论著·影像集锦

胰腺富血供肿瘤的影像学特征

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【摘要】 目的　探讨胰腺富血供肿瘤的CT及磁共振成像检查特征。**方法**　采用回顾性描述性研究方法。收集2007年3月至2021年2月2家医学中心收治的53例(宁波大学医学院附属医院32例、海军军医大学第一附属医院21例)胰腺富血供肿瘤病人的临床病理资料;男21例,女32例;年龄为(48±23)岁。53例病人[胰腺神经内分泌肿瘤(PNET)19例、肾透明细胞癌胰腺转移瘤(PRCC)9例、实性假乳头状瘤(SPTP)8例、胰腺异位副脾(IPAS)7例、浆液性囊腺瘤(SCP)6例、动脉瘤4例]行CT和MRI检查。观察指标:(1)PNET的影像学检查表现。(2)PRCC的影像学检查表现。(3)SPTP的影像学检查表现。(4)IPAS的影像学检查表现。(5)SCP的影像学检查表现。(6)动脉瘤的影像学检查表现。正态分布的计量资料以$\bar{x}\pm s$表示,偏态分布的计量资料以M(范围)表示,计量资料以绝对数表示。**结果**　(1)PNET的影像学检查表现:19例PNET病人中,1例Von Hippel-Lindau病,8例多发内分泌肿瘤1型,10例神经内分泌肿瘤。19例病人中,16例为单个肿瘤,3例为2个肿瘤;肿瘤位于胰头部9例,胰体尾部10例;肿瘤多为圆形或椭圆形,部分可见浅分叶,边界清楚;4例肿瘤中央有簇样钙化,15例未见钙化;肿瘤长径为(26.7±10.3)mm。19例病人中,1例胰腺萎缩、主胰管节段性扩张,18例未见萎缩,主胰管无明显扩张;2例胆管扩张,17例无胆管扩张。PNET影像学检查强化模式为"快进快出"型。(2)PRCC的影像学检查表现:9例PRCC病人中,2例为单个肿瘤,分别位于胰颈部和胰体部,7例为多个肿瘤,在胰头、颈、体尾部均可见;肿瘤为圆形或类圆形,边界清楚;单个肿瘤长径为(18.0±5.0)mm,多个肿瘤长径为2.0~50.0 mm。9例病人中,2例胰管可见扩张,7例胰管未见扩张。PRCC影像学检查强化模式为"快进快出"型。(3)SPTP的影像学检查表现:8例SPTP病人均为单个肿瘤,肿瘤位于胰头部4例,胰体尾部4例;肿瘤大部分可见分叶,边界清楚;2例肿瘤未见钙化,6例肿瘤内可见钙化;2例肿瘤未见囊变坏死,6例肿瘤内见囊变坏死;3例肿瘤内未见出血,5例肿瘤内见出血;肿瘤长径为(51.6±11.8)mm。8例病人胰管均未见扩张,邻近脏器受压推移。SPTP影像学检查强化模式为"渐进"型。(4)IPAS的影像学检查表现:7例IPAS病人均为单个肿瘤,位于胰尾部;肿瘤为圆形或类圆形,边界清楚;1例肿瘤为囊实性,密度不均,为胰尾部副脾合并表皮样囊肿,6例肿瘤为实性,密度均匀;肿瘤长径为(25.5±8.5)mm。7例病人胰管均未见扩张,周围结构清晰。IPAS影像学检查强化模式为"渐进"型。(5)SCP的影像学检查表现:6例SCP病人均为单个肿瘤,位于胰颈部1例,位于胰体尾部5例;肿瘤为圆形或类圆形,边界清楚;2例肿瘤为囊性,4例肿瘤为实性;肿瘤长径为(35.5±15.4)mm。6例病人中,2例胰管扩张,4例胰管未见扩张。SCP影像学检查强化模式为"快进快出"型。(6)动脉瘤的影像学检查表现:4例动脉瘤病人均为单个肿瘤,位于胰体部1例,为十二指肠上动脉瘤,位于胰尾部3例,为脾动脉瘤;肿瘤呈圆形,边界清楚;1例肿瘤未见钙化,3例肿瘤边缘钙化;肿瘤长径为(11.3±2.5)mm。4例病人胰管未见扩张。动脉瘤影像学检查强化模式为"快进快出"型。**结论**　胰腺富血供肿瘤CT和磁共振成像检查表现多样,PNET、PRCC、SCP及动脉瘤强化模式为"快进快出"型,SPTP、IPAS强化模式为"渐进"型。

【关键词】 胰腺肿瘤;　富血供;　体层摄影术;　磁共振成像;　鉴别诊断

DOI:10.3760/cma.j.cn115610-20210924-00477
收稿日期　2021-09-24
引用本文:唐微微, 徐榴, 徐开蔚, 等. 胰腺富血供肿瘤的影像学特征[J]. 中华消化外科杂志, 2021, 20(10): 1105-1112. DOI: 10.3760/cma.j.cn115610-20210924-00477.

