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recommandations

J Radiol 2009;90:1144-60

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formation médicale continue

recommandations

Indications cliniques appropriées de l'IRM en pathologie cardio-vasculaire





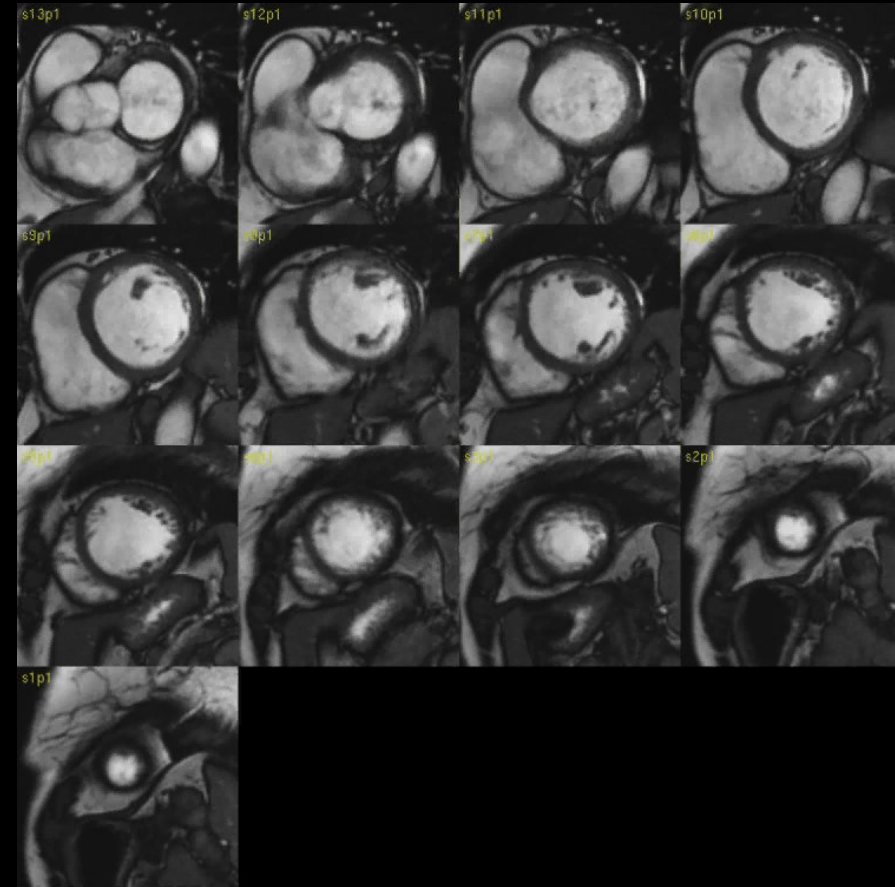
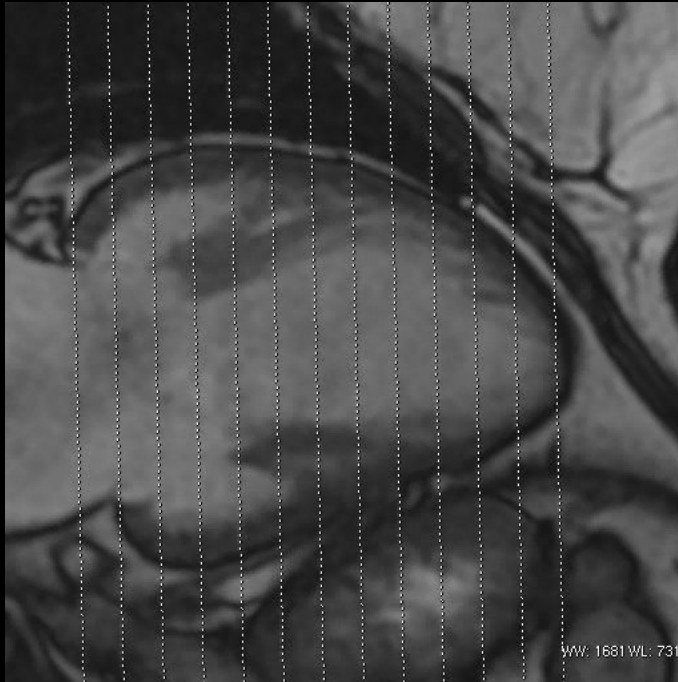
IRM cardio-vasculaire

Technique incontournable en pathologie cardiovasculaire grâce, notamment :

1. à ses performances dans l'évaluation des fonctions ventriculaires droite et gauche
2. aux séquences de « viabilité » acquises tardivement après injection de gadolinium.

Particulièrement intéressant dans la surveillance au long cours.

Précession à l'équilibre (SSFP)

