

吸烟对开放楔形胫骨高位截骨术后 截骨间隙骨愈合影响的 Meta 分析

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摘要 目的: 系统评价吸烟对开放楔形胫骨高位截骨术(high tibial osteotomy, HTO)后截骨间隙骨愈合的影响。方法: 应用计算机检索 PubMed、Cochrane Library、Embase、中国知网、维普网和万方数据库收录的有关吸烟对开放楔形 HTO 术后截骨间隙骨愈合影响的研究文献, 检索时限为数据库建库至 2022 年 6 月 30 日。由 2 名研究人员独立按照纳入和排除标准对相关文献进行筛选和数据提取, 采用纽卡斯尔-渥太华量表进行文献质量评价后, 采用 RevMan5.4 软件进行 Meta 分析, 并采用漏斗图进行发表偏倚分析。结果: 共检索到 35 篇文献, 经过逐层筛选最终纳入 5 篇文献, 均为英文文献。Meta 分析结果显示, 吸烟组开放楔形 HTO 术后截骨间隙骨不愈合率高于非吸烟组[RR=2.52, 95% CI(1.72, 3.67), P=0.000]。结论: 吸烟会增加开放楔形 HTO 术后截骨间隙骨不愈合的风险。

关键词 截骨术; 胫骨; 吸烟; 骨折愈合; 专题 Meta 分析

Effects of smoking on bone healing of osteotomy gap caused by open-wedge high tibial osteotomy: a meta-analysis

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ABSTRACT **Objective:** To systematically review the effects of smoking on bone healing of osteotomy gap caused by open-wedge high tibial osteotomy (OWHTO). **Methods:** All research articles about the effects of smoking on bone healing of osteotomy gap caused by OWHTO included from database establishing to June 30, 2022 were retrieved from PubMed, Cochrane Library, Embase, China National Knowledge Internet, Vip Database and Wanfang Database through computer. The pertinent articles were screened and the information was extracted independently by two researchers according to the inclusion and exclusion criteria. If any disagreement was found between them, discussion was conducted or another researcher was invited for making a final decision. The methodological quality of researches in the articles was evaluated according to Newcastle-Ottawa scale (NOS), and then a Meta-analysis was conducted by using RevMan5.4 software. Furthermore, the publication bias was analyzed by using funnel plot. **Results:** Thirty-five articles were searched out. After screening, 5 English articles were included in the final analysis. The results of Meta-analysis revealed that the bone nonunion rate of osteotomy gap caused by OWHTO was higher in smoking group compared to non-smoking group (RR=2.52, 95% CI(1.72, 3.67), P=0.000). **Conclusion:** Smoking can increase the risk of bone nonunion of osteotomy gap caused by OWHTO.

Keywords osteotomy; tibia; smoking; fracture healing; meta-analysis as topic

膝关节关节炎是临床常见的一种退变性疾病, 其患病率呈上升趋势^[1-3]。正常人膝关节内侧间室承载人体的重量最多, 因此临床上以内侧间室膝关节关节炎最为常见^[4]。开放楔形胫骨高位截骨术(high tibial osteotomy, HTO)是一种治疗内侧间室膝关节关节炎的常用矫形术, 此手术通过调整力线, 将内侧间室的压力部分转移至外侧间室, 从而缓解膝关节疼痛、减缓骨关节炎进程^[5-7]。

开放楔形 HTO 术后截骨间隙骨不愈合的影响因

素较多, 其中吸烟就是一个高危因素。但是, 吸烟是否被纳入 HTO 的排除标准, 目前学界仍然存在争议。有研究^[8-9]认为, 吸烟会对骨和软组织产生负面影响, 增加骨和切口延迟愈合的风险; 但也有研究^[10-11]认为, 吸烟不会影响 HTO 术后截骨间隙骨愈合。为了系统评价吸烟对开放楔形 HTO 术后截骨间隙骨愈合的影响, 我们基于以往的相关临床研究进行了 Meta 分析, 现总结报告如下。

1 资料与方法

1.1 文献纳入标准 ①研究类型为国内外公开发表的队列研究和病例对照研究; ②研究对象为行开放楔

形 HTO 术的内侧间室膝关节炎患者;③暴露因素为吸烟;④结局指标中包括吸烟组和非吸烟组的人数、术后截骨间隙骨不愈合的数据;⑤文献语种为中、英文。

1.2 文献排除标准 ①无法获取全文的文献;②研究数据不完整的文献;③重复发表的文献。

1.3 文献检索 计算机检索 PubMed、Cochrane Library、Embase、中国知网、维普网和万方数据库,检索时限为数据库建库至 2022 年 6 月 30 日。英文检索词为“smoking”“smoking behaviors”“behavior smoking”“behaviors smoking”“smoking behavior”“smoking habit”“habit smoking”“habits smoking”“smoking habits”“high tibial osteotomy”“HTO”;中文检索词为“吸烟”“胫骨高位截骨术”“胫骨截骨”。以 PubMed 为例,检索策略如下:

#1 high tibial osteotomy[Title/Abstract] ;

#2 smoking[MeSH Terms] ;

#3 smoking behaviors[Title/Abstract] OR behavior smoking[Title/Abstract] OR behaviors smoking[Title/Abstract] OR smoking behavior [Title/Abstract] OR smoking habit[Title/Abstract] OR habit smoking[Title/Abstract] OR habits smoking[Title/Abstract] OR smoking habits[Title/Abstract] ;

#2 OR #3 ;

#1 AND #2 OR #3

1.4 文献筛选与数据提取 由 2 名研究人员独立按照纳入和排除标准对相关文献进行筛选和数据提取,意见存在分歧时双方讨论解决或交予第 3 位研究者决定。从纳入研究的文献中提取题名、期刊、第 1 作者、发表时间、样本量、研究类型、随访时间等信息。

1.5 文献质量评价 采用纽卡斯尔-渥太华量表(Newcastle-Ottawa scale, NOS)^[12-13]对纳入研究的文献进行质量评估,该量表主要包括研究人群选择、可比性、暴露评价或结果评价 3 个因素来评估,该量表

主要包括研究人群选择(4 项条目)、研究方法可比性比较(2 项条目)、暴露或结局评价(3 项条目),共 3 部分 9 个条目,条目内提示给分点,满足记 1 分,总分共 9 分。总评分 ≥ 6 分的文献认为是高质量文献。2 位研究者独立评估文献质量,得分不一致时交予第 3 位研究者评估决定。

1.6 数据统计 采用 RevMan5.4 软件进行 Meta 分析。截骨间隙骨不愈合率以 RR 为综合效应量。采用 I^2 检验判断不同研究之间的异质性, $I^2 < 50\%$ 表明各项研究之间异质性较小,采用固定效应模型进行 Meta 分析; $I^2 \geq 50\%$ 表明各项研究之间异质性较大,采用随机效应模型进行 Meta 分析。Meta 分析检验水准 $\alpha = 0.05$ 。采用漏斗图分析发表偏倚情况。

2 结 果

2.1 文献筛选及质量评价结果 共检索到 35 篇文献,排除重复文献 6 篇,阅读题目和摘要后排除不相关文献 18 篇,阅读全文后排除数据不充分文献 6 篇,最终纳入 5 篇文献^[9-10,14-16],均为英文文献。纳入研究的基本特征见表 1。纳入研究的 5 篇文献质量均较高,NOS 评分均 ≥ 6 分(表 2)。

2.2 Meta 分析结果 5 篇文献均分析了吸烟与开放楔形 HTO 术后截骨间隙骨不愈合之间的关系。各研究之间无明显异质性;固定效应模型分析结果显示,吸烟组开放楔形 HTO 术后截骨间隙骨不愈合率高于非吸烟组(图 1)。

2.3 发表偏倚分析结果 基于开放楔形胫骨高位截骨术后截骨间隙骨不愈合率的发表偏倚风险分析结果显示,5 项研究的分布不完全对称,不排除存在发表偏倚的可能(图 2)。

3 讨 论

内侧开放楔形 HTO 被认为是减轻内侧间室膝关节炎患者内侧间室负荷的首选方法。与外侧闭合楔形 HTO 相比,内侧开放楔形 HTO 具有以下优点:无需行腓骨截骨,可以降低腓神经损伤的风险,并且

表 1 纳入研究的基本特征

研究	样本量/例		平均年龄/岁	研究类型	随访时间/年
	吸烟组	非吸烟组			
Floerkemeier2014 ^[9]	72	314		病例对照研究	3.6
Dornacher2021 ^[10]	36	60	41.4	病例对照研究	1.5
Meidinger2011 ^[14]	46	140	43.7	病例对照研究	3
van Houten2014 ^[15]	58	146	48	病例对照研究	3
W-Dahl2004 ^[16]	34	166	53	队列研究	

表 2 纳入研究的纽卡斯尔-渥太华量表文献质量评价结果

研究	纽卡斯尔-渥太华量表文献质量评分/分									总分
	暴露组的 代表性	非暴露 组的选择 方法	暴露因 素的确定 方法	研究开始 前无需观 察的指标	研究控 制了主 要因素	研究控制 了其他混 杂因素	结局事 件评估	随访的 完整性	暴露组和非 暴露组的随 访是否充分	
Floerkemeier2013 ^[9]	1	1	1	1	1	0	1	1	1	8
Dornacher2021 ^[10]	1	1	1	0	1	0	1	1	1	7
Meidinger2010 ^[14]	1	1	1	0	1	0	1	1	1	7
van Houten2013 ^[15]	1	1	1	0	1	0	1	0	1	6
W-Dahl2004 ^[16]	1	1	1	0	1	0	1	1	1	7

