·临床研究·

老年膝关节骨性关节炎患者骨质疏松症的共病情况及其影响因素研究

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【摘 要】 **目的** 探讨老年膝关节骨性关节炎(KOA)患者骨质疏松症(OP)的共病情况,并分析其影响因素。**方法** 选取2023年1月至2025年1月武汉市第一医院收治的180例老年KOA患者为研究对象。根据是否合并OP,将患者分为共病组(n=109)及对照组(n=71)。比较两组患者一般资料、KOA病情资料以及实验室指标水平。采用SPSS 26.0统计软件进行数据分析。根据数据类型,组间比较分别采用独立样本t检验或χ^2检验。采用多因素logistic回归模型分析老年KOA患者合并OP的影响因素。**结果** 两组患者性别、年龄、体质量指数(BMI)、运动频率、近3年跌倒史、近3年骨折史比较,差异均有统计学意义(均P<0.05)。共病组患者Kellgren-Lawrence分级Ⅲ~Ⅳ级、膝关节疼痛视觉模拟量表(VAS)评分≥4分者占比均高于对照组,25羟基维生素D_3[25-(OH)D_3]、血红蛋白、血清白蛋白、血尿酸以及血钙水平均低于对照组,差异均有统计学意义(均P<0.05)。多因素logistic回归分析发现,女性(OR=2.192,95%CI 1.362~3.530)、BMI<18.5 kg/m^2(OR=1.984,95%CI 1.421~2.240)、近3年骨折史(OR=1.784,95%CI 1.164~2.735)、膝关节疼痛VAS评分≥4分(OR=1.562,95%CI 1.180~2.067)是老年KOA患者合并OP的危险因素,BMI≥24 kg/m^2(OR=0.708,95%CI 0.580~0.865)、运动频率≥4次/周(OR=0.723,95%CI 0.555~0.942)、25-(OH)D_3水平(OR=0.678,95%CI 0.541~0.849)是其保护因素(P<0.05)。**结论** 老年KOA患者普遍合并OP,临床应重视对女性、低BMI、近3年骨折史及膝关节疼痛VAS评分≥4分的老年KOA患者进行OP筛查,同时建议老年KOA患者积极进行体育锻炼、补充维生素D,以防治OP。

【关键词】 老年人;膝关节骨性关节炎;骨质疏松症;共病;危险因素
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Comorbidity of osteoporosis and influencing factors in elderly patients with knee osteoarthritis

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【**Abstract**】 **Objective** To investigate the comorbidity of osteoporosis (OP) in elderly patients with knee osteoarthritis (KOA) and analyze its influencing factors. **Methods** A total of 180 elderly KOA patients admitted to Wuhan First Hospital from January 2023 to January 2025 were selected as the study subjects. They were divided into a comorbidity group (n=109) and a control group (n=71) based on the presence of OP. The two groups were compared in the general information, KOA data, and laboratory indicator levels. SPSS 26.0 was used for data analysis. According to the data type, independent sample t test or χ^2 test is used for inter-group comparison. A multiple logistic regression model was used to analyze the factors influencing OP in elderly KOA patients. **Results** There were statistically significant differences between the two groups of patients in gender, age, body mass index (BMI), exercise frequency, history of fall in the recent three years, and history of fracture in the recent three years (all P<0.05). The proportions of patients with Kellgren-Lavrance grades Ⅲ-Ⅳ and knee pain visual analog scale (VAS) scores ≥ 4 points were significantly higher in the comorbidity group than those in the control group, the comorbidity group had lower levels of 25-hydroxyvitamin D3 [25-(OH) D3], hemoglobin, serum albumin, serum uric acid, and blood calcium than the control group, and the differences were statistically significant (all P<0.05). Multivariate logistic regression analysis suggested that female (OR=2.192, 95%CI 1.362-3.530), BMI <18.5 kg/m^2(OR=1.984, 95%CI 1.421-2.240), history of fracture in the recent three years (OR=1.784, 95%CI 1.164-2.735), and knee pain VAS score ≥ 4 points (OR=1.562, 95%CI 1.180-2.067) were risk factors, and that BMI ≥ 24 kg/m^2(OR=0.708, 95%CI 0.580-0.865), exercise frequency ≥ 4 times/week (OR=0.723, 95%CI 0.555-0.942), and 25-(OH)D3 level (OR=0.678, 95%CI 0.541-0.849) were protective factors for OP comorbidity in elderly KOA patients (P<0.05). **Conclusion** OP is common in elderly KOA patients. Clinically, it is necessary to pay attention to OP screening in elderly KOA patients who were female, have low BMI, have a history fracture in the

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past three years, and have knee pain VAS score ≥ 4 points. Additionally, elderly KOA patients are advised to engage actively in physical exercise and supplement vitamin D to prevent and treat OP.

