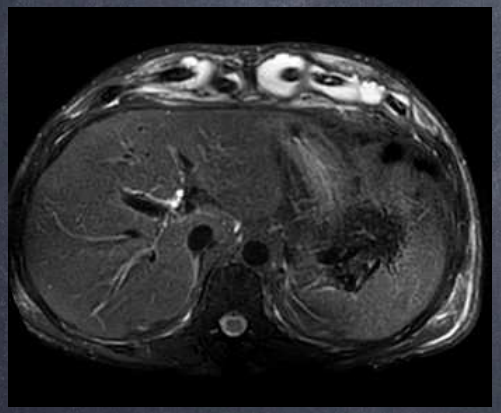
Anomalie costali

Office2



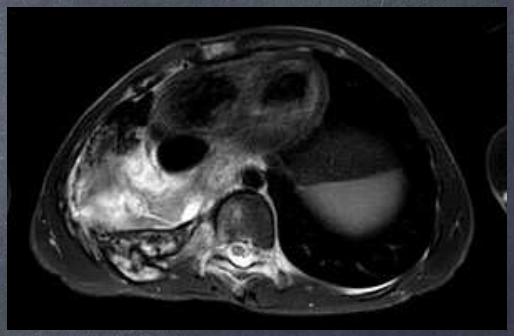
Pectus escavatum

Malformazioni vascolari e linfatiche

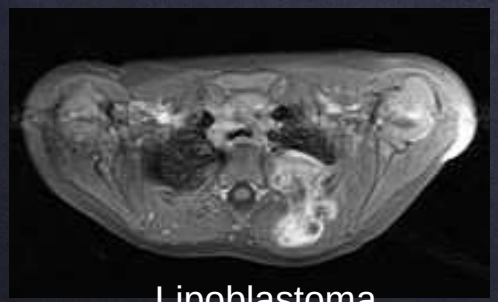


Osteomielite coste pz FC trapiantato

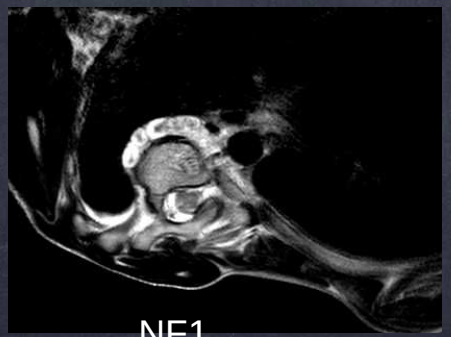
Amartoma fibroso infantile



s. Ewing costale



Lipoblastoma



NF1

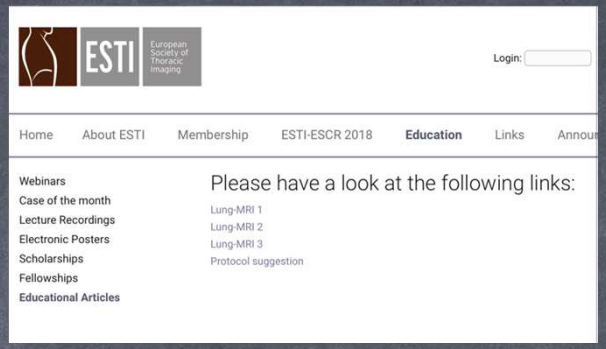
Empiema pleurico

Diapositiva 14

Office2 Utente di Microsoft Office; 23/03/2018

Office3 FUSIONE COSTALI (angolazione asimmetrica costocartilaginea della giunzione costosternale
Utente di Microsoft Office; 23/03/2018

Office4 MASSE DEI TESSUTI MOLLI:
LIPOMI, LIPOBLASTOMA, LIPOSARCOMA
LESIONI MUSCOLARI (DERMATOMIOSITE, ELASTOFIBROMA DEL DORSO,)
NEUROFIBROMI, RABDOMIOSARCOMA
Utente di Microsoft Office; 23/03/2018



Insights Imaging (2012) 3:355–371
DOI 10.1007/s13244-011-0146-8

GUIDELINE

MRI of the lung (2/3). Why … when … how?

J. Biederer · M. Beer · W. Hirsch · J. Wild · M. Fabel · M. Puderbach · E. J. R. Van Beek

Conclusion This article helps new users to implement appropriate protocols on their own MRI platforms.

Main Messages

- *MRI of the lung can be readily performed on state-of-the-art 1.5-T MRI scanners.*
- *Protocol suggestions based on the available literature facilitate its use for routine*
- *MRI offers solutions for complicated thoracic masses with atelectasis and chest wall invasion.*
- *MRI is an option for paediatrics and science when CT is contra-indicated*

La RM DEL POLMONE È ANCORA POCO USATA PER LA MANCANZA DI PROTOCOLLI STANDARDIZZATI adatti alle necessità cliniche

Table 1 Indications for lung MRI (in compliant patients)

