

胸腰段爆裂骨折合并Kummell病的MRI表现及其诊断价值

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【摘要】目的:探讨胸腰段爆裂骨折合并Kummell病的MRI表现及其诊断价值。**方法:**回顾性分析四川省骨科医院102例疑似胸腰段爆裂骨折合并Kummell病患者资料,所有患者均行MRI检查,以临床手术结果诊断为金标准,研究MRI对胸腰段爆裂骨折合并Kummell病的诊断价值及对胸腰段骨折部位韧带损伤的检出情况,分析胸腰段爆裂骨折合并Kummell病的MRI表现。**结果:**102例患者中手术结果诊断胸腰段爆裂骨折合并Kummell病阳性58例,阴性44例,MRI诊断阳性60例,阴性42例,其中漏诊5例,误诊7例,诊断敏感度、特异度、准确率、阳性预测值、阴性预测值分别为91.37%、84.09%、88.23%、88.33%、88.09%,Kappa值为0.758,与手术结果具有较高的一致性;MRI对前纵韧带、后纵韧带、棘上韧带、棘间韧带损伤的检出率与手术结果比较,差异均无统计学意义($P>0.05$);58例胸腰段爆裂骨折合并Kummell病患者中,MRI检查30例表现为不同程度的椎体压缩变扁,25例出现楔形改变,MRI平扫28例椎体内仍可见正常骨髓信号,54例患者椎体内可见斑片状T₂WI低信号、压脂低信号影,4例患者椎体相应层面有薄层硬膜外血肿形成,33例患者损伤椎体T₂WI呈低信号,17例患者损伤椎体T₂WI呈高信号,韧带损伤区域呈黑色条带状结构断裂、T₂WI呈高信号。**结论:**MRI对胸腰段爆裂骨折合并Kummell病具有较高的诊断价值,可清晰显示病变椎体信号特征。

【关键词】胸腰段爆裂骨折;Kummell病;磁共振成像;韧带损伤

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Imaging findings and diagnostic value of MRI on thoracolumbar burst fractures accompanied with Kummell's disease

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Abstract: Objective To explore the imaging findings and diagnostic value of magnetic resonance imaging (MRI) on thoracolumbar burst fractures accompanied with Kummell's disease. **Methods** A retrospective analysis was conducted on 102 patients with suspected thoracolumbar burst fractures accompanied with Kummell's disease in Sichuan Province Orthopedic Hospital. All patients underwent MRI examination. The clinical surgical diagnosis was taken as the gold standard to study the diagnostic value of MRI on thoracolumbar burst fractures accompanied with Kummell's disease and the detection of ligament injuries at thoracolumbar fracture site, and the MRI findings of thoracolumbar burst fractures accompanied with Kummell's disease were analyzed. **Results** The surgical results reported that out of 102 cases, 58 cases were positive for thoracolumbar burst fractures accompanied with Kummell's disease and 44 cases were negative, while MRI diagnosis revealed that there were 60 positive cases and 42 negative cases, including 5 cases of missed diagnoses and 7 cases of misdiagnoses. MRI had a diagnostic sensitivity, specificity, accuracy, positive predictive value, negative predictive value and Kappa value of 91.37%, 84.09%, 88.23%, 88.33%, 88.09% and 0.758, respectively, indicating a high consistency with surgical results. The detection rates of anterior longitudinal ligament, posterior longitudinal ligament, supraspinous ligament and interspinous ligament injuries through MRI were close to surgical results ($P>0.05$). MRI examination showed various degrees of vertebral compression and flattening in 30 cases out of 58 cases of thoracolumbar burst fractures accompanied with Kummell's disease, and wedge-shaped changes in 25 cases. On MRI plain scan, normal bone marrow signals were still found in vertebral body in 28 cases. There were 54 cases with patchy T₂WI hypointensity and lipid-suppression hypointensity in vertebral body, 4 cases with thin epidural hematoma at corresponding level of vertebral body, 33 cases with hypointensity on T₂WI of the injured

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vertebral body, and 17 cases with hyperintensity on T₂WI of the injured vertebral body, with the damaged ligament area being black banded structure fracture and hyperintensity on T₂WI. **Conclusion** MRI has high diagnostic value on thoracolumbar burst fractures accompanied with Kummell's disease, and it can clearly display the signal characteristics of the diseased vertebra.

