

# 关节置换术后感染预防的研究进展

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## 摘要

假体关节感染(PJI), 也称为假体周围感染, 是关节置换术后的最严重并发症之一, 早期感染的体征为持续存在的局部疼痛, 红斑, 水肿, 伤口愈合困难, 大血肿和发热。持久关节疼痛或疼痛增加和早期松弛是迟发性感染的标志, 晚期感染表现为出现全身症状或作为未识别后的亚急性感染菌血症。无论早期还是晚期感染都会为患者带来巨大的伤害, 本文章主要对PJI的预防根据术前、术中以及术后分为三个部分进行综述, 希望能够为临床医师提供参考, 以减少PJI的发生率, 从而尽可能为行关节置换术的患者减少痛苦。

## 关键词

关节置换术, 假体周围感染, 感染预防

# Research Progress of Infection Prevention after Joint Replacement

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## Abstract

Prosthesis joint infection (PJI), also known as periprostheses infection. It is one of the most serious complications after joint replacement. Signs of early infection are persistent local pain, erythema, edema, difficulty in wound healing, large hematoma, and fever. Prolonged joint pain or increased pain and early relaxation are the hallmarks of delayed infection, and late infection is manifested

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as systemic symptoms or as subacute infection bacteremia after unrecognized. No matter early or late infection will bring great harm to patients. This article mainly summarizes the prevention of PJI in three parts according to preoperative, intraoperative and postoperative, hoping to serve as a reference for clinicians to reduce the incidence of PJI, so as to reduce the pain of patients undergoing joint replacement as much as possible.

## Keywords

Joint Replacement, Prosthetic Joint Infection, Infection Prevention

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## 1. 引言

随着人口老龄化的进展, 股骨颈骨折、退行性关节炎等骨关节疾病患者也越来越多, 随之出现的髋关节以及膝关节置换手术也在增加, 然而 PJI 的发生会给患者带来身体与心理上的痛苦, 严重影响患者的生活质量。假体周围感染定义为涉及关节假体和临近组织的感染[1]。假体周围感染的晚期感染表现为出现全身症状(约 30%)或作为未识别后的亚急性感染菌血症(约 70%) [2]。国外研究表明目前 PJI 发生率为 0.3%~1.9% [3], 对于我国庞大的人口基数来说, 是值得引起重视的。但关节置换术的确为患者带来了福利, 此种手术是不可避免的, 因此预防 PJI 的发生是尤为重要的一步。

## 2. 术前预防采取措施

1) 术前血糖的控制: 高血糖如今已经被证明为 PJI 的危险因素[4], 糖尿病患者 PJI 的发生率近乎是一般患者的 3~5 倍, 术前血糖控制不佳( $\geq 194$  mg/dL 即 $\geq 10.8$  mmol/L)与 PJI 的发生有相关的联系[5], 因此术前对患者血糖(特别是糖尿病患者)进行有效的检测、调控是很有必要的。

2) 肥胖患者术前体重管理体重过大本身也是退行性关节炎的一个发病因素。Zhongxi Ma, Fengjin Guo 等人纳入 15 篇文章进行 meta 分析, 认为 BMI  $\geq 30$  组和 BMI  $\geq 40$  组 PJI 的发生风险显著高于 BMI  $< 30$  组, 超重和肥胖会增加 PJI 的发病率[6]。C. Xu, H. Guo 等人认为肥胖是中国汉族人群 PJI 发生的独立危险因素[7]。并且随着现在我国经济水平的提高, 人们的生活质量也得到了很大的改善, 肥胖人群也在逐渐增多, 使得问题更加严峻。因此术前对超重、肥胖患者的体重管理是有意义的。

3) 术前纠正营养不良由于蛋白质储备不足, 营养不良会影响胶原蛋白的合成和成纤维细胞的增殖。白蛋白水平降低也会导致组织水肿和氧含量降低[8], 并且健全的免疫系统要依靠有功能的淋巴细胞来根除或预防感染, 由于营养不良导致淋巴细胞计数减少, 使得营养不良患者更容易感染[9]。A. G. Tsantes, D. V. Papadopoulos 等人的 meta 分析得出结论营养不良患者 PJI 的发生率为正常患者的 3.6 倍[10]。而最广泛使用的评估营养不良的实验室参数是白蛋白[11]。因此, 围术期应该注意患者的营养状态, 检测蛋白情况, 及时发现并补充。

