

论著·临床研究

¹⁸F-FDG PET/CT 引导下穿刺活检在腹膜增厚性疾病良恶性鉴别中的应用

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[摘要] **目的**·探讨¹⁸F-氟脱氧葡萄糖(¹⁸F-fluorodeoxyglucose, ¹⁸F-FDG)正电子发射计算机断层/X线计算机体层摄影(positron emission tomography/computed tomography, PET/CT)引导下经皮腹膜穿刺活检在腹膜增厚性疾病良恶性鉴别中的应用价值。**方法**·回顾性分析10例腹膜增厚原因待查患者,其中男4例,女6例;¹⁸F-FDG PET/CT检查发现腹膜病变,选择¹⁸F-FDG代谢活性较高的靶区,在同机PET/CT引导下经皮腹膜穿刺活检。**结果**·所有病例均一次性穿刺取材成功,无严重并发症,均取得组织病理学诊断结果。7例腹膜穿刺病理诊断为恶性病变,包括4例腹膜转移肿瘤、3例淋巴瘤;余下的3例分别为1例腹膜假黏液瘤、1例结核病变、1例炎症病变。穿刺活检准确率为100%。**结论**·¹⁸F-FDG PET/CT引导下经皮腹膜穿刺活检是一种安全、有效的方法,在腹膜增厚性疾病的良恶性鉴别诊断和治疗决策中发挥重要作用。

[关键词] 腹膜; 穿刺活检术; 正电子发射计算机断层/X线计算机体层摄影; ¹⁸F-氟脱氧葡萄糖

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Application of ¹⁸F-FDG PET/CT-guided percutaneous biopsy to differential diagnosis of peritoneal thickening diseases

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[Abstract] **Objective**·To investigate the clinical value of ¹⁸F-fluorodeoxyglucose (¹⁸F-FDG) positron emission tomography/computed tomography (PET/CT)-guided percutaneous biopsy in peritoneal thickening of unknown origin. **Methods**·Ten cases of peritoneal thickening of unknown origin including 4 males and 6 females were analyzed. After ¹⁸F-FDG PET/CT examination, the peritoneal thickening regions with high ¹⁸F-FDG uptake were selected for the target areas. Percutaneous biopsy was operated under the guidance of the same PET/CT machine. **Results**·All lesions were successfully obtained by one-time puncture without serious complications, and histopathological diagnosis revealed that 7 cases were malignant, including 4 cases of peritoneal metastasis and 3 cases of lymphoma. The remaining cases were 1 case of pseudomyxoma, 1 case of tuberculosis and 1 case of inflammatory lesions. The accuracy of biopsy was 100%. **Conclusion**·¹⁸F-FDG PET/CT-guided peritoneal percutaneous biopsy is a safe and effective method, and may play an important role in differential diagnosis and treatment management.

[Key words] peritoneum; percutaneous biopsy; positron emission tomography/computed tomography (PET/CT); ¹⁸F-fluorodeoxyglucose (¹⁸F-FDG)

腹膜病变可以由多种疾病引起,影像学表现相对复杂,临床常规检查及影像学检查对其病因及良恶性的诊断价值有限,活检病理是最快速、有效的明确诊断的方法。目前临床常用的活检病理方法有超声、CT引导下经

皮穿刺活检,腹腔镜下腹膜活检,腹部小切口活检等。近年来,CT引导下穿刺活检已逐渐成为一种成熟且临床应用广泛的技术。正电子发射计算机断层/X线计算机体层摄影(positron emission tomography/computed tomography,

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PET/CT) 不仅可以对病变进行全身的评估, 而且可以很直观地呈现出腹膜病变代谢最活跃的部位。PET/CT 引导下经皮腹膜穿刺活检为穿刺部位选择提供了可靠的依据, 提高了活检的准确性^[1-2]。本研究回顾性分析行¹⁸F-氟脱氧葡萄糖(¹⁸F-fluorodeoxyglucose, ¹⁸F-FDG) PET/CT 引导下经皮腹膜穿刺活检的 10 例患者的病例资料, 探讨该方法的临床应用价值。

