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微创踝关节融合术治疗老年创伤性踝关节炎中的临床效果及对患者氧化损伤与骨代谢的影响 *

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摘要 目的：研究微创踝关节融合术治疗老年创伤性踝关节炎中的临床效果及对患者氧化损伤与骨代谢的影响。**方法：**收集2014年3月至2015年3月我院收治的94例老年创伤性踝关节炎患者，按随机数表法分为实验组和对照组，每组各45例。两组患者在手术前均进行常规检查，对照组采用常规开放式踝关节融合术，实验组采用微创踝关节融合术。对比两组治疗后血清氧化损伤指标肌红蛋白(MYO)、缺血修饰白蛋白(IMA)、总抗氧化能力(TAC)、丙二醛(MDA)水平，骨代谢指标碱性磷酸酶(ALP)、酸性磷酸酶(ACP)、甲状旁腺素(PTH)、骨钙素(BGP)、降钙素(CT)水平，视觉疼痛模拟评分(VAS)、美国矫形外科足踝协会(AOFAS)评分及不良反应的发生情况。**结果：**治疗后，实验组血清MYO、IMA、MDA水平显著低于对照组[(20.48± 2.59)ng/mL vs. (27.07± 2.97)ng/mL，(65.68± 8.20)U/L vs. (74.27± 9.01)U/L，(5.01± 1.03)nmol/L vs. (9.64± 2.17)nmol/L](P＜0.05)，血清TAC水平显著高于对照组[(11.40± 2.50)kU/L vs. (7.36± 1.03)kU/L](P＜0.05)；血清ALP、BGP、CT水平均显著高于对照组[(103.28± 12.47)U/L vs. (90.53± 10.02)U/L，(11.08± 1.42)ng/L vs. (8.01± 1.23)ng/L，(61.39± 5.87)ng/L vs. (50.28± 4.92)ng/L](P＜0.05)，ACP、PTH水平均显著低于对照组[(5.21± 0.60)U/L vs. (8.03± 0.92)U/L，(42.95± 5.38)ng/L vs. (60.49± 6.92)ng/L](P＜0.05)；VAS评分显著低于对照组[(1.06± 0.23)分 vs. (3.79± 0.67)分](P＜0.05)，AOFAS评分显著高于对照组[(73.02± 6.28)分 vs. (65.58± 5.13)分](P＜0.05)；不良反应总发生率显著低于对照组[6.66%(3/45) vs. 20.41%(10/49)](P＜0.05)。**结论：**微创踝关节融合术可调节老年创伤性踝关节炎患者的骨代谢，增强骨密度，减少术后不良反应，有利于改善患者预后。

关键词：微创踝关节融合术；创伤性踝关节炎；术后创伤；骨代谢

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Effect of Minimally Invasive Ankle Arthrodesis on the Postoperative Trauma and Bone Metabolism in Elderly patients with Traumatic Ankle Arthritis*

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ABSTRACT Objective: To study clinical effect of minimally invasive ankle arthrodesis for elderly patients with traumatic ankle arthritis and its effects on oxidative damage and bone metabolism. **Methods:** 94 cases of elderly patients with traumatic ankle arthritis treated in our hospital were selected as the research objects. According to the random number table, they were divided into the control group and the experimental group, with 45 cases in each group. Routine examinations were performed before operation in the two groups, the control group was treated with conventional open ankle arthrodesis, while the experimental group was treated with minimally invasive ankle arthrodesis. The levels of MYO, IMA, TAC, MDA, bone metabolism index alkaline phosphatase (ALP), acid phosphatase (ACP), parathyroid hormone (PTH), osteocalcin (BGP), calcitonin (CT), and visual pain analogue score (VAS), Orthopaedic foot and ankle Association (AOFAS) score and adverse reactions in the US were compared between the two groups after treatment. **Results:** After treatment, The levels of serum MYO, IMA and MDA in the experimental group were significantly lower than those in the control group[(20.48± 2.59) ng/mL vs. (27.07± 2.97) ng/mL,(65.68± 8.20) U/L vs. (74.27± 9.01) U/L,(5.01± 1.03) nmol/L vs. (9.64± 2.17) nmol/L](P＜0.05), The level of serum TAC was significantly higher than that of the control group [(11.40± 2.50)kU/L vs. (7.36± 1.03) kU/L](P＜0.05); The level of serum ALP, BGP and CT was significantly higher than that of the control group [(103.28± 12.47) U/L vs. (90.53± 10.02) U/L,(11.08± 1.42) ng/L vs. (8.01± 1.23) ng/L, (61.39± 5.87) ng/L vs. (50.28± 4.92) ng/L](P＜0.05), The levels of ACP and PTH were significantly lower than those in the control group [(5.21± 0.60)U/L vs. (8.03± 0.92)U/L, (42.95± 5.38)ng/L vs. (60.49± 6.92)ng/L] (P＜0.05); VAS score was lower than the control group [(1.06± 0.23) vs. (3.79± 0.67)](P＜0.05), AOFAS score was higher than the control group[(73.02± 6.28) vs. (65.58± 5.13)](P＜0.05). The total incidence of adverse reactions was significantly lower than