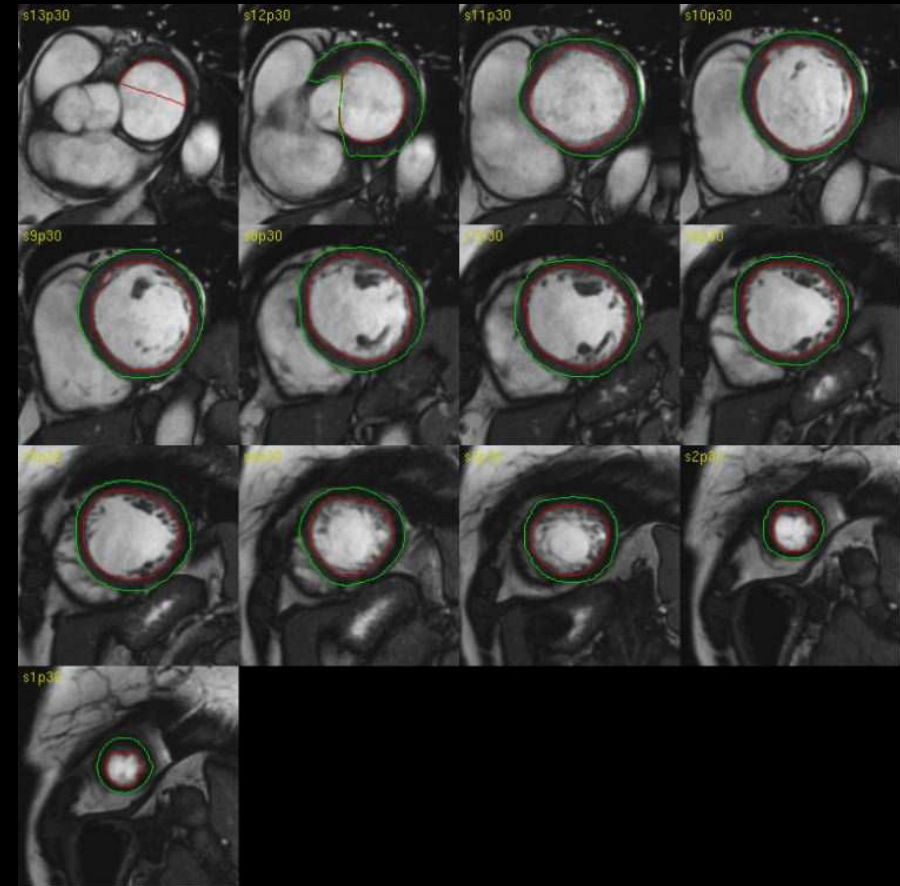
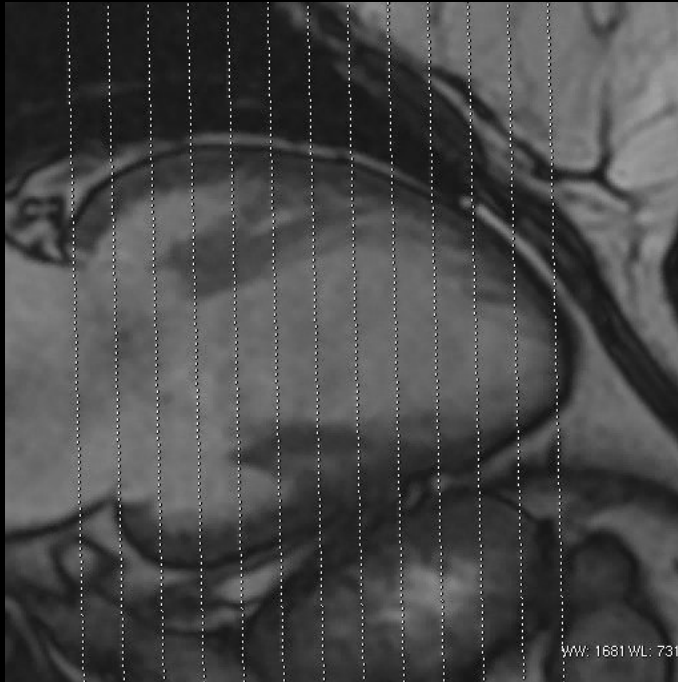


- Paramètres mesurés : volume VG,
: fonction VG globale et segmentaire,
: masse myocardique.
- Mesures plus précises et plus reproductibles qu'en échographie.

Higgins CB. *J Am Coll Cardiol.* 1992;19:1608.
Katz J, et al.. *Radiology.* 1988;169:495-8.

Mogelvang J et al. *Eur Heart J.* 1992;13:1677.
Rehr RB, et al. *Radiology.* 1985;156:717-9.

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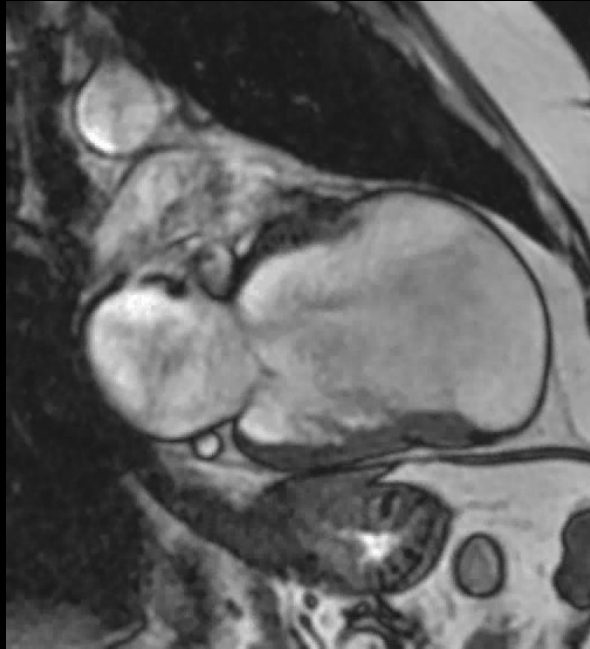
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Précession à l'équilibre (SSFP)

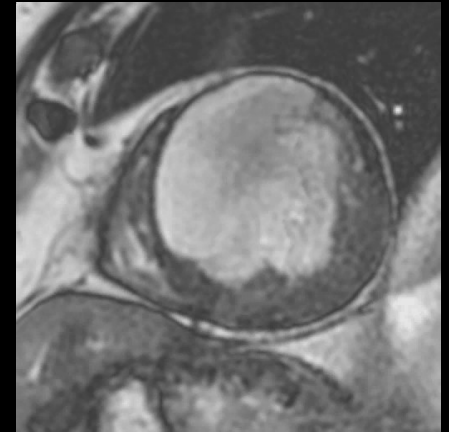
Grand-axe horizontal



Grand-axe vertical



Petit-axe



- Paramètres mesurés : volume VG,
: fonction VG globale et segmentaire,
: masse myocardique.
- Mesures plus précises et plus reproductibles qu'en échographie.

➔ **Identification des dysfonctions VG sévères (FEVG < 35%)**

Volume, ejection fraction and myocardial mass of LV

SSFP ($\pm$ parallel imaging)

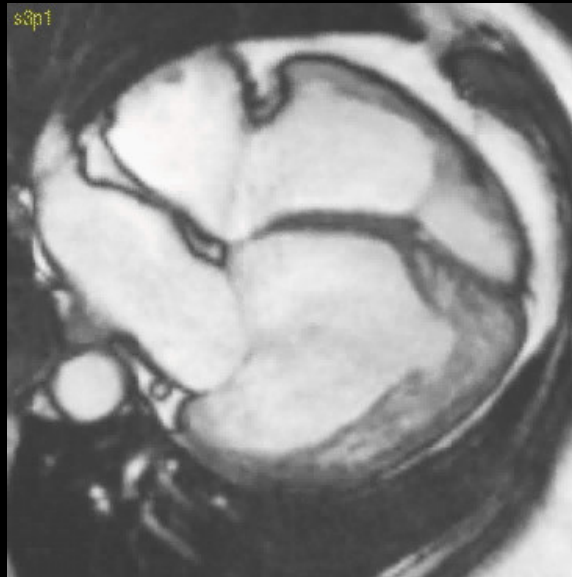
For the differentiation with other causes of cardiomyopathy: valvular, hypertrophic...

