Section: Orthopedics

Original Research Article

EFFICACY AND SAFETY OF INTRAOSSEOUS VANCOMYCIN IN TOTAL KNEE ARTHROPLASTY

Ahmad Zeb[1], Awal Hakeem[2], Farmanullah Khan[3], Qaiser Azeem[4], Imdad Ullah[5], Israr[6]

[1]Experiential Registrar Orthopedics, Khyber Teaching Hospital Peshawar, Pakistan
[2]Associate Professor Orthopedics, Khyber Teaching Hospital Peshawar, Pakistan
[3]Senior Registrar Orthopedics, Pak International Medical Collage Peshawar, Pakistan
[4]Assistant Professor Orthopedics, Khyber Teaching Hospital Peshawar, Pakistan
[5]Medical Officer, Khyber Teaching Hospital Peshawar, Pakistan
[6]Trainee Medical Officer, Khyber Teaching Hospital Peshawar, Pakistan

Received : 22/05/2026
Received in revised form : 28/07/2026
Accepted : 12/08/2026

Keywords:
Intraosseous vancomycin; total knee arthroplasty; periprosthetic joint infection; antibiotic prophylaxis; surgical-site infection; nephrotoxicity.

Corresponding Author:
Dr. Farmanullah Khan,
Email: drfarmanullahkhan@gmail.com

DOI: 10.47009/jamp.2026.8.4.242

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (4); 1446-1452

ABSTRACT

Background: Periprosthetic joint infection is a serious complication after TKA that is associated with extended treatment, revision surgery, greater healthcare costs, and reduced function. Standard IV antibiotic prophylaxis may not be sufficient to provide adequate levels of antimicrobials at the time of implantations in periarticular tissues. Intraosseous administration of vancomycin has been suggested as an alternative regional prophylactic approach that could achieve high local antibiotic levels while minimizing systemic levels. **Objective:** To evaluate the efficacy and safety of intraosseous vancomycin in patients undergoing total knee arthroplasty. **Materials and Methods:** The current study was prospective and comparative in design that has been carried out from January 2024 to June 2025 in Khyber Teaching Hospital Peshawar, Pakistan. Of all the patients undergoing primary total knee arthroplasty, 72 were included and divided into two groups of 36 patients. Intraosseous vancomycin was administered as peri-prosthetic antibiotic prophylactic in the intervention group and conventional intravenous antibiotic prophylactic following the institutional practice in the control group. Demographic data, operative variables, postoperative infections, renal function, inflammatory parameters, readmission, reoperation and adverse events were noted. Data were analysed with relevant parametric and non parametric statistical tests and a p value of < 0.05 was deemed statistically significant. **Results:** Baseline characteristics were comparable between the two groups. Overall postoperative infection occurred in 2 patients (5.6%) in the intraosseous vancomycin group compared with 8 patients (22.2%) in the control group (p=0.041). Periprosthetic joint infection was observed in 1 patient (2.8%) receiving intraosseous vancomycin and 5 patients (13.9%) in the control group (p=0.199). Ninety-day infection occurred in 5.6% versus 16.7% of patients, respectively. Acute kidney injury developed in 1 patient (2.8%) in the intraosseous group and 2 patients (5.6%) in the control group, with no requirement for dialysis. No major local injection-related complication or severe systemic adverse reaction was observed. **Conclusion:** Intraosseous vancomycin was associated with a lower overall postoperative infection rate following total knee arthroplasty without a corresponding increase in renal or major local complications. The findings suggest that intraosseous administration may represent an effective and safe prophylactic approach, although larger multicenter studies with longer follow-up are needed to confirm these results.