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that of the control group [6.66%(3/45) vs. 20.41%(10/49)] (P＜0.05). **Conclusion:** Minimally invasive ankle arthrodesis can regulate the bone metabolism in elderly patients with traumatic ankle arthritis, enhance bone density, reduce the postoperative adverse reactions and improve the prognosis of patients.

Key words: Minimally invasive ankle arthrodesis; Traumatic ankle osteoarthritis; Postoperative trauma; Bone metabolism

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前言

外伤、过量负重、承重失衡是导致创伤性踝关节炎的主要因素[1],其早期临床表现为关节疼痛、僵硬、活动受限,若未及时得到有效的治疗,后期严重影响关节功能[2],降低患者的生活质量[3]。创伤性踝关节炎早期可采用非手术治疗,中晚期则需要手术治疗,临床上多以融合术将受损的部位永久与功能位融合[4],但由于创伤大[5],术后可能发生软组织坏死、切口感染等一系列并发症,不利于患者早期锻炼及功能恢复[6]。

随着骨科微创技术的发展,微创踝关节融合术因具有创伤小、恢复快、保护距骨血运的优势而受到广泛关注[7]。近年来,国内外学者的研究发现[8]氧化损伤指标如肌红蛋白(MYO)[9]、缺血修饰白蛋白(IMA)[10]、总抗氧化能力(TAC)[11]、丙二醛(MDA)的表达变化有助于评价创伤性踝关节炎的病情变化[12]。本研究主要探讨了微创踝关节融合术对老年创伤性踝关节炎的氧化损伤和骨代谢的影响,结果报道如下。

1 资料与方法

1.1 一般资料

选择我院收治的 94 例老年创伤性踝关节炎患者, 均符合创伤性踝关节炎诊断标准[13]:经 X 线检查显示关节间隙变窄,边缘出现骨刺增生,关节面不平或出现关节内游离体,裸关节肿胀、疼痛、活动度减小等。纳入耐手术者;无其他严重疾病;心肺肝肾功能正常; 既往有裸关节组织受损而出现关节不稳;无凝血异常;配合研究者;排除患有感染性疾病;跟骨二次骨折;皮肤条件差。按随机数表法将所有患者随机分为两组:对照组 25 例男,20 例女,年龄 55~80 岁,平均(72.47± 3.86)岁,左侧 26 例,右侧 19 例,既往有 20 例裸关节炎骨折,15 例距骨骨折,9 例踝关节不稳;实验组 27 例男,22 例女,年龄 56~80 岁,平均(73.50± 3.90)岁,左侧 26 例,右侧 23 例,既往有 22 例踝关节炎骨折,16 例距骨骨折,11 例踝关节不稳。两组患者的性别、年龄、骨折部位等比较差异均无统计学意义(P>0.05),具有可比性。本研究经医院伦理委员会许可,由患者及家属签署知情同意书。

1.2 治疗方法

术前:采用 X 线观察患者的病变范围、情况并制定手术方案,采用腰硬联合麻醉,取仰卧位,对照组采用常规开放式踝关节融合术。

术中:实验组采用微创踝关节融合术治疗,将切口定于患肢跟腱外侧,行纵向切口,使内侧跟距关节充分暴露后,对其软骨面进行处理, 暴露跟骨关节间隙, 在 C 型臂 X 线机的观察下,将两枚克氏钉钻入胫骨远端至距骨方向作临时固定,随后将异体骨置入踝关节间隙处,沿克氏针将合适直径的两枚空心拉力螺钉拧入、固定。