➡ **Apical forms of non-compacted myocardium**

VLA



HLA



*Petersen SE, et al.
Left Ventricular Non-Compaction Insights From Cardiovascular Magnetic Resonance Imaging.
J Am Coll Cardiol
2005; 46:101-105.*

- ✓ Apical forms may be difficult to identify at echography
- ✓ MRI diagnosis criterion: NC / C ratio > 2.3 in diastole

Détection des foyers de nécrose et/ou fibrose, 10 à 20 min après l'injection de chélates de gadolinium

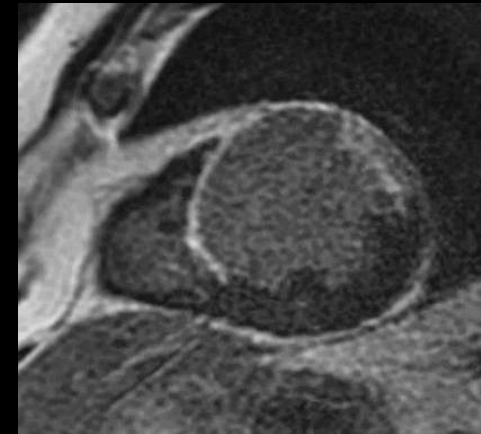
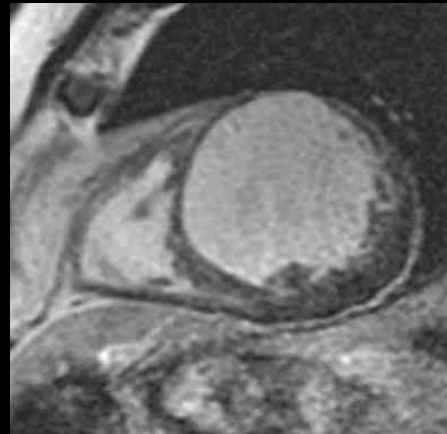
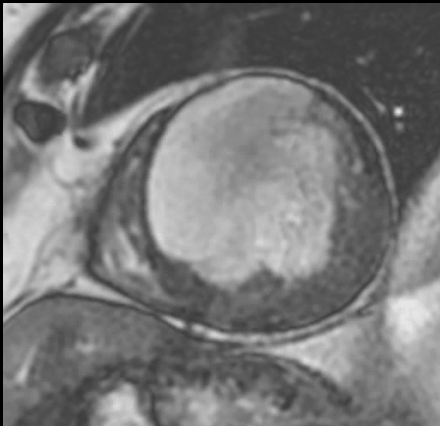
Wu E et al. Lancet 2001;357: 21-8, Ricciardi MJ et al. Circulation 2001;103:2780-3.

SSFP

Ga⁺⁺-DTPA

1 min post-injection

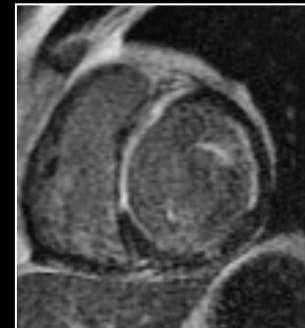
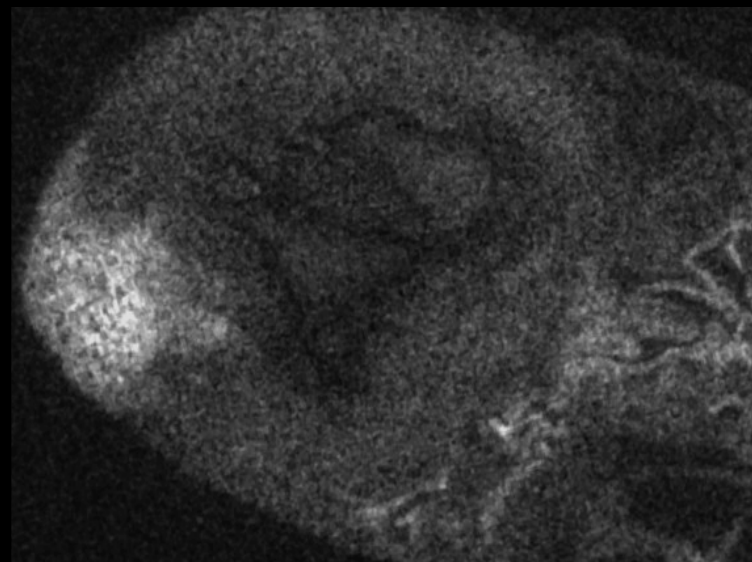
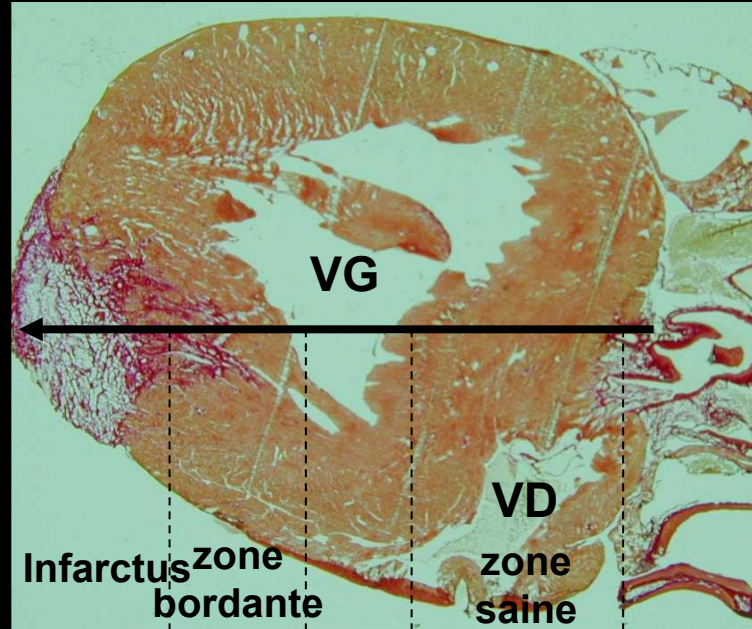
réten-tion-15min



