

肺癌に対するMRI拡散強調画像(DWI)の有用性

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Body DWI 研究会

COI 開示

演題発表に際し、
開示すべきCOI はありません。

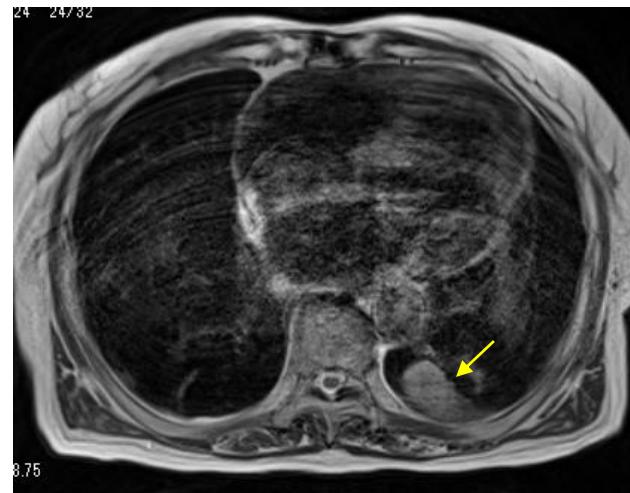
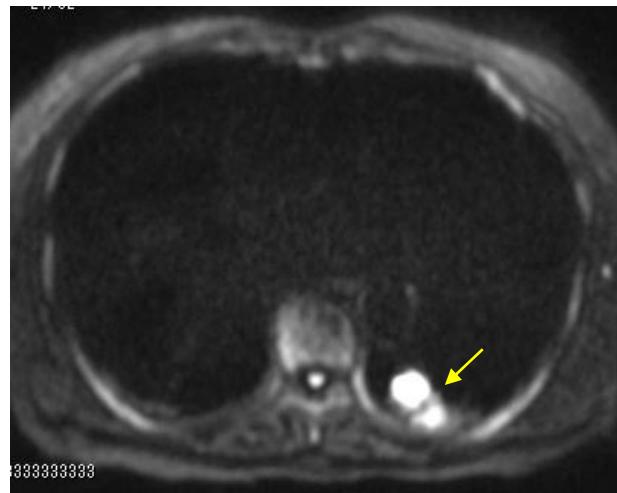
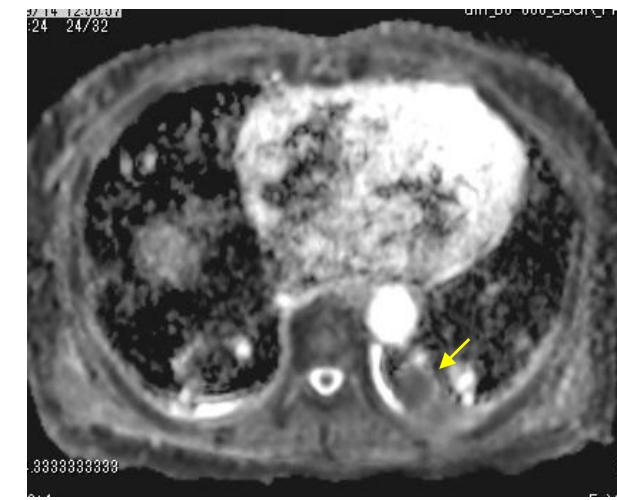
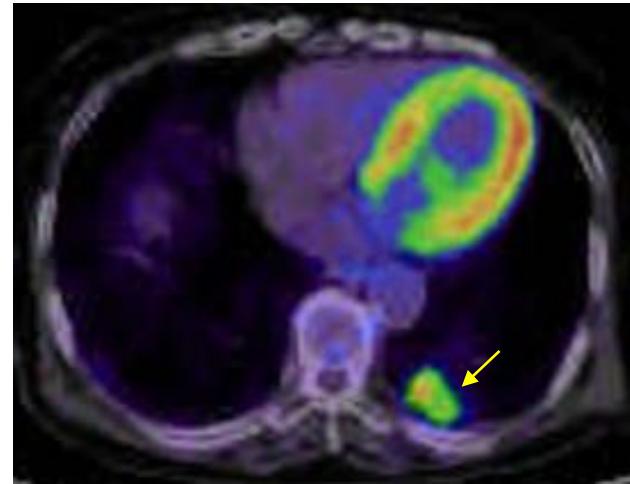
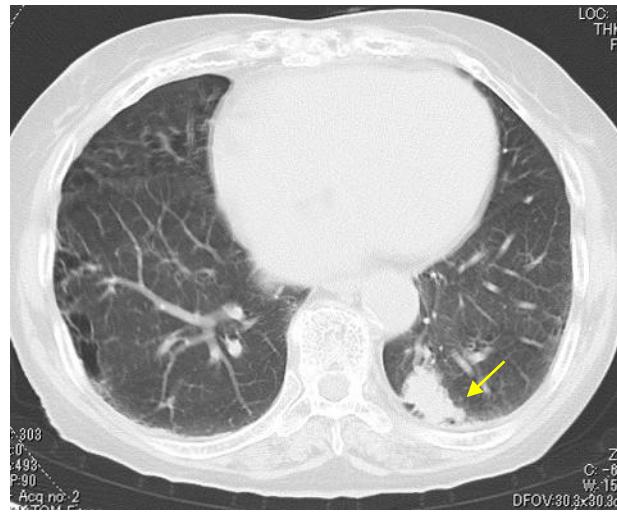
演者： 薄田 勝男

肺腫瘍陰影を有する患者328例の内訳

診断	患者数
肺癌	278
腺癌	192
扁平上皮癌	64
大細胞神經内分泌癌 (LCNEC)	5
大細胞癌	3
腺扁平上皮癌	4
カルチノイド	2
小細胞癌	7
癌肉腫	1
良性肺腫瘍	50
炎症性	39
抗酸菌感染症	13 (結核性 5, 非結核性 8)
肺炎	12
肺膿瘍	7
肺瘢痕	3
器質化肺炎	2
その他	2
非炎症性	11
過誤腫	5
肺分画症	2
その他	4
患者数	328

検査方法

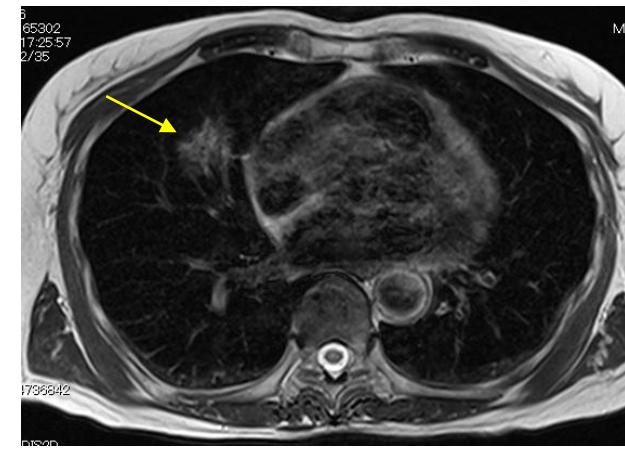
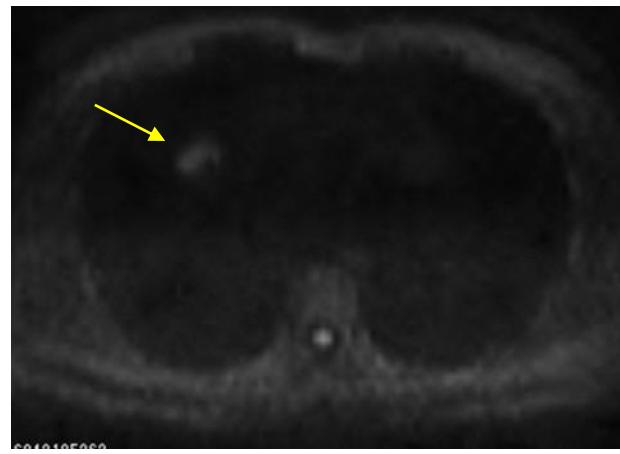
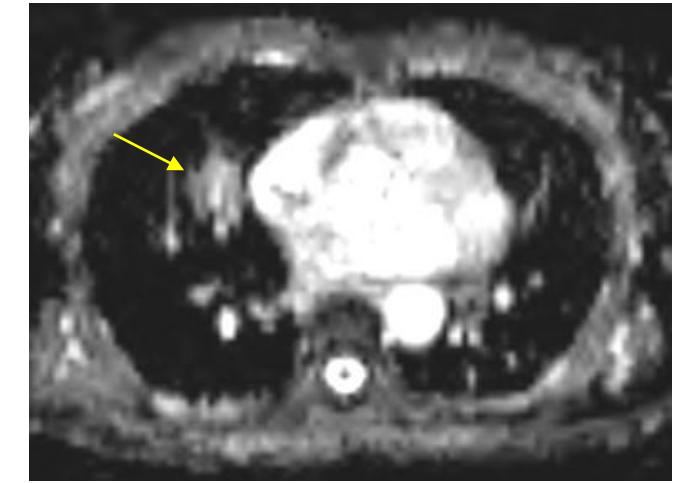
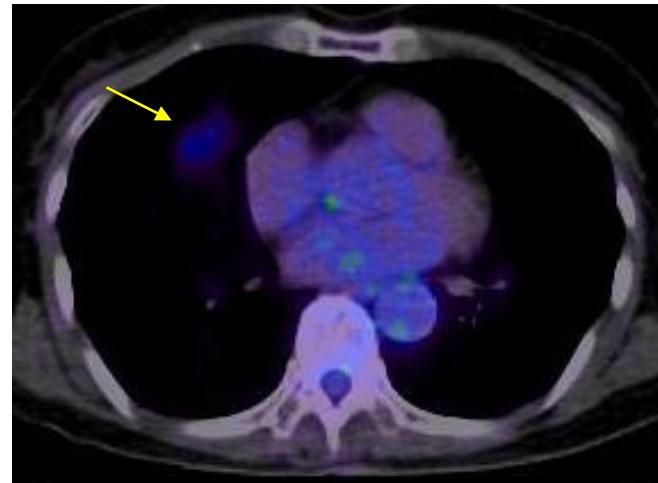
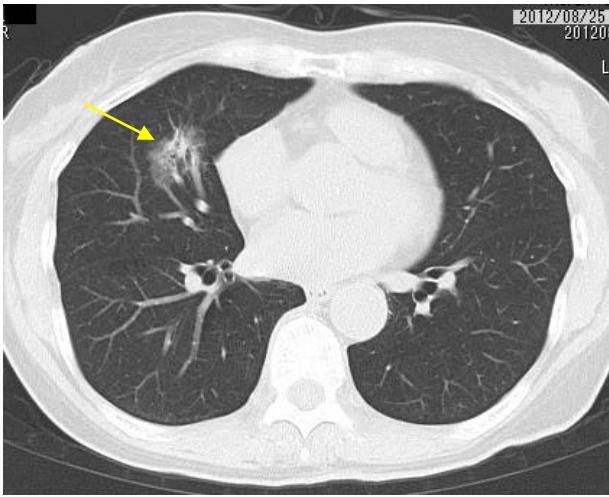
- MRI：
SIEMENS MAGNETOM Avanto 1.5T
b factor : 0 および 800
- PET-CT：
SIEMENS Biography Sensation 16
- 良性・悪性を分ける至適カットオフ値の設定
GraphPad Prism (USA)のROC (receiver operating characteristics) カーブを使用。
ADC : $1.459 \times 10^{-3} \text{mm}^2/\text{sec}$
T2 CR (contrast ratio): 2.46
(肺腫瘍のT2 signal intensityを菱形筋のT2 signal intensityで割った値)
Koyama et al. Eur. Radiol. 2008, 18, 2120-2131.
SUVmax : 3.605