Keywords: thoracolumbar burst fracture; Kummell's disease; magnetic resonance imaging; ligament injury

前言

胸腰段脊柱骨折为临床常见的外伤之一,占全身骨折的3%~5%。胸腰段爆裂骨折为脊柱骨折的常见类型,约占脊柱骨折的50%,主要由轴向暴力、猛烈的屈曲、旋转、伸展所致,患者多伴脊髓受损,病情恶化速度快^[1]。Kummell病是一种创伤后迟发性椎体塌陷,可加重病变脊柱的后凸畸形,胸腰段爆裂骨折常见,但合并Kummell病少见,临床影像较单纯性脊柱骨折更具特征性,若诊断不及时,很可能导致患者终身瘫痪,甚至休克死亡^[2]。根据Denis三柱理论,爆裂骨折主要发生于前中柱,损伤椎体后壁,爆裂骨折向后位移突出椎管,造成脊髓神经性损伤,需通过外科手术进行治疗,但由于无法了解解剖结构下的实际损伤程度,给临床术式选择带来不小的压力,故术前准确诊断和评估患者骨折类型、脊髓损伤程度、脊柱稳定性等基本情况十分必要^[3-4]。影像学检查是胸腰段骨折患者术前常规评估手段,主要包括CT、X射线、磁共振成像(MRI)等,其中X射线可较为准确地观察脊柱屈曲,CT对骨折类型判断的准确性较高,但二者对切面平行的骨折线检出率较低^[5-8]。MRI具有高分辨率优势,可多角度评估脊髓损伤,清晰显示脊髓形态,临床应用价值较高^[9-11],但其对胸腰段爆裂骨折及Kummell病的诊断研究报道较少。本研究拟探讨胸腰段爆裂骨折的MRI表现,并分析其诊断价值。

1 资料与方法

1.1 一般资料

回顾性分析四川省骨科医院收治的102例疑似胸腰段爆裂骨折合并Kummell病患者的临床资料。纳入标准:①明确胸腰段椎体损伤;②具备临床手术治疗指征,即椎体压缩超过50%,椎体后凸畸形角大于30°,椎体不稳症状明显或伴脊髓损伤、后方韧带复合体损伤;③经MRI影像学检查,临床资料完整。排除标准:①严重肝、肾、心功能异常者,恶性肿瘤患者;②炎性关节炎或强直性脊柱炎;③免疫、代谢异常者。

1.2 MRI检查

患者入院后行MRI检查,采用GE 1.5T核磁共振扫描仪,选用脊柱线圈,取仰卧位,横断面定位,矢状位、冠状位、轴位扫描;SE T₁WI序列参数设置:TR=500 ms, TE=11 ms; SE T₂WI序列参数设置:TR=2 800 ms,

TE=100 ms; T₂WI抑脂序列参数设置:TR=4 000 ms, TE=35 ms;各序列层间距1.0 mm,层厚4.0 mm,矩阵256×256,视野16 cm×16 cm。

1.3 观察指标

1.3.1 临床资料 根据临床手术结果统计入组患者的临床资料,包括性别、年龄、致伤原因、损伤椎体等。分析MRI诊断胸腰段爆裂合并Kummell病的价值。

1.3.2 韧带损伤诊断 以临床手术结果为金标准,统计MRI对胸腰段爆裂合并Kummell病韧带损伤检出情况。

1.3.3 影像学特征 分析胸腰段爆裂合并Kummell病患者的MRI表现,包括椎体损伤特征、椎体损伤部位MRI信号特征、韧带损伤MRI信号特征。

1.4 统计学方法

应用SPSS 25.0统计学软件对数据进行处理,计量资料用均数±标准差表示;计数资料以例数或率表示,行 χ^2 检验;以手术结果为金标准,评估MRI诊断胸腰段爆裂合并Kummell病的价值。检验水准 $\alpha=0.05$ 。 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 患者临床资料分析

