

# Risk Factors of Infection in Total Knee Arthroplasty

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## Abstract

**Background:** To determine risk factors of infection in total knee arthroplasty

**Methods:** In this descriptive study all patients undergoing primary total knee arthroplasty were included. Patients were followed post-operatively at 2,4,8,12 and 24 weeks. Signs of inflammation and inflammatory markers such as total leukocyte count (TLC), C-reactive protein (CRP) and ESR were measured. Risk factors like age, body mass index (BMI), ASA, co-morbid conditions were also noted.

**Results:** Out of the 78 patients osteoarthritis (94.87%) was the pre-dominant cause of total knee replacement (TKR). 6.41% cases got infected. In majority of the infected cases (60%), Staphylococcus aureus was the infective organism. Diabetes Mellitus ( $p=0.01$ ) and Obesity ( $p=0.02$ ) had a significant relation to post-operative infection.

**Conclusion:** Pre-operative risk evaluation and prevention strategies along with early recognition of infection and control can greatly reduce the risk of joint infection post-TKR which will not only improve the mobility of patient but also its morbidity and mortality as well.

**Key Words:** C-reactive protein (CRP), Erythrocyte Sedimentation Rate (ESR), Staphylococcus aureus, Total Knee Arthroplasty (TKA).

## Introduction

Total Knee Arthroplasty (TKA) is the mainstay of surgical treatment of patients with advanced osteoarthritis.<sup>1</sup> It is the most efficient and cost-effective alternative to medication which lasts for the remainder of their life.<sup>2</sup> Following TKA, patients have a chance of developing post-operative pain, infection, deep venous thrombosis, etc.<sup>3</sup> Although care is taken to promote asepsis by prophylactic antibiotics, sterilization methods, improving surgical skill and limiting intra-operative time.<sup>4</sup> Post-operative joint infection remains the most debilitating complication ensuing all joint arthroplasties.<sup>5</sup> The risk factors for infection are obesity (elevated BMI), diabetes, prior joint infection, immunocompromised patients

(Hepatitis B, Hepatitis C, HIV), malnutrition, prolonged hospital stay and systemic infections. Most of these risk factors are modifiable.<sup>6-10</sup> The diagnosis of infection is made on the basis of history (toxic symptoms such as fever, swelling, joint pain extending beyond four weeks after arthroplasty), clinical examination of the affected limb and laboratory evaluation of inflammatory markers such as C-reactive protein (CRP), ESR, etc.<sup>11</sup> The most commonly implicated organisms are staphylococcus species (52.9%), streptococcus (19.2%), E.coli (5.9%) and anaerobes (2.8%).<sup>12</sup> The worldwide incidence of post-operative infection in prosthetic joints is < 2% and is a significant morbidity in elderly patients presenting to the orthopaedic clinic.

## Patients and Methods

This descriptive study was conducted in the Department of Orthopaedics, Benazir Bhutto Hospital, Rawalpindi for a duration of three years from January 2014 to January 2017. All patients undergoing primary total knee replacement were included in the study. Exclusion criteria were all patients operated in another hospital and revision total knee replacement. All patients were followed up at 2, 4, 8, 12 and 24 weeks post-operatively. To see the effect of tranexamic acid in minimizing blood loss during surgery and on post-operative infection, 30 patients were given two doses intravenously (15 mg/kg body weight mixed in 10 mL normal saline each), i.e. one 15 minutes prior to incision and other immediately post-operatively while in 23 patients tranexamic acid infiltrated intra-articularly (IA) after wound closure (2 grams mixed in 10 mL normal saline). In 25 patients tranexamic acid not used. Stitches were removed at 2<sup>nd</sup> post-operative week. Signs of inflammation such as fever, skin changes (erythema), raised temperature, swelling and discharge from the operative site were noted. Inflammatory markers such as Complete Blood Count (CBC), Erythrocyte Sedimentation Rate (ESR) and C-reactive protein (CRP) levels were done pre and post operatively to monitor infection if any signs of inflammation were found. American Society of Anesthesiologists (ASA) score was noted (Table 1). Descriptive statistics such as mean, standard deviation

and frequency of patients with post-operative infection were calculated. P value < 0.05 was significant

**Table-1: American Society of Anaesthesiologists (ASA) scoring system**

ASA	
I	Patient is completely healthy fit
II	Patient has mild systemic disease
III	Patient has severe systemic disease that is not incapacitating
IV	Patient has incapacitating disease that is a constant threat to life
V	A moribund patient who is not expected to live 24 hour with or without surgery

### Results

A total of 78 patients underwent primary unilateral Total Knee Replacement (TKR) during the study period. Of these, 30 (34.09%) were male and 48 (61.54%) female patients. 32 (41.02%) of these underwent unilateral TKR. Mean age of patients was 68.32 ± 8.54 years. Average BMI 25.89 Kg/m<sup>2</sup>. Osteoarthritis was the pre-dominant cause of total knee replacement (Table-2). Among co-morbid factors 33.33% were diabetic, 28.20% having ischemic heart disease and 12.82% with chronic lung disease. Upon anaesthesia fitness pre-operatively, 91.02% patients had an American society of anaesthesiologist score (ASA) between 0-2 while 07 (8.97%) between 3-5. Average duration of surgery was 85.62± 4.11 minutes.