术后:放置引流条、闭合切口后采用石膏固定,给予抗生素治疗,3 个月后拆除石膏进行功能训练。

1.3 观察指标[14]

观察两组治疗前后血清氧化损伤指标 (肌红蛋白(MYO)、缺血修饰白蛋白(IMA)、总抗氧化能力(TAC)、丙二醛(MDA)水平)、骨代谢指标(碱性磷酸酶(ALP)、酸性磷酸酶(ACP)、甲状旁腺素(PTH)、骨钙素(BGP)、降钙素(CT))水平,视觉疼痛模拟评分(VAS),美国矫形外科足踝协会(AOFAS)评分的变化及不良反应的发生情况。

1.3.1 **视觉模拟评分法** (VAS) 分值为 0~10 分,0~2 分为优;3～5 分为良;6～8 分为可;9～10 分为差[15]。

1.3.2 **美国矫形外科足踝协会** (AOFAS) 90~100 分为优,75~89 分为良,50~74 分为一般,小于 50 分为差[16]。

1.3.3 **指标检测** 两组于治疗后采集静脉血, 离心分离血清,采用酶联免疫吸附法检测血清氧化损伤指标 MYO、IMA、TAC、MDA 水平,试剂盒均来自南京建成生物工程研究所。采用电化学发光法检测骨代谢指标 ALP、BGP、ACP、PTH、CT 水平。

1.4 统计学分析

以 SPSS18.0 软件包处理数据,计量资料均为正态分布,以均数± 标准差表示,组间比较采用独立样本 t 检验,计数资料以率表示,组间比较采用 x^2 检验,以 P＜0.05 为差异具有统计学意义。

2 结果

2.1 两组治疗后血清氧化损伤指标水平的对比

治疗后,实验组血清 MYO、IMA、MDA 水平显著低于对照组(P＜0.05),血清 TAC 水平显著高于对照组(P＜0.05),见表 1。

表 1 两组治疗后血清氧化损伤指标水平对比($\bar{x}$± s)

Table 1 Comparison of the serum oxidative damage indices between the two groups after treatment($\bar{x}$± s)

Groups	n	MYO(ng/mL)	IMA(U/L)	TAC(kU/L)	MDA(nmol/L)
Experimental group	45	20.48± 2.59*	65.68± 8.20*	11.40± 2.50*	5.01± 1.03*
Control group	49	27.07± 2.97	74.27± 9.01	7.36± 1.03	9.64± 2.17

Note: vs control group, *P<0.05.

2.2 两组治疗后血清骨代谢指标水平的对比

治疗后，试验组血清 ALP、BGP、CT 水平均显著高于对照组，而血清 ACP、PT 水平均明显低于对照组(P＜0.05)，见表 2。

表 2 两组治疗后血清骨代谢指标水平的对比($\bar{x}\pm s$)

Table 2 Comparison of the serum levels of bone metabolism between the two groups after treatment($\bar{x}\pm s$)

Groups	n	ALP(U/L)	ACP(U/L)	PTH(ng/L)	BGP(ng/L)	CT(ng/L)
Experimental group	45	103.28± 12.47*	5.21± 0.60*	42.95± 5.38*	11.08± 1.42*	61.39± 5.87*
Control group	49	90.53± 10.02	8.03± 0.92	60.49± 6.92	8.01± 1.23	50.28± 4.92

Note: vs before treatment, #P<0.05, vs the control group, *P<0.05.

2.3 两组治疗前后 VAS、AOFAS 评分对比

两组治疗前 VAS、AOFAS 评分比较均无统计学差异 (P＞0.05)，治疗后，两组 VAS 评分均较治疗前明显降低，而 AOFAS 评分均明显高于治疗前(P＜0.05)，且试验组 VAS 评分均较对照组明显降低，而 AOFAS 评分显著高于对照组，见表 3。

表 3 两组治疗前后 VAS、AOFAS 评分的对比($\bar{x}\pm s$，分)

Table 3 Comparison of the VAS and AOFAS score between the two groups before and after treatment($\bar{x}\pm s$, scores)

Groups	n	VAS		AOFAS	
		Before treatment	After treatment	Before treatment	After treatment
Experimental group	45	8.02± 1.38	1.06± 0.23*#	41.50± 4.16	73.02± 6.28*#
Control group	49	7.98± 1.34	3.79± 0.67#	40.98± 4.30	65.58± 5.13#

Note: vs before treatment, #P<0.05, vs the control group, *P<0.05.

