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膝骨关节炎患者关节疼痛与软骨下骨髓水肿的相关性研究*

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摘要 目的:探讨膝骨关节炎(KOA)患者关节疼痛与软骨下骨髓水肿(BME)的相关性。**方法:**选取 2012 年 12 月到 2016 年 1 月在我院接受治疗的 KOA 患者 70 例,所有患者均行 MRI 检查,并根据有无 BME 将其分为对照组和观察组,其中有 BME 的患者均纳入观察组,共 56 例,无 BME 的患者纳入对照组,共 14 例,对观察组的 BME 情况进行评分,并进一步根据 BME 得分情况将观察组分为 1 分组、2 分组和 3 分组。采用主诉疼痛分级法(VRS)、视觉模糊评分(VAS)对所有患者进行疼痛评分。比较对照组和观察组的 VRS 分级、VAS 评分,比较 1 分组、2 分组和 3 分组的 VRS 分级、VAS 评分,分析 BME 得分和 VRS 分级、VAS 评分的相关性。**结果:**观察组的 VRS 分级的 I 级比例为 17.86%,显著低于对照组的 50.00%,II 级比例为 64.29%,显著高于对照组的 28.57%,差异均有统计学意义($P<0.05$);观察组的 VAS 评分显著高于对照组,差异有统计学意义($P<0.05$);观察组三个分组的 VRS 分级 I 级、II 级、III 级比例整体比较差异有统计学意义($P<0.05$),1 分组的 VRS 分级 I 级比例显著高于 2 分组和 3 分组,2 分组的 VRS 分级 II 级比例显著高于 1 分组和 3 分组,3 分组的 VRS 分级 III 级比例显著高于 1 分组和 2 分组,差异均有统计学意义($P<0.05$);观察组三个分组的 VAS 评分整体比较差异有统计学意义($P<0.05$),3 分组的 VAS 评分显著高于 1 分组和 2 分组,2 分组的 VAS 评分显著高于 1 分组,差异均有统计学意义($P<0.05$);经 Spearman 统计分析显示 BME 得分和 VRS 分级、VAS 评分呈正相关($P<0.05$)。**结论:**大部分 KOA 患者存在 BME,而有 BME 的 KOA 患者关节疼痛更加明显,且 BME 越严重疼痛感越强。

关键词:膝骨关节炎;关节疼痛;软骨下骨髓水肿;相关性

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Correlation between Knee Pain and Subchondral Bone Marrow Edema in Patients with Knee Osteoarthritis*

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ABSTRACT Objective: To investigate the correlation between the knee pain and subchondral bone marrow edema (BME) in patients with knee osteoarthritis (KOA). **Methods:** A total of 70 patients with KOA, who were treated in First Hospital of Shijiazhuang from December 2012 to January 2016, were selected and underwent MRI examination. The patients were divided into observation group ($n=56$ with BME) and control group ($n=14$ without BME) according to whether or not BME. The BME score of the observation group was scored, and the observation group was further divided into 1 score group, 2 scores group and 3 scores group according to the score of BME. The pain scores of all the patients were assessed by the variable returns to scale (VRS) and visual blur scale (VAS). The VRS classification and VAS scores were compared between the control group and the observation group, and the VRS classification and VAS scores of the 1 score group, the 2 scores group and the 3 scores group were compared. The correlation between BME scores and VRS classification and VAS score was analyzed. **Results:** The I grade proportion of VRS classification in the observation group was 17.86%, which was significantly lower than that (50%) in the control group of; the II grade proportion was 64.29%, which was significantly higher than that (28.57%) the control group, the differences were statistically significant ($P<0.05$). The VAS scores of the observation group were significantly higher than those of the control group, the difference was statistically significant ($P<0.05$). There was significant difference in proportion of I grade, II grade and III grade of the VRS classification among the three small groups of observation group ($P<0.05$); the I grade proportion of VRS classification in 1 score group was significantly higher than that in 2 scores group and 3 scores group; the II grade proportion of VRS classification in 2 scores group was significantly higher than that of 1 score group and 3 scores group; the III grade proportion of VRS classification was significantly higher than that of 1 score group and 2 scores group, the differences were statistically significant ($P<0.05$). The difference of VAS scores among the three small groups in the observation group was statistically

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significant ($P<0.05$); the VAS score of 3 scores group was significantly higher than that of 1 score group and 2 scores group; the VAS score of 2 scores group was significantly higher than that of 1 score group, the differences were statistically significant ($P<0.05$). Spearman analysis showed that BME scores was positively correlated with VRS classification and VAS score ($P<0.05$). **Conclusion:** Most patients with KOA have BME, whose knee pain is more obvious, and the more severe the BME, the stronger the pain.

