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RESEARCH

Use of vancomycin powder under polyethylene in total knee arthroplasty: a technical note

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Abstract

Periprosthetic joint infections (PJI) remain a significant complication in total knee arthroplasty (TKA), often necessitating complex revisions. Vancomycin powder has been used intra-articularly to reduce PJI rates, but conflicting evidence suggests potential complications. This technical note introduces a novel approach: applying vancomycin powder beneath the polyethylene component during TKA, rather than directly into the joint space. We hypothesize that this technique could enhance infection prevention efficacy while minimizing complications associated with intra-articular vancomycin. We detail the indications, procedural steps, and potential complications of this method. Vancomycin powder is applied to the tibial surface before inserting the polyethylene component, maintaining the drug's proximity to potential infection sites without direct exposure to joint tissues. This approach aims to balance infection prevention with safety concerns, providing an alternative for patients at high risk for PJI. Further clinical validation is necessary to confirm the efficacy and safety of this technique.

Keywords Periprosthetic joint infection · Total knee arthroplasty · Surgical site infection · Vancomycin

Introduction

Total knee arthroplasty (TKA) is a widely performed orthopedic procedure; however, infections remain a major concern, often necessitating costly and complex revisions [1]. Staphylococcus aureus, particularly methicillin-resistant Staphylococcus aureus (MRSA), is one of the most common pathogens involved in periprosthetic joint infections (PJI), with reported MRSA rates ranging from 33 to 70% [2]. The use of intrawound vancomycin powder has been documented in spinal surgeries to reduce surgical site infections (SSIs) [3]. Intra-articular administration of 1 g of vancomycin can achieve therapeutic concentrations within the joint without reaching toxic levels systemically [4]. Several studies have demonstrated promising results with vancomycin powder in reducing PJIs in joint replacement surgery [3, 5].

However, conflicting evidence suggests that intra-articular vancomycin may not reduce PJI incidence and could potentially lead to additional complications [6, 7]. Therefore, there is a need for a more reliable technique to improve outcomes for both surgeons and patients.

We propose a novel approach: applying vancomycin powder beneath the polyethylene component during TKA, rather than directly into the joint space post-prosthesis positioning. We hypothesize that this method could enhance the efficacy of infection prevention while minimizing the complications associated with intra-articular vancomycin. This technical note provides detailed guidance on this approach.

This technique has been utilized in 754 patients across three hospitals—Milad, Bahman, and Akhtar Orthopedic Hospital in Tehran, Iran—between January 2019 and September 2023. Written and verbal informed consent was obtained from all patients prior to surgery. Additionally, ethical approval was secured for the use of patient images included in this report.

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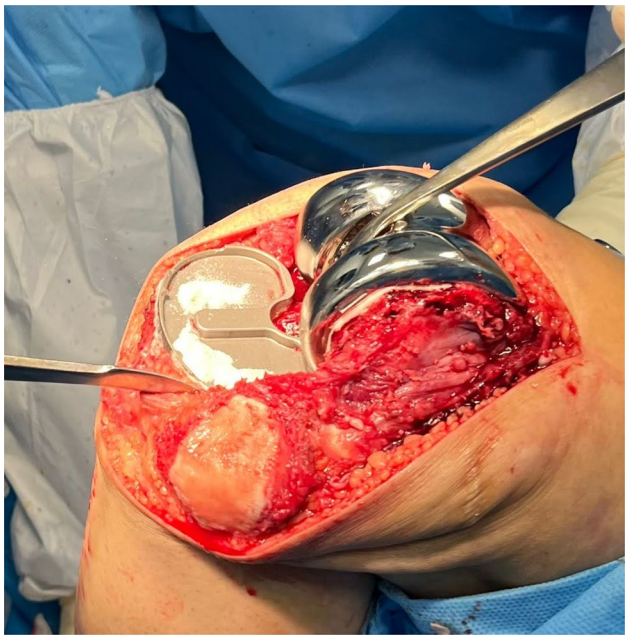

Fig. 1 Application of vancomycin powder onto the polyethylene component

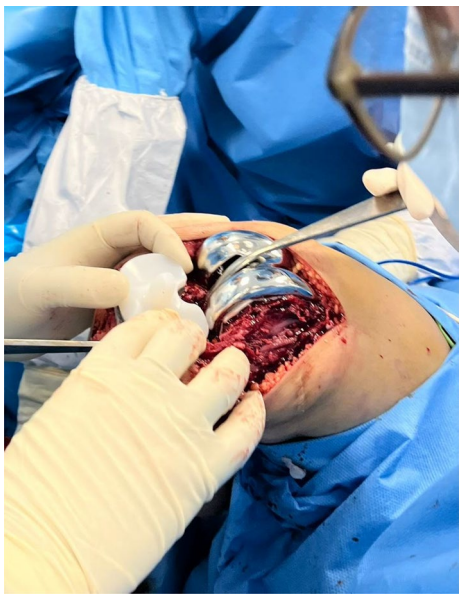

Fig. 2 Placement of the polyethylene component onto the tibial plate

Indications

- Primary or revision total knee arthroplasty
- Patients with a history of joint infections or at high risk for SSIs