**Nécrose transmurale
antéro-septale**

I - Séquence statique écho de gradient 2-D

3 mois après occlusion de l'IVA chez un rat
Maskali F. J Nucl Cardiol 2005



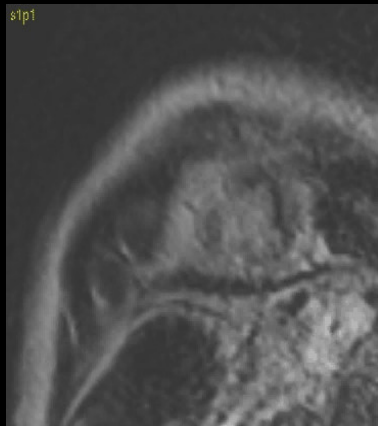
Injection avant le sacrifice :
➤ ^{111}In -DTPA (IRM)

μ -imager

Détection des foyers de nécrose et/ou fibrose, 10 à 20 min après l'injection de chélates de gadolinium

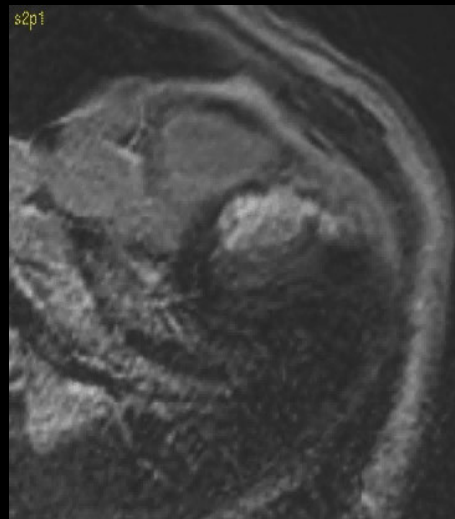
Wu E et al. Lancet 2001;357: 21-8, Ricciardi MJ et al. Circulation 2001;103:2780-3.

Petit-axe

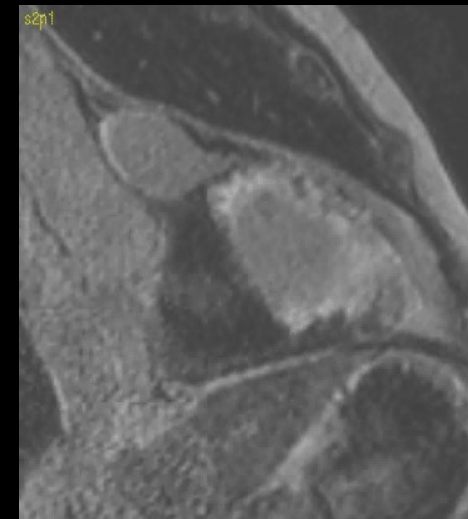


Grand-axes

horizontal



vertical



Séquence statique écho de gradient 3-D



Les principales indications

1. La viabilité pour les cardiopathies ischémiques et les syndromes coronariens aigus,
2. L' étiologie et l' évaluation pronostique des cardiopathies non ischémiques, incluant les myocardites et les dysplasies arythmogènes du VD,
3. les péricardites chroniques et les masses cardiaques,
4. Les anévrysmes et dissections aortiques en dehors de l' urgence,
5. Les cardiopathies congénitales : malformations vasculaires et contrôle de chirurgie correctrice ou palliative.

Bilan et suivi des cardiomyopathies et de l' insuffisance cardiaque

➡ des perspectives d' utilisation croissante



Les principales indications

1. La viabilité pour les cardiopathies ischémiques et les syndromes coronariens aigus, ➔ **localisation des foyers arythmogènes**
2. L'étiologie et l'évaluation pronostique des cardiopathies non ischémiques, incluant les myocardites et les dysplasies arythmogènes du VD, ➔ **présence de foyers arythmogènes**
3. les péricardites chroniques et les masses cardiaques,
4. Les anévrysmes et dissections aortiques en dehors de l'urgence,
5. Les cardiopathies congénitales : malformations vasculaires et contrôle de chirurgie correctrice ou palliative.

Bilan et suivi des cardiomyopathies et de l'insuffisance cardiaque
➡ des perspectives d'utilisation croissante

Delayed contrast enhancement

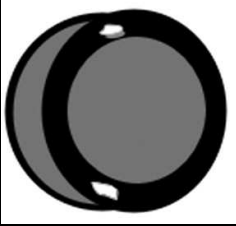
For detecting focal areas of dense fibrosis

- detected in the majority of patients with **hypertrophic cardiomyopathy**



HCM

Delayed contrast enhancement

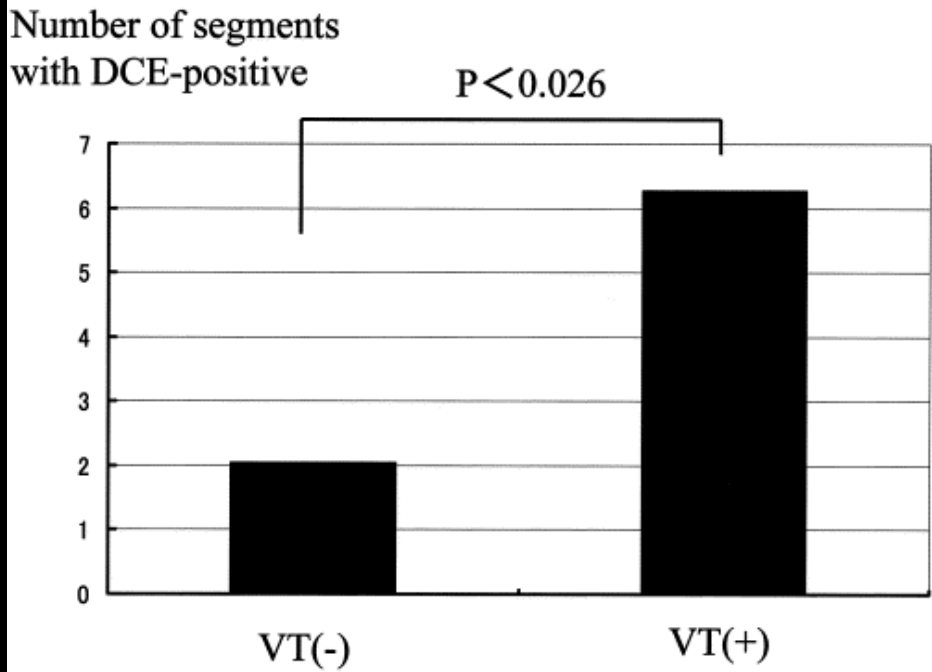


HCM

For detecting focal areas of dense fibrosis

- detected in the majority of patients with **hypertrophic cardiomyopathy**
- correspond to a substrate for arrhythmias

