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残留轻度内翻不影响弓形股骨膝内翻膝关节置换的临床效果

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[**摘要**] **目的** 探讨全膝关节置换(total knee arthroplasty, TKA)时,残留轻度下肢内翻对股骨外弓膝内翻患者功能的影响。**方法** 采用回顾性队列研究设计,收集2015年1-12月在我科行TKA的152例下肢力线内翻的内侧膝骨关节炎(medial osteoarthritis of the knee, MOA)患者病例资料。根据术后的下肢力线将患者分为3组:轻度内翻(>3°~6°,A组),重度内翻(>6°,B组),中立位(-3°~3°,C组)。平均随访4.3年,比较各组间的国际膝关节协会(international knee society score, KSS)及麦克马斯特大学骨关节炎指数(Western Ontario and McMaster University Osteoarthritis Index, WOMAC)评分。**结果** 随访期间,各组均无患者出现翻修。术后力线分别为A组术前(9.8±3.2)°,术后(4.3±0.6)°;B组术前(10.8±1.6)°,术后(7.1±1.2)°;C组术前(8.8±3.5)°,术后(0.6±1.3)°。术后各组KSS评分均有所提高,与C组[(157.0±29.4)分,$P=0.02$]及B组[(150.9±32.3)分,$P=0.01$]相比,A组总的KSS评分(167.5±26.1)提高更显著;功能评分上,与B组($P=0.04$)及C组($P=0.01$)相比,A组的KSS评分提高更显著;膝关节评分上,A组较B组改善更明显($P=0.03$),但与C组相似。WOMAC评分上,与C组相比,A组具有更低的WOMAC总评分($P=0.02$)、日常活动度($P=0.02$)及僵硬度评分($P=0.03$);B组和C组具有相近的WOMAC评分。**结论** 股骨外弓膝内翻患者行TKA时,残留轻度下肢内翻(>3°~6°)不影响术后的短期效果。

[**关键词**] 膝骨关节炎;全膝关节置换术;股骨外弓;内翻膝
[**中图法分类号**] R615; R684.2; R687.4 [**文献标志码**] A

Slight varus malalignment has no influence on clinical function in patients with femoral lateral bowing after total knee replacement

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[**Abstract**] **Objective** To investigate the effect of residual slight varus malalignment after total knee arthroplasty (TKA) on the function in patients with femoral lateral bowing and medial osteoarthritis of the knee (MOA). **Methods** A retrospective cohort study was performed on 152 patients suffering from femoral lateral bowing and MOA and undergoing TKA in our hospital from January to December 2015. After a mean follow-up period of 4.3 years, the patients were stratified into mild varus (>3°~6°, group A, $n=45$), severe varus (>6°, group B, $n=26$), and neutral (-3°~3°, group C, $n=81$) groups based upon their post-operative alignment. The International Knee Society Score (KSS) and Western Ontario and McMaster University Osteoarthritis Index (WOMAC) scores were compared among the groups. **Results** No implant was revised during the follow-up period. The patients in the group A were averagely corrected from (9.8±3.2)° pre-operatively to (4.3±0.6)° post-operatively, those in the group B from (10.8±1.6)° to (7.1±1.2)°, and those in the group C from (8.8±3.5)° to (0.6±1.3)°. KSS scores were increased following TKA for all the groups. The group A scored significantly better in the total KSS score (167.5±26.1) as compared with the group C (157.0±29.4, $P=0.02$) and group B (150.9±32.3, $P=0.01$). In the functional sub-scores, a

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significantly better score was obtained in the group A when compared with the group B and group C (P = 0.04, 0.01). The knee sub-score of the group A was significantly better than those of the group B (P = 0.03), but was similar to that of the group C. With regard to the WOMAC score, the group A scored significantly lower than the group C in the total score (P = 0.02) and in 2 of the sub-scores (Activities of daily living: P = 0.02; stiffness: P = 0.03). WOMAC scores were similar between the group B and C. **Conclusion** Our study indicates that mild varus malalignment (>3°~6°) didn't influence the effect of TKA for patients with femoral lateral bowing and MOA at the short-term follow-up period.

