doi: 10.13241/j.cnki.pmb.2015.18.029

直径大于3厘米的周围型肺癌血流动力学的多排螺旋CT动态增强扫描研究*

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摘要 目的：研究直径3厘米以上周围型肺癌血流动力学的螺旋CT（电子计算机断层扫描，Computed Tomography）动态增强扫描的特点。**方法：**选取我院收治的肿瘤直径>3 cm的周围型肺癌患者55例，肺部腺瘤（良性）患者10例，肺部炎性结节患者26例。分别进行螺旋CT动态增强扫描，记录其CT值、强化峰值（Peak enhancement，PH），绘制动态增强时间-密度曲线，计算并比较曲线最大增强线性斜率（steepes slope，SS）以及血流灌注量（blood perfusion, BP）。**结果：**肺部炎性结节患者的密度曲线在120 s达到最大值；肺癌患者的密度曲线至65 s达到高峰；胸腺瘤患者的密度曲线变化不明显。肺癌组PH平均值大于胸腺瘤组，差异有统计学意义（P<0.05）；胸腺瘤组PH平均值小于肺部炎性结节组，差异有统计学意义（P<0.05）；肺癌组SS和BP大于胸腺瘤组，差异有统计学意义（P<0.05）；胸腺瘤组SS和BP小于肺部炎性结节组，差异有统计学意义（P<0.05）。**结论：**螺旋CT动态增强扫描能够反映直径3厘米以上周围型肺癌的血流动力学特点从而有助于在肺癌的诊断和鉴别诊断。

关键词：周围型肺癌；血流动力学；螺旋CT；增强

中图分类号：R734.2 **文献标识码：**A **文章编号：**1673-6273（2015）18-3517-03

Dynamic Enhanced Spiral CT Scan on the Hemodynamics of Diameter 3 cm above the Peripheral Lung Cancer*

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ABSTRACT Objective: To study the hemodynamic characteristics of dynamic scanning of a diameter of 3 cm or more peripheral lung cancer enhanced spiral CT. **Methods:** 55 cases of patients with peripheral lung cancer, thymoma (benign) of 10 patients, 26 cases of pulmonary inflammatory nodule in our hospital were selected. Under the dynamic enhanced spiral CT scan, recording its CT value, peak enhancement (PH), rendering dynamic time density curve, maximum enhancement steepes slope (SS) and blood perfusion (BP). **Results:** The density curve of patients in pulmonary inflammatory nodules group reached the maximum at 120 s, in lung cancer reached the maximum at 65 s, and in undulating thymoma group there was no change. The average value of PH in lung cancer group was significantly higher than that of the thymoma group (P<0.05); the average PH in thymoma group was significantly lower than that of the pulmonary inflammatory nodule group (P<0.05). Lung cancer group SS and BP is greater than the thymoma, the difference was statistically significant (P<0.05); Thymoma group SS and BP is less than pulmonary inflammatory nodule group, the difference was statistically significant (P<0.05). **Conclusion:** Dynamic enhanced spiral CT scan can reflect more than 3 cm in diameter of peripheral lung cancer hemodynamic characteristics so as to help in the diagnosis and differential diagnosis of lung cancer.

Key words: Peripheral lung cancer; Hemodynamics; Spiral CT; Enhancement

Chinese Library Classification(CLC): R734.2 **Document code: A**

Article ID: 1673-6273(2015)18-3517-03

前言

肺癌是由于细胞异常分化增殖而引起的一种恶性肿瘤性疾病[1]，其发病率和死亡率持续上升。资料表明[2]，近50年来世界肺癌的发病率和死亡率明显增高，已成为致死性恶性肿瘤的首位。该病临床表现[3]早期可为咳嗽、痰中带血、胸痛、声音嘶哑、发热等，晚期会发生肺外转移，出现消瘦以及恶病质，危害生命。肺癌分为中央型、周围型[4]，其中周围型肺癌包括腺癌和鳞癌，占肺癌的30%，早期不明显，确诊时已错失手术机会。因此，周围型肺癌的诊断成为亟需解决的医学问题。目前，病理诊断是周围型肺癌诊断的金标准[5]，因其具有创伤性，难以为患者所接受。肿瘤标志物检测、x线检查等手没有明显的特异性。研究发现[6]，螺旋CT动态增强扫描可以观察肺癌特有的血流动力学改变，可作为肺部结节鉴别诊断的依据。目前研究主要集

* 基金项目：国家自然科学基金面上项目（81071213）

作者简介：周春容，研究方向：肺癌诊断与治疗

（收稿日期：2014-11-13 接受日期：2014-12-04）

中在 3 厘米以下的肺部结节血流动力学研究[7],而对于 3 厘米以上的周围型肺癌研究不足。我们观察 3 厘米以上周围型肺癌患者 CT 动态增强扫描下的血流动力学特点,为周围型肺癌的 CT 诊断提供临床依据。