CT	PET-CT	ADC map
DWI	T2 WI	

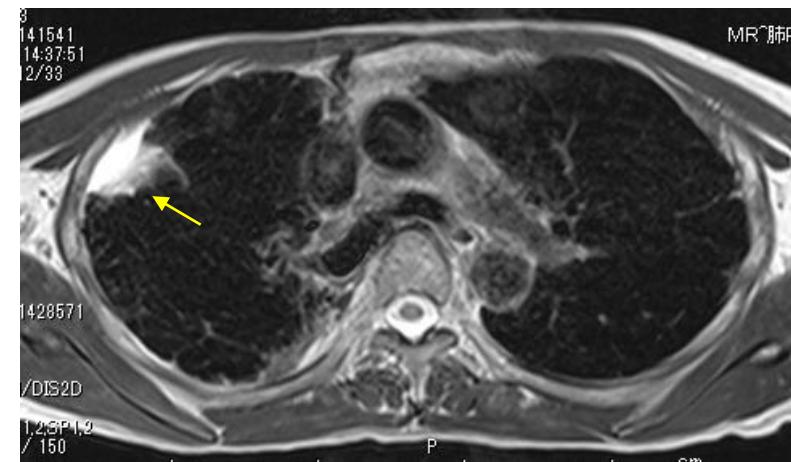
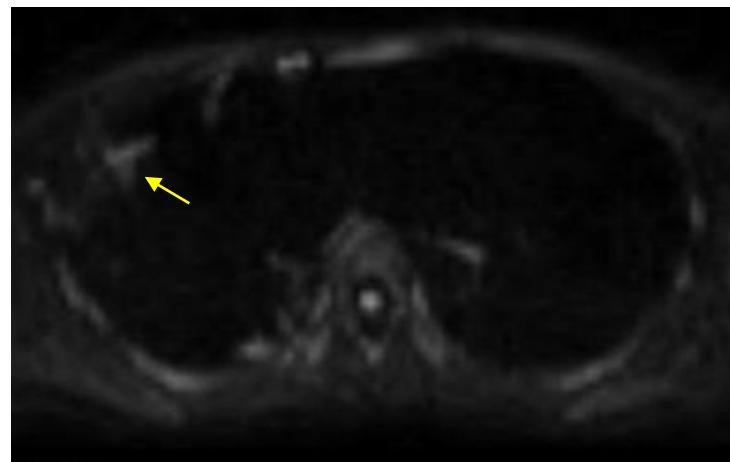
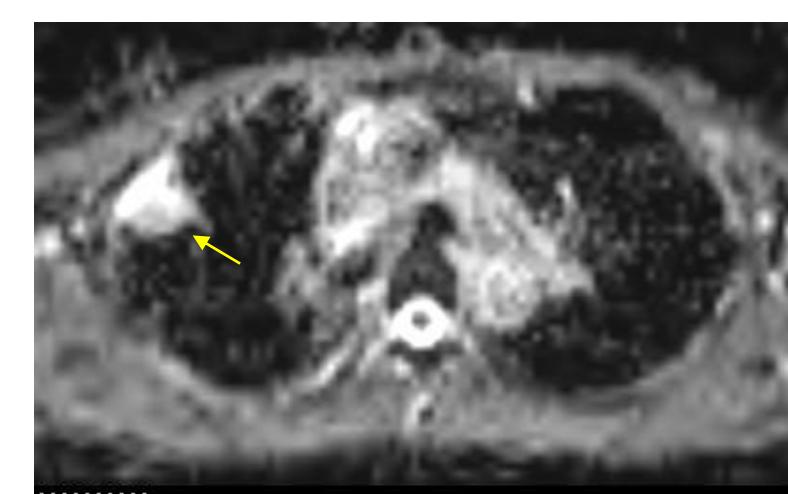
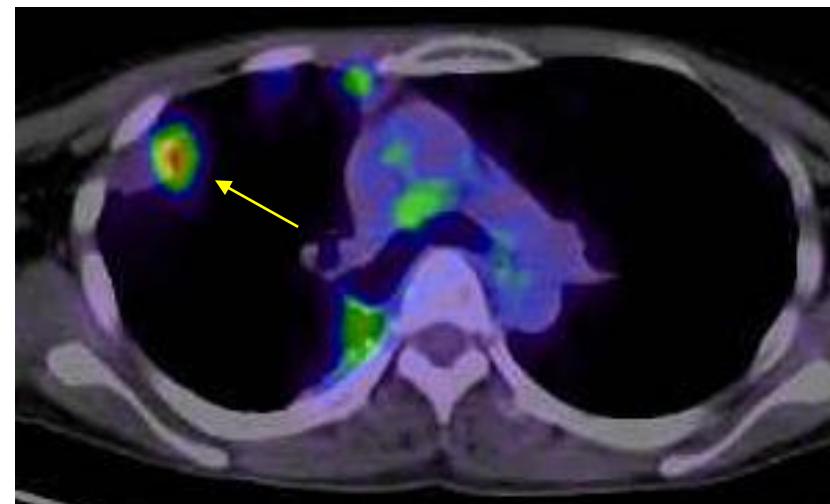
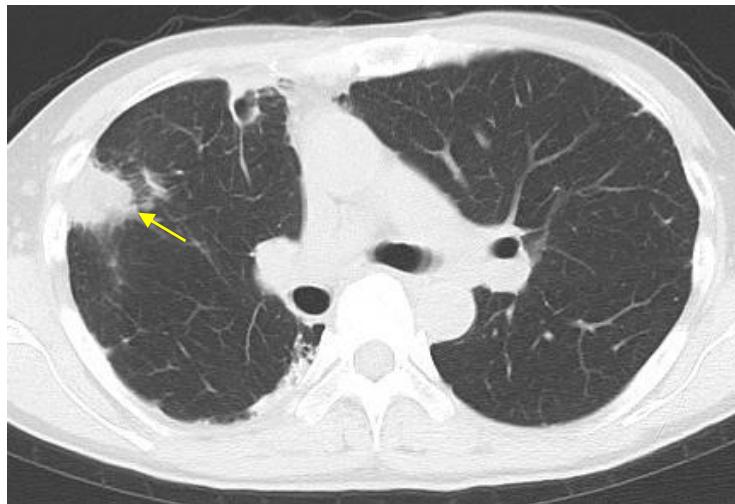
乳頭型腺癌