1 资料与方法

1.1 病例资料

收集 2017 年 12 月—2018 年 12 月在同济大学附属东方医院住院的 10 例患者的病例资料, 其中男 4 例, 女 6 例, 年龄 45 ~ 74 岁。病例入组标准: ①腹膜实性增厚伴¹⁸F-FDG 代谢增高。②无明确原发灶, 腹膜增厚为唯一影像学可显示病变; 或腹膜增厚与原发病灶¹⁸F-FDG 代谢水平相仿, 但原发灶取病理标本风险较大或过程复杂, 如需行外科手术等。排除标准: ①存在不能纠正的凝血功能异常。②缺乏安全的穿刺路径。③大量腹水患者(如果能配合术后穿刺处高位并耐受局部加压包扎, 则为相对禁忌证)。

体检发现糖类抗原-125(carbohydrate antigen 125, CA-125)增高 2 例, 胸部 CT 检查见腹膜增厚 1 例, 临床表现为腹痛、腹胀、腹水 7 例。所有患者均空腹 6 h 以上, 静脉注射¹⁸F-FDG 5.55 ~ 6.66 MBq/kg, 安静休息并充分水化 1 h 后行¹⁸F-FDG PET/CT 检查; 图像显示腹膜饼状增厚或结节状增厚, 伴有¹⁸F-FDG 代谢异常增高; 排除穿刺禁忌证后, 行 PET/CT 引导下经皮腹膜穿刺活检。所有病例均随访其治疗方法及转归。

1.2 仪器与设备

PET/CT 检查仪器为联影 PET/CT (uMI 510, 上海联影医疗科技有限公司)。图像为 3D 方式采集数据, 2 ~ 3 min/床, 有序子集期望值最大化(OSEM)重建图像。采用标准摄取最大值(SUV_{max}) ≥ 2.5 为阳性高代谢区标准。腹膜穿刺活检使用联影 PET/CT (uMI 510) 中的 16 层 CT 扫描, 扫描参数包括管电压 100 kV、管电流 80 mA、层厚 5 mm、螺距 1.062 5。采用美国 BARD 公司生产的活检针、活检枪(16G 或 18G), 取材长度 16 ~ 22 mm。

1.3 穿刺前准备

患者术前行血常规、凝血功能、肝肾功能、心电图等常规检查, 与患者或其家属签署手术知情同意书, 告知患者手术过程并行呼吸屏气训练, 取得患者充分理解及配合。

1.4 穿刺方法

患者首先行¹⁸F-FDG PET/CT 检查, 对病变进行全身评估后, 选取腹膜病变¹⁸F-FDG 代谢活性最高的部位作为拟取活检的靶区。

根据病灶位置和大小选择合适体位, 在预选出的穿刺区固定金属定位器, 再次行 CT 扫描, 以金属定位线与拟穿刺层面的交叉点为最佳穿刺点, 设计穿刺路径(一般选择距离腹膜病变最短且避开腹腔内血管、肠管的路径), 计算进针角度、深度。以穿刺点为中心常规消毒、铺洞巾, 2% 利多卡因 5 mL 逐层麻醉至腹膜, 麻醉满意后应用 16G 或 18G 同轴穿刺针从选定穿刺点, 按照既定角度、路径、深度进针, 再次行 CT 扫描确定穿刺针是否到目标靶区。如穿刺位置不理想, 可以根据 CT 扫描调整直至到达目前靶区。拔出同轴针芯置活检枪取材。每例患者常规取材 2 ~ 3 条, 标本经 10% 甲醛溶液固定后送检病理。穿刺完成后, 伤口按压包扎, 复查局部 CT, 观察有无出血、气腹等并发症。

