

# IRM DU HAUT APPAREIL URINAIRE

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Pourquoi et comment ?

Cas cliniques

# PLAN

- Quand faire une IRM ?
  - Séquences - Anatomie normale et anormale – URO-IRM et TCC
  - Masses rénales bénignes ou malignes ? 8 cas cliniques
-

# QUAND FAIRE UNE IRM DU HAUT APPAREIL?

## When is MRI Useful in Evaluating Renal Masses?

**Stuart G. Silverman, M.D., FACR**

*Professor of Radiology*

*Harvard Medical School*

*Director, Abdominal Imaging and Intervention*

*Brigham and Women's Hospital*

*Boston, MA*



### Population cible :

- Femme enceinte
- Bilan donneur vivant
- Examens répétitifs (STB, VHL)
- Patient allergique ou IR modérée - TCC

### Examen CT non concluant

Heilbrun, M. E., Remer, E. M., Casalino, D. D., Beland, M. D., Bishoff, J. T., Blaufox, M. D., ... Weinfeld, R. M. (2015). ACR appropriateness criteria indeterminate renal mass. *Journal of the American College of Radiology*, 12(4), 333-341. 10.1016/j.jacr.2014.12.012

# CARACTÉRISATION MASSE RÉNALE INDÉTERMINÉE

## ACR 2015 APPROPRIATENESS CRITERIA

= lésion 20-70UH au CT à blanc ou hétérogène >20UH post IV contraste

- Patient avec fonction rénale nl : - bilan par CT ou IRM – et + contraste
  - US avec Doppler (+/- contraste)
  - IRM sans contraste (kystes)
  - biopsie

# CARACTÉRISATION MASSE RÉNALE INDÉTERMINÉE

ACR 2015 APPROPRIATENESS CRITERIA

- Patient avec insuffisance rénale : - US doppler +/- contraste
- IRM sans contraste
  - CT sans contraste (détection AML typique)

# SÉQUENCES ET CARACTÉRISATION LÉSIONS

Eur Radiol (2007) 17: 2780–2793  
DOI 10.1007/s00330-007-0701-3

UROGENITAL

J. J. Nikken  
G. P. Krestin

**MRI of the kidney—state of the art**

Masse solide du rein de  
l'adulte : démarche  
diagnostique

D. EISS, S. POIREE,  
E. DEKEYSER, S. MERRAN, JM. CORREAS, O. HELE  
Service de Radiologie Adultes,  
Hôpital Necker - Enfants Malades, Paris.

**Caractérisation des tumeurs  
solides du rein en IRM**

*Nicolas Grenier*

*Université Bordeaux Segalen*

*Service de Radiologie, Groupe Hospitalier Pellegrin, Bordeaux*

**MASTER 1**

**MASTER 2**

**Démarche Clinique - Secteur Uro-Néphro**

[Pathologies Néphro-Urologiques et Radiologie chez l'adulte](#) E. Danse (PDF 16 MB)

[Pathologies Néphro-Urologiques et Radiologie chez l'adulte : partie 2](#) Pr E. Danse (PDF 40 MB)

[Pathologies Néphro-Urologiques et Radiologie chez l'adulte : TP 1](#) Pr E. Danse (PDF 22 MB)

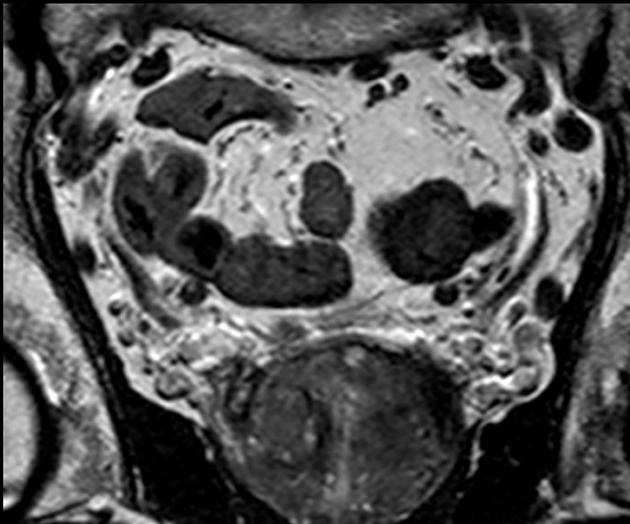
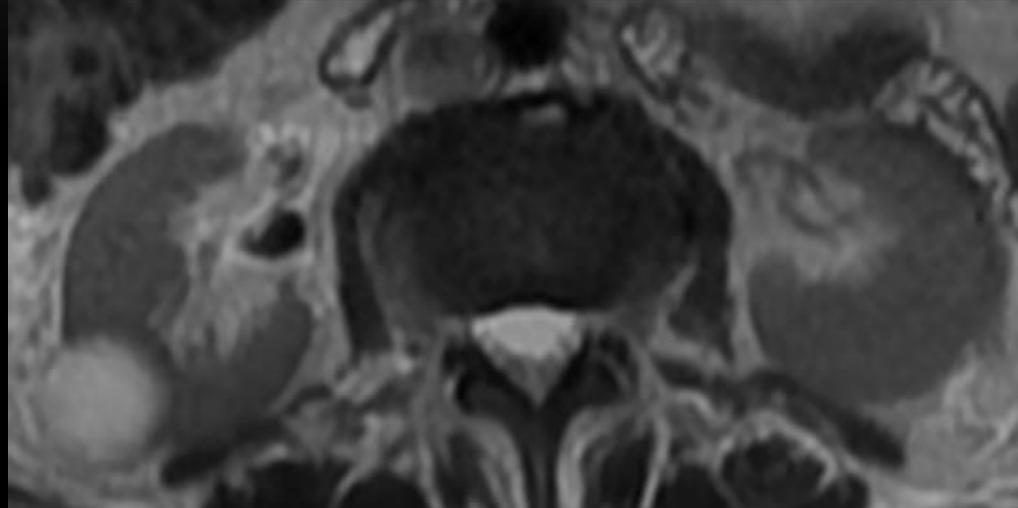
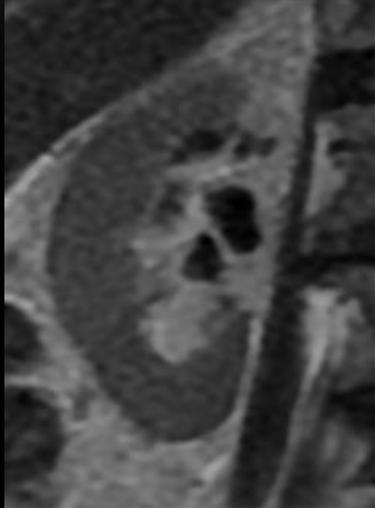
[Pathologies Néphro-Urologiques et Radiologie chez l'adulte : TP 2](#) Pr E. Danse (PDF 5 MB)

SÉQUENCES ET APPLICATIONS CLINIQUES

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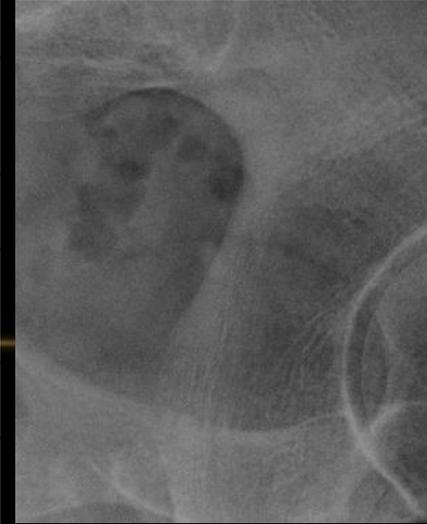
**URO - IRM**

# LITHIASE (PYÉLO)-URÉTÉRALE



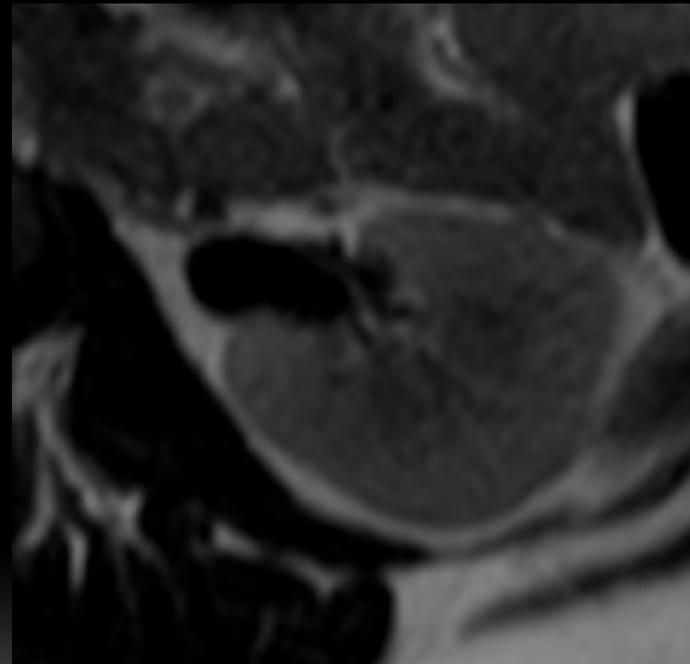
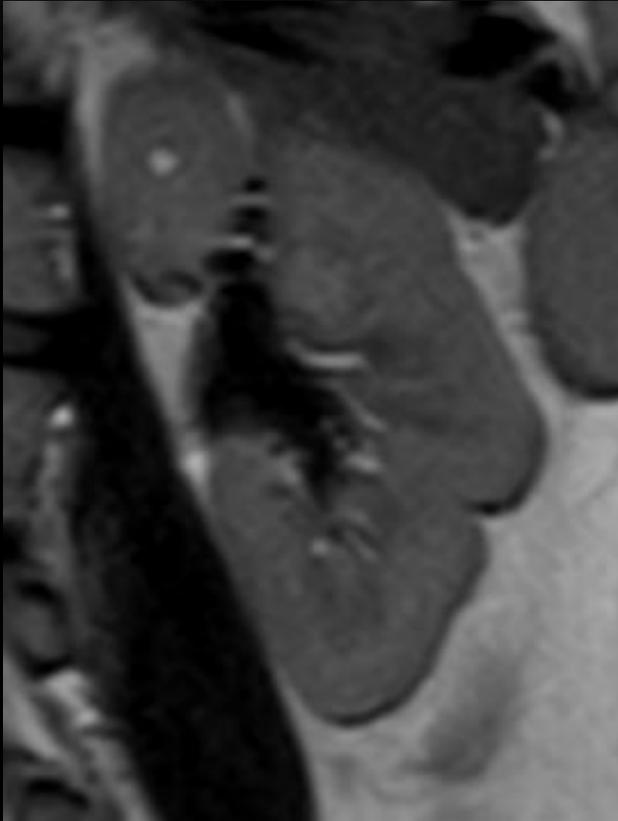
<b>Modality</b>	<b>Median SN</b>	<b>Median SP</b>
Conventional radiography	57%	76%
Ultrasound	61%	97%
Intravenous pyelography	70%	95%
MRI	82%	98.3%
CT (not as gold standard)	98%	97%

*AUA Guidelines 2012*

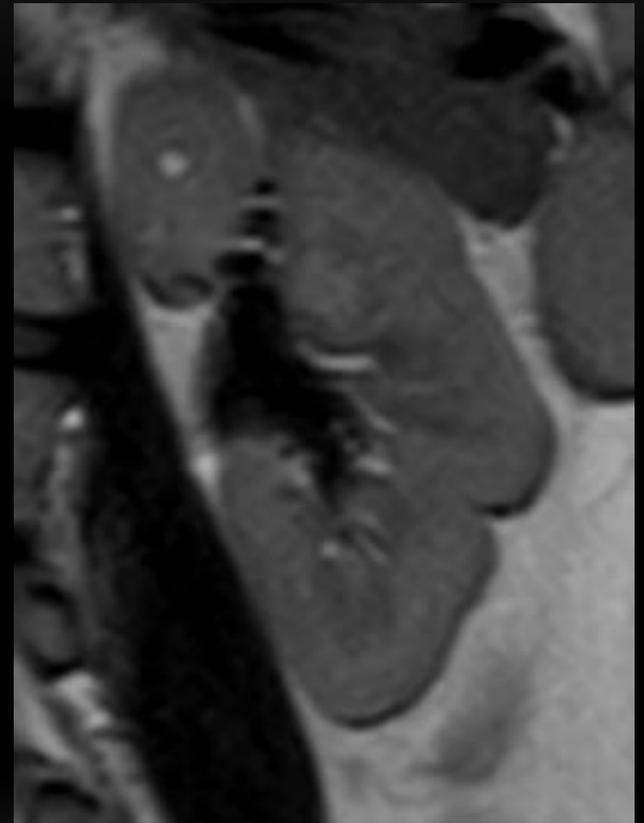
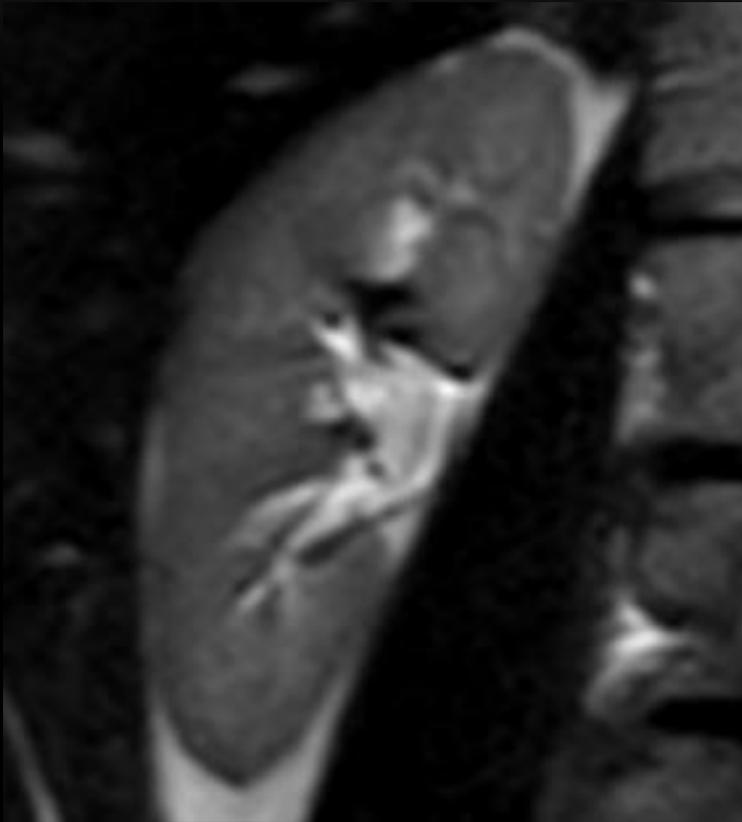


Allergie iode – contexte hématurie macroscopique - recherche lésion de TCC – T2 TSE

*Séquences utiles?*

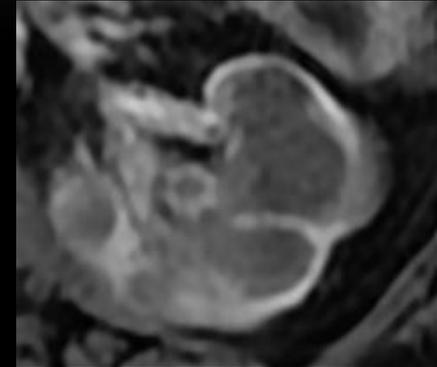
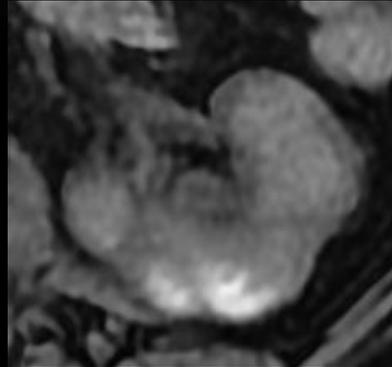


Réaliser les coupes T2TSE AVANT l'injection de GADOLINIUM



# URO-IRM – LASIX AVANT L'INJECTION DE GADO

Hématurie macroscopique – femme de 55 ans – allergie à l'iode – TCC



T1 sans et post IV de Gado



T2 TSE

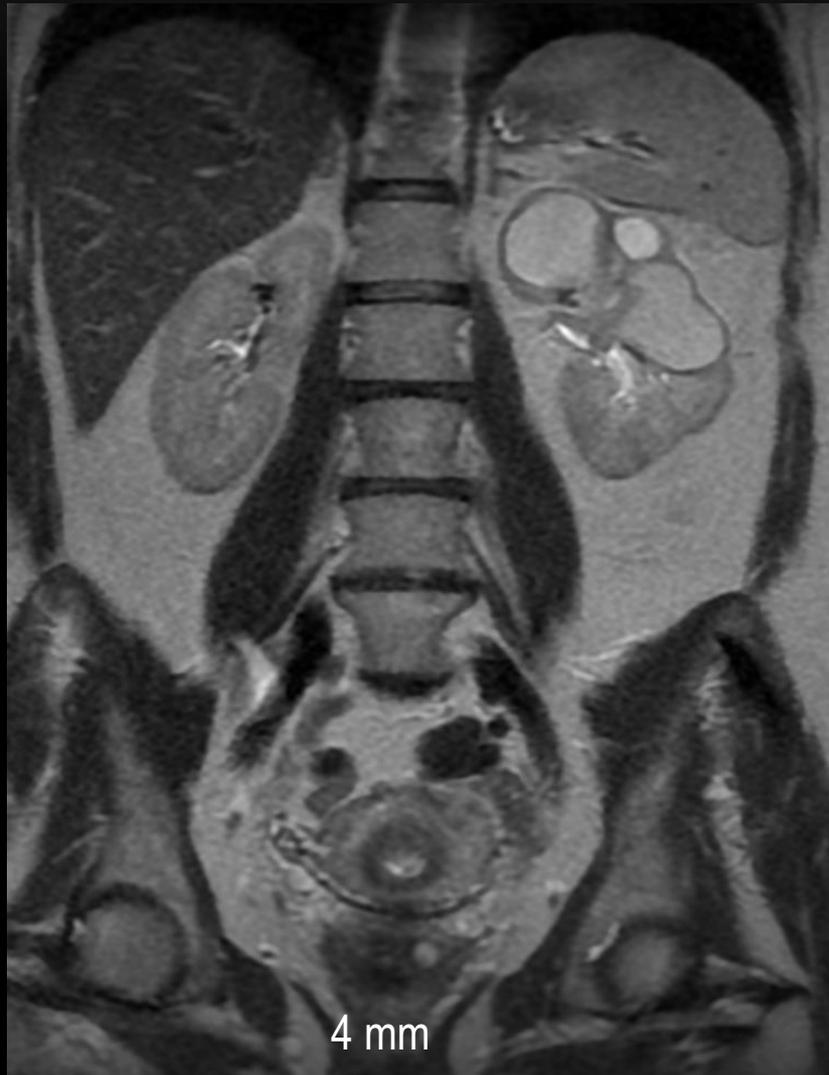


FIESTA/BFFE/True FSIP/SSFP

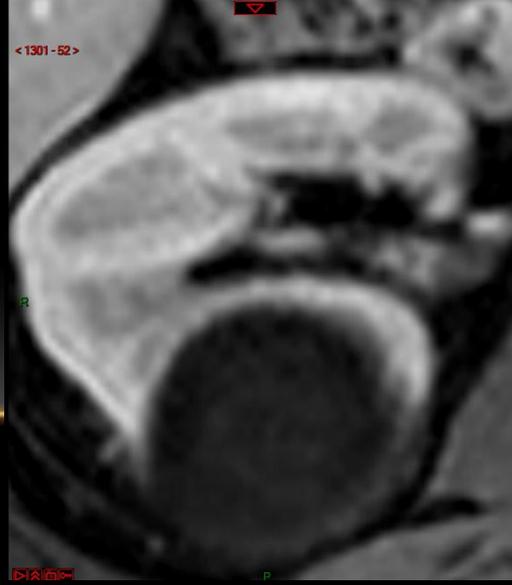
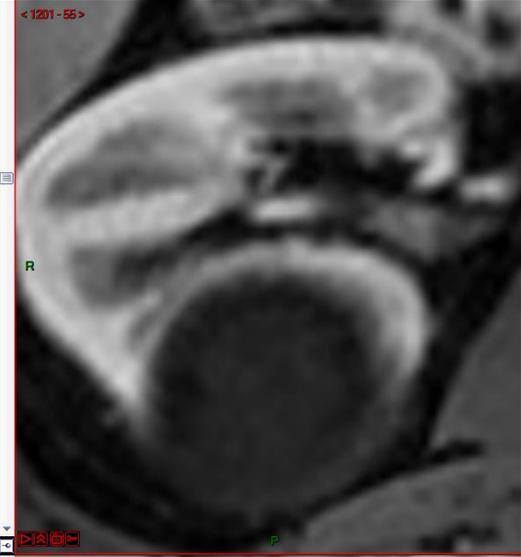
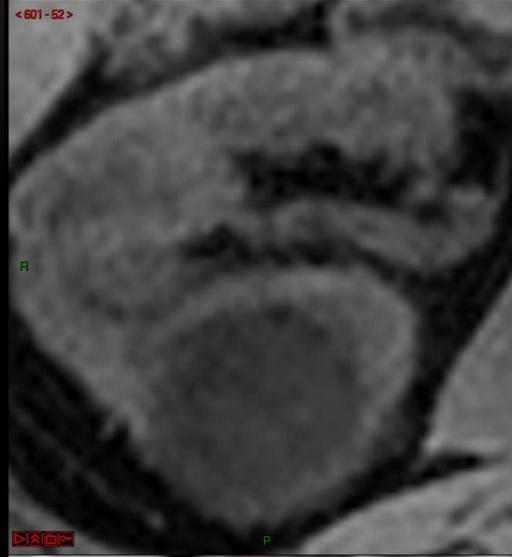
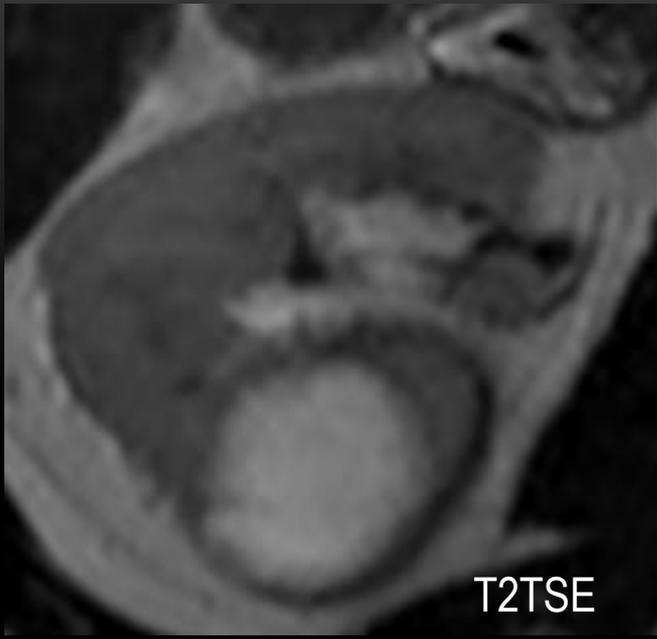
T2

vs

FIESTA/BFFE



# TCC - HOMME 55 ANS



# LÉSION INFILTRATIVE CENTRALE : RCC VS TCC?

Intérêt pour la chirurgie !

-> RCC : néphrectomie - partielle pour les T1  
- totale pour les T3

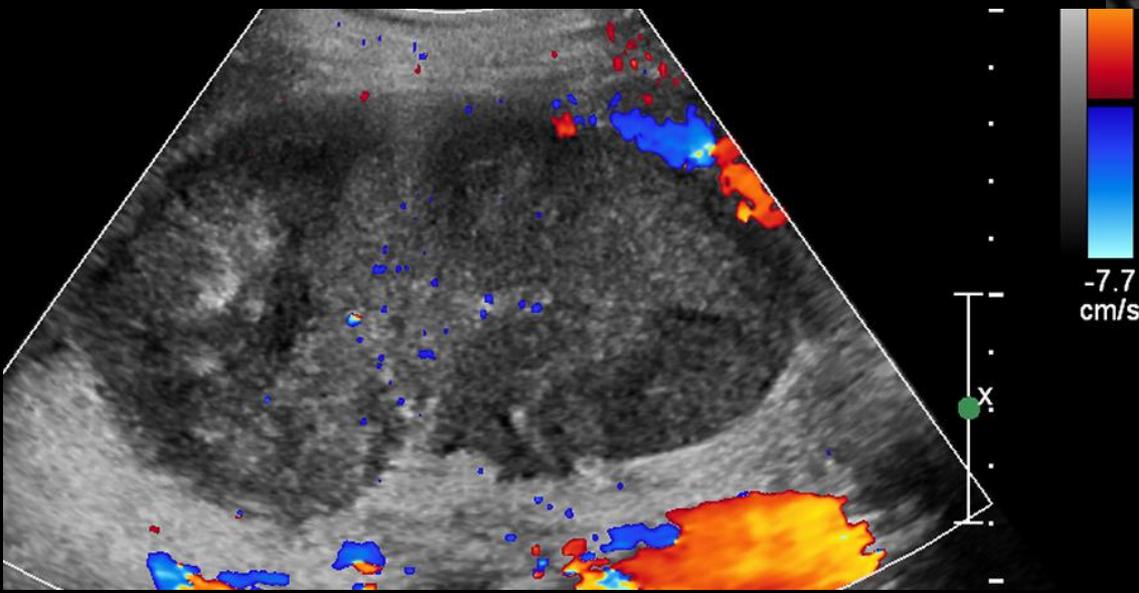
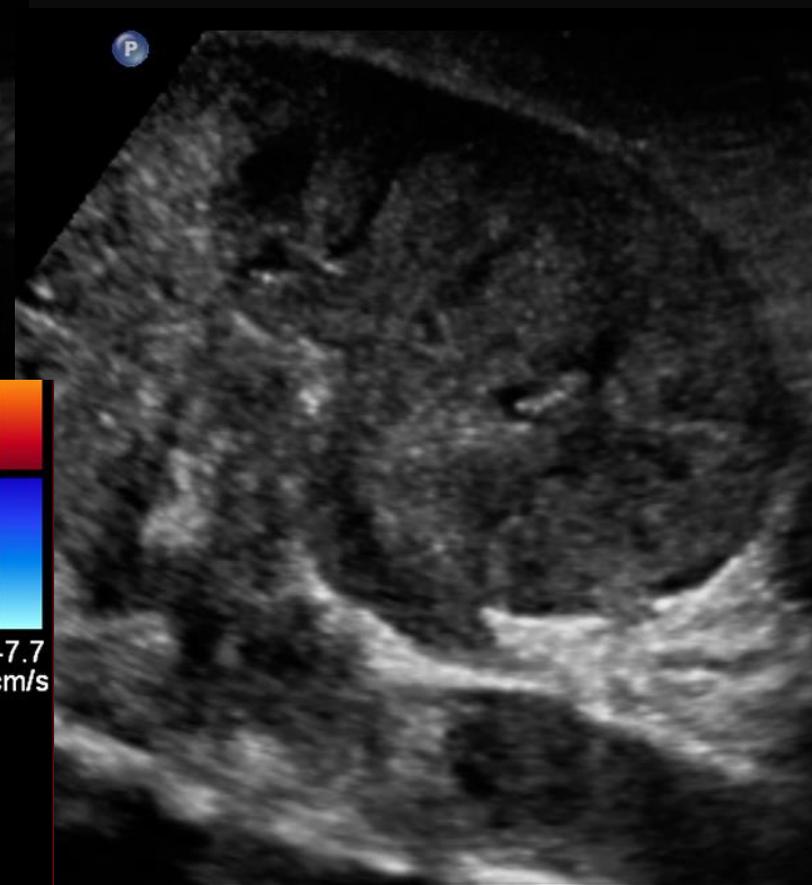
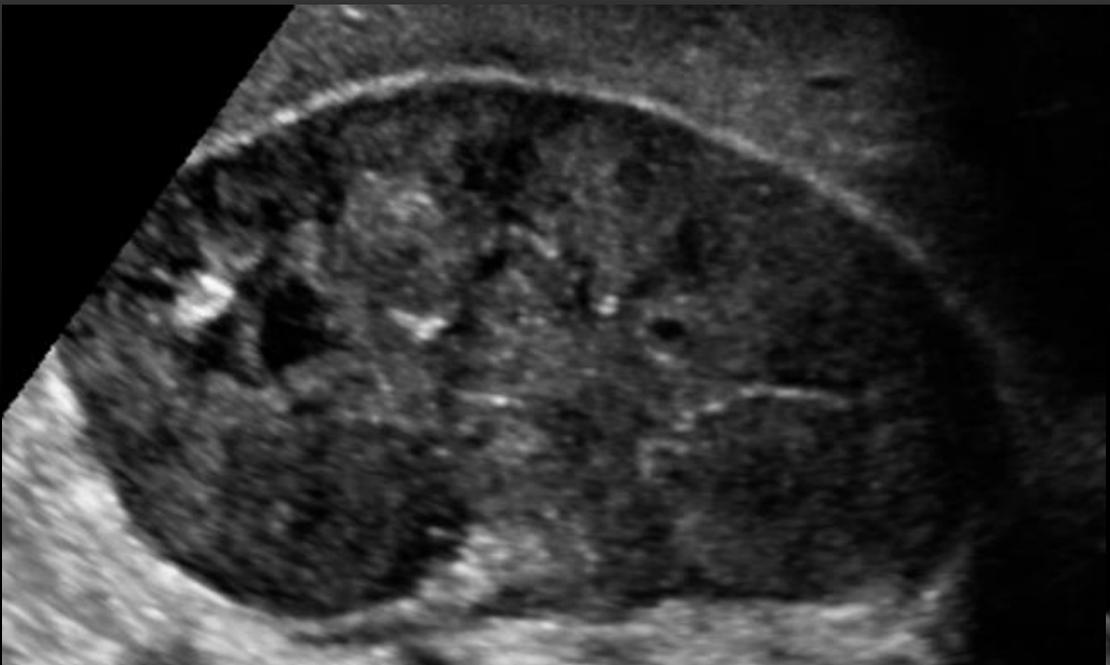
-> TCC : népro-urétérectomie

