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低剂量与常规剂量扫描在 CT 引导下经皮穿刺肺活检术中的 临床应用价值对比研究 *

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摘要 目的:比较低剂量与常规剂量扫描在 CT 引导下经皮穿刺肺活检术中的临床应用价值。**方法:**选择 2018 年 1 月至 2019 年 12 月我院行 CT 引导下经皮穿刺肺活检术的患者 96 例,采用随机数字表法分为低剂量组和常规剂量组,每组 48 例,两组分别在低剂量扫描、常规剂量扫描下行 CT 引导下经皮穿刺肺活检术,比较两组扫描范围、X 射线剂量、图像质量、穿刺成功率及并发症发生情况。**结果:**低剂量组 CT 吸收剂量加权指数(CTDIw)、平均剂量长度乘积(DLP)显著低于常规剂量组($P<0.05$),两组扫描范围比较无统计学差异($P>0.05$)。低剂量组图像质量 1 级 1 例、2 级 1 例、3 级 46 例;常规剂量组 1 级 0 例、2 级 1 例、3 级 47 例,两组图像质量比较无统计学差异($P>0.05$)。低剂量组穿刺成功率 87.50%,常规剂量组穿刺成功率 89.58%,两组穿刺成功率比较无统计学差异($P>0.05$)。低剂量组并发症发生率为 12.50%,常规剂量组并发症发生率为 10.42%,两组并发症发生率比较差异无统计学意义($P>0.05$)。**结论:**与常规剂量扫描相比,在 CT 引导下经皮穿刺肺活检术中应用低剂量扫描可以有效降低辐射剂量,但不影响图像质量和穿刺成功率,患者并发症发生率也未增加,具有较好的临床价值。

关键词:CT 引导;经皮穿刺肺活检术;低剂量扫描;常规剂量扫描;CT 吸收剂量加权指数;平均剂量长度乘积

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A Comparative Study of the Clinical Value of Low Dose and Conventional Dose Scanning in CT Guided Percutaneous Lung Biopsy*

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ABSTRACT Objective: To compare the clinical value of low dose and conventional dose scanning in CT guided percutaneous lung biopsy. **Methods:** 96 patients with CT guided percutaneous lung biopsy in our hospital were selected from January 2018 to December 2019, and they were divided into low dose group and conventional dose group by using random digital table method. 48 patients in each group. The two groups were CT guided percutaneous lung biopsy under low dose scanning and conventional dose scanning respectively. The scanning range, X-ray dose, image quality, puncture success rate and complications were compared between the two groups. **Results:** The CT absorbed dose weighted index (CTDIW) and the product of average dose length (DLP) in the low dose group were significantly lower than those in the conventional dose group ($P<0.05$), and there was no significant difference in the scanning range between the two groups ($P>0.05$). In the low dose group, the image quality was grade 1 in 1 case, grade 2 in 1 case and grade 3 in 46 cases, in the routine dose group: Grade 1 in 0 cases, grade 2 in 1 case, grade 3 in 47 cases, there was no significant difference in image quality between the two groups ($P>0.05$). The success rate of low dose group was 87.50%, while that of conventional dose group was 89.58%. There was no significant difference between the two groups ($P>0.05$). The incidence of complications was 12.50% in the low-dose group and 10.42% in the conventional dose group. There was no significant difference between the two groups ($P>0.05$). **Conclusion:** Compared with conventional dose scanning, low dose scanning in CT guided percutaneous lung biopsy can effectively reduce the radiation dose, but it does not affect the image quality and the success rate of puncture, and the incidence of complications has not increased.

Key words: CT guided; Percutaneous lung biopsy; Low dose scanning; Conventional dose scanning; CT absorbed dose weighted index; Average dose length product

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前言

CT 引导下经皮穿刺肺活检术是目前临床上诊断肺部病灶的重要方法之一,具有操作方便、并发症发生率低、结合病理学

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诊断、确诊率高等优点,已被临床广泛应用^[1]。但该方法需要在CT扫描下进行反复多次的操作,致使患者在检测中受到一定剂量的X线辐射^[2]。目前,临床上对于降低CT扫描时X线辐射剂量仍没有有效方法,如何降低经皮穿刺肺活检术中X线辐射剂量是影像医生面临的重要问题。由于肺组织密度较低且含气量较多,组织机构具有良好的对比,使得胸部相较于机体其他部位,更加适合低剂量扫描^[3,4]。通过低剂量扫描可以有效的降低X线辐射剂量^[5],但目前对于低剂量扫描是否能够影响CT引导下经皮穿刺肺活检术的诊断价值仍无定论。鉴于此,本研究通过比较低剂量与常规剂量扫描在CT引导下经皮穿刺肺活检术中的临床应用价值,旨在为实施CT引导下经皮穿刺肺活检术的扫描剂量选择提供参考,现报道如下。