Role of MRI	Situation/pathological condition	i.v. contrast
Situations that warrant the use of MRI	Children	Optional
	Pregnant women	Optional
	Young patients with need for repeated imaging of the lungs	Optional
	To replace CT if contrast media are contra-indicated	Optional
	Scientific studies	Optional
	Pharmaceutical trials	Optional
	In discussion: lung cancer screening	Optional
Indications covered by MRI with advantages over CT	Complicated thoracic mass (mediastinum and chest wall invasion)[a]	Optional
	Differentiation of atelectasis and pulmonary mass[a]	Optional
	Differentiation of mediastinal masses	Optional
	Evaluation of respiratory mechanics	No
	Diagnosis of pulmonary perfusion deficits (embolism, hypoxic vasoconstriction)	Yes
	Cystic fibrosis (with perfusion study)[a]	Yes
Indications covered by MRI as effectively as with CT (if situation warrants use of MRI)	Pneumonia	No
	Atelectasis	No
	Cystic fibrosis (without perfusion study)[a]	No
	Tuberculosis	No
	Pulmonary nodules (> 3 mm)	No
	Sarcoidosis	Optional
	Acute and chronic pulmonary embolism[a]	Yes
	Abnormalities of pulmonary venous drainage	Yes
	Pulmonary arterial aneurysm	Yes
	Lung sequestration	Yes
	AV malformation (M. Osler)	Yes
	Staging of lung cancer	Yes
	Vasculitis (e.g. Wegener's)	Yes
	Pleural effusion of unclear origin	Yes
	Mesothelioma	Yes
Indications covered less effectively than with CT	Pulmonary miconodules (< 3 mm)	Optional
	Interstitial lung disease[a]	Optional
	Emphysema/COPD*	Optional

Table 2 Sequences used for lung MRI

Sequence type	Features or variations	Vendor–specific acronyms					Respiration manoeuvre (Typical acquisition time)	Spatial resolution (Typical pixel size)	Temporalresolution (s per slice or volume)	Particular use for lung MRI (pathology)	Protocol suggestion[a]
		Siemens	Philips	GE	Hitachi	Toshiba					
3D gradient echo T1-weighted	Volume interpolati (ce with fa saturation)	VIBE	THRIVE	LAVA	TIGRE	Quick3D	Breath–hold (21 s)	High (1.5 × 1.5 mm)	Low	Pulmonary nodules, masses, airways	G, T, V
	Max. spatial resolution f angiograph	Flash 3D	FFE	SPGR	RF spoiled SARGE	FE, FFE	Breath-hold (21 s)	High (1.2 × 1 mm)	Low	High resolution angiogram (embolism AVM)	V
	Echo sharing	TWIST	TRAK	TRICKS	TRAQ	DRKS	Breath-hold or shallow breathing	Low (3.5 × 2 mm)	High (< 1.5 s/vol)	First pass lung perfusion (embolism, hypoxic vasoconstriction)	V, (T)
Fast spin echo T2-weighted	Half Fourier acquisition	HASTE	Halfscan F	½ NEX FS	Half scan Single shot FSE	AFI RO	Multiple breath-hold (2 × 20 s)	Low (1.8 × 1.8 mm)	High	Infiltrates	G, T
	Rotating pha encoding	BLADE	MultiVane	PROPELL	RADAR	JET	Multiple breath hold (4-5 × 20 s)	Moderate (1.8 × 1.5 mm)	Moderate	Nodules and masses	G, T
	Respir. triggered, high res.	TSE-rt	TSE	FSE	FSE	FSE	Respiration triggered (5-10 min)	Moderate-high (1.3 × 1 mm)	Low	Masses	(G), (T)
	Fat saturated	TSE fs BLADE	TSE fs or MultiVar	FSE fs or PROPEL	FSE fs or RADAR	FSE fs or JET fs	Multiple breath-hold (4-5 × 20 s) or respiration triggered (4-8 min)	Moderate (1.8 × 1.5 mm)	Moderate	Lymph nodes bone metastases	G, T
Short tau inversion recovery	Fast spin echo	STIR	STIR	STIR	STIR	STIR					
Diffusion weighted imaging (DWI)	Echo planar imaging or other fast technique	REVEAL (DWI)	DWIBS (D	Whole Bo Diffusion (DWI)	DWI	Body Visi (DWI)	Multiple breath-hold (3-4 × 20 s) or respiration triggered (4-5 min)	Low (3 × ×2 mm)	Low	Nodules and masses	T
Steady state GRE	T1/T2 contra	TrueFISP	bFFE	FIESTA	BASG	TrueSSFP	Free breathing (60 s) or instructed br. manoeuvres	Moderate (2.4 × 1.6 mm)	High (< 0.5 s/sl.)	Pulmonary embolism Respiration mechanics	G, T, V T

[a] *G* general, *T* tumour, *V* vessel

PAZIENTI PEDIATRICI

La qualità dell’imaging dipende dalla compliance del paziente

Breath-hold frequentemente non possibile in bambini sotto gli 8 anni

Preparare protocolli per i soggetti più piccoli con adeguati campi di vista, spessore di fetta e risoluzione con ottimizzato rapporto segnale/rumore

PAZIENTI PEDIATRICI

Per compensare gli artefatti da movimento:

- Fast single shot imaging con tempo di acquisizione molto corto (SSFP o HASTE) in breath hold o a respiro libero
- Tecniche Fast spin echo con gating o trigger respiratorio, aumenta il tempo di acquisizione, ma miglior risoluzione spaziale e risoluzione di contrasto per i tessuti, l'alta frequenza di respirazione del bambino aiuta a velocizzare l'acquisizione
- Sequenze T2 pesate con trigger respiratorio per pazienti non collaboranti e con difficoltà con il breath hold
- Necessità di sedazione, ma con il propofol: atelettasie dorsali nel 42% dei pazienti (metterli proni….)