2 结果

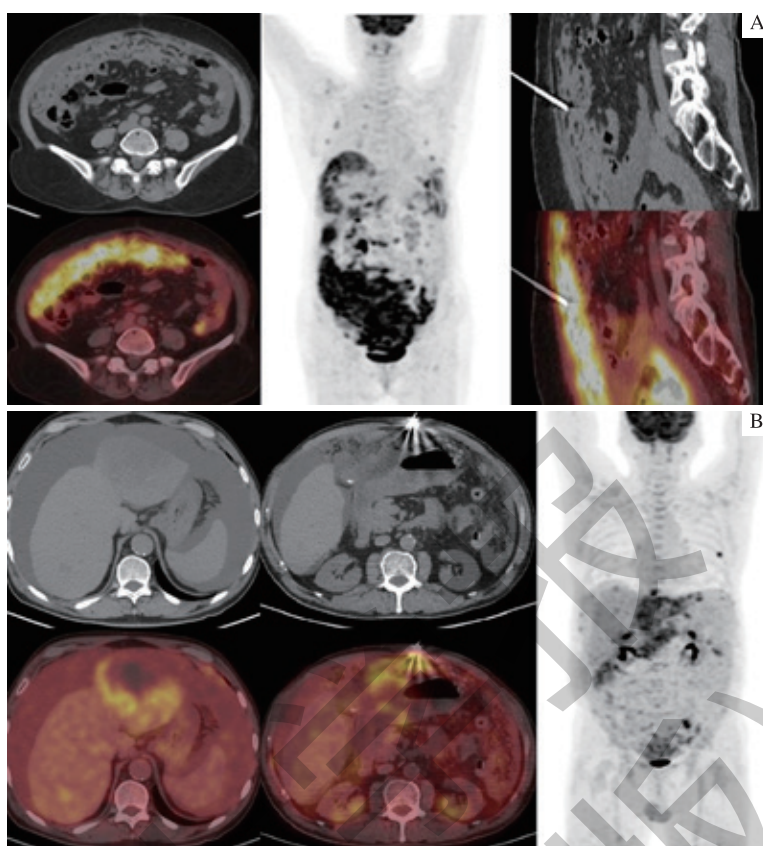
2.1 穿刺活检手术完成情况

10 例患者均顺利完成腹膜穿刺活检手术。所有病例均一次性穿刺取材成功, 并获得病理诊断。10 例¹⁸F-FDG PET/CT 引导下腹膜穿刺活检病例临床资料及转归情况见表 1。根据 PET/CT 图像选定穿刺靶区, 其中大网膜 6 例、肝周腹膜 2 例、肠系膜 1 例、右侧结肠膀胱腹膜 1 例。穿刺病理结果显示: 弥漫大 B 细胞淋巴瘤 3 例, 腹膜转移癌 4 例, 腹膜假黏液瘤、结核和炎症各 1 例。穿刺活检准确率为 100%。除 1 例高龄患者未行治疗, 其余 9 例均进行了疾病的对症治疗。随访至 2019 年 12 月, 5 例患者死亡, 生存期为 2 ~ 16 个月, 其余 5 例患者临床评价为完全缓解。图 1 为 2 例典型病例的 PET/CT 图像及穿刺活检路径。

表 1 10 例 ^{18}F -FDG PET/CT 引导下腹膜穿刺活检病例临床资料及转归Tab 1 Clinical data of 10 cases of ^{18}F -FDG PET/CT guided peritoneal biopsy