基金项目：国家自然科学基金（82172004）；国家卫生健康委科学研究基金-浙江省医药卫生重大科技计划项目（WKJ-ZJ-1912）；浙江省自然科学基金（Y20H180008）；宁波市自然科学基金（2019A610206）；宁波市公益类科技计划项目（20211JCGY020358）

Imaging features of pancreatic hypervascular tumors

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【**Abstract**】 **Objective** To investigate the imaging features of pancreatic hypervascular tumors in computed tomography (CT) and magnetic resonance imaging (MRI) examinations. **Methods** The retrospective and descriptive study was conducted. The clinicopathological data of 53 patients with pancreatic hypervascular tumors who were admitted to two medical centers, including 32 cases in the Affiliated Hospital of Medical School, Ningbo University and 21 cases in the First Affiliated Hospital of Naval Medical University, from March 2007 to February 2021 were collected. There were 21 males and 32 females, aged (48±23)years. Of the 53 patients, there were 19 cases with pancreatic neuroendocrine tumor (PNET), 9 cases with pancreatic metastasis from renal cell carcinoma (PRCC), 8 cases with solid pseudopapillary tumors of pancreas (SPTP), 7 cases with intrapancreatic accessory spleen (IPAS), 6 cases with serous cystadenoma of pancreas (SCP) and 4 cases with aneurysms. All the 53 patients underwent CT and MRI. Observation indicators: (1) imaging feature of PNET; (2) imaging feature of PRCC; (3) imaging feature of SPTP; (4) imaging feature of IPAS; (5) imaging feature of SCP; (6) imaging feature of aneurysms. Measurement data with normal distribution were represented as *Mean±SD*, and measurement data with skewed distribution were represented as *M* (range). Count data were described as absolute numbers. **Results** (1) Imaging feature of PNET: of the 19 cases with PNET, there were 1 case with Von Hippel-Lindau disease (VHLD), 8 cases with multiple endocrine neoplasia type 1 (MEN1) and 10 cases with neuroendocrine tumor (NET). Of the 19 cases, 16 cases had single tumor and 3 cases had 2 tumors, 9 cases had tumor located at head of pancreas and 10 cases had tumor located at body and tail of pancreas. Morphology of tumors in the 19 cases were mostly round or elliptical, with some shallow lobes and clear boundary. There were 4 cases with cluster-like calcifications in the center of tumors and 15 cases with no cluster-like calcification in the center of tumors. The tumor diameter of 19 cases was (26.7±10.3)mm. Of the 19 cases, 1 case underwent pancreatic atrophy and segmental expansion of the main pancreatic duct and 18 cases underwent no pancreatic atrophy or segmental expansion of the main pancreatic duct, 2 cases underwent dilated bile ducts and 17 cases underwent no dilated bile ducts. The enhancement mode of imaging examination of PNET was wash in and wash out. (2) Imaging feature of PRCC: Of the 9 cases with PRCC, 2 cases had single tumor and 7 cases had multiple tumors. Of the 2 cases with single tumor, 1 case had tumor located at neck of pancreas and 1 case had tumor located at body and tail of pancreas. All the 7 cases with multiple tumors had tumor located at head, neck, body and tail of pancreas. Morphology of tumors in the 9 cases were round or quasi-circular, with clear boundary. The tumor diameter were (18.0±5.0)mm of the 2 cases with single tumor and 2.0－50.0 mm of the 7 cases with multiple tumors, respectively. Of the 9 cases, 2 cases underwent pancreatic ducts dilatation and 7 cases underwent no pancreatic ducts dilatation. The enhancement mode of imaging examination of PRCC was wash in and wash out. (3) Imaging feature of SPTP: all 8 cases with SPTP had single tumor, including 4 cases with tumor located at head of pancreas and 4 cases with tumor located at body and tail of pancreas. Morphology of tumors in the 8 cases were lobulated with clear boundary. Of the 8 cases, there were 2 cases with no calcifications of tumors and 6 cases with calcification of tumors, 2 cases with no cystic necrosis of tumors and 6 cases with cystic necrosis of tumors, 3 cases with no bleeding in the tumors and 5 cases with bleeding in the tumors. The tumor diameter of 8 cases was (51.6±11.8)mm. All the 8 cases were negative for pancreatic ducts dilatation, but the adjacent organs were compressed and moved. The enhancement mode of imaging examination of SPTP was asymptotic enhancement. (4) Imaging feature of IPAS: all the 7 cases with IPAS had single tumor located at tail of pancreas. Morphology of tumors in the 7 cases were round or quasi-circular shape with clear boundary. Of the 7 cases, 1 case with solid-cystic