- situé dans le système collecteur
- défaut pyélon
- respect contours du rein
- extension > jonction pyélo-urétérale

Se : 68-82%

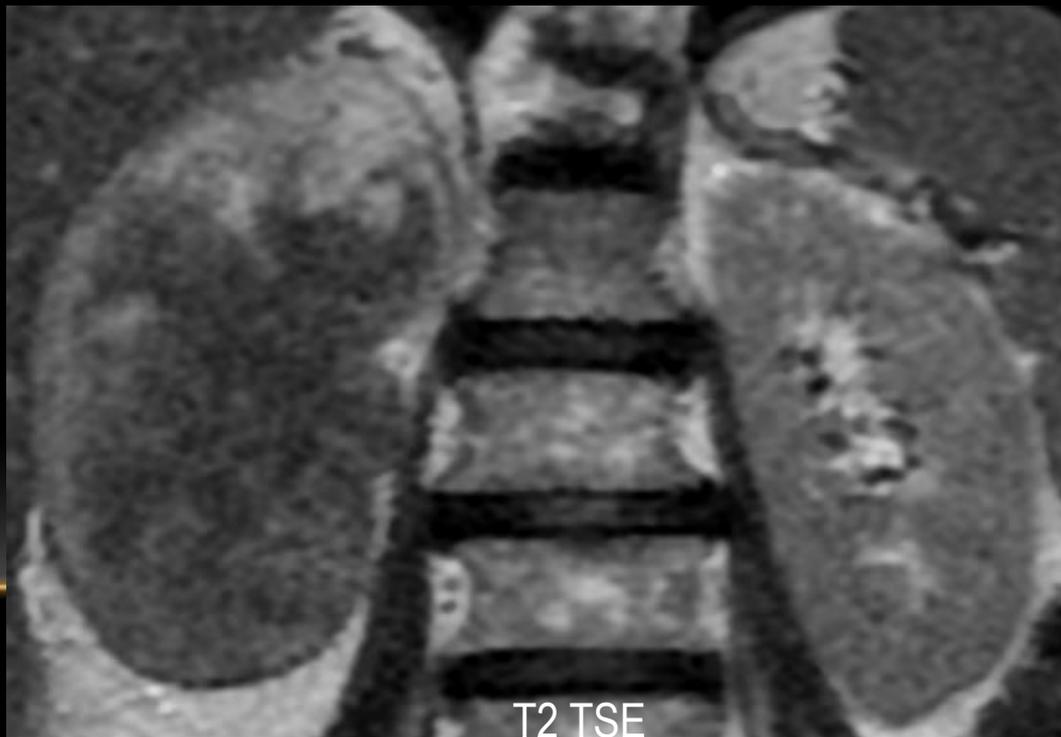
Sp : 79-89%

FEMME 74 ANS

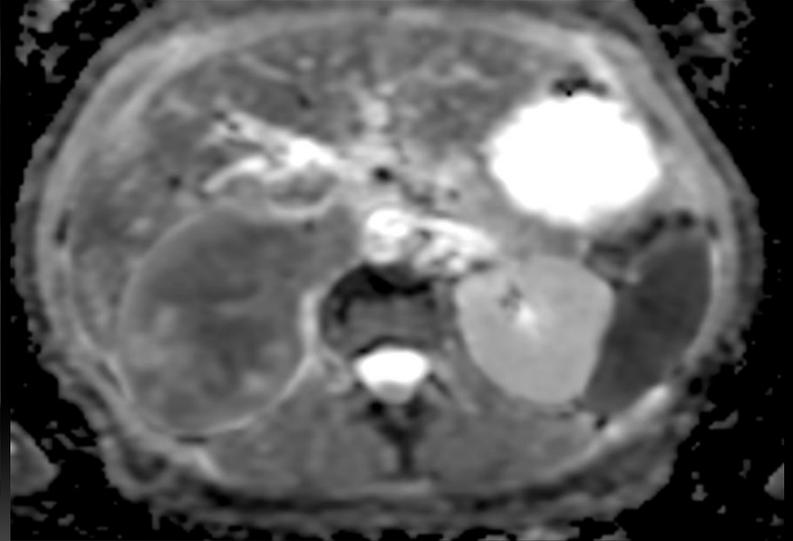
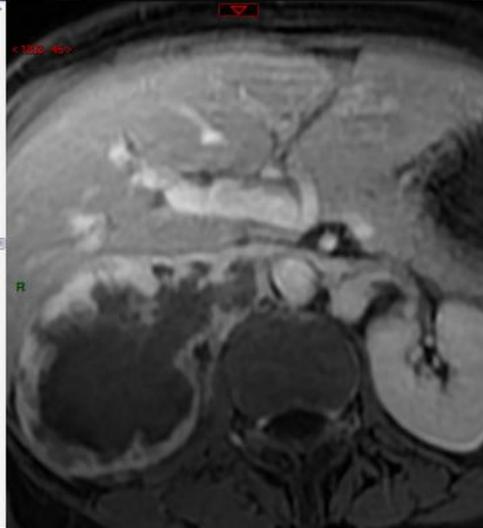
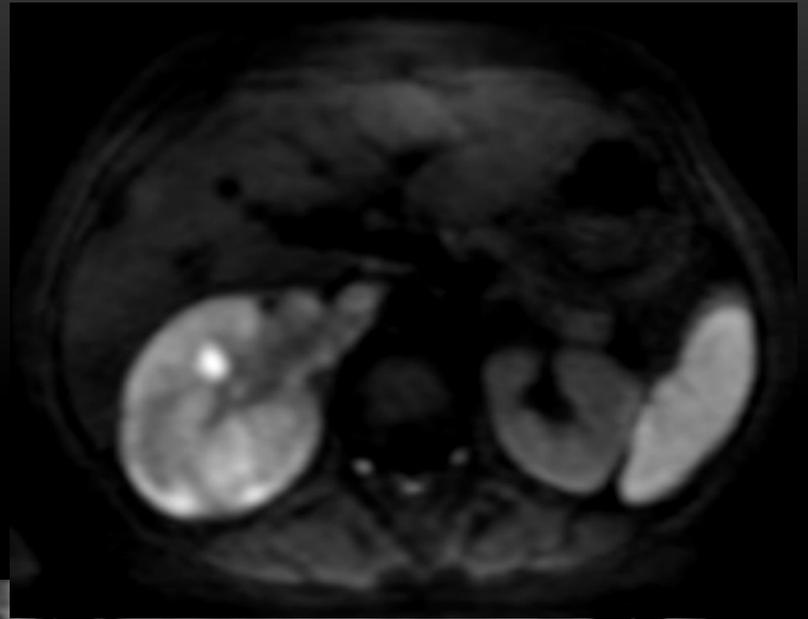
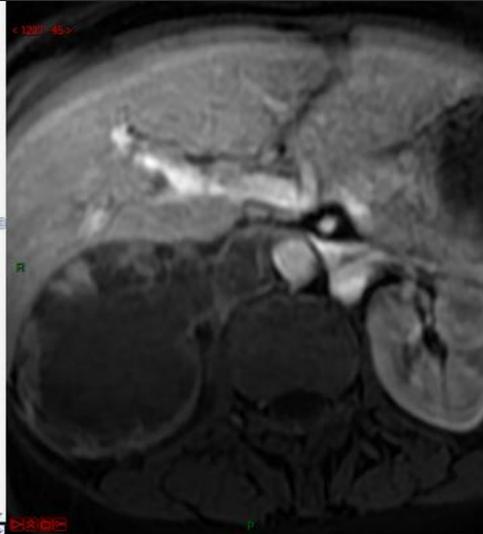
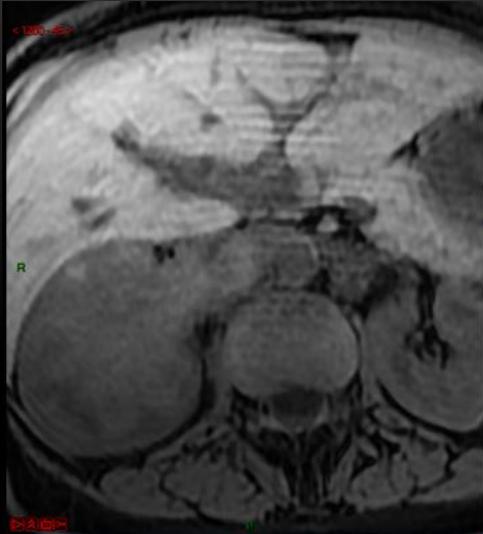




CT+IV de contraste



T2 TSE



# CARCINOME UROTHÉLIAL À L'IRM

- **TCC multifocal**
- Pyélon atteint dans 7% - 2-4% des patients atteints d'un polype de vessie ont un cancer du haut appareil
- 19% développe un cancer métachrone
- **Gold standard** = CT avec phase tardive (Se 92%)  
pas de différenciation entre le Ta et T2



IRM en cas d'allergie à l'iode ou d'IR (se 89%)

# SÉQUENCES ET ANATOMIE NORMALE

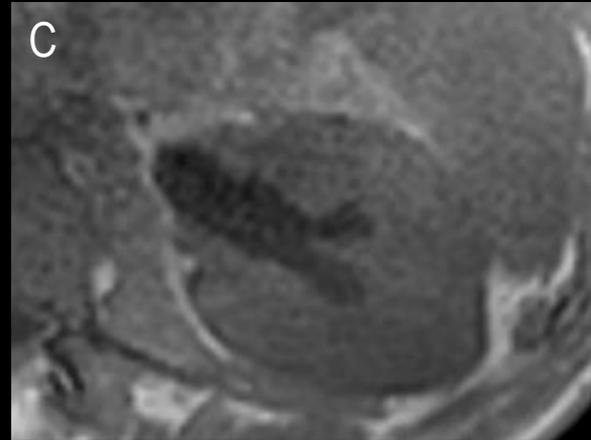
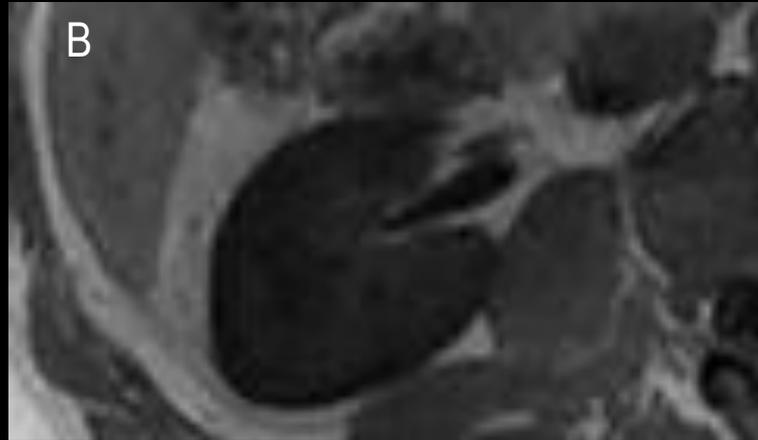
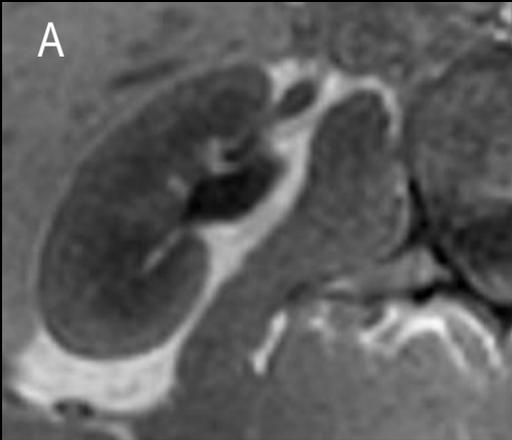
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Rein normal

Pathologie non tumorale

# ANATOMIE RÉNALE NORMALE

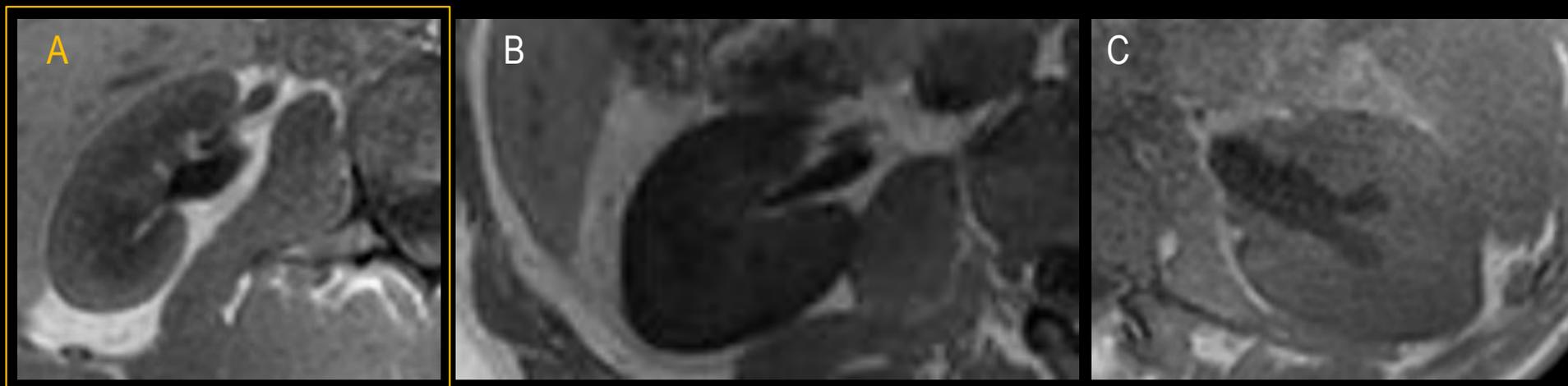
*Quel est le patient avec un fonction rénale normale ?*



T1 in phase

# ANATOMIE RÉNALE NORMALE

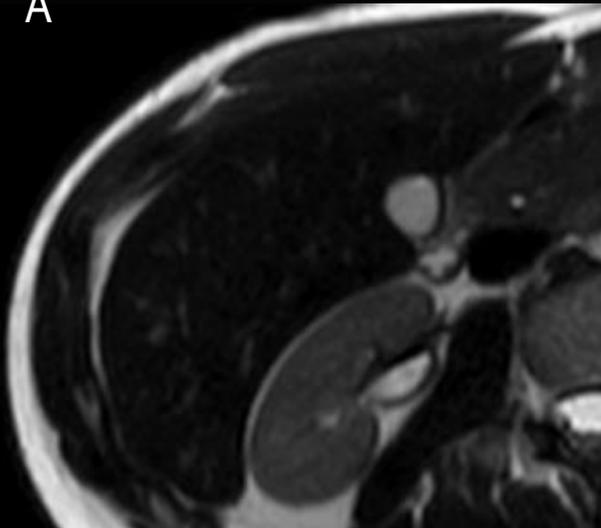
*Quel est le patient avec un fonction rénale normale ?*



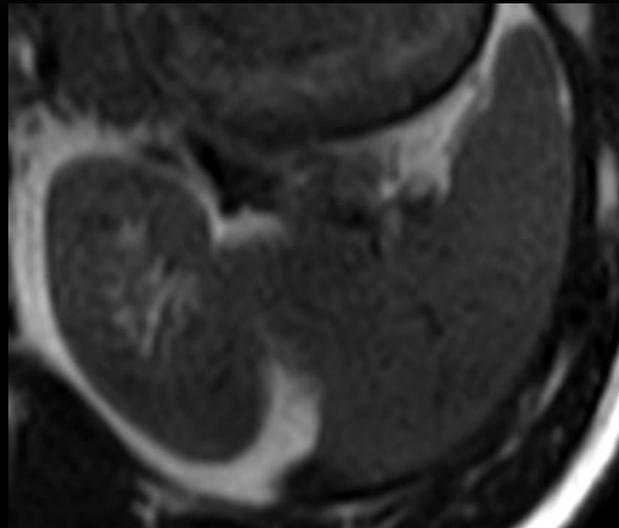
T1 in phase

# ANATOMIE NORMALE — SÉQUENCES ANATOMIQUES

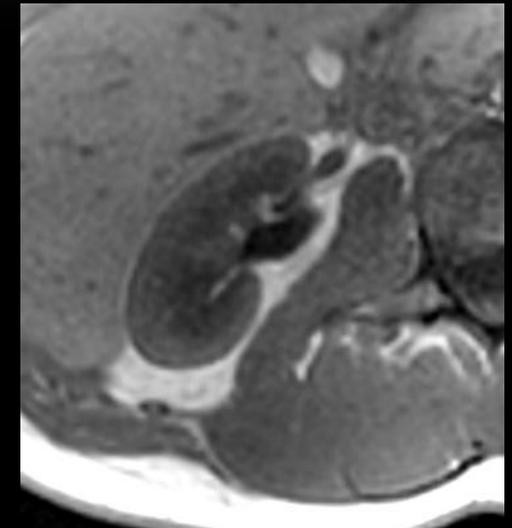
A



Signal T2 rein > T2 foie



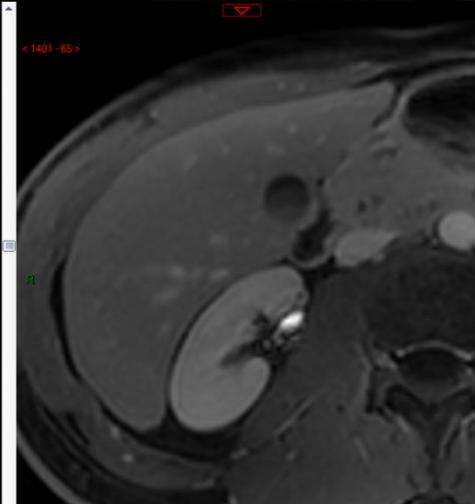
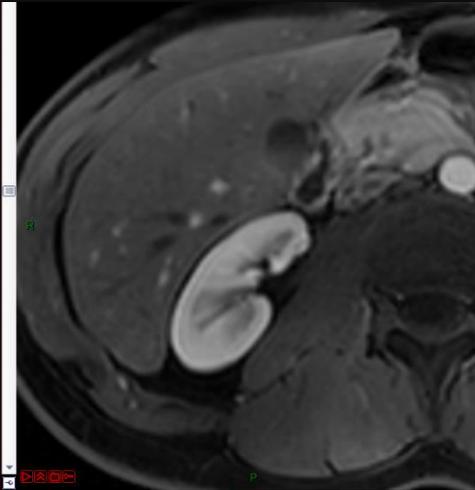
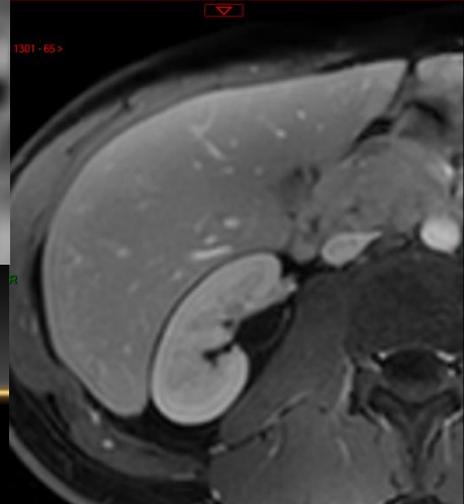
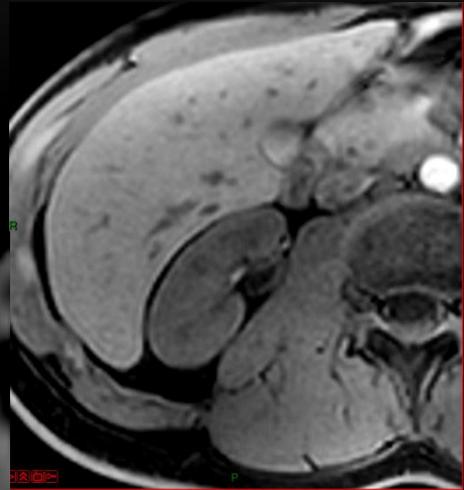
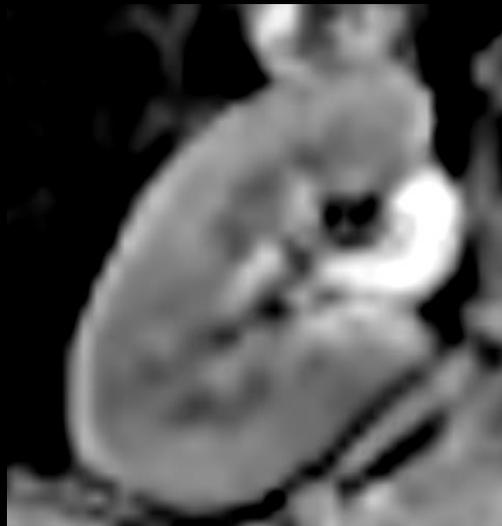
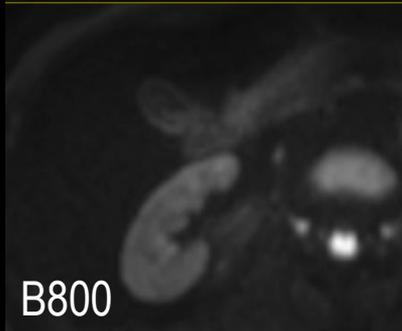
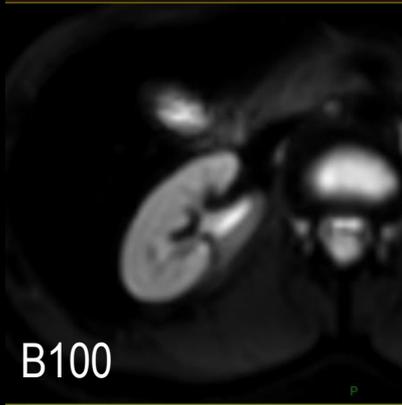
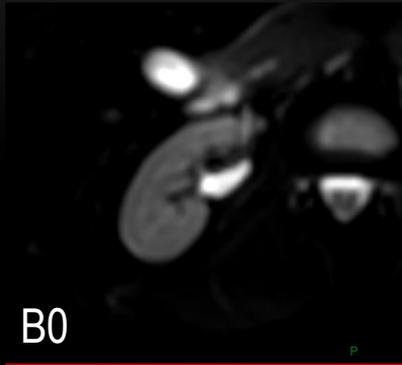
Signal T2 reins ~ rate



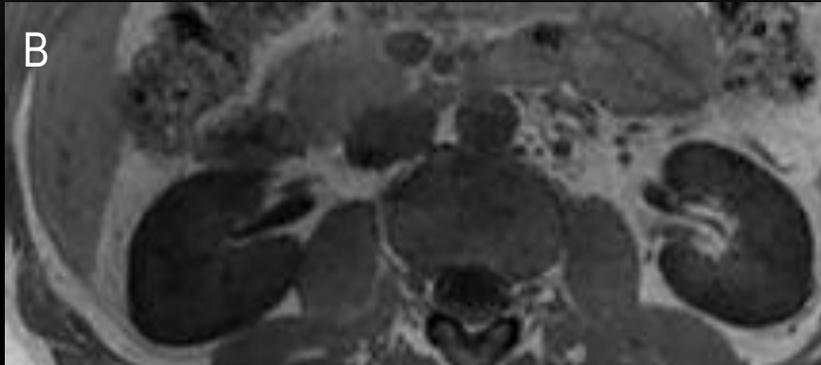
Signal T1 médullaire ~ muscle

→ Différenciation cortico-médullaire

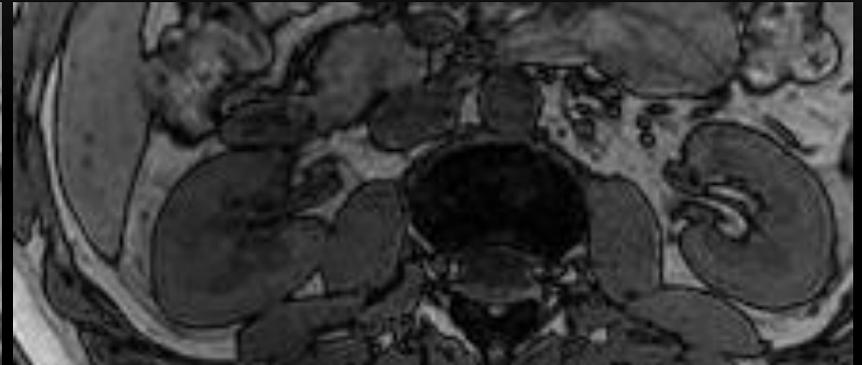
# ANATOMIE NORMALE — SÉQUENCES FONCTIONNELLES



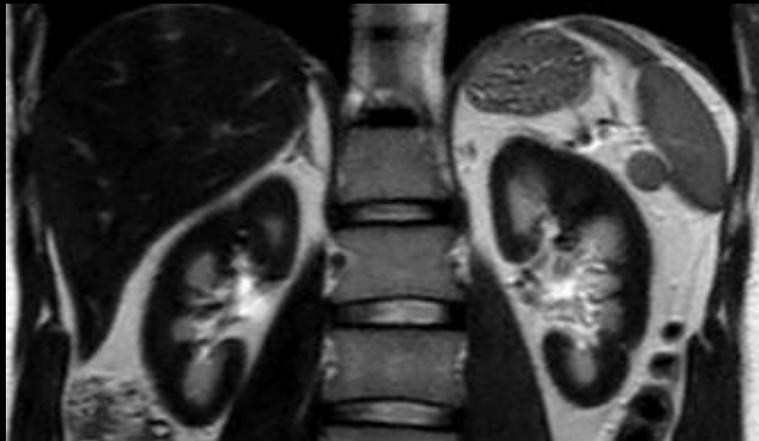
Séquences post IV de Gadolinium



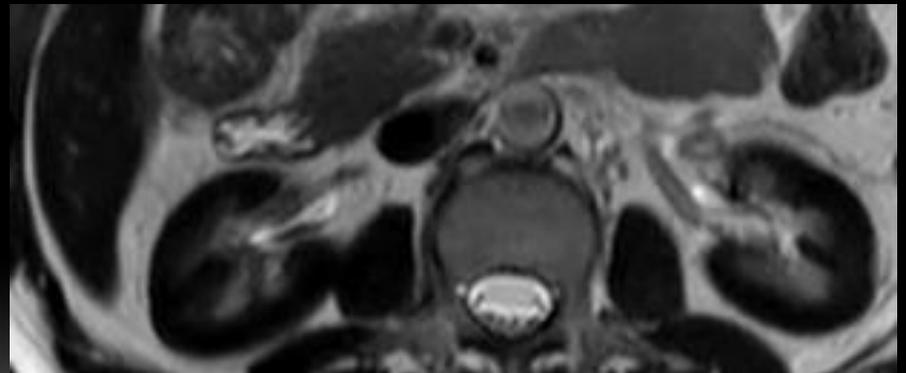
T1 IP



T1 OP

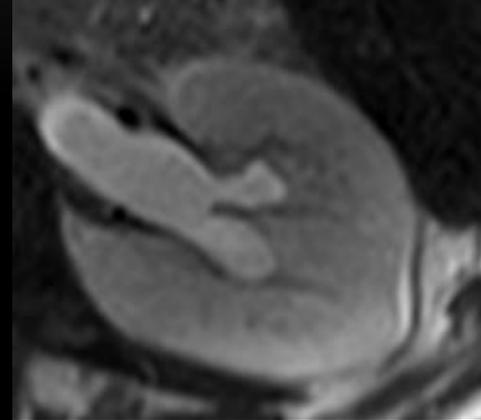
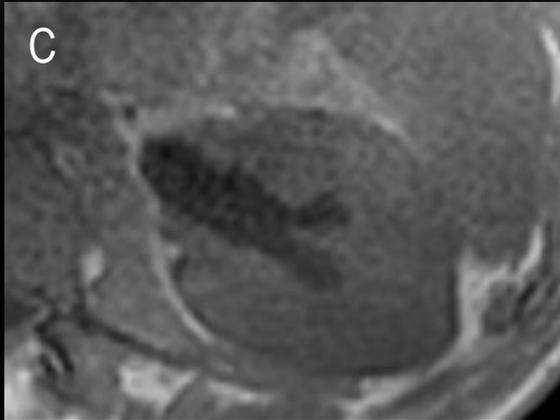