No.	Gender	Age/ year	Medical history	^{18}F -FDG PET/CT findings	Puncture site	Pathological result	Therapeutic regimen	Outcome
1	Female	64	Elevated CA125	Diffuse peritoneal thickening with significantly increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=16.3$)	Greater omentum	DLBCL	Chemotherapy (R-CEOP)+transverse colon resection+T cell immunotherapy	Death, 16-month-survival
2	Male	68	Abdominal pain and distension frequently	Diffuse peritoneal thickening; mesentery and retroperitoneal lymph nodes enlarged with significantly increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=20.9$)	Greater omentum	DLBCL	Chemotherapy (R-EPOCH)	Death, 2-month-survival
3	Male	55	Abdominal discomfortable for more than 10 d	Greater omentum and mesentery thickening; mediastinum, mesentery and retroperitoneal lymph nodes enlarged with significantly increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=27.8$)	Greater omentum	DLBCL	Chemotherapy (R-EPOCH)	Complete remission
4	Female	45	Abdominal distension for more than 30 d, ultrasound and CT revealing a mass in the left accessory area and ascites	Diffuse peritoneal thickening; neck, mediastinum, retroperitoneal and pelvic wall lymph nodes enlarged with increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=9.4$); bilateral accessory area cystic solid mass with increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=19.3$)	Greater omentum	Adenocarcinoma, ovarian origin	Tumor resection+chemotherapy (TP)	Complete remission
5	Female	69	Abdominal distension for 3 months	Diffuse peritoneal thickening with increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=10.5$)	Greater omentum	Serous adenocarcinoma (high grade)	Chemotherapy (TP)	Death, 5-month-survival
6	Male	74	Pain in the right upper abdomen for 30 d	Parahepatic peritoneum and right pleura thickening; mediastinum and retroperitoneal lymph nodes enlarged with significantly increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=11.8-13.6$)	Parahepatic space	Hepatic adenocarcinoma	Palliative care	Death, 3-month-survival
7	Male	64	Discomfortable in upper abdomen for 1 month	A mass in the left hepatic lobe with multiple nodules in peritoneum with increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=4.9$)	Peritoneum nodules	Cholangiocarcinoma	Chemotherapy (XELOX)+TACE	Death, 6-month-survival
8	Female	60	Abdominal distension for 6 months	Diffuse peritoneal thickening; low density cystic lesion around liver with slightly increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=2.5-4.0$)	Mesentery	Peritoneal pseudomyxoma (low grade)	Tumor resection, peritoneal cavity perfusion chemotherapy	Complete remission
9	Female	69	Ascites	Diffuse peritoneal thickening with slightly increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=4.2$); multiple lymph nodes enlarged with increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=6.2$)	Greater omentum	Peritoneal tuberculosis	Anti-tuberculosis regimes (isoniazid +rifampicin +pyrazinamide)	Recovery
10	Female	62	Ascites	Diffuse peritoneal thickening in the right paracolic sulcus with increased ^{18}F -FDG uptake ($\text{SUV}_{\text{max}}=8.1$)	Peritoneum of right paracolic sulcus	Inflammation	Antibiotic therapy (levofloxacin+metronidazole)	Recovery

Note: DLBCL—diffuse large B-cell lymphoma; R-CEOP—rituximab/cyclophosphamide/epirubicin/vincristine/dexamethasone; R-EPOCH—rituximab/etoposide/epirubicin/vincristine/cyclophosphamide/dexamethasone; XELOX —capecitabine/oxaliplatin; TP—taxotere/cisplatin; TACE—transcatheter hepatic arterial chemoembolization.



Note: A. A 64-year-old woman. PET/CT showed diffuse peritoneal thickening and abnormal increase in ^{18}F -FDG uptake. In this case, peritoneum thickening was the only abnormal image. No puncture contraindication was presented. The biopsy was performed in the thickened peritoneum with high activity in supine position. The pathological result was diffuse large B cell lymphoma. B. A 64-year-old man. PET/CT showed a mass in the left lobe of the liver, necrosis in the central area and ^{18}F -FDG uptake in peripheral region. The image showed peritoneal thickening with flocculent and nodules, and increase of ^{18}F -FDG uptake. Peritoneum biopsy was performed after the exclusion of contraindications. The pathological result was intrahepatic cholangiocarcinoma.

图 1 2 例典型病例的 PET/CT 图像及穿刺活检路径

Fig 1 PET/CT findings and biopsy routes of two typical cases

2.2 术后并发症

本组病例术后均未发生并发症。活检时患者感到疼痛, 但均能耐受, 数小时后自行缓解。1 例患者因大量腹水, 穿刺术后嘱患者半卧位 12 ~ 24 h, 无腹水渗漏发生。

2.3 治疗方案的选择

本组 3 例淋巴瘤病例, 在获得明确病理及免疫组织化学结果后, 行化学治疗 (化疗); 2 例卵巢癌, 其中 1 例先行肿瘤减灭术后再行化疗, 1 例行化疗; 2 例肝脏肿瘤, 其中 1 例行化疗结合肝脏介入治疗, 1 例因患者高龄行内科保守治疗; 1 例腹膜假黏液瘤先经腹腔镜行肿瘤减灭术, 再行腹腔灌注化疗; 1 例腹膜结核患者转专科医院接受抗结核治疗; 1 例腹膜炎患者, 对症抗炎后痊愈出院。

