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全部膝关节置换围术期的镇痛方法

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摘　要

随着医疗技术的进步，我国全膝关节置换术数量不断增加，如何有效缓解术后疼痛已经成为临床医生所关注的重要难题。其中，外周神经阻滞是多模式镇痛的重要组成，其对TKA患者术后功能康复具有良好的促进作用，并且可以明显减少镇痛药物，常用阻滞方式包括股神经阻滞、坐骨神经阻滞、内收肌管阻滞等。本文对TKA围术期镇痛方法进行综述，并重点讨论以区域神经阻滞为主导的多模式镇痛方法。

关键词

全部膝关节置换，神经阻滞，多模式镇痛

Analgesic Methods during the Perioperative Period of Total Knee Arthroplasty

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Abstract

With the advancement of medical technology, the number of total knee arthroplasty surgeries in China continues to increase, and how to effectively alleviate postoperative pain has become an important issue of concern for clinical doctors. Among them, peripheral nerve block is an important component of multimodal analgesia, which has a good promoting effect on postoperative functional rehabilitation of TKA patients and can significantly reduce analgesic drugs. Common block methods include femoral nerve block, sciatic nerve block, adductor canal block, and local infiltration anesthesia around joints. This article provides a review of perioperative analgesia methods for TKA, with a focus on multimodal analgesia methods dominated by regional nerve block.

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Keywords

TKA, Nerve Block, Multi-Model Analgesia

1. 背景

随着我国人口老龄化，膝关节症状性骨关节炎和其他退行性膝部疾病的发病率增加，且创伤性膝关节炎等其他膝关节疾病在终末期均会导致膝关节疼痛、活动度降低等症状，使得患者身体残疾及精神痛苦，极大地影响了人们的生活质量，并给家庭和社会带来沉重负担。全部膝关节置换(total knee arthroplasty, TKA)是治疗终末期膝关节疾病最有效、最理想的方法，明显提高患者的生活质量[1]。继疼痛被世界卫生组织确定为第五大生命体征之后，其逐渐引起广泛关注[2]。术后疼痛也是至今尚未从根本解决的问题，据统计，TKA 术后近 80%患者会出现中度、重度或极度疼痛[3]，而术后镇痛不足将影响患者早期功能锻炼，增加围术期关节僵直及深静脉血栓风险，导致住院时间及医疗费用增加，患者满意度降低[4]。单一的镇痛方法达不到理想的镇痛，随着加速康复外科(enhanced recovery after surgery, ERAS)的理念提出，多模式镇痛顺应而生，即联合应用不同作用机制的镇痛药和多种镇痛方法，来达到完美镇痛的目的。包括超前镇痛、患者自控镇痛、外周神经阻滞、关节周围软组织注射以及多种镇痛方式联合应用的多模式镇痛等方法[5]-[7]。但目前尚无统一的多模式镇痛方案，文章就目前临床上关于全膝关节置换围手术期镇痛的研究进展作一综述。

2. 疼痛机制

外科手术中对关节周围的骨和软组织造成损伤，导致一系列炎症因子的释放，从而激活外周伤害性感受器，这些神经冲动通过外周神经传入脊髓，然后由脊髓背角传向丘脑，经丘脑皮质束到达中央后回感觉区，从而产生疼痛感觉。因此，临床上主要可通过三种途径进行镇痛：减少外周致痛物质的产生；减少外周痛觉神经向中枢的传导；降低中枢兴奋性。

3. 镇痛方法

3.1. 超前镇痛

近年来随着人们对疼痛认识的不断加深，超前镇痛再次受到重视，通过给予一种或几种药物干预，降低外周和中枢敏化，从而降低伤害性刺激引起的痛觉过敏和痛觉异常[8]。在 TKA 术前进行预防镇痛，目的是降低由手术切口或手术操作引起的外周和中枢神经系统的疼痛敏感性[9]，常用的超前镇痛药物有非甾体类抗炎药(NSAIDs)、COX-2 抑制剂、中枢性镇痛药、对乙酰氨基酚、NMDA 受体拮抗剂等。

3.2. 椎管内麻醉

3.2.1. 硬膜外镇痛

若在术后使用椎管内置管镇痛，将阿片类药物和局部麻醉药均可以注入到硬膜外间隙，以发挥镇痛作用。硬膜外镇痛曾广泛应用于 TKA 术后镇痛治疗，但硬膜外导管长期留置可引起恶心呕吐、低血压、尿潴留等不良反应发生[10]。且 TAK 患者大多是老年人，术后患者的血液处于高凝状态，预防性使用抗

