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·综述·

人工全膝关节置换术后膝关节功能的影响因素研究进展*

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人工全膝关节置换术(total knee arthroplasty, TKA)是严重或终末期膝关节病变的有效治疗方法。近年来,该手术操作量在全球范围内以倍数增长。有研究预计美国2030年手术量将是2005年手术量的6倍,年手术量将超过300万

例,住院花费将超过20亿美金^[1]。虽然该手术对改善患者膝关节功能、提高生活质量有明显的疗效,但仍有部分患者术后功能未恢复到理想程度。

本文以“total knee replacement”、“total knee arthroplas-

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ty”、“functional outcome”等为关键词,检索PUBMED数据库,同时以“人工全膝关节置换术”、“术后功能康复”等为关键词,检索中国知网数据库,从2013—2018年的文献中选取与TKA术后患者功能影响因素有关的文章进行综述。影响患者术后功能的因素有多种,包括个体因素如人口学因素、临床因素、手术因素和康复因素等。了解这些因素对TKA术后功能的作用,可以有助于手术医师、康复医师及治疗师等医疗工作者在临床中做出更好的决策。

TKA术后功能障碍包括疼痛、关节活动范围受限、转移能力受限、日常活动能力受限等。除疼痛评分、关节活动度(range of motion, ROM)以外,临床常用患者报告的功能量表(patient-reported outcome scores, PROS),如美国膝关节协会评分(knee society score, KSS)、加州大学洛杉矶分校活动评分、美国西部 Ontario 和 McMaster 大学骨关节炎指数评分(western ontario and mcmaster universities osteoarthritis index, WOMAC)等来整体评估TKA术后功能。此外一些客观的功能试验,如站起一走计时试验(time up and go test, TUG)、楼梯试验(stair climbing test, SCT)等也常被用来评估TKA患者术后转移功能^[2]。

1 个体因素

1.1 人口学因素

人口学因素包括年龄、性别、体重指数(body massing index, BMI)及社会因素等。

1.1.1 年龄:多个研究发现年龄对关节活动度无影响^[3-4],但在年龄对TKA术后整体功能的影响上尚存争议。研究显示,美国2010年行TKA的患者,<50岁的约占3.7%,50—59岁占13.3%,60—69岁占28.7%,70—79岁占31.1%,>80岁占23.1%^[5]。Elmallah等^[3]比较不同年龄组(<55岁,55—75岁,>75岁)的KSS评分发现,>75岁组在术后第七年时KSS临床评分最高,小于55岁组在第二年和第五年的随访KSS功能评分最高。Keeney等发现<55岁组相较于65—75岁组在加州大学洛杉矶分校活动评分中,术前、术后患者功能分布比例无明显差异^[6]。部分研究发现高龄者术后整体功能更差^[4]。同时,部分研究存在样本量不足^[3]、未排除合并症的影响^[3,6]等问题,使得年龄对TKA术后整体功能的影响尚不明确,尤其是过于年轻或者高龄者的TKA术后整体功能恢复情况,需要进一步更大样本量、更加规范的研究。

1.1.2 性别:大部分研究发现女性术前整体功能比男性更差^[7-9],而性别对术后短期和长期功能的影响尚不统一。Cherian等研究发现男性在术后短期和长期的健康调查简表(the short form health survey-36, SF-36)物理功能亚量表中的评分均优于女性^[7]。Gen等^[8]研究发现,女性患者术后6月和2年的KSS评分、OKS评分和ROM与男性相比无显著性

差异。而在TKA患者中,女性肥胖和患有肥胖症的比例更高,其原发病更有可能是类风湿关节炎等非骨关节炎,这些患者发生术后输血、尿路感染的风险更高,住院时间更长^[10],今后在研究性别对TKA患者功能恢复的影响作用时有必要排除这些混杂因素的影响。

1.1.3 体重指数:部分研究发现TKA患者术前BMI与术后患者报告的功能量表评分呈负相关^[11],但也有研究发现患者术后功能的提升程度不受BMI的影响^[12]。因此,肥胖是否预示TKA远期功能水平更差这一观点尚存争议,这与各项研究中人群肥胖的程度^[12]、是否考虑并发症^[11-12]等相关。此外,有研究发现术前或术后1年内减轻体重不会带来手术获益^[11,13],术后1年体重增加10%会导致术后功能恢复更差^[11]。

1.2 心理因素

大多数研究发现术前抑郁和焦虑的患者术后1年的整体功能更差^[14],也有研究发现术前抑郁的患者在术后3天内疼痛更剧烈^[15]。恐动症是对疼痛不恰当的反应模式,为避免活动或身体锻炼对机体产生伤害或再次损伤,而对运动产生的极度恐惧的一种特殊心理现象,多见于慢性疾病疼痛及外科术后患者^[16],近年来亦有关于恐动症对TKA术后恢复影响的研究。有研究发现存在恐动症的TKA患者在出院时6分钟步行试验可行走的距离更短^[17]。有研究发现恐动症 Tampa 评分表(tampa scale for kinesiphobia, TSK)得分越高的患者,术后短期和中期WOMAC评分越差,且随着时间推移,恐动症对患者功能的影响逐渐减小,但有恐动症者最终WOMAC评分可能更差^[18]。

