绝经后骨质疏松症合并膝骨关节炎患者的骨代谢特征研究

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摘　要　目的:探讨绝经后骨质疏松症(postmenopausal osteoporosis,PMOP)合并膝骨关节炎(knee osteoarthritis,KOA)患者的骨代谢特征。**方法:**选择 2014 年 11 月至 2017 年 3 月在浙江省中医院就诊的 PMOP 合并 KOA 患者作为研究对象。拍摄患者站立位膝关节 X 线片,根据 Kellgren 和 Lawrence 影像分级标准将纳入研究的患者分为 5 组。采用双能 X 线吸收法测定患者 L_1 ~ L_4 的骨密度,采用电化学发光免疫分析法测定患者的血清维生素 D、甲状旁腺激素(parathyroid hormone,PTH)、Ⅰ型前胶原氨基端前肽(N-terminal propeptide of type Ⅰ precollagen,PⅠNP)、N 端中段骨钙素(N-terminal in the middle osteocalcin,N-MID-OT)、Ⅰ型胶原羧基端肽 β 特殊序列(β cross-linked C-telopeptide of type Ⅰ collagen,β-CTX)水平。**结果:**纳入研究的患者共 124 例,0 级组 26 例、Ⅰ级组 15 例、Ⅱ级组 39 例、Ⅲ级组 26 例、Ⅳ级组 18 例。5 组患者的骨密度比较,差异有统计学意义[(0.800 ± 0.045) g·cm^{-2},(0.788 ± 0.048) g·cm^{-2},(0.813 ± 0.042) g·cm^{-2},(0.827 ± 0.051) g·cm^{-2},(0.849 ± 0.049) g·cm^{-2},F = 4.724,P = 0.001];0 级组的骨密度与Ⅰ级组、Ⅱ级组比较,组间差异均无统计学意义(P = 0.436,P = 0.291);0 级组的骨密度小于Ⅲ级组、Ⅳ级组(P = 0.040,P = 0.001);Ⅰ级组与Ⅱ级组的骨密度比较,差异无统计学意义(P = 0.088);Ⅰ级组的骨密度小于Ⅲ级组、Ⅳ级组(P = 0.012,P = 0.000);Ⅱ级组与Ⅲ级组的骨密度比较,差异无统计学意义(P = 0.228);Ⅱ级组的骨密度小于Ⅳ级组(P = 0.007);Ⅲ级组与Ⅳ级组的骨密度比较,差异无统计学意义(P = 0.126)。5 组患者的血清维生素 D、N-MID-OT 含量比较,组间差异均无统计学意义[(16.72 ± 9.66) ng·mL^{-1},(17.46 ± 13.18) ng·mL^{-1},(17.92 ± 13.22) ng·mL^{-1},(15.93 ± 6.51) ng·mL^{-1},(16.23 ± 5.54) ng·mL^{-1},F = 0.180,P = 0.948;(24.39 ± 4.73) ng·mL^{-1},(25.92 ± 5.45) ng·mL^{-1},(23.55 ± 4.35) ng·mL^{-1},(22.44 ± 4.71) ng·mL^{-1},(21.29 ± 5.48) ng·mL^{-1},F = 2.424,P = 0.052]。