4) 术前皮肤准备术前皮肤准备包括脱毛以及皮肤消毒, 并且关节置换手术为无菌手术, 所以术前皮肤准备再怎么被强调都不为过。脱毛是一种传统的皮肤准备方法, 但应该使用电动剪而不是剃须刀片进行[12] [13]。并且目前的观点认为由专业人员使用酒精溶液进行擦洗, 重点是从手术前一天晚上开始使用葡萄糖酸氯己定溶液[13]。在手术前一天晚上和手术当天早晨使用葡萄糖酸氯己定浸渍湿巾擦拭的患者深

部感染的发生率较低[14]。因此,术前皮肤准备应该从手术前一天晚上就着手准备。

5) 术前贫血纠正 PJI 在患有贫血的患者中的发生率更高,贫血患者的 PJI 发病率为 4.3%,而非贫血患者的发病率为 2%。数据表明,术前贫血与后面 PJI 的发生有关[15]。术前血常规的检查是临床科室的基本检查项目,因此应及时发现贫血情况并且及时改善。

### 3. 术中预防采取措施

大约有三分之二的 PJI 病例是由于术中微生物接种引起的。根据微生物毒力, PJI 可以早期(植入后的前四周内)或者是延迟(通常在三个月至三年之间)表现出来[16]。因此术中预防措施显得尤为关键。

1) 手术时长的控制手术时间大于 90 分钟的患者手术部位感染(SSI)和 PJI 的发生率(分别为 2.1%和 1.4%)明显高于手术时间持续 60~90 分钟的病例(1.1%和 0.7%),以及持续小于等于 60 分钟的患者(0.9%和 0.7%,  $p < 0.01$ )。并且在接受关节置换术的患者中,手术时间每增加 20 分钟,后续 PJI 的风险就会增加近 25% [17]。因此手术医生可以在不影响手术质量的情况下,尽可能的缩短手术时间。

2) 抗生素的使用抗生素的使用是临床科室预防以及治疗感染的常用措施,围术期抗生素的使用已经被证明为有效措施[18]。全关节置换的患者最合适的抗生素治疗是第一代或第二代头孢菌素,因为它们作用广,效果也好。而且体重大于 120 公斤的患者术后 1 年内 PJI 发生率高于体重小于 120 公斤的患者(3.25%和 0.83%,  $p < 0.001$ ),与使用剂量不足和合并症较多有关[19]。因此手术医生对于体重较大患者可适量增加抗生素的计量,从而更好地预防 PJI。

3) 术中手套更换 Katy Kim 等人 meta 分析认为,由于此方面研究较少,暂无法得出结论认为更换手套可以降低 PJI 的发生率,但是由于手套的微生物污染率随着手术时间的增加而增加,因此建议至少每小时更换一次手套[20] [21]。此外,在手术铺单后、安装植入物之前、如果看到可见穿孔等情况为减少污染都应该更换手套[21]。术中根据情况更换手套还是有必要的。

4) 止血药物的使用由于关节置换术失血导致的异体输血已被确定为全关节置换 SSI 和 PJI 的危险因素[22] [23],因此术前及术中止血药物使用来控制出血是有意义的,而氨甲环酸的使用与 PJI 发生率的降低是有联系的[24]。

5) 术中冲洗液的选择稀释聚维酮碘(倍他定)、葡萄糖酸氯己定、生理盐水和万古霉素粉是预防初次全关节置换术期间假体周围关节感染的常见伤口内预防性冲洗剂,稀释聚维酮碘可以杀死所有在接触时立即测试的细菌,并且暴露时间不是关键因素,稀释聚维酮碘在短暴露时间内的细菌覆盖率优于葡萄糖酸氯己定,而万古霉素需要进一步研究耐药菌株发展的潜力[25] [26]。Noam Shohat MD 等发现支持使用聚维酮碘灌溉作为减少 PJI 的安全且具有成本效益的措施[27]。从当前研究来看,稀释聚维酮碘似乎更受学者们推崇。