T2 TSE

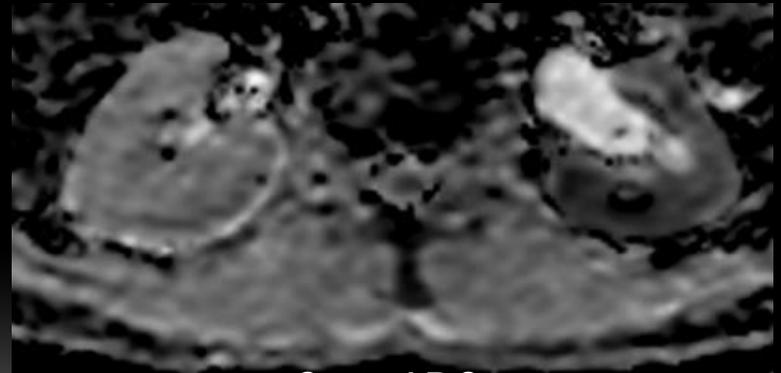


Hémossidérose corticale

# OBSTRUCTION ET /OU ATROPHIE RÉNALE



DWI b800

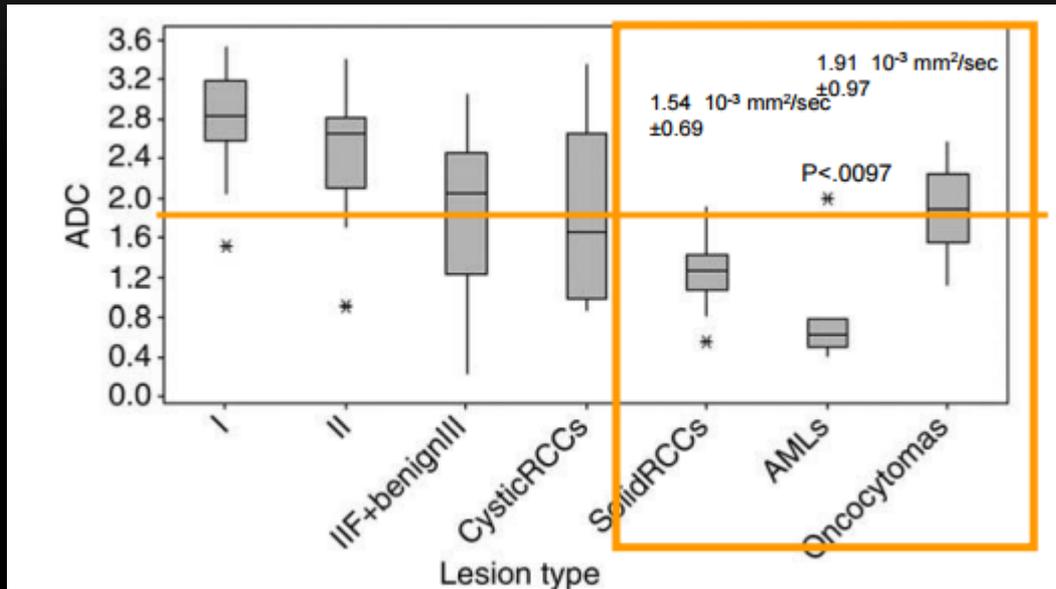


Carte ADC

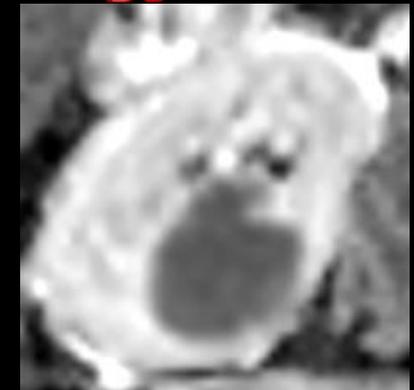
# LES SÉQUENCES FONCTIONNELLES ...

DWI, DTI	Apparent diffusion constant	Morphologic and functional (flow, fluid exchange and reabsorption)	Renal cell carcinoma	Complex interpretation
	Pseudo/diffusivity		Renal artery stenosis (18)	lack of standard imaging and analysis protocols
	Fluid fraction Fractional anisotropy		Allograft assessment (7,22) Diabetic nephropathy	
			Ureteral obstruction CKD	

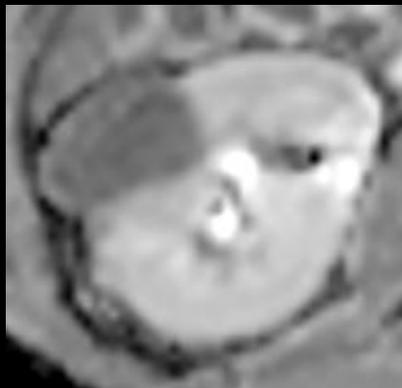
# DIFFUSION DANS LES LÉSIONS DU REIN...



Taouli B et al Radiology 2009



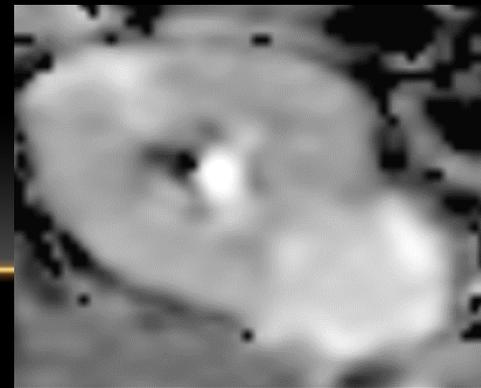
Lymphome



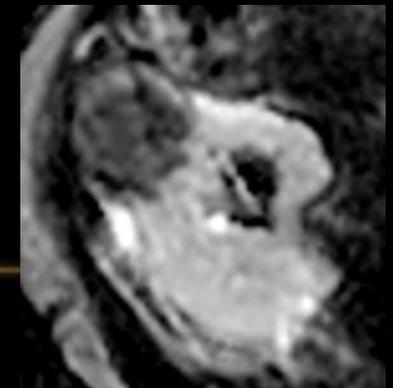
AML faible en graisse



Kyste infecté



cRCC



pRCC

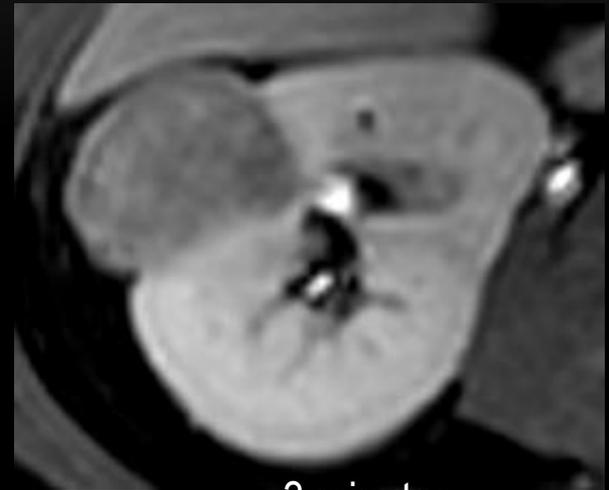
# AML FAIBLE EN GRAISSE



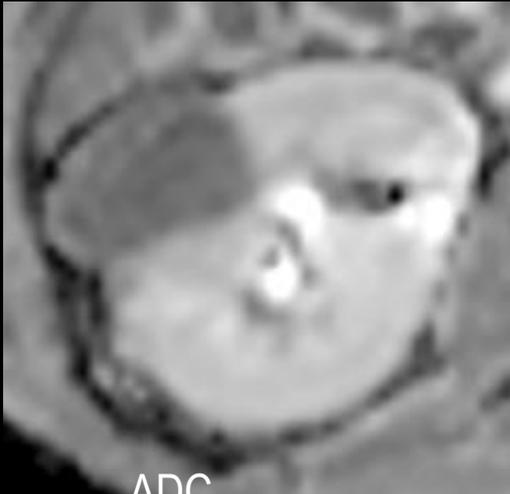
T2 TSE



T1 + IV



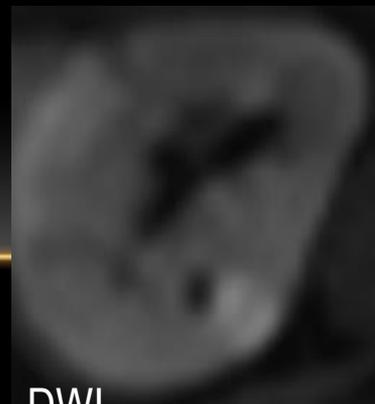
3 minutes



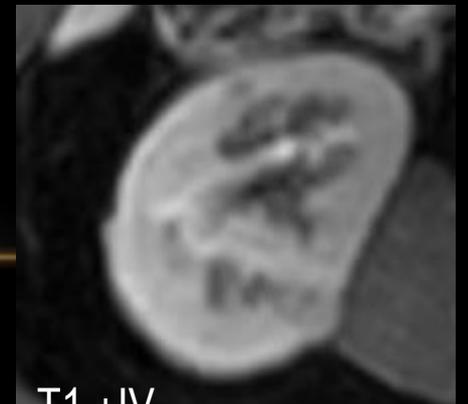
ADC



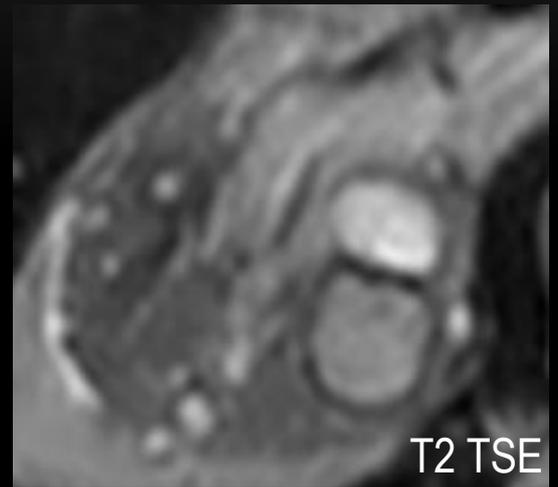
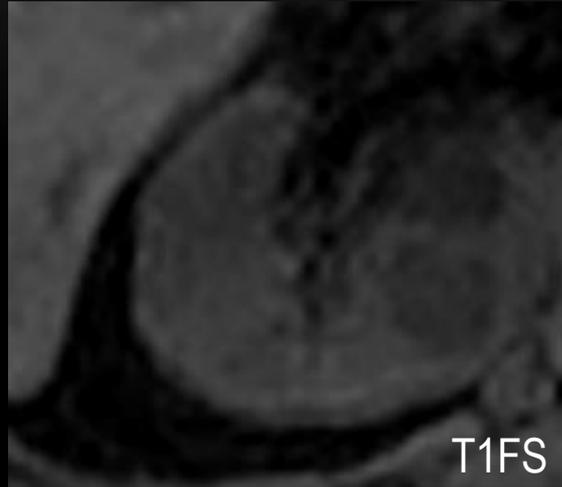
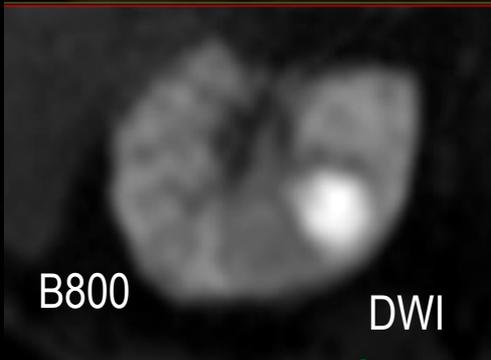
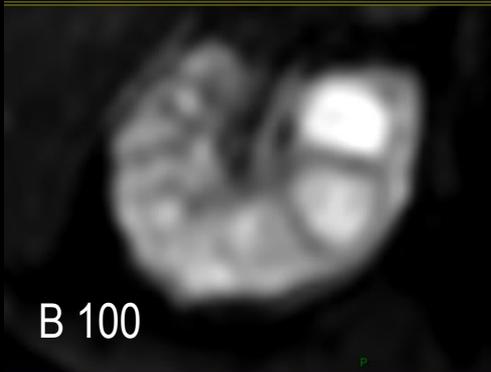
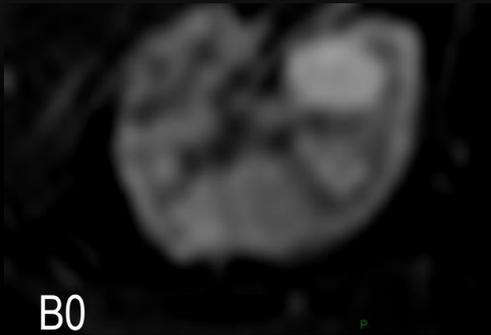
DWI



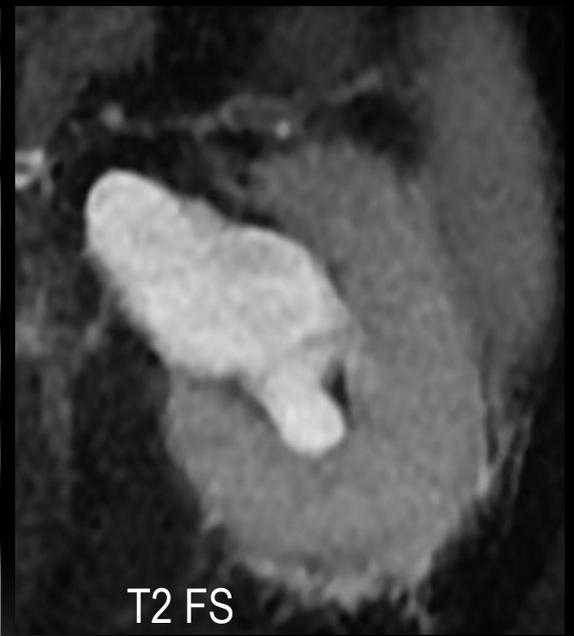
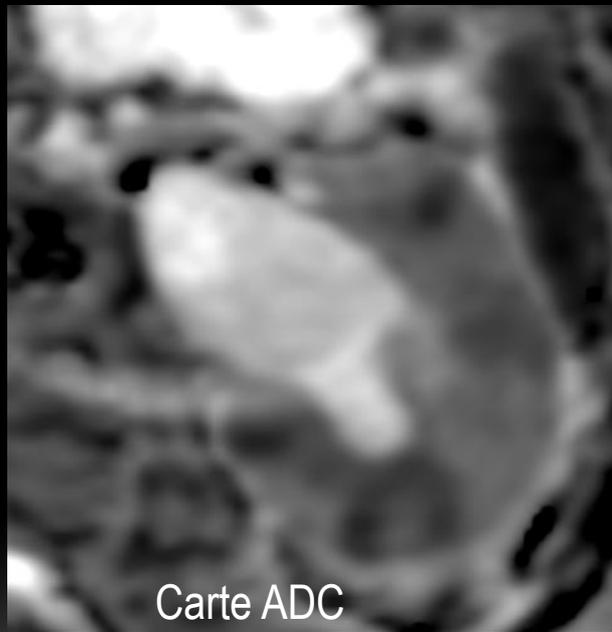
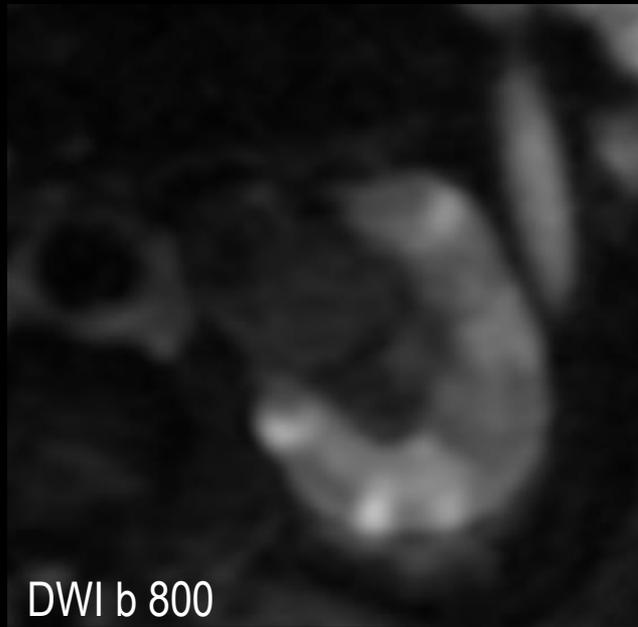
T1 + IV



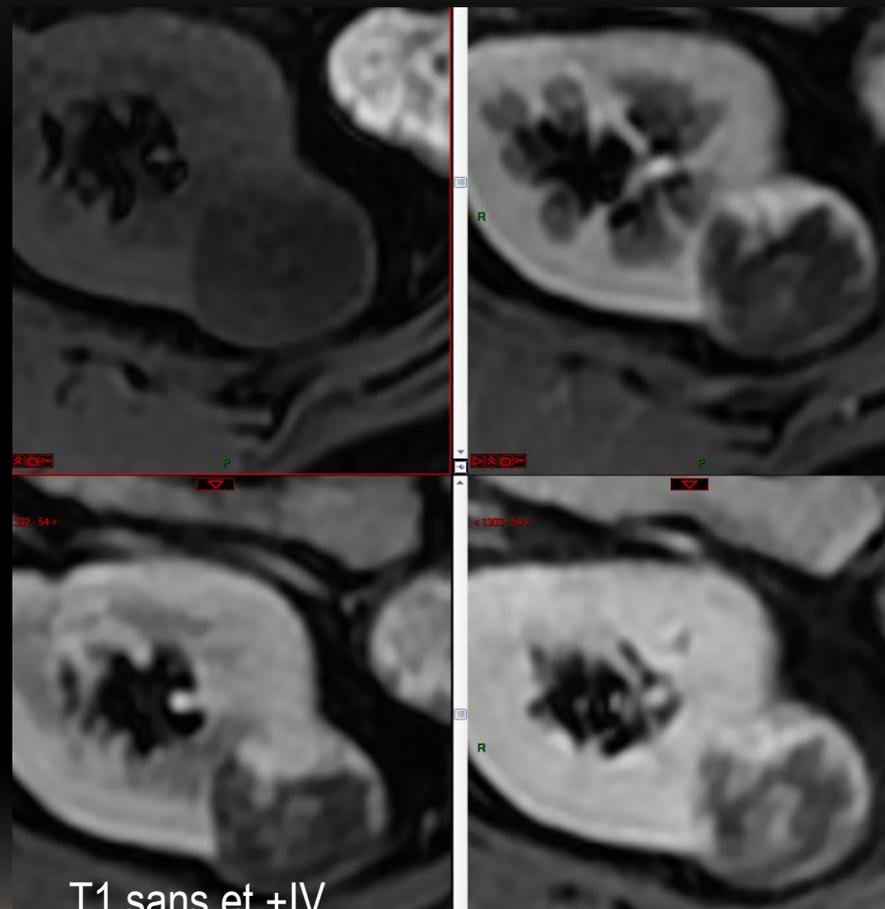
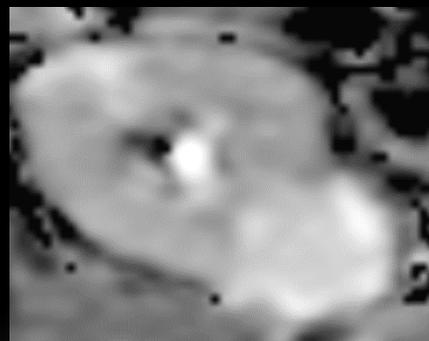
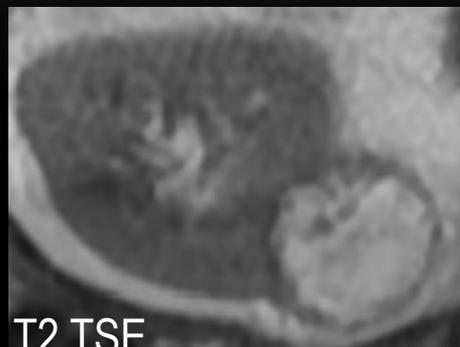
# KYSTE RÉNAL INFECTÉ



# FOYERS DE PNA

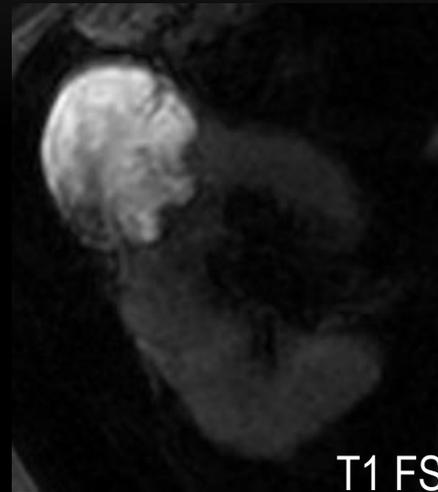
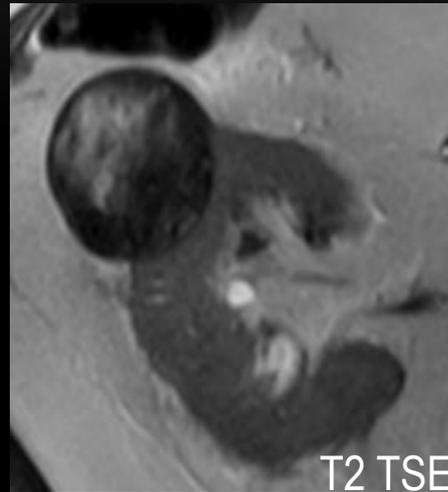


# CARCINOME A CELLULES CLAIRES

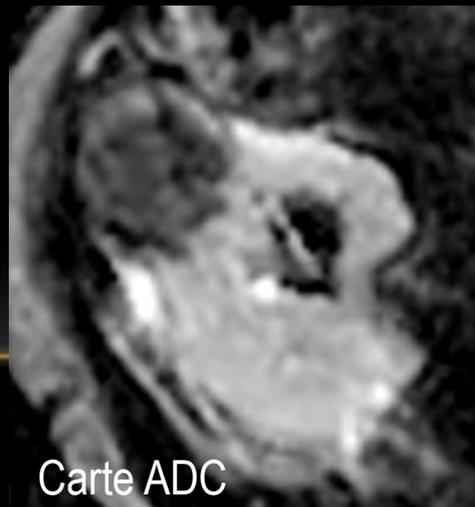


# C. PAPILLAIRE

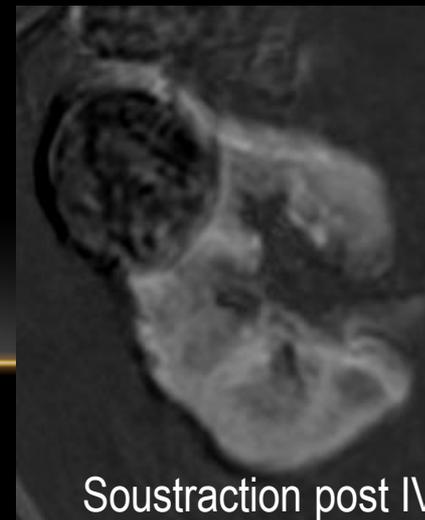
B0



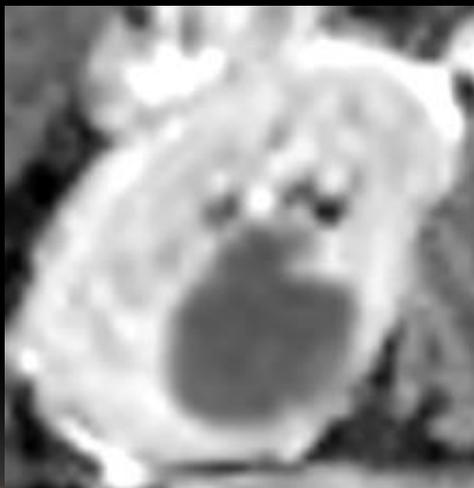
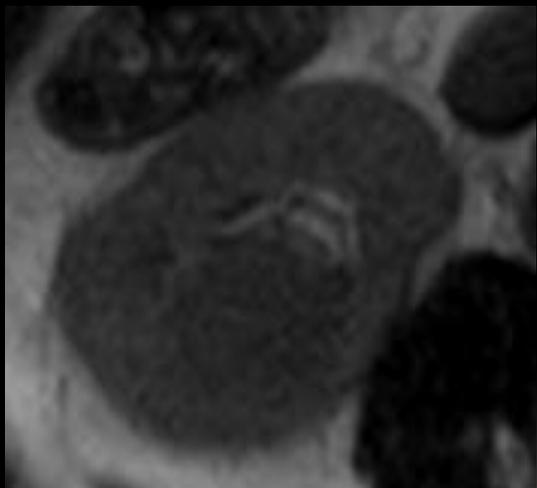
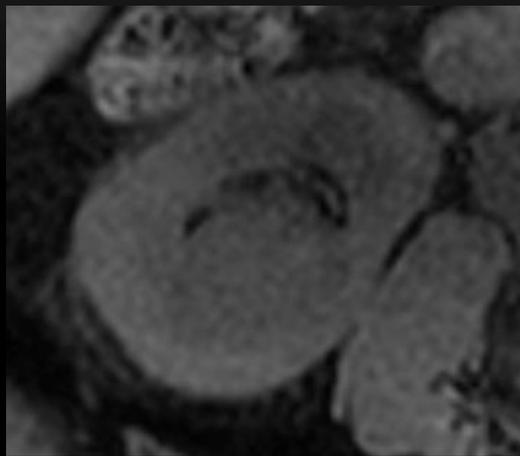
B100