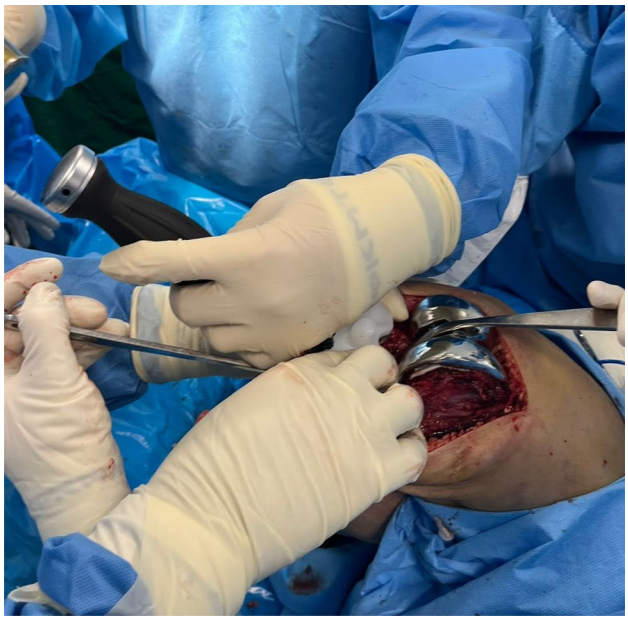

Fig. 3 Insertion of the polyethylene component using a pusher onto the tibial plate and beneath the femoral component

Materials

- Vancomycin powder (1 g)
- TKA implant components (femoral, tibial, and polyethylene)
- Standard surgical instruments
- Sterile drapes and dressings

Procedure

Patient preparation

- Administer standard prophylactic antibiotics as per institutional protocols (e.g., cefazolin).
- Position the patient supine with access to the operative knee.

Incision and exposure

- Perform a standard midline incision or lateral approach, exposing the knee joint through soft tissue mobilization.
- Use retractors to maintain exposure and visualize the joint.

Bone preparation

- Prepare the femur and tibia using standard reaming and cutting techniques suitable for the implant components.
- Achieve meticulous hemostasis with electrocautery.

Application of vancomycin powder

Apply 1 g of vancomycin powder to the tibial surface before inserting the polyethylene component Fig. 1, ensuring even distribution

Insert polyethylene component

Place the polyethylene insert onto the tibial component (fig. 2), ensuring correct alignment and stability. Fig. 3 shows the insertion of the polyethylene component using a pusher onto the tibial plate and beneath the femoral component.

Closure

- Secure the femoral and tibial components, and close the joint capsule, subcutaneous layers, and skin using appropriate sutures.
- Apply a sterile dressing to the incision site.

Postoperative care

- Monitor for signs of infection and manage pain as appropriate.
- Initiate physical therapy early to promote rehabilitation.

Complications

- Local allergic reactions to vancomycin
- Risk of antibiotic resistance with inappropriate use
- Potential for SSIs, though reduced with proper technique

Conclusion

The use of vancomycin powder in TKA has shown promise in reducing PJI rates [4]. Animal studies suggest that doses of 1–2 g are effective without increasing complication rates, while lower doses (0.5 g) may be insufficient [8]. Our proposed technique utilizes 1 g of vancomycin, balancing efficacy with safety concerns. Although vancomycin use is associated with a reduced PJI risk, it is not without potential adverse effects, such as renal injury and aseptic wound complications [9]. Continued research and clinical validation are necessary to further refine and substantiate this approach.

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Author contributions H.A and M.G. conceptualized the study, led the design of the new technique, and contributed to writing and revising the manuscript. A.A and M.M assisted in the surgical design and oversaw adherence to procedural protocols and accurate documentation. M.M and S.B performed the literature review and assisted in drafting the technical aspects of the manuscript. M.G coordinated the project, handled submission processes, and managed communication with the journal. All authors have read and approved the final version of the manuscript, agreeing to be accountable for all aspects of the work.

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Data availability No datasets were generated or analyzed during the current study.

Declarations

Conflict of interest The authors declare no competing interests.

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