

半月板根部损伤的研究进展

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摘 要

半月板根部撕裂是一种越来越被认可的损伤, 会导致膝关节显著的功能限制, 受影响的间室软骨可能快速退化, 如果不及时治疗, 后期会有全膝关节置换术的风险。解剖根部修复可恢复膝关节负荷和稳定性。对轻度骨关节炎的患者进行半月板根部修复可显著改善患者预后并延缓骨关节炎的进展。

关键词

半月板, 半月板根部, 半月板损伤

Research Progress on Meniscal Root Injury

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Abstract

Meniscal root tears are an increasingly recognized injury that can lead to significant functional limitations of the knee joint, rapid deterioration of the affected compartment cartilage, and the risk of total knee replacement later if left untreated. Anatomical root repair restores knee load and stability. Meniscal root repair in patients with mild osteoarthritis significantly improves patient prognosis and delays the progression of osteoarthritis.

Keywords

Meniscus, Meniscus Root, Meniscal Injury

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1. 引言

半月板损伤是常见的膝关节损伤之一，占膝关节骨科损伤的 12%~14%，年发病率为每 100,000 人 60~70 例[1] [2] [3]。在过去的几十年里，对半月板，特别是前根和后根的功能和生物力学作用的了解有所发展。半月板根部损伤(Meniscus Root Tears, MRT)定义为胫骨附着点 1 cm 以内的完全放射状损伤或骨性撕脱，越来越多的数据显示半月板根部损伤与半月板次全切除术有相似的结果[4] [5]。MRT 在临床上诊断困难，因为许多患者在初次就诊时未被诊断出来并且在常规影像学检查中被遗漏[6]。因此，人们对 MRT 的诊断和治疗越来越重视。本文总结了有关 MRT 解剖、临床表现、治疗方法和预后的当代文献。

2. 解剖和生物力学

半月板是新月形的楔形纤维软骨，覆盖胫骨平台的二分之一到三分之二。这些结构的主要目的是通过胫股关节传递载荷，从而减少对周围关节软骨的影响并随着时间的推移保护关节[7]。内侧和外侧半月板根部负责将半月板前后锚固到胫骨平台，将轴向载荷转换为周向环向应力，在防止半月板挤压和保持膝关节运动学方面具有重要的生物力学功能[4] [8]。前外侧根的胫骨附着面积为 140.7 mm，前交叉韧带(Anterior Cruciate Ligament, ACL)插入面积为 218.4 mm。LaPrade 等人研究表明 ACL 和前外侧根之间的平均重叠为 88.9 mm，简而言之 ACL 胫骨插入部位约为 63.2%的前外侧根和 40.7%的 ACL [9]。这种关联在 ACL 重建的胫骨隧道扩孔过程中是相关的，因为对根部的医源性损伤可能是不可避免的[4] [10]。前内侧根呈扇形，位于内侧胫骨隆突顶点前 27.5 mm 处[9]。它是所有根附着部位中最大和最强的。在胫骨髓内钉固定过程中，该位置的解剖意识很重要[11]。后外侧半月板根距后交叉韧带(Posterior Cruciate Ligament, PCL)最近点 12.7 mm，距胫骨外侧隆突顶点后内侧 5.3 mm [9]。特别的是，外侧半月板的后角通过半月板股骨韧带(Meniscal Femoral Ligaments, MFL)连接到股骨的髁间区域[12]。据报道，在孤立的后外侧根撕裂期间，这些结构至少可以部分减少接触压力并减轻挤压[13]。后内有亮白纤维的扩张，这是 PCL 重建过程中重要的可见标志[14]。

3. 病因学和自然史

据估计，接受半月板切除术或修复术的患者中有 10%到 20%为 MRT，估计每年 100,000 名患者受到影响，但考虑到近年对 MRT 认识的增加，患病率可能更高[6] [15] [16] [17]。外侧半月板后根损伤更常见于年轻人的急性创伤，并伴有单一或多韧带损伤[18]。在这些患者中，二级稳定性丧失，因为后外侧根和 MFL 是 ACL 缺陷膝关节胫骨前移和内旋的已知阻力[19]，相比之下，大约 70%的内侧根部损伤本质上是退行性的[4]，约出现在 40 至 50 岁，并且 Outerbridge 二级或以上级别的风险增加 6 倍[20]。

4. 临床表现和诊断

根部损伤很难通过简单的临床评估来诊断，因为不存在用于明确诊断的临床测试或标志。患者可能会描述在轻微扭伤或膝关节深度屈曲后疼痛突然发作，导致反复积液、关节线压痛、屈曲功能丧失或膝关节深度屈曲疼痛[21]。有时，患者可能会出现膝关节弹响或绞索的感觉。半月板测试，如 McMurray 和 Apley 测试可能呈阳性，但不一定有机械咔哒声[22]。MRT 通常分为以下两类：1) 创伤性损伤，通常发