and uneven density tumor was epidermoid cyst in the accessory spleen of the tail of the pancreas, and 6 cases had solid and uniform density tumors. The tumor diameter of 7 cases was (25.5±8.5)mm. All the 7 cases were negative for pancreatic ducts dilatation and the surrounding structures of pancreatic ducts were clear. The enhancement mode of imaging examination of IPAS was asymptotic enhancement. (5) Imaging feature of SCP: all 6 cases with SCP had single tumor, including 1 case with tumor located at neck of pancreas and 5 cases with tumor located at body and tail of pancreas. Morphology of tumors in the 6 cases were round or quasi-circular, with clear boundary. Of the 6 cases, 2 cases had cystic tumors and 4 cases had solid tumors. The tumor diameter of 6 cases was (35.5±15.4)mm. Of the 6 cases, 2 cases were positive for pancreatic ducts dilatation and 4 cases were negative for pancreatic ducts dilatation. The enhancement mode of imaging examination of SCP was wash in and wash out. (6) Imaging feature of aneurysms: all the 4 cases with aneurysms had single tumor, including 1 case with tumor located at body of pancreas and 3 cases with tumor located at tail of pancreas. One case with tumor located at body of pancreas was superior duodenal aneurysm and 3 cases with tumor located at tail of pancreas were splenic aneurysms. Morphology of tumors in the 4 cases were round, with clear boundary. Of the 4 cases, 1 case was negative for tumor marginal calcification and 3 cases were positive for tumor marginal calcification. The tumor diameter of 4 cases was (11.3±2.5)mm. All the 4 cases were negative for pancreatic ducts dilatation. The enhancement mode of imaging examination of aneurysms was wash in and wash out. **Conclusions** The imaging features of pancreatic hypervascular tumors in CT and MRI examinations show diversity. The enhancement mode of imaging examination of PNET, PRCC, SCP and aneurysms is wash in and wash out. The enhancement mode of imaging examination of SPTP and IPAS is asymptotic enhancement.

【**Key words**】 Pancreatic neoplasms; Hypervascular; Tomography; Magnetic resonance imaging; Differential diagnosis

Fund programs: National Natural Science Foundation of China (82172004); National Health and Health Commission Scientific Research Fund-Zhejiang Province Medicine and Health Major Science and Technology Project (WKJ-ZJ-1912); Natural Science Foundation of Zhejiang Province (Y20H180008); Natural Science Foundation of Ningbo (2019A610206); Ningbo Public Welfare Science and Technology Plan Project (20211JCGY020358)

胰腺富血供肿瘤影像学检查表现为强化幅度达到或高于胰腺强化幅度的一类肿瘤或肿瘤样病变。胰腺富血供肿瘤主要有胰腺神经内分泌肿瘤（pancreatic neuroendocrine tumors，PNET）、肾透明细胞癌胰腺转移瘤（pancreatic metastasis from renal cell carcinoma，PRCC）、实性假乳头状瘤（solid pseudopapillary tumors of pancreas，SPTP）、胰腺异位副脾（intrapancreatic accessory spleen，IPAS）、浆液性囊腺瘤（serous cystadenoma of the pancreas，SCP）及动脉瘤[1]。CT、MRI检查是胰腺富血供肿瘤术前诊断的重要手段。本研究回顾性分析2007年3月至2021年2月2家医学中心收治的53例（宁波大学医学院附属医院32例、海军军医大学第一附属医院21例）胰腺富血供肿瘤病人的临床病理资料，探讨其CT及MRI检查特征。

资料与方法

一、一般资料

采用回顾性描述性研究方法。收集53例胰腺富血供肿瘤病人的临床病理资料；男21例，女32例；年龄为（48±23）岁。53例病人中，PNET 19例，PRCC 9例，SPTP 8例，IPAS 7例，SCP 6例，动脉瘤4例。本研究通过宁波大学医学院附属医院医学伦理委员会审批，批号为KY20210408。病人及家属均签署知情同意书。

二、纳入标准和排除标准

纳入标准：（1）手术或介入检查诊断明确。（2）术前CT和（或）MRI检查资料完整。

排除标准：（1）无明确病理学检查结果。（2）术前CT和（或）MRI检查资料缺失。

三、研究方法

（一）CT和MRI检查扫描方法

宁波大学医学院附属医院采用荷兰飞利浦公司256层螺旋CT机，管电压为120 kV，管电流为450 mA，层厚及层间距均为5.0 mm。所有病人检查前需禁食8~12 h。平扫后经肘静脉注射对比剂碘海醇（300 mgI/mL），流速为3.0 mL/s，分别于注射对比剂后20~30 s（动脉期）、50~60 s（门静脉期）及120~180 s（平衡期）进行3期扫描。MRI检查采用美国