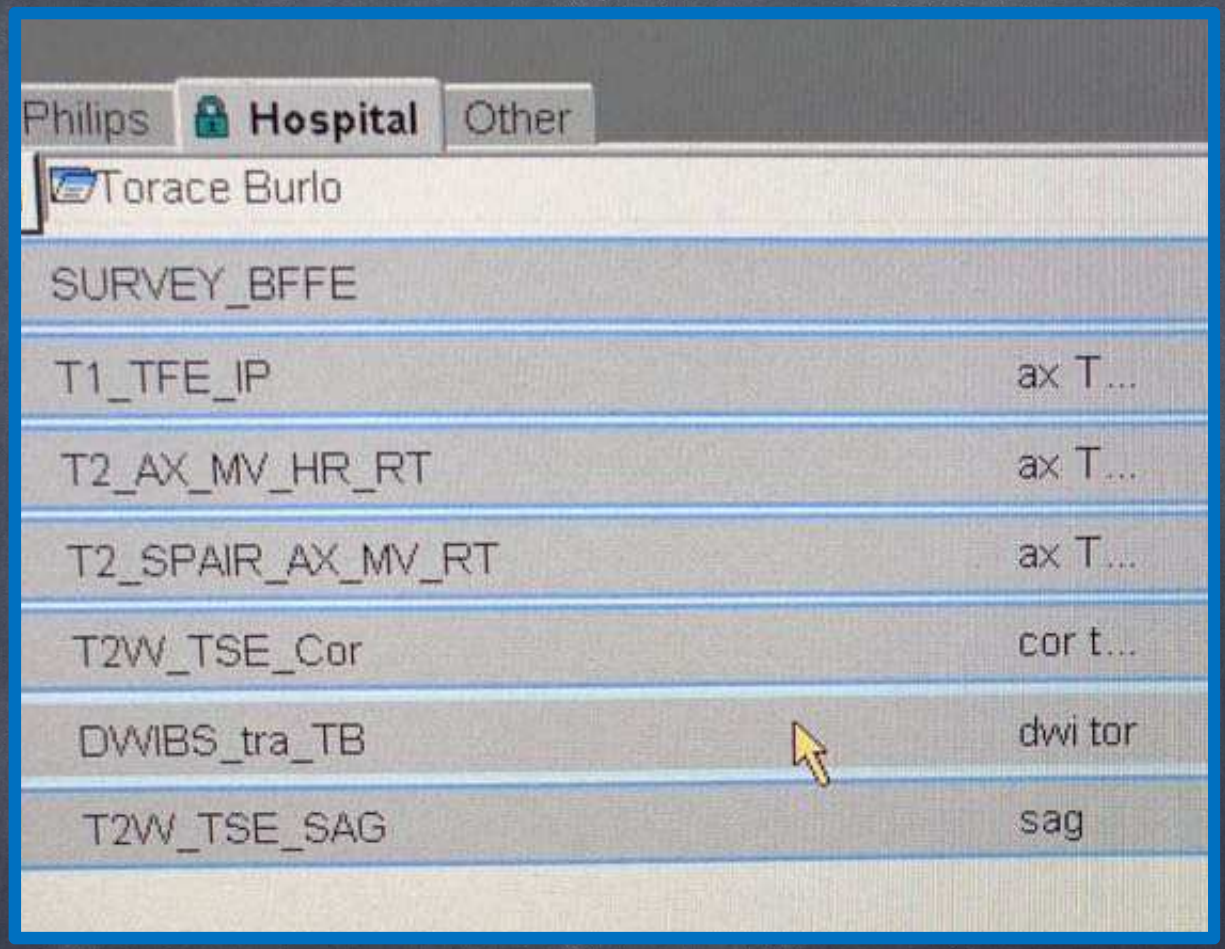
PAZIENTI PEDIATRICI
Consigli Tecnici

FOV 450-500 mm in coronale
FOV 400 mm in assiale
Matrice 256-384 pixels (con trigger fino a 512 pixels)
Slice 4-6 mm
Angio RM a. Polmonari: spessore 2 mm

Table 1
Basic MR imaging protocol for evaluation of lung parenchyma

Sequence	Imaging Plane	Weighting
Gradient recalled echo (GRE) localizer	3-plane	T1
Single-shot half Fourier turbo spin echo (HASTE)	Coronal	T2
3-D GRE volumetric interpolated breath-hold (VIBE)	Axial	T1
Steady-state free precession (TrueFISP)	Coronal	PD/T1/T2[a]
Short tau inversion recovery (STIR)	Axial	(STIR)
Optional		
Postcontrast 3D-GRE VIBE with fat saturation	Axial	T1
Propeller (BLADE + navigator) free breathing[b]	Axial	T2

[a] Combination of proton density and T1 and T2 contrast.
[b] Can be used in place of STIR in patients who cannot perform breath-hold.