凝药物会增加硬膜外血肿形成的风险。据报道，使用低分子肝素抗凝的患者使用连续硬膜外镇痛出现硬膜外血肿的风险为 1/3000 [11]。另外，硬膜外导管脱落、单侧阻滞、药物泄漏和导管移位等问题也限制了该方法在 TKA 术后镇痛的应用。

3.2.2. 蛛网膜下腔镇痛

单次蛛网膜下腔注入局部麻醉剂并不能为 TKA 术后提供足够长时间的镇痛。Rathmell 的研究表明该方法在全髋关节置换术后镇痛效果显著，但在 TKA 术后却没有很好的镇痛预期[12]。

3.3. 外周神经阻滞

外周神经阻滞镇痛机制是通过神经阻断作用来减少和去除伤害传入对中枢神经的刺激作用，从而减少应激反应，达到解除疼痛的目的。因其风险低、术后镇痛效果确切，可有效减少阿片类药物用量以及其带来的恶心、呕吐、皮肤瘙痒等不良反应[13]。随着超声技术的普及，外周神经阻滞的可操作性和安全性都有了很大的提高。外周神经阻滞可为单次阻滞或置管连续神经阻滞。主要方式包括股神经阻滞(FNB)和收肌管阻滞(ACB) [14]，其潜在不良反应主要有神经损伤及肌力改变。

3.3.1. 股神经阻滞(FNB)

股神经支配股四头肌的运动神经、大腿内侧和膝关节的皮神经，对膝关节前方及侧方感觉的阻滞作用明确。连续 FNB 相比单次阻滞在降低患者术后总体阿片类药物使用量更具优势[15]。但 FNB 会出现股四头肌肌力下降[16]，出现术后功能训练延迟，增加术后跌倒的风险[17]-[19]，应引起医务工作者的重视。

3.3.2. 收肌管阻滞(ACB)

(1) 解剖 ACB 是近年来应用于全膝关节置换后镇痛的新方法[20]，其靶神经为隐神经，因此许多学者常使用“收肌管阻滞”这一名称。收肌管(adductor canal, AC)位于大腿中段 1/3 前内侧，缝匠肌深面，大收肌和股内侧肌之间。隐神经是股神经发出的纯感觉分支，在收肌管内先走行于股动脉外侧，接近大收肌末端时，由股动脉前方跨越至内侧，经收肌管前壁筋膜穿出收肌管。之后与膝降动脉隐支伴行，沿膝关节内侧下行并分为两支。其中，髌下支支配膝关节前内侧感觉，缝匠肌支继续下行并支配小腿及足踝内侧感觉[21]。除隐神经外，收肌管内还有股神经股内侧肌支、股内侧皮神经、股内侧韧带神经，以及闭孔神经后支发出的关节支，闭孔神经前支也在收肌管远端通过[22]。

(2) 阻滞位点 麻醉医生在使用超声技术时，首先应该找到收肌管的起止，以确定收肌管位置。超声下先找到股三角尖位置，再找到缝匠肌内侧缘与长收肌内侧缘交叠处，即为收肌管的上口；沿股动脉向下继续探查收肌管内部，当股动脉穿出收肌管裂孔时，即为收肌管的下口，普遍认为在这两个解剖标志之间阻滞可保证局麻药物进入收肌管。传统 ACB 穿刺部位为同侧大腿中段髂前上棘与髌骨底缘之间连线的中点。有学者提出一种远端收肌管阻滞技术[23]，超声下发现股动脉后，沿大腿继续向远端扫描，找到股动脉穿入腘窝延续为腘动脉处，在收肌管裂孔近端 2~3 cm 阻滞。理论上这种远端阻滞方式可以使局麻药通过收肌管裂孔阻滞腘窝中的感觉分支，有助于膝关节后方的镇痛。还有研究推荐在收肌管中点阻滞[24]。尽管上述阻滞方式在临床上都有应用，但何处为 ACB 最佳阻滞位点尚待进一步研究。

3.3.3. 坐骨神经阻滞(SNB)

坐骨神经是腰骶丛的分支，支配着外侧和后侧的膝关节以及膝关节以下的大部分小腿。股神经阻滞能够为 TKA 术后提供良好的镇痛，但无法阻滞支配膝关节后方的神经来自于坐骨神经支配的区域。坐骨神经无论近端还是远端阻滞，都能达到良好的镇痛效果[25]，而且相较单纯股神经阻滞，股神经和坐骨神经的联合阻滞在 TKA 术后显著改善了患者的疼痛[26]。但由于坐骨神经阻滞导致膝关节感觉和运动障碍，以及足背屈不能，影响术后功能康复锻炼，因此其推广受到限制。此外，手术操作过程中误入腓神经损