【Key words】 aged; knee osteoarthritis; osteoporosis; comorbidity; risk factor

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膝关节骨性关节炎(knee osteoarthritis,KOA)是以关节软骨退行性变与关节周围骨质增生为主要病理改变的慢性进行性骨关节疾病,随着病情的不断进展,将严重影响患者日常生活与生活质量[1]。骨质疏松症(osteoporosis, OP)是一种累及全身的骨代谢性疾病,OP 患者骨量下降,骨脆性增加,骨折风险较高。KOA 及 OP 均是临床常见的骨科疾病,且其患病率均与年龄呈正相关,在老年群体中常见[2]。临床上,KOA 并 OP 者并不少见,两者之间的关系尚处于研究阶段,合并 OP 对 KOA 的影响较大[3,4]。OP 早期表现隐匿,其诊断主要以双能 X 线测量骨密度为依据,但并不是所有医疗机构都具备相应检测条件。因此,筛查老年 KOA 合并 OP 的高危人群并分析其影响因素,有助于制定针对性干预措施,对防治 OP、改善 KOA 患者预后具有重要意义。

1 对象与方法

1.1 研究对象

选取 2023 年 1 月至 2025 年 1 月武汉市第一医院收治的 180 例老年 KOA 患者为研究对象。纳入标准:(1)年龄≥60 岁。(2)KOA 诊断参照中华医学会骨科学分会制定的相关标准[5]。①近 1 个月出现膝痛表现;②X 线提示膝关节间隙狭窄,软骨下骨变硬或发生囊性病变,关节边缘有骨刺形成;③关节腔积液检查提示骨关节炎;④年龄≥40 岁;⑤晨僵时间≤30 min;⑥活动时有骨摩擦音。满足①+②、①+③+⑤+⑥或①+④+⑤+⑥即可确诊 KOA。排除标准:因妇科肿瘤或其他原因导致手术切除子宫的非生理性绝经女性;合并甲状腺疾病、长期服用激素或钙剂等,影响骨密度值;合并其他骨代谢性疾病;正在接受抗骨质疏松药物治疗;肝肾功能衰竭;生命体征不平稳;合并精神异常、认知障碍;严重脊柱侧弯,近期使用钡剂造影等,影响骨密度检测值。本研究方案经武汉市第一医院伦理委员会批准(批准文号:[2023]57 号)。所有受试者均在参与研究前签署书面知情同意书。研究符合《赫尔辛基宣言》。

1.2 方法

1.2.1 骨密度检测及 OP 诊断 采用双能 X 线骨密度仪(美国 Hologic 公司,型号:Discovery-Wi)检测患者腰椎 L1~L4、左侧股骨颈及左侧髋部骨密度。检查人员熟悉掌握双能 X 线骨密度仪检测方法,仪器使用前对其进行开机质控与校准,精确度变异系数<1%。要求被检测者均采用前后位腰椎骨密度测量标准体位与髋部骨密度检测标准体位进行站位,由同一位检测人员进行检查操作,以减小检查误差。T 值=(测量值-同性别、同种族正常成人骨峰值)/正常人骨密度标准差,参照世界卫生组织最新标准[6]诊断 OP:T 值≤-2.5 为 OP,-2.5<T 值<-1.0 为骨量减少,T 值≥-1.0 为骨量正常,任意一处骨密度 T 值≤-2.5即可诊断为 OP。此外,患者已发生髋部或椎体脆性骨折(即轻微外力下发生的骨折),或骨密度检测提示骨量减少+肱骨近端、骨盆或前臂远端脆性骨折,均可诊断为 OP。根据是否合并 OP,将老年 KOA 患者分为共病组(n=109)和对照组(n=71)。