Key words: Knee osteoarthritis; Knee pain; Subchondral bone marrow edema; Correlation

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前言

膝骨关节炎(Knee osteoarthritis, KOA)又称退行性膝关节炎,是临床上常见的骨科类疾病,多发于中老年人群,是引起中老年人腿疼的主要疾病之一^[1-3]。KOA的临床表现为膝盖红肿、膝盖肿痛、膝关节弹响、膝关节僵硬、站立起身时膝部酸痛不适等,如没有得到及时有效的治疗,易引发关节畸形,导致患者残疾^[4-6]。相关报道,我国约有1亿骨关节炎患者,而KOA在所有骨关节炎的患病率排名中位于第二位,由此可见KOA对我国人民的健康和生活质量构成巨大威胁^[7-8]。KOA患者多数伴有不同程度的软骨下骨髓水肿(Bone marrow edema, BME),相关研究发现KOA在发病初期软骨下骨就出现结构上的变化,而此时X片尚难以观察到关节间隙狭窄、关节边缘有骨赘等病变,但通过MRI检查可发现有轻微的BME,由此可见BME与KOA的发生和发展具有内在联系^[9-11]。关节疼痛是大部分KOA患者最明显的临床症状,可在一定程度上反映疾病的发展方向,同时部分KOA患者因关节疼痛而大量减少运动量,进而导致肌肉萎缩、骨骼退化,引起恶性循环^[12-14]。本研究旨在探讨KOA患者关节疼痛与BME的相关性,以进一步了解关节疼痛与BME的关系,现将研究结果整理如下。

1 资料与方法

1.1 一般资料

选取2012年12月到2016年1月在我院接受治疗的KOA患者70例,纳入标准:①所有患者经X片检测,显示有骨赘形成,且临床表现为大多数时间内有膝痛、有骨摩擦音、清晨膝盖僵硬、存在骨性肥大;②年龄 ≥ 38 岁;③均为原发性KOA;④患者及其家属对本次研究知情同意,并签署知情同意书。排除标准:①继发性KOA患者;②有膝关节手术史者;③患有类风湿性关节炎、感染性关节炎、强直性脊柱炎等疾病者;④意识不清,不具备正常行为能力者。所有患者均行MRI检查,并根据有无BME将其分为对照组和观察组,其中有BME的患者均纳入观察组,共56例,无BME的患者纳入对照组,共14例。观察组男20例,女36例,年龄38-76岁,平均年龄 (52.8 ± 5.4) 岁。对照组男5例,女9例,年龄38-77岁,平均年龄 (53.12 ± 5.6) 岁。两组患者的性别、年龄等一般资料比较差异无统计学意义($P>0.05$),可行组间对比。

1.2 BME的检查方法和分级标准

使用美国GE公司的744GE1.5 T核磁共振机对患者膝关节进行检查。所有患者统一采用8通道进行扫描,根据快速自旋回波序列产生的相关影像来判断BME是否存在。如图像的T1加权成像呈现出低信号,而T2加权成像呈现出高信号,同

时脂肪抑制序列像呈现出较为明显高信号,则可以判断存在BME。检查人员均为我院经验丰富的检验医师。BME的分级标准:将膝关节划分为15个区域,根据每个区域被高信号所占的比例来评估BME的严重程度。其中,0分:不存在BME;1分:总受累区域在0-25%范围内;2分:总受累区域在25%-50%范围内;3分:总受累区域 $\geq 50\%$ ^[7]。