1 资料与方法

1.1 一般资料

选取 2009 年 6 月至 2013 年 1 月于我院以周围型肺癌为诊断而收入院患者 55 例,其中男 38 例,女 17 例,平均年龄为 60.1± 6.7 岁, 癌肿直径在 3 厘米以上, 平均直径 5.4± 2.1 厘米;以胸腺瘤(良性)为诊断而收入院患者 10 例,其中男 6 例,女 4 例,平均年龄为 61.3± 5.9 岁,瘤体直径在 3 厘米以上,平均直径 4.1± 0.9 厘米; 以肺部炎性结节为诊断而收入院患者 26 例,其中男 15 例,女 11 例,平均年龄为 58.3± 6.9 岁结节直径在 3 厘米以上,平均直径 4.5± 1.3 厘米。三组患者的一般资料相仿,差异无统计学意义(P> 0.05)。患者自愿参与本实验,并签署知情同意书。

1.2 纳入及排除标准

纳入标准:周围型肺癌、胸腺瘤患者均经支气管镜、病理穿刺证实;肺部炎性结节结节患者经抗炎治疗后,炎性病灶减小;病灶为孤立立性;病灶均在 3 厘米以上;年龄在 50-70 岁。排除标准:存在多个病灶;病灶小于 3 厘米;因各种原因不能配合;肺结核球患者。

1.3 检查方法

使用德国 Siemense Biograph 16 排螺旋 CT,首先进行胸部常规扫描,扫描螺距为 1.5,每层层厚为 5 mm,确定以病灶为中心的增强扫描层面;之后,经前臂注入 100 mL 对比剂,注射速度为 2.5 mL/s,对比剂选用 300 mgI /m 的欧乃派克;从注射对比剂开始后的 10 s、20 s、30 s、40 s、50 s、60 s、90 s、120 s、180 s 均进行一次扫描,采用螺距 1,每层层厚 3 mm。

1.4 数据处理

1.4.1 **CT 值的测量** 测量增强最明显区域的 CT 值以及此处平扫的 CT 值,两者之差即为强化峰值(英文全称,PH),计算各组平均 CT 值、平均 pH 值。

1.4.2 **描绘动态增强时间 - 密度曲线** 将三组患者不同时间扫描的 CT 值做成表格,利用 Excel 软件,以时间为横轴,以 CT 值为纵轴,分别描绘各组患者 CT 值得变化曲线,观察其形态及特点。

1.4.3 **计算时间 - 密度曲线最大增强线性斜率**(steepes slope, SS) 首先找出各组曲线快速上升段最大的 CT 值(SCTend)及其时间点(Tend)、起使的 CT 值(SCTprior) 及其时间点(Tprior),平扫的 CT 值(SCTo),Tend 与 Tprior 分别表示和 SCTend, SCTprior 相应的时间点(以秒为单位),之后根据公式[8]计算:SS=(SCTend - SCTprior)/[SCTo× (Tend-Tprior)]× 100 %(%/s),并计算各组 SS 的平均值。

1.4.4 **计算血流灌注量** (blood perfusion, BP) BP 为病灶组织时间 - 密度曲线上升段最大斜率(TACSPN)与主动脉最大增强 CT 峰值(PHAA)的比值[9],并计算各组 BP 的平均值。

1.5 统计学方法

采用统计学软件 SPSS19.0 进行统计学分析, 计量资料采用 t 检验,计数资料采用卡方检验处理,以 P< 0.05 为有显著性差异。

2 结果

2.1 各组患者的动态增强时间 - 密度曲线

从图中可以看出肺部炎性结节患者的密度曲线,起始快速上升,之后稍有波动,在 120 s 达到最大值后趋于平稳;肺癌患者的密度曲线起始段稳步上升,至 65 s 达到高峰,65 s 到 120 s 缓慢下降,之后维持平稳;胸腺瘤患者的密度曲线起伏不大,变化不明显,见图 1。

2.2 各组患者 PH 比较

肺癌组 PH 平均值明显小于肺部炎性结节组,差异有统计学意义(P< 0.05);肺癌组 PH 平均值明显大于胸腺瘤组,差异有统计学意义(P< 0.05);胸腺瘤组 PH 平均值明显小于肺部炎性结节组,差异有统计学意义(P< 0.05),如表 1。

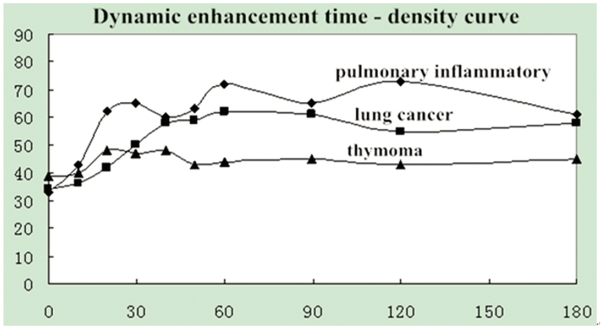

Fig.1 Dynamic enhancement time - density curve

Note: The horizontal axis is time (s); the vertical axis is PH(H4u).

