

doi: 10.13241/j.cnki.pmb.2014.26.016

· 临床研究 ·

关节置换前后髌骨高度对膝关节功能的影响 *

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摘要 目的:研究全膝关节置换术前、术后 Insall-Salvati 指数和改良 Insall-Salvati 指数与术后膝关节活动度的关系。**方法:**采用 HSS 评分系统对患者全膝关节置换术后半年至一年的关节功能、活动度、肌力、屈曲畸形、稳定性等进行评价。测量 81 例(106 膝)患者术前、术后 X 线片 Insall-salvati 指数及改良 Insall-salvati 指数。**结果:**术后 HSS 评分为(89± 10)分,术前 Insall-salvati 指数及改良 Insall-salvati 指数分别为(1.00± 0.13)、(1.61± 0.21),术后 Insall-salvati 指数及改良 Insall-salvati 指数分别为(0.94± 0.19)、(1.67± 0.34)。关节置换术后 Insall-salvati 指数较置换前显著降低($P<0.05$),改良 Insall-salvati 指数显著提高($P<0.05$)。术后低位髌骨组(Insall-salvati 指数 <0.8)HSS 评分、活动度和屈曲畸形分值均较正常髌骨组($0.8<\text{Insall-salvati 指数}<1.5$)显著降低($P<0.05$)($P>0.05$)。高位髌骨组(Insall-salvati 指数 >1.5)和正常髌骨组各项评分均无显著差异($P>0.05$)。术前改良 Insall-salvati 指数小于 1.8 的患者术后膝关节 HSS 评分、功能、活动度、肌力、屈曲畸形、稳定性显著高于大于 1.8 的患者($P<0.05$)。**结论:**术前改良 Insall-salvati 指数和术后 Insall-salvati 指数可作为评价术后膝关节功能的参考指标。术前、术后的膝关节高度均会影响术后关节功能,全膝关节置换术中精确截骨对术后关节功能十分重要。

关键词:Insall-Salvati 指数;改良 Insall-Salvati 指数;全膝关节置换术;髌骨

中图分类号:R687.4 **文献标识码:**A **文章编号:**1673-6273(2014)26-5063-05

The Effects of Preoperative and Postoperative Patellar Position on Postoperative Knee Joint Function*

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ABSTRACT Objective: To study the relationship between preoperative and postoperative Insall-Salvati ratio, modified Insall-Salvati ratio and postoperative knee joint function. **Methods:** The Hospital for Special Surgery (HSS) score was used to evaluate the joint function, activity, myodynamia, flexion deformity, stability, etc between half a year and one year after total knee replacement. The preoperative and postoperative Insall-Salvati ratio, modified Insall-Salvati ratio of 81 patients (106 knee joint) on X ray were measured. **Results:** The postoperative HSS score was (89± 10). The preoperative Insall-Salvati ratio and modified Insall-Salvati ratio were (1.00± 0.13) and (1.61± 0.21), while the postoperative Insall-Salvati ratio and modified Insall-Salvati ratio were (0.94± 0.19) and (1.67± 0.34). The postoperative Insall-Salvati ratio significantly increased as compared with the preoperative Insall-Salvati ratio ($P<0.05$), while the postoperative modified Insall-Salvati ratio significantly decreased as compared with the preoperative modified Insall-Salvati ratio ($P<0.05$). The postoperative HSS score, range of motion score and flexion contracture score significantly decreased in postoperative patella baja (Insall-salvati ratio <0.8) when compared with that in postoperative normal patella ($0.8<\text{Insall-Salvati ratio}<1.5$)($P<0.05$). There was no significant difference between patella alta(Insall-salvati ratio >1.5) and normal patella($P>0.05$). The postoperative HSS score, range of motion score, stability score, functional score, quadriceps strength score, flexion contracture score of patients whose preoperative modified Insall-salvati ratio were higher than 1.8 significantly increased, when compared with that of patients whose preoperative modified Insall-salvati ratio were lower than 1.8 ($P<0.05$). **Conclusion:** Preoperative modified Insall-salvati ratio and postoperative Insall-salvati ratio could be considered as reference index of postoperative knee joint function. Both preoperative and postoperative patellar position affected the postoperative knee joint function. So exact resection in total knee arthroplasty was very important.

