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基于 CT 血管成像的血流储备分数对肺癌的诊断价值 *

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摘要 目的:探讨基于 CT 血管成像的血流储备分数对肺癌淋巴结转移的诊断价值。**方法:**2018 年 1 月到 11 月选择在本院进行治疗的肺癌患者 60 例, 所有患者都给予常规 CT 检查与 CT 血管成像, 记录成像特征与相关血流储备分数 - 血流量 (blood flow, BF)、血容量(blood volume, BV)、平均通过时间(mean transit time, MTT), 判断诊断价值。**结果:**在 60 例患者中, 病理确诊为淋巴结转移 20 例, 非淋巴结转移 40 例。转移组的毛刺征、分叶征、棘突征、空泡征等 CT 征象发生率显著高于非转移组($P<0.05$)。转移组的肺动脉 BF、BV 值显著低于非转移组($P<0.05$), MTT 值显著高于非转移组($P<0.05$)。在 60 例患者中, Spearman 相关分析显示淋巴结转移与 MTT 成显著正相关性($P<0.05$), 与 BF、BV 值成显著负相关性($P<0.05$)。**结论:**CT 血管成像在肺癌中的应用能反映患者的血流储备分数状况, 有利于判断患者的淋巴结转移情况, 有很好的应用价值。

关键词:CT 血管成像; 血流储备分数; 肺癌; 诊断价值; 血容量

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Diagnostic Values of Blood Flow Reserve Fraction Based on CT Angiography for Lung Cancer*

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ABSTRACT Objective: To investigate the diagnostic values of blood flow reserve fraction based on CT angiography for lymph node metastasis of lung cancer. **Methods:** From January to November 2018, 60 patients with lung cancer who were treated in our hospital were selected. All patients were underwent routine CT and CT angiography. The imaging characteristics and associated blood flow reserve scores - blood flow (BF) blood volume (BV), mean transit time (MTT) were recorded, and were to determine the diagnostic value. **Results:** Of the 60 patients, 20 were diagnosed with lymph node metastasis and 40 with non-lymph node metastasis. The incidence of CT signs such as burr sign, lobulated sign, spinous process sign and vacuole sign in the metastatic group were significantly higher than that in the non-metastasis group ($P<0.05$). The BF and BV values of pulmonary artery in the metastatic group were significantly lower than those in the non-metastasis group ($P<0.05$), and the MTT value were significantly higher than that in the non-metastasis group($P<0.05$). In 60 patients, Spearman correlation analysis showed a significant positive correlation between lymph node metastasis and MTT ($P<0.05$), and a significant negative correlation with BF and BV values ($P<0.05$). **Conclusion:** The application of CT angiography in lung cancer can reflect the patient's blood flow reserve score, which is helpful for judging the lymph node metastasis of patients, and has good application value.

Key words: CT angiography; Blood flow reserve fraction; Lung cancer; Diagnostic value; Blood volume

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前言

由于各种因素的影响,我国肺癌的发病率和死亡率显著上升,其中 85 %以上为非小细胞肺癌^[1]。影响该病预后的因素比

较多,包括临床分期、组织学分化、淋巴结转移等,手术为早期肺癌的主要治疗方法,但是很多患者本身的肺功能比较低,患者对根治手术的耐受性非常差^[2,3];而保留部分组织,则可能导致患者术后复发,为此早期评估患者的肺血流储备功能,对于

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合理选择治疗方法具有重要的价值^[45]。超声、数字减影血管造影、CT、核磁共振在肺癌血流监测中的应用都有相关报道,其中数字减影血管造影为诊断标准的金标准,但是对患者有一定的创伤^[6,7]。超声监测的敏感性好,但是特异性不强。MRI 检查的费用比较高,在部分医院还无法施行^[8]。多层螺旋 CT(Multi-slice CT, MSCT)具有扫描速度快、密度分辨率高、呼吸伪影少等特点,并且能够提供肺部淋巴结、胸膜胸壁、上腹部等诊断信息^[9,10]。CT 血管成像(computed tomography angiography, CTA)能定量测量循环血流状况,是当前比较无创、较新的血流动力学状态评价工具,也具有高分辨力、高精度度、广覆盖度等优势^[11,12]。其可精确描述血管解剖三维定位及血管与病变关系,可实现一次采集可同时获得多层图像,加快了数据采集速度,提高了图像分辨率,可用于判断肺血流量变化^[13,14]。本文具体探讨了基于 CT 血管成像的血流储备分数对肺癌的诊断价值,以提高肺癌的早期诊断能力。