1.2.2 资料收集 (1)一般资料:包括年龄、性别、体质量指数(body mass index, BMI)、糖尿病、高血压、文化程度、是否退休、劳动类型、住房爬楼情况、睡眠障碍、吸烟史、饮酒史、运动频率、跌倒史及骨折史。(2)KOA 病情相关资料:包括 KOA 患病侧别、Kellgren-Lawrence(K-L)分级[7](分为 0~Ⅳ级,0 级为 X 线表现正常,分级越高,病变程度越严重)、膝关节疼痛视觉模拟量表(visual analog scale, VAS)评分[8](VAS 评分 0~10 分,0 分表示无痛,10 分表示不能忍受的剧烈疼痛,1~3 分为轻度疼痛,4~6 分为中度疼痛,≥7 分为重度疼痛)、治疗方式及患病时间。(3)实验室指标:包括 25 羟基维生素 D_3[25-hydroxyvitamin D_3, 25-(OH)D_3]、血红蛋白(hemoglobin, HGB)、血清白蛋白(albumin, ALB)、血尿酸(serum uric acid,SUA)、血磷及血钙。

1.3 统计学处理

采用 SPSS 26.0 统计软件进行数据分析。计量资料呈正态分布者以均数±标准差($\bar{x}\pm s$)表示,组间比较采用独立样本 t 检验;计数资料以例数(百分率)表示,组间比较采用 χ^2 检验。采用多因素 logistic 回归模型分析影响老年 KOA 患者合并 OP 的相关因素。P<0.05 为差异有统计学意义。

2 结 果

2.1 两组患者一般资料

两组患者性别、年龄、BMI、运动频率、近 3 年跌

倒史、近3年骨折史比较,差异均有统计学意义($P<0.05$;表1)。

表1 两组患者一般资料比较

Table 1 Comparison of general data between two groups

[n(%)]

Item	Comorbidity group(n=109)	Control group(n=71)	χ^2	P value
Gender			5.264	0.022
Male	38(34.86)	37(52.11)		
Female	71(65.14)	34(47.89)		
Age			6.717	0.010
60-80 years	40(36.70)	40(56.34)		
≥80 years	69(63.30)	31(46.66)		
BMI			12.112	0.002
<18.5 kg/m^2	25(22.93)	8(11.27)		
18.5-24 kg/m^2	64(58.72)	34(47.89)		
≥24 kg/m^2	20(18.35)	29(40.84)		
Education level			0.211	0.900
Primary school and below	35(32.11)	21(29.58)		
Middle school	50(45.87)	35(49.29)		
Junior college or above	24(22.02)	15(21.13)		
Retirement	92(84.40)	56(78.87)	0.900	0.343
Type of labor			0.407	0.524
Manual labor	75(68.81)	52(73.24)		
Mental labor	34(31.19)	19(26.76)		
Living condition			3.008	0.083
No elevator high-rise	47(43.12)	40(56.34)		
Elevator room/low floor	62(56.88)	31(43.66)		
Sleep disorder	43(39.45)	18(25.35)	3.814	0.051
Smoking history	23(21.10)	13(18.31)	0.209	0.647
Alcohol drinking history	16(14.68)	12(16.90)	0.162	0.688
Exercise frequency			10.323	0.006
Never	35(32.11)	9(12.67)		
1-3 times/week	47(43.12)	33(46.48)		
≥4 times/week	27(24.77)	29(40.85)		
History of fracture in the recent three years	32(29.36)	6(8.45)	11.284	<0.001
History of fall in the recent three years	17(15.60)	3(4.23)	5.629	0.018
Diabetes mellitus	13(11.93)	9(12.68)	0.023	0.881
Hypertension	17(15.60)	16(22.54)	1.383	0.240
Hyperlipidemia	8(7.34)	6(8.45)	0.074	0.786
Cardiovascular disease	11(10.09)	5(7.04)	0.494	0.482
Kidney disease	3(2.75)	3(4.23)	0.290	0.591
Lung disease	5(4.59)	6(8.45)	1.119	0.290
Digestive system disease	12(11.01)	10(14.08)	0.379	0.538

BMI: body mass index.

2.2 两组患者KOA病情资料

共病组患者K-L分级Ⅲ~Ⅳ级、膝关节疼痛VAS评分≥4分者占比均高于对照组,差异均有统计学意义(均$P<0.05$;表2)。

2.3 两组患者实验室指标

共病组患者25-(OH)D_3、HGB、ALB、SUA以及血钙水平均低于对照组,差异均有统计学意义($P<0.05$;表3)。

2.4 影响老年KOA患者合并OP的多因素logistic回归分析

以老年KOA患者是否合并OP作为因变量,将表1、2、3中有统计学意义的指标作为自变量进行赋值(表4),行多因素logistic回归分析,发现女性、BMI<18.5 kg/m^2、近3年骨折史、膝关节疼痛VAS评分≥4分是老年KOA患者合并OP的危险因素,BMI≥24 kg/m^2、运动频率≥4次/周、25-(OH)D_3水平是其保护因素($P<0.05$;表5)。

