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64 排螺旋 CT 对粗隆间骨折 Evans 分型的影响研究 *

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摘要 目的:探讨 64 排螺旋 CT 对粗隆间骨折 Evans 分型的影响,为临床使用提供参考依据。**方法:**2015 年 3 月至 2017 年 3 月,三甲医院高年资创伤骨科主任医师 2 名,医师 1、医师 2 分别按照术前 X 线、术前 64 排螺旋 CT 平扫和三位重建结果对 128 例新鲜闭合单侧粗隆间骨折患者进行 Evans 分型,分别记为 X 线分型、CT 分型。本院术者依据围术期 X 线、CT 及术中所见骨折情况进行 Evans 分型(逆粗隆间骨折定义为Ⅴ型)作为最终分型。记录分型结果,计算并对比准确率、误诊率。**结果:**(1)剔除 5 例, 90.09%(123/128)的患者完成研究。(2)分型结果:X 线分型中,3 例(最终分型Ⅲ型 2 例,Ⅳ型 1 例)无法定型;Ⅰ型正确 1 例,改为Ⅱ型 1 例;Ⅱ型正确 18 例,改为Ⅰ型 2 例,改为Ⅲ型 3 例,Ⅳ型 2 例;Ⅲ型正确 45 例,改为Ⅱ型 7 例,改为Ⅳ型 1 例;Ⅳ型正确 19 例,改为Ⅱ型 3 例,改为Ⅲ型 15 例。CT 分型中,Ⅰ型正确 3 例,Ⅱ型正确 29 例,Ⅲ型正确 64 例,改为Ⅳ型 1 例,Ⅳ型正确 22 例,Ⅴ型正确 3 例。(3)CT 分型的总准确率、总误诊率优于 X 线分型(99.19%vs67.48%、0.81%vs30.08%,P<0.05)。(4)Ⅰ型、Ⅱ型、Ⅲ型、Ⅳ型骨折进行 CT 分型,准确率高于 X 线分型(*P*<0.05),误诊率低于 X 线分型(*P*<0.05);Ⅴ型骨折,两种分型准确率、误诊率相等。**结论:**64 排螺旋 CT 平扫及三维重建是粗隆间骨折 Evans 分型较为可靠的辅助检查,可考虑推广运用。

关键词:粗隆间骨折;64 排螺旋 CT;三维重建;Evans 分型

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Effect of 64 Slice Spiral CT on Evans Classification of Intertrochanteric Fractures*

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ABSTRACT Objective: To investigate the effect of 64-slice spiral CT on Evans classification of intertrochanteric fractures, and to provide reference for clinical use. **Methods:** From March 2015 to March 2017, 128 patients with unilateral unilateral intertrochanteric fractures were classified by Evans according to preoperative X-ray, preoperative 64-slice spiral CT plain scan and three-dimensional reconstruction, and were classified into X-ray and CT types. According to the perioperative X-ray, CT and intraoperative findings of the fracture, Evans classification (inverse intertrochanteric fracture defined as type V) as the final classification. The typing results were recorded, and the accuracy and misdiagnosis rate were calculated and compared. **Results:** 5 patients were excluded and 90.09% (123/128) completed the study. Typing results: 3 cases (2 cases of final type III, 1 case of type IV) could not be typed; 1 case of correct type I was changed to type II 1 case; 18 cases of correct type II were changed to type I 2 cases, changed to type III 3 cases, changed to type IV 2 cases; 45 cases of correct type III, changed to type II 7 cases, changed to type IV 1 case; 19 cases of correct type IV, changed to type II 3 cases. 15 cases were changed to type III. Among the CT typing, 3 were correct in type I, 29 in type II, 64 in type III, 1 in type IV, 22 in type IV, and 3 in type V. The total accuracy and misdiagnosis rate of CT typing were better than that of X-ray typing (99.19% vs 67.48%, 0.81% vs 30.08%, *P*<0.05). For type I, type II, type III and type IV fractures, the accuracy of CT classification was higher than that of X-ray classification (*P*<0.05), and the misdiagnosis rate was lower than that of X-ray classification (*P*<0.05); for type V fractures, the accuracy and misdiagnosis rate of the two types were equal. **Conclusion:** 64-slice spiral CT plain scan and three-dimensional reconstruction are reliable auxiliary examinations for Evans classification of intertrochanteric fractures, and can be considered for popularization and application.