1.3 膝关节疼痛评分标准

分别采用主诉疼痛分级法(VRS)^[15]、视觉模糊评分(VAS)^[16]对所有患者进行疼痛评分,其中VRS分级法主要由患者自身来述说疼痛程度,根据患者的描述来进行分级。其中I级:轻度疼痛,即有疼痛但在可承受的范围,不对生活造成干扰,不影响睡眠。II级:重度疼痛,疼痛较为明显,患者较难忍受,对生活造成干扰,影响睡眠质量,患者主动要求服用镇痛药物。III级:疼痛剧烈,患者难以忍受,需用及时服用镇痛药物,睡眠受到的干扰十分严重,可伴自主神经紊乱。VAS评分又称划线法,在白纸上画一条长为100 mm的直线,线上没有任何标记或词语,以免对患者造成影响,告知患者直线的一端代表无痛,另一端代表剧痛,让患者根据自身情况在直线上最能反应自己疼痛程度的地方划一交叉线,根据患者划线的位置赋予相应的评分,满分为10分,评分越高代表疼痛程度越明显。

1.4 观察指标

对比对照组和观察组患者的VRS分级情况和VAS评分,根据BME的得分情况将观察组分为1分组、2分组和3分组,分别为12例、31例和13例,比较1分组、2分组和3分组的VRS分级情况和VAS评分,并分析BME得分和VRS分级、VAS评分的相关性。

1.5 统计学方法

选用SPSS20.0对所有数据进行统计分析,计数资料以率(%)表示,进行 χ^2 检验,计量资料以均值 $\pm$ 标准差($\bar{x} \pm s$)表示,多组间比较采用方差分析,两两比较进行t检验,采用Spearman统计分析分析BME得分和VRS分级、VAS评分的相关性,以 $P<0.05$ 为差异有统计学意义。

2 结果

2.1 对照组和观察组患者的VRS分级情况、VAS评分比较

观察组的VRS分级的I级比例为17.86%,显著低于对照组的50.00%,II级比例为64.29%,显著高于对照组的28.57%,差异均有统计学意义($P<0.05$),两组的III级比例差异无统计学意义($P>0.05$);观察组的VAS评分显著高于对照组,差异有统计学意义($P<0.05$),详见表1。

2.2 不同BME得分的患者VRS分级情况、VAS评分比较

三组的VRS分级I级、II级、III级整体比较差异有统计学

表 1 对照组和观察组患者的 VRS 分级情况、VAS 评分比较

Table 1 Comparison of VRS classification and VAS score between control group and observation group

Groups	n	VRS classification[n(%)]			VAS score($\bar{x} \pm s$, scores)
		I grade	II grade	III grade	
Control group	14	7(50.00)	4(28.57)	3(21.43)	4.35 $\pm$ 1.02
Observation group	56	10(17.86)	36(64.29)	10(17.86)	6.48 $\pm$ 1.21
X ² /t	-	4.667	5.833	0.094	6.061
P	-	0.031	0.016	0.759	0.000

意义($P<0.05$),1分组的VRS分级I级比例显著高于2分组和3分组,2分组的VRS分级II级比例显著高于1分组和3分组,3分组的VRS分级III级比例显著高于1分组和2分组,差异均有统计学意义($P<0.05$);三组的VAS评分整体比较差异

有统计学意义($P<0.05$),3分组的VAS评分显著高于1分组和2分组,2分组的VAS评分显著高于1分组,差异均有统计学意义($P<0.05$),详见表2。

表 2 不同 BME 得分的患者 VRS 分级、VAS 评分比较

Table 2 Comparison of VRS classification and VAS score in patients with different BME scores

BME scores	n	VRS classification[n(%)]			VAS score($\bar{x} \pm s$, scores)
		I grade	II grade	III grade	
1 score group	12	7(58.33)	4(33.33)	1(8.33)	4.49 $\pm$ 1.12
2 scores group	31	2(6.45) ^a	27(87.10) ^a	2(6.45)	5.78 $\pm$ 1.03 ^a
3 scores group	13	1(7.69) ^a	5(38.46) ^b	7(53.85) ^{ab}	6.94 $\pm$ 1.36 ^{ab}
X ² /F	-	17.068	15.809	14.970	16.321
P	-	0.000	0.000	0.000	0.000

Note: compared with 1 score group, ^a $P<0.05$; compared with 2 scores group, ^b $P<0.05$.