5 组患者血清 PTH 含量比较,差异有统计学意义[(40.59 ± 7.74) pg·mL^{-1},(42.37 ± 8.08) pg·mL^{-1},(44.37 ± 9.44) pg·mL^{-1},(45.86 ± 8.88) pg·mL^{-1},(48.18 ± 8.69) pg·mL^{-1},F = 2.457,P = 0.049];0 级组的血清 PTH 含量与Ⅰ级组、Ⅱ级组比较,组间差异均无统计学意义(P = 0.529,P = 0.089);0 级组的血清 PTH 含量低于Ⅲ级组、Ⅳ级组(P = 0.031,P = 0.005);Ⅰ级组的血清 PTH 含量与Ⅱ级组、Ⅲ级组、Ⅳ级组比较,组间差异均无统计学意义(P = 0.452,P = 0.220,P = 0.059);Ⅱ级组的血清 PTH 含量与Ⅲ级组、Ⅳ级组比较,组间差异均无统计学意义(P = 0.502,P = 0.128);Ⅲ级组与Ⅳ级组的血清 PTH 含量比较,差异无统计学意义(P = 0.388)。5 组患者血清 PINP 含量比较,差异有统计学意义[(44.33 ± 7.01) ng·mL^{-1},(45.55 ± 6.55) ng·mL^{-1},(43.60 ± 8.34) ng·mL^{-1},(39.25 ± 6.31) ng·mL^{-1},(36.06 ± 7.19) ng·mL^{-1},F = 5.912,P = 0.000];0 级组的血清 PINP 含量与Ⅰ级组、Ⅱ级组比较,组间差异均无统计学意义(P = 0.606,P = 0.695);0 级组的血清 PINP 含量高于Ⅲ级组、Ⅳ级组(P = 0.014,P = 0.000);Ⅰ级组与Ⅱ级组的血清 PINP 含量比较,差异无统计学意义(P = 0.381);Ⅰ级组的血清 PINP 含量高于Ⅲ级组、Ⅳ级组(P = 0.009,P = 0.000);Ⅱ级组的血清 PINP 含量高于Ⅲ级组和Ⅳ级组(P = 0.020,P = 0.000);Ⅲ级组与Ⅳ级组的血清 PINP 含量比较,差异无统计学意义(P = 0.157)。5 组患者血清 β-CTX 含量比较,差异有统计学意义[(874.93 ± 189.91) pg·mL^{-1},(1 010.00 ± 241.77) pg·mL^{-1},(810.64 ± 104.43) pg·mL^{-1},(761.18 ± 119.94) pg·mL^{-1},(728.25 ± 193.47) pg·mL^{-1},F = 8.178,P = 0.000];0 级组与Ⅱ级组的血清 β-CTX 含量比较,差异无统计学意义(P = 0.120);0 级组的血清 β-CTX 含量高于Ⅲ级组、Ⅳ级组(P = 0.013,P = 0.004);Ⅰ级组的血清 β-CTX 含量高于 0 级组、Ⅱ级组、Ⅲ级组、Ⅳ级组(P = 0.011,P = 0.000,P = 0.000,P = 0.000);Ⅱ级组的血清 β-CTX 含量与Ⅲ级组、Ⅳ级组比较,组间差异均无统计学意义(P = 0.231,P = 0.077);Ⅲ级组与Ⅳ级组的血清 β-CTX 含量比较,差异无统计学意义(P = 0.510)。**结论:**PMOP 合并 KOA 患者,在 KOA 初期骨代谢呈以骨吸收为主的高转换状态,后期骨转