表 1 各组患者 PH 比较情况(Hu)

Table 1 Comparison of PH(Hu)

Group	N	PH<20	20≤ PH< 60	PH≥ 60	Mean
Lung cancer group	55	6	40	9	30.1± 13.4△
Inflammatory nodule group	26	0	8	18	59.6± 15.1※
Thymoma group	10	5	5	0	14.9± 4.3△

Note:△P< 0.05, compared with pulmonary inflammatory nodules;※P< 0.05, compared with thymoma.

2.3 各组患者 SS、BP 比较

肺癌组 SS、BP 明显小于肺部炎性结节组, 差异有统计学意义(P< 0.05);肺癌组 SS、BP 明显大于胸腺瘤组,差异有统计学意义(P< 0.05);胸腺瘤组 SS、BP 明显小于肺部炎性结节组,差异有统计学意义(P< 0.05),如表 2。

表 2 各组患者 SS、BP 比较情况

Table 2 Comparison of SS and BP

Groups	N	SS (%/s)	BP ($mL \cdot min^{-1} \cdot mL^{-1}$)
Lung cancer group	55	4.83± 4.32△※	1.17± 0.68△※
Inflammatory nodule group	26	7.96± 5.89※	2.01± 0.85※
Thymoma group	10	1.24± 0.78△	0.18± 0.06△

Note:△P＜0.05,compared with pulmonary inflammatory nodules;※P＜0.05,compared with thymoma.

3 讨论

大量的研究资料表明[13-15],周围型肺癌的诊断与鉴别诊断是影像学上的重点与难点,现代大多数的影像技术只能提供分叶、毛刺、胸膜凹陷等形态学上的特征,极易误诊。螺旋 CT 的出现,为肺癌的诊断提供了新思路,螺旋 CT 的动态增强扫描,突破了传统影像学检查的固定模式[16],通过观察病灶注射对比剂后密度的动态变化,了解病灶是否有血液供应、血供的来源、变化等血液动力学特点,协助分析病灶的性质,为诊断提供更多依据[17]。本研究即利用螺旋 CT 动态增强扫描直径 3 厘米以上周围型肺癌、肺部炎性结节、胸腺瘤,比较三者的 PH、SS、SP 差异,得出周围型肺癌的血流动力学特点,为其诊断提供支持。

研究结果显示, 肺部炎性结节患者的密度曲线在 120 s 达到最大值;肺癌患者的密度曲线 65 s 达到高峰;胸腺瘤患者的密度曲线变化不明显。可以看出,肺部炎症性结节密度曲线变化较大,可能由于炎症因子的存在,使得炎性结节内部微血管扩张,血流速度较快,导致起始快速上升,之后由于淋巴回流、再循环等原因,曲线发生波动,达到最大值后对比剂随血液流走,趋于平稳;肺癌的密度曲线类似于胸主动脉的曲线,可能由于肺癌血供多来源于支气管动脉[18-20],与胸主动脉血流条件相同;胸腺瘤内部一般无血液供应,故密度没有很大改变。本研究结果还显示,肺癌组 PH 平均值明显小于肺部炎性结节组(P＜0.05);肺癌组 PH 平均值明显大于胸腺瘤组(P＜0.05);胸腺瘤组 PH 平均值明显小于肺部炎性结节组(P＜0.05)。结果提示,肺内炎性结节的强化程度最高,其次是肺癌,胸腺瘤的强化程度很小。我们还发现,肺癌组 SS、BP 明显小于肺部炎性结节组(P＜0.05);肺癌组 SS、BP 明显大于胸腺瘤组(P＜0.05);胸腺瘤组 SS、BP 明显小于肺部炎性结节组(P＜0.05)。结果提示,三组患者的血流灌注速度肺内炎性结节＞肺癌＞胸腺瘤,可能由于炎性结节内毛细血管扩张,血流速度快,而肺癌的灌流速度与氧气的供应和血管的舒张度有关, 胸腺瘤内很少血液供应,因此灌流最少。

综上所述,螺旋 CT 动态增强扫描能够反映直径 3 厘米以上周围型肺癌的血流动力学特点,在肺癌的诊断和鉴别诊断方面具有较高的临床价值。

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