**Table-2: Indication for Total Knee Replacement (TKR)**

Indication for TKR	No	Percentage
Osteoarthritis	74	94.87%
Rheumatoid arthritis	02	2.56%
Septic arthritis	01	1.28%
Psoriatic arthritis	01	1.28%

**Table-3: Factors related to surgery**

Factor	No	Mean ± S.D
Average 24-hour volume of drain output (without tranexamic acid)	2	309.23±58.92
Average 24-hour volume of drain output (with IV tranexamic acid)	30	265.79±34.40
Average 24-hour volume of drain output (with IA tranexamic acid)	23	215.92±55.18
Average duration of surgery	78	85.62±4.11 minutes

Mean volume of post-operative drain output was less in patients who were given tranexamic acid during surgery (Table-3). Among various factors involved in surgery, patients with Diabetes mellitus (p = 0.01) and obesity (p = 0.02) showed a significant correlation with infection after total knee arthroplasty (Table 4). Out of the total 78 cases, 05 (6.41%) cases got infected. Staphylococcus aureus was the pre-dominant (60%) organism in infected cases (Table-5). All patients were given antibiotics according to sensitivity along with daily dressings. In 02 patients drainage of infective collection had to be done.

**Table-4: Risk factors associated with infection**

Risk factors	Total no. of patients	No. of patients with infected wound	p-value
Diabetes mellitus	26	03	0.01
Ischemic heart disease	22	01	0.69
Obesity	34	04	0.02
3 or more surgeons involved in surgery	37	02	0.89
Foley's catheterization	19	01	0.99
American society of anaesthesiologists (ASA) score 3 or more	07	01	0.81
Use of tranexamic acid	53	03	0.54

**Table-5: Frequency of organisms in infected cases**

Infective Organism	Number of patients	Percentage
Staphylococcus aureus	03	60%
Klebsiella pneumoniae	01	20%
Acinetobacter baumannii	01	20%

### Discussion

Despite thorough sanitation and aseptic measures adopted by the surgeons and paramedical staff, intra-articular infection is the leading complication following arthroplasty which warrants extensive management, both medical and surgical. The overall risk factors that were significant in our study were the patients' age, gender, BMI, co-morbid conditions, ASA score and Foley's catheterization. The route of administration of TXA and number of surgeons involved per surgery were the factors associated with the orthopaedic team. The patients who presented

for primary TKA were predominantly female, within the age bracket of 65-75 years. These findings were consistent with results shown by Woolhead et al and Feldman et al.<sup>14,16</sup> The leading indication for TKA was osteoarthritis, followed by rheumatoid arthritis, septic arthritis and other degenerative infections. This was also reported by Nassif et al and Beal et al<sup>17</sup> in their studies in 2015 and 2016 respectively.<sup>15,17</sup>

Diabetes was the predominant co-morbid condition in 34.2% of all cases and 11% of those cases got infected. Ischemic heart disease and chronic lung disease were the second and third most common pre-morbidities. Worldwide statistics corroborate the same results with diabetes mellitus and IHD fluctuating as the leading cause depending upon the prevalence and incidence of the co-morbidity in that particular area. Elmallah et al, Moon et al and Bolognesi et al cited results similar to ours.<sup>18-20</sup>

As reported by Mi et al use of intra-articular tranexamic acid was associated with better post-operative outcome in our study, evidenced by monitoring drain output in all patients for at least 48 hours.<sup>21</sup> The overall rate of infection was 6.41% in our study whereas a study conducted on the same patterns and lines by Babkin<sup>22</sup> et al in 2007 showed rates of 5.6%.<sup>22</sup>

The predominant organism was *Staphylococcus aureus* with 60% cultures being positive for the organism.<sup>3</sup> Bongartz et al and Cho et al observed similar rates of 65.2% and 52.9%.<sup>1,13</sup> The measures that need to be undertaken to limit infection after arthroplasty extend beyond the nursing staff and orthopaedic team, all factors must be taken account when devising a disinfection protocol.<sup>23</sup>

Points of entry in the operating room must be limited, with only surgeons and staff relevant to the case being allowed entry. All machinery, surgical instruments, gowns, drapes and devices installed in the operating room (OR) must be inspected and inspected for contamination, especially air conditioning. Ventilation systems must be inspected and laminar air flow must be established with a 5 micrometre filter which should be cycled through the or about 25 times per hour to keep the bacterial count less than 180 colony forming units/m<sup>3</sup>.

Surgical techniques must be proper and hemostasis must be maintained at all times since a peri-operative hematoma leads to bacterial growth and wound infection. Intra-operative time must be limited.<sup>24,25</sup> Diabetics and hypertensive patients must reach optimum control prior to surgery. Wounds must be monitored in diabetics since they are prone to poor

wound healing and sepsis. Focal source of sepsis in or around the incision site must be disinfected properly before surgery. Prophylactic antibiotics must be administered in all patients pre-operatively.<sup>26</sup> Since the pre-dominant organism causing infection was the patients' own flora (*Staphylococcus aureus* resides in the skin) antiseptic measures are a must for control of infection.

## Conclusion

Despite pre-operative risk assessment and prevention, joint infection still remains the most feared complication after arthroplasty. It takes a toll on the patients' mobility, morbidity and mortality. Early recognition of infection and aggressive control can drastically improve outcomes.

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