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换速率逐渐减慢,以骨形成为主。

关键词 骨关节炎,膝;骨质疏松,绝经后;骨密度;骨代谢

A clinical study of characteristics of bone metabolism in patients with postmenopausal osteoporosis and knee osteoarthritis

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ABSTRACT **Objective**:To explore the characteristics of bone metabolism in patients with postmenopausal osteoporosis(PMOP) and knee osteoarthritis(KOA). **Methods**:The patients with PMOP and KOA who were treated in Zhejiang Provincial Hospital of Traditional Chinese Medicine from November 2014 to March 2017 were selected out as the subjects. The X-ray films of affected knee in standing position were taken,and the patients enrolled in the study were divided into 5 groups according to Kellgren – Lawrence imaging classification criteria. The bone densities of vertebrae from L_2 to L_4 were detected by using dual – energy X-ray absorptiometry(DEXA),and the serum levels of vitamin D,parathyroid hormone(PTH),N – terminal propeptide of type Ⅰ precollagen(PⅠNP),N – terminal in the middle osteocalcin(N – MID – OT) and β cross – linked C – telopeptide of type Ⅰ collagen(β – CTX) were measured by using electro – chemiluminescence immunoassay(ECLIA). **Results**:One hundred and twenty – four patients were enrolled in the study and were divided into grade 0 group(26),grade Ⅰ group(15),grade Ⅱ group(39),grade Ⅲ group(26) and grade Ⅳ group(18). There was statistical difference in the bone density between the 5 groups(0.800 +/– 0.045,0.788 +/– 0.048,0.813 +/– 0.042,0.827 +/– 0.051,0.849 +/– 0.049 g/cm(–2),F = 4.724,P = 0.001). There was no statistical difference in the bone density between grade 0 group and grade Ⅰ group and between grade 0 group and grade Ⅱ group(P = 0.436,P = 0.291). The bone density was lower in grade 0 group compared to grade Ⅲ group and grade Ⅳ group(P = 0.040,P = 0.001). There was no statistical difference in the bone density between grade Ⅰ group and grade Ⅱ group(P = 0.088). The bone density was lower in grade Ⅰ group compared to grade Ⅲ group and grade Ⅳ group(P = 0.012,P = 0.000). There was no statistical difference in the bone density between grade Ⅱ group and grade Ⅲ group(P = 0.228). The bone density was lower in grade Ⅱ group compared to grade Ⅳ group(P = 0.007). There was no statistical difference in the bone density between grade Ⅲ group and grade Ⅳ group(P = 0.126). There was no statistical difference in the serum contents of vitamin D and N – MID – OT between the 5 groups(16.72 +/– 9.66,17.46 +/– 13.18,17.92 +/– 13.22,15.93 +/– 6.51,16.23 +/– 5.54 ng/mL,F = 0.180,P = 0.948;24.39 +/– 4.73,25.92 +/– 5.45,23.55 +/– 4.35,22.44 +/– 4.71,21.29 +/– 5.48 ng/mL,F = 2.424,P = 0.052). There was statistical difference in the serum contents of PTH between the 5 groups(40.59 +/– 7.74,42.37 +/– 8.08,44.37 +/– 9.44,45.86 +/– 8.88,48.18 +/– 8.69 pg/mL,F = 2.457,P = 0.049). There was no statistical difference in the serum contents of PTH between grade 0 group and grade Ⅰ group and between grade 0 group and grade Ⅱ group(P = 0.529,P = 0.089). The serum contents of PTH were lower in grade 0 group compared to grade Ⅲ group and grade Ⅳ group(P = 0.031,P = 0.005). There were no statistical difference in the serum contents of PTH between grade Ⅰ group and grade Ⅱ group,between grade Ⅰ group and grade Ⅲ group,between grade Ⅰ group and grade Ⅳ group,between grade Ⅱ group and grade Ⅲ group,between grade Ⅱ group and grade Ⅳ group and between grade Ⅲ group and grade Ⅳ group(P = 0.452,P = 0.220,P = 0.059;P = 0.502,P = 0.128;P = 0.388). There were statistical difference in the serum contents of PINP between the 5 groups(44.33 +/– 7.01,45.55 +/– 6.55,43.60 +/– 8.34,39.25 +/– 6.31,36.06 +/– 7.19 ng/mL,F = 5.912,P = 0.000). There was no statistical difference in the serum content of PINP between grade 0 group and grade Ⅰ group and between grade 0 group and grade Ⅱ group(P = 0.606,P = 0.695). The serum contents of PINP were higher in grade 0 group compared to grade Ⅲ group and grade Ⅳ group(P = 0.014,P = 0.000). There was no statistical difference in the serum contents of PINP between grade Ⅰ group and grade Ⅱ group(P = 0.381). The serum contents of PINP were higher in grade Ⅰ group compared to grade Ⅲ group and grade Ⅳ group(P = 0.009,P = 0.000) and were higher in grade Ⅱ group compared to grade Ⅲ group and grade Ⅳ group(P = 0.020,P = 0.000). There was no statistical difference in the serum contents of PINP between grade Ⅲ group and grade Ⅳ group(P = 0.157). There was statistical difference in the serum contents of β – CTX between the 5 groups(874.93 +/– 189.91,

1 010.00 +/- 241.77,810.64 +/- 104.43,761.18 +/- 119.94,728.25 +/- 193.47 pg/mL,F = 8.178,P = 0.000). There was no statistical difference in the serum contents of β - CTX between grade 0 group and grade Ⅱ group(P = 0.120). The serum contents of β - CTX were higher in grade 0 group compared to grade Ⅲ group and grade Ⅳ group(P = 0.013,P = 0.004),and were higher in grade Ⅰ group compared to grade 0 group,grade Ⅱ group,grade Ⅲ group and grade Ⅳ group(P = 0.011,P = 0.000,P = 0.000,P = 0.000). There was no statistical difference in the serum contents of β - CTX between grade Ⅱ group and grade Ⅲ group and between grade Ⅱ group and grade Ⅳ group(P = 0.231,P = 0.077). There was no statistical difference in the serum contents of β - CTX between grade Ⅲ group and grade Ⅳ group(P = 0.510). **Conclusion**: The bone metabolism presents a state of high conversion characterized mainly by bone absorption in patients with PMOP and KOA in the early stage of KOA,and the bone turnover slows down gradually and presents mainly with bone formation in the later stage of KOA.