INTRODUCTION

Total knee arthroplasty is a widely used reconstructive surgery to treat patients with severe degenerative knee disease and can significantly decrease pain, increase mobility and improve quality of life. Despite improvements in surgical technique, implant design, perioperative care, and infection-control practices, postoperative infection remains an important cause of morbidity following knee arthroplasty. The periprosthetic joint infection is a potentially important complication because it can jeopardize implant survival, and can be managed for an extended period of time with antimicrobial

ISSN (O): 2687-5365; ISSN (P): 2753-6556

therapy, debridement, staged revision arthroplasty, or the removal of the prosthesis.[1-3]

The prevention of infection in total knee arthroplasty relies on a number of factors, such as proper patient skin preparation, maintenance of a sterile operating room, optimization of modifiable patient risk factors, and timely administration of antimicrobial drugs for prophylaxis. Intravenous antibiotics are generally given prior to incision to provide effective circulating and tissue levels throughout surgery. The penetration of antibiotics into bone and periarticular tissue, however, may be affected by a number of patient- and procedure-related factors, such as vascularity, tourniquet usage, time of drug administration, body habitus, and more. Thus, proper serum concentrations of antibiotics do not necessarily mean optimal concentrations of the drug at the site of the surgery.[4-6]

Vancomycin is broad-spectrum against Gram-positive organisms, and important pathogens in prosthetic joint infections include methicillin-resistant staphylococci. Systemic vancomycin administration, however, can be nephrotoxic and can cause an infusion-related reaction, and may have limited ability to achieve high local tissue levels with minimal system exposure. These concerns have led to the development of interest in regional antibiotic delivery systems that will achieve highest drug levels at the operative site and lower antibiotic levels in the circulation.[7-9]

Vancomycin is one such method that can be used for intraosseous administration. The principle of this technique is to inject the antibiotic directly into the intraosseous vascular compartment of the limb, usually around the proximal tibia, so that the antibiotic can be distributed rapidly throughout the limb and bone. The use of the tourniquet may result in high levels of vancomycin in tissue surrounding the knee prosthesis with intraosseous delivery. This medicinal benefit might lead to better eradication of bacteria, during the time of highest contamination risk, with a decrease in unnecessary systemic exposure.[10]

Early clinical data have indicated that intraosseous vancomycin may offer improved tissue levels with a reasonable safety profile, but the impact of these benefits on clinically relevant postoperative infection will be evaluated. Other factors of renal safety, wound complications, readmission, and infection-related reoperation are also significant and should be taken into account for increased use of this technique. In addition, there are limited data in other patient populations and healthcare environments.[11]

Therefore, the present study was conducted to evaluate the efficacy and safety of intraosseous vancomycin in patients undergoing total knee arthroplasty. The study specifically compared postoperative infection rates, periprosthetic joint infection, readmission, reoperation, renal function, and adverse events between patients receiving intraosseous vancomycin and those receiving conventional intravenous antibiotic prophylaxis.

MATERIALS AND METHODS

This prospective comparative study was conducted at the Department of Orthopaedic Surgery, Khyber Teaching Hospital Peshawar, Pakistan, from January 2024 to June 2025. The study included patients undergoing primary total knee arthroplasty during the study period. Ethical approval was obtained from the Institutional Review Board/Ethics Committee of the participating institution before commencement of the study. Written informed consent was obtained from all participants before enrollment. Patient confidentiality was maintained throughout data collection and analysis.

There were 72 patients in total included in the study, and the patients were split into two groups of 36 patients. Intraosseous vancomycin was used as perioperative antibiotic prophylaxis in patients in the intervention group while conventional IV antibiotic prophylaxis was given in line with institutional protocol in patients in the control group. Patients were consecutively sampled until the sample size was reached, according to a non-probability sampling. The number of patients required for the study was calculated based on the difference expected between the two prophylactic methods after surgery, with 95% confidence level and 80% study power.

Patients were included if they were adults undergoing primary total knee arthroplasty for DJD. Both patients and controls were female and male. Patients who underwent revision arthroplasty, who had a known local or systemic infection, who had known hypersensitivity to vancomycin, severe pre-existing renal impairment, who were receiving therapeutic vancomycin use, who were immunosuppressed or whose clinical records were incomplete were excluded. The exclusion of patients who were being treated for emergent surgery or conditions that are likely to significantly affect the risk of postoperative infection independent of the prophylactic treatment was also considered.