有研究指出既往研究心理因素的影响时,往往忽略术后心理状态的变化,应该将术后状态变化考虑在内^[14],且大多数研究仅观察了焦虑、抑郁对患者术后1年的功能影响,缺乏对短期功能影响的研究^[15]。

2 社会因素

社会因素包括教育程度、经济水平、社会支持水平等。教育水平不同的患者对治疗的理解程度以及患者可得到的医疗资源有差异,医生在接诊时可能存在偏见。经济水平不同的患者可能就诊的时机也不相同^[19]。研究发现教育水平越高的患者术前功能可能越好,术后有更低比例的疼痛和更好的整体功能恢复^[19]。也有研究发现不同教育水平的TKA患者术后1年的功能水平无明显差异^[20],但该研究中不同教育水平者比例悬殊。一般研究认为经济水平越高者术后功能越好^[19-21]。同时有研究发现社会支持较大的患者如已婚、同居等,术后功能恢复程度比社会支持较少的患者更好^[21]。

3 临床因素

3.1 原发病因素

最常见的TKA的原发病为终末期骨关节炎(osteoarthritis, OA)^[22],此外临床上亦有不少类风湿关节炎(rheumatoid arthritis, RA)者行TKA术。多个研究发现RA患者相比OA患者术前疼痛及整体功能障碍更显著,术后疼痛程度无明显差别^[23-24]。Singh等^[23]研究发现原发病为OA的TKA患者在术后第2年和第5年时有更好的日常活动能力。而在Goodman等^[24]的队列研究中,RA患者与OA患者在术后第2年的WOMAC功能评分上无明显差异。此外,有研究发现OA患者术前影像分级越差者术后1年的KSS临床评分提升越高,而KSS功能评分无明显差别^[25]。

3.2 临床合并症因素

3.2.1 糖尿病:研究显示,糖尿病患者术后发生感染、下肢深静脉血栓、假体周围骨折、无菌性假体松动等并发症的可能性更高,并发症的发生将影响TKA术后的功能,且糖尿病影响胶原蛋白的合成、影响伤口愈合,与不良的功能预后关系密切^[26]。有研究发现,糖尿病患者术后ROM更小,可能与糖尿病患者中关节囊增厚和瘢痕组织增生更多有关^[26]。Amusat等^[27]研究发现,合并影响正常生活的糖尿病患者较无糖尿病者以及未影响正常生活的糖尿病者,其WOMAC评分在术后3个月和6个月时更差,提示有影响正常生活的糖尿病才会影响TKA术后功能的恢复。Singh等^[28]发现糖尿病与术后2年和术后5年日常活动能力受限明显相关,且合并糖尿病者术后功能更差,提示糖尿病与远期更差的预后明显相关。

3.2.2 腰痛:研究发现大多数合并腰痛的患者临床症状更加严重,原因包括腰痛导致不良生物力学模式、疼痛的来源混淆等,这些因素将进一步影响TKA术后功能^[29]。多个研究发现合并腰痛的患者术后功能更差,且术后功能恢复程度与腰痛的程度有关^[30-31]。

3.2.3 其他:有研究发现维生素D缺乏者TKA术前WOMAC评分更差,但术后WOMAC评分无明显差异,提示维生素D缺乏可能影响骨骼肌肉功能从而影响术前功能,但术后补充维生素D可以减少此影响,因此,维生素D缺乏者不应被延迟手术^[32]。还有研究发现合并心脑血管疾病者术后的远期日常活动能力更差^[33]。

3.3 术前膝关节功能

多个研究发现,术前膝关节功能越好者,术后膝关节功能更好,但术后膝关节功能提高的程度也越小^[34-35]。Berliner等^[34]的研究发现,术前骨关节炎评分(the knee injury and osteoarthritis score, KOOS)58分、健康调查简表-12(the short form health survey-36, SF-12)物理功能亚评分34分可以作为一个阈值,高于此值则显示术前膝关节物理功能更好,同时说明术后物理功能获得明显提高的可能性越小。

4 手术相关因素

4.1 计算机导航辅助技术

计算机导航技术可以使假体的植入位置更为准确,改善术后下肢力线,因此可能可以提高术后功能^[36]。目前对计算机导航辅助技术能否促进TKA患者术后膝关节功能存在较大争议,有研究发现计算机导航辅助技术相对传统手术而言患者术后整体功能更好^[37],亦有研究发现二者之间无差别^[38]。

4.2 假体类型

我国常用的膝关节假体为非限制性假体,根据关节面是否固定可分为固定平台型、活动平台型,根据是否保留后交叉韧带可分为保留后交叉韧带型(CR型)、不保留后交叉韧带型(PS型)^[39],目前的研究认为固定平台型、活动平台型假体之间术后整体功能无显著差异^[40],CR型假体和PS型假体之间术后整体功能亦无显著性差异^[41]。