1 资料与方法

1.1 一般资料

选择2018年1月至2019年12月我院行CT引导下经皮穿刺肺活检术的患者96例,纳入标准:(1)所有患者均存在肺部肿块或结节,肿块性质诊断不明确;(2)研究前均告知患者及家属操作目的、过程和可能存在的风险;(3)患者及其家属均签署知情同意书。排除标准:(1)合并凝血功能障碍者;(2)病灶与大血管关系密切,无法进针者;(3)合并严重感染者;(4)剧烈咳嗽,无法接受操作者;(5)身体状况较差,无法耐受操作者。将患者按照随机数字表法分为低剂量组和常规剂量组,低剂量组48例,其中男性29例、女性19例;年龄38~75岁,平均年龄(58.25±8.43)岁;病灶直径1~10cm,平均(4.78±1.62)cm。常规剂量组48例,其中男性28例、女性20例;年龄39~74岁,平均年龄(58.26±5.79)岁;病灶直径1~11cm,平均(4.86±1.75)cm。两组患者性别构成、年龄、病灶直径比较无统计学差异($P>0.05$),具有可比性,本研究经医院伦理委员会同意。

1.2 仪器与设备

德国GE Hispeed NX/II 64层螺旋CT扫描机,16G、18G穿刺针,德国Optimed分体切割活检枪,医用胶带。

1.3 方法

对两组患者的检查均由同一组高年资医生进行,操作前详

细了解患者影像学资料,根据病灶部位、大小、深度确定穿刺途径。根据影像学资料决定患者取卧位、侧卧位或仰卧位,进行CT扫描,扫描参数:常规剂量组管电压120Kv、管电流30~100 mAs,采集方式64×0.5 mm,螺距1.5,重建层厚5 mm;低剂量组管电压100Kv、管电流20 mAs,采集方式64×0.5 mm,螺距1.5,重建层厚5 mm。扫描后应用标准算法进行重建,观察肺窗和纵膈窗图像。确定最佳体表穿刺点、进针深度和进针角度。穿刺点周围常规消毒,铺手术巾,应用2%利多卡因局部麻醉,嘱咐患者深吸一口气并屏住气,选择合适穿刺针缓慢进针,在CT扫描下确认进针方向和深度,再根据病灶大小调整活检枪切割槽长度,切取组织后局部压迫止血,并拔出活检枪,将组织置于10%甲醛溶液中固定,送病理科检测诊断。

1.4 观察指标和评价标准

比较两组X射线辐射剂量,X射线辐射剂量包括CT吸收剂量加权指数(CT absorbed dose weighted index, CTDIw)、平均剂量长度乘积(Dose length product, DLP)。比较两组扫描范围。由两位高年资医生对采集的影像学图像质量进行评估,按照肺内病灶是否清晰显示、肺纹理是否清晰、有无伪影等指标进行分级^[6]:0级:肺内病灶、肺纹理等图像显示差,伪影重;1级:肺内病灶、肺纹理等图像显示一般,有中等程度伪影;2级:肺内病灶、肺纹理等图像显示较为清晰,仅存在少量伪影;3级:肺内病灶、肺纹理等图像显示清晰,无伪影。比较两组穿刺成功率。比较两组血气胸、咯血、急性胸膜反应等并发症发生情况。

1.5 统计学方法

应用SPSS26.0软件进行统计学分析,计量资料以($\bar{x} \pm s$)表示,两组间比较采用配对t检验,计数资料以比或率表示,实施卡方检验,等级资料比较应用秩和检验,以 $P<0.05$ 有统计学意义。

2 结果

2.1 两组X射线辐射剂量及扫描范围比较

低剂量组CTDIw、DLP显著低于常规剂量组($P<0.05$),两组扫描范围比较无统计学差异($P>0.05$),见表1。

表1 两组X射线辐射剂量及扫描范围比较($\bar{x} \pm s$)

Table 1 Comparison of X-ray dose and scanning range between the two groups($\bar{x} \pm s$)

Groups	n	CTDIw(mGy)	DLP(mGy·m)	Scan range(mm)
Low dose group	48	2.50±0.00	28.97±4.34	115.26±16.56
Conventional dose group	48	6.92±1.24	175.13±37.55	116.08±15.78
t		24.696	26.789	0.248
P		0.000	0.000	0.804

2.2 两组图像质量比较

低剂量组图像质量1级1例、2级1例、3级46例;常规剂量组1级0例、2级1例、3级47例,经秩和检验,两组图像质量比较无统计学差异($P>0.05$),见表2。

2.3 两组穿刺成功率比较

低剂量组穿刺成功42例,穿刺成功率87.50%(42/48),常规剂量组穿刺成功43例,穿刺成功率89.58%(43/48),两组穿

刺成功率比较无统计学差异($\chi^2=0.103, P=0.749$)。

2.4 两组并发症发生情况比较

低剂量组并发症发生率为12.50%(6/48),常规剂量组并发症发生率为10.42%(5/48),两组并发症发生率比较无统计学意义($P>0.05$),见表3。

3 讨论

表 2 两组图像质量比较

Table 2 Comparison of image quality between two groups

Groups	n	Level 0	Level 1	Level 2	Level 3
Low dose group	48	0(0.00)	1(2.08)	1(2.08)	46(95.83)
Conventional dose group	48	0(0.00)	0(0.00)	1(2.08)	47(97.92)
U			5.221		
P			0.087		