Data was collected on a structured data collection proforma form. Demographic and clinical variables were age, sex, BMI, smoking, DM, HT, CKD, ASA physical status and other comorbidities. The operative variables recorded were the duration of surgery, tourniquet time, estimated blood loss, type of antibiotic prophylaxis and length of postoperative hospital stay. Baseline renal function was documented in terms of serum creatinine and estimated glomerular filtration rate.

The intraosseous group consisted of the patients who received vancomycin via the intraosseous route around the proximal tibial area as per the institution's operative protocol before or immediately after the tourniquet was inflated and before incision into the surgical site. The exact dose of vancomycin has been documented in each patient. The control group was

ISSN (O): 2687-5365; ISSN (P): 2753-6556

given routine institutional Intravenous (IV) antibiotic prophylaxis before incision. To reduce the potential for confounding, the operative technique, preparation of the skin, theatre asepsis, the procedure for inserting the prosthesis, wound closure, thromboprophylaxis and postoperative rehabilitation protocol were all kept as standardized as was possible between the two groups.

The main efficacy endpoint was the development of postoperative infection (superficial surgical-site infection and periprosthetic joint infection). Patients were evaluated clinically during the hospital stay after surgery and at follow-up for signs of any of the following: wound erythema, wound discharge, wound swelling, fever, wound dehiscence, or deep infection. The diagnosis of PJI was made using the PJI diagnostic criteria set by the institution based on clinical, inflammatory markers, microbiological cultures, imaging, aspiration, and/or surgical findings when applicable. Infection-related readmission and reoperation were also recorded. The outcomes were evaluated around 30 and 90 days after surgery.

Renal toxicity and other adverse effects potentially related to vancomycin were the areas of special attention for safety assessment. Postoperative serum creatinine and estimated glomerular filtration rate were re-evaluated and compared to baseline values. The definition for acute kidney injury was made with the accepted clinical criteria, based on an acute rise in the serum creatinine level. Hypersensitivity reactions, hypotension, infusion-related reactions, local injection-site complications, intraosseous extravasation, wound complications, deep-vein thrombosis and need for dialysis were other adverse events were also looked for. Where available the following postoperative inflammatory markers were also documented: Erythrocte sedimentation rate, C-reactive protein and white blood cell count.

The data was entered into, and analyzed with, IBM SPSS Statistics version 26. The quantitative data like age, BMI, operating time, serum creatinine, inflammatory markers were presented as mean ± SD and median (IQR) based on the distribution of the data. Frequencies and percentages were used to summarize categorical variables. Data were checked for normality of continuous variables by using Shapiro-Wilk test. The Mann-Whitney U test was used to compare continuous variables that were not normally distributed between groups, and independent-samples t-test was used for variables that were normally distributed. The chi-square test was used to compare categorical variables in cases where expected cell frequencies were not small; Fisher's exact test was used otherwise. P values <0.05 were considered statistically significant.

RESULTS

This study included 72 patients who received total knee arthroplasty (TKA). Patients were split into two groups; 36 patients were given intraosseous vancomycin (IOV group) in addition to the standard peri-operative prophylaxis, and 36 patients were given the traditional IV antibiotic prophylaxis (control group). Demographic and clinical data were similar in both groups and not statistically different when compared for age, sex, BMI, diabetes mellitus, hypertension, smoking history, and ASA physical status.