3 讨论

腹膜是由丰富的脂肪、血管、淋巴结及结缔组织组

成, 具有吸收和保护功能, 感染性、炎症性、肿瘤性和创伤性等疾病常累及腹膜^[3]。单纯的影像学检查对腹膜病变诊断效能有限, 腹水脱落细胞学、肿瘤标志物等实验室检查方法的特异度较低, 因此明确病理诊断对指导治疗有重要意义。随着免疫组织化学方法的广泛应用, 通过免疫组织化学分析可以辨别组织来源, 这对病理活检取材来说是一个概念上的飞跃, 可以根据病变选择最安全、最简便的部位取材, 而不是局限于原发部位。

本组 1 例淋巴瘤、1 例卵巢癌腹膜转移、1 例腹膜假黏液瘤、1 例腹膜炎患者中, 腹膜增厚是唯一可见的病变, 这时能够通过腹膜活检获得病理诊断尤为重要; 但是, 准确选择腹膜活检的部位是诊断的关键。 ^{18}F -FDG PET/CT 全身显像, 可以直观显示 ^{18}F -FDG 代谢增高的腹膜增厚区域, 从而准确指导腹膜活检的部位。以往常行腹腔镜检查, 直视下见腹膜表面成簇或散在分布的结节, 活检确诊率较高; 但该技术需在手术室进行, 手术过程复杂, 手术风险高、费用高, 且需全身静脉麻醉, 手术时间

长,不易被患者接受。超声引导下经皮穿刺腹膜活检可对穿刺全过程进行实时动态监视,可避免损伤重要脏器及血管;但对结节样增厚或者较深位置的腹膜,超声检查容易受肠气干扰,难以区分腹膜与肠管,在临床应用中具有一定局限性。CT引导下经皮穿刺活检被广泛认为是一种安全、简便的诊断方法^[4-5]。本组4例患者在结束PET/CT检查后,同机对PET/CT融合图像显示的腹膜病变取材,操作方便、定位准确^[6-7],获得了确切的病理诊断结果。

对于淋巴瘤患者的确诊,传统首选浅表淋巴结切除标本病理活检。本组2例淋巴瘤病例,PET/CT全身显像均未见明显浅表淋巴结¹⁸F-FDG代谢增高,仅表现为腹膜增厚及腹腔、腹膜后肿大淋巴结¹⁸F-FDG代谢增高。从¹⁸F-FDG代谢水平来看,腹膜病变的SUV_{max}值与腹腔、腹膜后淋巴结病变SUV_{max}值相当,甚至有些部位SUV_{max}值高于淋巴结病变;从操作角度来说,腹腔或腹膜后淋巴结相对位置较深,腹腔结构复杂,此时的腹膜病变相对表浅,解剖结构简单,更容易获得病理标本。

本组有2例肝脏来源的恶性肿瘤。众所周知,肝脏穿刺是临床应用比较成熟的技术^[8]。但本组2例中,其中1例肝样腺癌,PET/CT显示以肝包膜、右侧胸壁及胸膜增厚为主,此时的病变不能确定是肝脏原发,所以选择病灶最明显、¹⁸F-FDG代谢最高的位置取材。另1例肝脏肿瘤,PET/CT示肝左叶软组织肿块,由于肝左叶体积相对较小,肿块占据整个肝左叶,肿块中央区坏死,无肿瘤活性组织可以取材,周边¹⁸F-FDG代谢异常增高区邻近肝包膜,穿刺风险大,有肝包膜损伤、肝瘘、肝门部血管损伤的风险;另外,肝左叶周围大量积液,穿刺术后腹水渗漏、腹腔种植的风险增高;肝左叶周边腹膜絮状增厚,¹⁸F-FDG代谢增高,影像学上可以明确为肝肿瘤的腹膜转移;比较肝脏病变和腹膜

病变,选择腹膜取材更安全、更简便,且PET/CT明确显示了¹⁸F-FDG代谢的高活性区,保证了取材的准确性。

卵巢癌的病理诊断通常依据手术病理、腹水病理、腹腔镜探查活检、妇科后穹窿穿刺等。本组1例病例PET/CT除可见双侧附件区占位外,大网膜广泛饼状增厚,全身广泛淋巴结转移;此时,PET/CT一站式操作,在完成PET/CT检查后立刻行腹膜穿刺病理活检,可以极大地缩短诊断周期,简化患者的门诊就诊流程及降低门诊费用,具有良好的临床价值和社会价值。