Keywords　osteoarthritis,knee;osteoporosis,postmenopausal;bone density;bone metabolism

膝骨关节炎(knee osteoarthritis,KOA)和骨质疏松症(osteoporosis,OP)同属绝经妇女的多发疾病[1],在临床中常常同时存在[2],严重影响了绝经女性的身体健康和生活质量。KOA 与绝经后骨质疏松症(postmenopausal osteoporosis,PMOP)的发生均破坏了机体骨吸收和骨形成之间的平衡,最终导致骨量升高或下降[3-5]。为探讨这两种疾病的关系,本研究观察了 PMOP 合并 KOA 患者的骨代谢特征,现总结报告如下。

1　临床资料

1.1　一般资料　选择 2014 年 11 月至 2017 年 3 月在浙江省中医院就诊的 PMOP 合并 KOA 患者作为研究对象。试验方案经医院医学伦理委员会审查通过。

1.2　OP 诊断标准　采用 WHO 推荐的骨质疏松症诊断标准,即采用双能 X 线吸收法测定,T 值≤ -2.5 SD[6]。

1.3　KOA 诊断标准　美国风湿病学会 1995 年提出的 KOA 诊断标准[7]。

1.4　纳入标准　①同时符合上述 OP 和 KOA 诊断标准;②年龄 45 ~ 75 岁;③绝经后女性;④绝经年限≥1 年;⑤同意参与本研究,签署知情同意书。

1.5　排除标准　①有外伤性骨折史者;②合并糖尿病、甲状腺功能亢进症等内分泌系统疾病者;③合并恶性肿瘤者;④近 6 个月内使用过胰岛素制剂、抗凝药、降压药、抗惊厥药者;⑤曾应用过激素类药物治疗 OP 或 KOA 者。

2　方　法

2.1　病例分组　采用飞利浦 DR 机拍摄患者站立位膝关节 X 线片,根据 Kellgren 和 Lawrence 影像分级标准[8],将纳入研究的患者分为 5 组。0 级组,正常;Ⅰ级组,可能有骨赘,关节间隙可疑变窄;Ⅱ级组,有明显骨赘,关节间隙可疑变窄;Ⅲ级组,中等量的骨赘,关节间隙变窄较明确,有轻度软骨下骨硬化,但范围较小;Ⅳ级组,大量骨赘,关节间隙明显变窄,重度软骨下骨硬化,范围较大,关节肥大、畸形改变。

2.2　骨密度及骨代谢指标测定　采用 Prodigy 双能 X 线骨密度分析仪(GE 公司)测定患者 L_1 ~ L_4 的骨密度。清晨空腹采血,采血前禁食 12 h 以上,离心后取血清置于 -80 ℃冰箱保存备用。血清标本采集完毕后,应用 β - 胶原特殊序列试剂盒(Roche 公司),采用电化学发光免疫分析法测定患者的血清维生素 D、甲状旁腺激素(parathyroid hormone,PTH)、Ⅰ型前胶原氨基端前肽(N - terminal propeptide of type Ⅰ procollagen,PⅠNP)、N 端中段骨钙素(N - terminal in the middle osteocalcin,N - MID - OT)、Ⅰ型胶原羧基端肽 β 特殊序列(β cross - linked C - telopeptide of type Ⅰ collagen,β - CTX)水平。

2.3　数据统计　采用 SPSS17.0 软件进行数据统计分析。5 组患者年龄、绝经年限、体质量指数、骨密度、血清维生素 D 水平、血清 PTH 水平、血清 PⅠNP 水平、血清 N - MID - OT 水平、血清 β - CTX 水平的整体比较均采用单因素方差分析,组间两两比较均采用 LSD - t 检验。检验水准 α = 0.05。

3　结　果

纳入研究的患者共 124 例,0 级组 26 例、Ⅰ级组 15 例、Ⅱ级组 39 例、Ⅲ级组 26 例、Ⅳ级组 18 例。5 组患者的年龄、绝经年限比较,组间差异均无统计学意义。5 组患者体质量指数比较,差异有统计学意义;0 级组与Ⅰ级组、Ⅱ级组、Ⅲ级组的体质量指数比较,组间差异均无统计学意义(P = 0.083,P = 0.227,P = 0.051);0 级组的体质量指数小于Ⅳ级组(P = 0.019);Ⅰ级组的体质量指数小于Ⅱ级组、Ⅲ级组、Ⅳ

级组（$P=0.005$，$P=0.001$，$P=0.000$）；Ⅱ级组的体质量指数与Ⅲ级组、Ⅳ级组比较，组间差异均无统计学意义（$P=0.346$，$P=0.140$），Ⅲ级组与Ⅳ级组的体质量指数比较，差异无统计学意义（$P=0.549$）。见表 1。