3 讨 论

KOA及OP的发生均与年龄密切相关,老年群体KOA及OP发生率均明显高于年轻人,且有研究显示,KOA与OP的危险因素存在交叉部分[9]。本研究180例老年KOA患者中有109例(60.56%)合并OP,提示老年KOA患者普遍合并OP。OP对KOA病情及治疗产生一定影响,胡楠等[10]研究发现,合并OP会加速KOA病情进展,降低患者生活质量。刘蒙飞等[11]研究发现,OP易引起KOA患者单踝置换术后膝关节内部结构生物力学异常,增加术后并发症及后期翻修风险,降低治疗效果。且已有学者提出,抗骨质疏松治疗在缓解KOA病程进展,降低患者手术率中具有重要意义[12,13]。但OP的诊断主要依靠双能X线,不少基线医院无条件开展,因此,积极筛查合并OP的高危KOA患者并分析其影响因素,有助于临床针对KOA患者制定个性化干预措施,改善其预后。

本研究经多因素logistic回归分析发现,女性、BMI<18.5 kg/m^2、近3年骨折史、膝关节疼痛VAS评分≥4分是老年KOA患者合并OP的危险因素,BMI≥24 kg/m^2、运动频率≥4次/周、25-(OH)D_3水平是其保护因素。分析其原因:(1)雌激素可抑制骨吸收、促进骨形成、调节钙代谢,在维持骨代谢中具有重要意义。女性KOA患者更易合并OP,可能与老年女性绝经后雌激素水平降低有关[14]。(2)BMI与OP的关系密切,本研究发现,BMI<18.5 kg/m^{2}为老年KOA患者合并OP危险因素,而BMI≥24 kg/m^{2}则为其保护因素。有研究发现,高水平BMI者可借助体质量优势为骨骼提供更高的机械负荷,促进成骨,提高骨细胞活跃度,进而减少OP患病率[15]。同时,脂肪组织也是分泌雌激素的重要来源,可提高绝经后女性机体雌激素水平,发挥抗OP功效[16]。基于此,建议临床重视对低BMI老年KOA患者的OP筛查。(3)有近3年骨折史者合并OP的风险更高,这与OP患者本身更易发生骨折,而骨折史也提示OP

表 2 两组患者 KOA 病情资料比较

Table 2 Comparison of KOA disease data between two groups [n(%)]

Group	n	KOA affected side			K-L grading		Knee pain VAS score		Treatment method	
		Left	Right	Bilateral	Ⅰ-Ⅱ	Ⅲ-Ⅳ	1-3 points	≥4 points	Conservative treatment	Surgical treatment
Comorbidity	109	44(40.37)	48(44.04)	17(15.60)	40(56.34)	31(43.66)	55(50.46)	54(49.54)	48(44.04)	61(55.96)
Control	71	26(36.62)	36(50.70)	9(12.68)	40(56.34)	31(43.66)	48(67.61)	23(32.39)	35(49.30)	36(50.70)
χ^2		0.819			7.379		5.164		0.479	
P value		0.664			0.007		0.023		0.489	

KOA: knee osteoarthritis; K-L: Kellgren-Lawrence; VAS: visual analogue scale.

表 3 两组患者实验室指标比较

Table 3 Comparison of laboratory indicators between two groups ($\bar{x}\pm s$)

Group	n	25-(OH)D_3(μg/L)	HGB(g/L)	ALB(g/L)	SUA(μmol/L)	P(mmol/L)	Ca(mmol/L)
Comorbidity	109	15.15±2.79	124.15±35.67	32.15±5.43	295.15±34.19	1.39±0.21	2.46±0.49
Control	71	23.84±3.11	141.32±37.43	36.87±5.75	310.77±35.09	1.42±0.23	2.81±0.53
t		19.514	3.095	5.568	2.965	0.902	4.535
P value		<0.001	0.002	<0.001	0.003	0.368	<0.001

25-(OH)D_3: 25-hydroxyvitamin D_3; HGB: hemoglobin; ALB: albumin; SUA: serum uric acid; P: phosphorus; Ca: calcium.