[**Key words**] osteoarthritis; total knee arthroplasty; femora lateral bowing; varus knees

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传统观点认为,膝关节置换(total knee arthroplasty, TKA)时恢复下肢中立位力线(neutral mechanical axis)可使内外侧平台均匀负重,降低假体磨损及松动,相反,下肢力线恢复不充分则会影响假体的生存率,为避免中远期置换失败,(0±3)°的下肢力线通常被认为是可以接受的[1-5]。然而,术后患者不满意度仍高达20%~25%[6]。BELLEMANS 等[7]的研究指出大部分正常人的下肢力线并不是中立位,而是存在≥3°的内翻,男性、女性占比分别为 32%和 17%,自骨骼发育成熟以来这部分人群下肢力线就处于内翻状态,已适应该内翻力线。如果在 TKA 时采用韧带松解、股骨或胫骨截骨等技术过度矫正下肢力线至中立位,既不正常,还会导致术后膝关节的不自然。研究证实下肢力线内翻与股骨颈干角(femoral neck-shaft angle, NSA)减小、增加的冠状面股骨外弓(coronal femoral lateral bowing, CFLB)以及关节外畸形等有关[8-10]。还有研究指出,与完全恢复中立位相比,对术前下肢力线即存在内翻的患者,残留轻度内翻(>3°~6°)将具有更好的临床功能评分[11-17]。在亚洲地区,股骨冠状面外弓的发病率达到 62%以上[18-19]。在日常临床工作中,我们也发现许多中国患者存在下肢股骨的冠状面外弓,导致术前下肢力线内翻。因此,本研究对股骨存在外弓及内侧膝骨关节炎(medial osteoarthritis of the knee, MOA)的 TKA 术后患者进行随访,将患者术后下肢力线按轻度(>3°~6°)、中度、重度内翻分为 3 组,了解轻度内翻是否影响股骨外弓 MOA 患者术后的功能结果。

1 资料与方法

1.1 一般资料

本研究采用回顾性队列研究设计,对 2015 年 1-12 月在我科完成 TKA 手术的 152 例患者进行随访。比较各组间的 KSS 及 WOMAC 评分,了解轻度内翻是否影响股骨外弓 MOA 患者术后的功能结果。诊断标准:影像学检查提示以内侧间室退行性改变为主,符合 Kellgren-Lawrence 放射学诊断标准Ⅲ级及以上。纳入标准:①疼痛集中在膝关节内侧间室,髌股关节无明显症状,下肢力线内翻;②前交叉韧带及内侧副韧带功能正常;③患者心肺功能等能耐受手术、配合术后康复训练及按时随访;④术前 C 反应蛋白(C-reaction protein, CRP)、降钙素原(procalcitonin, PCT)、血沉(erythrocyte sedimentation rate, ESR)在正常范围;⑤术后 1 年内均未出现感染或肿瘤等情况。排除标准:感染性膝关节炎、创伤性关节炎、胫骨存在畸形、膝关节外翻畸形、既往曾行过股骨或胫骨的截骨矫形手术以及存在除股骨外弓以外原因导致的下肢力线内翻患者。本研究所有患者术前均签署知情同意书。