5 组患者的骨密度比较，差异有统计学意义；0 级组的骨密度与Ⅰ级组、Ⅱ级组比较，组间差异均无统计学意义（$P=0.436$，$P=0.291$）；0 级组的骨密度小于Ⅲ级组、Ⅳ级组（$P=0.040$，$P=0.001$）；Ⅰ级组与Ⅱ级组的骨密度比较，差异无统计学意义（$P=0.088$）；Ⅰ级组的骨密度小于Ⅲ级组、Ⅳ级组（$P=0.012$，$P=0.000$）；Ⅱ级组与Ⅲ级组的骨密度比较，差异无统计学意义（$P=0.228$）；Ⅱ级组的骨密度小于Ⅳ级组（$P=0.007$）；Ⅲ级组与Ⅳ级组的骨密度比较，差异无统计学意义（$P=0.126$）。5 组患者的血清维生素 D、N－MID－OT 含量比较，组间差异均无统计学意义。5 组患者血清 PTH 含量比较，差异有统计学意义；0 级组的血清 PTH 含量与Ⅰ级组、Ⅱ级组比较，组间差异均无统计学意义（$P=0.529$，$P=0.089$）；0 级组的血清 PTH 含量低于Ⅲ级组、Ⅳ级组（$P=0.031$，$P=0.005$）；Ⅰ级组的血清 PTH 含量与Ⅱ级组、Ⅲ级组、Ⅳ级组比较，组间差异均无统计学意义（$P=0.452$，$P=0.220$，$P=0.059$）；Ⅱ级组的血清 PTH 含量与Ⅲ级组、Ⅳ级组比较，组间差异均无统计学意义（$P=0.502$，$P=0.128$）；Ⅲ级组与Ⅳ级组的血清 PTH 含量比较，差异无统计学意义（$P=0.388$）。5 组患者血清 PINP 含量比较，差异有统计学意义；0 级组的血清 PINP 含量与Ⅰ级组、Ⅱ级组比较，组间差异均无统计学意义（$P=0.606$，$P=0.695$）；0 级组的血清 PINP 含量高于Ⅲ级组、Ⅳ级组（$P=0.014$，$P=0.000$）；Ⅰ级组与Ⅱ级组的血清 PINP 含量比较，差异无统计学意义（$P=0.381$）；Ⅰ级组的血清 PINP 含量高于Ⅲ级组、Ⅳ级组（$P=0.009$，$P=0.000$）；Ⅱ级组的血清 PINP 含量高于Ⅲ级组和Ⅳ级组（$P=0.020$，$P=0.000$）；Ⅲ级组与Ⅳ级组的血清 PINP 含量比较，差异无统计学意义（$P=0.157$）。5 组患者血清 β－CTX 含量比较，差异有统计学意义；0 级组与Ⅱ级组的血清 β－CTX 含量比较，差异无统计学意义（$P=0.120$）；0 级组的血清 β－CTX 含量高于Ⅲ级组、Ⅳ级组（$P=0.013$，$P=0.004$）；Ⅰ级组的血清 β－CTX 含量高于 0 级组、Ⅱ级组、Ⅲ级组、Ⅳ级组（$P=0.011$，$P=0.000$，$P=0.000$，$P=0.000$）；Ⅱ级组的血清 β－CTX 含量与Ⅲ级组、Ⅳ级组比较，组间差异均无统计学意义（$P=0.231$，$P=0.077$）；Ⅲ级组与Ⅳ级组的血清 β－CTX 含量比较，差异无统计学意义（$P=0.510$）。见表 2。

表 1　5 组绝经后骨质疏松症合并膝骨关节炎患者的一般资料

组别	样本量（例）	年龄（$\bar{x}\pm s$，岁）	绝经年限（$\bar{x}\pm s$，年）	体质量指数（$\bar{x}\pm s$，kg·m^{-2}）
0 级组	26	60.35±3.52	10.81±2.42	22.08±1.57
Ⅰ级组	15	60.93±3.79	11.13±2.62	20.08±1.97
Ⅱ级组	39	60.26±3.42	10.97±2.61	22.77±2.23
Ⅲ级组	26	59.69±4.02	9.96±3.35	23.31±2.60
Ⅳ级组	18	60.22±5.20	10.33±3.85	23.72±2.74
F 值		0.250	0.644	4.561
P 值		0.909	0.632	0.002