GE公司1.5T磁共振扫描仪，检查前禁水禁食6 h，扫描自膈顶至肾脏下缘。病人行轴位T1加权成像、T2加权成像和多期增强T1加权成像。扫描序列：T1加权成像采用LAVA序列（TR 2.6 ms，TE 1.2 ms，TI 5.0 ms，层厚为5.0~7.0 mm）；T2加权成像采用脂肪抑制FSE序列，扫描参数：TR 6 316 ms，TE 90 ms，层厚为5.0~7.0 mm。平扫后经肘静脉注射对比剂钆喷酸葡胺（0.1 mmol/kg），流速为2.0 mL/s，分别于注射对比剂后15~20 s（动脉期）、50~60 s（门静脉期）、120~180 s（延迟期）进行扫描及获得T1加权成像多期增强图像，成像参数同平扫LAVA系列T1加权成像。

海军军医第一附属医院CT机型分别为荷兰飞利浦公司16层螺旋CT和德国西门子公司64层螺旋CT，层厚为3.0 mm，螺距为0.5 mm，平扫后经肘静脉注射对比剂碘海醇（300 mgI/mL）80~90 mL，流速为3.0~4.0 mL/s，分别于注射对比剂后20~25 s（动脉期）、60~70 s（门静脉期）、110~130 s（平衡期）进行3期扫描。MRI检查采用德国西门子1.5T avanto全身扫描仪和1.5T siphony全身扫描仪。扫描采用8通道腹部表面线圈。扫描序列：T1加权成像为三维容积内插快速扰相梯度回波序列（层间距统一为1.2 mm，层厚为4.0 mm）；T2加权成像为快速反转恢复脂肪抑制自旋回波序列（TR 6 300 ms，TE 86 ms）。平扫后经肘静脉注射对比剂钆喷酸葡胺（0.1 mmol/kg），流速为2.0 mL/s，分别于注射对比剂后15~20 s（动脉期）、60~70 s（门静脉期）、110~130 s（延迟期）进行3期扫描。

（二）影像学分析

经2位影像科高年资副主任医师审阅。如有异议，则讨论后达成一致。主要观察内容包括病灶大小、数量、分布、边缘，与相邻器官的关系、内部密度（信号）、增强后表现和对胰管影响等方面进行分析。CT检查密度及MRI检查信号评判标准以正常胰腺组织为参照。CT值测量以实性部分为准，若为囊性病灶，CT检查值取其强化最明显的区域，各期感兴趣区设置的位置及大小尽量保持一致。

四、观察指标

（1）PNET的影像学检查表现。（2）PRCC的影像学检查表现。（3）SPTP的影像学检查表现。（4）IPAS的影像学检查表现。（5）SCP的影像学检查表现。（6）动脉瘤的影像学检查表现。上述疾病影像学检查表现包括肿瘤数目、肿瘤位置、肿瘤形状、肿瘤性状、肿瘤长径、胰管或胆管情况，CT检查结果（平扫、动脉期、门静脉期）和MRI检查结果（T1加权成像、T2加权成像）。

五、统计学分析

应用SPSS 21.0统计软件进行分析。正态分布的计量资料以 $\bar{x}\pm s$ 表示，偏态分布的计量资料以 M（范围）表示，计量资料以绝对数表示。

结　果

一、PNET的影像学检查表现

19例PNET病人中，1例Von Hippel-Lindau病，8例多发内分泌肿瘤1型，10例神经内分泌肿瘤，见图1~3。19例病人中，16例为单个肿瘤，3例为2个肿瘤；肿瘤位于胰头部9例，胰体尾部10例；肿瘤多为圆形或椭圆形，部分可见浅分叶，边界清楚；4例肿瘤中央有簇样钙化，15例未见钙化；肿瘤长径为（26.7±10.3）mm。19例病人中，1例胰腺萎缩、主胰管节段性扩张，18例未见萎缩，主胰管无明显扩张；2例胆管扩张，17例无胆管扩张。

PNET影像学检查强化模式为“快进快出”型。CT检查结果显示：肿瘤平扫呈等、低密度（图2A），增强扫描动脉期均匀强化（图2B），门静脉期强化减退；部分较大肿瘤向外生长，增强扫描动脉期可见粗大血管影（图3B）。MRI检查结果显示：肿瘤T1加权成像呈低信号，T2加权成像呈高信号。

二、PRCC的影像学检查表现

9例PRCC病人中，2例为单个肿瘤，分别位于胰颈部和胰体部，7例为多个肿瘤，在胰头、颈、体尾部均可见；肿瘤为圆形或类圆形，边界清楚；单个肿瘤长径为（18.0±5.0）mm，多个肿瘤长径为2.0~50.0 mm。9例病人中，2例胰管可见扩张，7例胰管未见扩张。

