

The use of a visual 4-point scoring scale improves the yield of ¹⁸F-FDG PET-CT in the diagnosis of cyst infection in patients with ADPKD

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Introduction

- ¹⁸F-FDG PET/CT proved useful in the diagnosis of cyst infection (Cyl) in patients with autosomal dominant polycystic kidney disease (ADPKD)
- The definition of Cyl by ¹⁸F-FDG PET/CT remains unclear

Patients & Methods

- All ADPKD patients hospitalized between 2007 and 2019, who underwent an ¹⁸F-FDG PET/CT within the 14 days before or after admission
- Cyl was defined on the basis of 5 concomitant criteria:
 - fever $\geq 38^{\circ}\text{C}$;
 - abdominal pain;
 - plasma CRP levels ≥ 70 mg/L;
 - no other cause of inflammation;
 - favorable outcomes after antibiotics for ≥ 21 days
- All ¹⁸F-FDG PET/CT were classically assessed (**Figure 1**) by 2 physicians in nuclear medicine unaware of the clinical and biological parameters
- The uptake of ¹⁸F-FDG around the suspected Cyl was scored using a 4-point scoring scale (**Figure 2**) by the same observers

Fig. 1 Representative PET/CT images of 3 different patterns of ¹⁸F-FDG uptake within or around an infected cyst. Each pattern is represented by a panel composed of a transversal positron emission tomography (PET) image of the abdomen; the corresponding transversal computed tomography (CT) image; and the fusion PET/CT image. From left to right: (1) homogeneous wall [¹⁸F]FDG accumulation; (2) heterogeneous wall [¹⁸F]FDG uptake; and (3) diffuse [¹⁸F]FDG accumulation within the cyst