SUV_{max} 7.7, ADC $1.20 \times 10^{-3} \text{ mm}^2/\text{s}$, T2 CR 1.98



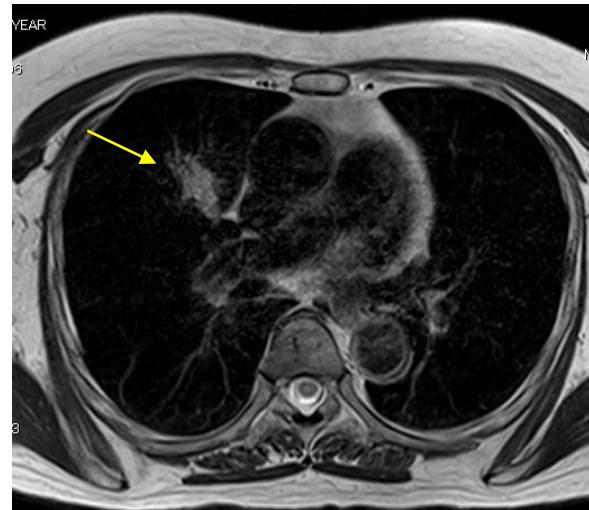
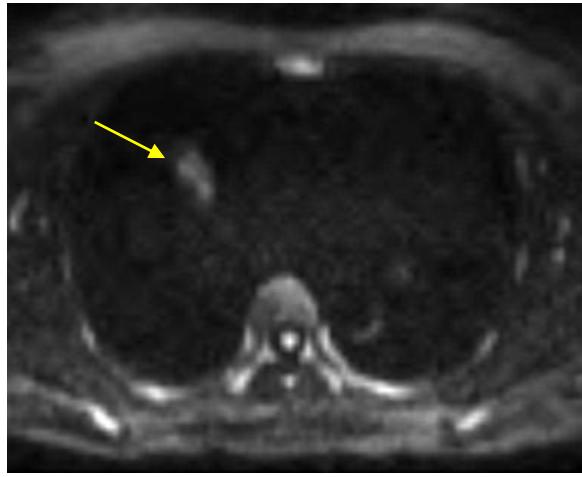
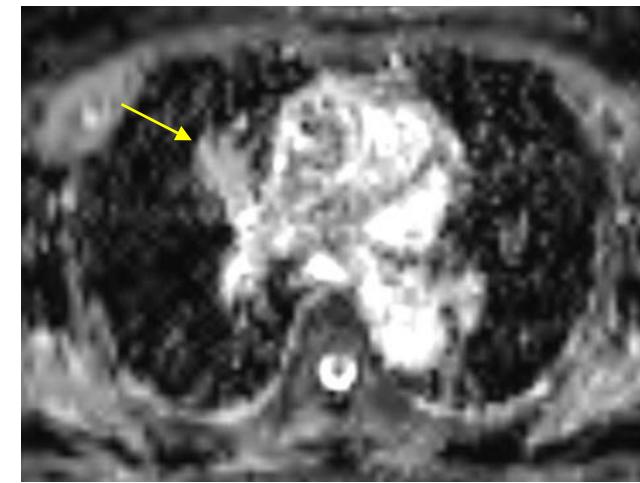
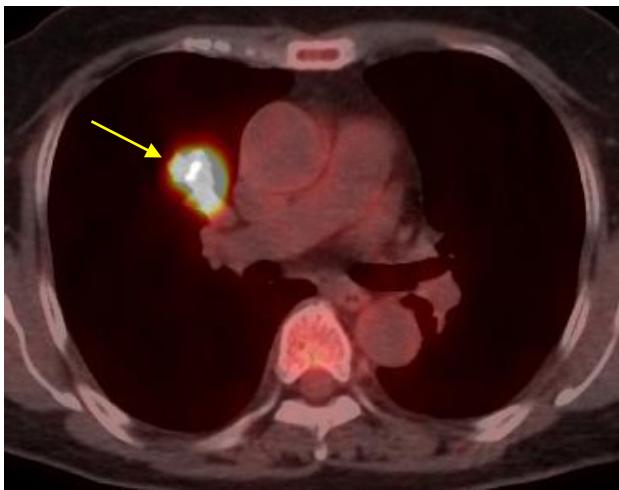
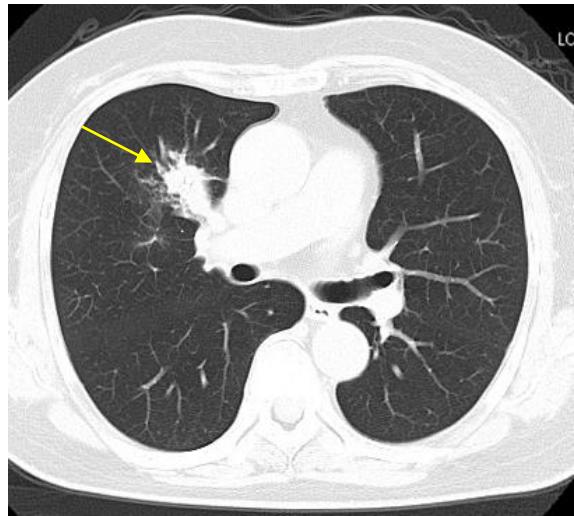
CT	PET-CT	ADC map
DWI	T2 WI	

腺管型腺癌 SUVmax 2.17, ADC $1.67 \times 10^{-3} \text{ mm}^2/\text{s}$, T2 CR 1.34



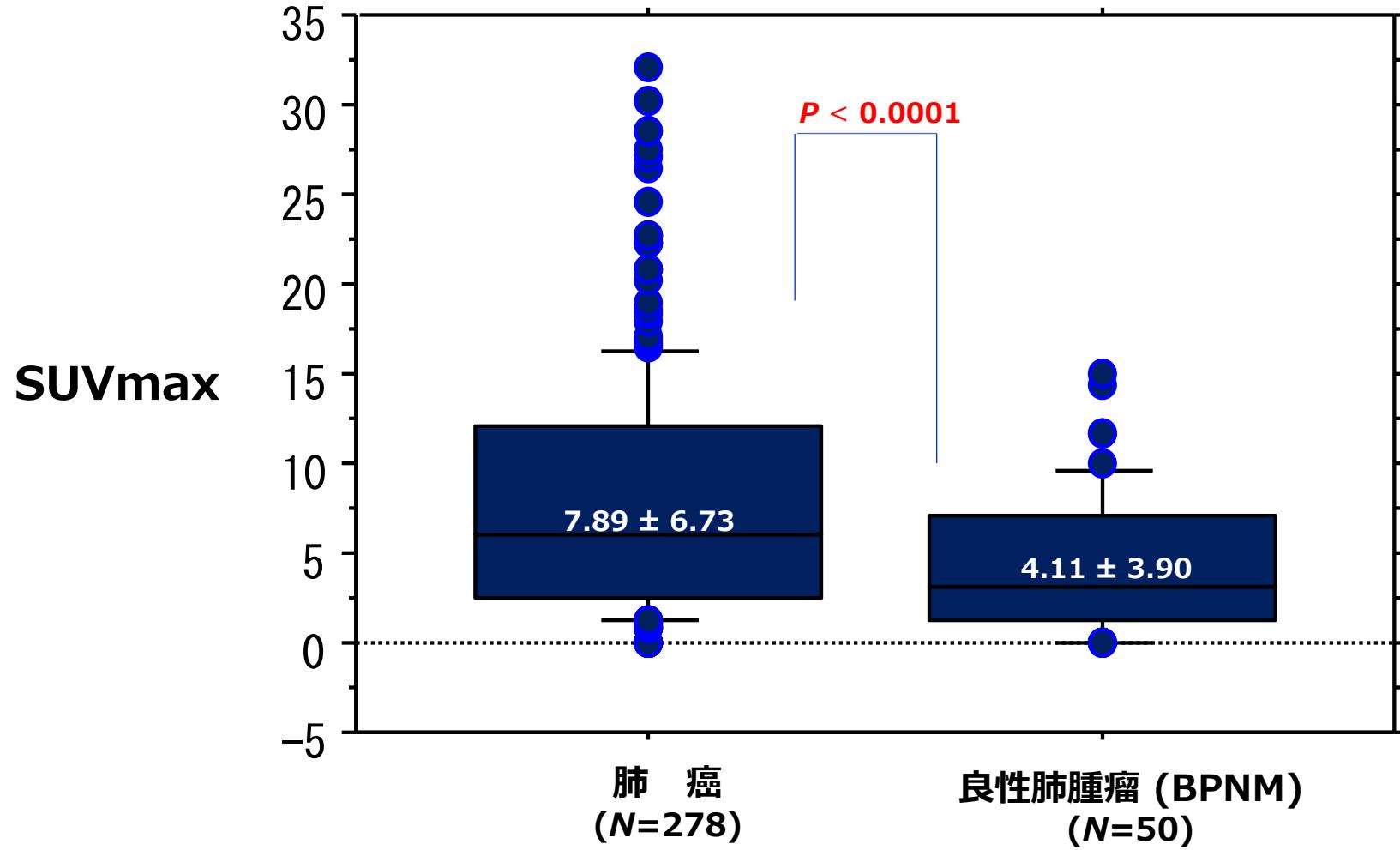
CT	PET-CT	ADC map
DWI	T2 WI	

非結核性抗酸菌症 **SUVmax 5.00, ADC $2.50 \times 10^{-3} \text{ mm}^2/\text{s}$, T2 CR 4.00**