PRCC影像学检查强化模式为“快进快出”型。CT检查结果显示：肿瘤平扫呈等密度或等低密度，增强扫描动脉期强化明显，强化幅度与动脉相近（图4A、4B）。MRI检查结果显示：肿瘤在T1加权成像为显著低信号，边界清楚；T2加权成像为等高或高信号。MRI检查增强扫描后肿瘤强化表现与CT检查相同。

三、SPTP的影像学检查表现

8例SPTP病人中，均为单个肿瘤；肿瘤位于胰头部4例，胰体尾部4例；肿瘤大部分可见分叶，边界清楚；2例肿瘤未见钙化，6例肿瘤内可见钙化（图5A）；2例肿瘤未见囊变坏死，6例肿瘤内见囊变

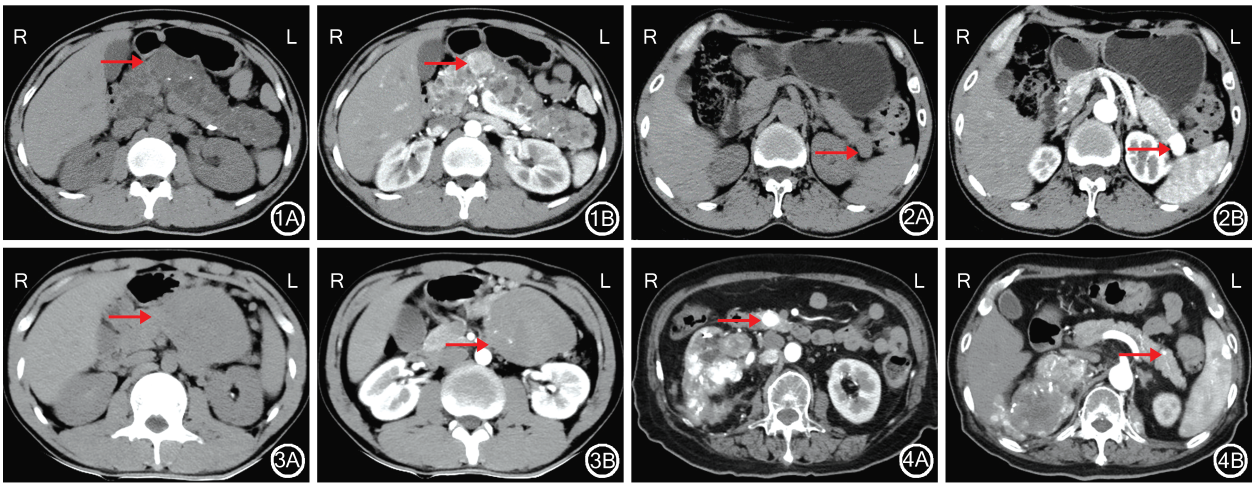

图1　Von Hippel-Lindau 病病人的 CT 检查结果　1A：CT 检查平扫结果显示胰腺肿大，密度不均，可见弥漫性低密度影及散在点状钙化影，胰颈体交界处见一圆形低密度影（→）；1B：CT 检查增强扫描结果显示胰腺颈体交界处肿瘤明显强化（→）　**图2**　胰腺神经内分泌肿瘤 G1 级病人的 CT 检查结果　2A：CT 检查平扫结果显示胰腺尾部一类圆形等密度结节影（→），边界清楚；2B：CT 检查增强扫描结果显示动脉期胰尾部肿瘤均匀强化（→）　**图3**　胰腺神经内分泌肿瘤 G2 级病人的 CT 检查结果　3A：CT 检查平扫结果显示胰腺尾部一较大类椭圆形肿瘤，密度不均，边界清楚（→）；3B：CT 检查增强扫描结果显示动脉期肿瘤内见粗大血管影（→）　**图4**　肾透明细胞癌胰腺转移病人的 CT 检查结果　4A：CT 检查增强扫描结果显示动脉期胰腺颈部最大病灶（→），强化明显，边界清楚；4B：CT 检查增强扫描结果显示动脉期胰腺尾部肉眼可见的最小病灶（→）

Figure 1　Computed tomography (CT) results of patient with Von Hippel-Lindau disease　1A: CT plain scan showed enlarged pancreas with uneven density, diffuse low-density shadows and scattered punctate calcification shadows, and a round low density shadow at the junction of pancreatic neck and body (→); 1B: CT enhanced scan showed obvious enhancement of the tumor at the pancreatic neck-body junction (→)　**Figure 2**　Computed tomography (CT) results of patient with G1 grade of pancreatic neuroendocrine tumor　2A: CT plain scan showed a quasi-circular isodense nodules in the tail of the pancreas (→), with clear boundary; 2B: CT enhanced scan in arterial phase showed uniform enhancement of the tail nodules of pancreas(→)　**Figure 3**　Computed tomography (CT) results of patient with G2 grade of pancreatic neuroendocrine tumor　3A: CT plain scan showed a large elliptical tumor in the tail of the pancreas with uneven density and clear boundary (→); 3B: CT enhanced scan in arterial phase showed thick vascular shadows in the tumor (→)　**Figure 4**　Computed tomography (CT) results of patient with pancreatic metastasis from renal clear cell carcinoma　4A: CT enhanced scan in arterial phase showed the largest lesions in the neck of pancreas(→), with obvious enhancement and clear boundary; 4B: CT enhanced scan in arterial phase showed the smallest visible lesion (→) in the tail of pancreas