B800



# LYMPHOME

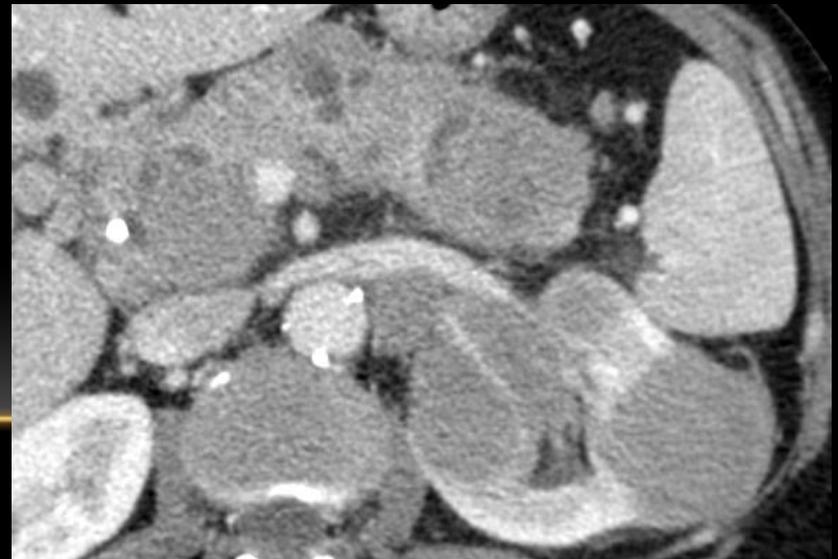
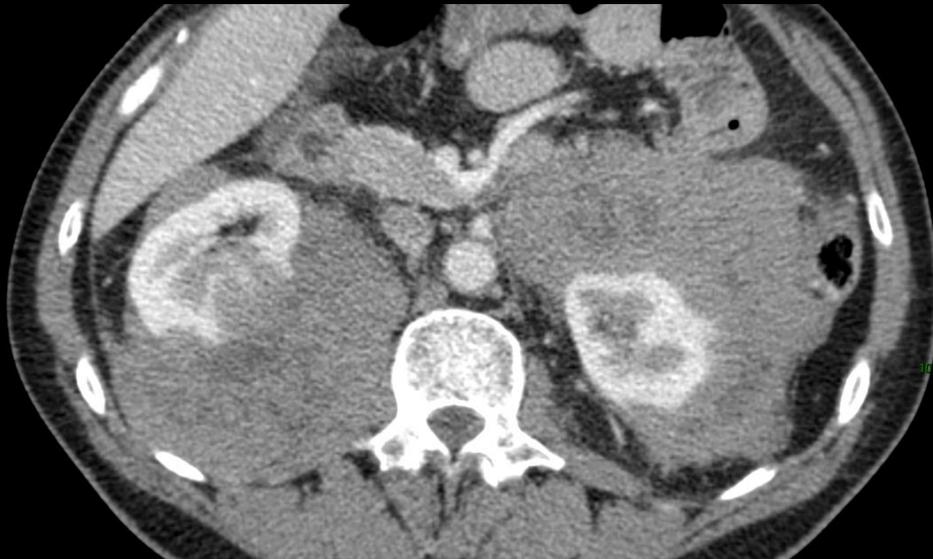
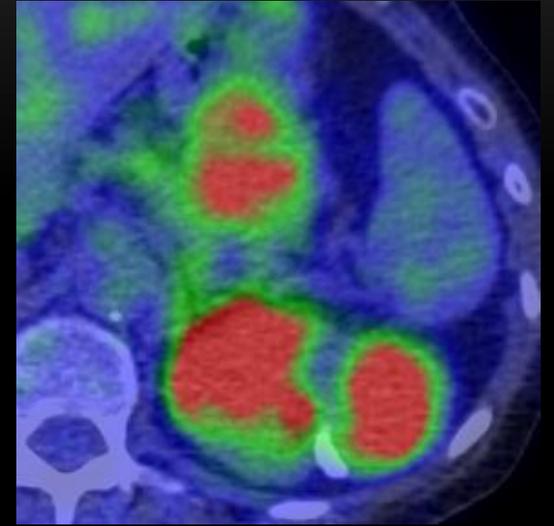


T2 TSE

ADC :  $0,67 \times 10^{-3}$

SUV max : 8

# LYMPHOME



# CAS CLINIQUES

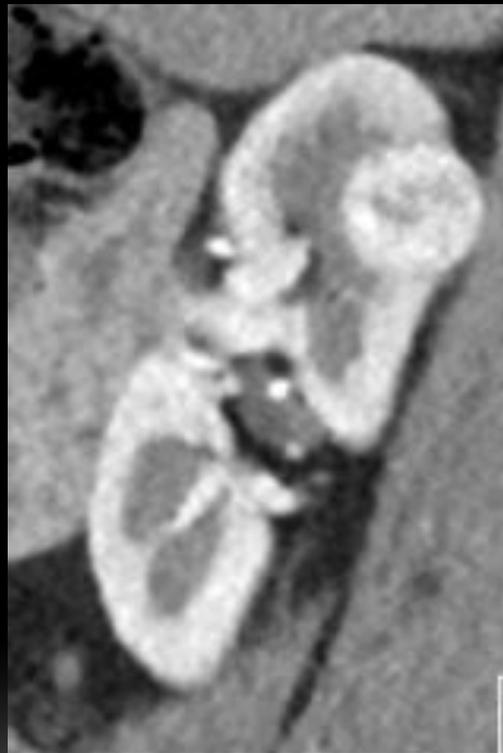
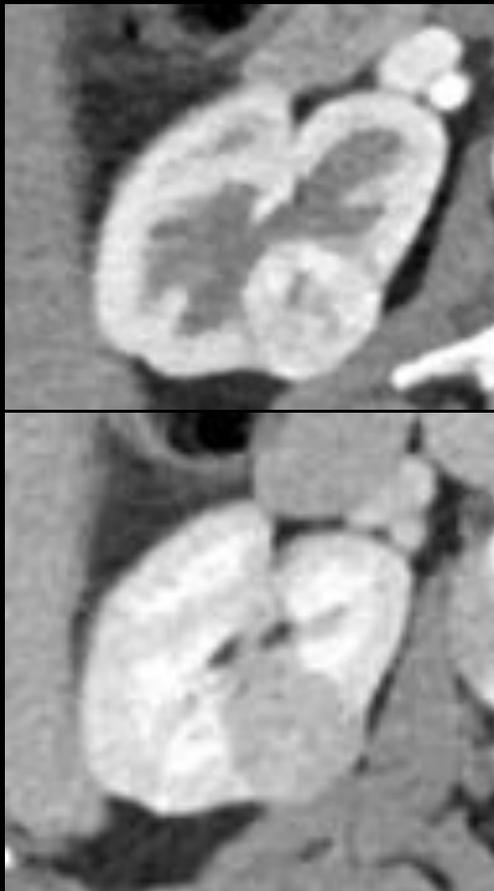
---

Masses rénales bénignes vs malignes?

Intérêt IRM?

# 1 - AVIS URGENT

« ... tu veux bien cliquer sur le lien ci-dessous... Une IRM a-t-elle un intérêt ? »



Lésion hypervascularisée avec pseudo-capsule et centre hypodense rehaussant tardivement

# AVIS URGENT

IRM : lésion sans chute de signal en OP - ADC  $>1,7 \times 10^{-3} \text{ mm}^2/\text{s}$  - pseudo capsule - cicatrice centrale

**Question** : « Je pense que je connais la réponse mais tu en penses quoi? Possibilité d'oncocytome? Plutôt AdénoC? »

**Réponse** :

- A. Vous préféreriez le temps où on vous demandait juste si c'était une masse
- B. Lésion charnue indéterminée, cf. biopsie
- C. Lésion de 2 cm, je propose un suivi
- D. Vous ne répondez pas

# AVIS URGENT

IRM : lésion sans chute de signal en OP - ADC  $>1,7 \times 10^{-3} \text{ mm}^2/\text{s}$  - pseudo capsule - cicatrice centrale

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**Réponse** :

- A. Vous préféreriez le temps où on vous demandait juste si c'était une masse
- B. Lésion charnue indéterminée, cf. biopsie 😊
- C. Lésion de 2 cm, je propose un suivi
- D. Vous ne répondez pas

**Mais une tumeur avec cicatrice centrale qui se rehausse tardivement, sans effet en opp de phase avec un ADC élevé et une hyperartérialisation, a toutes les chances d'être un oncocytome**



**! BIOPSIE !**

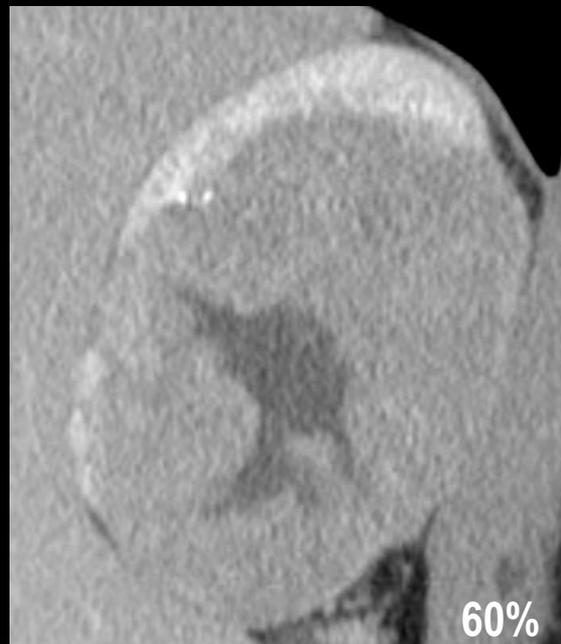
Oncocytome

Chromophobe

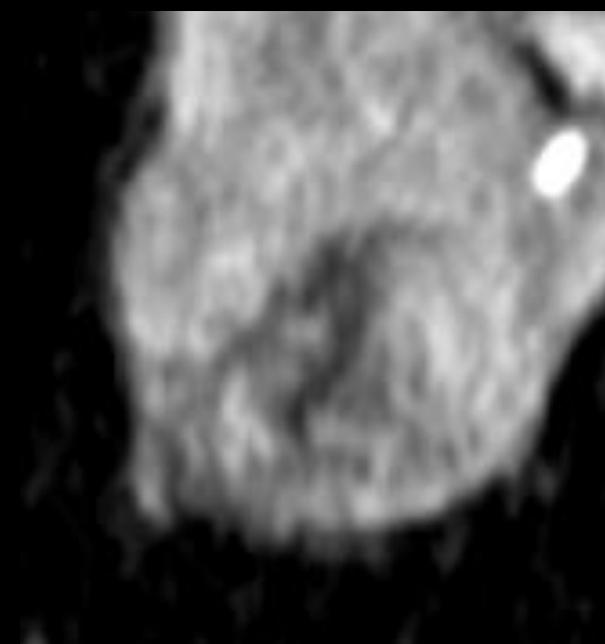
# ONCOCYTOME - « CICATRICE »



Chromophobe



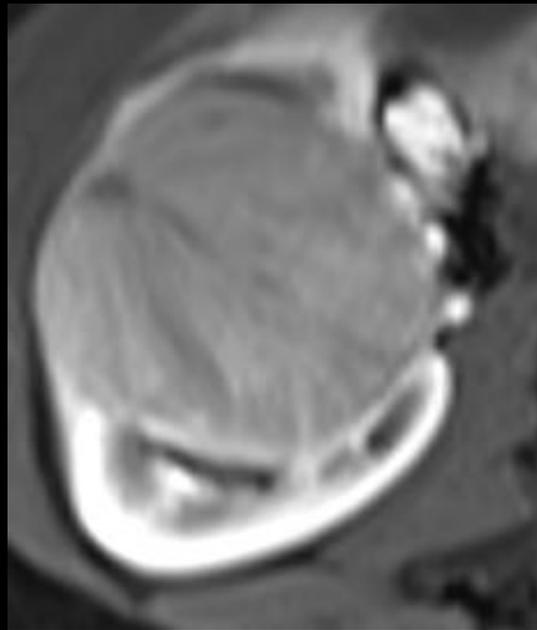
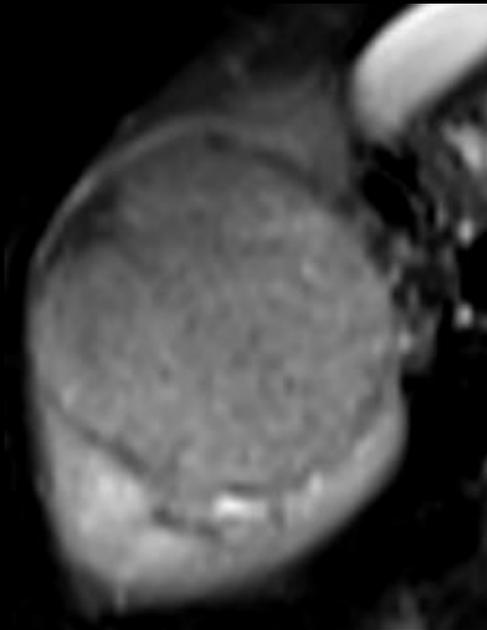
Oncocytome



cRCC

## -PSEUDO-CAPSULE -

RCC < 4 cm 66% / 28% >4 cm = oncocytome (50%)



Roy C. et al, AJR 2005;184:113-120

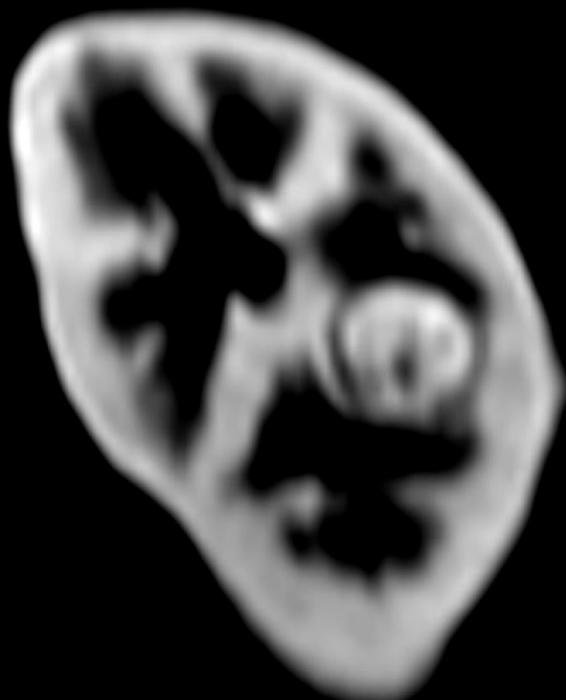
Yamashita Y et al. AJR1996;166:1151-1155

# Oncocytome

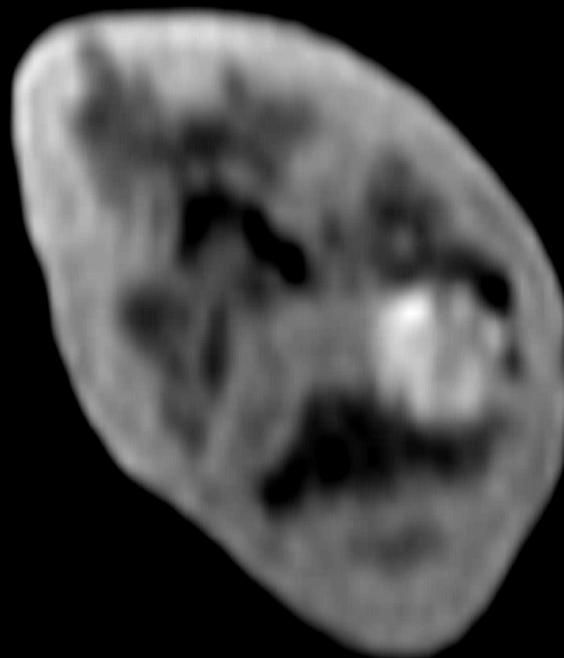
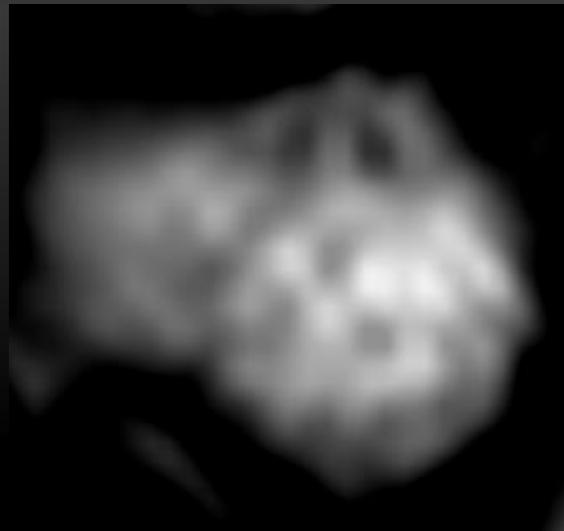
- « SEI »



Se 80%, SP 99%  
VPP 89%, VPN 98%



Phase cortico-médullaire



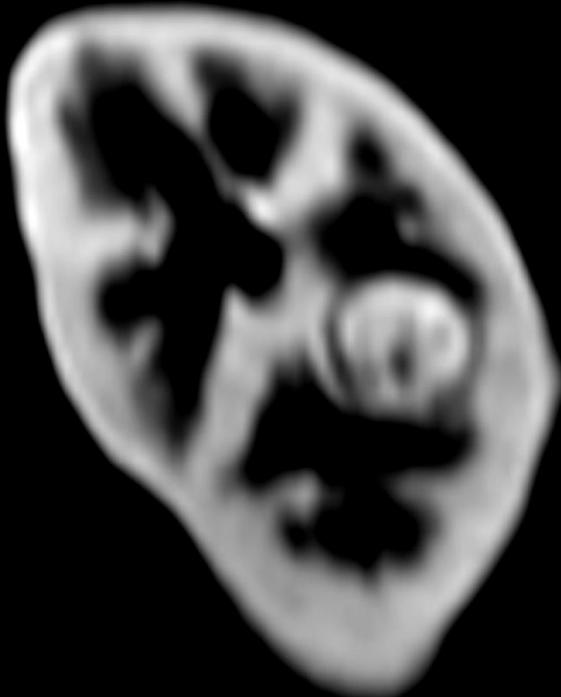
Phase excrétrice – 3-5 min



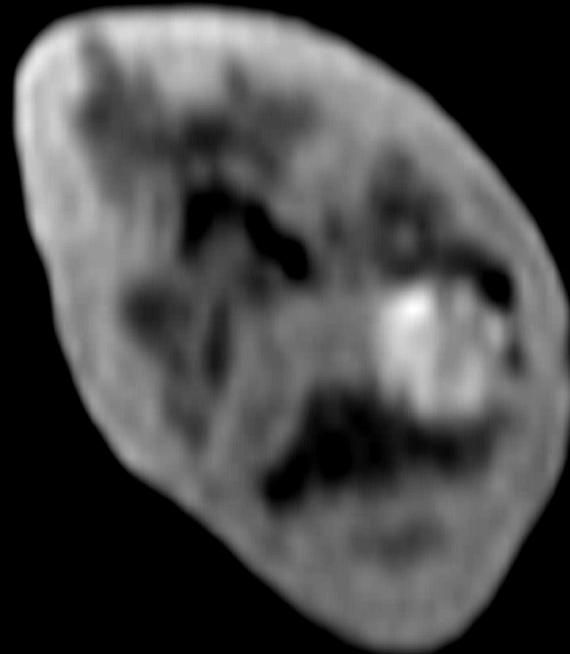
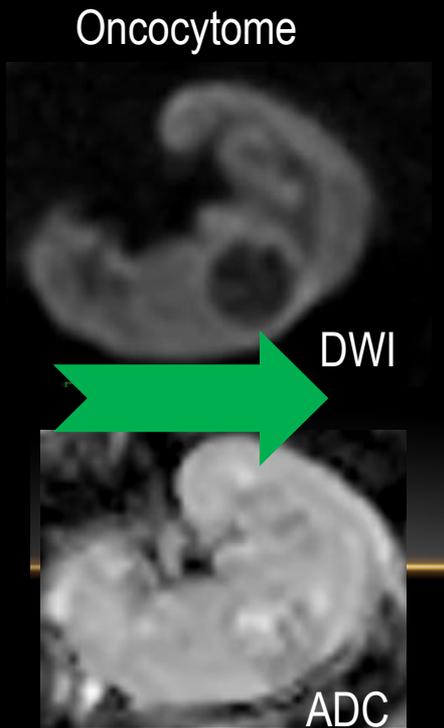
- « SEI »



Chromophobe

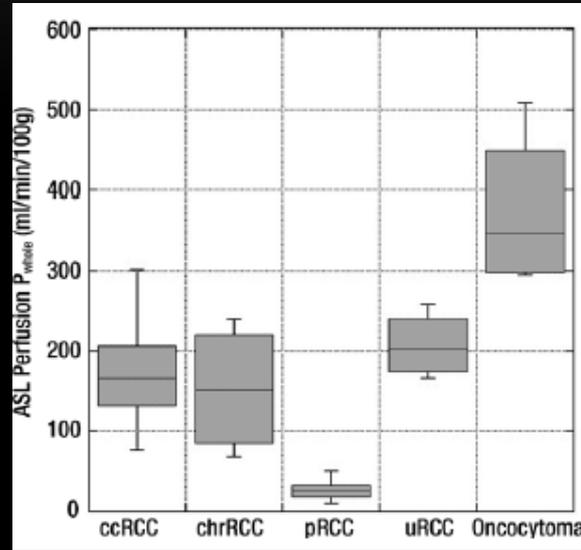


Phase cortico-médullaire



Phase excrétrice – 3-5 min

# - NOUVELLE TECHNIQUE - ASL

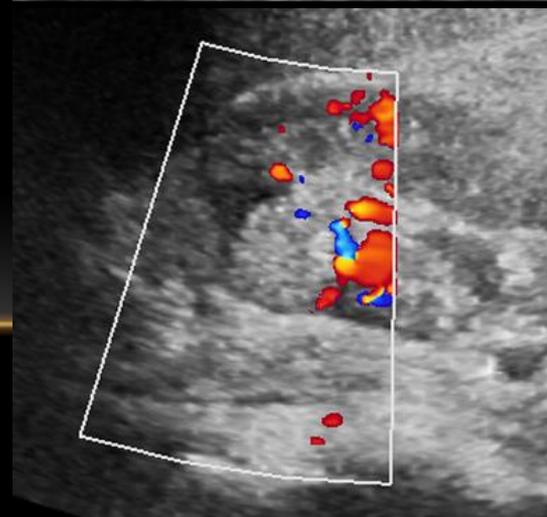
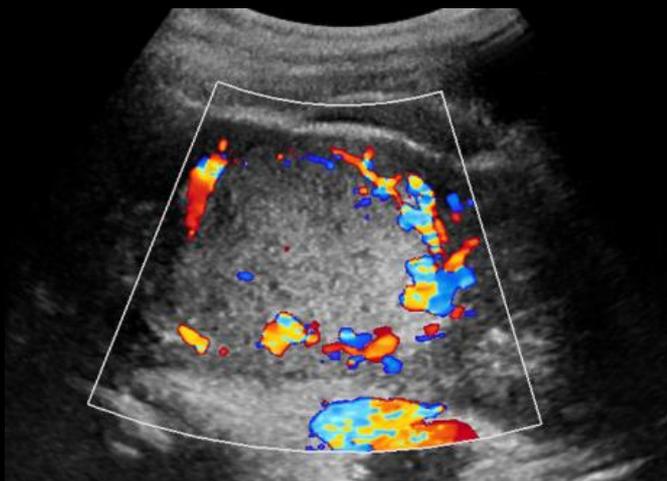
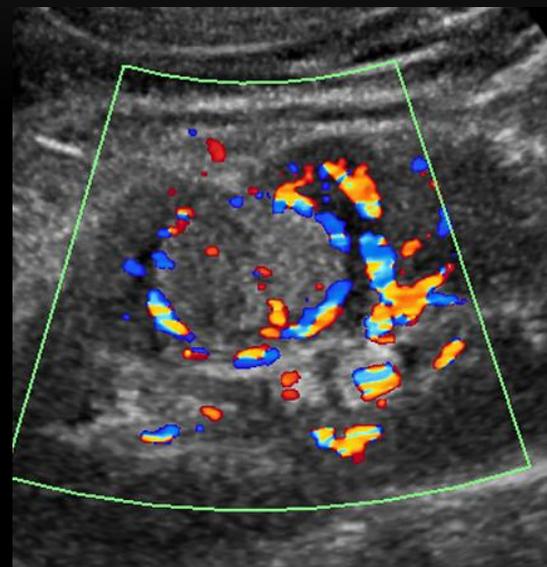
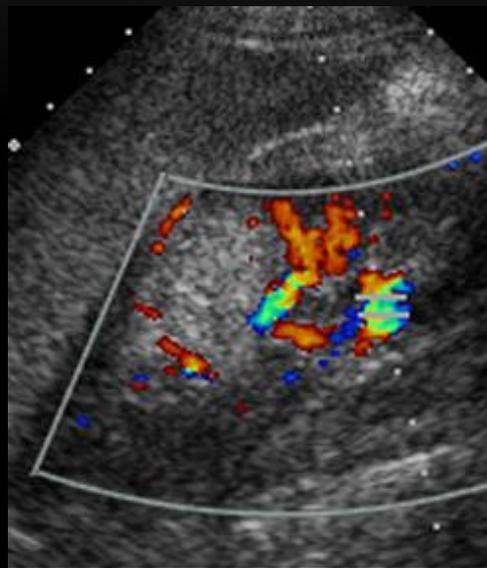


**Demographic Data and Average and Peak Perfusion Values for Different RCC Subtypes and Oncocytoma**

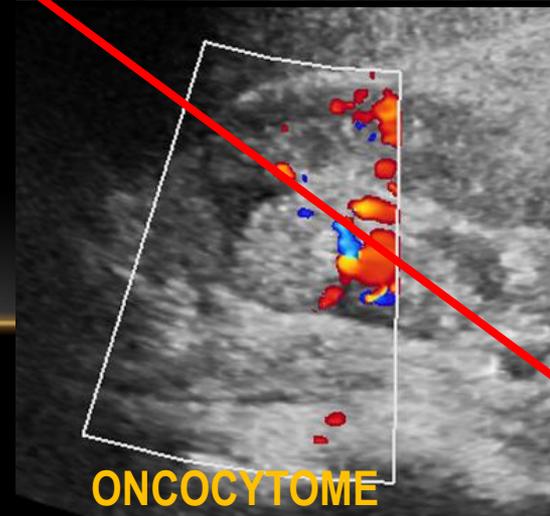
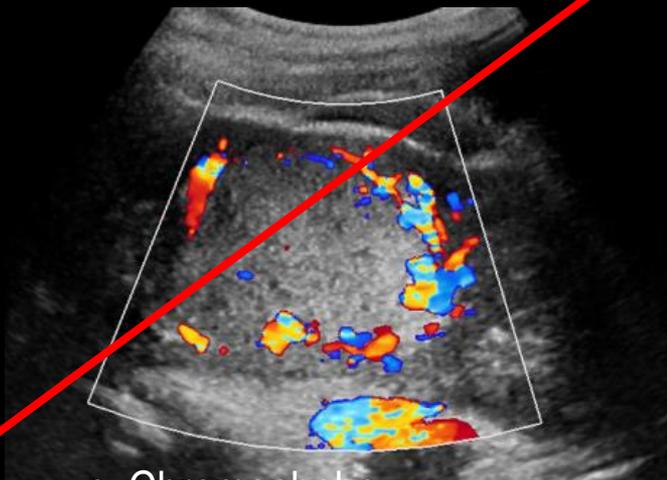
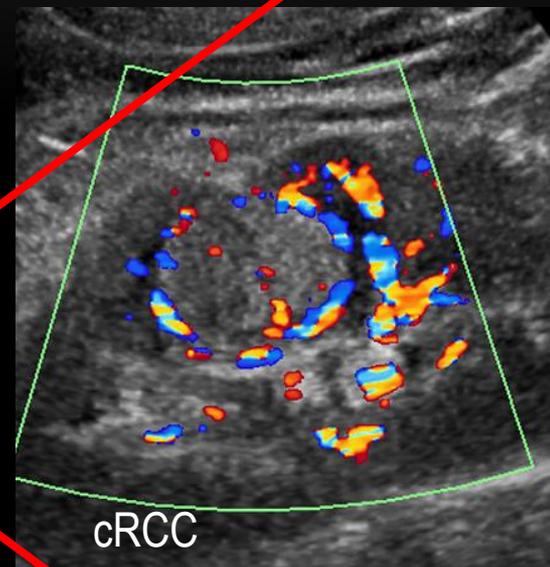
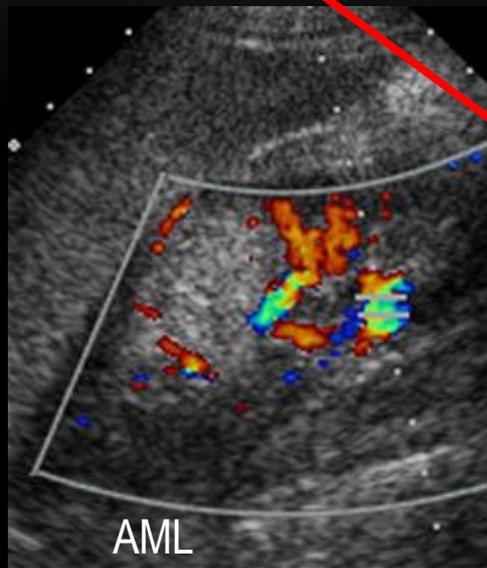
Parameter	ccRCC (n = 15)	chrRCC (n = 4)	pRCC (n = 5)	uRCC (n = 4)	Oncocytoma (n = 4)	PValue*
Age (y)	60.5 ± 9.6	59.8 ± 4.6	60.8 ± 25.1	59.0 ± 10.9	61.5 ± 1.3	.99
Tumor size (cm)	5.7 ± 3.3	6.6 ± 3.4	7.9 ± 5.5	3.6 ± 1.8	3.5 ± 1.6	.31
ASL perfusion (mL/min/100 g)						
Mean	171.6 ± 61.2	152.9 ± 80.7	27.0 ± 15.1 <sup>†</sup>	208.0 ± 41.1	373.9 ± 99.2 <sup>‡</sup>	<.001
Peak	338.0 ± 123.9 <sup>§</sup>	260.9 ± 61.9	78.2 ± 39.7	273.3 ± 83.4	512.3 ± 146.0 <sup>  </sup>	<.001

Note.—Data are means ± standard deviations. ccRCC = clear cell RCC, chrRCC = chromophobe RCC, pRCC = papillary RCC, uRCC = unclassified RCC.