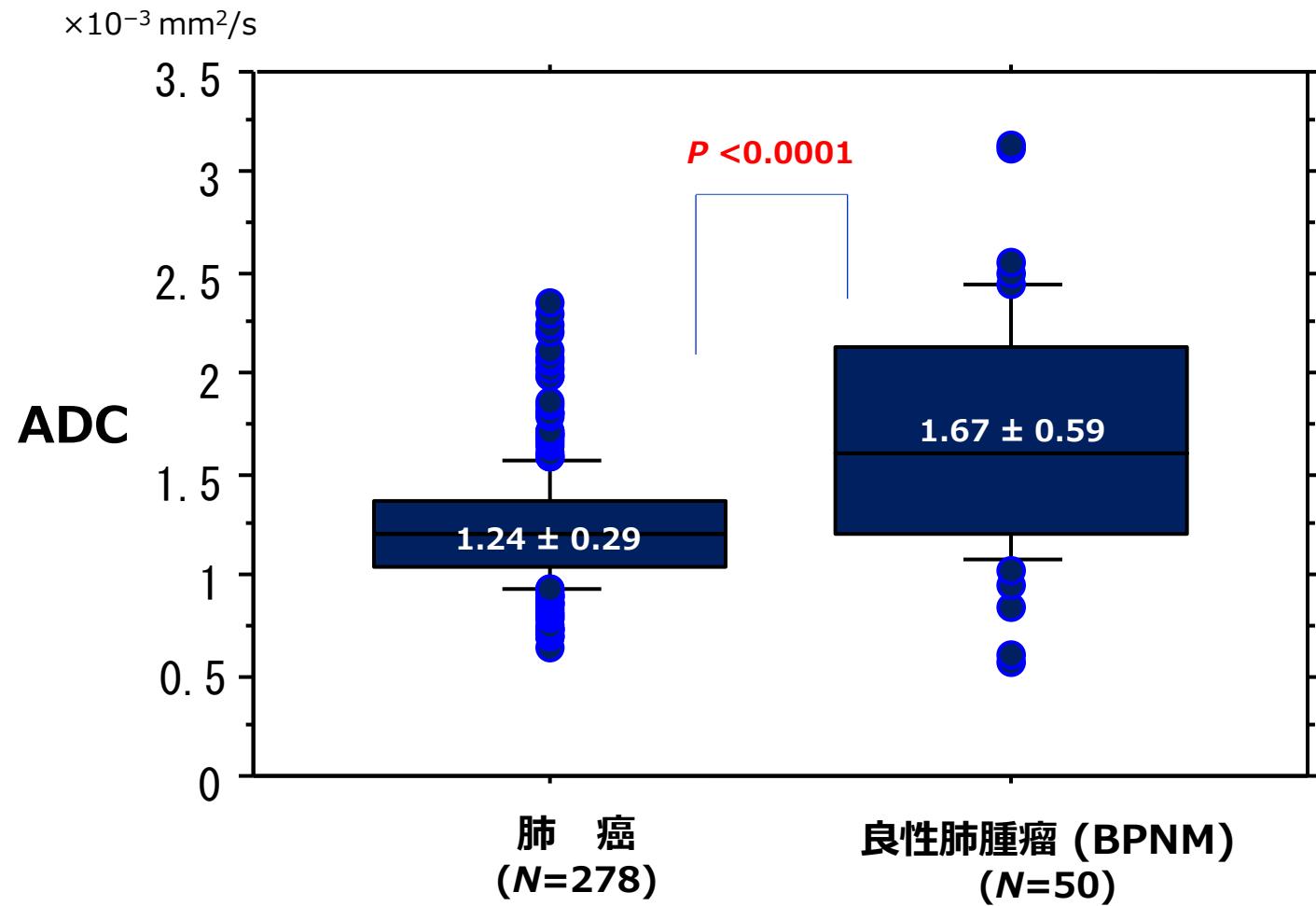


CT	PET-CT	ADC map
DWI	T2 WI	

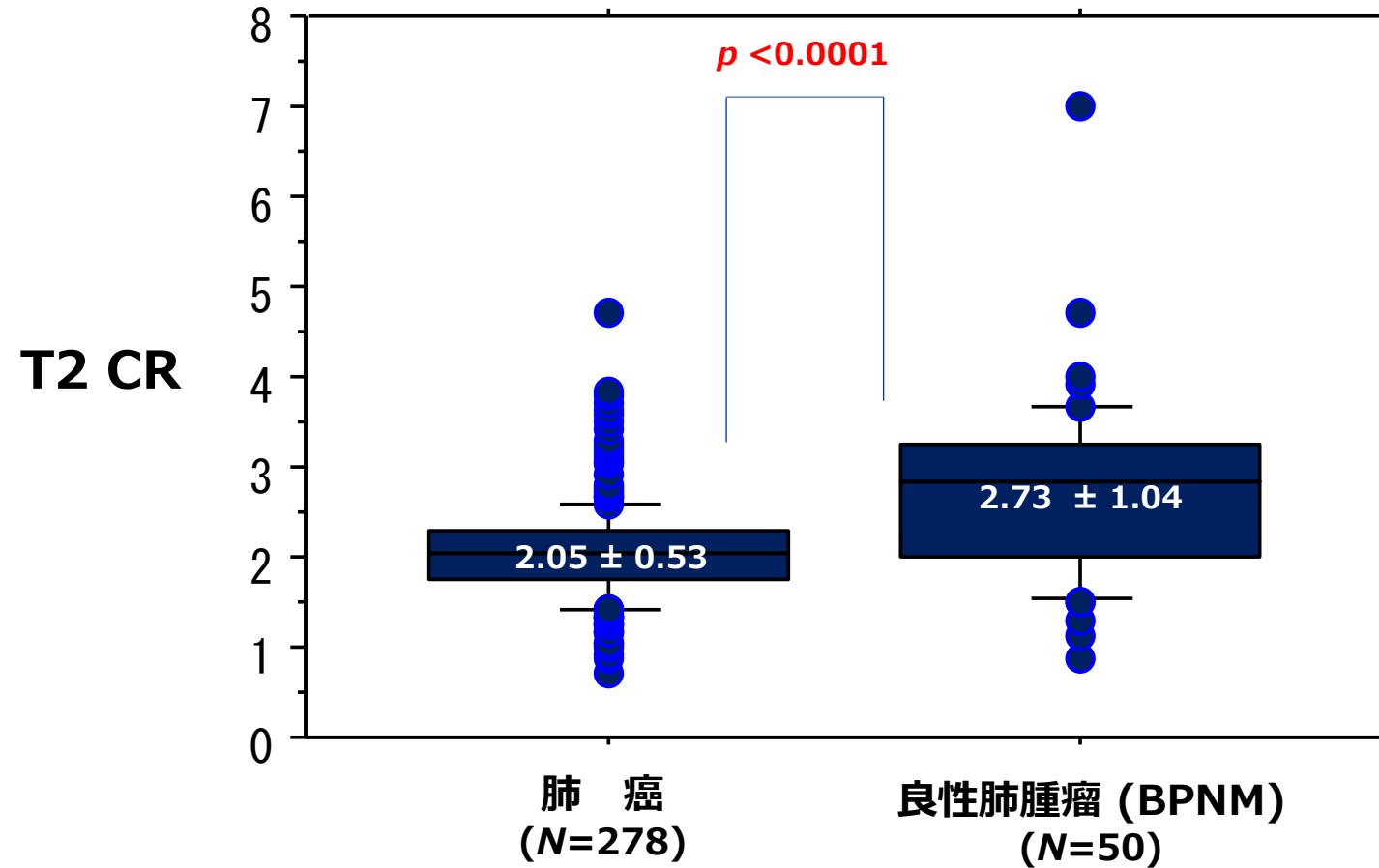
肺炎 **SUVmax 15.0, ADC $1.62 \times 10^{-3} \text{ mm}^2/\text{s}$, T2 CR 3.33**



肺良悪性病変別のSUVmaxの比較



肺良悪性病変別のADCの比較



肺良悪性病変別のT2 CRの比較

至適カットオフ値を用いた良悪性肺腫瘍の感度・特異度・正診率 n= 328

	真陽性 TP	偽陰性 FN	真陰性 TN	偽陽性 FP	感度	特異度	正診率
SUVmax	183	95	31	19	0.658 (183/278) *	0.62 (31/50)	0.652 (214/328) *
ADC	233	45	32	18	0.838 (233/278) **	0.64 (32/50)	0.808 (265/328) **
T2 CR	242	36	32	18	0.871 (242/278) ***	0.64 (32/50)	0.835 (274/328) ***
					* vs. ** p = 0.0089	* vs. ** p = 0.0365	
					* vs. *** p = 0.0176	* vs. *** p < 0.001	