Magnetic Resonance Imaging of Pediatric Lung Parenchyma, Airways, Vasculature, Ventilation, and Perfusion

State of the Art

Mark C. Liszewski, MD[a], F. William Hersman, PhD[b,c], Talissa A. Altes, MD[d], Yoshiharu Ohno, MD, PhD[e], Pierluigi Ciet, MD[f,g], Simon K. Warfield, PhD[h], Edward Y. Lee, MD, MPH[i,*]

Radiol Clin N Am 51 (2013) 555–582

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REVIEW

MRI of the lung (3/3)—current applications and future perspectives

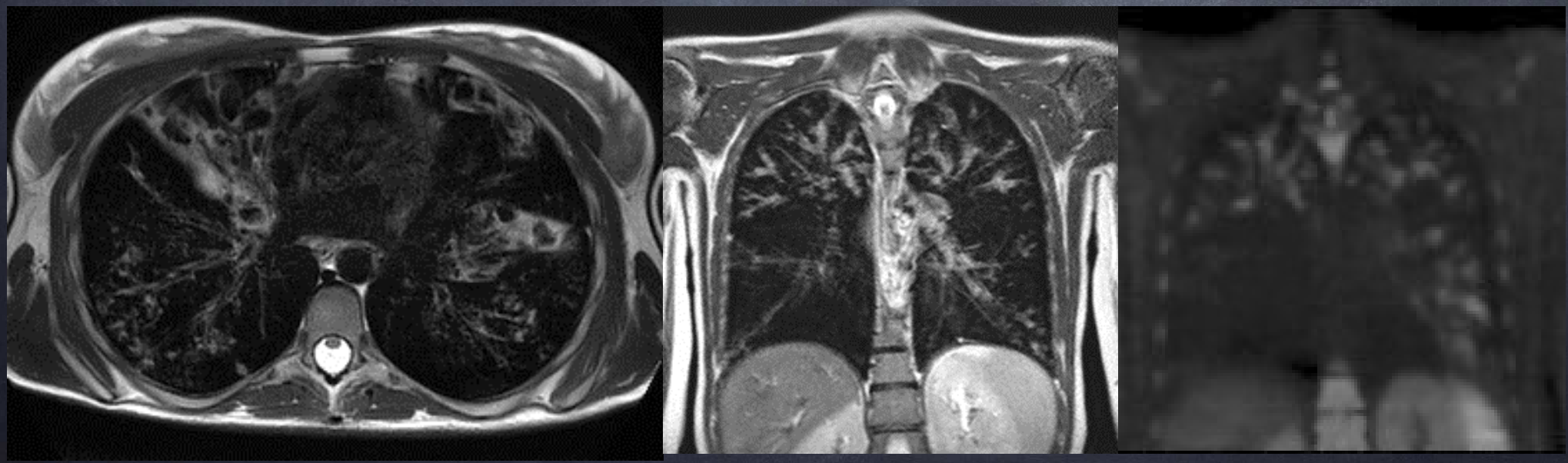
Jürgen Biederer · S. Mirsadraee · M. Beer · F. Molinari · C. Hintze · G. Bauman · M. Both · E. J. R. Van Beek · J. Wild · M. Puderbach

SCENARI CLINICI IN CUI LA RM POTREBBE ESSERE CONSIDERATA MODALITÀ DI PRIMA SCELTA:

- FIBROSI CISTICA
- EMBOLIA POLMONARE ACUTA IN GIOVANI PAZIENTI E DONNE IN GRAVIDANZA

FIBROSI CISTICA

- dato il progresso nella terapia e nel management i pazienti FC hanno un'aspettativa di vita aumentata (sopravvivenza mediana di 40 anni)
- Necessità di controlli ripetuti per tutta la vita
  - TC del TORACE: gold standard per la valutazione delle vie aeree e del parenchima polmonare, risoluzione spaziale submillimetrica, più sensibile dei test di funzionalità respiratoria nelle fasi precoci della malattia
- MA maggior esposizione alle radiazioni ionizzanti rispetto a RX
- RM del TORACE: tecnica sensibile, non invasiva, quantitativa, senza esposizione alle radiazioni per monitorare l'attività della malattia



STUDIO DELLA VENTILAZIONE E PERFUSIONE POLMONARE

- In RM zone di air trapping meno visibili rispetto alla TC, si vedono come aree di ulteriormente ridotto segnale

In RM si possono sincronizzare le sequenze in espirio con l'acquisizione delle immagini: più semplice la distinzione tra air trapping e ipoperfusione

- INALAZIONE DELL"OSSIGENO (elevato segnale in T1 per effetto paramagnetico): normale ventilazione: distribuzione omogenea dell'intensità di segnale negli spazi aerei

nei pz FC: disomogenea distribuzione del segnale da alterata ventilazione polmonare

Nei paz. In fase avanzata di malattia si ha vasocostrizione ipossica nelle zone con alterata ventilazione (danni alle vie aeree da ripetuti fenomeni flogistici)

-valutazione severità malattia: i difetti di perfusione sono correlati con il grado di distruzione tissutale, la reversibilità dopo terapia, permette di distinguere zone con danno reversibile, da quelle con danno irreversibile

In TC: nelle scansioni in espirio la densità aumenta per riduzione volumetrica dell'aria che causa un affastellamento delle strutture vascolari

In RM: le zone di ipoperfusione non sono visibili nelle sequenze di routine, mentre si visualizzano dopo mdc come aree di ridotta vascolarizzazione mediante sequenze angiografiche ad elevata risoluzione temporale e spaziale.

