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**ORIGINAL RESEARCH**

# Infection rates in joint replacement surgeries at a tertiary-level government hospital in north India

[1]Dr. Majumdar Krishna P, [2]Dr. Gopal Krishna, [3]Dr. Virender Kumar, [4]Dr. Piyush Punia, [5]Dr. S. Roy, [6]Dr. Amandeep Mittal, [7]Dr. Goutam Goyal, [8]Dr. Swagat Narayan Dash, [9]Dr. Aditya Malik, [10]Dr. Raj Singh Potalia, [11]Dr. Umesh Yadav

[1,3-11]Department of Orthopaedics, PGIMS, Rohtak, Haryana, India
[2]Dept. of Neurosurgery, PGIMS,Rohtak, Haryana, India

**Corresponding Author**
Dr. Virender Kumar
Department of Orthopaedics, PGIMS, Rohtak, Haryana, India
**Email:** drvirender80@gmail.com

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**ABSTRACT**
Post-operative infection is a serious complication in any surgical procedure, particularly in arthroplasty, presenting limited options for both the surgeon and the patient. The use of antibiotic prophylaxis in arthroplasty remains a therapeutic gray area, with no clear consensus on the appropriate role, timing, dosage, or type of antibiotics. Large studies generally report an infection rate of 1-2% for arthroplasty. Leading prosthesis manufacturers emphasize the importance of disposable instrument sets, sterile helmet systems, and modular operating theaters (OTs) for optimal outcomes, particularly in arthroplasty. Despite our operating conditions being far from ideal, we have managed to maintain a surprisingly low infection rate. Our OT is a basic room without laminar flow, specialized flooring, or advanced air-conditioning. We use reusable, autoclaved cotton gowns and sheets, and ensure that the OT and patient rooms are fumigated before every surgery. For prophylaxis, we administer Linezolid and Amikacin. We conducted a review of 173 consecutive arthroplasty patients (235 joints, including hips and knees) with a minimum follow-up of one year. The results suggest that our infection rate (<1%) is comparable to, if not better than, the world's leading centers, and this has been achieved at just a fraction of the cost (<$1100 vs. ~$55,000). This raises important questions about the factors contributing to infection rates and may offer valuable insights for smaller centers without state-of-the-art facilities, encouraging them to consider offering joint replacement procedures.

**Keywords:** immunity,India, arthroplasty, joint replacement, infection rate, operation theaters



## INTRODUCTION

Asepsis is essential for preventing the introduction of pathogens into surgical wounds, thereby protecting the patient from healthcare-associated infections that can lead to delayed recovery, prolonged hospitalization, increased pain and higher morbidity. Aseptic practices must never be compromised for the convenience of the caregiver and emergencies in which asepsis is deemed a secondary concern are exceedingly rare.[1]Bacterial shedding, wound contamination and the rate of clinical infections in clean wounds are affected by the operating theater's dress code.[2]

A study demonstrated a 22-fold increase in colony-forming units (CFUs) on settle plates at waist height when neither a cap nor mask was worn, a 15-fold increase when only a cap was worn and a fourfold increase when only a mask was worn, all within vertical laminar airflow enclosures. Despite air sample counts remaining low, the study concluded that theater air sampling alone does not accurately reflect local contamination, particularly when a surgeon is positioned over a wound in such an environment. It emphasized that both caps and masks are crucial components of the required attire in these settings.[2]

Prosthesis companies often highlight studies that advocate for the use of disposable instrument sets, disposable helmet systems and modular operating theaters as key to achieving optimal outcomes, particularly in arthroplasty. However, research indicates that surgical helmet systems may lead to higher levels of intraoperative contamination, even in laminar airflow OTs, compared to standard surgical gowns. While the pressure differential within the suit may contribute to this, many institutions still choose to use helmet systems during arthroplasty

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procedures.[3]Post-operative infection is a feared complication in any surgery, particularly in arthroplasty, where it limits the options available to both the surgeon and the patient. The minimal infectious dose is reduced by more than 105 times when a foreign body, such as an implant or prosthesis, is present.[4]

An extensive review to define the duration of post-operative infection proved inconclusive, with various sources citing different time frames. The focus of this paper is on our operating conditions, which are notably far from ideal.

## MATERIAL &METHODS

We conducted a retrospective study at a tertiary government hospital in India, reviewing 235 consecutive primary arthroplasties (85 hip and 150 knee replacements) performed between 2017 and 2024. Patients who passed away or were lost to follow-up were excluded. All cases had a minimum follow-up of one year, and the study focused on postoperative infection rates. Antibiotic-laden cement (500mg gentamicin) was used whenever cement was applied.

Despite advances in many areas, the modernization of infrastructure and instrumentation has not fully reached several government hospitals, including ours. The preoperative preparation included the use of hair removal cream, scrubbing the surgical limb with Povidone Iodine Scrub (7.5%), Povidone Iodine Solution (10%) and surgical spirit (>70% ethanol) at least twice, accompanied by draping the limb in sterile sheets, which were to be opened in the operating room the following day. The operating theater was fumigated overnight before each case, with only one replacement performed as the first case of the day.