肺癌および肺腫瘍の診断

- **MRI 論文のmeta 解析により、MRIが肺の良悪性病変の鑑別に有用**

Li B, et al. Acad Radiol 2014; 21: 21-9

Shen G, et al. Eur Radiol 2016; 26: 556-66

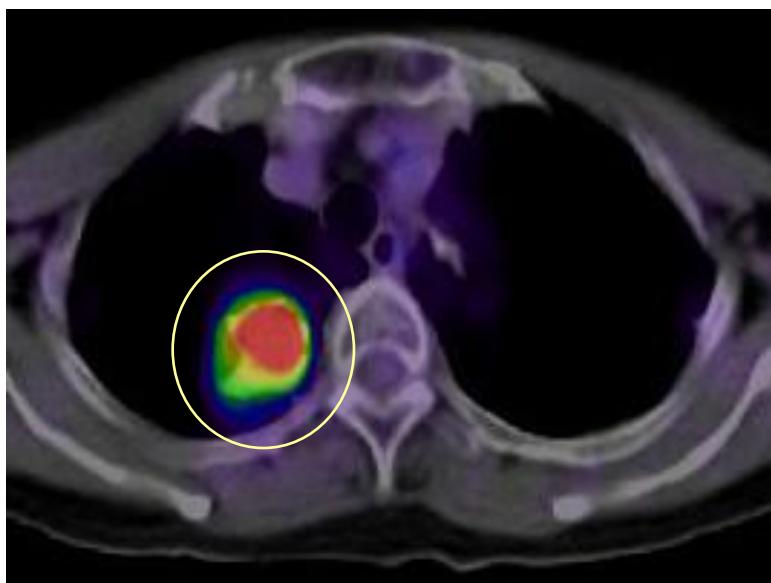
- **MRIの診断能は、PET-CTと同等ないしそれ以上**

Mori T, et al. J Thoracic Oncol 2008; 3: 358-64

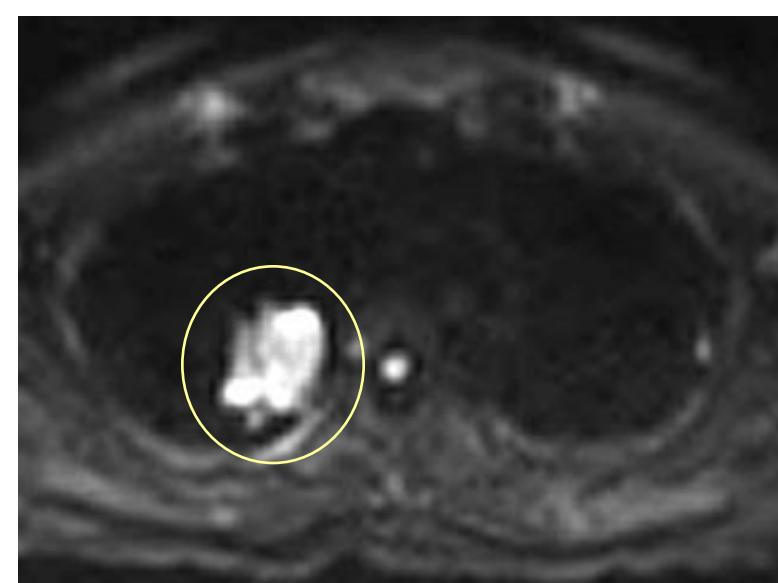
Usuda K, et al. Asian Pac J Cancer Prev 2014; 15: 4629-35

肺癌の臨床病期の診断におけるMRIの有用性

Usuda K, et al. Ann Surg Oncol 2013; 20 (5);1676-1683.