Teraoka K, et al. Magn Reson Imaging 2004; 22:155–161



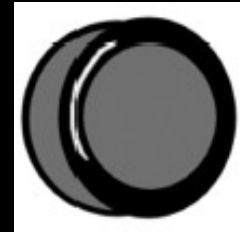
HCM patients with (n=14)
or without (n=45)
ventricular tachycardia

Delayed contrast enhancement

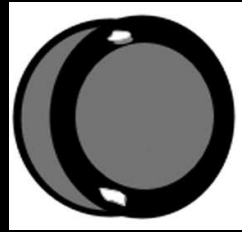
For identifying the causes of cardiomyopathies

Mahrhold H et al. Eur Heart J (2005) 26, 1461–1474

Soriano CJ, et al. J Am Coll Cardiol. 2005 1;45(5):743-8.



DCM



HCM

Dilated cardiomyopathy: midwall fibrosis in $\approx 30\%$ of cases

McCrohon, et al. Circulation 108 (2003), pp. 54–59.

DCE

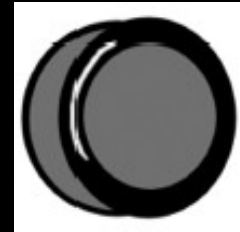


Delayed contrast enhancement

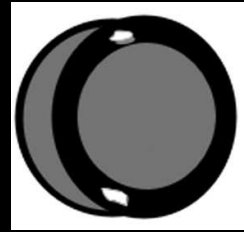
For identifying the causes of cardiomyopathies

Mahrhold H et al. Eur Heart J (2005) 26, 1461–1474

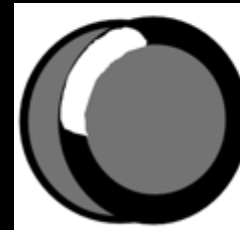
Soriano CJ, et al. J Am Coll Cardiol. 2005 1;45(5):743-8.



DCM



HCM



**Sub-endocardial
or transmural MI**

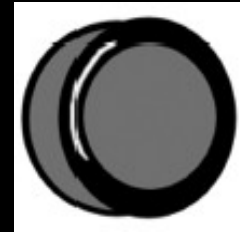
Delayed contrast enhancement

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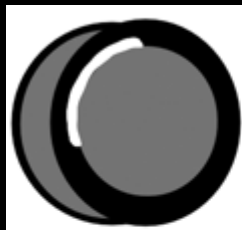
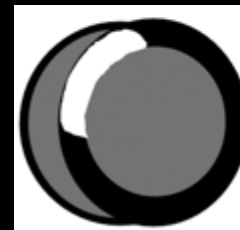
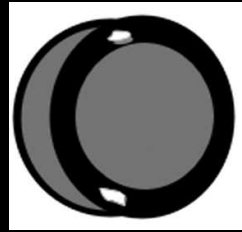
Mahrhold H et al. Eur Heart J (2005) 26, 1461–1474

Soriano CJ, et al. J Am Coll Cardiol. 2005 1;45(5):743-8.

Myocardial infarction

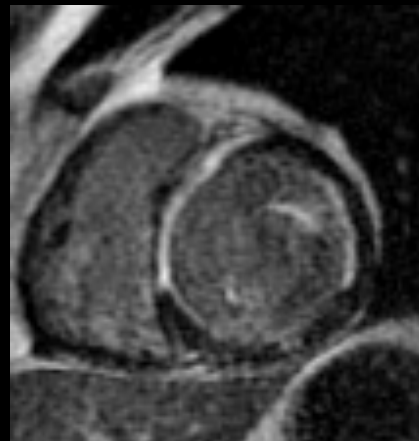
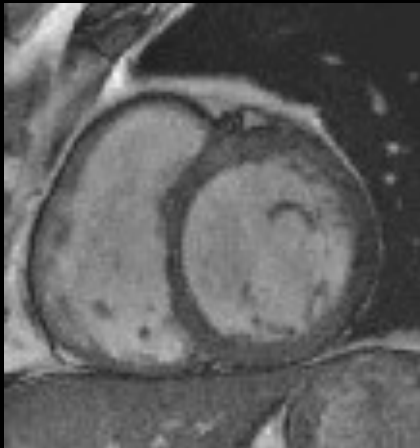


DCM



**Sub-endocardial
or transmural MI**

DCE



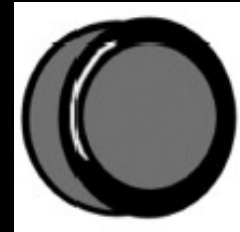
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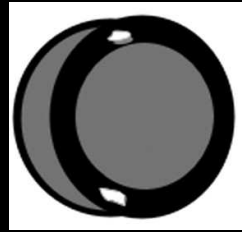
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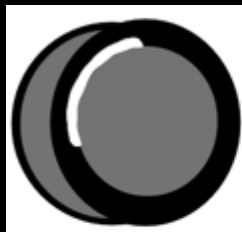
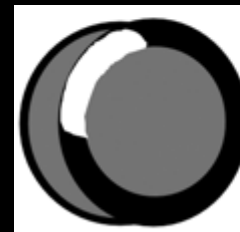
Small areas of myocardial infarction