1.2 手术方式

所有手术由同一个手术医师完成。麻醉生效后,患者取平卧位,术野常规碘伏、酒精消毒,铺无菌巾单。驱血,气囊止血带止血。取膝前正中切口,上起于髌骨上方腱腹交界处,止于胫骨结节内侧 1 cm。切开皮肤、皮下组织,自股直肌与股内侧肌间隙腱腹交界处,向远端沿髌骨内侧切开肌腱、关节囊及髌内侧支持带。切除滑膜及髌下部分脂肪垫,于胫骨结节内侧 1 cm 处切开骨膜,沿骨膜下锐性剥离,初步松解内侧关节囊,将髌骨外翻,屈膝关节,咬骨钳咬除股骨及胫骨骨赘,切除增生滑膜、半月板及前、后交叉韧带。将胫骨平台向前脱位,清理残余滑膜、半月板、骨赘,注意保护内侧副韧带。安装胫骨髓外定位器,胫骨进针点位于髁间嵴前方、前交叉韧带止点中央、胫骨结节内 1/3,与胫骨中心线相一致。安装截骨器,注意保持定位杆指向踝关节中心大约 1、2 趾之间,与胫骨力线平行,于胫骨近端安装胫骨截骨器。垂直胫骨力线沿内侧平台最低点定位截骨厚度,于刻度"0"处定位胫骨平台截骨板并后倾 3°截骨,用摆锯切除胫骨平台关节面,修剪平台边缘,测试胫骨平台假体大小。从股骨髁间窝上方,后交叉韧带止点前 5 mm 置入股骨髓内杆,选取合适外翻角安放定位器。用定位器定位,安放股骨远端截骨器,取下髓内定位器,行股骨远端截骨,以间隙试

模测伸直间隙,见膝关节可完全伸直,力线正常,侧向稳定。测股骨远端假体大小,以合适的外旋角度安放截骨器,分别行股骨前髁、后髁及两个斜面截骨。取下截骨器,以间隙试模测屈膝间隙,见间隙合适,与伸直间隙一致。安放股骨髁间截骨器,稍偏外侧行髁间截骨。于股骨侧、胫骨侧安放假体试模和衬垫,复位后见力线好,关节松紧适宜,屈伸膝关节,见屈伸间隙合适,取出试模冲洗切口,调好骨水泥,计时安放膝关节胫骨、股骨假体及衬垫。伸直位保持计时至骨水泥完全固化后行髌骨去神经化处理,切除髌骨边缘骨赘,修整关节面,测试髌骨运行轨迹良好。大量生理盐水冲洗伤口后复位膝关节,测力线经过髌骨正中,伸屈适宜。清点器械敷料无误,松开止血带止血后逐层缝合髌内侧关节囊、腱膜、皮下、皮肤,敷料覆盖切口,弹力绷带包扎。患者安返病房。人工全膝关节假体由 Smith & Nephew 公司提供。

1.3 术后处理

术后所有患者统一康复治疗方案:麻醉复苏后即开始行踝泵训练,行股四头肌力量和膝关节主被动屈伸功能锻炼;第 2 天无特殊情况所有患者均下地扶助行器行走;术后常规预防血栓、感染,待患者膝关节主动完全伸直、屈曲超过 120°时复查膝关节 X 片及标准的双下肢全长片,根据术后下肢力线(mechanical femorotibial alignment,FTMA)——股骨头中心(H)到膝关节中心(K)的连线与膝关节中心到踝关节中心(A)连线的夹角,将患者分为 A、B、C 3 组,分别为轻度内翻(>3°~6°,n=45),重度内翻(>6°,n=26)及中立位组[(0±3)°,n=81]。分别在术前及术后最后随访点时对患者进行国际膝关节协会(international knee society score, KSS)及西安大略和麦克马斯特大学骨关节炎指数(Western Ontario and McMaster University Osteoarthritis Index , WOMAC)评分。

1.4 术后随访

术后对患者行 KSS、WOMAC 评分,并统计患者术后最后 1 次随访时的相关并发症,主要包括任何原因导致的翻修、无菌性松动、假体周围骨折、假体周围感染(periprosthetic joint infection, PJI)、深静脉血栓形成、麻醉下手法松解或手术松解等。

1.5 统计学分析

对所有随访患者进行下肢力线测量,分析患者术后最后一次随访时的 KSS、WOMAC 评分,所有数据采用 $\bar{x}\pm s$ 表示,符合正态分布的计量资料录入 SPSS 19.0 软件进行独立样本 t 检验,以 P<0.05 为差异有统计学意义。