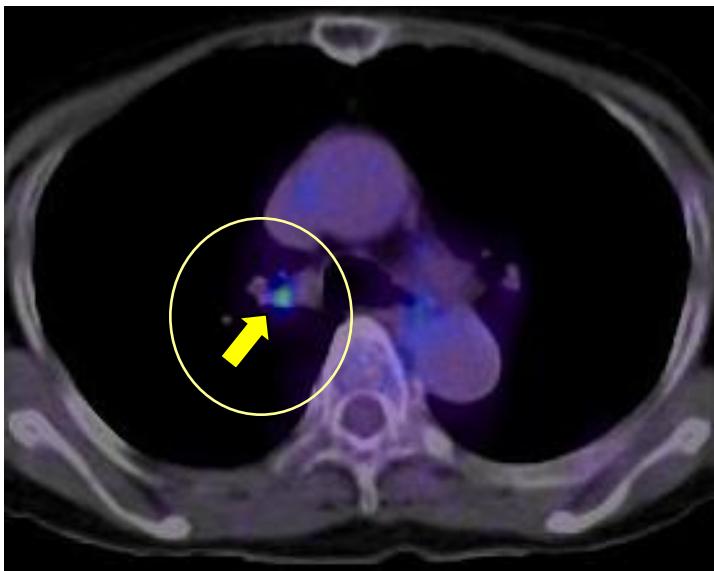
PET-CT



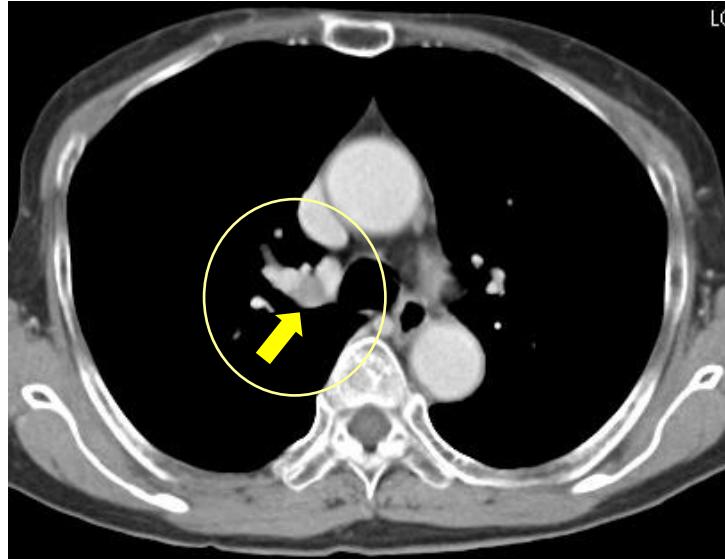
DWI

症例 1 腺癌

PET-CT

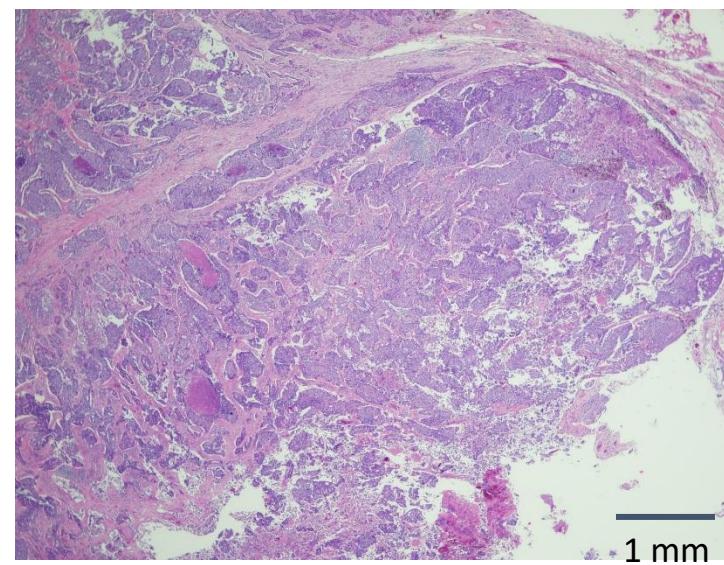


SUVmax 2.82, 隆性

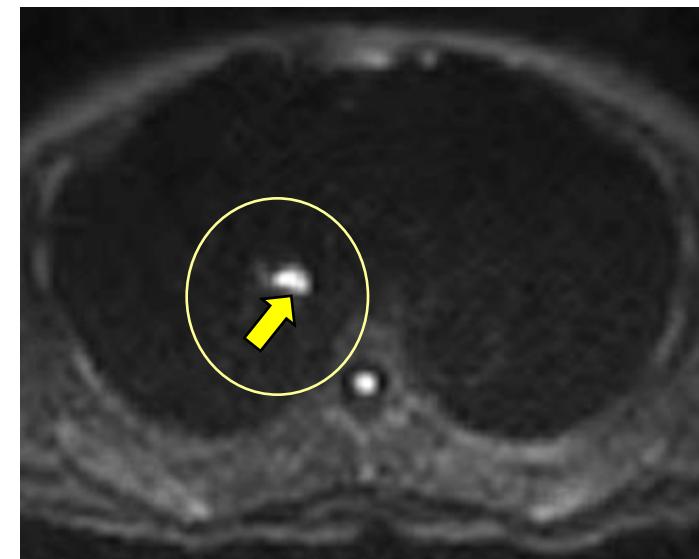


症例 1. リンパ節 #12u

リンパ節 #12u, 肿瘍経 11mm 陽性



DWI

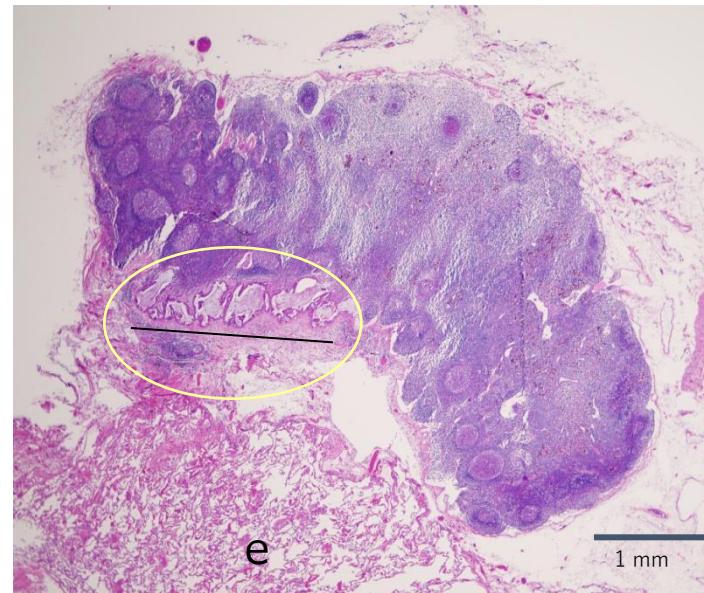
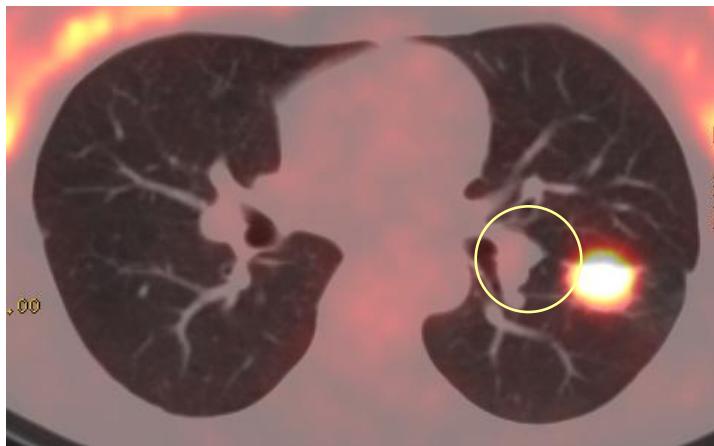


ADC $1.452 \times 10^{-3} \text{mm}^2/\text{sec}$, 陽性



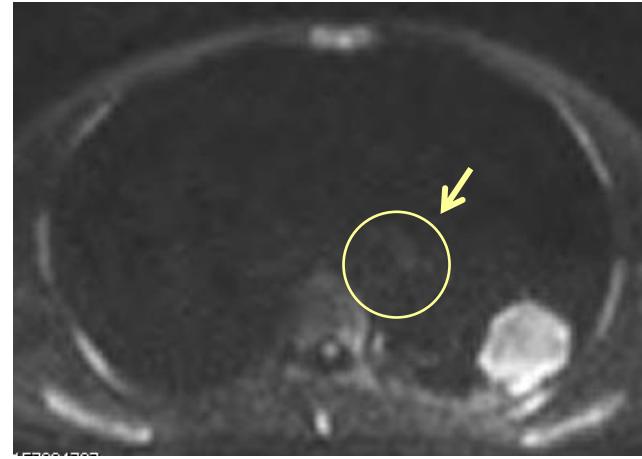
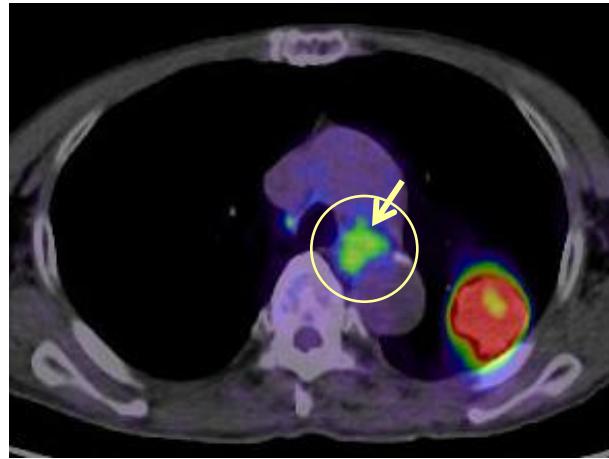
DWI

#12Lリンパ節 陽性



PET-CT #12Lリンパ節 隆性 リンパ節転移陽性 肿瘍経 2.1 mm

症例 2. 腺癌

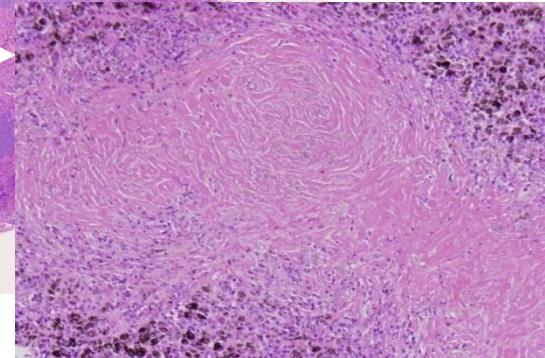
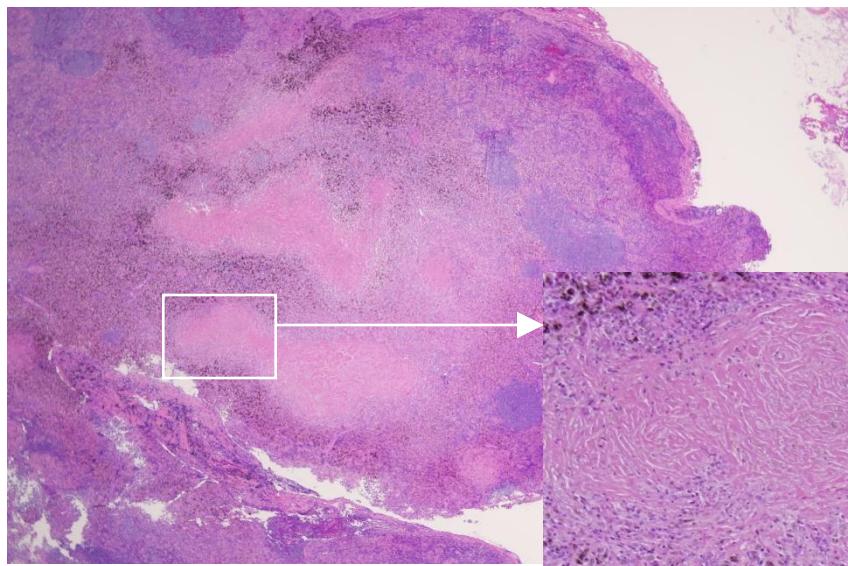