Key words: Intertrochanteric fracture; 64 slice spiral CT; 3D reconstruction; Evans typing

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前言

粗隆间骨折系股骨小粗隆水平以上至股骨颈基底部以下骨质连续性和(或)完整性中断的一种医学现象,在髋部骨折中的比例及致死率分别约(30%-50%)、(15%-20%),对国民身心健康、社会医保支出及家庭经济负担的影响不容忽视[1-5]。现如今,粗隆间骨折治疗方法取得了长足发展,但确诊并进行临床公认的 Evans 分型成为其治疗方案选择的前提及关键。X 线作为骨折诊断最为常用的辅助检查目前虽应用较多,但影像重叠等局限性引发的误漏诊也不可避免[6-10]。近年来,电子计算机断层扫描(Computerized tomography,CT)对骨折的临床价值正逐渐得到重视。本研究探讨 64 排螺旋 CT 对粗隆间骨折 Evans 分型的影响,为临床使用提供参考依据。

1 资料与方法

1.1 一般资料

前瞻性选取 2015 年 3 月至 2017 年 3 月就诊于我院的新鲜闭合单侧粗隆间骨折患者 128 例,其中,男 45 例,女 83 例;年龄(32-83)岁,平均 54.5 岁;致伤原因:坠落伤 18 例,交通伤 67 例,摔伤 43 例;骨折侧别:左侧 79 例,右侧 48 例;骨折至就诊时间:0.5 小时至 13 天,平均 5.5 个小时。

1.2 诊断标准

需同时满足以下 4 项:(1)外伤病史;(2)髋部疼痛、瘀斑等症状;(4)髋部压痛、活动受限等体征;(4)X 线和 CT 检查同时提示粗隆间骨折。

1.3 分型标准

参照 Evans 分型[11],依据骨折线走形分为顺、逆粗隆间骨折,前者是指骨折线平行于粗隆间线者,后者是指骨折线自大粗隆外下走行至小粗隆内上者(本研究定义为Ⅴ型)。其中,顺粗隆间骨折又分为以下 4 型:Ⅰ型:骨折为两部分,无明显移位者;Ⅱ型:骨折移位多数呈内翻畸形,骨折线达到小粗隆上端,股骨矩无破坏;Ⅲ型:骨折移位,小粗隆游离,股骨内翻畸形者或粗隆间、大粗隆均骨折,大粗隆游离;Ⅳ型:大、小粗隆均游离或粉碎。

1.4 受试者选择标准

纳入诊断明确、拟行手术治疗、术前 X 线(患髋关节正、蛙式位片)和 64 排螺旋 CT (平扫及重建)资料完善、对本研究知情同意并签署知情同意书者,排除孕妇、哺乳期妇女、存在严重危及生命基础病等无法进行手术者,剔除手术失败或意外停止、自愿退出研究者。

1.5 CT 检查和治疗方法

在仰卧状态下,采用 64 层螺旋 CT(德国西门子公司生产)对患髋股股骨头至小粗隆下 5 cm 进行平扫,设置电流、电压分别为(95-110)毫安、120000 伏特,以(1-2)毫米为重建间距,(0.625-1.250)毫米为层厚,螺距参数(1: 1.5),床台速度(1-5)秒,扫描时间 1 秒,三维重建间距 1 毫米,立体显示域值上、下限分别为(2000-2048)、(140-300)。之后将扫描数据传到 Vitrea2 工作站,经 3D bone 软件依据水平面图像了解骨折情况,然后行矢状位、冠状位重新组合,最后经 VR、MIP、MPR 等构建三维图像。按照治疗方案行切开复位钢板或髓内针内固定术,所有手术由同一高年资主任医师主刀完成。