102例患者中,男20例,女82例,年龄40~90岁,平均(69.32±4.71)岁;损伤原因:摔伤31例,撞伤36例,砸伤17例,压伤18例;其中单椎体骨折56例,2椎体骨折14例,3椎体骨折24例,经手术证实共损伤椎体156个,骨折范围为T₂~L₅,T₂ 9个,T₃ 14个,T₄ 3个,T₅ 7个,T₆ 23个,T₇ 32个,L₁ 42个,L₂ 11个,L₃ 5例,L₄ 6个,L₅ 4个。

2.2 MRI对胸腰段爆裂合并Kummell病的诊断价值

102例患者中,手术结果显示胸腰段爆裂合并Kummell病阳性58例,阴性44例,MRI诊断阳性60例,阴性42例,其中漏诊5例,误诊7例。诊断敏感度为91.37%(53/58),特异度为84.09%(37/44),准确率为88.23%(90/102),阳性预测值为88.33%(53/60),阴性预测值为88.09%(37/42),Kappa值为0.758(>0.75),与手术结果具有较高的一致性。

2.3 MRI对胸腰段骨折患者韧带损伤检出情况分析

MRI对前纵韧带、后纵韧带、棘上韧带损伤、棘间韧带损伤的检出率与手术结果比较,差异均无统计学意义($P>0.05$),见表1。

表 1 MRI 对胸腰段骨折患者韧带损伤检出结果[例(%)]

Table 1 Detection rates of different ligament injuries in patients with thoracolumbar burst fractures through MRI [cases (%)]

组别	<i>n</i>	前纵韧带损伤	后纵韧带损伤	棘上韧带损伤	棘间韧带损伤	总检出
手术结果	102	24(23.53)	17(16.67)	26(25.49)	23(22.55)	90(88.24)
MRI 检测	102	22(21.57)	14(13.73)	25(24.51)	21(20.59)	82(80.39)
χ^2 值		0.112	0.343	0.026	0.116	2.372
<i>P</i> 值		0.738	0.558	0.872	0.734	0.124

2.4 胸腰段爆裂合并 Kummell 病的 MRI 表现

102 例胸腰段椎体损伤患者中,胸腰段爆裂合并 Kummell 病 58 例,占比 56.86%。58 例胸腰段爆裂骨折患者中,MRI 检测 30 例表现为不同程度的椎体压缩变扁,25 例出现楔形改变,MRI 平扫中 28 例椎体内仍可见正常骨髓信号,54 例患者椎体内可见斑片状 T₂WI 低信号、压脂低信号影,4 例患者椎体相应层面有薄层硬膜外血肿形成,33 例患者损伤椎体 T₂WI 呈低信号,17 例患者损伤椎体 T₂WI 呈高信号,韧带损伤区域呈黑色条带状结构断裂、T₂WI 呈高信号。典型病例见图 1。

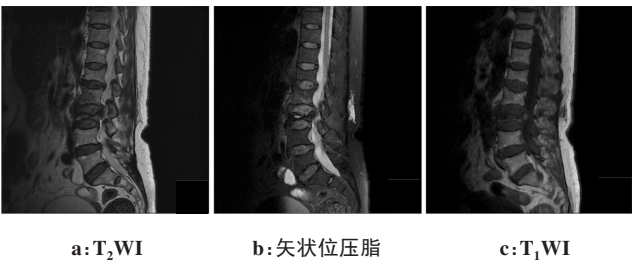


图 1 胸腰段爆裂合并 Kummell 病的 MRI 表现

Figure 1 MRI findings of thoracolumbar burst fractures accompanied with Kummell's disease