# - US – « RAYON DE ROUE »

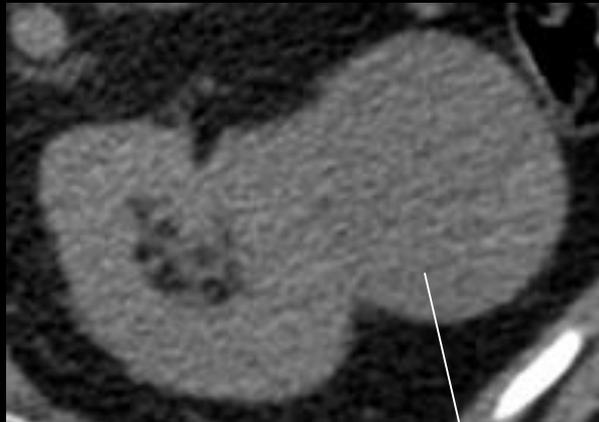


- US – « RAYON DE ROUE »

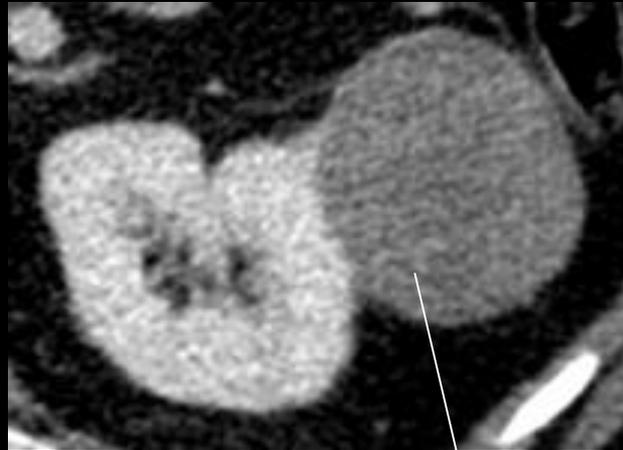


## 2- APPEL TÉLÉPHONIQUE...

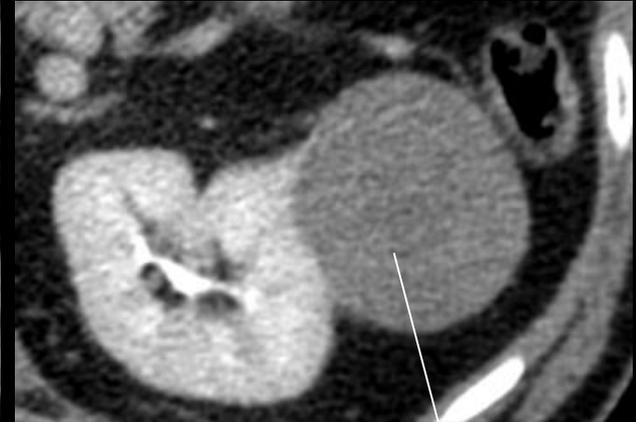
« Je vois le dossier de Mr X qui doit se faire opéré demain. Mais j'ai regardé les images et je pense que c'est un kyste. Est-ce qu'on ne devrait pas faire une écho ou une IRM pour être sûr? »



15UH



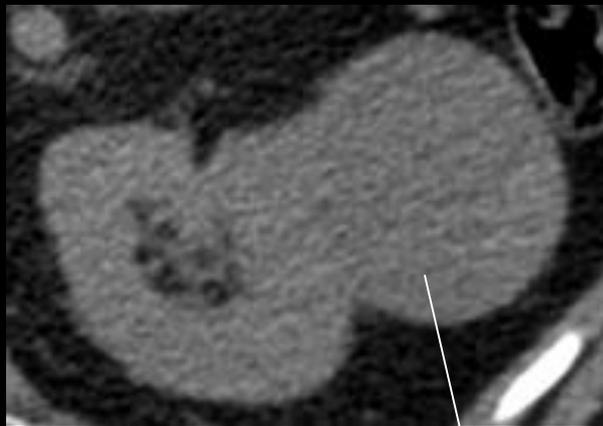
35 UH



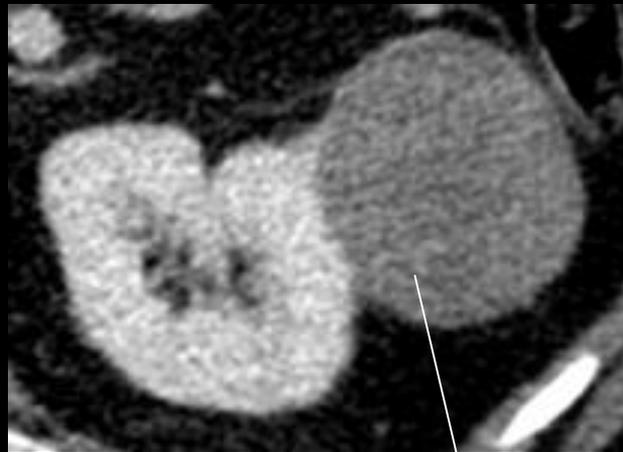
40UH

Conclusion CR radiologique : lésion compatible avec un carcinome papillaire

« Je vois le dossier de Mr X qui doit se faire opéré demain. Mais j'ai regardé les images et je pense que c'est un kyste. Est-ce qu'on ne devrait pas faire une écho ou une IRM pour être sûr? »



15UH



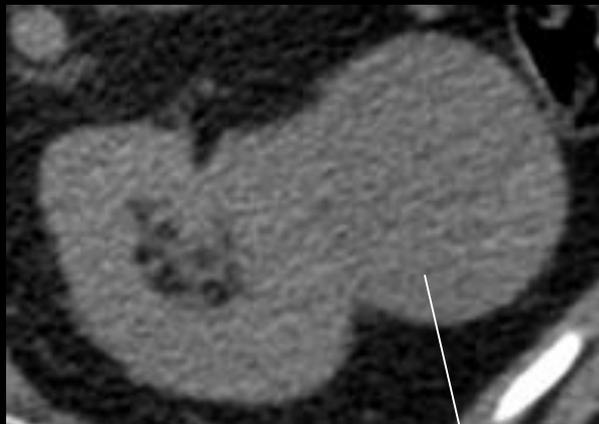
35 UH



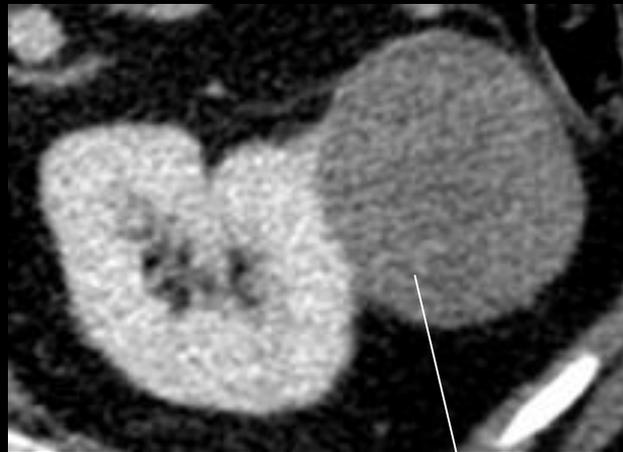
40UH

*Changez-vous votre avis et faites vous le complément ?*

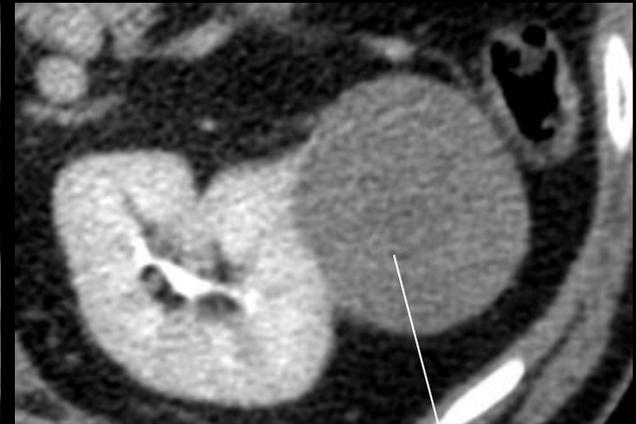
« Je vois le dossier de Mr X qui doit se faire opéré demain. Mais j'ai regardé les images et je pense que c'est un kyste. Est-ce qu'on ne devrait pas faire une écho ou une IRM pour être sûr? »



15UH



35 UH

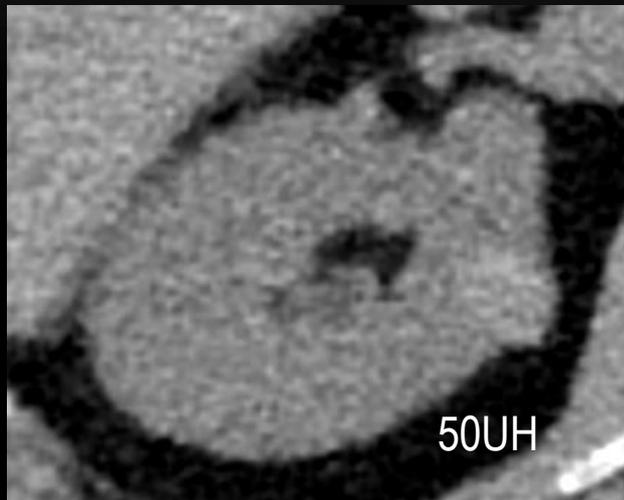


40UH

*Changez-vous votre avis et faites vous le complément ?*

**NON – lésion faiblement rehaussante >20UH**

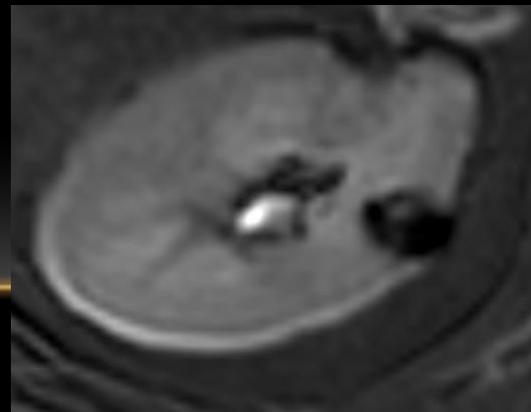
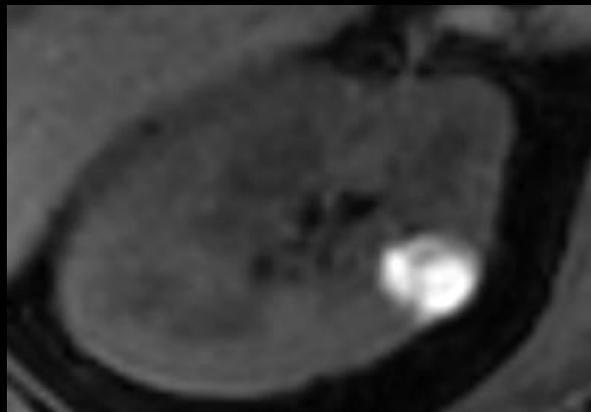
# DIFFÉRENCIATION KYSTE COMPLIQUÉ VS C. PAPILLAIRE



+ 15UH

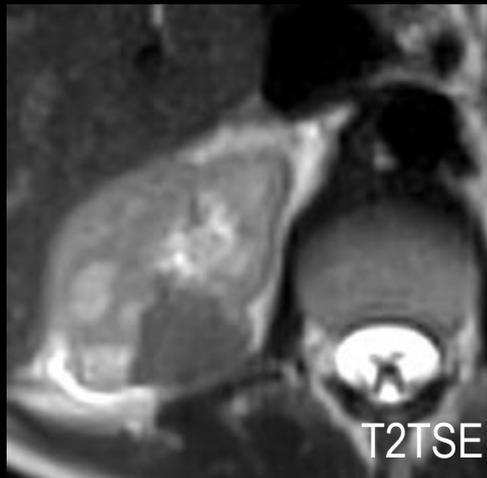
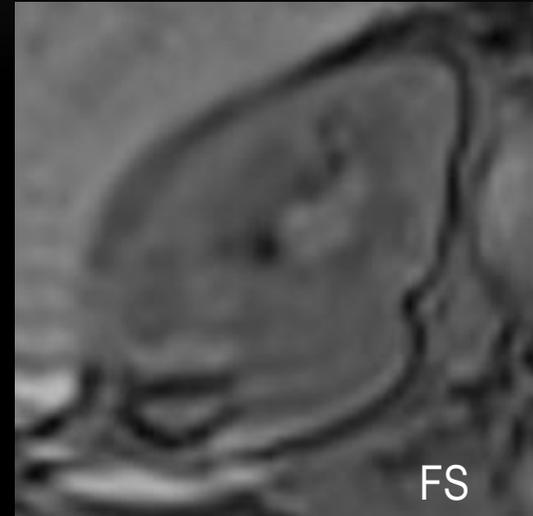
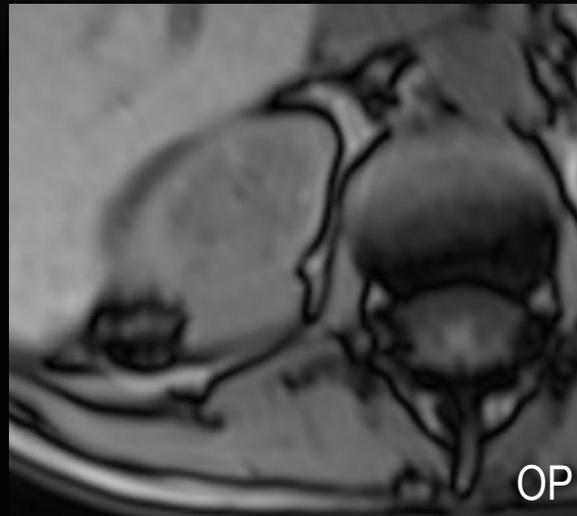
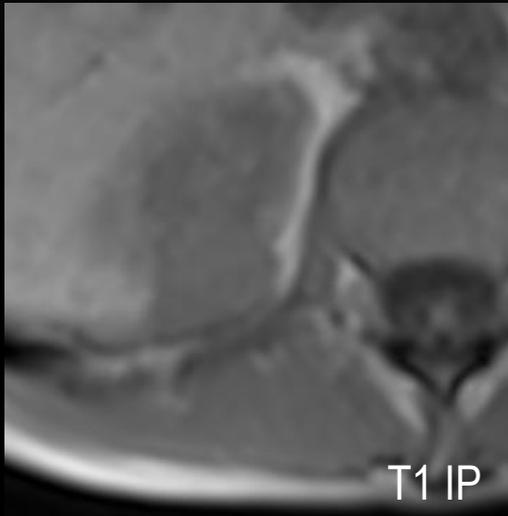


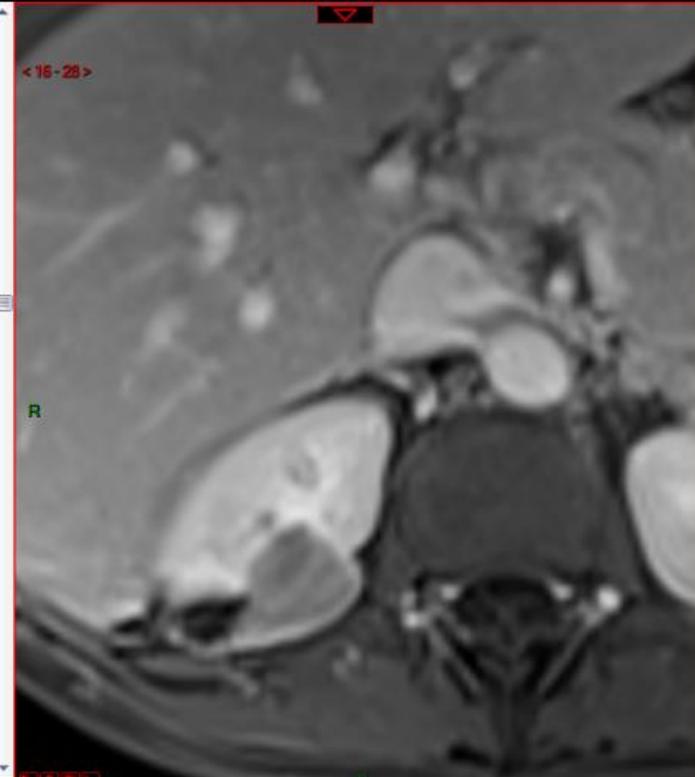
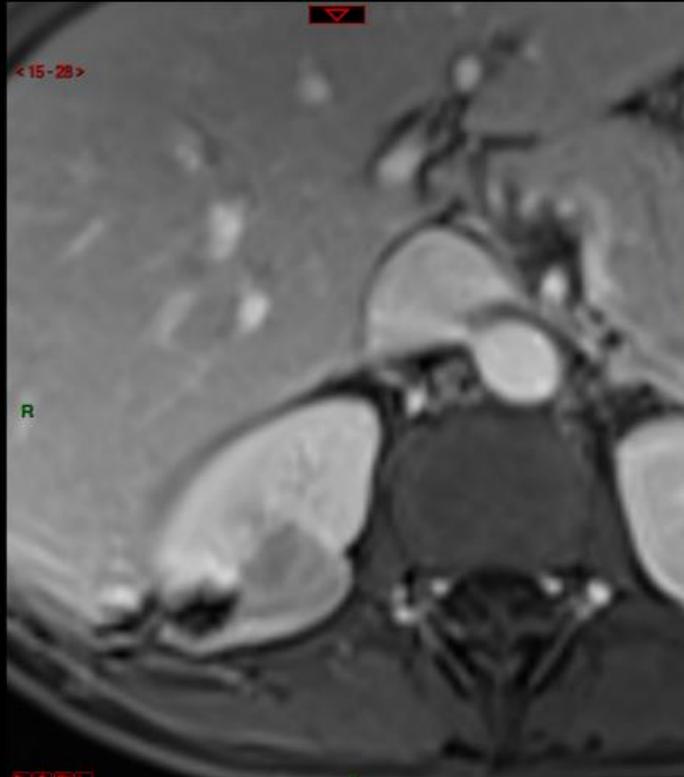
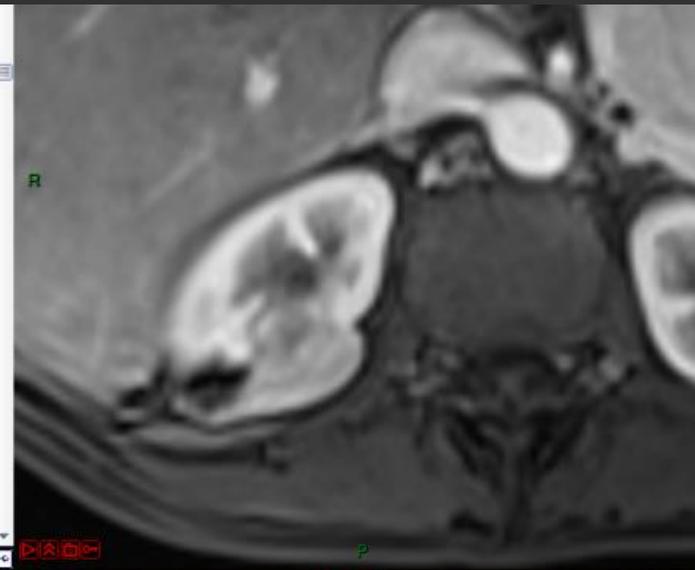
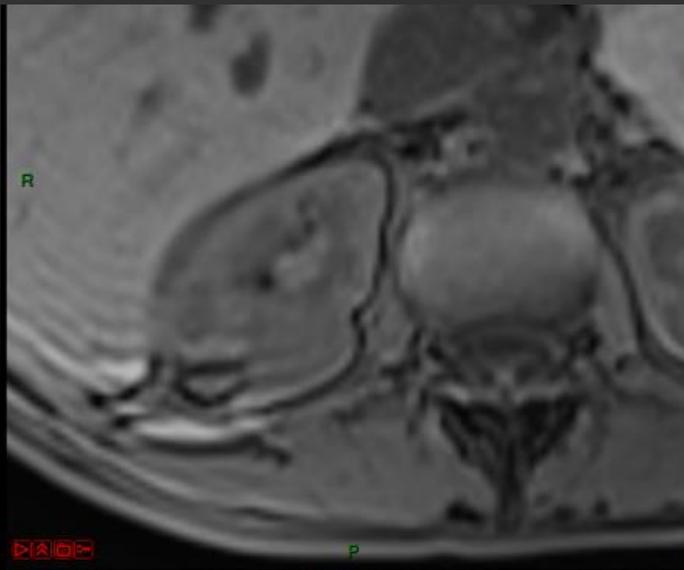
Intérêt de la RMN



# 3 - AVIS EXTERNE...

« J'ai ici une patiente chez qui on a découvert une lésion suspecte du rein droit... »





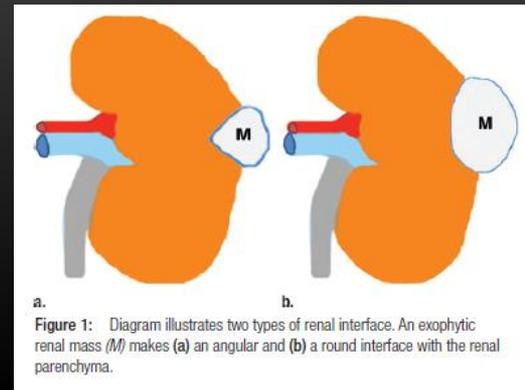
- Réponse :
    - A. On rassure le clinicien et la patiente
    - B. On fait un CT sans injection
    - C. Sans avis
-

- Réponse :

**A. On rassure le clinicien et la patiente**

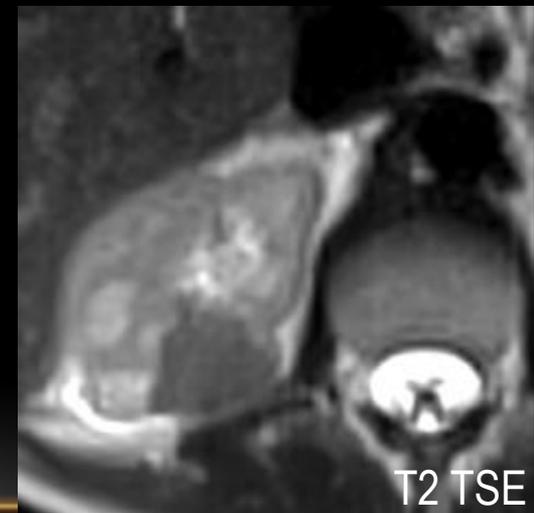
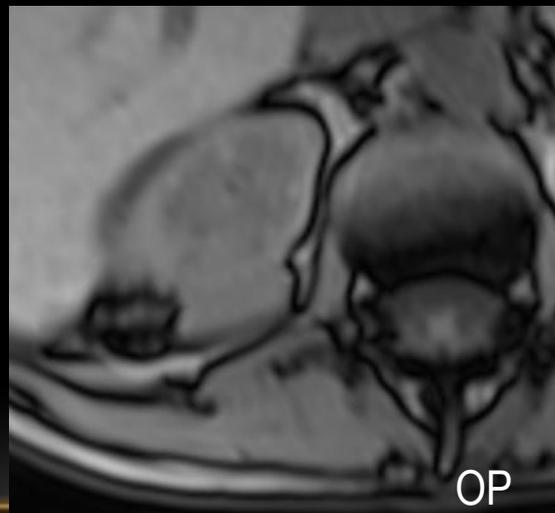
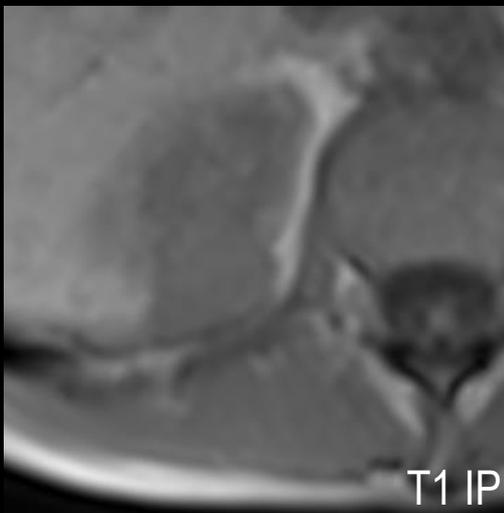
B. On fait un CT sans injection