伤危险区、膝关节严重外翻和屈曲畸形、粗暴操作、止血带使用不当、血肿形成、局部压迫等都会导致腓总神经损伤。坐骨神经阻滞可能掩盖腓总神经牵拉或损伤，不利于术后判断。

3.3.4. 腘动脉与膝关节囊后间隙阻滞(IPACK)

通过在超声引导下将局部麻醉药物注入腘动脉和膝关节后囊之间的间隙，仅对坐骨神经在膝关节的终末细小神经的分支进行阻滞，能为膝关节后方提供良好镇痛，且不会导致足下垂。虽然注药位置较深，但周围没有重要结构毗邻，因此相对安全。Sankineani 的前瞻性非随机对照研究发现，在术后 2 天内的视觉模拟评分、膝关节运动幅度和行走距离指标中，ACB + IPACK 组显著优于单纯 ACB 组[27]。国内学者发现基于 ACB，联合远端 IPACK 用于老年患者全膝关节置换术，操作简便，镇痛效果明显，对运动功能影响小，效果优于联合近端 IPACK [28]。

3.3.5. 持续神经阻滞

为了延长单次注射的效果，不论是 FNB，还是 ACB，均可选择留置导管持续给药。与安慰剂相比，持续 ACB 可降低接受 TKA 的患者的平均疼痛评分和阿片类药物需求[29] [30]另有研究提示股神经区域持续给药相比单次注射有更好的镇痛效果[31]。进一步的随机对照研究比较了持续 ACB 和持续 FNB，结果表明 TKA 患者镇痛效果和麻醉药物需求相当[32] [33]。最近几篇研究比较 FNB 和 ACB 的荟萃分析得出了类似的结论，发现两种持续阻滞镇痛效果和麻醉药物需求相当[34] [35]。无论何种给药方式，均需要仔细识别高风险患者和评估跌倒风险，做好置管管理。

3.4. 关节周围局部浸润麻醉镇痛

使用局部麻醉剂直接浸润切口区域，也可以注入局部麻醉药与非甾体类抗炎药、肾上腺皮质激素和肾上腺素等的混合物，后者通常被称为鸡尾酒疗法(PMI)，其原理是消除手术伤口对疼痛的刺激与传导，以达到预防和控制术后疼痛的目的[36]，由于其效果肯定，不影响运动神经传导，且操作简便，镇痛效果显著，全身副作用小，已广泛应用。但 PMI 的药物配方、剂量尚未形成共识[37] [38]若是高龄患者或合并有肝、肾功能不全等疾病，应警惕大剂量使用增加局部麻醉药中毒的风险。

3.5. 患者静脉自控镇痛：(IV PCA)

通常指采用 PCA 泵为术后患者提供静脉长时间小剂量持续泵注阿片类镇痛药物，患者可根据自身需要控制药物的使用时机，是 TKA 术后镇痛的一种经典方式[39]常用阿片类药物包括舒芬太尼，氢吗啡酮，吗啡等。这种镇痛效果虽然显著，但是副作用也多，包括皮肤瘙痒，恶心呕吐、肠梗阻、呼吸抑制等，特别注意肾功能不良和肾衰的患者在使用时需定时监测肾功能，防止加重肾衰[40]。

3.6. 其他术后镇痛方法

肌肉注射药物镇痛是传统术后镇痛形式，常用药物有曲马多、哌替啶等，由于药物吸收速度取决于药物脂溶性及组织血液灌流量，其起效需要一定时间，难以达到有效控制疼痛的目的。经口镇痛药物 NSAIDs 尤其是 COX-2 抑制剂类(帕瑞昔布钠、塞来昔布等)是临床常见的口服镇痛药物，亦可用于超前镇痛。

4. 小结

TKA 已经成为治疗膝关节疾病终末期的有效治疗方式，但术后疼痛可影响患者术后的康复进程，而单一药物和方法难以实现完全控制疼痛的，多模式镇痛是目前公认的有效镇痛模式，超前镇痛、关节腔周围注射及外周神经阻滞相组合，既能有效控制术后疼痛，又能减少对阿片类药物的依赖及并发症发生，

但至今尚无统一的最佳镇痛方案。而对于外周神经阻滞，越来越多的证据显示，相比于 FNB，ACB 对股四头肌肌力影响更小，更有利于患者术后早期下床及功能锻炼，具有良好的临床应用前景，适宜的 ACB 给药剂量、浓度、给药方式，仍存在一定争议，尚未完全探明。除此之外以往的研究多为样本量都比较少，且为单中心的研究，试验比较的方法也比较单一，未来还需在不同人群进行更多高质量的多中心、大样本、更长时间随访的随机临床对照研究，使外周神经阻滞术后镇痛效果更加清晰明确。

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