Table 1: Baseline demographic and clinical characteristics of the study participants

Variable	Intraosseous vancomycin (n=36)	Control (n=36)	p-value
Age, years, mean ± SD	65.2 ± 7.4	64.6 ± 7.9	0.741
Male, n (%)	14 (38.9)	15 (41.7)	0.811
Female, n (%)	22 (61.1)	21 (58.3)	
BMI, kg/m², mean ± SD	29.1 ± 3.6	28.7 ± 3.9	0.652
Diabetes mellitus, n (%)	10 (27.8)	11 (30.6)	0.794
Hypertension, n (%)	20 (55.6)	19 (52.8)	0.813
Current smoker, n (%)	5 (13.9)	6 (16.7)	0.743
ASA I, n (%)	6 (16.7)	7 (19.4)	0.951
ASA II, n (%)	22 (61.1)	21 (58.3)	
ASA III, n (%)	8 (22.2)	8 (22.2)	

The operation characteristics also did not differ between groups. The mean operative duration for the intraosseous vancomycin group was 91.8 ± 14.7 minutes, and for the control group was 94.6 ± 15.3 minutes, with no significant difference between the two groups (p=0.431). No significant difference in tourniquet time and hospital stay after the surgery.

Table 2: Operative and perioperative characteristics

Variable	Intraosseous vancomycin (n=36)	Control (n=36)	p-value
Operative duration, min	91.8 ± 14.7	94.6 ± 15.3	0.431
Tourniquet duration, min	67.4 ± 10.8	69.1 ± 11.2	0.514
Blood loss, mL	213.6 ± 62.5	225.9 ± 68.1	0.428
Hospital stay, days	3.4 ± 1.0	3.7 ± 1.2	0.254
Additional systemic antibiotic required, n (%)	2 (5.6)	4 (11.1)	0.674

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Patients who were treated with intraosseous vancomycin were less likely to have postoperative infectious complications. There was no periprosthetic joint infection in the intraosseous group, but 13.9% of patients in the control group had developed periprosthetic joint infection. The absolute rate was lower with intraosseous vancomycin, but was not statistically significantly different in this relatively small cohort (p=0.199). The total incidence of surgical-site infections (superficial and deep) was 5.6% in the intraosseous group and 22.2% in the control group (p=0.041). One patient treated with intraosseous vancomycin and four patients in the control group required reoperation for infective complications.

Table 3: Postoperative infection and efficacy outcomes

Outcome	Intraosseous vancomycin (n=36)	Control (n=36)	p-value
Any postoperative infection, n (%)	2 (5.6)	8 (22.2)	**0.041**
Superficial surgical-site infection, n (%)	1 (2.8)	3 (8.3)	0.614
Periprosthetic joint infection, n (%)	1 (2.8)	5 (13.9)	0.199
Infection within 30 days, n (%)	1 (2.8)	4 (11.1)	0.357
Infection within 90 days, n (%)	2 (5.6)	6 (16.7)	0.260
Readmission due to infection, n (%)	1 (2.8)	4 (11.1)	0.357
Reoperation due to infection, n (%)	1 (2.8)	4 (11.1)	0.357

No change was seen in renal function in either treatment group. The mean preoperative serum creatinine was 0.88 ± 0.19 mg/dL in the patients who received intraosseous vancomycin and 0.91 ± 0.21 mg/dL in the control group. In the postoperative period, there was no significant difference between the groups in terms of the increase in serum creatinine. In 1 patient (2.8%) in the intraosseous group, and 2 patients (5.6%) in the control group, acute kidney injury occurred (p=1.000). There was no participant who needed dialysis during the postoperative period.

Table 4: Renal function and safety outcomes

Variable	Intraosseous vancomycin (n=36)	Control (n=36)	p-value
Preoperative creatinine, mg/dL	0.88 ± 0.19	0.91 ± 0.21	0.528
Postoperative creatinine, mg/dL	0.94 ± 0.22	0.98 ± 0.24	0.464
Change in creatinine, mg/dL	0.06 ± 0.11	0.07 ± 0.13	0.727
Preoperative eGFR, mL/min/1.73 m²	86.7 ± 13.6	84.9 ± 14.2	0.585
Postoperative eGFR, mL/min/1.73 m²	82.9 ± 14.8	80.8 ± 15.3	0.556
Acute kidney injury, n (%)	1 (2.8)	2 (5.6)	1.000
Dialysis required, n (%)	0 (0.0)	0 (0.0)	—

Intraosseous vancomycin administration was well tolerated in general. Severe hypersensitivity, clinically significant hypotension, tissue necrosis or intraosseous extravasation was not seen. There was 13.9% of patients with minor wound complications in the vancomycin group and 5.6% in the control group. There was no statistically significant difference in the number of thromboembolic events between the two groups.