C. Sans avis



Se : 78% - Sp : 100%  
PPV : 100%  
NPV : 87%

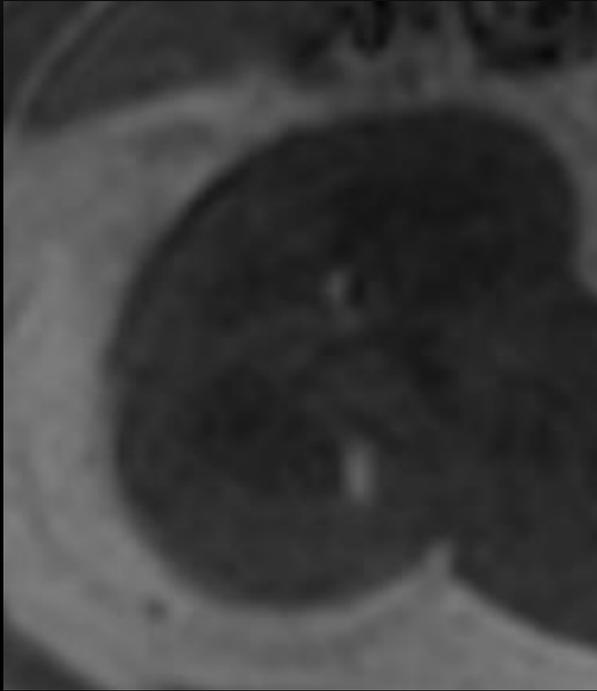
Verna et al. Radiology 2010



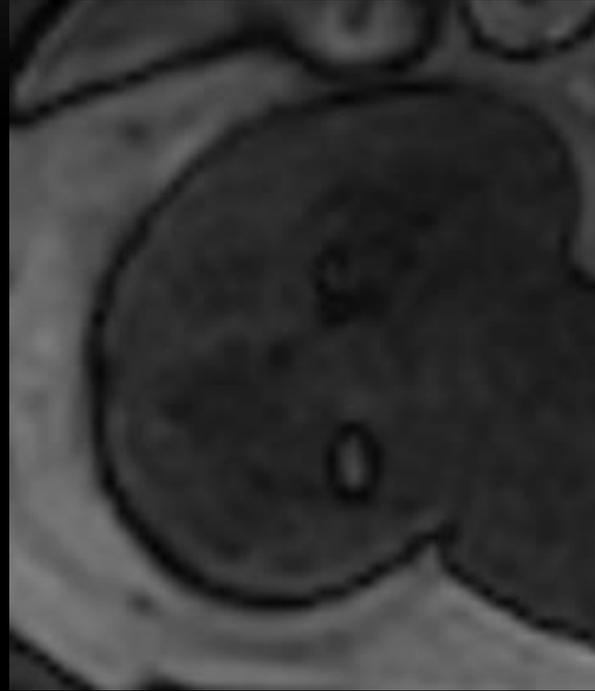
« India ink artifact » – interface AML et rein

Pas de pseudo-capsule

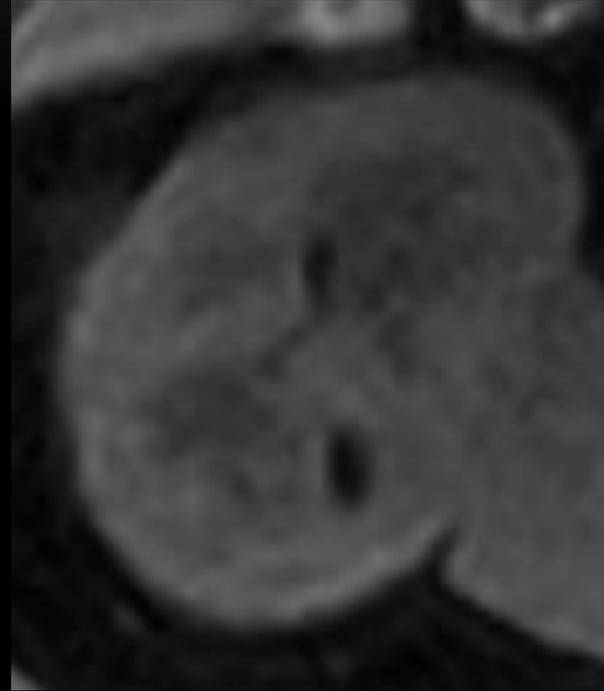
# AML TYPIQUE EN RMN



T1 IP



OP



FS



## 4- DEMANDE D'EXAMEN ...

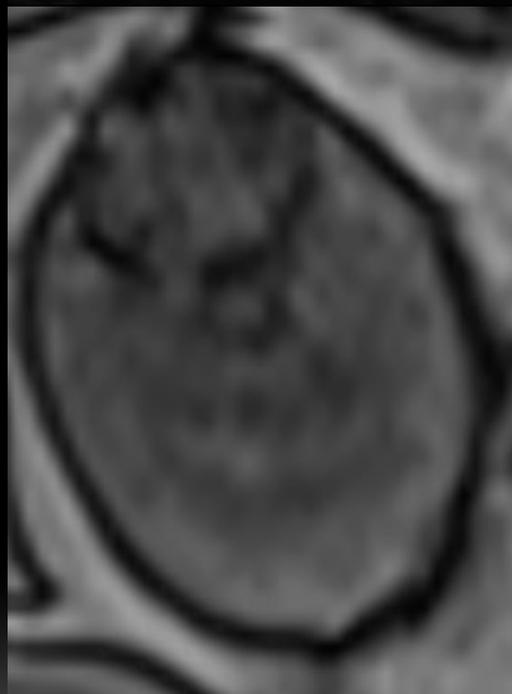
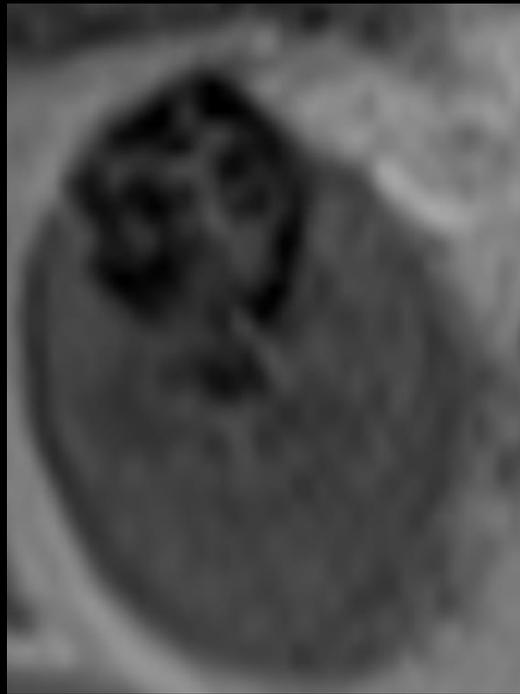
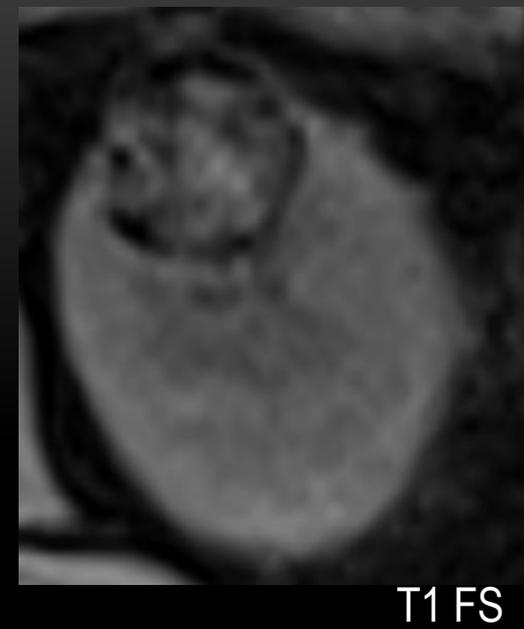
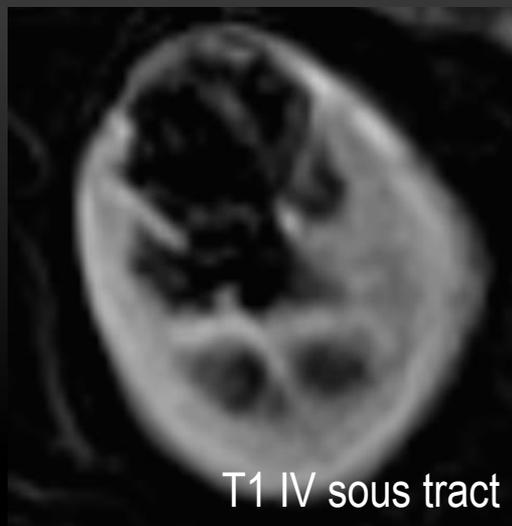
CLINIQUES UNIVERSITAIRES SAINT-LUC - SERVICE DE RADIOLOGIE  
Avenue Hippocrate, 10 - 1200 Bruxelles  
UNITE D'IMAGERIE PAR RESONANCE MAGNETIQUE (ETAGE -2, LOCAL V3)

### DEMANDE D'EXAMEN IRM

BUT DE L'EXAMEN :

Hématome microscopique, patients perimé  
Cystoscopie ⊖  
Cytologie vésicale / pyélogie G ⊖  
UPR G +/-  
CT amygdalien pôle inf. rein G  
→ Cortisole

# RÉSULTAT



- Quel est votre conclusion?
    - A. Lésion rénale aspécifique
    - B. Lésion compatible avec un AML, cf. indication
    - C. Lésion compatible avec un kyste hémorragique
    - D. Lésion compatible avec un carcinome papillaire
-

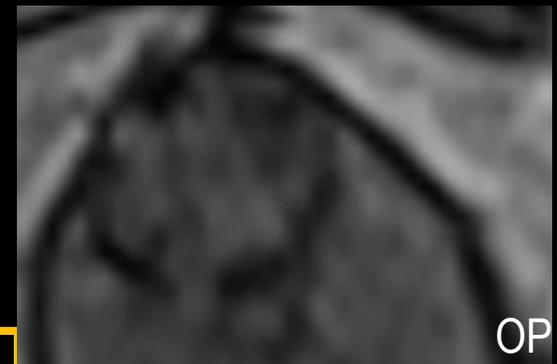
- Quel est votre conclusion?

A. Lésion rénale aspécifique

B. Lésion compatible avec un AML, cf. indication

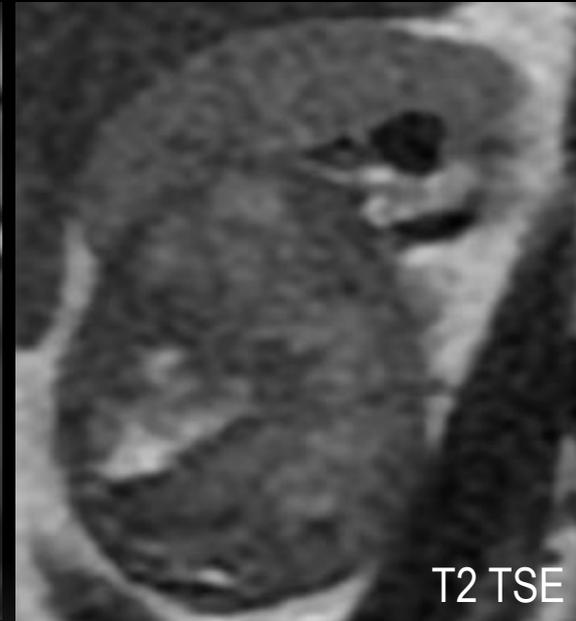
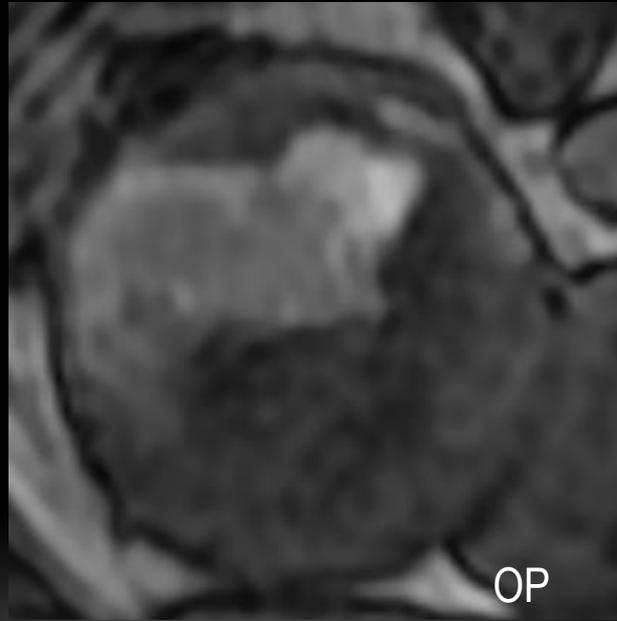
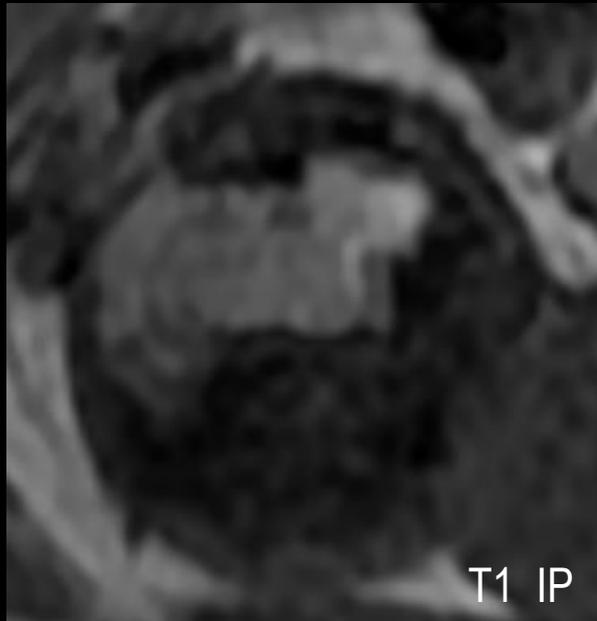
C. Lésion compatible avec un kyste hémorragique

D. Lésion compatible avec un carcinome papillaire

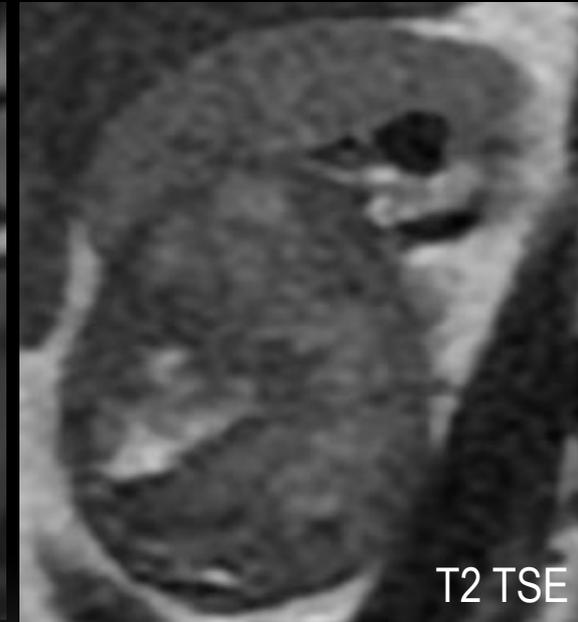
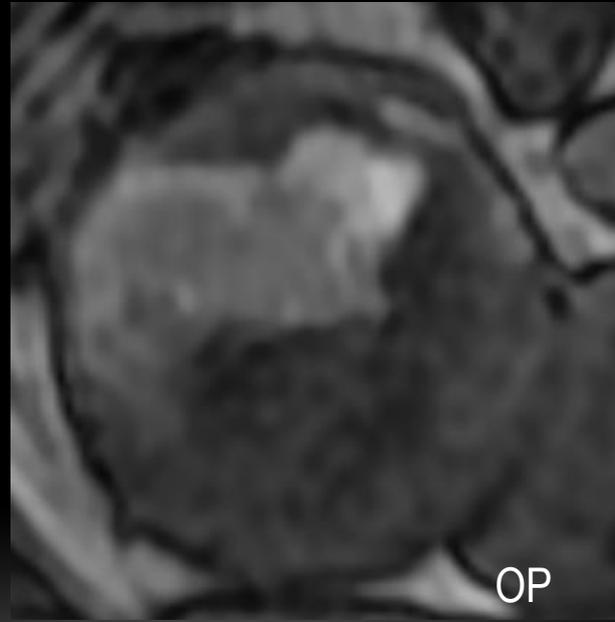
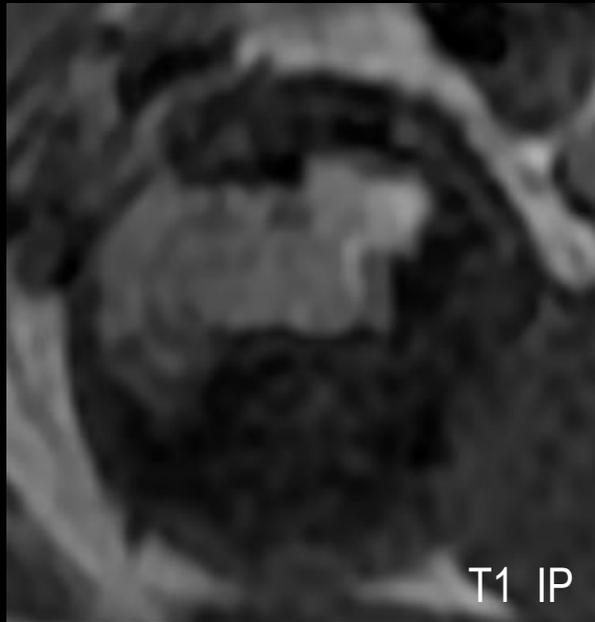


**40% pRCC** - Yoshimitu K et al,  
J. Res Magn 2006

Femme enceinte 33 ans – bilan de D+ flanc D, découverte d'une masse à l'US  
« ils ont parlé d'abcès, puis d'une masse ... Tu en penses quoi ? »



Femme enceinte 33 ans – bilan de D+ flanc D, découverte d'une masse à l'US  
« ils ont parlé d'abcès, puis d'une masse ... Tu en penses quoi ? »



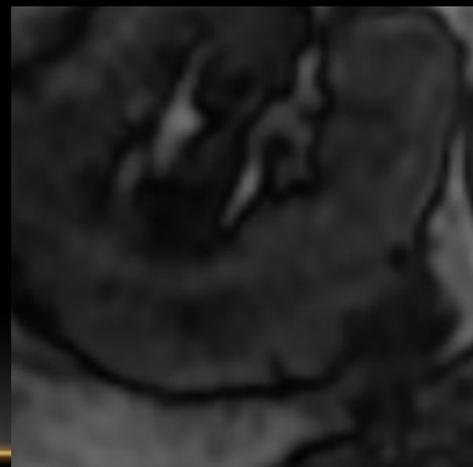
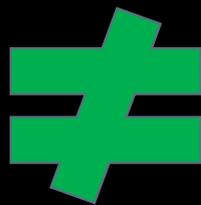
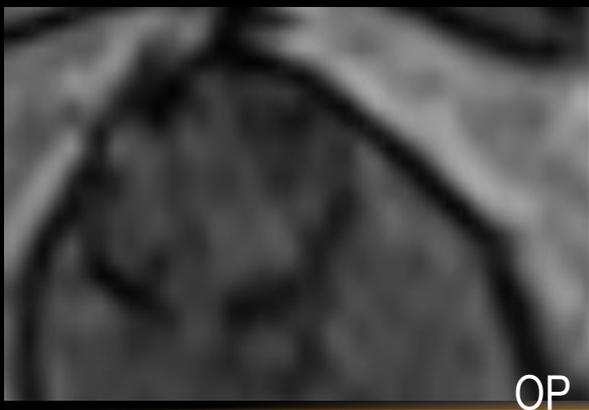
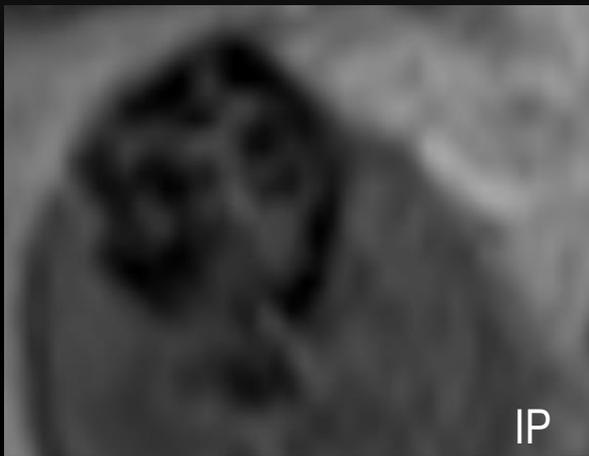
Lésion charnue suspecte hémorragique – histo = RCC

C. PAPILLAIRE

vs

AML

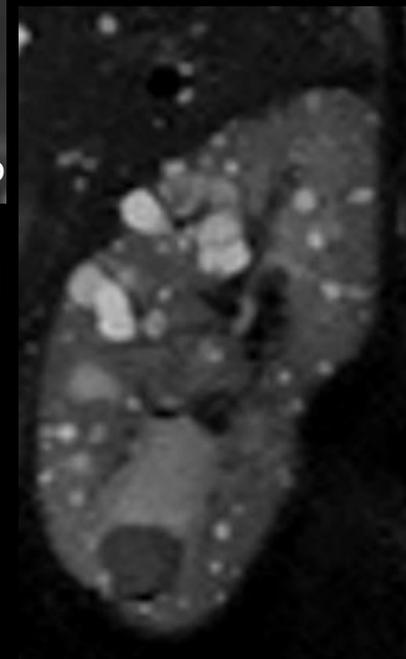
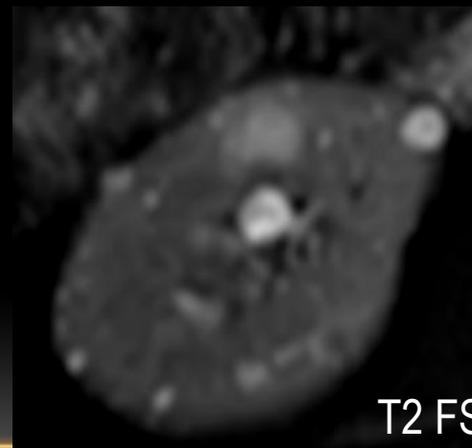
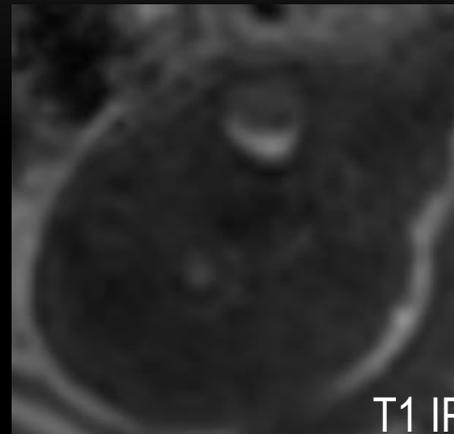
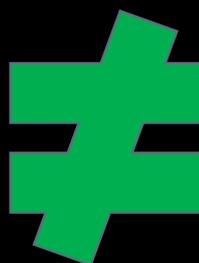
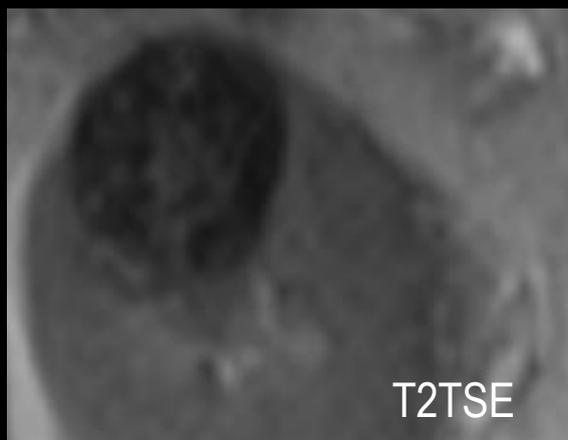
- T1



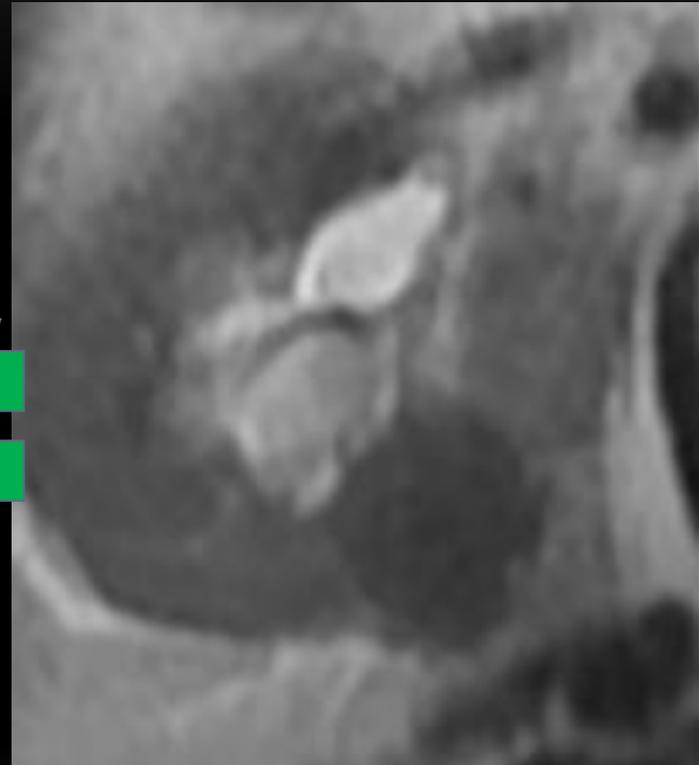
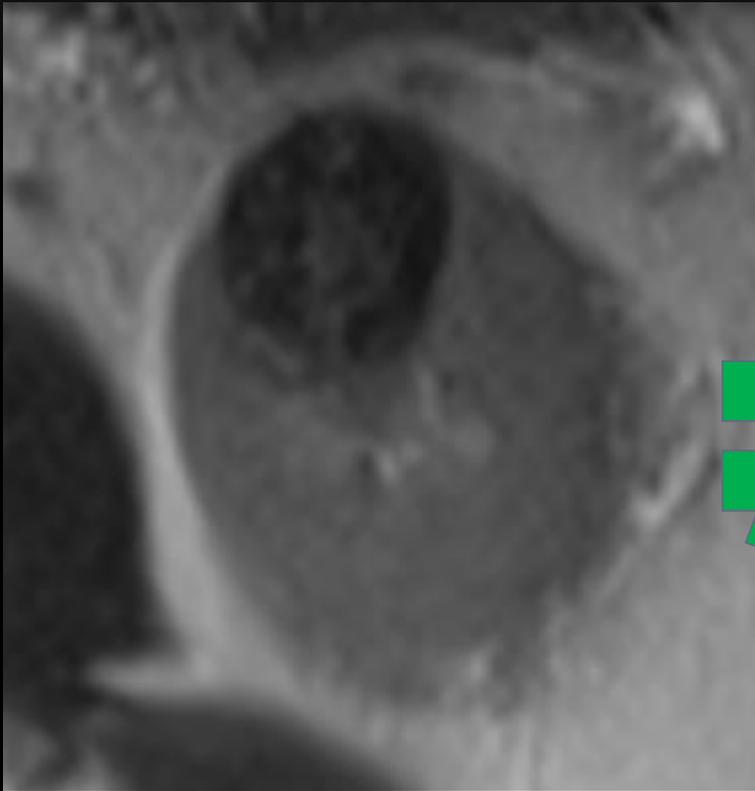
C. PAPILLAIRE