Key words: Insall-Salvati ratio; Modified Insall-Salvati ratio; Total knee replacement; Patella

Chinese Library Classification(CLC): R687.4 **Document Code:** A

Article ID: 1673-6273(2014)26-5063-05

* 基金项目:国家自然科学基金面上项目(81371926)

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(收稿日期:2014-03-03 接受日期:2014-03-31)

前言

人工全膝关节置换术极大地改善了骨性关节炎患者的疼痛及关节活动功能,已成为骨性关节炎终末期最有效的治疗手段,但仍有极少数患者置换术后出现假体过早松动,假体部位粘连及关节线抬高或降低引起的高位或低位髌骨,使术后患者膝关节功能不能达到预期的效果。大量的研究表明,膝关节的活动度在 $100^{\circ} \sim 110^{\circ}$ 时可基本满足人们日常大部分生活所需^[1],因而术中精确的截骨获得良好的关节线及屈伸间隙是术后膝关节获得最大活动功能的解剖学基础。Kanpandji 最早在 1978 年提出关节线的相关概念^[2],认为膝关节线与其生物力学密切相关。关节线的降低或抬高均会导致低位髌骨和高位髌骨的形成,进而影响髌股关节受到的应力,最终引起膝关节后动范围减小等并发症,直接影响患者术后膝关节功能。本实验通过研究全膝关节置换术前、术后 Insall-Salvati 指数和改良 Insall-Salvati 指数^[3]与术后膝关节 HSS 等评分的相互关系,旨在探讨关节置换前后髌骨高度对膝关节功能的影响,为确定最佳的关节线位置提供理论依据。

1 资料与方法

1.1 一般资料

收集 2011 年 1 月至 2012 年 12 月在我科行的全膝关节置换术患者病历 84 例(110 膝),其中骨性关节炎 74 例 94 膝,类风湿性关节炎 10 例 16 膝,84 例患者中男性 20 例,女性 64 例,年龄 56-78 岁,平均年龄 68 岁。排除标准:(1)股四头肌伸膝装置明显的外伤史;(2)髌骨发育畸形和骨折病史;(3)交叉韧带断裂和重建病史;(4)先天性内外翻畸形;(5)二次翻修感染;(6)膝关节周围肿瘤需置换膝关节患者。

1.2 治疗方法

所用假体类型为美国强生公司 DePuy-PFC 固定平台后稳定型假体和 DePuy-RP 活动平台型假体,所有假体屈膝均可超过 135° 。关节置换术均由同一名经验丰富的术者严格按照手术操作要求完成。术前 30 分钟给予一个剂量得抗生素,常用头孢唑啉 1 g,静脉输入。术中均采用膝关节正前方纵形切口,术中我们遵循标准的截骨方式即股骨远端截骨要垂直于股骨的

力学轴,外翻角度为 $5^{\circ} \sim 7^{\circ}$ 。截骨量为 9 mm,和股骨假体所替代的骨量相当,如术前膝关节屈曲挛缩严重,术中可以适当增加股骨远端的截骨量来增加伸膝间隙,但均未超过 2 mm,胫骨的截骨与胫骨力线垂直,并有 $0^{\circ} \sim 3^{\circ}$ 的后倾角度,所有病例均保持膝下脂肪垫得完整,不做切除,在保护好髌腱和侧副韧带的前提下截除胫骨近端在正常侧平台向下的 $8 \sim 10$ mm,所有病例均不做髌骨置换,仅切除髌骨周围骨赘,修整髌骨,电刀烧灼髌骨周围。术后加压包扎患膝并予以抬高,术后当日及术后 24 小时再次给予同等剂量抗生素 1 次,术后 6 小时即给予低分子肝素钙皮下注射抗凝,一般术后 24 小时拔出引流管,出血较多者适当延长到 72 小时。

术后均按同一康复计划进行功能训练:术后立即行股四头肌等张收缩,3 天后进行主动股四头肌功能锻炼,拔管后应用 CPM 机进行膝关节被动功能锻炼,初始角度从患者能耐受疼痛的范围开始,每次 30 分钟,每天一次,一周后即鼓励患者扶双拐下床活动。

1.3 随访方法

随访采用来院门诊复查及电话随访,均为术后半年至一年的随访结果。采用 Insall 等于 1976 年提出的评分系统对患者术后的关节功能、活动度、肌力、屈曲畸形、稳定性等对术后关节功能进行评价。测量术前、术后 X 线片 Insall-salvati 指数及改良 Insall-salvati 指数。