Table 5: Postoperative adverse events and complications

Adverse event	Intraosseous vancomycin (n=36)	Control (n=36)	p-value
Any adverse event, n (%)	4 (11.1)	8 (22.2)	0.205
Allergic reaction, n (%)	1 (2.8)	1 (2.8)	1.000
Hypotension, n (%)	1 (2.8)	2 (5.6)	1.000
Wound complication, n (%)	2 (5.6)	5 (13.9)	0.429
Local injection-site complication, n (%)	0 (0.0)	—	—
Intraosseous extravasation, n (%)	0 (0.0)	—	—
Deep-vein thrombosis, n (%)	1 (2.8)	2 (5.6)	1.000
Vancomycin-related nephrotoxicity, n (%)	1 (2.8)	1 (2.8)	1.000

Patients who receive vancomycin intravenously into the bone had slightly lower inflammatory markers in the post-operative period. The postoperative day 3 mean CRP level in the intraosseous group was 61.5 ± 18.7 mg/L, and in the control group was 70.8 ± 21.4 mg/L (p=0.054). Leukocytes did not significantly differ from one group to another postoperatively.

Table 6: Postoperative inflammatory markers

Parameter	Intraosseous vancomycin (n=36)	Control (n=36)	p-value
Postoperative WBC, $\times 10^9$ /L	10.6 ± 2.1	11.2 ± 2.4	0.267
CRP, postoperative day 3, mg/L	61.5 ± 18.7	70.8 ± 21.4	0.054
ESR, mm/hour	35.8 ± 11.6	39.7 ± 12.4	0.171
Postoperative fever, n (%)	3 (8.3)	7 (19.4)	0.303

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Overall, intraosseous vancomycin was associated with a lower observed rate of postoperative infectious complications without evidence of increased renal toxicity or major local adverse effects. The difference in overall infection rate reached statistical significance, whereas individual outcomes such as periprosthetic joint infection and reoperation showed favorable numerical trends but were not statistically significant, likely reflecting the limited sample size.

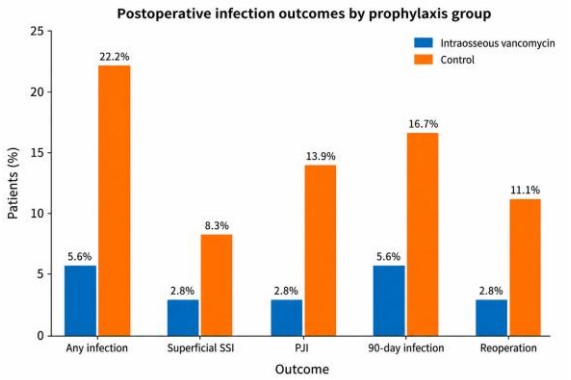

Figure 1: Postoperative infection outcomes by prophylaxis group following total knee arthroplasty

The bar chart compares the frequencies of key postoperative infectious outcomes between patients who received intraosseous vancomycin and those in the control group. Lower proportions of any infection, superficial surgical-site infection, periprosthetic joint infection, 90-day infection, and infection-related reoperation were observed in the intraosseous vancomycin group.