DCM



HCM

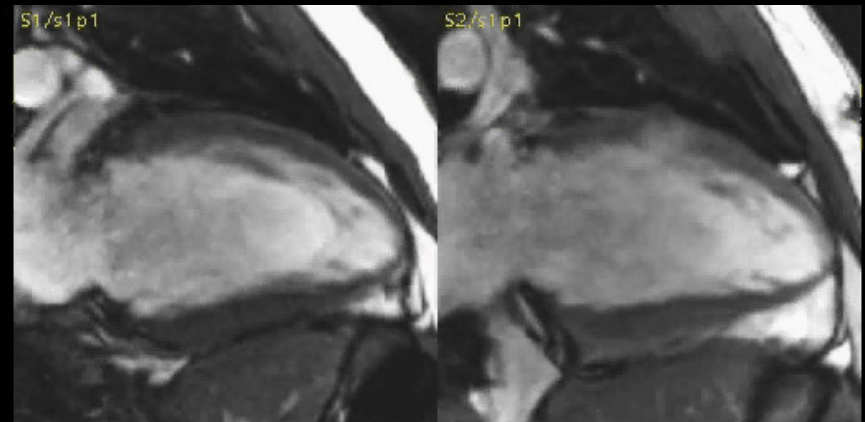


**Sub-endocradial
or transmural MI**

DCE

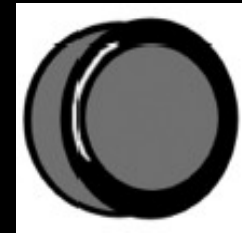


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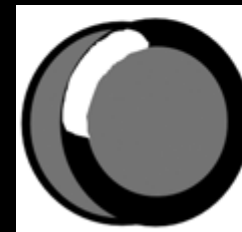
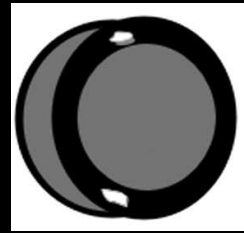


Delayed contrast enhancement

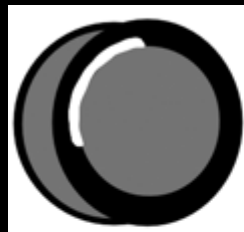
For identifying the causes of cardiomyopathies



DCM



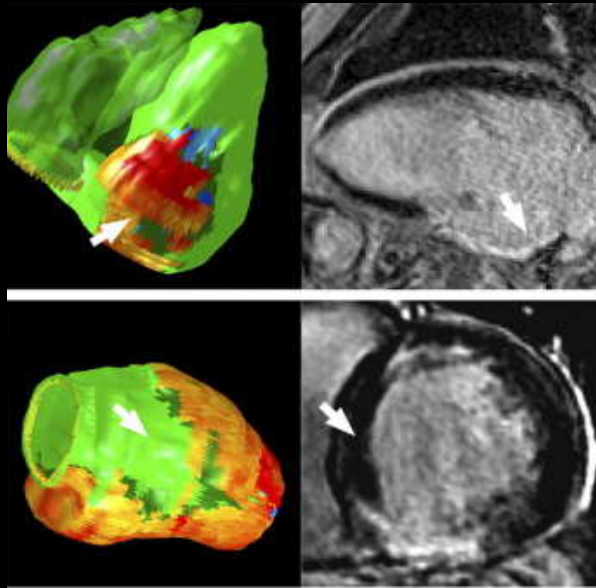
*Sub-endocardial
or transmural MI*



Myocardial infarction: scar localisation

3D-MRI

MRI



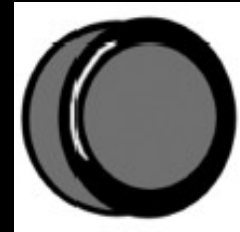
**Electroanatomic Characterization
of Post-Infarct Scars: Comparison
With 3-Dimensional Myocardial
Scar Reconstruction Based on
Magnetic Resonance Imaging**

Andrei Codreanu, ...Christian de Chillou
J Am Coll Cardiol 2008; 52:839-842

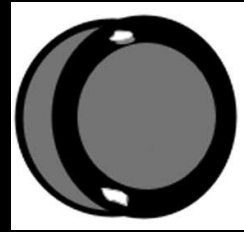
Delayed contrast enhancement

For identifying the causes of cardiomyopathies

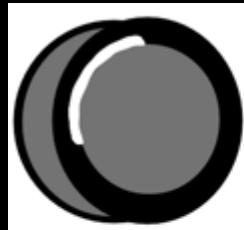
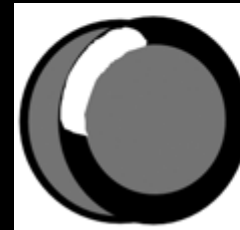
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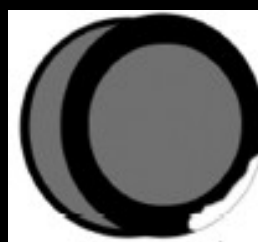
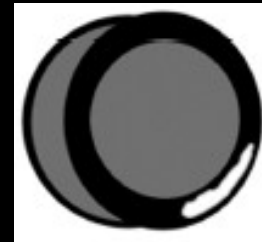
DCM



HCM



**Sub-endocardial
or transmural MI**



- **Myocarditis**
- **Sarcoidosis**
- **Amyloidosis...**

Delayed contrast enhancement

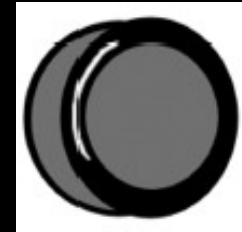
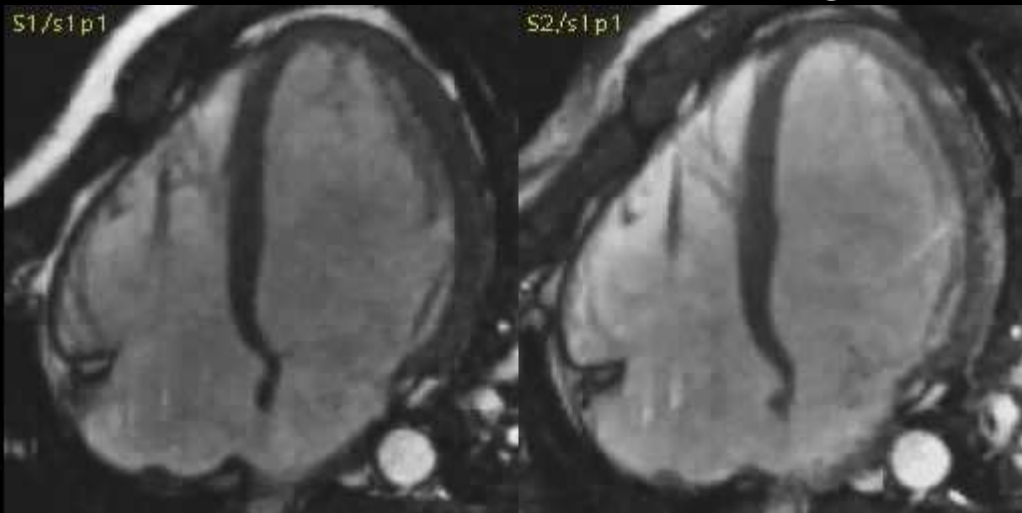
For identifying the causes of cardiomyopathies