1 资料与方法

1.1 研究对象

2018 年 1 月~11 月选择在本医院进行诊治的肺癌患者 60 例,纳入标准:经病理证实为非小细胞肺癌的患者;临床资料完整;患者知情同意并签署同意书;年龄 20~70 岁;医院伦理委员会批准了此次研究;既往无心脏病史,无肾病史。排除标准:有心脏病史及其他严重疾病的患者;入院前已接受相关治疗的患者;临床资料缺乏者;妊娠与哺乳期妇女;未签订知情同意书的患者;伴有肺实变、肺不张或弥漫性肺气肿者;临床资料缺乏者。其中男 32 例,女 28 例;年龄最小 21 岁,最大 68 岁,平均年龄 46.55 ± 2.83 岁;平均体重指数 22.48 ± 1.24 kg/m²;平均病程 3.19 ± 0.28 个月。

1.2 CT 血管成像方法

选择 GE 公司生产的 Light-Speed 多层螺旋 CT, 与美国

MEDRAD 双筒高压注射器,对比剂优维显(300 mgI/mL)由先灵(药业有限公司提供,每次扫描均应在一次屏气完成,扫描范围肺尖至肾上腺。患者检查前 20~30 min 口服清水 500~1000 mL,扫描前再口服清水 500 mL。扫描参数:层厚 2.5 mm,管电压 108 kV,管电流 150 mA,旋转时间 0.5 s,扫描视野 330 mm,准直 32×1.2 mm,覆盖范围 4 cm。经肘前静脉利用 21G 头皮针一次性快速注射优维显,注射速率为 4.5 mL/s,自动触发后于 20~25 s 时扫描全肺动脉,50~60 s 行门脉期扫描,180 s 后行平衡期扫描,每次扫描均应在一次屏气完成。

所有 CT 图像均随机由两位具有 5 年以上 CT 诊断经验的影像学医师进行判断,影像学医生不知晓患者的任何临床资料和其他检查结果,记录毛刺征、分叶征、棘突征、空泡征等特征。绘制感兴趣区(region of interest, ROI),避免部分容积效应,尽量避开大血管及主要分支,记录 BF、BV、平 MTT 等血流储备分数。

1.3 病理确诊

所有患者都给予手术治疗,术中沿叶支气管向远端解剖,清扫叶支气管、肺段及亚段支气管周围淋巴结,送病理检查,确诊淋巴结转移情况。

1.4 统计方法

应用 SPSS 22.00,计量资料以($\bar{x} \pm s$)表示,计数数据采用%表示,对比方法为 t 检验与卡方分析,相关性分析采用 Spearman 相关分析,检验水准 $\alpha=0.05$ 。

2 结果

2.1 淋巴结转移情况

在 60 例患者中,病理确诊为淋巴结转移 20 例,非淋巴结转移 40 例。

2.2 一般资料对比

转移组的性别、年龄、病理类型、体重指数等资料与非淋巴结转移组等对比差异无统计学意义($P>0.05$)。见表 1。

表 1 两组一般资料对比

Table 1 Comparison of general data between the two groups

Groups	n	Gender (male / female)	Age (years)	Type of pathology	BMI (kg/m ²)
				(adenocarcinoma/ squamous cell carcinoma/ adenosquamous cell carcinoma)	
Transfer group	20	11/9	45.62 ± 2.20	10/6/4	22.88 ± 2.10
Non-transfer group	40	21/19	45.12 ± 1.94	21/10/9	22.42 ± 1.83

2.3 CT 征象对比

转移组的毛刺征的发生率为 90.0 %、分叶征的发生率为 85.0 %、棘突征的发生率为 85.0 %、空泡征的发生率为 90.0 %,

显著高于非转移组(20.0 %、22.5 %、31.0 %、25.0 %,均 $P<0.05$)。见表 2。

表 2 两组 CT 征象对比(例,%)

Table 2 Comparison of CT signs between the two groups (n, %)

Groups	n	Spicule sign	Sign of lobulation	Spinous process sign	Vacuole sign
Transfer group	20	18 (90.0)*	17(85.0)*	17(85.0)*	18(90.0)*
Non-transfer group	40	8(20.0)	9(22.5)	12(31.0)	10(25.0)

Note: Compared with the non-transfer group, * $P<0.05$.