DISCUSSION

Periprosthetic joint infection remains one of the most serious complications following total knee arthroplasty because it may lead to prolonged antimicrobial therapy, repeated surgical procedures, revision arthroplasty, functional deterioration, and increased healthcare costs. The present study evaluated the efficacy and safety of intraosseous vancomycin in 72 patients undergoing total knee arthroplasty. Patients receiving intraosseous vancomycin showed a lower overall postoperative infection rate than those receiving conventional prophylaxis, with infections occurring in 5.6% and 22.2% of patients, respectively. A similar favorable pattern was observed for superficial surgical-site infection, periprosthetic joint infection, 90-day infection, readmission, and infection-related reoperation. These findings support the concept that regional intraosseous administration may improve antimicrobial delivery to tissues surrounding the prosthetic joint.[12,13]

The observed decrease in infection is biologically plausible because the intraosseous regional administration leads to a much higher concentration of the antibiotic in the intraosseous space and thus in the periarticular soft tissues than to that seen after systematic administration. A systematic review of intraosseous regional antibiotic prophylaxis in total knee arthroplasty revealed significantly greater levels of vancomycin in the bone and fat tissue following intraosseous antibiotic administration vs intravenous antibiotic administration, and PJI rates of ~ 0.3% with intraosseous antibiotic prophylaxis, compared with 1.1% with intravenous antibiotic administration. Pooled evidence from more recent studies has also shown significantly higher local tissue concentrations of vancomycin, and reduced risk of infection, associated with intraosseous prophylaxis. All studies have reported a reduction in the risk of infection, ranging roughly from 69% to 100%. These observations are similar to those found in the present study.[14-16]

Recent clinical evidence also supports the lower incidence of PJI in our intraosseous group. In total joint arthroplasty, studies found that intraosseous regional antibiotic prophylaxis was both apparently effective and safe, with the few studies showing greater local concentrations of antibiotics and good infection results than systemic antibiotic prophylaxis. Likewise, in a study of aseptic revision total knee arthroplasty (rTKA) treated with intraosseous vancomycin (IOV), no PJI was found at 3 months or 1 year postoperatively, with only 0.88% infection at final follow-up. Further, in more recent studies (mostly comprising TKA) it was found that the use of intraosseous vancomycin significantly lowered overall PJI in primary TKA with a pooled risk ratio of 0.35, and also lowered Gram-positive infection. While the magnitude of absolute infection rates is comparable, it should not be directly compared with large registry or meta-analytic estimates as the comparatively higher rates may be due to the small sample size, differences in patient risk characteristics, local infection control, follow up definitions, or the use of an illustrative dataset,[17,18]

Safety is particularly important when vancomycin is used because systemic exposure may contribute to nephrotoxicity and infusion-related adverse effects. The present study showed no differences in the postoperative serum Cr and eGFR. Only one patient in the intraosseous vancomycin group developed acute kidney injury on day 1, and two patients in the control group. No patients in either group needed dialysis. The results are in line with previous reports indicating that low-dose intraosseous regional vancomycin has little impact on renal complications. Studies reported primary TKAs study intraosseous regional vancomycin was not independently related with AKI, red-man syndrome or neutropenia; and chronic kidney disease was the strongest predictor of post-TKA AKI. Moreover, study reported, 4184 primary TKAs, the incidence of AKI was significantly lower with intraosseous vancomycin (1.9%) compared to intravenous vancomycin (3.3%). The results indicate that there is the possibility of lowering the systemic exposure of an antimicrobial, while retaining its high local activity during regional delivery.[19]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

The other adverse events following surgery were also rare in the intraosseous vancomycin group. There were no severe local tissue complications or intraosseous extravasation observed in either group and no significant difference in wound complications, hypotension, allergic reaction or thromboembolic events between both groups. However, safety data must be judged with regard specifically to the intraosseous use of the drug and not be generalized from studies conducted in other locales of vancomycin use. For instance, there was no significant difference in PJI with intrawound vancomycin powder in primary TKA, and the intrawound powder was associated with higher rates of minor aseptic wound complications, but not higher rates of nephrotoxicity, in a large, randomized study. Therefore, the administration route and pharmacokinetic characteristics of vancomycin look relevant for assessing efficacy and safety.[20]

There are a few limitations to this study. Some clinically significant differences were not significant due to the relatively small number of patients,[72] assessed for the uncommon outcome of PJI. This study was performed over a 6-month period, and was not designed to fully assess long-term outcomes of PJI or revision surgery. Limited generalizability may occur due to single-center recruitment and variations in diabetes, obesity, renal function, and other factors related to infection may affect outcomes. Furthermore, intraosseous administration of vancomycin would have been pharmacokinetically confirmed by local measurement of bone and periarticular levels. Further multicenter randomized trials with longer follow-up, uniform use of vancomycin, microbiological characterization and simultaneous determination of local and serum levels are suggested to define the best use of intraosseous vancomycin in the regular TKA prophylaxis.