坏死（图 5B）；3 例肿瘤内未见出血，5 例肿瘤内见出血；肿瘤长径为（51.6±11.8）mm。8 例病人胰管均未见扩张，邻近脏器受压推移。

SPTP 影像学检查强化模式为“渐进”型。CT 检查结果显示：肿瘤平扫密度呈等、低密度（图 6A），增强扫描呈不均匀强化，中央坏死囊变（图 6B）；MRI 检查结果显示：肿瘤信号混杂，T1 加权成像低信号，T2 加权成像高信号为主，肿瘤出血在 T1 加权成像上为高信号（图 6C），增强扫描肿瘤呈渐近性强化。

四、IPAS 的影像学检查表现

7 例 IPAS 病人均为单个肿瘤，位于胰尾部；肿瘤为圆形或类圆形，边界清楚；1 例肿瘤为囊实性，密度不均，为胰尾部副脾合并表皮样囊肿，6 例肿瘤为实性，密度均匀；肿瘤长径为（25.5±8.5）mm。7 例病人胰管均未见扩张，周围结构清晰。

IPAS 影像学检查强化模式为“渐进”型。CT 检查结果显示：肿瘤平扫呈等、低密度影（图 7A），实性成分强化幅度与正常脾脏相仿（图 7B）。

五、SCP 的影像学检查表现

6 例 SCP 病人均为单个肿瘤，位于胰颈部 1 例，位于胰体尾部 5 例；肿瘤为圆形或类圆形，边界清楚；2 例肿瘤为囊性，4 例肿瘤为实性；肿瘤长径为（35.5±15.4）mm。6 例病人中，2 例胰管扩张，4 例胰管未见扩张。

SCP 影像学检查强化模式为“快进快出”型。2 例囊性肿瘤 CT 检查结果显示：肿瘤平扫呈低密度，肿瘤呈囊性内见分隔（图 8A），增强扫描动脉期肿瘤边缘强化（图 8B），可见较粗大杂乱的血管影（图 8C）。MRI 检查结果显示：肿瘤 T1 加权成像呈低信号，T2 加权成像呈高信号。4 例实性肿瘤 CT 检查结果显示肿瘤平扫呈稍低密度影，增强扫描肿瘤明显强化；MRI 检查结果显示：肿瘤 T2 加权成像为高信号。

六、动脉瘤的影像学检查表现

4 例动脉瘤均为单个肿瘤，位于胰体部 1 例，为十二指肠上动脉瘤，位于胰尾部 3 例，为脾动脉瘤；肿瘤呈圆形，边界清楚；1 例肿瘤未见钙化，3 例肿瘤边缘钙化（图 9A）；肿瘤长径为（11.3±2.5）mm。4 例病人胰管未见扩张。

动脉瘤影像学检查强化模式为“快进快出”型。CT 检查结果显示：肿瘤平扫呈混杂密度，增强扫描肿瘤强化明显，与血管密度相同；血管成像结果显示：肿瘤与血管相连，边缘可见未强化血栓影（图 9B）；MRI 检查结果显示：肿瘤呈流空信号。