Mahrhold H et al. Eur Heart J (2005) 26, 1461–1474

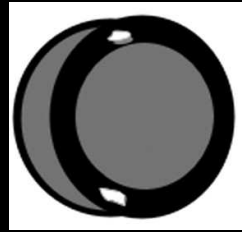
Acute myocarditis

Codreanu A, et al. J Magn Reson Imaging. 2007

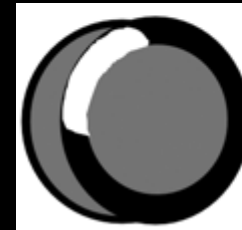
DCE



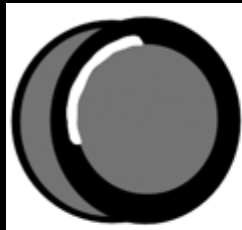
DCM



HCM



***Sub-endocardial
or transmural MI***

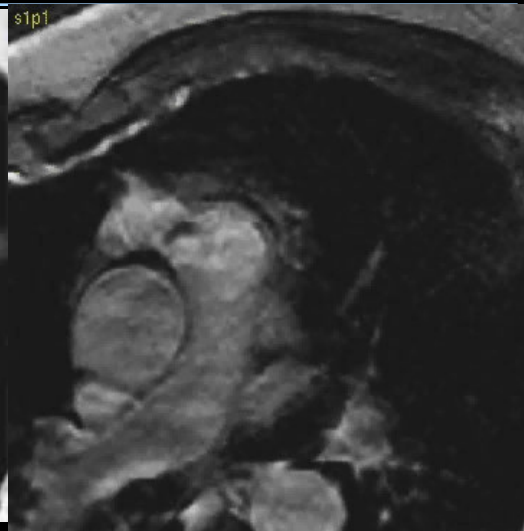


- ***Myocarditis***
- ***Sarcoidosis***
- ***Amyloidosis...***

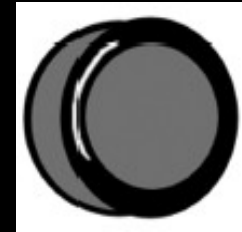
Delayed contrast enhancement

For identifying the causes of cardiomyopathies

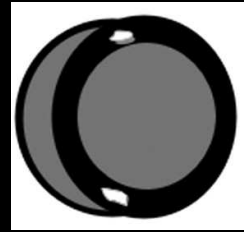
Sarcoidosis
Sarcoidosis



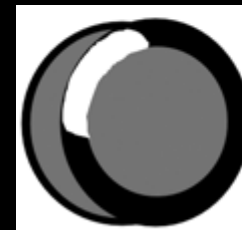
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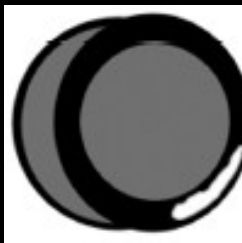
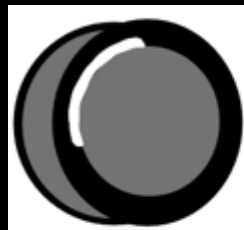
DCM