另外,腹膜病变形态多样、位置各异,应根据病变的解剖位置和¹⁸F-FDG代谢活性设计相应的穿刺路径。首先,选择穿刺靶区时,应该根据¹⁸F-FDG代谢活性程度,选择最高临床分期的病灶进行活检^[9]。穿刺路径应该避开大血管和重要脏器^[10]。腹部最常见的穿刺路径遮挡为肠管,如果不能避开肠管,应在穿透腹膜后改用钝头针芯,缓慢进针,可以推开穿刺路径上的肠管。另外,对于腹膜病变,多数患者伴大量腹水,有穿刺后腹水渗漏的报道^[8]。对于这类患者,应该选择合适的穿刺时期,穿透腹壁肌肉邻近腹膜时,可以参照胸腔穿刺的方法,嘱患者呼吸配合,确保腹壁与腹膜穿刺点不在一条直线上;术后,可以嘱患者体位配合,如半卧位或侧卧位等;另外,考虑到腹壁脂肪层较薄、常规无菌纱布密封性能低,可以使用弹力绷带绕腹壁1周或固定加压24h以降低渗漏概率。

本研究是一项回顾性研究,样本量较小,但本组病理类型涵盖较多,相对而言具有一定的代表意义。我们认为,对于腹膜增厚患者,¹⁸F-FDG PET/CT引导下穿刺活检具有取材准确、安全、快速、微创、有效、可重复的特点,能为临床直接提供可靠的病理学依据,实现疾病精准病理诊断的一站式服务,对疾病的进一步诊疗具有指导价值。

参·考·文·献

- [1] 中华医学会核医学分会分子影像介导精确诊断工作委员会. PET/CT引导下微创经皮生物靶区活检检查术专家共识[J]. 中华核医学与分子影像杂志, 2016, 36(6): 542-545.
- [2] Fei B, Schuster DM. PET molecular imaging-directed biopsy: a review[J]. Am J Roentgenol, 2017, 209(2): 255-269.
- [3] Tirkles T, Sandrasegaran K, Patel AA, et al. Peritoneal and retroperitoneal anatomy and its relevance for cross-sectional imaging[J]. Radiographics, 2012, 32(2): 437-451.
- [4] Babaei Jandaghi A, Lebaday M, Zamani AA, et al. A randomised clinical trial to compare coaxial and noncoaxial techniques in percutaneous core needle biopsy of renal parenchyma[J]. Cardiovasc Intervent Radiol, 2017, 40(1): 106-111.
- [5] Cerci JJ, Tabacchi E, Bogoni M, et al. Comparison of CT and PET/CT for biopsy guidance in oncological patients[J]. Eur J Nucl Med Mol Imaging, 2017, 44(8): 1269-1274.
- [6] Wu MH, Xiao LF, Liu HW, et al. PET/CT-guided versus CT-guided percutaneous core biopsies in the diagnosis of bone tumors and tumor-like lesions: which is the better choice?[J]. Cancer Imaging, 2019, 19(1): 69-80.
- [7] Cazzato RL, Garnon J, Shaygi B, et al. PET/CT-guided interventions: indications, advantages, disadvantages and the state of the art[J]. Minim Invasive Ther Allied Technol, 2017, 27(1): 27-32.
- [8] Chen I, Lorentzen T, Linnemann D, et al. Seeding after ultrasound-guided percutaneous biopsy of liver metastases in patients with colorectal or breast cancer[J]. Acta Oncol, 2016, 55(5): 638-643.
- [9] Guo W, Hao B, Chen HJ, et al. PET/CT-guided percutaneous biopsy of FDG-avid metastatic bone lesions in patients with advanced lung cancer: a safe and effective technique[J]. Eur J Nucl Med Mol Imaging, 2017, 44(1): 25-32.
- [10] Vadvala HV, Furtado VF, Kambadakone A, et al. Image-guided percutaneous omental and mesenteric biopsy: assessment of technical success rate and diagnostic yield[J]. J Vasc Interv Radiol, 2017, 28(11): 1569-1576.

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