PET-CT

#4L リンパ節
SUVmax: 4.39 陽性

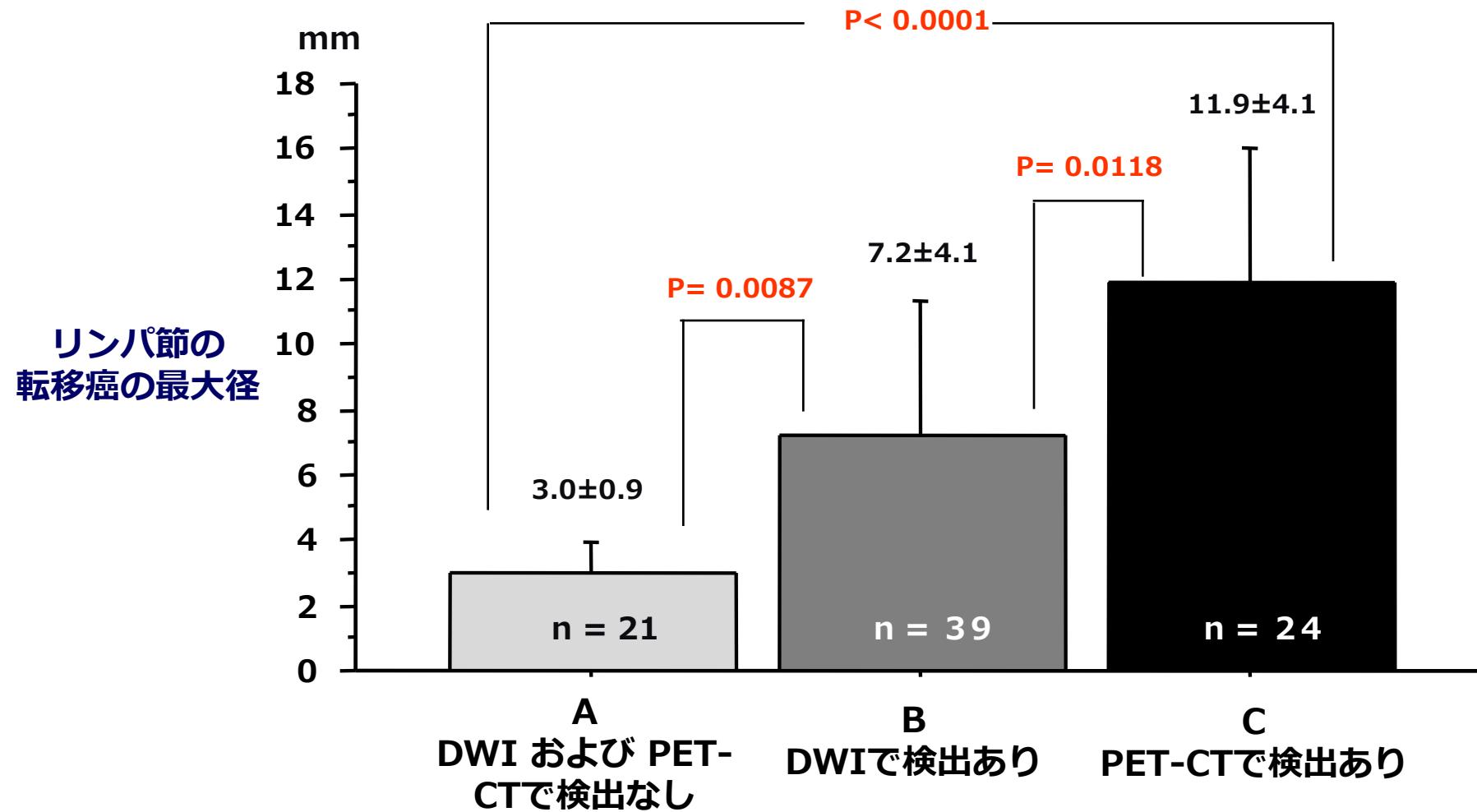
DWI

#4L リンパ節 陰性



症例 3. 大細胞癌

#4L リンパ節の病理診断：硅肺（陰性）



リンパ節の転移癌の最大径の比較

肺癌のリンパ節転移 DWIの成績

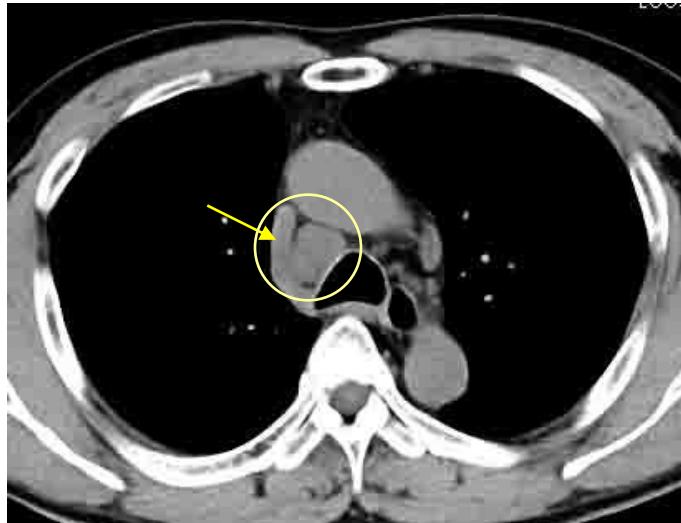
- Peerlingsら MRIの多数の論文の解析
リンパ節診断の感度：0.87、特異度：0.88
Peerlings J, et al. Radiology 2016; 281: 86-98
- Shenら MRIによるN因子の評価：**有用**
Shen G, et al. AJR 2016; 206: 283-90
- 転移性リンパ節の感度および正診率 **MRI > PET-CT**
Usuda K, et al. Ann. Thorac. Surg. 91: 1689-1695, 2011
Usuda K, et al. Ann Surg Oncol 2013; 20: 1676-83
Nomori H, et al. J Thoracic Cardiovasc Surg 2008; 135: 816-22

拡散強調画像による治療効果判定について

Usuda K, et al. Transl Oncol. 2019;12(5):699-704.

腺癌/RUL後/pStageIB その後#4Rリンパ転移陽性

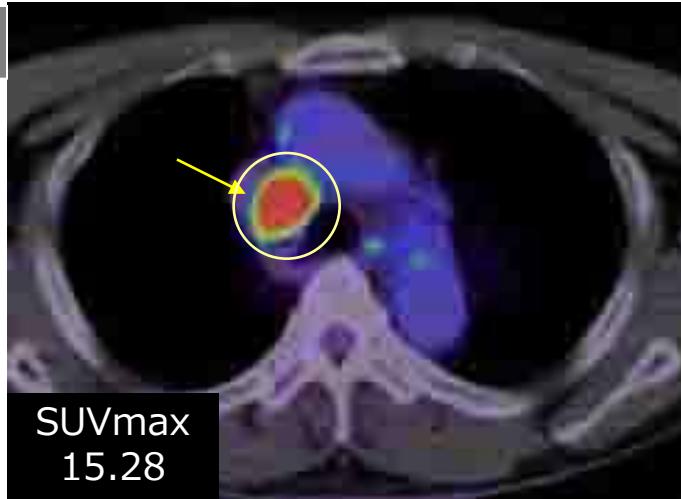
CT



DWI

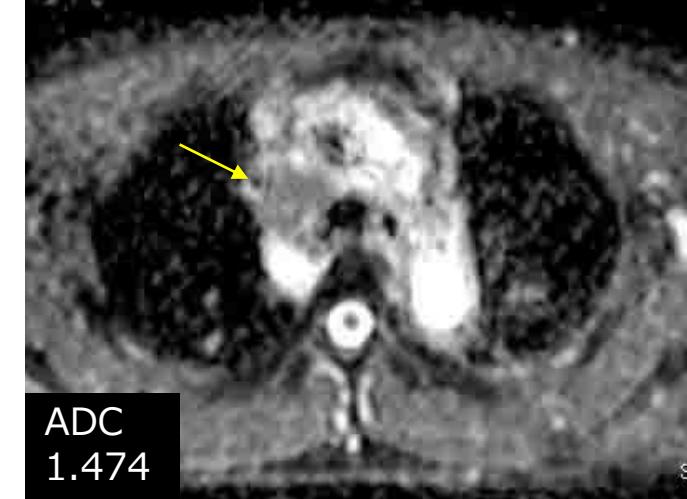


PET-CT

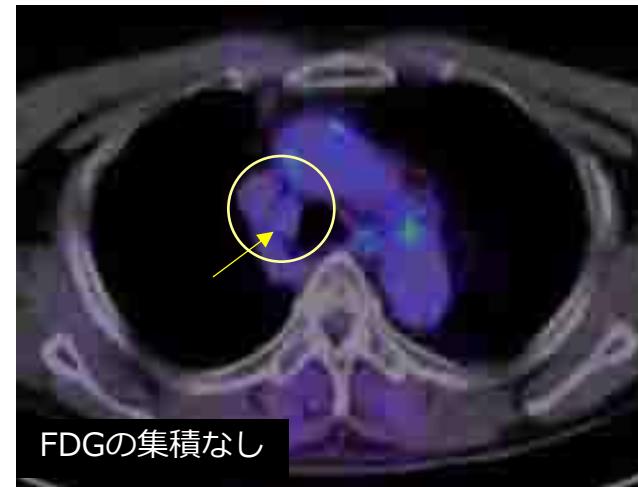
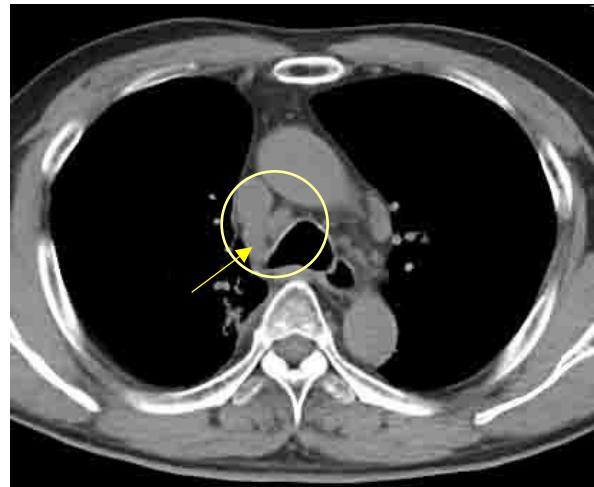