表 4 变量赋值

Table 4 Variable assignment

Factor	Variable	Assignment method
Concurrent OP	Y	No=0, Yes=1
Gender	X1	Male=0, Female=1
Age	X2	60-80 years =0, ≥80 years =1
BMI	X3	18.5-24.0 kg/m^2=0, <18.5 kg/m^2=1, ≥24.0 kg/m^2=2
Exercise frequency	X4	Never exercise=1, 1-3 times/week=2, ≥4 times/week=3
History of fall in the recent three years	X5	No=0, Yes=1
History of fracture in the recent three years	X6	No=0, Yes=1
K-L grading	X7	Ⅰ-Ⅱ=0, Ⅲ-Ⅳ=1
Knee pain VAS score	X8	1-3 points =1, ≥4 points=2
25-(OH)D_3	X9	Actual value input
HGB	X10	Actual value input
ALB	X11	Actual value input
SUA	X12	Actual value input
Ca	X13	Actual value input

OP: osteoporosis; BMI: body mass index; K-L: Kellgren-Lawrence; VAS: visual analogue scale; 25-(OH)D_3: 25-hydroxyvitamin D_3; HGB: hemoglobin; ALB: albumin; SUA: serum uric acid; Ca: calcium.

表 5 影响老年 KOA 患者合并 OP 的多因素 logistic 回归分析

Table 5 Multivariate logistic regression analysis of OP in elderly patients with KOA

Factor	β	*SE*	*Wald* χ^2	*OR*	95%*CI*	*P* value
Female	0.785	0.243	10.436	2.192	1.362-3.530	0.001
Age ≥80 years	0.669	0.451	2.200	1.952	0.807-4.725	0.139
BMI						
18.5-24 kg/m^2	-	-	-	1.000	-	-
<18.5 kg/m^2	0.579	0.116	24.914	1.984	1.421-2.240	<0.001
≥24 kg/m^2	-0.345	0.102	11.440	0.708	0.580-0.865	<0.001
Exercise frequency						
Never	-	-	-	1.000	-	-
1-3 times/week	-0.267	0.168	2.526	0.766	0.551-1.064	0.113
≥4 times/week	-0.324	0.135	5.760	0.723	0.555-0.942	0.017
History of fracture in the recent three years	0.579	0.218	7.054	1.784	1.164-2.735	0.008
History of fall in the recent three years	0.693	0.526	1.736	2.000	0.713-5.607	0.188
K-L grade Ⅲ-Ⅳ	0.463	0.317	2.133	1.589	0.854-2.957	0.145
Knee pain VAS score≥4 points	0.446	0.143	9.727	1.562	1.180-2.067	0.020
25-(OH)D_3	-0.389	0.115	11.442	0.678	0.541-0.849	<0.001
HGB	-0.294	0.184	2.553	0.745	0.520-1.069	0.111
ALB	-0.339	0.249	1.854	0.712	0.437-1.161	0.174
SUA	-0.334	0.298	1.256	0.716	0.399-1.284	0.263
Ca	-0.415	0.302	1.888	0.660	0.365-1.194	0.170

KOA: knee osteoarthritis; OP: osteoporosis; BMI: body mass index; K-L: Kellgren-Lawrence; VAS: visual analogue scale; 25-(OH)D_3: 25-hydroxyvitamin D_3; HGB: hemoglobin; ALB: albumin; SUA: serum uric acid; Ca: calcium. -: no datum.

患病高风险有关,故应重视对有骨折史的老年KOA患者进行OP筛查。(4)膝关节疼痛VAS评分≥4分的KOA患者可能会因疼痛限制活动,出现强迫体位,进而产生失用性骨密度降低,增加OP患病率。同时,本研究发现,运动频率≥4次/周是老年KOA患者合并OP的保护因素,证实运动及锻炼对预防OP的重要性。基于此,建议临床除了积极缓解KOA患者疼痛症状外,还需加强运动在防治OP中重要性的相关健康宣教,提升患者运动效能与运动依从性。(5)25-(OH)D_3是反映机体维生素D水平的指标,维生素D能直接抑制骨骼矿物质化,进而增加骨骼钙释放,抑制骨骼钙结合,在维持循环钙浓度中具有重要作用[17]。因此,补充维生素D在防治老年KOA患者OP中也具有重要意义。

综上,老年KOA患者普遍合并OP,临床应重视对女性、低BMI、近3年骨折史及膝关节疼痛VAS评分≥4分的老年KOA患者的OP筛查,同时建议此类患者积极进行体育锻炼、补充维生素D,以防治OP。但本研究所纳入的样本量较小,且均来源于同一所医院,样本代表性较弱,所得结论存在一定偏倚。

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