表 2　5 组绝经后骨质疏松症合并膝骨关节炎患者的骨密度及各骨代谢指标血清水平

组别	样本量（例）	骨密度（$\bar{x}\pm s$，g·cm^{-2}）	维生素 D（$\bar{x}\pm s$，ng·mL^{-1}）	PTH[1)]（$\bar{x}\pm s$，pg·mL^{-1}）	PINP[2)]（$\bar{x}\pm s$，ng·mL^{-1}）	N－MID－OT[3)]（$\bar{x}\pm s$，ng·mL^{-1}）	β－CTX[4)]（$\bar{x}\pm s$，pg·mL^{-1}）
0 级组	26	0.800±0.045	16.72±9.66	40.59±7.74	44.33±7.01	24.39±4.73	874.93±189.91
Ⅰ级组	15	0.788±0.048	17.46±13.18	42.37±8.08	45.55±6.55	25.92±5.45	1 010.00±241.77
Ⅱ级组	39	0.813±0.042	17.92±13.22	44.37±9.44	43.60±8.34	23.55±4.35	810.64±104.43
Ⅲ级组	26	0.827±0.051	15.93±6.51	45.86±8.88	39.25±6.31	22.44±4.71	761.18±119.94
Ⅳ级组	18	0.849±0.049	16.23±5.54	48.18±8.69	36.06±7.19	21.29±5.48	728.25±193.47
F 值		4.724	0.180	2.457	5.912	2.424	8.178
P 值		0.001	0.948	0.049	0.000	0.052	0.000

1）PTH 为甲状旁腺激素；2）PINP 为Ⅰ型前胶原氨基端前肽；3）N－MID－OT 为 N 端中段骨钙素；4）β－CTX 为Ⅰ型胶原羧基端肽 β 特殊序列

4　讨　论

KOA 与 PMOP 是绝经后女性的常见病,很多研究认为二者具有不同的病因和病理基础,然而这两种疾病在临床上常常同时存在。Gossan 等[9]认为,KOA 和 PMOP 受基因、内分泌、年龄、雌激素水平、性别等因素影响。纪京绪等[10]认为,绝经后女性同时发生 KOA 和 OP 的发生率与增龄有密切关系,但赵玺[1]的研究结果则与之相反。体质量指数亦被认为与 KOA 和 PMOP 的发病有关,本文研究的结果也显示,随着 KOA 病情的加重,体质量指数总体上呈增大的趋势。

PMOP 是以骨密度下降为主要特征的骨代谢疾病,PMOP 患者雌激素水平较低,使骨代谢加快、骨量丢失增加,造成全身骨密度下降,甚至发生脆性骨折[11]。对于 KOA 患者的骨密度是升高还是降低,目前仍存在较大分歧。Dequeker 等[12-13]的研究表明,KOA 患者的骨密度高于同龄正常人群,但冯歆等[14]的研究结果则与此相反。这可能与 KOA 患者某些部位的骨密度受骨赘、组织钙化等影响假性升高有关。本研究中,从 0 级到Ⅳ级,患者的骨密度总体呈逐渐升高的趋势。以往的动物实验表明,KOA 的进展顺序是软骨退化、软骨下骨质疏松、硬化、骨赘生成[15-17]。Pickarski 等[18]从基因表达方面也证明了 KOA 的这一进展顺序。这些均与本研究的结果一致。

血清 PINP 是反映骨形成的敏感指标,血清 β-CTX 水平是反映骨吸收的指标。从 0 级到Ⅳ级,患者的血清 PINP 水平和血清 β-CTX 水平总体均呈降低的趋势。结合患者骨密度的变化趋势,我们推测 PMOP 合并 KOA 患者,在 KOA 初期骨代谢呈以骨吸收为主的高转换状态,后期随着 KOA 病情的加重骨转换速率逐渐减慢,以骨形成为主。PTH 是人体钙磷调节的一种重要激素,以往的研究表明,骨关节炎患者的 PTH 水平明显高于健康人群[19-21]。本研究中各组血清 PTH 水平的差异并不明显。

维生素 D 是调节体内钙和磷代谢的激素,骨代谢和软骨代谢都需依赖维生素 D[22]。有研究认为,血清维生素 D 水平下降影响软骨细胞活性,最终诱导 KOA 早期退变[19]。从本研究结果来看,各组间的血清维生素 D 水平差异无统计学意义。N-MID-OT 是由成骨细胞合成骨钙素,在外周血被蛋白酶水解产生的 N 端片断,属于一种非胶原骨蛋白,性质比较稳定,不受骨吸收因素的影响[23],最主要的功能是维持正常骨矿化率[24],是骨形成的特异性指标。N-MID-OT 具有和骨钙素大致相同的功用,因骨钙素不稳定,所以常选用前者作为观察指标。本研究中各组血清 N-MID-OT 差异无统计学意义。

本研究的结果提示,PMOP 合并 KOA 患者,在 KOA 初期骨代谢呈以骨吸收为主的高转换状态,后期骨转换速率逐渐减慢,以骨形成为主。

5　参考文献

[1] 赵玺. 绝经妇女骨关节炎及骨质疏松症的相关性研究[D]. 遵义:遵义医学院,2014.