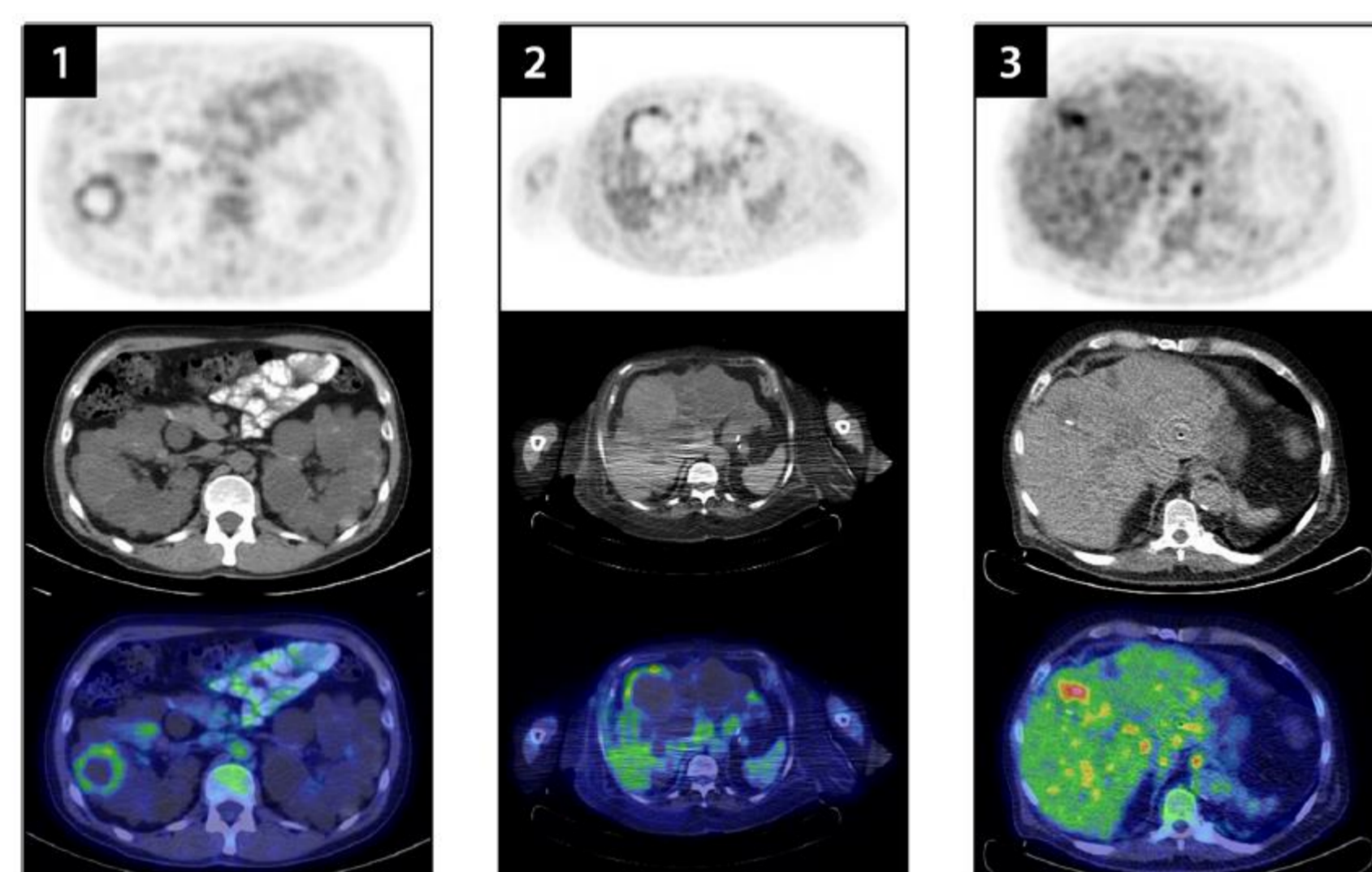
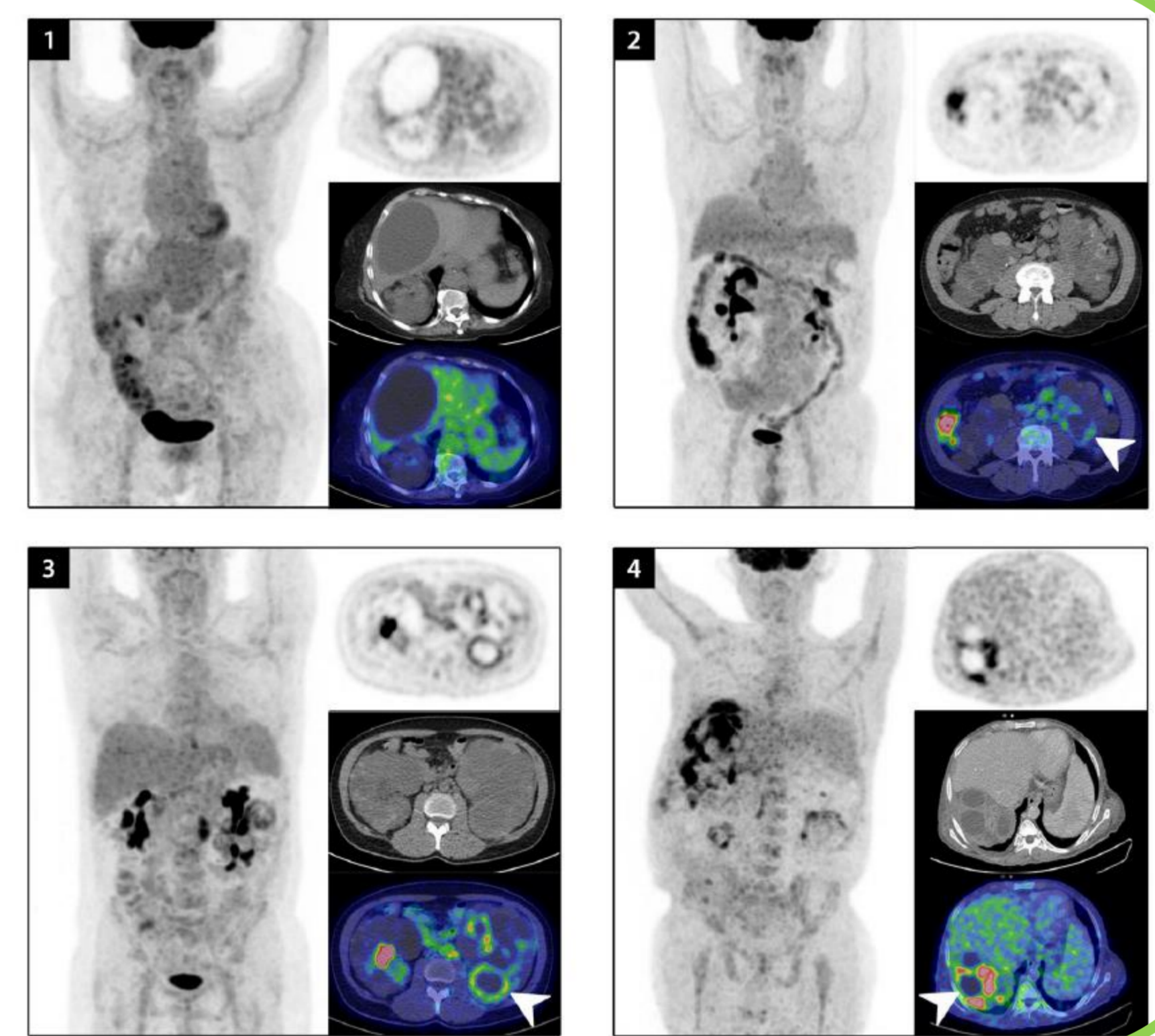