生在年轻的活动患者中,通常为外侧并伴有韧带损伤;2) 退行性撕裂,通常是内侧,约占后根撕裂的 70%,由慢性、低能量损耗机制造成[4]。退行性损伤通常是根部附近的损伤,不是半月板附着处的真正撕裂。由于大多数退行性半月板根部损伤没有外伤史,因此临床医生在评估非创伤性膝关节疼痛患者时应该有高度的临床怀疑,尤其是与内侧半月板相关的疼痛。后根损伤的危险因素有据可查,包括内翻畸形、年龄较大、体重指数(BMI)增加、女性和 Kellgren-Lawrence 分级增加[23] [24] [25] [26] [27]。

5. 成像和分类

MRI 是 MRT 的首选诊断方式,因为在患者病史和体格检查中没有高度敏感或特异性的发现[6]。在进行 MRI 时,最好使用 T2 加权序列评估,主要为:1) 轴位半月板根部垂直于半月板的线性高信号强度(放射状撕裂);2) 冠状位上半月板根部的垂直线性缺陷(截断征),通常合并半月板挤压;3) 矢状面上没有正常的半月板信号(鬼影征) [28]。

6. 非手术治疗

希望避免手术干预的患者可以尝试非手术治疗。通常需要一个疗程的抗炎药物、活动调整和物理治疗或监督锻炼计划[5] [29] [30]。关节腔穿刺注射也可以改善退行性 MRT 的疼痛和功能[31]。尽管有一些早期症状好转,但已证明不解决半月板病理损伤会对关节寿命产生负面影响[5] [29] [30] [32]。Neogi 等人表明临床改善通常是短暂的,在治疗后约 6 个月达到峰值,随后下降。此外,非手术治疗与预后不佳、关节炎恶化和相对较高的关节置换率相关[5] [30] [32]。此外,明显半月板挤压患者不应考虑非手术治疗,因为明显挤压与预后不良相关[29]。

7. 手术治疗

7.1. 根修复术及危险因素

根修复优于半月板切除术的理论在技术上可行越来越多地得到现有文献的支持。Chung 等人[33]在至少 5 年的随访中比较了 37 例根部修复术和 20 例半月板部分切除术,并观察到修复组的客观膝关节功能评分更高。此外,35%的半月板部分切除术组转为全膝关节置换术,而修复组为 0%。Krych [34]也反映了这些发现,他证明因症状性内侧半月板后根损伤而接受部分半月板切除术的患者在报告的结果评分中没有显著获益,而且 52%的半月板切除术患者在平均 4.5 年时进展为行全膝关节置换术。最近,报告了半月板根部修复的长期结果,表明 96%的患者效果良好,Lysholm 量表平均术后改善 30.2 分[35]。值得注意的是,所提出的研究代表回顾性系列,可能受一定程度的选择偏差影响,与接受半月板修复的同龄人相比,接受半月板切除术的患者健康状况较差,关节保护的候选者较差。

半月板根部修复的结果很值得期待,支持手术干预以维持功能和预防关节炎[29] [31] [32]。平均随访 6 年,Chung 等人[33]证明在 37 名半月板根修复患者中,只有 14%的患者表现出 Kellgren Lawrence ≥ 2 级。还有研究指出,在对 91 名患者进行的随访研究中,只有 1 名患者(1%)在平均随访 7 年时转为行全膝关节置换术[35]。尽管根修复已证明进行性骨关节炎和转为行全膝关节置换术的发生率降低,但各种潜在因素仍然存在,重要的是确定根修复手术的成功。Brophy 等人[36]证明,至少 2 年的随访中,BMI 大于 35 的患者重复手术率更高,临床骨关节炎患者比例更高。尽管 BMI 和骨关节炎风险可能存在于连续统一体,但诸如此类的结果突出了患者咨询的重要性以及 BMI 在指示患者进行根修复方面的作用。此外,之前的研究已经证实,根撕裂的完全结构愈合与半月板根部挤压的显著改善相关,那些不完全愈合和相关高度挤压的患者在随访 2 年时会早期出现软骨退化[37]。因此,术中应尽量减少挤压的半月板,以支持解剖损伤愈合和天然关节生物力学的恢复。

7.2. 关节置换术

关节置换术是 MRT 患者和对保守措施无效的终末期关节炎患者的可靠治疗选择[38]。Tagliero 及其同事完成了一项匹配的病例对照研究，比较了接受关节置换术治疗继发性骨关节炎的患者与原发性骨关节炎患者的结果，并报告了两者在疼痛、活动水平、并发症和再手术率方面的相似改善[32]。

8. 重返运动

患者重返运动的时间点受手术方式和患者身体情况的影响。恢复 4 至 6 个月后，力量恢复正常，步态对称者，可逐渐开始参加体育活动。从孤立的根修复到完全恢复到高强度的体育活动的典型时间线是 6 至 9 个月。

9. 总结

越来越多的文献主张在没有明显关节炎的有症状患者中修复 MRT。外侧半月板后根损伤的患者通常合并 ACL 损伤，这种损伤有时很难通过 MRI 成像在术前识别出来。此外，ACL 重建的外科医生需要识别外侧半月板后根损伤，因为漏诊肯定会增加 ACL 重建移植失败的风险[19]。内侧半月板根损伤影响中年人，单独发生，并且在女性患者中更常见。现在人们普遍认识到，MRT 很常见，它们的解剖修复更好地恢复关节负荷和功能。强烈建议对有适当指征的患者进行半月板根部修复术，以预防或延缓骨关节炎的进展。

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