Liszewski et al
Radiol Clin N Am 51 (2013) 555-582

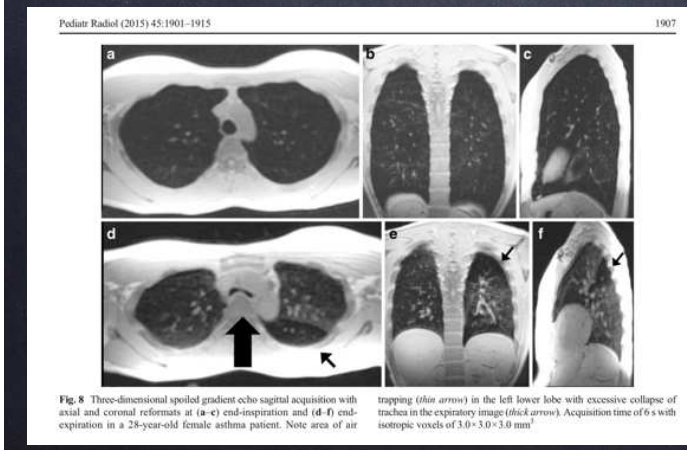


Fig. 8 Three-dimensional spoiled gradient echo sagittal acquisition with axial and coronal reformats at (**a**–**c**) end-inspiration and (**d**–**f**) end-expiration in a 28-year-old female asthma patient. Note area of air trapping (*thin arrow*) in the left lower lobe with excessive collapse of trachea in the expiratory image (*thick arrow*). Acquisition time of 6 s with isotropic voxels of 3.0×3.0×3.0 mm^3

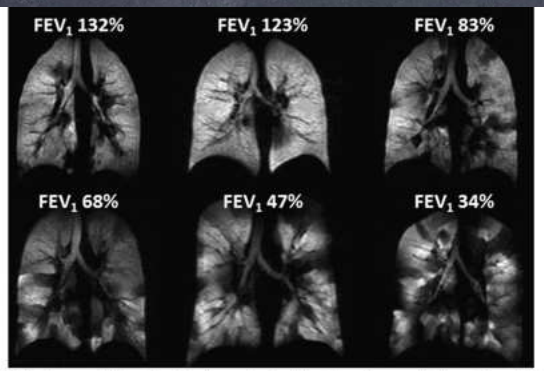


Fig. 21. HP ^{3}He MR lung ventilation imaging in a patient with asthma. Images obtained at variable forced expiratory volume in first second of expiration (FEV$_1$) demonstrate numerous regions of signal hypointensity reflecting regions of hypoventilation, which increase as FEV$_1$ decreases.

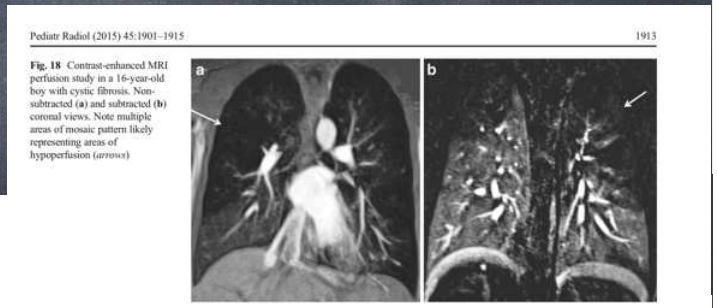


Fig. 18 Contrast-enhanced MRI perfusion study in a 16-year-old boy with cystic fibrosis. Non-subtracted (**a**) and subtracted (**b**) coronal views. Note multiple areas of mosaic pattern likely representing areas of hypoperfusion (*arrows*)

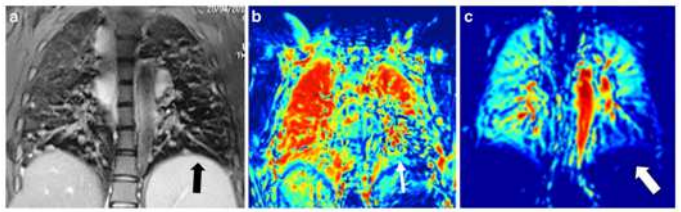
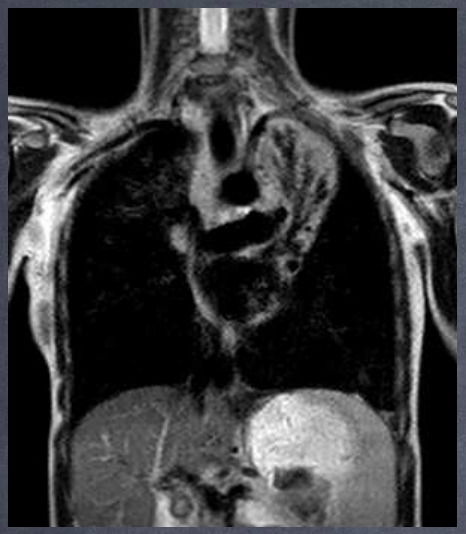