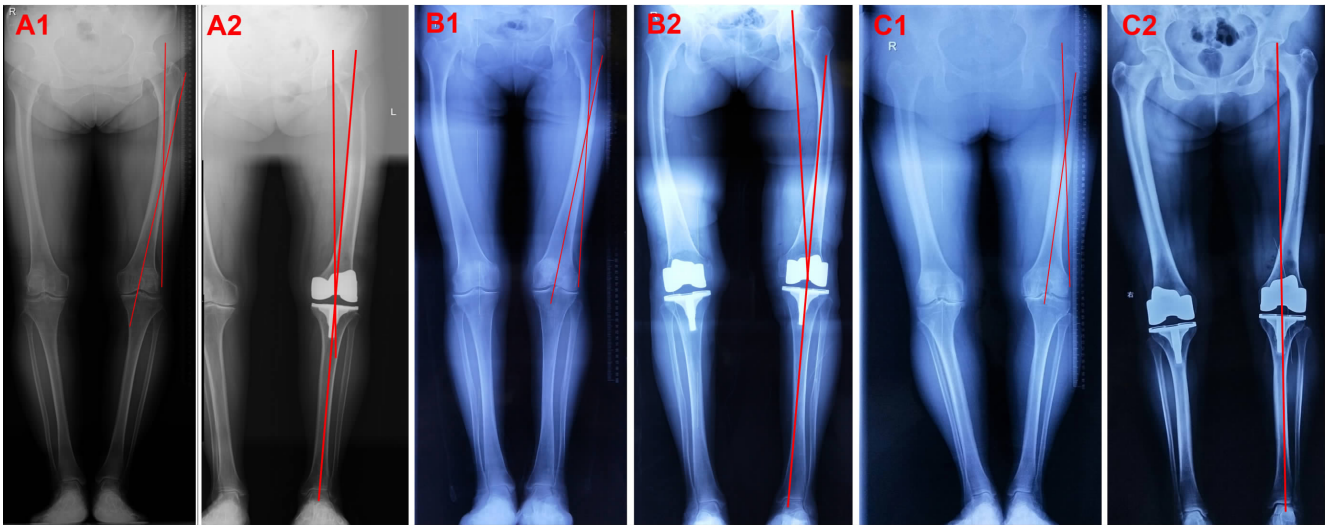
2 结果

2.1 患者基本资料及术前、术后下肢力线测量结果

患者术前基本资料见表 1,所有患者存在下肢股骨的冠状面外弓。A 组从术前的(9.8±3.2)°到术后的(4.3±0.6)°,B 组从术前的(10.8±1.6)°到术后的(7.1±1.2)°,C 组力线从术前的(8.8±3.5)°恢复到术后的(0.6±1.3)°,见图 1。

2.2 随访结果

随访 3.1~5.2 (4.3±1.2)年,到随访终点为止,没有发现因机械性、无菌性松动或聚乙烯磨损造成的翻修患者,没有患者发生假体周围骨折、假体周围感染、深静脉血栓形成、麻醉下手法松解或手术松解等。



A1:轻度内翻组患者术前下肢全长片;A2:轻度内翻组显示术后平均下肢力线为偏离 0°力线 3°~6°;B1:重度内翻组患者术前下肢全长片;B1:重度内翻组显示术后平均下肢力线为偏离 0°力线>6°;C1:中立位力线组患者术前下肢全长片;C2:中立位力线组显示术后下肢力线平均为偏离 0°力线-3°~3°

图 1 合并股骨外弓的内侧膝骨关节炎患者术前下肢全长片及术后下肢力线测量

表 1 术前 3 组患者基线资料($\bar{x}\pm s$,例)