VS

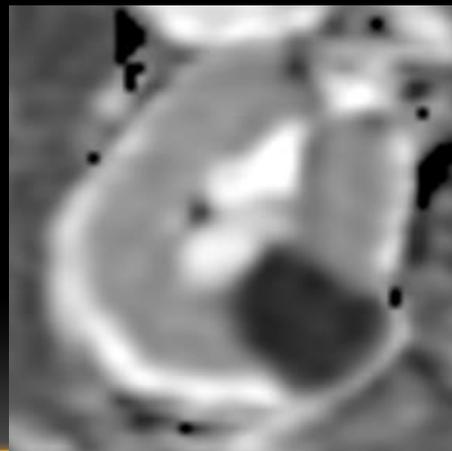
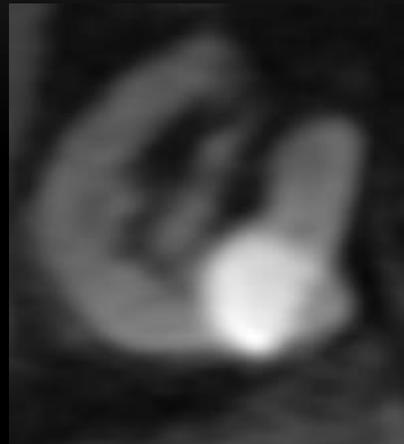
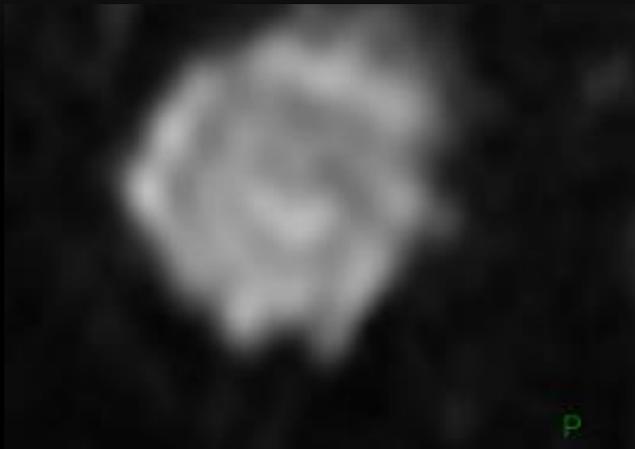
KYSTE BOSNIAK 2



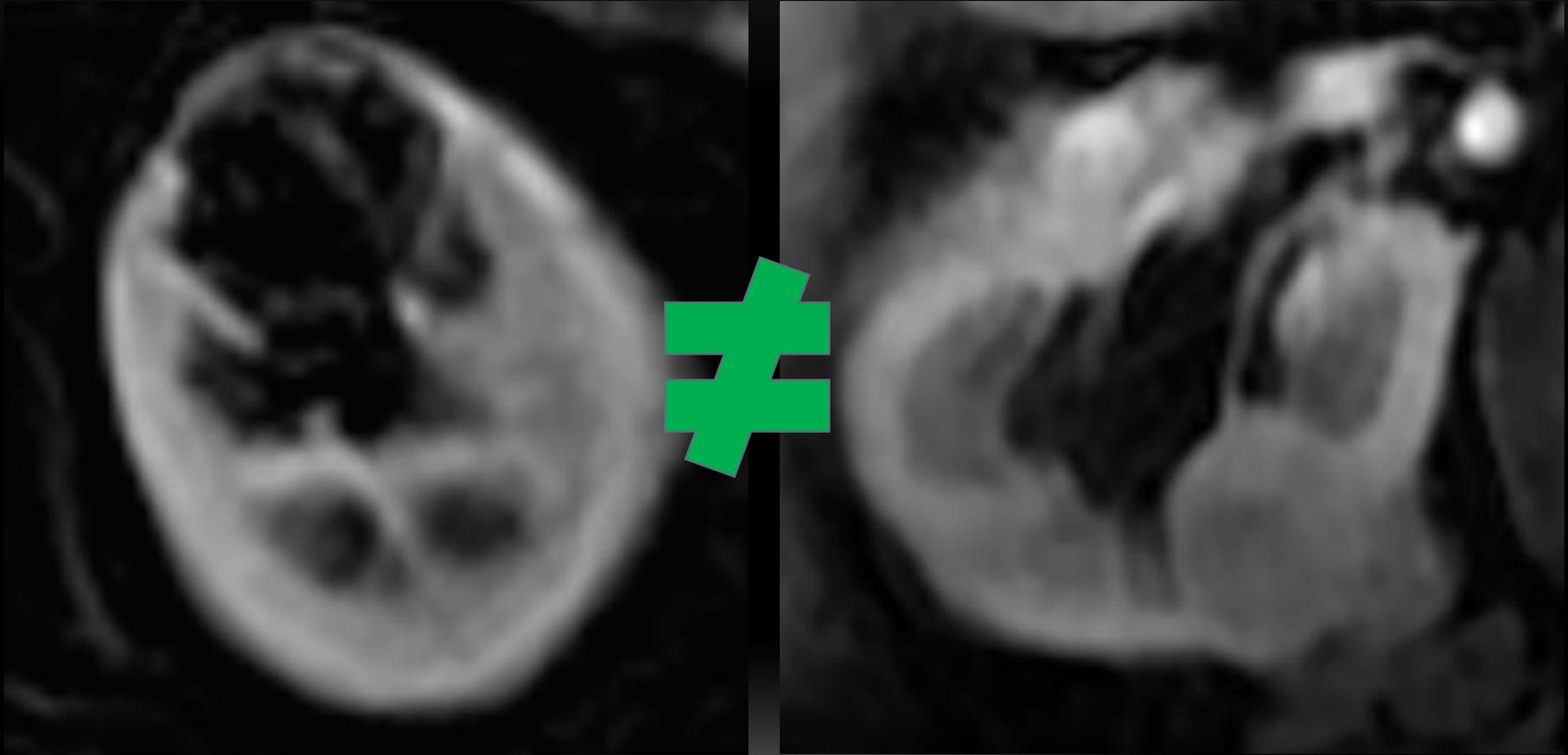
# C.PAPILLAIRE VS AML PAUVRE EN GRAISSE – T2



# PAPILLAIRE VS AML PAUVRE EN GRAISSE - DWI

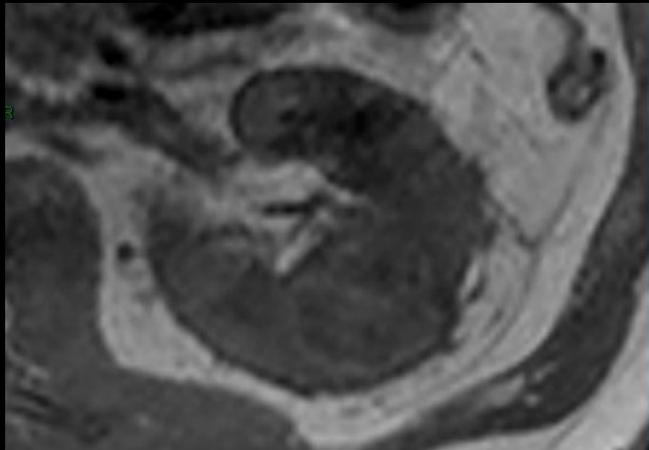


# PAPILLAIRE VS AML PAUVRE EN GRAISSE - IV

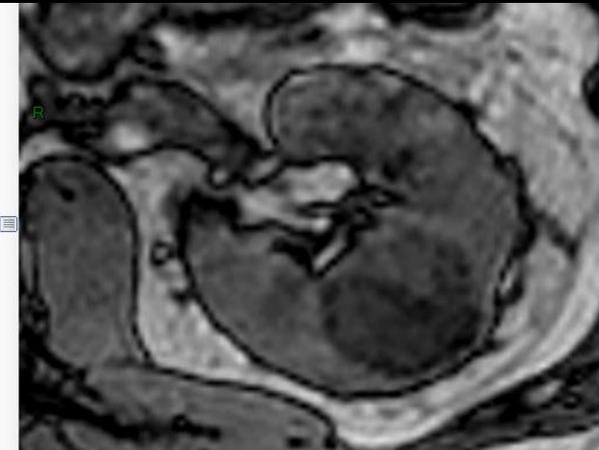


# 5- SUIVI D'ANGIOMYOLIPOME...

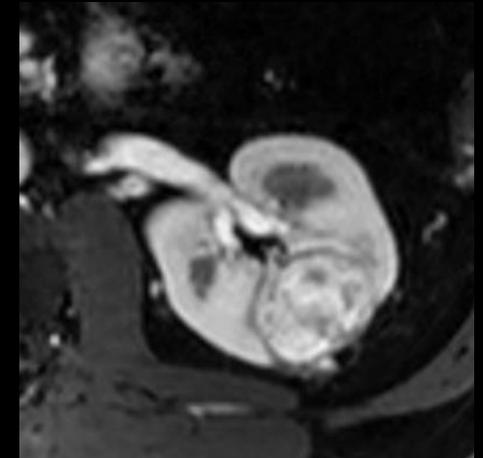
*Séquences en faveur d'un AML?*



T1 IP

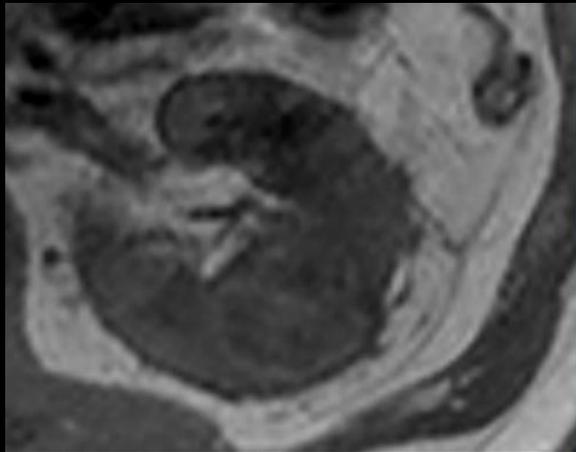


OP



T1 post IV

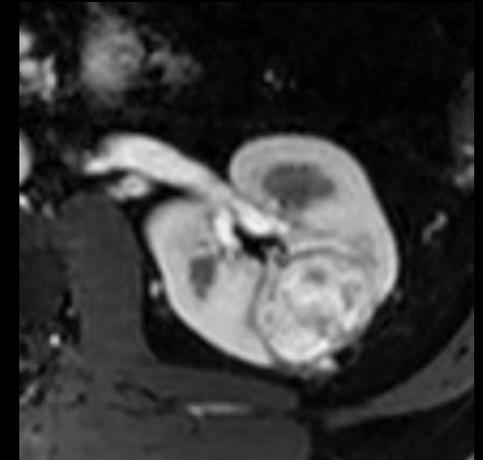
*Séquences en faveur d'un AML?*



T1 IP



OP

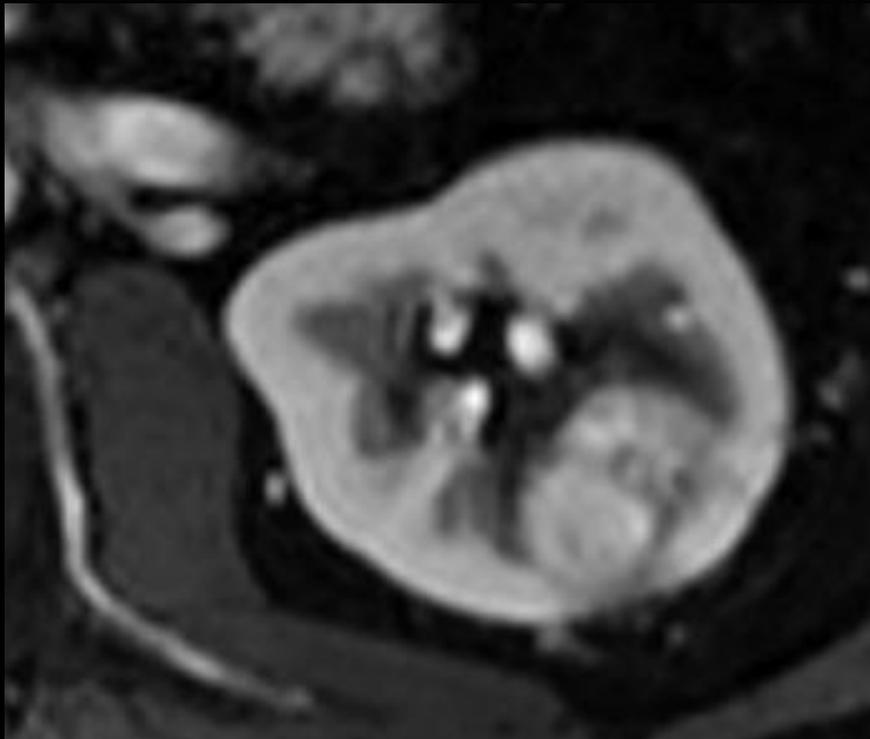


T1 post IV

**Chute de signal en OP = non spécifique**

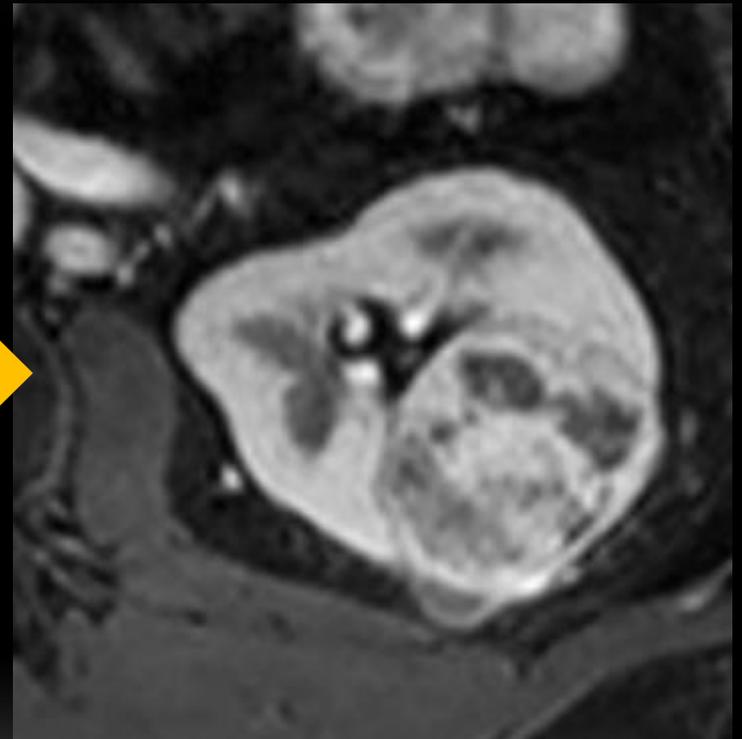
**Pseudo-capsule  $\neq$  AML**

# LÉSION TYPIQUE DE cRCC



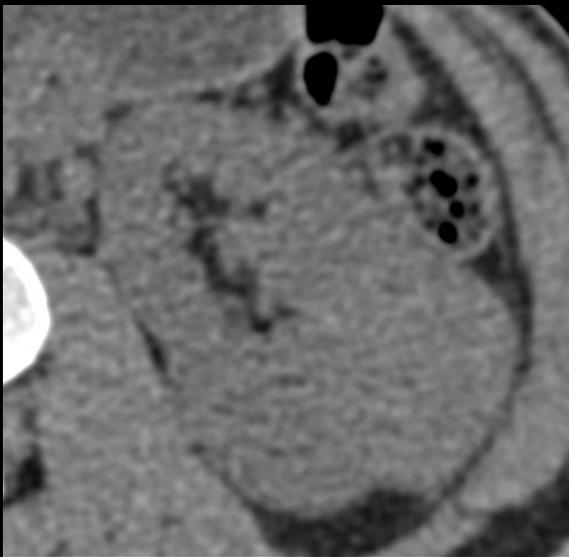
T1 + IV

+ 1 an  
→



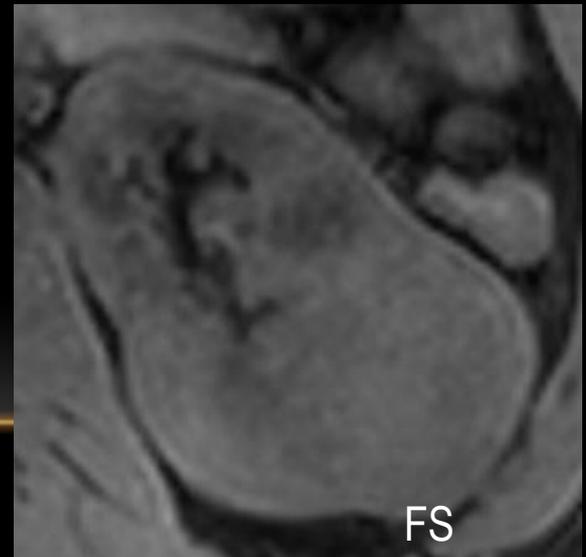
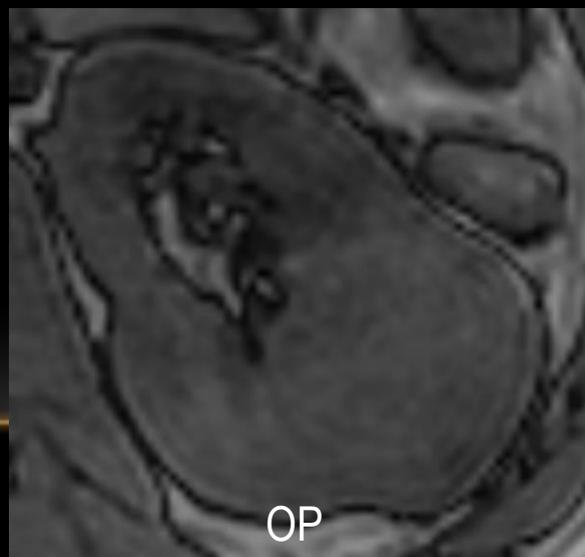
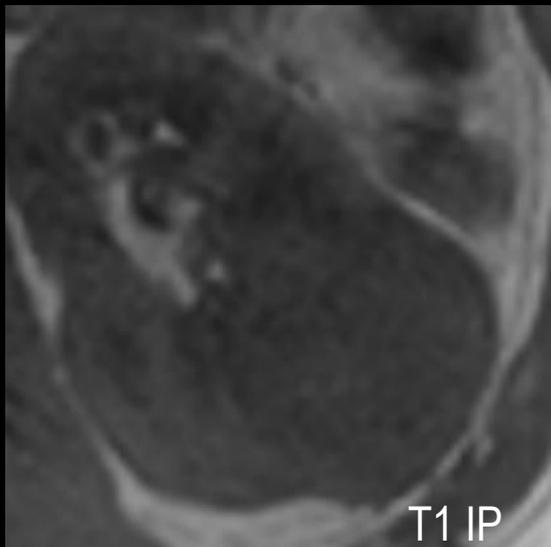
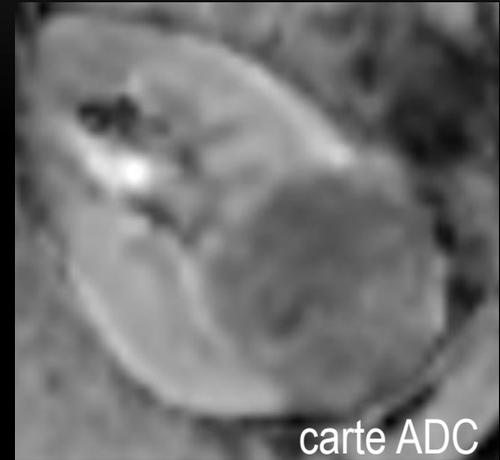
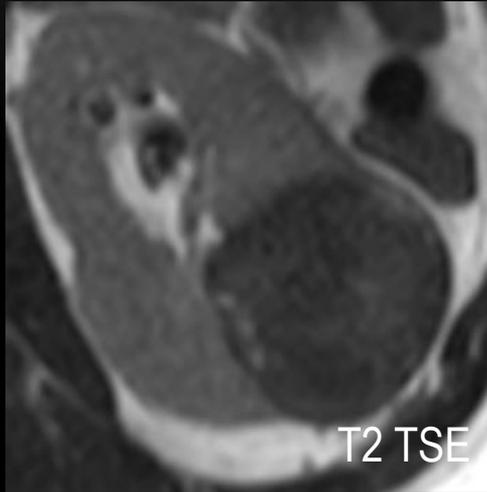
## 6- DEMANDE D'AVIS SUR UN CT EXTERNE ...

« Peux-tu regarder le CT de ce patient sur le PACS externe et me donner ton avis...  
Patient de 26 ans avec grosse tumeur du rein G »

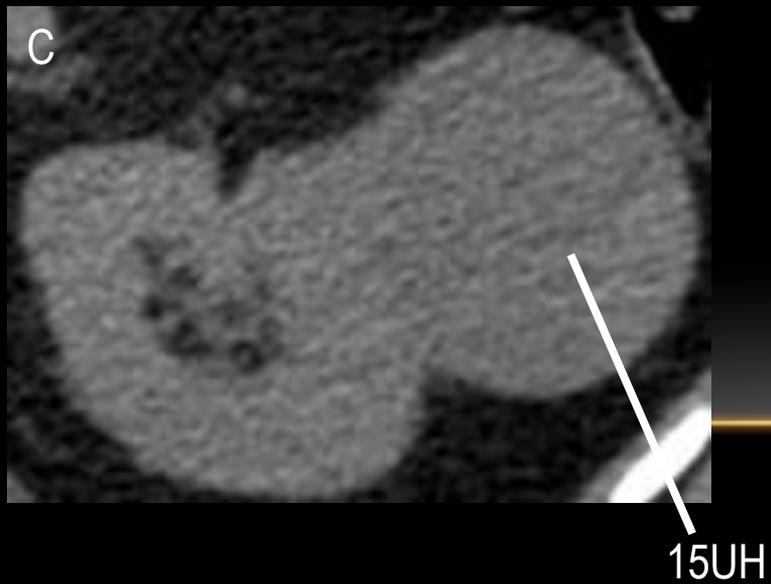
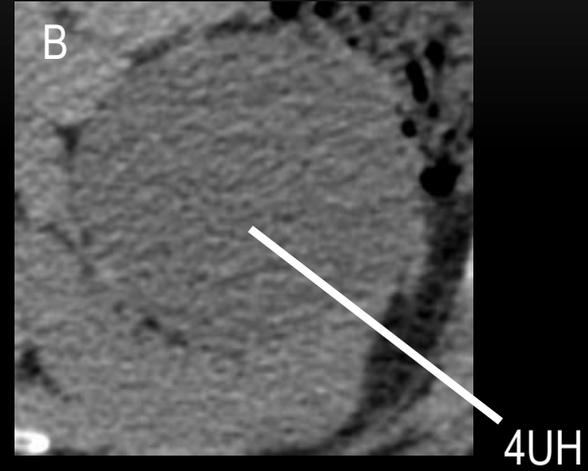
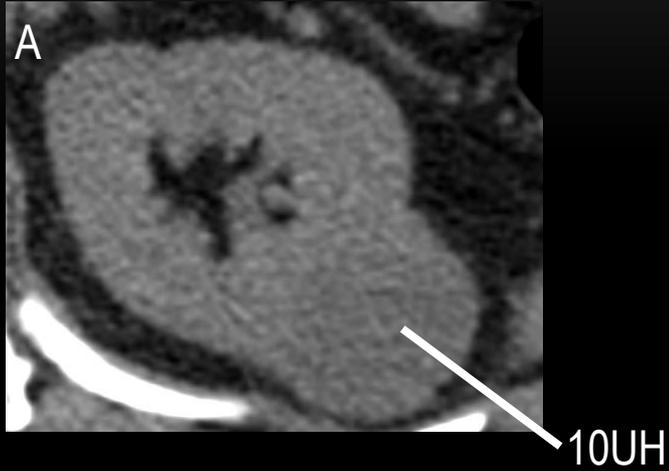


**Réponse** : Elle est bien délimitée, homogène – pas typique des lésions habituelles

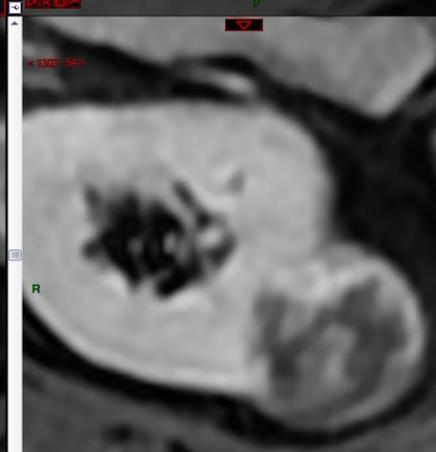
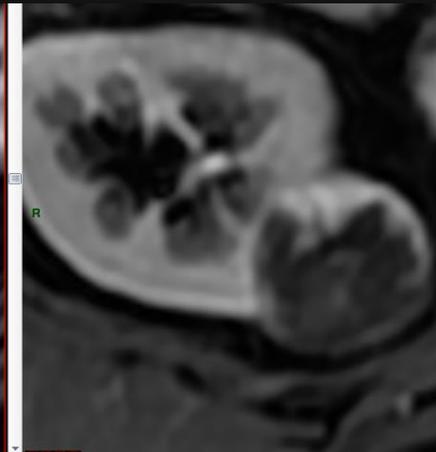
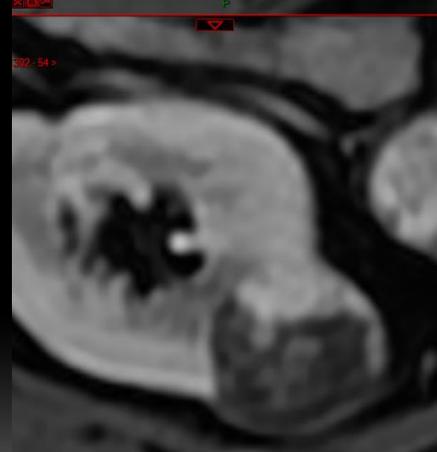
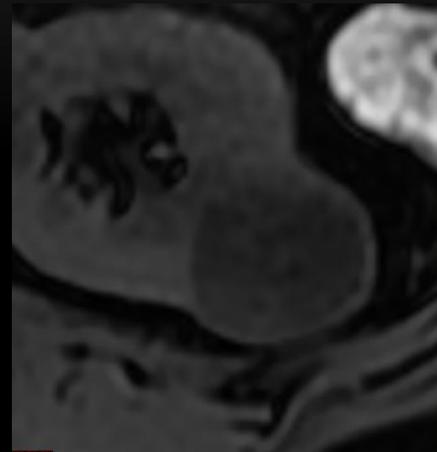
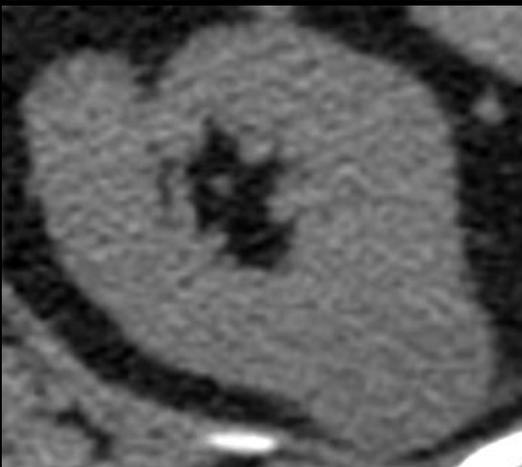
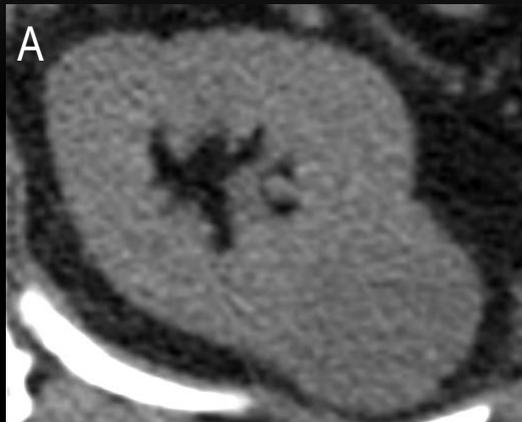
# IRM = LÉSION BÉNIGNE



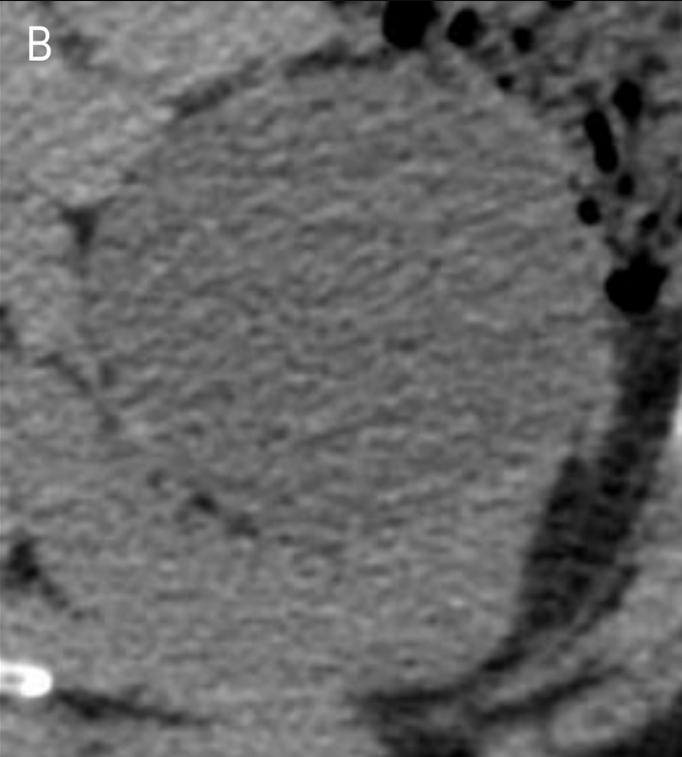
# 7. CRISE DE CCN - DÉCOUVERTE D'UNE LÉSION HYPODENSE AU CT - KYSTE?