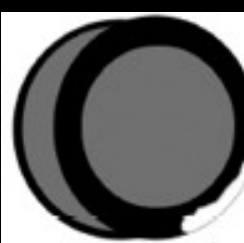
HCM



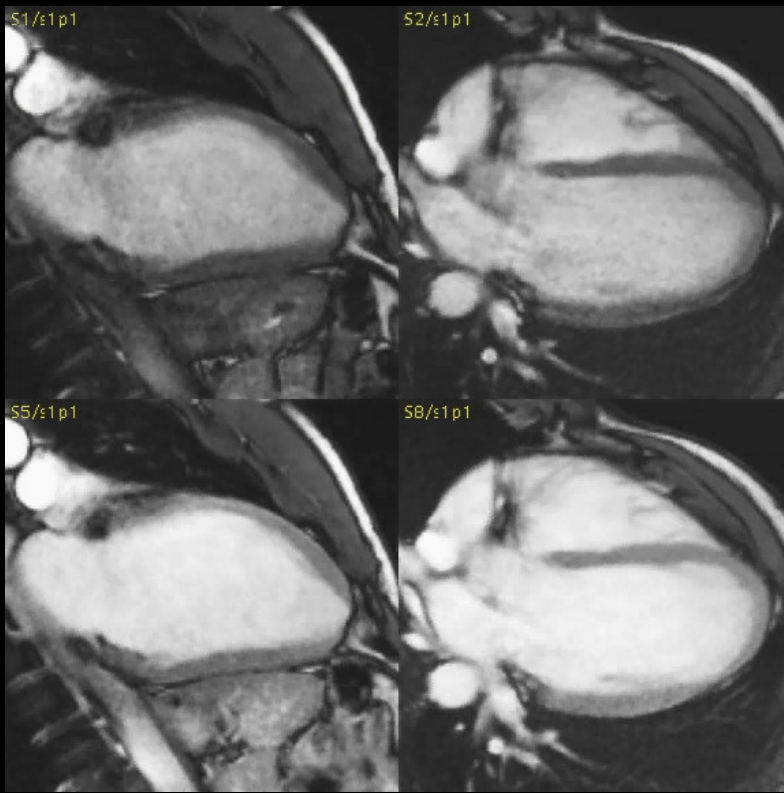
**-endocardial
or transmural MI**



**- Myocarditis
- Sarcoidosis
- Amyloidosis...**

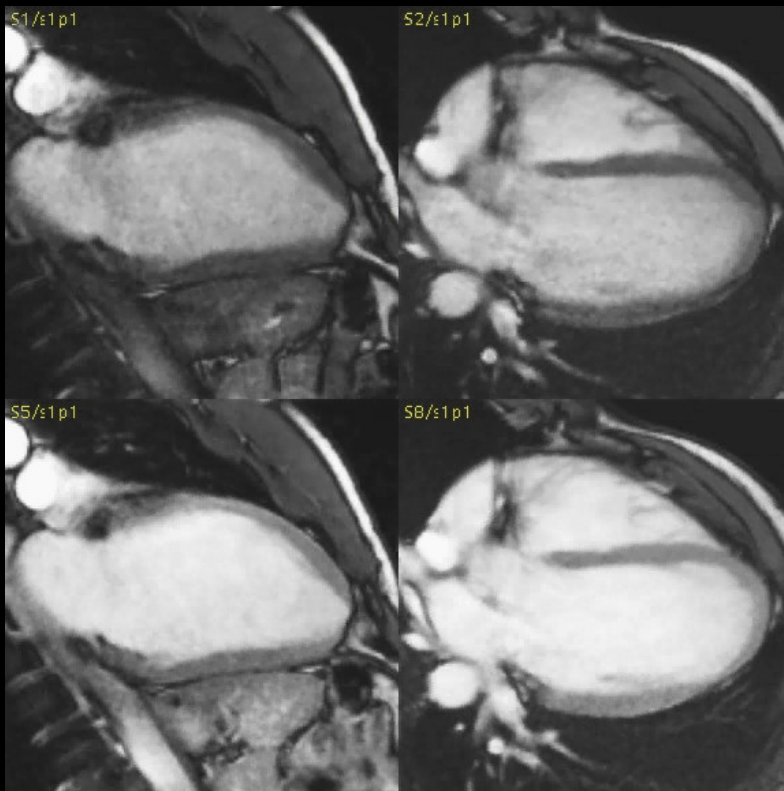


Rétention tardive



- ✓ Cycliste professionnel, 30 ans,
- ➡ TV provenant du cœur gauche

Rétention tardive

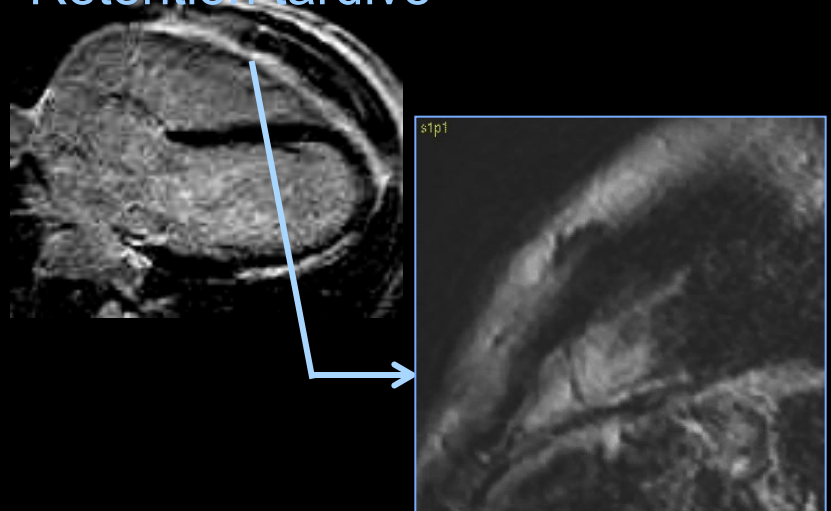


✓ Cycliste professionnel, 30 ans,
➡ TV provenant du cœur gauche

Recherche de foyers de
fibrose, nécrose, oedème
Rétention tardive

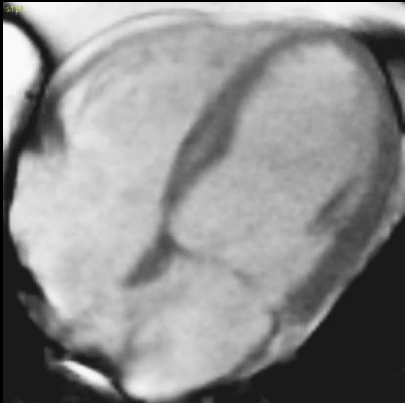


*Séquelle ancienne
de myocardite ?*

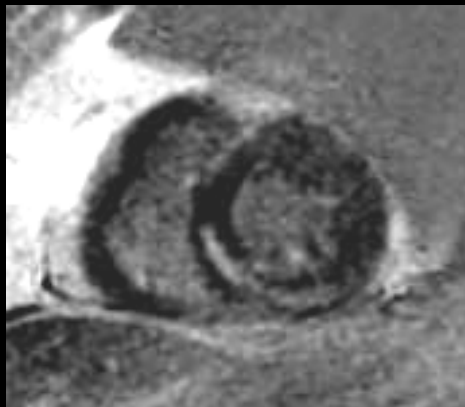
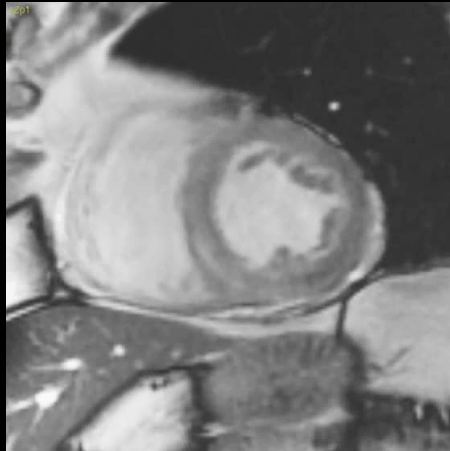


➡ TV provenant du septum basal

GAH



PA



Recherche de foyers de
fibrose, nécrose, oedème
Rétention tardive



***Sarcoïdose, ...
ou autre ?***

L'IRM cardiaque dans les cardiomyopathies, pour :

L'IRM cardiaque dans les cardiomyopathies, pour :

1. identifier

2. en préciser l'atteinte cardiaque,

3. en recherche la sévérité (FEVG < 35%),

4. rechercher et localiser, un

5. en suivre substrat arythmogène,