表 3 两组并发症发生情况比较[n(%)]

Table 3 Comparison of complications between the two groups[n(%)]

Groups	n	Hemothorax	Hemoptysis	Acute pleural reaction	Total
Low dose group	48	2(4.17)	2(4.17)	2(4.17)	6(12.50)
Conventional dose group	48	2(4.17)	2(4.17)	1(2.08)	5(10.42)
χ^2					0.103
P					0.749

CT 引导下经皮穿刺肺活检术可以对各类不明性质的肺内病灶进行定性诊断、病理分型及分级,为临床肺内实质性病变患者的治疗和预后判断提供重要的依据^[7,8]。但是在操作过程中需要对患者进行重复的 CT 扫描,会增加患者受辐射剂量。有报道显示,X 线辐射可以增加肿瘤发病风险,大约有 0.6%~3.2% 的肿瘤是在影像检查中受到 X 线辐射形成的^[9,10]。如何降低医疗操作中 X 线辐射剂量是临床医生面临的重要问题。通常情况下决定 CT 辐射剂量的主要因素包括扫描次数、管电流、管电压和螺距等^[11]。通过降低管电流的方法可以实现低剂量扫描,进而降低 X 线辐射剂量^[12]。但低剂量扫描也可能存在图像不清晰、伪影增加等不足。而肺部密度较低,含气量较高,其外部有肋骨、胸骨、脊柱胸段、肌肉和组织构成的胸廓,致使胸部形成了良好的天然对比,适合低剂量扫描^[13-15]。

本研究通过对低剂量 CT 扫描和常规剂量 CT 扫描引导下实施经皮穿刺肺活检术比较发现,低剂量组 CTDIw、DLP 显著低于常规剂量组,表明低剂量 CT 扫描可以显著降低辐射剂量。但两组扫描范围比较无统计学差异,提示低剂量 CT 扫描并不会降低对肺组织的扫描范围。目前降低扫描剂量的主要方法包括:对管流量进行控制、对螺距进行增加同时缩短扫描时间、对扫描野进行缩减^[16-18]。其中对螺距进行增加同时缩短扫描时间的方法可能导致扫描时间不够,并降低图像质量;而缩减扫描野的方法主要是根据病灶部位进行区域扫描,这种方法可能导致扫描覆盖范围不够^[19,20]。本研究通过控制管流量的方法实现低剂量扫描,即将管电压降至 100Kv、管电流降至 20mAs,进而达到降低辐射剂量目的。但降低管流量后可能会使图像分辨率下降。有报道显示^[21,22],降低管电流后可以使肝脏、脑 CT 图像质量降低。本研究中低剂量组仅有 1 例为 1 级图像,1 例为 2 级图像,常规剂量组 1 级图像例数为 0 例,2 级图像例数为 1 例,经秩和检验,两组图像质量比较无统计差异,表明低剂量扫描并未降低肺部图像质量。这主要由于胸部具有良好的天然对比度,通过调整管电流和管电压后,在肺窗观察并不会给肺部病灶诊断带来影响^[23-25]。另外,笔者注

意到由于个体差异,可能导致个体最佳扫描参数不同,例如最佳扫描参数可能会因个体胖瘦而不同^[26]。本研究中低剂量组穿刺成功率 87.50%,常规剂量组穿刺成功率 89.58%,两组穿刺成功率比较无统计学差异,提示控制扫描剂量可能并不会影响穿刺成功率。CT 引导下经皮穿刺肺活检术的主要并发症包括血气胸、咯血和急性胸膜反应。本研究中低剂量组并发症发生率为 12.50%,常规剂量组并发症发生率为 10.42%,两组并发症发生率比较无统计学意义,表明降低扫描剂量后没有明显增加并发症发生率。另外,在 CT 引导下经皮穿刺肺活检术操作中需要注意以下几点:(1) 严格把握 CT 引导下经皮穿刺肺活检术的适应症和禁忌症,譬如对于重度肺气肿患者,特别是穿刺部位有肺大泡的患者应视为禁忌症^[27,28];(2) 穿刺部位应尽可能靠近胸膜,术前制定详细的进针路径,选择最短的进针路径,以降低血气胸的发生率^[29,30];(3) 提高穿刺操作者的技术水平,以降低并发症发生率。

综上所述,与常规剂量扫描相比,在 CT 引导下经皮穿刺肺活检术中应用低剂量扫描可以有效降低辐射剂量,且图像质量、扫描范围和穿刺成功率并未受到影响,患者并发症发生率也未增加,具有较好的临床应用价值。

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