1.4 测量方法

患者膝关节屈曲 30° 拍摄膝关节侧位 X 片,在侧位 X 射线片上测量置换前后的 Insall-salvati 指数测量如图 1 中 I、II 所示:A 为髌腱止点到髌骨下极的长度,B 为髌骨下极到上级的长度。改良 Insall-salvati 指数^[3]测量如图 1 中 III、IV 所示:A 髌腱止点到髌骨下极关节面的距离,B 为髌骨关节面长度的距离。拍片时放大率应该控制在 100 %。采用 SimensAXIOM Aristos FD DR 摄片设备及 VBI OK 测量软件可准确的测量和控制 X 射线片的放大率,为了控制操作和测量方面的偏奇,在测量中由同一组人员完成。把 Insall-salvati 指数将小于 0.8 定义为低位髌骨,大于 1.5 定义为高位髌骨,0.8~1.5 为正常髌骨。

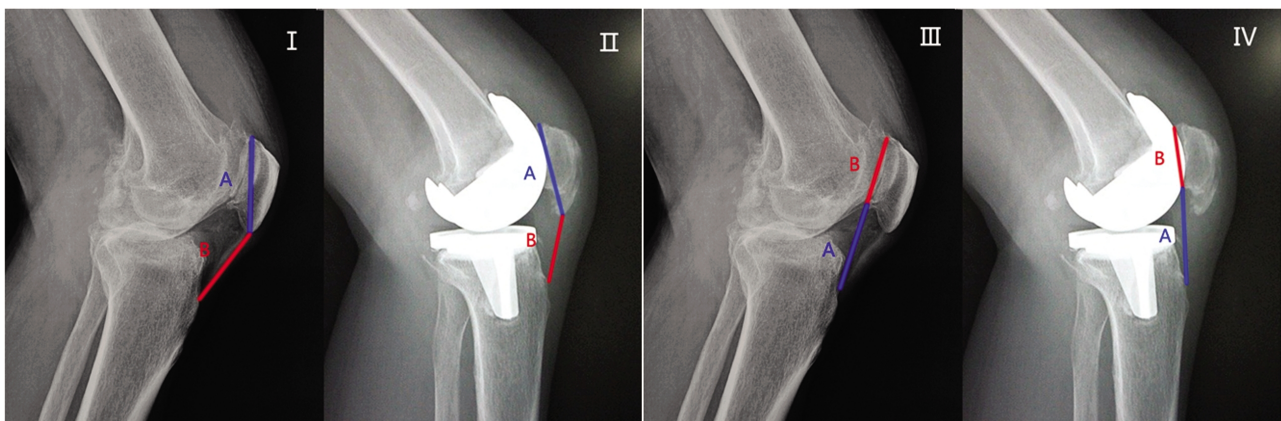


图 1 I、II 为 Insall-Salvati 指数测量方法,III、IV 为改良 Insall-Salvati 指数测量方法

Fig.1 I and II showed the method to measure Insall-Salvati ratio, III and IV showed the method to measure modified Insall-Salvati ratio

1.5 统计学分析

实验结果用 SPSS 13.0 软件分析, 数据以均数 $\pm$ 标准差($\bar{x} \pm s$)表示, 术前术后的采用配对 t 检验(Paired t-text)比较, 不同指数组间采用单因素方差分析 (One-Way ANOVA) 比较, 以 $P < 0.05$ 表示差异有统计学意义。

2 结果

共随访 81 名患者(106 例膝), 3 名患者(4 例膝)失访。所有

随访患者术后均可完成日常活动, 无明显不适及膝关节疼痛表现。术后 HSS 评分为 (89 ± 10) 分, 术前 Insall-salvati 指数为 (1.00 ± 0.13) , 术后 Insall-salvati 指数为 (0.94 ± 0.19) , 关节置换术后 Insall-salvati 指数较置换前显著降低 ($P < 0.05$)。术前改良 Insall-salvati 指数为 (1.61 ± 0.21) , 术后改良 Insall-salvati 指数为 (1.67 ± 0.34) , 术后改良 Insall-salvati 指数较术前显著提高 ($P < 0.05$)。术前改良 Insall-salvati 指数男性患者显著高于女性患者 ($P < 0.05$)(表 1)。