ADC
1.474

ADC map



化学放射線療法後の判定 CTでPR, DWIでCR



PET-CT

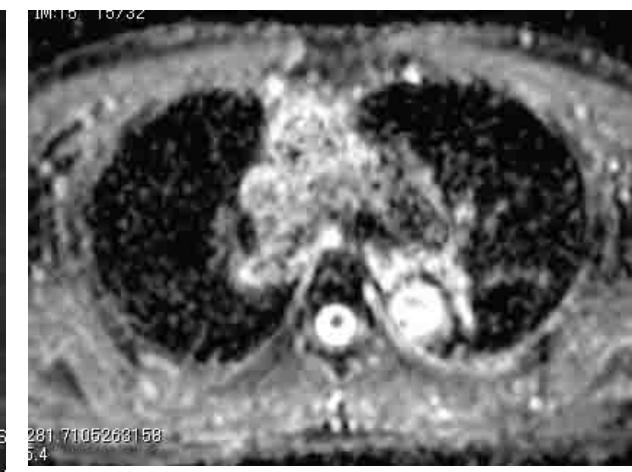
T1 WI



DWI



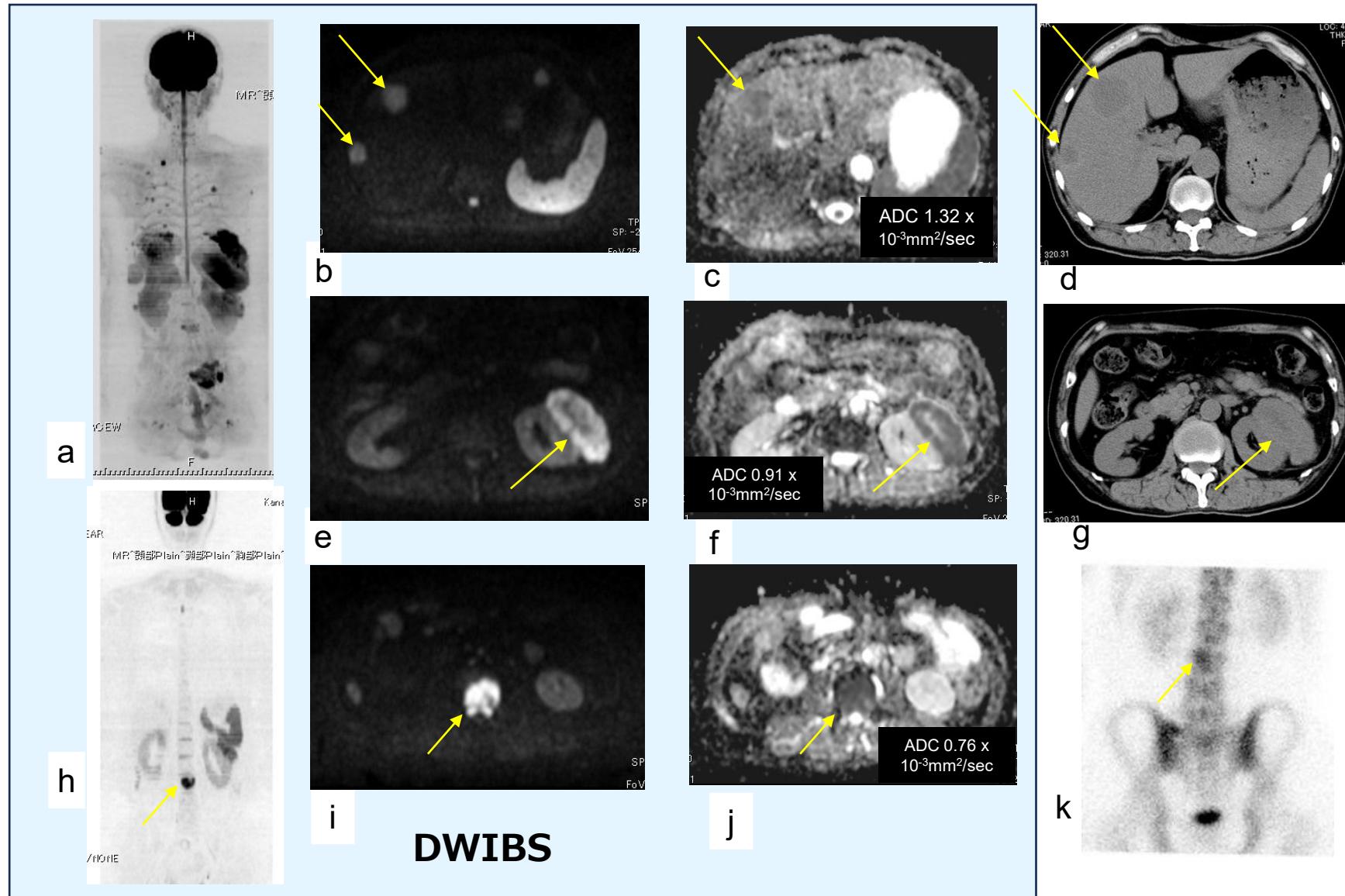
ADC map



PET-CT同様に、DWIでも、質的な治療効果を評価可能。

DWIBSによる肺癌の転移・再発病変

Usuda K, et al. Thoracic cancer 2021;12 (5):676 – 684.

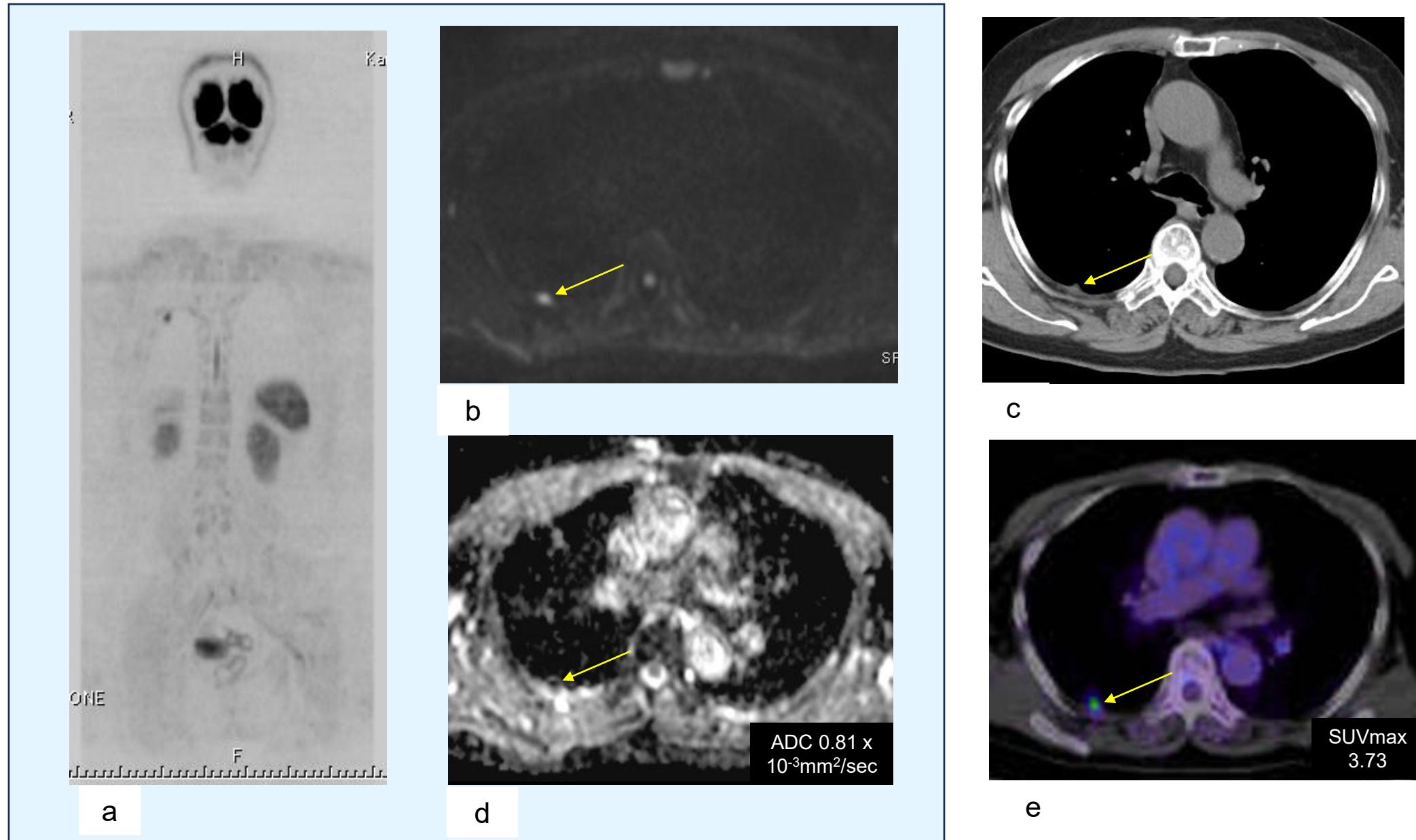


症例 1. LCNEC 術後

多発肝転移 : $ADC 1.32 \times 10^{-3} \text{mm}^2/\text{sec}$
 左腎転移 : $ADC 0.91 \times 10^{-3} \text{mm}^2/\text{sec}$
 腰椎転移 : $ADC 0.76 \times 10^{-3} \text{mm}^2/\text{sec}$

DWIBSで、肝・腎臓・椎体・腸骨の多発転移が検出

腰椎転移は、DWIBS(h)の方が骨シンチ(k)より明瞭



症例2. 腺癌 術後

胸膜転移 : DWIBS (a, b, d) **ADC $0.81 \times 10^{-3} \text{mm}^2/\text{sec}$** (d). **SUV max 3.73** (e)
外科切除により肺癌の胸膜播種と診断

まとめ

- 1. 拡散強調画像は、肺癌の良悪性の鑑別に有用であり、肺癌のN因子・M因子・病期診断が可能である。**
- 2. 拡散強調画像により、肺癌の化学療法や放射療の効果判定が可能である。**

A wide-angle photograph of a traditional Japanese garden during autumn. The scene is filled with vibrant red, orange, and yellow maple leaves. In the foreground, there's a calm pond reflecting the surrounding trees. A small, traditional thatched-roof pavilion sits on a low platform near the water. Several tall, thin trees with conical canopies, likely pine or cypress, stand in the background. The sky is clear and blue.

ご清聴 ありがとうございました