患者,女,76 岁,因摔伤住院,MRI 显示 L₃ 椎体爆裂骨折,压缩约 1/4,椎体内见斑片状骨髓水样信号,上缘凹陷,相应层面椎管未见明显狭窄,椎旁软组织略肿胀,腰椎序列连续,腰椎体边缘骨质增生,椎间隙无明显狭窄,有真空裂隙征,各腰椎间盘 T₂WI 信号强度降低,L_{4/5} 椎间盘向后轻度突出

3 讨论

胸腰段是稳定的胸椎及腰椎的结合部位,亦是骨折好发部位,临床常见骨折类型包括压缩型骨折、爆裂型骨折、脱位型骨折等,其中胸腰段爆裂性骨折临床主要表现为椎体破骨片、椎体移位等,若处理不及时则可能累及椎体后缘,引发脊髓神经损伤^[12]。Kummell 病主要由脊柱的骨结构和韧带受轻伤、骨折及小血肿形成而发病,椎体松质骨骨折引起骨坏死和塌陷^[13]。患者多为高龄,部分患者可能无明显外

伤史,临床表现为长期性腰背疼痛,体位变化时疼痛感加重,卧位时减轻。临床上针对 Kummell 病患者主要通过手术方式治疗,术前对患者骨折数目、受累椎体分布、骨折分型等的评估是手术顺利开展的关键^[14-16]。

正常生理状态下,脊柱矢状面存在生理性弯曲,而胸腰段是由胸椎后凸过渡到腰椎前凸部位,胸椎位于人体重力线的后方而腰椎则位于人体重力线的前方,当机体遭受到撞击或摔伤时,脊柱往往做出保护性前屈姿态,因而前凸的腰段在此过程中会产生更大的曲度,L₁~L₂ 相对 T₁₁~T₁₂ 而言受到的牵拉更大^[17-19]。胸腰段爆裂性骨折主要是因轴向超负荷导致的脊柱前柱和中柱骨折,部分患者还可能合并屈曲和旋转负荷,引起爆裂骨折周围软组织损伤,进而累计后柱,临床表现为椎体压缩、椎体后侧皮质骨折、椎管骨折、椎弓根间距增宽、小关节分离等^[20-21]。合并 Kummell 病的胸腰段爆裂骨折患者脊柱病变加重,临床疼痛感增强,长期骨结构、脊柱韧带损伤、炎症很可能影响手术效果及术后恢复,其影像学表现为椎内增生硬化、骨质疏松、椎内真空裂隙等。由于 Kummell 病无明显外伤史,病情可能被爆裂性骨折掩盖,因而存在漏诊可能^[22]。本研究中纳入的 102 例患者以 L₁、L₂、T₁₁、T₁₂ 骨折为主,其次为 T₂、T₃、L₃、L₄。MRI 是目前临床使用较为广泛的检查手段,它能够从矢状位和轴向位成像,不仅能够观察骨折以及周围组织情况,还对细微病变有较高敏感度,清晰展现损伤椎体结构,MRI 的突出优势还在于对椎体周围韧带损伤、水肿的诊断,一般正常软组织、韧带 MRI 呈现低信号,一旦出现组织间断裂、损伤,MRI 可呈现高信号^[23-24]。

本研究结果显示 MRI 诊断胸腰段爆裂合并 Kummell 与手术结果具有较高的一致性。MRI 对前纵韧带、后纵韧带、棘上韧带、棘间韧带损伤的检出率与手术结果均无显著性差异,说明 MRI 增强扫描对软组织部位成像的优势。胸腰段爆裂合并 Kummell 病患者普遍呈现不同程度的椎体压缩变扁或楔形改变,平扫中 48.28% 患者椎体内仍可见正常骨髓信号,93.10% 患者椎体内可见斑片状 T₂WI 低信

号、压脂低信号影,部分患者椎体相应层面有薄层硬膜外血肿形成,整体而言,多数患者损伤椎体T₂WI呈低信号,少数患者呈高信号,韧带损伤区域T₂WI呈高信号。以上信号特征表明,胸腰段爆裂合并Kummell病及周围韧带损伤具有明显的影像学特征,可为临床手术治疗提供可靠性参考。

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