讨　论

目前胰腺富血供肿瘤定义不明确，有研究者将富血供定义为测量病灶实性部分及同层面胰腺组

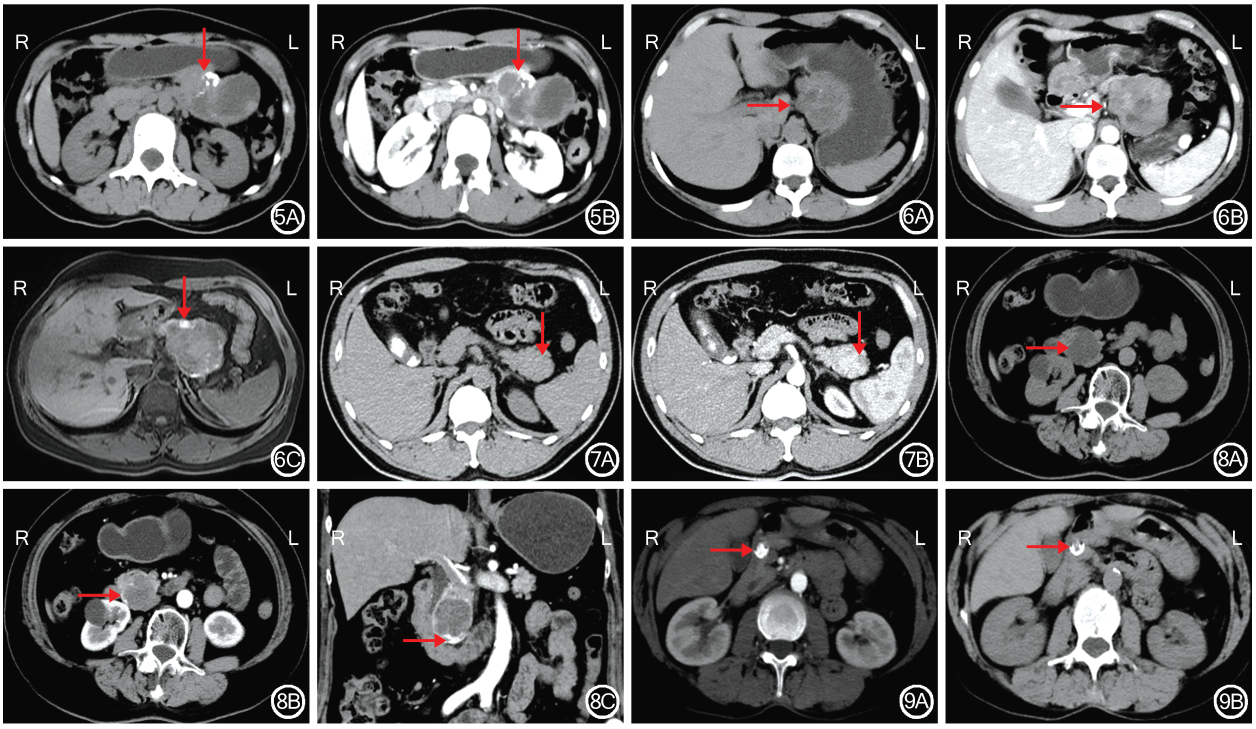

图 5　实性假乳头状瘤病人的 CT 检查结果　5A：CT 检查平扫结果显示胰腺尾部混杂密度影，向外生长，囊性为主，边缘可见斑片状钙化影（↓）；5B：CT 检查增强扫描结果显示门静脉期肿瘤囊性坏死，实性部分强化明显（↓），液性部分未见强化　**图 6**　实性假乳头状瘤病人的 CT 和 MRI 检查结果　6A：CT 检查平扫结果显示胰腺尾部分叶状肿瘤，密度不均，内见点状钙化（→）；6B：CT 检查增强扫描结果显示门静脉期肿瘤不均匀强化，中央囊性坏死（→）；6C：MRI 检查示 T1 加权成像肿瘤边缘出血呈高信号影（↓）　**图 7**　胰腺异位副脾病人的 CT 检查结果　7A：CT 检查平扫结果显示胰腺尾部等密度结节影（↓），边界清楚；7B：CT 检查增强扫描结果显示动脉期肿瘤呈花斑样强化（↓），与脾脏强化方式相仿　**图 8**　浆液性囊腺瘤病人的 CT 检查结果　8A：CT 检查平扫结果显示胰头部囊性肿瘤（→），边界清楚；8B：CT 检查增强动脉期肿瘤边缘强化（→）；8C：CT 检查冠状位重建检查结果显示肿瘤边缘见粗大杂乱的血管影（→）　**图 9**　动脉瘤病人的 CT 检查结果　9A：CT 检查平扫结果显示胰腺颈部混杂密度结节，边缘钙化（→）；9B：CT 检查增强扫描结果显示结节强化明显，边缘可见低密度未强化血栓影（→）

Figure 5　Computed tomography (CT) results of patient with solid pseudopapillary tumors of pancreas　5A: CT plain scan showed a mixed density mass in the tail of pancreas, in growing outwards, mainly cystic, and patchy calcifications on the edge (↓); 5B: CT enhanced scan in portal venous phase showed cystic necrotic tumor with significantly enhanced solid part (↓), and no enhanced liquid part　**Figure 6**　Computed tomography (CT) and magnetic resonance imaging (MRI) results of patient with solid pseudopapillary tumors of pancreas　6A: CT plain scan showed a lobular mass in the tail of pancreas with uneven density and punctate calcification (→); 6B: CT enhanced scan in portal venous phase showed uneven enhanced tumors, with cystic necrotic area in the central region (→); 6C: MRI scan showed T1-weighted imaging of hemorrhage hyperintense shadow in tumor edge (↓)　**Figure 7**　Computed tomography (CT) results of patient with intrepancreatic accessory spleen (IPAS)　7A: CT plain scan showed isodensity in the tail of pancreas (↓), with clear boundary; 7B: CT enhanced scan in arterial phase showed motley-like enhancement of tumor (↓), which was similar to the enhancement model of spleen　**Figure 8**　Computed tomography (CT) results of patient with serous cystadenoma of pancreas　8A: CT plain scan showed cystic tumor in the head of pancreas (→), with clear boundary; 8B: CT enhanced scan in arterial phase showed tumor marginal enhancement (→); 8C:The coronary reconstruction of CT images showed large and messy vascular shadows (→) at the tumor edge　**Figure 9**　Computed tomography (CT) results of patient with aneurysms　9A: CT plain scan showed mixed-density nodules in the neck of pancreas, with tumor marginal calcification (→); 9B: CT enhanced scan showed obvious enhancement of nodules, and low-density unenhanced thrombosis (→)