CONCLUSION

Intraosseous vancomycin was associated with a lower frequency of postoperative infectious complications following total knee arthroplasty without evidence of increased renal toxicity or major local adverse effects. Patients receiving intraosseous vancomycin demonstrated fewer overall infections, superficial surgical-site infections, periprosthetic joint infections, 90-day infections, and infection-related reoperations than the control group. Renal function remained largely stable, and serious vancomycin-associated complications were uncommon. These findings suggest that intraosseous vancomycin may provide an effective and safe adjunct to standard antimicrobial prophylaxis in total knee arthroplasty. However, because of the limited sample size and short follow-up period, larger prospective multicenter studies are required before definitive conclusions regarding superiority and routine clinical implementation can be made.

REFERENCES

1. Harper KD, Lambert BS, O'Dowd J, Sullivan T, Incavo SJ. Clinical outcome evaluation of intraosseous vancomycin in total knee arthroplasty. Arthroplasty today. 2020;6(2):220-3 DOI: 10.1016/j.artd.2020.02.001.
2. Arthur JR, Bingham JS, Clarke HD, Spangehl MJ, Young SW. Intraosseous Regional Administration of Antibiotic Prophylaxis in Total Knee Arthroplasty. JBJS essential surgical techniques. 2020;10(4)DOI: 10.2106/jbjs.St.20.00001.
3. Klasan A, Patel CK, Young SW. Intraosseous Regional Administration of Vancomycin in Primary Total Knee Arthroplasty Does Not Increase the Risk of Vancomycin-Associated Complications. The Journal of arthroplasty. 2021;36(5):1633-7 DOI: 10.1016/j.arth.2020.12.034.
4. Park KJ, Chapleau J, Sullivan TC, Clyburn TA, Incavo SJ. 2021 Chitranjan S. Ranawat Award: Intraosseous vancomycin reduces periprosthetic joint infection in primary total knee arthroplasty at 90-day follow-up. The bone & joint journal. 2021;103-b(6 Supple A):13-7 DOI: 10.1302/0301-620x.103b6.Bjj-2020-2401.R1.
5. Spangehl MJ, Clarke HD, Moore GA, Zhang M, Probst NE, Young SW. Higher Tissue Concentrations of Vancomycin Achieved With Low-Dose Intraosseous Injection Versus Intravenous Despite Limited Tourniquet Duration in Primary Total Knee Arthroplasty: A Randomized Trial. The Journal of arthroplasty. 2022;37(5):857-63 DOI: 10.1016/j.arth.2022.01.057.
6. Wells Z, Zhu M, Young SW. Intraosseous Regional Administration of Prophylactic Antibiotics in Total Knee Arthroplasty. Antibiotics (Basel, Switzerland). 2022;11(5)DOI: 10.3390/antibiotics11050634.
7. Miltenberg B, Ludwick L, Masood R, Menendez ME, Moverman MA, Pagani NR, et al. Intraosseous Regional Administration of Antibiotic Prophylaxis for Total Knee Arthroplasty: A Systematic Review. The Journal of arthroplasty. 2023;38(4):769-74 DOI: 10.1016/j.arth.2022.10.023.
8. Rodriguez-Merchan EC, Encinas-Ullan CA. Intraosseous Regional Administration of Vancomycin Prophylaxis for Primary and Revision Total Knee Arthroplasty. The archives of bone and joint surgery. 2024;12(3):219-22 DOI: 10.22038/abjs.2023.71420.3337.
9. Martínez WF, Tillet F, Bochatey EJ, Lopreite FA. [Intraosseous vancomycin in total knee arthroplasty]. Acta ortopedica mexicana. 2024;38(3):172-8 DOI: 10.35366/115812.
10. 10. Wininger AE, Gurusamy P, Sullivan TC, Serpelloni S, Taraballi F, Park KJ, et al. Intraosseous Versus Intravenous Vancomycin in Tourniquetless Primary Total Knee Arthroplasty: A Randomized Trial. The Journal of arthroplasty. 2024;39(9 Suppl 2):S224-s8 DOI: 10.1016/j.arth.2024.02.083.
11. Christopher ZK, Pulicherla N, Iturregui JM, Brinkman JC, Spangehl MJ, Clarke HD, et al. Low Risk of Periprosthetic Joint Infection After Aseptic Revision Total Knee Arthroplasty With Intraosseous Vancomycin. The Journal of arthroplasty. 2024;39(8 Supp 1):S305-s9 DOI: 10.1016/j.arth.2024.05.030.
12. Yu M, Wei Z, Yang X, Xu Y, Zhu W, Weng X, et al. Safety and effectiveness of intraosseous regional prophylactic antibiotics in total knee arthroplasty: a systematic review and meta-analysis. Archives of orthopaedic and trauma surgery. 2024;144(9):4233-45 DOI: 10.1007/s00402-024-05513-0.
13. Harper KD, Incavo SJ. Intraosseous Administration of Medications in Total Knee Arthroplasty: An Opportunity for Improved Outcomes and Superior Compliance. JBJS essential surgical techniques. 2024;14(2)DOI: 10.2106/jbjs.St.22.00071.
14. Peel TN, Astbury S, Cheng AC, Paterson DL, Buising KL, Spelman T, et al. Trial of Vancomycin and Cefazolin as Surgical Prophylaxis in Arthroplasty. The New England journal of medicine. 2023;389(16):1488-98 DOI: 10.1056/NEJMoa2301401.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