[2] LIU JM,NING G,CHEN JL. Osteoporotic fractures in Asia:risk factors and strategies for prevention[J]. J Bone Miner Metab,2007,25(1):1-5.

[3] CASTAÑEDA S,ROMAN-BLAS JA,LARGO R,et al. Subchondral bone as a key target for osteoarthritis treatment[J]. Biochem Pharmacol,2012,83(3):315-323.

[4] HUNTER DJ,SPECTOR TD. The role of bone metabolism in osteoarthritis[J]. Curr Rheumatol Rep,2003,5(1):15-19.

[5] KARSDAL MA,LEEMING DJ,DAM EB,et al. Should subchondral bone turnover be targeted when treating osteoarthritis?[J]. Osteoarthritis Cartilage,2008,16(6):638-646.

[6] 中国老年学学会骨质疏松委员会骨质疏松症诊断标准学科组. 中国人骨质疏松症诊断标准专家共识(第三稿·2014 版)[J]. 中国骨质疏松杂志,2014,9(20):1007-1010.

[7] 中国中医药研究促进会骨科专业委员会,中国中西医结合学会骨伤科专业委员会关节工作委员会. 膝骨关节炎中医诊疗专家共识(2015 年版)[J]. 中医正骨,2015,27(7):4-5.

[8] KELLGREN JH,LAWRENCE JS. Radiological assessment of osteo-arthrosis[J]. Ann Rheum Dis,1957,16(4):494-502.

[9] GOSSAN N,BOOT-HANDFORD R,MENG QJ. Ageing and osteoarthritis:a circadian rhythm connection[J]. Biogerontology,2015,16(2):209-219.

[10] 纪京绪,李秀君. 膝关节骨性关节炎与骨质疏松症的相关性研究[J]. 医药前沿,2016,6(12):75-76.

[11] EASTELL R,O'NEILL TW,HOFBAUER LC,et al. Postmenopausal osteoporosis[J]. Nat Rev Dis Primers,2016,104(2):66-67.

[12] DEQUEKER J,AERSSENS J,LUYTEN FP. Osteoarthritis and osteoporosis:clinical and research evidence of inverse relationship[J]. Aging Clin Exp Res,2003,15(5):426-439.

[13] KARLSSON MK,MAGNUSSON H,COSTER M,et al. Patients with knee osteoarthritis have a phenotype with higher bone mass,higher fat mass,and lower lean body mass[J]. Clin Orthop Relat Res,2015,473(1):258-264.

[14] 冯歆,李生强,赖玉琏,等. 绝经后妇女膝关节骨性关节

炎与骨质疏松症的相关性研究[J]. 中国骨质疏松杂志,2014,20(4):357 - 359.
[15] GOLDRING MB, GOLDRING SR. Articular cartilage and subchondral bone in the pathogenesis of osteoarthritis[J]. Ann N Y Acad Sci,2010,1192:230 - 237.
[16] FUNCK - BRENTANO T, COHEN - SOLAL M. Crosstalk between cartilage and bone: When bone cytokines matter[J]. Cytokine Growth Factor Rev,2011,22(2):91 - 97.
[17] TADASHI HAYAMI, MAUREEN PICKARSKI, YA ZHAO, et al. characterization of articular cartilage and subscondral bone changes in the rat anterior cruciate ligament transaction and menisectomized models of osteoarthritis[J]. Bone, 2006, 38: 234 - 243.
[18] PICKARSKI M, HAYAMI T, ZHUO Y, et al. Molecular changes in articular cartilage and subchondral bone in the rat anterior cruciate ligament transection and meniscectomized models of osteoarthritis[J]. BMC Musculoskelet Disord,2011,12(197):197.
[19] 赵芳,邓玮,丁剑冰. 骨性关节炎血清骨代谢指标变化情况研究[J]. 新疆医科大学学报,2015,38(12):1492 - 1495.
[20] CHANG JK, CHANG LH, HUNG SH, et al. Parathyroid hormone 1 - 34 inhibits terminal differentiation of human articular chondrocytes and osteoarthritis progression in rats[J]. Arthritis Rheum,2009,60(10):3049 - 3060.
[21] 孙敏,尹良军. 甲状旁腺激素及其受体与骨关节炎的关系研究进展[J]. 中国骨质疏松杂志,2013,19(8):885 - 888.
[22] STEINGRIMSDOTTIR L, GUNNARSSON O, INDRIDASON OS, et al. Relationship between serum parathyroid hormone levels, vitamin D sufficiency, and calcium intake[J]. JAMA,2005,294(18):2336 - 2341.
[23] 吴松,阎璠,袁万博,等. 骨代谢标志物检测在类风湿关节炎患者继发骨质疏松症中的意义[J]. 实用检验医师杂志. 2014,6(2):81 - 83.
[24] NAKASATO YR, JANCKILA AJ, HALLEEN JM, et al. Clinical significance of immunoassays for type - 5 tartrate - resistant acid phosphatase[J]. Clin Chem, 1999, 45(12): 2150 - 2157.