The surgical team comprised the chief surgeon (an Associate professor or senior), an assistant professor, one or two senior residents, a final-year junior resident, an implant technician and a scrub nurse. All team members used regular soap for scrubbing and wore double gloves routinely. In cases where disposable ethylene oxide (EO) sterilized non-absorbent gowns were unavailable, autoclaved absorbent cloth gowns were used. Non-absorbent surgical drapes were used on top of the cloth gowns and incise drapes were also applied. There was no dedicated scrubbing team and junior members took turns scrubbing the patient. After anesthetic clearance, three alternate coats of Povidone Iodine (10%) and surgical spirit were applied to the surgical site.

Pulse/Jet lavage was employed for all knee replacements and occasionally for cemented hip replacements. Surgical helmet systems and face shields were not used; only simple disposable caps and masks were worn. Stainless steel instruments were reused for each case and autoclaved between uses, while the prostheses (Stryker, USA) were pre-sterilized. Cautery pencils and suction tips were reused after sterilization with formaldehyde gas (formalin tablets) and suction tubes were boiled and reused.

The operating theater lacked laminar airflow and the air conditioning was often nonfunctional, so ceiling fans were used instead. The average operating temperature was around 35°C due to heat-generating overhead lights. The theater floor was rough cement, with no specialized flooring and there were no restrictions on personnel movement or control over the anesthesia team's proper use of face masks. A simple two-layer cotton cloth barrier was used between the trolley and instruments.

A negative suction drain was placed in all cases before closure. Dry gauze dressing was applied and secured with sticky paper tape. Drains were removed on postoperative day 2 and sutures or staples were taken out 12-14 days post-surgery. Preoperative antibiotics included two doses of 600mg Linezolid, administered 12 and 4 hours before surgery. Postoperative antibiotics consisted of parenteral Linezolid (600mg twice daily) and Amikacin (500mg twice daily) for 5 days, followed by oral Linezolid (600mg twice daily) for an additional week until suture removal. No intraoperative antibiotics were given and no further antibiotics were administered after suture removal.

Following surgery, most patients were transferred to isolation or separate rooms, which were fumigated overnight. Postoperative anticoagulation was not used unless the patient was already on such medication for other reasons. There was no control over smoking or alcohol consumption after discharge.

## RESULTS

We reviewed 173 patients with a total of 235 joints (both hips and knees), with a mean age of 56 years (range: 21-83 years). The cohort consisted of 95 females and 78 males. Seven patients had a BMI greater than 30. The average operating time, from incision to closure, was 58 minutes. Seven patients had rheumatoid arthritis and were on disease-modifying anti-rheumatic drugs (DMARDs) pre- and post-operatively, excluding the perioperative period of two weeks. Five patients had ankylosing spondylitis. The remaining patients were diagnosed with osteoarthritis (OA), which included post-traumatic OA, avascular necrosis and sequelae of joint tuberculosis. Nine percent of the patients (15/173) were immunocompromised, either due to diabetes or hepatitis B/C. The average follow-up duration was 16.8 months.

Out of the 235 joints, only three developed post-operative infection (1.3%). One patient underwent surgery for secondary OA following the sequelae of tuberculosis in the hip. Six months after surgery, she developed a deep abscess at the surgical site. Incision, drainage, and testing confirmed a tuberculosis infection. She was treated with surgical debridement and joint lavage twice over three months, along with a five-drug anti-tuberculosis regimen (Isoniazid,

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Rifampicin, Pyrazinamide, Ethambutol, and Streptomycin). The patient made a full recovery and remained off antibiotics for more than a year without any signs of recurrence. Of the other two, one cultured *Staphylococcus aureus*, whereas the other grew *E. coli*, due to poor nursing care at home after discharge. One of these patients passed away after three weeks with an infection that could not be well contained due to poor diabetic control while the other required a staged revision with an antibiotic spacer. All other patients had no signs of infection and recovered without complications.

## DISCUSSION & CONCLUSION

Antibiotic prophylaxis in arthroplasty remains a therapeutic gray area, with no clear consensus on its role, timing, dosage, or choice of antibiotic. A variety of antibiotics have been used in the postoperative period, including but not limited to teicoplanin, cefuroxime, vancomycin, tobramycin and gentamicin. In the United States and Germany, 1-2% of joint replacement surgeries result in infection.[5]A recent meta-analysis involving 4,036 patients found no evidence to support the effectiveness of postoperative antibiotic prophylaxis in preventing surgical-site infections in individuals undergoing total hip or knee arthroplasty.[6]A more recent study involving over 18,800 patients reported a surgical-site infection (SSI) rate of at least 1% within 30 days post-surgery.[7]A meta-analysis involving over 11,000 patients concluded that antibiotic prophylaxis reduced the absolute risk of wound infection by 8% and the relative risk by 81% compared to no prophylaxis.[8]Our observation aligns with a study indicating that a hip previously affected by tuberculosis, even after completing treatment, can experience a resurgence of the disease following hip replacement surgery.[9]

The authors would like to emphasize that, despite the challenging, "warzone-like" conditions in our operating theatre, strict adherence to aseptic practices ensured almost no infections. We also reject the need for costly measures such as ‘space suits’ or helmet systems. This could serve as encouragement for smaller centers lacking state-of-the-art facilities to confidently embark on offering joint replacements. We are proud to report that our infection rates are comparable to, if not better than, the best centers worldwide, achieved at just one-fiftieth of the cost (< $1100 vs. ~$55,000).[10,11]

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