2.3 观察组的 BME 得分和 VRS 分级、VAS 评分的相关性

经 Spearman 统计分析,BME 得分和 VRS 分级、VAS 评分均呈正相关($r=0.688, 0.721, P=0.014, 0.009$)。

3 讨论

KOA 的主要特点为关节软骨退变,随着病情的加重,软骨逐渐出现软化、变性,同时软骨膜过度增生导致新骨出现,经骨化后形成骨赘,任其发展可对关节囊、关节周围肌肉的正常结构造成破坏,严重时可引发关节畸形,导致患者残疾^[17-19]。相关研究指出^[20],KOA 的发病率与性别、体重以及年龄有明显的关系,由于男女体内激素水平存在较大差异,且激素的水平可影响骨骼的功能,进而导致 KOA 的患病率和性别相关;而体重较大的人对关节造成的压力较大,更易导致关节软骨变形;在 40-60 岁的年龄范围内,约有 15% 的人患有 KOA,而在 60 岁以上的老年人群体,约有一半的人患有 KOA,由此可见 KOA 与年龄紧密相关,随着我国老龄化社会的到来,可以预见 KOA 的患者数量将呈现新一轮的增长,严重影响我国人民的生活质量和健康,因此研究与 KOA 相关的指标具有重要的意义^[21-22]。X 片检测是评估 KOA 的常用技术手段,但在 KOA 初期,由于关节软骨变化不明显,X 片常常难以检测出具体问题,进而导致漏诊。MRI 具有强大的组织分辨能力,能清晰的显示关节软骨的轮廓,可发现微小的病变^[23,24]。BME 是一种具有典型的 MRI 信号特征的病变,由病变组织间隙中的体液过量滞留而形成,相关研究指出,BME 与 KOA 的发生、发展有密切的关系^[25,26],

本研究从关节疼痛这一层面出发,来探究 BME 与 KOA 的内在联系。

在本次研究中,观察组的 VRS 分级的 I 级比例显著低于对照组,II 级比例显著高于对照组($P<0.05$),观察组的 VAS 评分显著高于对照组($P<0.05$),1 分组的 VRS 分级 I 级比例显著高于 2 分组和 3 分组,2 分组的 VRS 分级 II 级比例显著高于 1 分组和 3 分组,3 分组的 VRS 分级 III 级比例显著高于 1 分组和 2 分组($P<0.05$),3 分组的 VAS 评分显著高于 1 分组和 2 分组,2 分组的 VAS 评分显著高于 1 分组($P<0.05$),这说明存在 BME 的 KOA 患者的关节疼痛比无 BME 的更加明显,且 BME 得分越高,关节疼痛的程度越严重。究其原因,由于关节软骨没有神经纤维存在,因此关节软骨遭到破坏并不是导致膝关节疼痛的直接原因,主要是关节软骨在被破坏后会导致周围的软骨下骨受力情况发生变化,进而导致软骨下骨会发生压力、密度的改变,最终导致对软骨下骨和骨髓内的痛觉感受器造成刺激,引发剧烈疼痛。而软骨下骨的这些变化易增加骨小梁间隙,进而导致间隙内充填大量体液,同时纤维血管和新骨增生,进而导致 BME 形成。通过上述分析可知当软骨下骨所受压力增大后可刺激相应的疼痛感受器,进而产生疼痛感,且压力越大疼痛越明显,而 BME 也和软骨下骨所受的压力大小有关,所受压力越大 BME 越严重,因此 BME 和 KOA 患者的关节疼痛具有内在联系,可以通过疼痛的程度来推算 BME 的情况^[27,28]。从中医的角度来看,疼痛的基本原因是血循环受阻,筋脉气血运行受阻,正所谓不通则痛,而 BME 则是一种不通的表现形式,

因此可以从 BME 的情况来侧面的反应关节疼痛情况^[29,30]。本研究还分析了 BME 得分和 VRS 分级、VAS 评分的相关性,结果显示 BME 得分与两种疼痛量表均呈正相关,这进一步验证了上述分析,说明 KOA 患者的关节疼痛随着 BME 得分的升高而加重。

综上所述,大部分 KOA 患者存在 BME,而有 BME 的 KOA 患者关节疼痛更加明显,且 BME 越严重疼痛感越强,临床上评估 KOA 患者病情时,可将 BME 情况加入综合考量,以更加全面的了解患者情况。

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