1.6 研究方法

选取三甲医院高年资创伤骨科主任医师 2 名(确保对入选受试者病情未知),医师 1、医师 2 分别按照术前 X 线、术前 CT 平扫和三位重建结果进行 Evans 分型,分别记为 X 线分型、CT 分型。将本院术者依据围术期 X 线、CT 及术中所见骨折情况进行 Evans 分型作为最终分型。记录分型结果,计算并对比准确率、误诊率。

1.7 统计学方法

统计学分析用 SPSS20.0 进行,准确率等计数资料用百分率(%)表示,组间比较采用卡方检验,P<0.05 时,则表示有统计学差异性。

2 结果

2.1 研究完成情况

2 例主动要求退出研究,1 例手术失败,1 例因合并心率失常(二联律)手术停止,1 例要求改为保守治疗,均剔除,90.09%(123/128)的患者完成研究。

2.2 分型结果

X 线分型、CT 分型、最终分型结果见表 1。X 线分型中,3 例(最终分型Ⅲ型 2 例,Ⅳ型 1 例)无法定型;Ⅰ型正确 1 例,改为Ⅱ型 1 例;Ⅱ型正确 18 例,改为Ⅰ型 2 例,改为Ⅲ型 3 例,Ⅳ型 2 例;Ⅲ型正确 45 例,改为Ⅱ型 7 例,改为Ⅳ型 1 例;Ⅳ型正确 19 例,改为Ⅱ型 3 例,改为Ⅲ型 15 例。CT 分型中,Ⅰ型正确 3 例,Ⅱ型正确 29 例,Ⅲ型正确 64 例,改为Ⅳ型 1 例,Ⅳ型正确 22 例,Ⅴ型正确 3 例。

表 1 123 例患者 Evans 分型结果(例)

Table 1 Evans typing results of 123 patients (examples)

Typing	Cannot typing	Ⅰ Typing	Ⅱ Typing	Ⅲ Typing	Ⅳ Typing	Ⅴ Typing
X-ray typing	3	2	25	53	37	3
CT typing	0	3	29	66	22	3
Final typing	0	3	29	65	23	3

2.3 X 线与 CT 分型准确率及误诊率对比情况

经统计,与 X 线分型相比,CT 分型的总准确率高、总误诊率低(P<0.05);Ⅰ型、Ⅱ型、Ⅲ型、Ⅳ型骨折 CT 分型,准确率高于 X 线分型(P<0.05),误诊率低于 X 线分型(P<0.05);Ⅴ型骨折,两种分型准确率、误诊率相等,见表 1、表 2。

表 2 X 线与 CT 分型准确率对比情况

Table 2 Comparison of X-ray and CT typing accuracy

Typing	Accuracy rate					Total accuracy rate
	Ⅰ Typing	Ⅱ Typing	ⅢTyping	Ⅳ Typing	Ⅴ Typing	
X-ray typing	50.00%	72.00%	84.91%	51.35%	100.00%	67.48%
CT typing	100.00%	100.00%	98.48%	100.00%	100.00%	99.19%
x^2	29.334	12.951	8.963	27.496	-	17.956
P	0.000	0.007	0.018	0.000	-	0.000

表 3 X 线与 CT 分型诊断误诊率对比情况

Table 3 Comparison of misdiagnosis rate between X-ray and CT classification

Typing	Misdiagnosis rate					Total misdiagnosis rate
	Ⅰ Typing	Ⅱ Typing	ⅢTyping	Ⅳ Typing	Ⅴ Typing	
X-ray typing	50.00%	28.00%	15.09%	48.65%	0%	30.08%
CT typing	0%	0%	0.81%	0%	0%	0.81%
x^2	48.632	25.415	11.365	39.526	-	27.335
P	0.000	0.000	0.017	0.000	-	0.000