2.4 两组不良反应发生情况的对比

试验组不良反应如感染、骨折不愈合、力线异常等的发生率均明显低于对照组(P＜0.05)，见表 4。

表 4 两组不良反应发生情况的对比[例(%)]

Table 4 Comparison of the incidence of adverse reactions between the two groups[n(%)]

Groups	n	Infection	Nonunion of bone	Abnormality of force line	Refurbishment	Total incidence
Experimental group	45	1(2.22)	0(0.00)	2(4.44)	0(0.00)	3(6.66)*
Control group	49	3(6.12)	4(8.16)	1(2.04)	2(4.08)	10(20.41)

Note: vs the control group, *P<0.05.

3 讨论

踝关节是是承载人体重量的重要关节部位，老年患者由于的身体机能逐步降低，骨质发生改变，创伤性踝关节是临床上常见的骨科疾病[17]。当踝关节受到创伤性损伤时，关节的机械力加载会出现改变，可通过手术修复恢复关节功能，但不可避免会造成关节损伤后改变[18-20]。创伤性踝关节炎多由暴力、过度负重等造成，反应性损伤、炎性细胞、关节软骨等多种因素均可导致关节早期退变[21-23]。随着时间的变化以及社会老龄化的发展，该病的发生率也越来越多[24]。踝关节融合术能够缓解患者的疼痛、矫正畸形，稳定关节功能，是治疗踝关节炎的理想方法[25]。但传统融合术需要将关节彻底暴露，创伤较大[26]，术后骨不连、假关节、畸形、感染等不良反应较严重[27]，应用受到限制[28]。

微创踝关节融合术具有创伤小、恢复快的特点[29]，其可减少大面积骨膜剥离、皮瓣坏死[30]，保护距骨血运，减轻术后疼痛、利于早期功能锻炼[31,32]。此外，其可在直视下切除关节软骨面，能够保证硬化骨的彻底清除[33]，且不会对周围软组织造成较大的损伤，减少对局部血液供应的破坏[34]，更有利于术后植骨融合[35]。国内外研究表明[36-38]踝关在手术入路稳定性及融合性作用较好。本研究显示采用微创踝关节融合术治疗的患者 VAS、AOFAS 评分均显著优于采用传统踝关节融合术治疗的患者，说明微创踝关节融合术能够显著缓解患者的疼痛[39]，且更能够促进踝关节活动功能的恢复[40]。此外，采用微创踝关节融合术治疗的患者不良反应总发生率显著低于对照组，表明微创融合术对患者造成的创伤更小，有利于促进术后愈合[41]。

研究表明[42,43]骨关节损伤本身会对患者造成较大的痛苦，加上麻醉及术后疼痛，会增加患者的疼痛感，而手术创伤不可避免会对患者体内的多种因子水平造成改变[44]，创伤及疼痛会诱发机体出现氧化应激反应[45]。骨科手术后，部分患者因疼痛而拒绝早期功能锻炼，长期卧床休息极其容易引发褥疮、肺炎、深静脉血栓等并发症，不利于术后康复，严重的可导致患者死亡[46]。当氧化应激发生后，血清 MYO、IMA、MDA 水平会出现显著上升，血清 TAC 水平下降[47]。在本研究中，两组患者经过手术后血清 MYO、IMA、TAC、MDA 水平均出现异常改变，但

采用微创踝关节融合术治疗的患者血清 MYO、IMA、MDA 水平更低，提示微创术式能够减少创伤性应激反应，减轻对机体造成的损伤[48]。骨细胞平衡可反映骨关节功能，ALP、BGP、CT、ACP、PTH 是常见典型骨代谢指标[49]。本研究结果显示采用微创踝关节融合术治疗的患者 ALP、BGP、CT、ACP、PTH 水平显著优于采用传统踝关节融合术治疗的患者，表明微创术式能够调节骨代谢，促进骨折端愈合[50]。

综上所述，微创踝关节融合术可调节老年创伤性踝关节炎患者的骨代谢，增强骨密度，减少术后不良反应，有利于改善患者预后。

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