Fig. 20 Fourier decomposition used in a 4-year-old girl with common variable immunodeficiency. **a** Radial k space-trajectory spin echo (PROPELLER), Fourier decomposition ventilation (**b**) and (**c**) perfusion generated maps. Note in (**a**) darker area in the left lower lobe (*black arrow*), which consists of an area of trapped air. In the correspondent (**b**) ventilation map that area appears not ventilated (*thin arrow*). The same area in the perfusion map (**c**) shows reduced perfusion (*thick arrow*), according to the physiological reflex of hypoxic vasoconstriction

RM versus TC



RM:

NON UTILIZZO DELLE RADIAZIONI IONIZZANTI, adatta pertanto alla popolazione pediatrica e al followup

INFORMAZIONI FUNZIONALI: Studio della ventilazione (mediante inalazione di ossigeno) e della perfusione polmonare (mediante iniez. di mdc) e studio delle aree di flogosi attiva (mediante la diffusione) senza le sostanze radioattive della medicina nucleare, per la valutazione della severità e della progressione della malattia

TC:

MIGLIOR DETTAGLIO MORFOLOGICO e RISOLUZIONE SPAZIALE

CORRELAZIONE TRA ENTRAMBE LE MODALITÀ (TC E RM) E CON I TEST CLINICI DI FUNZIONALITÀ

EMBOLIA POLMONARE ACUTA IN GIOVANI PAZIENTI E DONNE IN GRAVIDANZA

- VANTAGGI TC: disponibilità, breve tempo di acquisizione,
- SVANTAGGI: radiazioni ionizzanti
- Protocollo:
- Primo step: Sequenza steady state GRE acquisite in 2 o 3 piani in respiro libero (per grandi emboli centrali sens. 90%, spec. 100%)
- Se primo step negativo o poco chiaro: first pass perfusion imaging, high spatial resolution contrast enhanced (CE) MRA, volumetric interpolated 3D FLASH seqUenza in assiale (breath hold)
- Flusso mdc 2-5 ml/s seguito da soluzione fisiologica. (preferenzialmente con bolus test)
- Se paziente gravida senza mdc.

EMBOLIA

1 **Suspected pulmonary embolism. Intermediate probability with a negative D-dimer or low pretest probability.** 13

Name	Rating	Adult RRL	Peds RRL	Comments
X-ray chest				
CTA chest with IV co				
CT chest with IV con				
US duplex Doppler lo				
CT chest without IV c				
CTA chest with IV co venography lower ex				
MRA chest without a contrast				
Tc-99m V/Q scan lun				
US echocardiograph resting				
Arteriography pulmo heart catheterization				
CT chest without and				
MRA chest without IV				
US echocardiograph transesophageal				

2 **Suspected pulmonary embolism. Intermediate probability with a positive D-dimer or high pretest probability.** 13

Name	Rating	Adult RRL	Peds RRL	Comments
CT chest with IV contrast				
CTA chest with IV contrast				
X-ray chest				
Tc-99m V/Q scan lung				
US duplex Doppler lower extremity				
MRA chest without and with IV contrast				
CTA chest with IV contrast with CT venography lower extremities				
Arteriography pulmonary with right heart catheterization				
US echocardiography transthoracic resting				
CT chest without and with IV contras				
CT chest without IV contrast				
MRA chest without IV contrast				

3 **Suspected pulmonary embolism. Pregnant patient.** 13

Name	Rating	Adult RRL	Peds RRL	Comments
X-ray chest	9	<0.1 mSv	<0.03 mSv [ped]	
US duplex Doppler lower extremity	8	O 0 mSv	O 0 mSv [ped]	This procedure may be an initial examination prior to CTA, which may prevent the need for ionizing radiation in the appropriate clinical setting.
CT chest with IV contrast	7	1-10 mSv	3-10 mSv [ped]	This procedure should be optimized for pulmonary circulation. This procedure may be an alternative to CTA, but both should not be performed.
CTA chest with IV contrast	7	1-10 mSv		This procedure should be optimized for pulmonary circulation.
Tc-99m V/Q scan lung	7	1-10 mSv		This procedure may be an alternative to CTA, but both should not be performed. Ventilation should be done only if necessary.
Arteriography pulmonary with right heart catheterization	4	10-30 mSv		This procedure is rarely indicated. It is used for clarification or catheter-directed intervention.
CTA chest with IV contrast with CT venography lower extremities	3	1-10 mSv		
MRA chest without and with IV contrast	3	O 0 mSv	O 0 mSv [ped]	This procedure may be used as a problem solver or if intervention is planned. There is concern for fetal exposure to contrast.
MRA chest without IV contrast	3	O 0 mSv	O 0 mSv [ped]	
CT chest without and with IV contrast	2	1-10 mSv	3-10 mSv [ped]	
CT chest without IV contrast	2	1-10 mSv	3-10 mSv	

Choosing Wisely
An initiative of the ABIM Foundation

American College of Radiology
ACR American College of Radiology

Five Things Physicians and Patients Should Question

1 **Don't do imaging for uncomplicated headache.**

Imaging headache patients absent specific risk factors for structural disease is not likely to change management or improve outcome. Those patients with a significant likelihood of structural disease requiring immediate attention are detected by clinical screens that have been validated in many settings. Many studies and clinical practice guidelines concur. Also, incidental findings lead to additional medical procedures and expense that do not improve patient well-being.