### 4. 术后预防措施

1) 伤口引流将 PJI 组与对照组进行比较发现,住院期间伤口渗漏明显增加(88% vs 36%,  $p = 0.001$ )和术后前 3 天的早期伤口敷料变化(88% vs 40%,  $p = 0.002$ )。PJI 患者组相较观察组观察到的血肿形成更多(44% vs 10%,  $p = 0.005$ )。趋势检验显示伤口敷料更换总数与 PJI 发展之间存在显著关联( $p < 0.001$ ) [28]。关节置换术后使用引流管可以帮助防止血肿的形成,从而通过引流装置排出渗血来防止感染。从理论上讲,使用引流装置不仅有助于降低感染和血肿形成的风险,还可以通过引流伤口分泌物和降低伤口内压力来减轻患者术后疼痛,以及更换敷料的需要[29]。因此,关节置换术后安置引流管应该常规进行。

2) 抗凝药物的使用进行关节置换术的患者发生 VTE 的风险增加,发生率在 0.9%~1.6%之间[30]。由于所选的血栓预防药物类型可能会增加出血、伤口并发症和潜在的 PJI 的风险,阿司匹林已成为一种合

适的静脉血栓栓塞预防药物, 将阿司匹林与其他血栓预防药物进行比较时, 接受全关节置换术的患者近端 DVT 风险无差异[31], 而且因为它的成本较低、易于给药(口服), 与其他皮下注射等药物相比, 依从性会更高[32]。并且与非阿司匹林组相比, 阿司匹林血栓预防与早期 PJI 的低发生率也有一定的关系[33]。就目前研究来看, 阿司匹林或许可成为关节置换术后的常规抗凝药物。

3) 术后血糖控制骨科以外的其他研究认为, 术后良好的血糖控制可减少并发症发生[34]。假体周围关节感染率从血糖水平  $\geq 115$  mg/dL (6.39 mmol/L) 开始线性增加。多变量分析显示, 血糖水平与假体周围关节感染显著相关( $p = 0.028$ )。降低假体周围关节感染可能性的最佳血糖阈值为 137 mg/dL (7.6 mmol/L)。整个队列的假体周围关节感染率为 1.59% (非糖尿病患者为 1.46%, 糖尿病患者为 2.39%;  $p = 0.001$ )。糖尿病患者的血糖水平与假体周围关节感染之间没有显著关联( $p = 0.276$ ), 尽管存在线性趋势。术后高血糖, 即使只是轻微的升高, 也与假体周围关节感染的风险增加有关[35]。然而临床中对糖尿病患者的血糖关注更多, 这就提醒我们对于非糖尿病患者的血糖也应该着手监测与控制。

4) 远期血源性的预防所有假体关节在整个留置期间仍然容易受到来自远处原发病灶的血源性播种的影响。假体周围组织的高血管性是假体周围感染的危险因素[36]。而找到并且消除原发病灶对于预防感染是一个关键点。最常见的原发病灶包括: 皮肤和软组织的感染(金黄色葡萄球菌等)、呼吸道的感染(肺炎链球菌等)、胃肠道的感染(沙门氏菌、拟杆菌、溶血食子链球菌等)以及尿路的感染(大肠杆菌、克雷伯菌、肠杆菌属等)。感染的血源性播散也可能发生在口气科手术过程中, 尤其是草绿色链球菌。在血管内装置受感染的情况下, 即使是低毒力细菌(表皮葡萄球菌等)也会引起血源性感染[37]。因此对于这些引起血源性感染的因素平时应该提起关注, 并且正确的治疗与处理。

## 5. 总结

PJI 对患者来说是不幸的, PJI 对关节功能具有破坏性后果, 并且对于患者的严重并发症的发病率甚至死亡率相关[38]。目前, 早期或急性 PJI 的治疗主要包括为关节穿刺抽液注射抗菌药物及保留假体联合抗菌药物抑制、一期翻修; 晚期 PJI 的治疗方法主要有二期翻修、关节融合术、关节切除成形术、截肢术[39]; 尽管现在有一定的治疗方法, 但是它给患者带来身体上、精神上以及经济上的痛苦是巨大且可怕的, 甚至是不可逆的伤害。虽然目前有一定的治疗手段作为相应的保障, 但是预防更是关键, 是重中之重, 应该在临床工作中被严格规范操作。

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