Table 1 Preoperative and postoperative Insall-Salvati ratio and modified Insall-Salvati ratio

Gender	Number	Insall-Salvati ratio		Modified Insall-Salvati ratio	
		Preoperative	Postoperative	Preoperative	Postoperative
Male	30	0.99 ± 0.11^a	0.94 ± 0.16	1.73 ± 0.21	1.74 ± 0.43
Female	76	1.00 ± 0.14	0.93 ± 0.21	1.56 ± 0.19	1.65 ± 0.31
Total	106	1.00 ± 0.13	0.94 ± 0.19^b	1.61 ± 0.21	1.67 ± 0.34^c

Note: a. The postoperative Insall-Salvati ratio of male was significantly higher than that of female. ($P < 0.05$) b. The postoperative Insall-Salvati ratio was significantly higher than preoperative Insall-Salvati ratio. ($P < 0.05$) c. The postoperative modified Insall-Salvati ratio was significantly lower than preoperative modified Insall-Salvati ratio. ($P < 0.05$).

术前, Insall-salvati 指数仅 6 例膝关节为低位髌骨, 5 例高位髌骨膝关节。术前的低位髌骨、正常髌骨和高位髌骨组术前的 HSS 评分、疼痛评分、功能评分、活动度、肌力及稳定性均无显著差异 ($P > 0.05$)。术后, 3 例高位髌骨膝关节, 25 例膝关

节为低位髌骨, 其中 19 例膝术前为正常髌骨, 术后为低位髌骨。术后低位髌骨组 HSS 评分、活动度和屈曲畸形分值均较正常髌骨组显著降低, 其余评分无显著差异(表 2)。高位髌骨组和正常髌骨组各项评分均无显著差异 ($P > 0.05$)。

Table 2 The scores of postoperative patella infera, nomal and patella infera

	Patella infera	Nomal	Patella infera	Total
Number	25	78	3	106
HSS score	$86 \pm 12^*$	91 ± 7	91 ± 4	90 ± 9
Functional score	19.2 ± 4.5	20.8 ± 2.9	22 ± 0	20.5 ± 3.8
Range of motion score	$10.4 \pm 2.0^{**}$	12.0 ± 1.9	11.5 ± 0.7	11.7 ± 2.0
Quadriceps strength score	9.5 ± 1.7	9.8 ± 0.9	9.0 ± 1.4	9.7 ± 1.1
Flexion contracture score	$8.3 \pm 3.1^*$	9.6 ± 1.3	10.0 ± 0.0	9.3 ± 1.9
Stability score	9.2 ± 1.9	9.7 ± 1.3	10.0 ± 0.0	9.6 ± 1.4

Note: $*P < 0.05$, $**P < 0.01$ Patella infera vs numal.

术前, 改良 Insall-salvati 指数以 1.8 为界, 小于 1.8 的有 85 例膝, 大于 1.8 的有 21 例, 术前改良 Insall-salvati 指数小于 1.8

的患者术后膝关节 HSS 评分、功能、活动度、肌力、屈曲畸形、稳定性显著高于大于 1.8 的患者(表 3)。

Table 3 Evaluation of preoperative modified Insall-salvati ratio on postoperative score

Postoperative modified Modified Insall-Salvati ratio	<1.8	>1.8	Total
Number	85	21	106
HSS score	92 ± 6	$81 \pm 13^{**}$	90 ± 9
Functional score	20.9 ± 3.0	$18.8 \pm 4.1^*$	20.5 ± 3.3
Range of motion score	12.1 ± 1.7	$9.9 \pm 2.1^{**}$	11.6 ± 2.0
Quadriceps strength score	9.9 ± 0.8	$9.2 \pm 1.8^*$	9.7 ± 1.1
Flexion contracture score	9.6 ± 1.3	$8.3 \pm 3.3^*$	9.3 ± 1.9
Stability score	9.8 ± 1.0	$8.8 \pm 2.3^*$	9.6 ± 1.4

Note: $*P < 0.05$, $**P > 0.05$ Compared with <1.8.