2 **Don't image for suspected pulmonary embolism (PE) without moderate or high pre-test probability of PE.**

While deep vein thrombosis (DVT) and PE are relatively common clinically, they are rare in the absence of elevated blood d-Dimer levels and certain specific risk factors. Imaging, particularly computed tomography (CT) pulmonary angiography, is a rapid, accurate and widely available test, but has limited value in patients who are very unlikely, based on serum and clinical criteria, to have significant value. Imaging is helpful to confirm or exclude PE only for such patients, not for patients with low pre-test probability of PE.

3 **Avoid admission or preoperative chest x-rays for ambulatory patients with unremarkable history and physical exam.**

Performing routine admission or preoperative chest x-rays is not recommended for ambulatory patients without specific reasons suggested by the history and/or physical examination findings. Only 2 percent of such images lead to a change in management. Obtaining a chest radiograph is reasonable if acute cardiopulmonary disease is suspected or there is a history of chronic stable cardiopulmonary disease in a patient older than age 70 who has not had chest radiography within six months.

4 **Don't do computed tomography (CT) for the evaluation of suspected appendicitis in children until after ultrasound has been considered as an option.**

Although CT is accurate in the evaluation of suspected appendicitis in the pediatric population, ultrasound is nearly as good in experienced hands. Since ultrasound will reduce radiation exposure, ultrasound is the preferred initial consideration for imaging examination in children. If the results of the ultrasound exam are equivocal, it may be followed by CT. This approach is cost-effective, reduces potential radiation risks and has excellent accuracy, with reported sensitivity and specificity of 94 percent.

5 **Don't recommend follow-up imaging for clinically inconsequential adnexal cysts.**

Simple cysts and hemorrhagic cysts in women of reproductive age are almost always physiologic. Small simple cysts in postmenopausal women are common, and clinically inconsequential. Ovarian cancer, while typically cystic, does not arise from these benign-appearing cysts. After a good quality ultrasound in women of reproductive age, don't recommend follow-up for a classic corpus luteum or simple cyst <5 cm in greatest diameter. Use 1 cm as a threshold for simple cysts in postmenopausal women.

Released April 4, 2012

Insights Imaging (2012) 3:373–386
DOI 10.1007/s13244-011-0142-z

REVIEW

MRI of the lung (3/3)—current applications and future perspectives

Jürgen Biederer · S. Mirsadraee · M. Beer · F. Molinari · C. Hintze · G. Bauman · M. Both · E. J. R. Van Beek · J. Wild · M. Puderbach

SCENARI CLINICI IN CUI LA RM DEL POLMONE POTREBBE ESSERE CONSIDERATA MODALITÀ ALTERNATIVA O IN AGGIUNTA:

- MASSA CENTRALE CON ATELETTASIA E VERSAMENTO PLEURICO
- POLMONITE IN GIOVANI PAZIENTI

MASSA CENTRALE CON ATELETTASIA E VERSAMENTO PLEURICO

- La TC è il metodo di scelta nell'imaging del torace per la patologia neoplastica
- La RM metodo di scelta se il mdc è controindicato o per monitorare metastasi note durante la terapia
- Limitazione RM rispetto alla TC: lesioni <4-5 mm (clinicamente importanti)

POLMONITE IN GIOVANI PAZIENTI

MR Imaging of Pneumonia in Immunocompromised Patients: Comparison with Helical CT

Claudia C. Leutner[1]
Jürgen Gieseke[2]
Götz Lutterbey[1]
Christiane K. Kuhl[1]
Axel Glasmacher[3]
Eva Wardelmann[4]
Albert Theisen[3]
Hans H. Schild[1]

OBJECTIVE. A T2-weighted turbo spin-echo sequence was compared with CT in immunocompromised patients with opportunistic pneumonia.
SUBJECTS AND METHODS. Sixteen patients with pneumonia shown on helical CT were examined using MR imaging within 2 days. MR examinations were performed on a 1.5-T system with a transversal T2-weighted ultrashort turbo spin-echo sequence using expiratory gating and diastolic triggering. Two radiologists reviewed the MR and CT images independently. The number, localization, and morphology of lesions were noted. MR image quality was rated using a 4-point scale.
RESULTS. The results of the CT and MR examinations concerning the number and morphol-

AJR, 2000; 175:391-397

Pazienti con rischio di infezione opportunistica sottoposti a ripetuti esami TC durante la loro malattia

J Clin Immunol (2015) 35:491–500
DOI 10.1007/s10875-015-0172-2

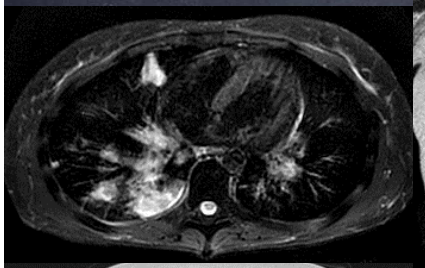
ORIGINAL RESEARCH

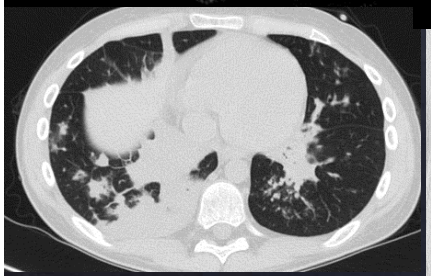
Lung Magnetic Resonance Imaging with Diffusion Weighted Imaging Provides Regional Structural as well as Functional Information Without Radiation Exposure in Primary Antibody Deficiencies