Fig. 2 Representative [¹⁸F]FDG PET/CT images of cyst infection according to the visual 4-point scoring system. Each score on the visual 4-category scale (from 1 to 4) is represented by a panel composed of a maximal intensity projection (MIP) image of positron emission tomography (PET) post [¹⁸F]FDG; a transversal PET image of the abdomen; the corresponding transversal computed tomography (CT) image and the fusion PET/CT image. The arrowhead shows the infected cyst considered for the scoring



Results

Table 1. Features of the cohort

Parameters		All patients (n = 60)	Cyl (+) (n = 26)	Cyl (-) (n = 34)
Age	years	59 ± 13	59.9 ± 15	58.5 ± 11.5
Gender	M/F	32/28	16/10	16/18
BMI	Kg/m ²	27.4 ± 4.2	26.3 ± 4.4	28.3 ± 4.1
Dialysis	N (%)	6 (10)	2 (7.7)	4 (11.8)
KTR	N (%)	44 (73.3)	20 (76.9)	24 (70.6)
Nephrectomy	N (%)	17 (28.3)	6 (23.1)	11 (32.4)
Duration of hospital stay	days	9 [11.5]	14 [15]*	7.5 [7]*
Use of antibiotics	N (%)	52 (86.7)	26 (100)*	26 (76.5)*
Duration of antibiotics	days	29.3 ± 14.2	37.8 ± 10.3*	20.8 ± 12.5*
Btw antibiotic initiation and PET-CT	days	9 [7]	9 [7]	8 [8]
Glycemia (n = 48)	mg/dL	93 [41.5]	90 [22.5]	99 [52]
Delays btw injection and acquisition	minutes	64 [13]	64 [18.5]	63.5 [10]

M/F, number of male/number of female; KTR, kidney transplant recipients; BMI, body mass index; btw antibiotic initiation and PET-CT, number of days between antibiotic initiation and PET-CT imaging; glycemia, glycemia measured just before injection the ¹⁸F-FDG; delays btw injection and acquisition, number of minutes between the ¹⁸F-FDG injection and PET-images acquisition; Cyl+, patient fulfilling the 5 criteria for cyst infection; Cyl-, patients not fulfilling the 5 criteria for cyst infection. Result expressed in N, number of patients and %, percentage of the considered group or median [with interquartile range] or mean ± SD. *p < 0.05

Table 2. PET/CT Findings

	N (%)
PET (+): cystic fixation	29 (48.3)
Liver	10 (34.5)
Right kidney	7 (24.1)
Left kidney	9 (31)
Both kidneys	3 (10.4)
Pattern of [¹⁸ F]FDG uptake	
Homogeneous cyst wall	12 (41.4)
Heterogeneous cyst wall	12 (41.4)
Interior of the cyst	5 (17.2)
Visual scale of [¹⁸ F]FDG uptake	
2	6 (20.7)
3	7 (24.1)
4	16 (55.2)
PET (+): non-cystic fixation	8 (13.3)
Peritonitis/diverticulitis	5
Prostatitis	1
Pneumonia	1
Kidney transplant pyelonephritis	1
PET (-)	25 (41.6)

Table 3. Distribution upon the 4-point scale

Visual scale		Cyl+ (n = 26)	Cyl- (n = 34)	OR (95% CI)	p value
1	N (%)	7 (26.9)	24 (70.6)	1.00	0.0015
2	N (%)	1 (3.8)	5 (14.7)	0.69 (0.07–6.88)	
3	N (%)	4 (15.4)	3 (8.8)	4.57 (0.82–25.5)	
4	N (%)	14 (53.8)	2 (5.9)	24 (4.37–132)	
1 and 2	N (%)	8 (30.8)	29 (85.3)	1.00	< 0.0001
3 and 4	N (%)	18 (69.2)	5 (14.7)	13.1 (3.69–46.1)	

OR (95% CI), odds ratio and 95% confidence interval; OR 4 vs. 2 = 35 (95% CI 2.58–500)

Conclusions

- The classical subjective assessment of ¹⁸F-FDG PET/CT images reaches a sensitivity of 74% and a specificity of 71%
- The 4-point scoring scale improves the specificity to 85% using a diagnostic threshold ≥ 3 (which corresponds to cyst uptake \geq liver activity), with no change in sensitivity
- The positive and negative predictive values of the 4-point scoring scale are 79% and 78%, respectively