4.3 围手术期镇痛

TKA患者围手术期的疼痛控制是治疗的重要部分,有利于患者早期下地活动和进行康复训练^[42]。研究发现术中应用收肌管阻滞相比局部浸润麻醉可以有效减少术后阿片类镇痛药物的用量,但对术后2天内转移功能是否有影响尚存争议^[43-44]。亦有研究发现患者使用收肌管阻滞比股神经阻滞在术后2天内的转移功能更好^[45]。

4.4 止血带

多个研究发现止血带的使用会使术后短期(1—3个月)的股四头肌肌力更低,术后KSS评分更差,关节活动度更低,术后疼痛程度更高^[46-47]。有研究发现这种影响是由于止血带的使用激活了患者的肌肉代谢,加快了其肌萎缩的速度^[48]。部分研究发现止血带的影响不会持续到术后1年^[46-47]。

4.5 膝关节对位

目前大多数研究支持解剖对位即术后膝关节内外翻在3°以内相比对照组术后整体功能无显著性差异^[49]。另外,有研究发现,TKA患者胫骨过度内旋是术后疼痛和功能不良的危险因素,而外旋对术后整体功能无明显影响^[50]。

5 康复因素

5.1 术前康复

术前膝关节功能将影响术后膝关节功能。术前康复可能可以通过提高术前膝关节功能,从而促进术后膝关节功能恢复。近年来关于术前康复的干预方式异质性较大,故术前康复对术后功能的影响尚有争议^[51-52]。有研究发现术前进行增强肌力训练可以减少住院日,提高术后短期关节活动度和TUG水平、改善WOMAC评分^[52]。同时亦有研究发现术前进行康复训练组与对照组相比术后KOOS评分无差异^[51]。

5.2 术后康复

近年来有不少文献研究了加强肌力训练、电刺激、平衡

训练及术后康复地点对术后功能的影响。

5.2.1 加强肌力训练:TKA术后患者股四头肌、股内收肌肌力明显下降,以术后1个月内最为显著,且下肢肌力与术后功能明显相关^[53]。有研究发现术后早期在常规康复上增加强化肌力训练并不能提高患者术后2个月的转移功能,这可能与术后早期膝关节疼痛、肿胀抑制了股四头肌有关^[54]。同时,有研究发现术后股四头肌激活不良会影响术后早期的恢复和转移功能,是抗阻训练效果不佳的原因^[55]。另外有研究发现高速收缩的训练(在2秒内完成向心收缩)有助于早期股四头肌肌力的恢复和提高术后转移功能,这可能与TKA患者多为老年人,而老年人快肌纤维萎缩更多有关^[56]。

5.2.2 电刺激:Yue等^[57]的meta分析,神经肌肉电刺激可以增强TKA术后患者股四头肌肌力和功能恢复,经皮神经电刺激在强度为15—40mA,频率为70—150Hz时可以有效缓解TKA术后的疼痛,穴位电刺激在强度为2mA,频率为2Hz时可能也有镇痛效果。另外有研究指出,神经肌肉电刺激对术后短期功能恢复有效,对术后中期和远期功能无明显影响^[58]。

5.2.3 平衡训练:TKA患者术后协调能力和本体感觉能力下降,这种现象可能长达6个月^[59]。Moutzouri等^[59]提示感觉运动训练可以提高TKA患者术后的整体功能和转移功能,并且建议在TKA术后2周开始,持续6—8周。研究发现平衡训练可以提高术后1年内的平衡功能和整体功能^[60]。

5.2.4 康复环境:门诊康复与家庭康复或护理机构治疗相比,治疗师可以直接指导患者训练,纠正患者动作,但是相比之下医疗费用更高。国外有多个研究对门诊康复与家庭康复对患者的术后功能的影响,发现二者无显著性差异^[61]。另外有研究发现,术后早期对TKA患者进行群体康复比单独康复效率更高,患者可获得更大的关节活动度、更强的股四头肌肌力、更低的疼痛水平,这可能跟群体治疗中患者获得的社会支持更大、更有锻炼的动力有关^[62]。

6 小结

TKA术后功能的因素包括个体因素、临床因素、手术相关因素和康复因素。目前大部分研究以患者报告的功能量表来评估TKA术后的整体功能,部分研究以TKA术后的疼痛程度、关节活动度、转移功能来评估。经济水平高、社会支持大、术前膝关节功能好是术后更好的膝关节整体功能的预测因素,增强肌力训练、神经肌肉电刺激、平衡功能训练可以提高术后肌力及转移功能,经皮神经电刺激可以缓解术后疼痛,群体治疗相比单独康复效率更高。存在心理因素如焦虑、抑郁、恐动症,合并临床疾病如糖尿病、腰痛、心脑血管疾病,术中使用止血带、术后胫骨内旋度数过大,这些因素都可能导致术后功能更差。而年龄、性别、体重、术前康复对术后

功能的影响尚不明确。

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