Cinzia Milito[1] · Federica Pulvirenti[1] · Goffredo Serra[2] · Michele Valente[2] · Anna Maria Pesce[1] · Guido Granata[1] · Carlo Catalano[2] · Francesco Fraioli[3,4] · Isabella Quinti[1]

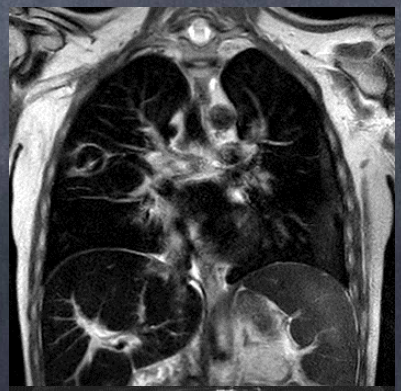
TC in pz neutropenici con febbre in terapia antibiotica o con segni di polmonite e RX negativi

Polmonite da aspergillus in trapiantato Linfoma non Hodgkin



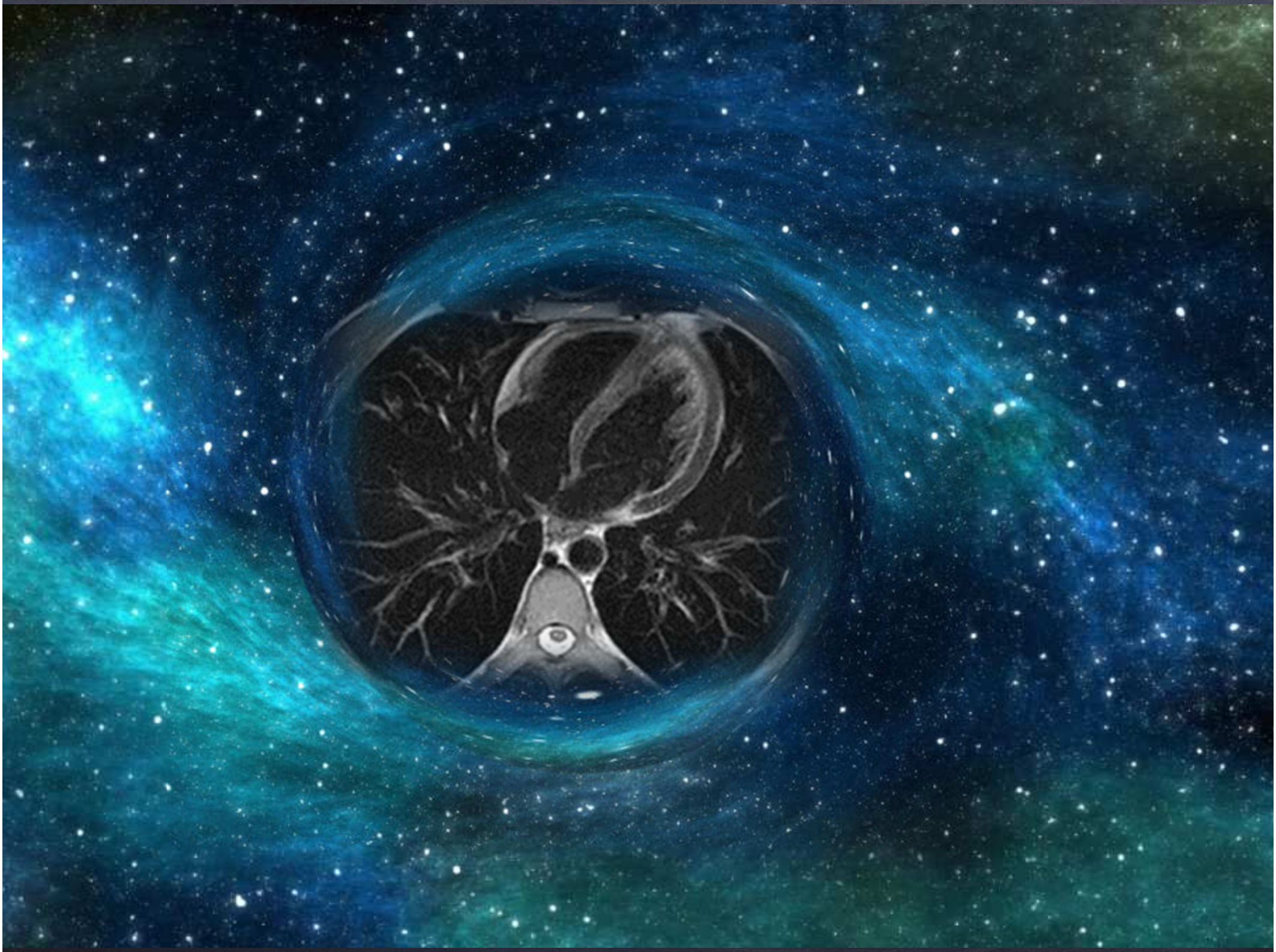


2 mesi dopo



Bambina con IMMUNODEFICIENZA PRIMITIVA


la RM del polmone è un buco nero?



Grazie