织CT值，病灶动脉期与平扫CT值差>同层胰腺动脉期与平扫CT差[2]。在胰腺富血供肿瘤中以PNET、PRCC、SPTP、IPAS、SCP及动脉瘤为主。其中PNET以G1或G2级为主，可能随着肿瘤级别的提升，肿瘤明显强化可能性越小[3-4]。

PNET、PRCC、SCP及动脉瘤4者影像学检查均呈“快进快出”型强化模式，而SPTP及IPAS两者影像学检查呈“渐进”型强化模式，且PRCC及动脉瘤CT检查峰值明显超过PNET及SCP，因此，可将此6种肿瘤分成下述3组进行鉴别诊断。

一、PNET与SCP的鉴别诊断

功能性PNET因其临床症状，发现时体积较小，无功能性PNET通常无临床症状，发现时体积较大，容易坏死囊变。若为多发病灶，结合胰腺外脏器病变，需要考虑多发内分泌肿瘤1型及Von Hippel-Lindau病。多发内分泌肿瘤1型主要表现为原发甲状旁腺功能亢进伴全身多发相关肿瘤[5-6]。Von Hippel-Lindau病有单个或多个的胰腺内分泌肿瘤，同时合并肾癌或血管母细胞瘤[7]。SCP好发于老年女性，富血供SCP少见。SCP动脉期肿瘤边缘可见较粗大杂乱血管影。实性SCP由于囊腔小而整体强化明显，容易被误诊为PNET。CT检查平扫时，实性SCP密度<PNET，MRI检查T2加权成像上可以显示囊性实质[8-9]。

二、PRCC与动脉瘤的鉴别诊断

PRCC是最常见的胰腺转移性肿瘤[10]。肿瘤在动脉期显著强化，强化程度超过胰腺组织，而在门静脉期或延迟期衰减，与肾透明细胞癌的强化方式相仿[11]。动脉瘤经血管CT造影检查可以明确诊断，肿瘤与血管相连，强化与血管一致，通常肿瘤边缘可见钙化，内见瘤栓。

三、SPTP与IPAS的鉴别诊断

SPTP以年轻女性多见，多为外生性生长，可发生于胰腺任何部位，呈分叶状。肿瘤内钙化或出血常见[12-16]。MRI检查结果显示出血区域T1加权成像为高信号。IPAS通常为圆形或卵圆形的实质性肿瘤，边界清楚，肿瘤长径为10.0~25.0 mm，肿瘤体积<SPTP[17]。副脾组织基本位于或非常接近胰腺尾部尖端处。IPAS与脾脏组织成分一致，所以影像学检查表现同脾脏，增强动脉期呈花斑样强化，平衡期强化均匀[18]。

此外，在胰腺富血供肿瘤中，G1级PNET动脉期CT值>150 HU，尤其当为多发病灶时，其与胰腺转移性肾癌影像表现非常相近，结合肾癌病史是准确影像诊断的关键[10,19]。已有的研究结果显示：PRCC与PNET的相对廓清率值不同，PRCC的相对廓清率值显著>PNET[20]。这有助于两者鉴别诊断。

本研究存在以下局限性：(1)本研究病例中未包含所有可能的病种，如少见类型胰腺癌、血管瘤等[21]。(2)部分病例未行MRI检查，MRI检查表现的总结欠全面。

综上，胰腺富血供肿瘤影像学检查表现多样，PNET、PRCC、SCP及动脉瘤强化模式为“快进快出”型，SPTP、IPAS强化模式为“渐进”型，功能性PNET临床症状典型，非功能性PNET容易坏死囊变；SPTP好发于年轻女性，出血钙化多见；IPAS强化方式与正常脾脏一致；SCP好发于老年女性，肿瘤多呈囊性，内见分隔，部分可呈实性；PRCC有肾癌病史；动脉瘤与血管相连，并多见钙化及血栓。

利益冲突　所有作者均声明不存在利益冲突

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