2.4 血流储备分数对比

MTT 值显著高于非转移组($P<0.05$)。见表 3。

转移组的肺动脉 BF、BV 值显著低于非转移组($P<0.05$)，

表 3 两组血流储备分数对比($\bar{x} \pm s$)

Table 3 Comparison of blood flow reserve scores between the two groups($\bar{x} \pm s$)

Groups	n	BF (mL/min/100 g)	BV (mL/100g)	MTT(s)
Transfer group	20	97.53± 6.77*	12.43± 1.65*	10.87± 0.44*
Non-transfer group	40	140.29± 14.10	16.09± 1.22	8.27± 1.11

2.5 相关性分析

MTT 成显著正相关性($r=0.444, P<0.05$)，与 BF、BV 值成显著负

在 60 例患者中，Spearman 相关分析显示淋巴结转移与

相关性($r=-0.544, r=-0.495, P<0.05$)。见表 4。

表 4 肺癌患者淋巴结转移与血流储备分数的相关性($n=60$)

Table 4 Correlation between lymph node metastasis and blood flow reserve score in lung cancer patients ($n=60$)

Index	BF	BV	MTT
r	-0.544	-0.495	0.444
P	0.002	0.004	0.013

3 讨论

肺癌在早期临床症状并不显著，而晚期患者由于病情恶化，基本失去了手术的可能性^[15,16]。影响该病预后的因素比较多，其中重要的因素淋巴结转移，研究显示无淋巴结转移的患者术后 5 年的存活率在 60 % 以上，而伴有淋巴结转移的患者术后 5 年的生存率在 30 % 以下^[17,18]。因此通过切实有效的方法在早期评估患者的淋巴结转移情况，对早期评估患者预后具有重要价值。

CT 检查具有多方位、多参数成像等优点，在肺癌的定位和定性诊断中发挥着重要作用^[19]。本研究显示在 60 例患者中，病理确诊为淋巴结转移 20 例，非淋巴结转移 40 例；转移组的毛刺征、分叶征、棘突征、空泡征等 CT 征象发生率显著高于非转移组。特别是 CT 扫描能够分辨血管与非血管结构，分辨有血供与无血供组织，有利于观察观察小支气管、肺间质改变^[20,21]。

肺癌是发生于支气管至终末细支气管上皮、肺泡上皮、腺上皮的恶性肿瘤，其发病率与死亡人数已居癌症之首^[22]。淋巴结转移是决定肺癌分期、治疗、预后的重要因素，不过肺癌细胞的转移为比较复杂的过程，其中丰富的毛细血管可为肿瘤细胞侵袭到脉管系统提供了便利，患者肿瘤血管的生成可随肿瘤细胞会脱落并侵入到基质内，进入到脉管系统，导致癌细胞在血液循环中存活^[23,24]。CT 血管成像能够显示肺动脉的血液循环供给状况，观察肺动脉的血管生成特征；其也能根据肺癌的血流储备分数特点来评价其病变程度或病变阶段，进而对淋巴结转移进行评定^[25,26]。本研究显示转移组的肺动脉 BF、BV 值显著低于非转移组，MTT 值显著高于非转移组。BF、BV、MTT 是主要反映肺动脉总血流量的常规指标，随着淋巴结转移的发生，肺动脉血流量的增加不足以代偿静脉血流量下降，间接导致 BF、BV、MTT 的变化^[27]。

已有研究显示发生肺癌淋巴结转移的患者，其无瘤生存期与总生存期均较低^[28]。术前准确评估淋巴结转移，及时进行清扫转移淋巴结，对改善患者预后具有重要作用。CT 可早期检出

肺内病灶部位与对邻近结构的侵犯等，提高了扫描速率，可避免漏诊和误诊出现^[29]。CT 血管成像能准确显示肺动脉狭窄或闭塞的部位、程度和长度等，可提供多方位信息，具有定量研究、成像快速、无创、无磁敏感伪影等优点。特别是当前多层螺旋 CT 血管成像可精确描述血管解剖三维定位及血管与病变关系，能消除运动伪影。本研究 Spearman 相关分析显示肺癌患者的淋巴结转移与 MTT 成显著正相关性，与 BF、BV 值成显著负相关性。特别是肺动脉血流量的减少，可使血流与肺脏间的交换明显减少，导致肺部功能损害程度的加重，而通过对肺癌患者 CT 血管成像参数的分析可为其病情程度的判定提供依据^[30]。但本研究的病例样本不足，且反映血流储备分数的参数比较少，可能存在研究偏倚，将在后续研究中深入探讨。

总之，CT 血管成像在肺癌中的应用能反映患者的血流储备分数状况，有利于判断患者的淋巴结转移情况，有很好的应用价值。

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