3 讨论

恢复关节线的位置对于维持最大的关节功能和避免髌骨并发症至关重要。关节线抬高导致髌骨相对低位时可使伸膝装置的力臂变短,在伸膝过程中牵引力增大,能量消耗也增大,造成伸膝延长;肌腱过度疲劳严重时会造成股四头肌腱和髌韧带断裂及聚乙烯衬垫磨损;而关节线降低可以引起相对高位髌骨,造成髌股关节不稳,髌骨内侧应力增加^[4],引起膝关节疼痛。Laskin^[5]的研究显示初次膝关节置换术后约有 40 %以上膝关节的关节线出现抬高,Partington^[6]等的研究则表明膝关节翻修后约有 80%患者的关节线出现抬高。关节线抬高 6 mm 以上时,膝关节仅能屈曲 90° 左右^[7]。TKA 术中确定准确的关节线有利于膝关节功能的恢复,也是膝关节置换术成功的关键^[8]。

膝关节置换术后良好的骨性结构和平衡的膝关节周围软组织是获得良好膝关节功能的结构基础。关节线的改变打破了膝关节正常的生物力学,进一步出现髌股关节之间的“错格现象”,随后胫股关节和髌股关节的功能紊乱^[9,10],患者术后出现关节功能不稳,膝关节疼痛,当屈曲角度增大时,假体周围接触压力加大,髌骨部件和聚乙烯柱之间发生撞击,长时间引起金属假体疲劳性断裂,随后假体松动失效。

Insall-salvati 指数是评价髌骨高度的常用方法,已被广泛用于临床^[11-14]。本研究发现术后低位髌骨和正常位置髌骨的部分关节功能有显著差异,提示术后髌骨高度对关节功能具有一定影响,术后 Insall-salvati 指数可作为评价关节功能的参考指标之一。高位髌骨和正常位置髌骨的关节功能无显著差异,可能是与高位髌骨比例较小及样本量不足有关。关节置换术后 Insall-salvati 指数较置换前显著降低,与其他文献结果相一致^[15],但是术后 Insall-salvati 指数降至 0.8 以下可能会影响术后膝关节功能,这就要求术者对术中的截骨位置做更精确合理的定位。

改良 Insall-salvati 指数是 Ronald 等对 Insall-salvati 指数的改进,克服了在没有明显的标志点的情况下测到相对的准确的数值,用以更精确地评价髌骨高度。患者术前关节功能不佳、屈曲畸形导致影像学资料拍摄角度不到位,而骨性关节炎及类风湿性关节炎患者骨质增生明显,可导致髌骨测量线没有准确标志点。改良 Insall-salvati 指数对放射参数的影响较小,因而在测量不同参数标准和不同条件下影像学资料时具有优越性^[16],也逐渐成为临床上评价髌骨高度的标准之一^[17-19]。本研究结果表明术前改良 Insall-salvati 指数小于 1.8 的患者术后膝关节 HSS 评分、功能、活动度、肌力、屈曲畸形、稳定性显著高于大于 1.8 的患者,提示术前改良 Insall-salvati 指数也许可以作为预测术后关节功能的参考指标。

HSS 评分包括术后局部情况和整体情况,本研究中接受置换术的患者平均年龄为 56-78 岁,往往合并全身情况和局部病变,这些因素可以影响膝关节的 HSS 评分结果。随着年龄的增长和身体其他器官的逐渐衰竭及合并内科系统疾病,如类风湿性关节炎患者并非一处关节受损,而是累计全身关节,即使术中恢复良好关节线,术后随着疾病的发展膝关节功能也会受到一定影响^[20]。

本研究结果表明髌骨位置对于术后膝关节功能至关重要,

因而在膝关节置换术中应实行个体化手术治疗的原则。术前通过改良 Insall-salvati 指数预测术后关节功能,采用精确测量关节线的变化,术中精确截骨,初次膝关节置换应该遵守的等量截骨原则,术后建立长期的随访机制及时监测 Insall-salvati 指数及膝关节评分的变化。术后尽早进行膝关节功能锻炼,预防膝关节周围血肿形成导致假体周围粘连,防止长期制动引起髌韧带的挛缩。由于我国膝关节解剖结构偏小,而根据欧美人解剖形态设计的人工膝关节很难和国人达到最佳匹配的状态,这也在某种程度上影响了膝关节的功能;此外,我们所用的 Insall-salvati 指数的比值一直借鉴的是国外的标准,不一定完全符合中国人的解剖比例。因此,进一步研究要加大的样本量,更加深入的研究拟定出适合我国自身的标准比值。

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