组别	n	年龄/岁	BMI/kg·m^{-2}	女性/男性	术前下肢力线/°
中立位(C 组)	80	73.8±8.1	29.1±4.6	58/23	8.8±3.5
轻度内翻(A 组)	45	74.2±7.9	30.2±4.5	27/18	9.8±3.2
重度内翻(B 组)	26	77.5±7.3	31.2±5.5	14/12	10.8±1.6

表 2 TKA 术前、术后各组患者膝关节 KSS 评分比较($\bar{x}\pm s$,分)

组别	n	术前膝关节评分	术前功能评分	术前总 KSS	术后膝关节评分	术后功能评分	术后总 KSS
中立位(C 组)	81	62.0±12.1	52.0±21.2	114.0±24.2	87.0±12.7	70.0±15.2[b]	157.0±29.4[b]
轻度内翻(A 组)	45	56.1±14	49.9±20.2	106.0±23.3	87.2±13.1[a]	80.3±13.3[a]	167.5±26.1[a]
重度内翻(B 组)	26	60.8±13.2	47.4±23.1	108.2±28.9	79.8±11.2	71.1±12.2	150.9±32.3

a:$P<0.05$,与重度内翻组比较;b:$P<0.05$,与轻度内翻组比较

表 3 TKA 术后各组膝关节 WOMAC 评分比较($\bar{x}\pm s$, 分)

组别	n	疼痛	僵硬	活动度	总体 WOMAC 评分
中立位(C 组)	81	4.3±4.6	2.5±2.0[a]	20.1±18.2[a]	25.3±24.1[a]
轻度内翻(A 组)	45	2.7±3.0	1.6±1.5[b]	11.6±13.2[b]	14.6±15.2[b]
重度内翻(B 组)	26	4.5±4.0	2.8±1.8	24.7±20.5	24.9±20.7

a: $P<0.05$,与轻度内翻组比较;b: $P<0.05$,与重度内翻组比较

如表 2 所示,C 组、A 组及 B 组术前 KSS 评分差异无统计学意义;TKA 术后各组 KSS 评分均有所提高。与 C 组($P=0.02$)及 B 组($P=0.01$)相比,A 组 KSS 评分提高更显著;在功能评分上获得了相近的研究结果,与 C 组及 B 组相比($P=0.01$,$P=0.04$),A 组 KSS 评分提高更显著;膝关节评分上,A 组较 B 组改善更明显($P=0.03$),但与 C 组相似。

如表 3 所示,术后 C 组、A 组及 B 组 WOMAC 疼痛评分差异无统计学意义;僵硬评分 A 组与 C 组($P=0.03$)、A 组与 B 组($P=0.04$)之间差异具有统计学意义;日常活动度(activities of daily living, ADL)评分 A 组与 C 组($P=0.02$)、A 组与 B 组($P=0.04$)之间差异有统计学意义;与 C 组及 B 组相比,A 组具有更低的 WOMAC 评分($P=0.02$,$P=0.01$);C 组和 B 组具有相似的 WOMAC 评分。

3 讨论

3.1 中立位力线及其对 TKA 的传统意义

下肢中立位力线被定义为一条从股骨头中心到距骨中心的直线。传统观点认为,TKA 时需恢复下肢力线至中立位,即膝关节假体的中心位于股骨头中心与踝关节中心连线上,如此可使膝关节内外侧平台均匀负重,避免假体早期磨损及松动,大部分学者认为偏离下肢中立位(0±3)°的下肢力线是可以接受的[20-22]。然而,术后患者不满意度仍高达 20%~25%[6]。

3.2 机械轴变异及股骨冠状面外弓

BELLEMANS 等[7]的研究指出,大部分正常人的下肢力线并不是中立位的,而是存在≥3°的内翻,男、女性占比分别为 32% 和 17%。研究证实下肢力线内翻与股骨颈干角(femoral neck-shaft angle, NSA)减小、增加的冠状面股骨外弓(coronal femoral lateral bowing, CFLB)以及关节外畸形等有关[8-10]。CFLB 在中国乃至亚洲人群中非常普遍。这部分患者自骨骼发育成熟以来下肢力线就处于内翻状态,已适应该内翻力线,如果在 TKA 时采用韧带松解、股骨或胫骨截骨等技术过度矫正下肢力线至中立位,事实上对患者自身而言既不正常,还会导致术后膝关节的不自然。

3.3 下肢内翻力线一定不好吗?