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[14] 秦元,赵毅,沈雪勇,等. 不同型号传统银质针温针灸在人体内的温度特性比较[J]. 上海针灸杂志,2014,33(3):189 - 191.
[15] 赵毅,秦元,郑娟娟,等. 银质针温针灸在人体内的温度分布特点[J]. 中国针灸,2012,32(9):803 - 806.
[16] 杨洁,余思奕,杨晓明,等. 穴位具有特异性作用——"973 计划"经穴特异性项目概览[J]. 成都中医药大学学报,2015,38(2):93 - 96.
[17] 李国艳,李霞,李淑琴,等. 穴位特异性研究进展[J]. 上海针灸杂志,2016,35(4):383 - 387.
[18] 马忆南. 穴位特异性研究在治疗软组织损伤中的应用及存在问题分析[J]. 中国中医基础医学杂志,2014,20(2):225 - 227.
[19] HUANG ST, CHEN GY, LO HM, et al. Increase in the vagal modulation by acupuncture at neiguan point in the healthy subjects[J]. Am J Chin Med,2005,33(1):157 - 164.
[20] YOO SS, TEH EK, BLINDER RA, et al. Modulation of cerebellar activities by acupuncture stimulation: evidence from fMRI study[J]. Neuroimage,2004,22(2):932 - 940.
[21] 徐书君,符文彬. 穴位特异性与针刺得气对颈椎病颈痛的疗效影响[J]. 中华中医药杂志,2014,29(9):3003 - 3007.

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(上接第 13 页)

[3] 黄晓琳,燕铁斌. 康复医学[M]. 5 版. 北京:人民卫生出版社,2013:215 - 218.
[4] CONSTANT CR, MURLEY AH. A clinical method of functional assessment of the shoulder[J]. Clin Orthop Relat Res,1987,(214):160 - 164.
[5] CHENG JH, WANG CJ. Biological mechanism of shockwave in bone[J/OL]. Int J Surg,2015,24(Pt B):143 - 146.
[6] WANG L, JIANG Y, JIANG Z, et al. Effect of low - energy extracorporeal shock wave on vascular regeneration after spinal cord injury and the recovery of motor function[J]. Neuropsychiatr Dis Treat,2016,12:2189 - 2198.
[7] CASSAR A, PRASAD M, RODRIGUEZ - PORCEL M, et al. Safety and efficacy of extracorporeal shock wave myocardial revascularization therapy for refractory angina pectoris[J]. Mayo Clin Proc,2014,89(3):346 - 354.
[8] ROMPE JD, KIRKPATRICK CJ, KÜLLMER K, et al. Dose-related effects of shock waves on rabbit tendo Achillis. A sonographic and histological study[J]. J Bone Joint Surg Br,1998,80(3):546 - 552.
[9] CHANG KV, CHEN SY, CHEN WS, et al. Comparative effectiveness of focused shock wave therapy of different intensity levels and radial shock wave therapy for treating plantar fasciitis: a systematic review and network Meta - Analysis[J]. Arch Phys Med Rehabil,2012,93(7):1259 - 1268.
[10] DYMAREK R, HALSKI T, PTASZKOWSKI K, et al. Extracorporeal shock wave therapy as an adjunct wound treatment: a systematic review of the literature[J]. Ostomy Wound Manage,2014,60(7):26 - 39.

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