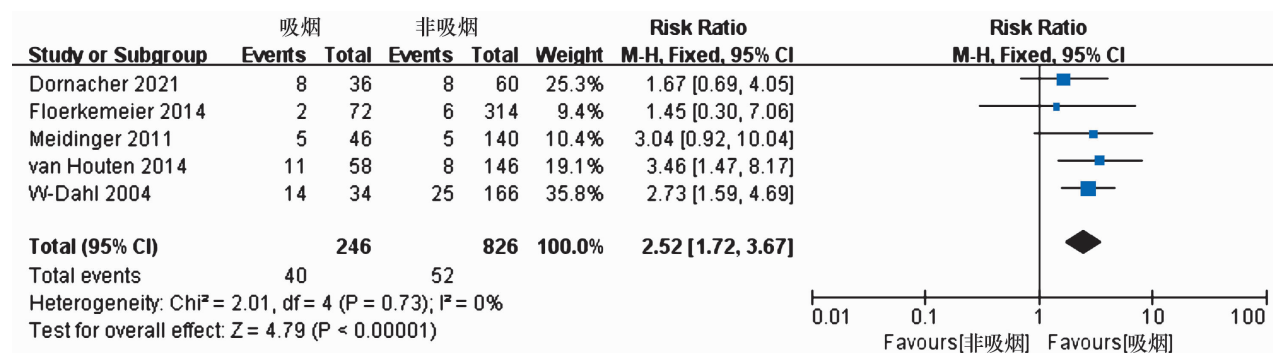


图 1 开放楔形胫骨高位截骨术后截骨间隙骨不愈合率的 Meta 分析森林图

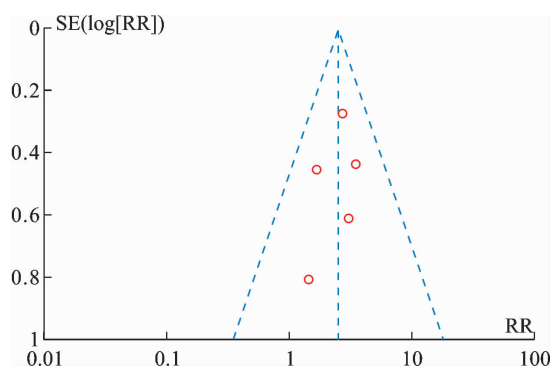


图 2 基于开放楔形胫骨高位截骨术后截骨间隙骨不愈合的发表偏倚漏斗图

可以精确调整矫正角度。Primeau 等^[17-19]研究认为,通过锁定钢板固定可避免矫正角度丢失,降低因机械因素导致的骨不愈合率。

导致开放楔形 HTO 术后截骨间隙骨不愈合的因素较多,主要包括吸烟、吸毒、酗酒、肥胖、高龄、感染、血流灌注减少、糖尿病等^[11,20-22]。吸烟被认为是骨折修复受损的危险因素。尼古丁可以刺激神经末梢和肾上腺释放肾上腺素和去甲肾上腺素,引起血管收缩,增加血流阻力,减慢血流,导致术区血供减少,从而影响骨的愈合^[23]。有研究^[24]认为,香烟燃烧产生的一氧化碳对血红蛋白有很强的亲和力,可以减少截骨部位携带的氧气总量。Cui 等^[25]研究认为,吸烟可以导致小动脉收缩、骨矿物质丢失和血管重建延迟,从而增加骨不愈合的发生率。

Meta 分析结果显示吸烟组开放楔形 HTO 术截骨间隙骨不愈合发生的相对危险因素是非吸烟组的 2.52 倍,提示吸烟会增加开放楔形 HTO 术截骨间隙骨不愈合的风险。Hoogendoorn 等^[26]认为,吸烟应作为所有截骨术的相对禁忌证。Staubli 等^[27-28]同样不建议对吸烟者实施 HTO。van Houten 等^[15,29]的研究结果显示,吸烟是 HTO 术后患者发生骨不连的主要危险因素;并建议患者在行 HTO 之前停止吸烟。Meidinger 等^[14]研究发现,在 HTO 术后发生骨不愈合的患者中,50% 的患者是吸烟者。然而,也有一些研究持相反观点。Dornacher 等^[10]研究认为,吸烟习惯对骨愈合并无明显影响。Floerkemeier 等^[9]研究认为,吸烟在临床上不会影响 HTO 术后骨的愈合,因此吸烟者也可以进行 HTO。Schröter 等^[11]的研究结果显示,不论是吸烟者还是非吸烟者行开放楔形 HTO 术后截骨间隙都存在骨延迟愈合的情况。

现有的研究证据表明,吸烟会增加开放楔形 HTO 术后截骨间隙骨不愈合的风险,临床上行开放楔形 HTO 截骨术需考虑吸烟对于截骨间隙骨愈合的不利影响。但本研究尚存在以下局限性:①纳入研究的文献数量较少;②纳入研究的文献中术后随访时间不同,且缺乏长期临床效果的评价;③纳入研究的文献均来自于国外,无法体现中国人群的特征。

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