PARRATTE 等[24]对 398 例 TKA 患者进行 15 年的 Kaplan-Meier 生存率分析,发现中立位对线组和内翻对线组间差异并无统计学意义,为此研究指出:用“对位对线”良好和不良来预测 TKA 术后假体的生存时间是无用的。许多学者也提出了类似的建议[23,25-27],对 TKA 术后患者进行下肢力线分析,并确定最严重的内翻对线不良患者,比较影像学、KSS 及 WOMAC 评分、膝关节的活动范围等,他们指出:①导致 TKA 术后无菌性松动的原因很多,下肢力线可能并不是导致无菌性松动的最重要原因;②整体的下肢内翻力线与假体失败率的增加并无显著相关性;③与重建中立位力线组相比,残留轻度的下肢内翻力线可能会获得更好的临床和功能结果,轻度的内翻矫正不足并不会影响假体的长期生存率。本研究所有患者术前即存在股骨的冠状面外弓,即内翻的下肢力线,既往已有研究指出恢复患者术前的生理性内翻力线,膝关节周围的韧带张力将更接近术前的生理状态,TKA 术后患者将具有更理想的临床及功能结果[28]。诚然,研究

中所有组 KSS 评分均有所提高,但与中立位组(P=0.02)及重度内翻组(P=0.01)相比,轻度内翻组 KSS 评分提高更显著;在功能评分上也获得了相似的研究结果,与中立位及重度内翻组相比(P=0.01,P=0.04),轻度内翻组 KSS 评分提高更显著;膝关节评分上,轻度内翻组也较重度内翻组改善更明显(P=0.03),但与中立位组相似。VANLOMMEL 等[29]对 172 例 TKA 患者(患者术前即存在下肢力线的内翻)进行 5~9 年的随访研究,结果显示术后下肢力线轻度内翻的患者不仅在临床和功能结果方面更优于重度内翻和中立位力线组,而且 KSS 和 WOMAC 评分改善也最大。SCHIFFNER 等[30]也指出残留轻度的下肢内翻力线,对于术前即存在下肢内翻力线的患者将有更好的临床效果。

在本研究纳入随访研究的所有病例中,无论是术后力线偏离中立位超过 6°,还是在-3°~3°范围内的中立位组,短期随访时间内均未发现有因机械性、无菌性松动或聚乙烯磨损造成的翻修患者,没有患者发生假体周围骨折、假体周围感染、深静脉血栓形成、麻醉下手法松解或手术松解等的患者。

与传统假体不同,本研究使用的是现代人工膝关节假体,改良的假体耐磨性能及设计参数对假体的生存率和术后功能评分有一定的改善。但 PARATTEETAL 等[23,31-32]前期使用现代假体研究下肢力线与假体生存率之间的关系,并未发现假体安放在轻度内翻位或中立位之间存在统计学差异。

3.4 本研究的局限性

首先,本研究随访时间较短,缺乏中长期研究结果,需要后期跟踪随访。其次,本研究只讨论了股骨外弓这一种下肢力线内翻患者,缺乏对因胫骨侧内翻畸形、韧带张力不平衡、骨缺损等原因所致内翻畸形病例的研究,需进一步对这类患者进行分析。

综上所述,虽然恢复中立位力线是一个成功膝关节置换的合理目标,但其证据并不确凿,存在争议,轻度内翻的下肢力线并不一定会导致更坏的效果,尤其对于术前即存在下肢内翻力线的患者。

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