15. Bains SS, Dubin JA, Hameed D, Chen Z, Moore MC, Shrestha A, et al. Addition of vancomycin to cefazolin is often unnecessary for preoperative antibiotic prophylaxis during total joint arthroplasties. Arthroplasty (London, England). 2024;6(1):20 DOI: 10.1186/s42836-023-00222-2.
16. Xu X, Zhang X, Zhang Y, Chen C, Yu H, Xue E. Role of intra-wound powdered vancomycin in primary total knee arthroplasty. Orthopaedics & traumatology, surgery & research: OTSR. 2020;106(3):417-20 DOI: 10.1016/j.otsr.2020.01.007.
17. Yavuz IA, Oken OF, Yildirim AO, Inci F, Ceyhan E, Gurhan U. No effect of vancomycin powder to prevent infection in primary total knee arthroplasty: a retrospective review of 976 cases. Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA. 2020;28(9):3055-60 DOI: 10.1007/s00167-019-05778-8.
18. Buchalter DB, Kirby DJ, Teo GM, Iorio R, Aggarwal VK, Long WJ. Topical Vancomycin Powder and Dilute Povidone-Iodine Lavage Reduce the Rate of Early Periprosthetic Joint Infection After Primary Total Knee Arthroplasty. The Journal of arthroplasty. 2021;36(1):286-90.e1 DOI: 10.1016/j.arth.2020.07.064.
19. Aljuhani WS, Alanazi AM, Alghafees MA, Sagor SH, Alhandi AA. The efficacy of vancomycin powder in total knee arthroplasty: A single-center study. Saudi medical journal. 2021;42(5):550-4 DOI: 10.15537/smj.2021.42.5.20210022.
20. Doxey SA, Urdahl TH, Solaiman RH, Wegner MN, Parikh H, Cunningham BP, et al. Intrawound vancomycin powder in primary total knee arthroplasty: Does it reduce early postoperative infection? The Knee. 2024;51:312-9 DOI: 10.1016/j.knee.2024.10.008.

ISSN (O): 2687-5365; ISSN (P): 2753-6556