3 讨论

3.1 股骨粗隆间解剖及 X 线成像特点

粗隆间是人体承载剪切应力较大的结构，临床通常界定为股骨干顶端至股骨颈基底部之间的骨质区域，由大量松质骨和少量密质骨组成，近端接股骨头颈，远端连股骨干，其组成的前倾角、颈干角范围一般为 12°-15°、110°-140°。大粗隆是居于股骨颈后上、位置表浅、较易触及的方形体表标记；小粗隆是居于股骨干顶端后内上的骨性凸起，水平高度低于大粗隆；大小粗隆之间前侧为粗隆间线，有关节囊附着，后侧为粗隆间嵴。此外，股骨干、颈之间后内侧有一致密骨质区域，临床称之为股骨矩。这些结构相互关联形成立体的粗隆间。X 线片可清晰反映粗隆间局部骨质形态和密度，如发生骨折，可显示为骨质连续性中断及局部形态发生变化，即骨折 X 线征象。但 X 线片的不足也较多[12-15]：(1)二维成像，重影较多，空间分辨率低，裂纹骨折易遗漏，粉碎骨折无法明示具体骨折情况；(2)骨折伪影多，最终图像收检查体位影响较大；(3)对骨折线、骨折片大小、移位程度无法准确量化。本研究基于 X 线进行 Evans 分型总准确率 67%，总误诊率 30%，3 例无法定型，约近一半的Ⅳ型骨折出现误诊，这与 Zeng 等[16]的研究并不矛盾，这可能与粗隆间骨折 X 线成像模糊、易出现伪影、无法立体呈现骨折等有关，因此，仅依据 X 线进行 Evans 分型并非十分科学。

3.2 CT 对 Evans 分型的影响

64 排螺旋 CT 是集光学、信息学、影像学等学科为一体检查设备，其运用的 Z 轴多排探测器、锥形 X 射线束使扫描时的单次曝光范围得到显著提高，薄层扫描成为现实，这对加快扫描速度、提高各个方向同性空间分辨率有重要意义。目前三维重建有曲面重建、最大密度投影、多平面重建、容积再现等几种方式，其中的容积再现技术可将骨折全貌、关节对合关系呈立体展现出来，有效提高图像的感观性。需注意的是容积再现实施过程中其阈值应确保选择合理，此参数对粗隆间局部结构及形态显影影响较大，如阈值选择过高，则会导致骨质信号不通程度丢失，从而出现误诊；若阈值偏低，又可能无法显示微小骨折，导致漏诊[16-20]。另外，多平面重建亦较常用，可较为准确、清晰的显示粗隆间骨折的内部情况，如裂纹骨折、粉碎骨折、嵌插骨折等，对发现微小骨折、避免漏诊有指导意义[21-25]。X 线与最大密度投影较为相似，但后者灵活性较强，如可随意调节窗宽和窗位，角度转换方便，亦可将靶区以外重叠部分去掉从而消除伪影。与容积再现相比，最大密度投影重建形成的骨折线更加清晰、锐利，它在空间重建上优于单纯平面重建，但由于立体感欠佳，故目前多用于空间定位及整体形态观察[9,12]。另外，Cho 等[13]还指出，容积再现使用的数据来源于轴位扫描，重建图像清晰度与扫描层厚呈负相关，即当扫描层厚增加时，分布在图像表面的台阶影会显著表现，但这对空间分辨率、图像清晰度均无明显影响，因此，其建议尽量减小扫描层厚。本研究 CT 分型的总准确率 99%，且仅 1 例出现误诊，总准确率、总误诊率及顺粗隆间骨折的分型均优于 X 线分型($P<0.05$)，与以上观点吻合，提示依据 64 排螺旋 CT 结果进行 Evans 分型可靠、可行。

最后，我们有以下心得提醒同道：(1)扫描层厚太薄可导致球管温度急剧升高，导致运行故障，从而影响正常医务工作[26-28]；(2) 检查过程中患者检查部位的微小移动可对结果造成较大影响[29,30]；(3)CT 对骨质成像明显，粗隆间局部血运丰富、重要肌腱和韧带不少，当骨折粉碎严重或大小转子游离时，血管、肌腱等软组织损伤同样不容忽视，因此，条件允许时联合 MRI 检查，更能准确把握伤情。

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