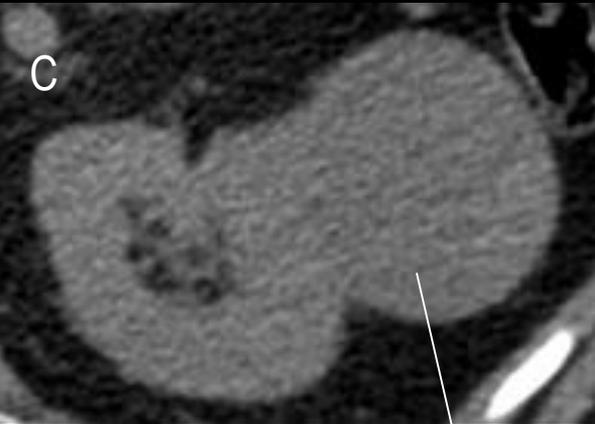
# CARCINOME A CELLULES CLAIRES



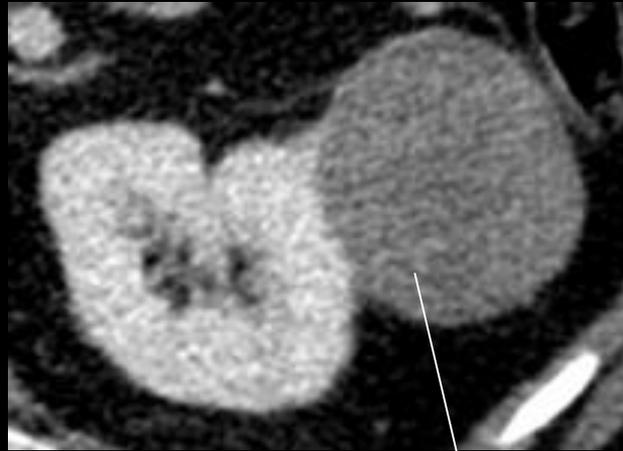
# KYSTE RÉNAL



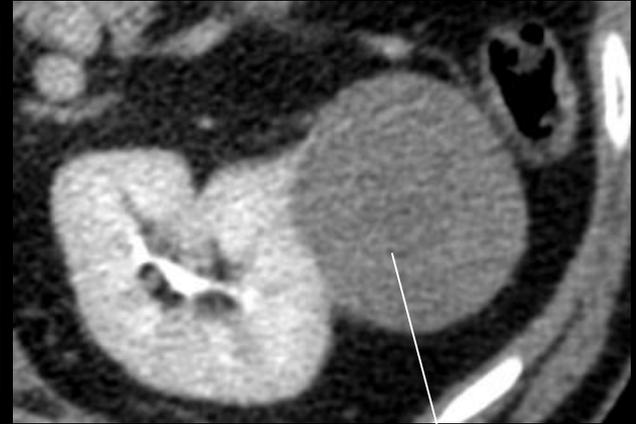
# C. PAPILLAIRE



15UH

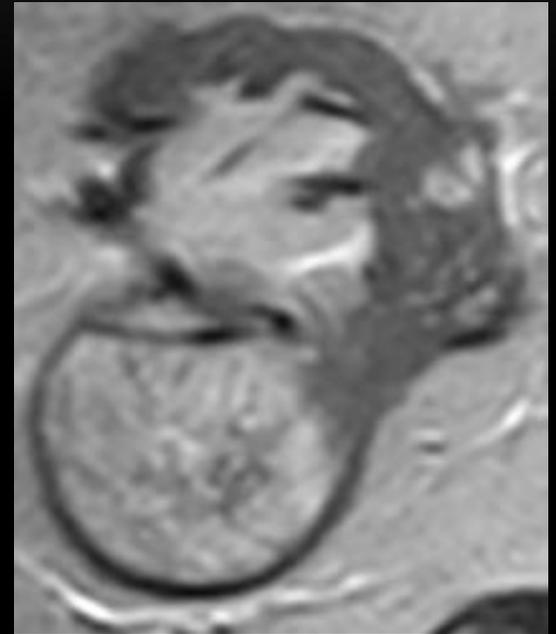
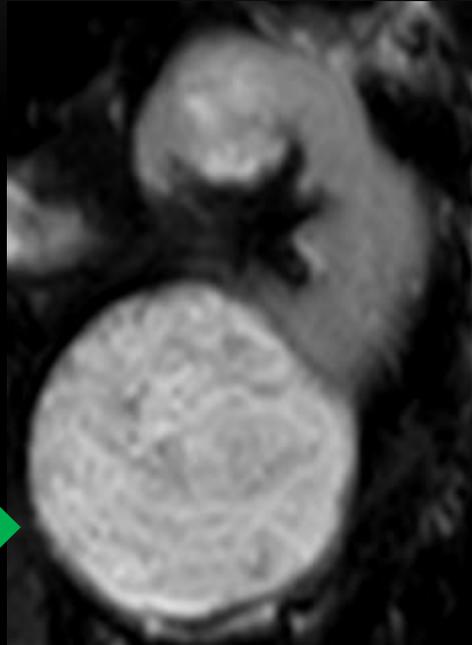
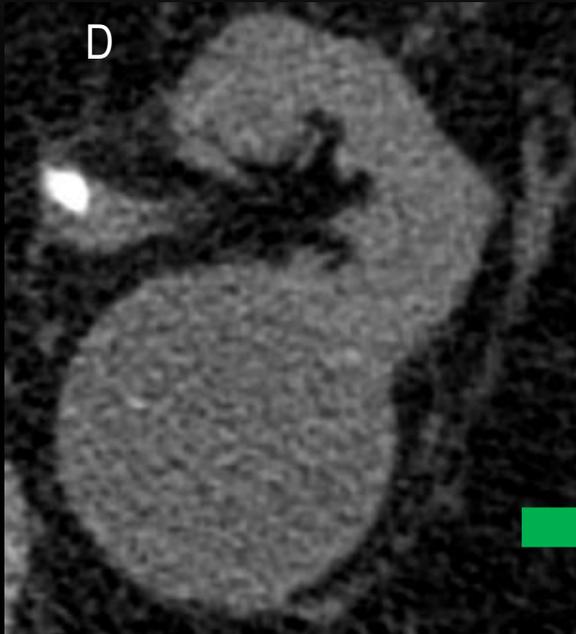


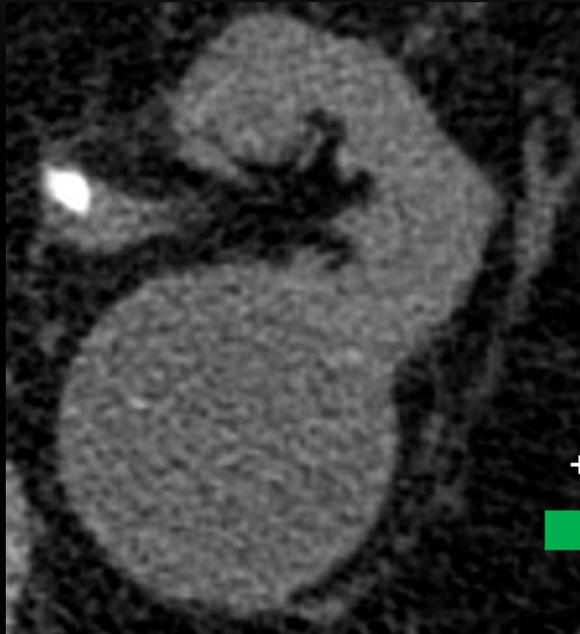
35 UH



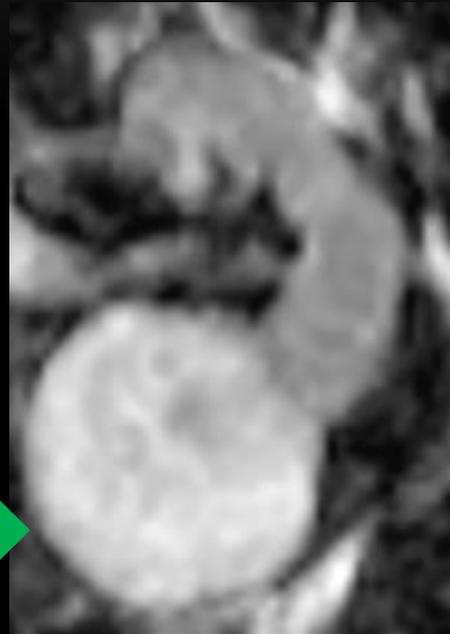
40UH

# ONCOCYTOME RÉNAL — PATIENT IR

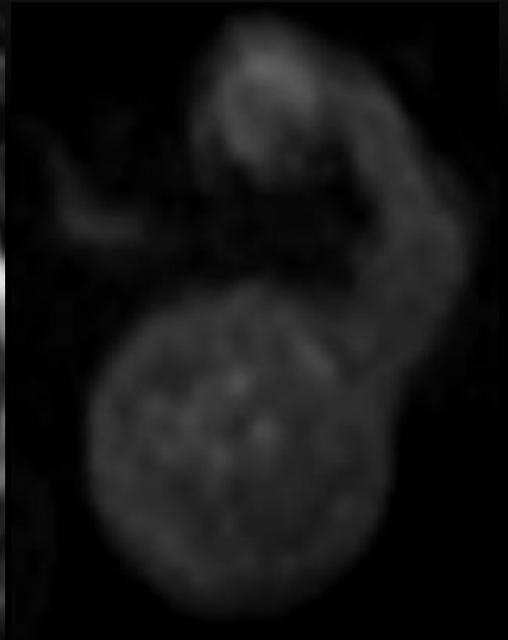




+ 2 ans

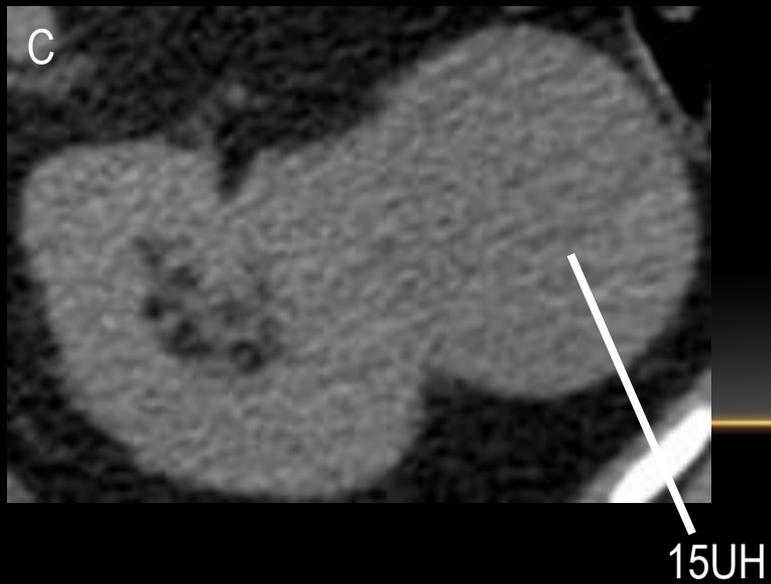
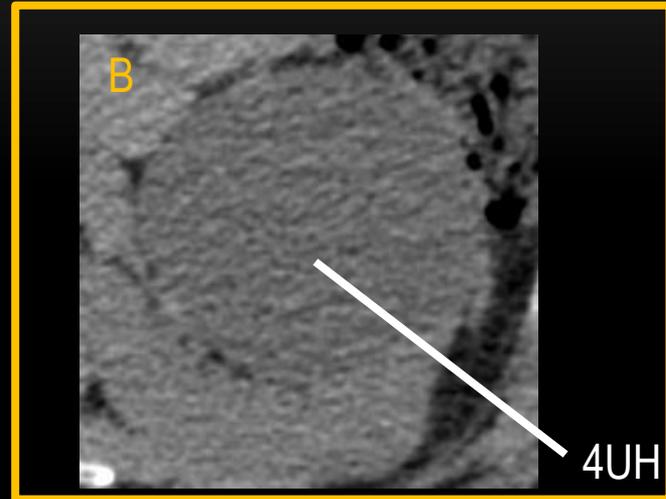
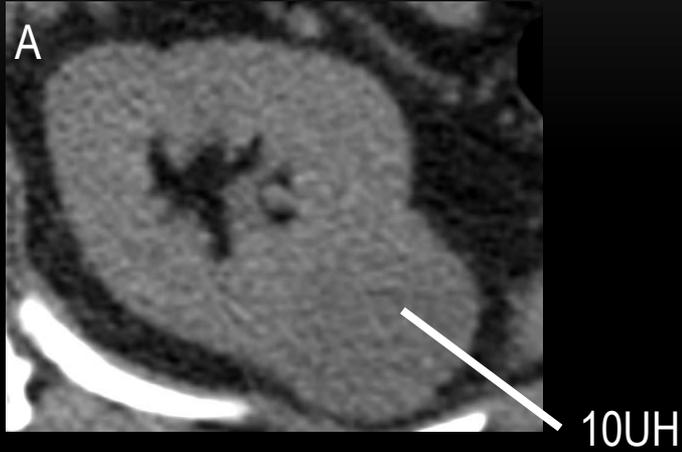


Carte ADC



DWI b800

# UN SEUL KYSTE RÉNAL... B



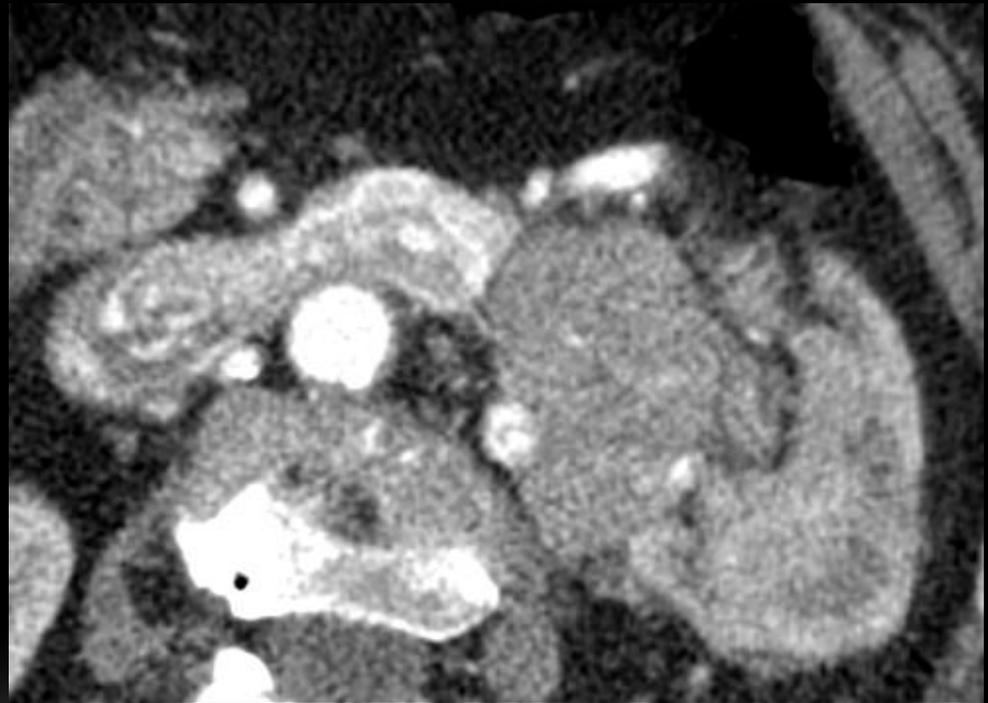
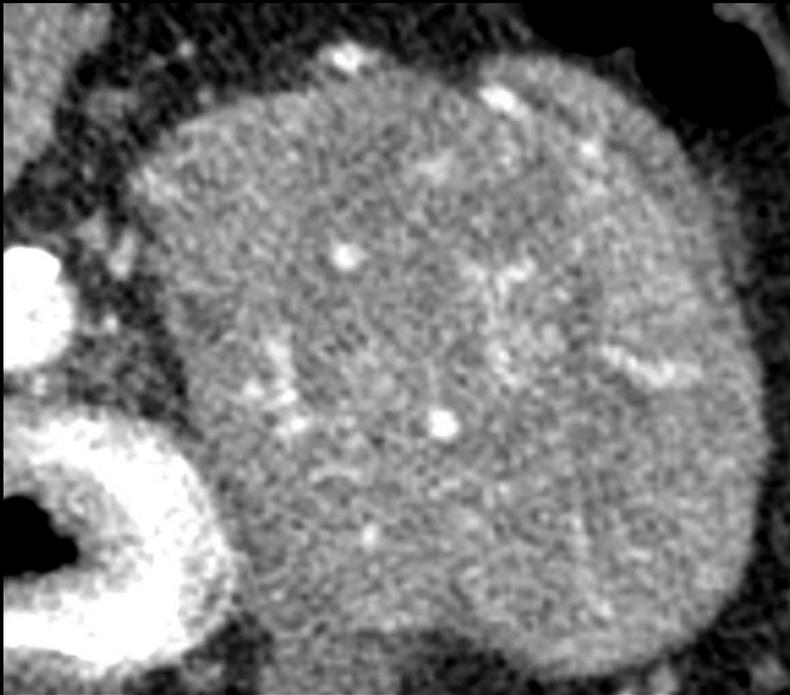
UNE LÉSION RÉNALE HYPODENSE SUR UN  
CT À BLANC

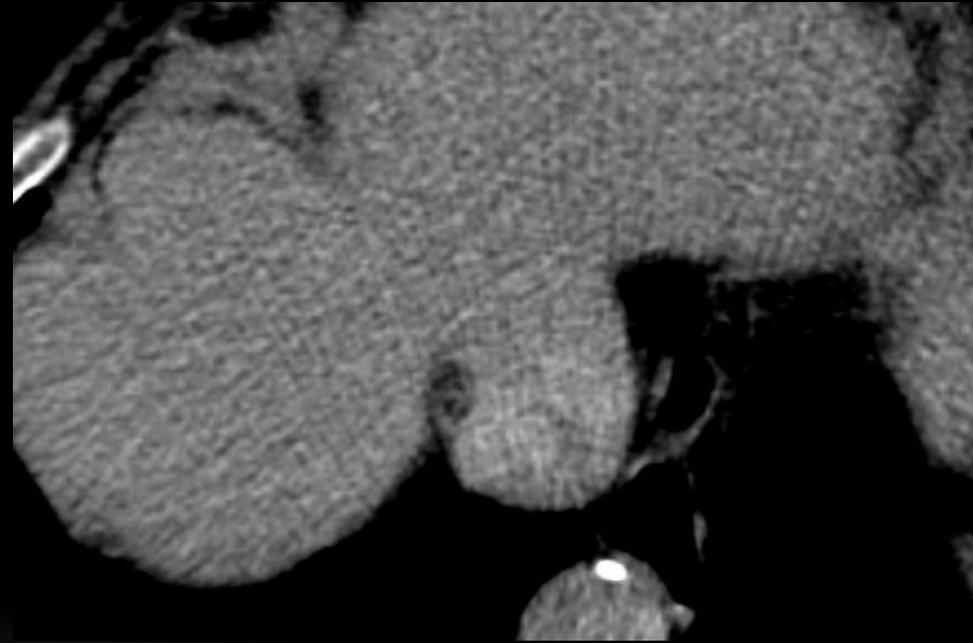
---

~~Kyste~~

## 8. BILAN D'EXTENSION

75ans – contexte de chute et d'hématurie



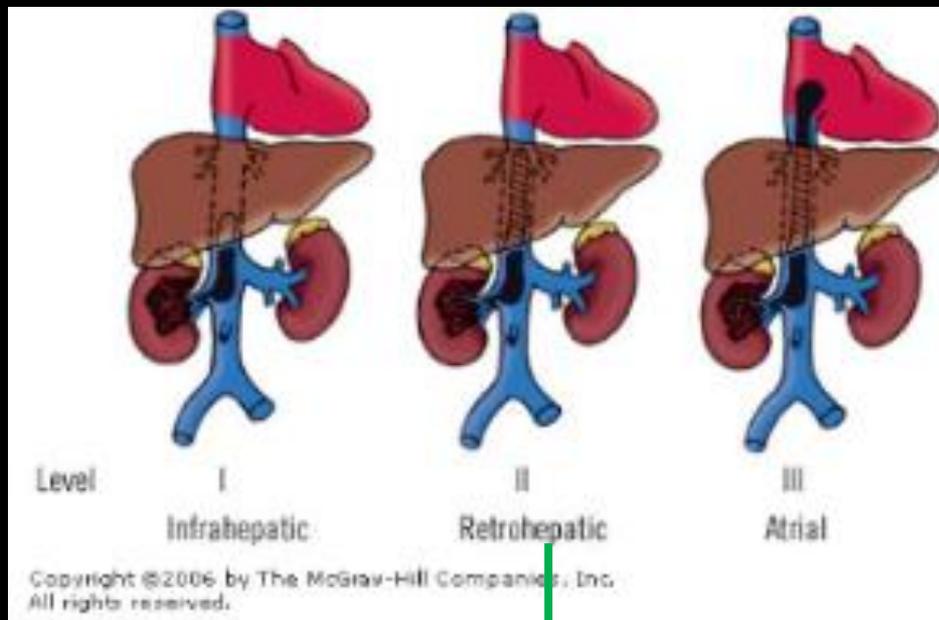


Conclusion CR : tumeur rénale G classée cT3c (T4-psoas) avec thrombus cave sus-diaphragmatique

# PATIENTE HL- DEMANDE D'IRM DANS LE BAC

Indication : Suspicion de thrombus cave. Extension du caillot ?

## Intérêt de faire l'examen?



→ Circulation Extra-Corporelle

Intervention avec l'équipe hépato-biliaire – reconstruction VCI

# PATIENTE HL- DEMANDE D'IRM DANS LE BAC

Indication : Suspicion de thrombus cave. Extension du caillot ?

## Intérêt de faire l'examen?

Invasion de la veine rénale et VCI (T3a-c)

- **CT** : Se 85% -100% - sp 98% **==** **IRM** : Se 89-100% - sp 96-100%

# BILAN D'EXTENSION - T

- Scanner (67-95%) = IRM (67-96%)

Invasion de la graisse péri-rénale (T3a) -> nodule péri rénal (Se : 46% - Sp : 98%)

-> vx tortueux et dilatés non spécifiques

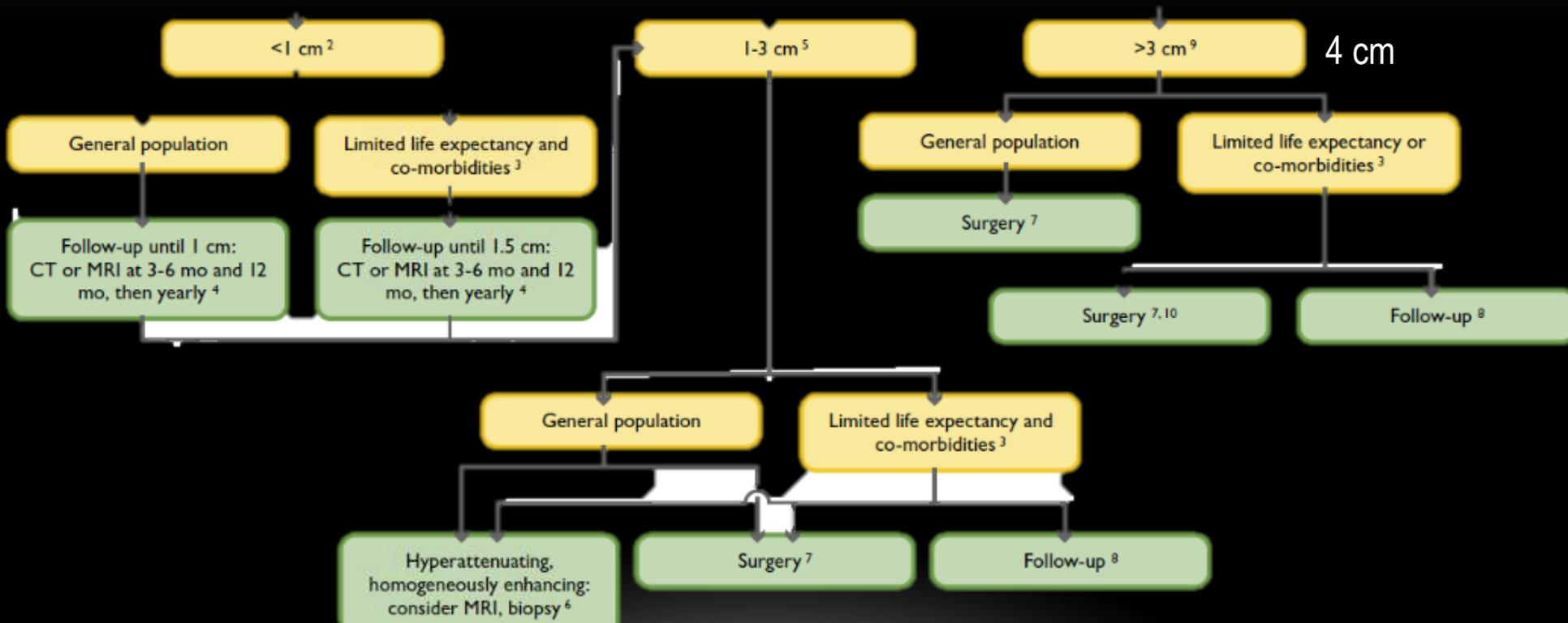
-> infiltration de la graisse : 50% dans le

stade 1

# CONCLUSION

- ! Allergie ou IR, femme enceinte, lésion non caractérisable au CT !
  - IRM – caractérisation des lésions rénales / TCC – connaitre les limites
- > intérêt de la biopsie et du suivi

# INCIDENTAL RENAL MASS



Berland, et al (2010) Managing Incidental Findings on Abdominal CT: White paper of the ACR Incidental Findings Committee. Radiology, 2010;7:754-773

« CECI N'EST PAS UNE LÉSION »

