

Infection risk stratification in total knee joint arthroplasty using a new scoring system

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Abstract

Periprosthetic joint infection (PJI) is a catastrophic complication of total knee arthroplasty (TKA) adding significant costs to the health care system with increasing morbidity and mortality. The goal of this study was to develop a prognostic scoring system that could risk-stratify patients undergoing TKA for the risk of PJI. The study included 150 patients who underwent primary TKA from June 2012 to February 2016. There were 60 patients in group I who were not risk stratified using the scoring system, while 90 patients were assigned to group II and were prospectively assigned scores based on the scoring system. Points were assigned for each pre-operative variable and a scoring chart was developed. Group II patients scoring 4 or more were counseled to optimize their modifiable risk factors before proceeding with surgery. Retrospective chart review was done for patients in group I to find out their risk score for the study purpose. Nine out of 60 patients in group I were found to have score above 4 based on the chart review, of which 4 patients got infected ($P < 0.05$). None of the group II patients got infected after TKA. In conclusion, our scoring system is an objective scoring system for preoperative risk stratification of patients undergoing TKA, thus helping identification and optimization of the risk factors preoperatively to decrease the risk of PJI.

Introduction

Total knee arthroplasty (TKA) is currently one of the most frequently performed

and successful surgical procedures, greatly improving patient quality of life and functional status.¹ By 2030, 3.48 million primary TKA will be performed annually in United States alone.² Incidence of all post-operative infection accounts for 1% to 7% of total joint arthroplasties and adds a cost of \$30,000 to \$40,000 per infection.³ Recent studies show that periprosthetic infection (PJI) is the third most common indication for revision hip arthroplasty (14.7%) and the most common cause for failure of total knee arthroplasty (25.2%).⁴

Periprosthetic joint infection (PJI) is a catastrophic complication, increasing the morbidity and mortality of the affected patients and adding significant costs to the health care system. Many studies have^{5,6} showed a clear association between demographic characteristics and pre-operative co-morbid conditions with PJI. Based on such associations a few scoring systems like the Mayo prosthetic joint infection risk score,⁷ McPherson staging system⁸ and Charlson Comorbidity Index⁹ have been developed for the infection risk assessment of the patients. In a recent large cohort study Tan *et al*¹⁰ were able to identify and validate risk factors for predicting PJI.

We conducted a prospective study at our institute from June 2012 to February 2016 with the aim to develop and validate a scoring system for preoperative risk stratification to identify patients at higher risk for prosthetic joint infection following TKA.

Materials and Methods

The preoperative risk stratification scoring system was initially developed at another hospital facility and was successfully used by the senior author (SNS) prior to 2012 to significantly decrease the rate of prosthetic joint infections at this hospital facility. Marculescu *et al*¹¹ showed clear association between factors like demographic characteristics, comorbidity conditions, local skin factors, infection characteristics and the risk of PJI. A committee, including quality control board, hospital management, intensivist, microbiologist and orthopedic surgeons pooled and analyzed the local knee joint arthroplasty data, reviewed all the available literature to develop a scoring system which included multiple pre-operative risk factors (Table 1). The present study was conducted at our regional hospital following institutional review board approval. The senior author (SNS) continued to implement this scoring system in his practice after moving to our institute in 2012. Our study group included

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Key words: Prosthetic joint infection, risk stratification score, total knee arthroplasty.

Contributions: PP, JC, PS and SS designed the initial study, wrote the protocol and wrote the first draft of the manuscript. Authors OPS, VS and SV did the literature search, analyses of the results. All the authors read and approved the final manuscript.

Conflict of interest: The authors declare no conflict of interest.

Funding: Self funding.

Availability of data and materials: Data and materials are available within the text.

Ethics approval and consent to participate: The study has been approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Received for publication: 26 November 2019.
Accepted for publication: 16 April 2020.

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Orthopedic Reviews 2020;12:8394
doi:10.4081/or.2020.8394

150 patients who underwent primary total knee arthroplasty from June 2012 to February 2016 at a single institution. Revision surgeries were excluded. Patients who lost to follow up and those with missing data were excluded from the study as well. Two surgeons were independently performing total knee replacement surgeries in the institute, one surgeon was not using this scoring system and the other surgeon (SNS) was using the scoring system (Table 2) for preoperative risk stratification during the study period. The patients were divided into group I (60 patients, surgeon I) with no preoperative score assignment and group II (90 patients, surgeon II) with preoperative infection risk score assignment (Figure 1).

Once the patient decided to proceed with surgery, they underwent preoperative medical screening with medical history and routine investigations including blood parameters, routine urine analysis, chest x-ray, electro-cardiograph (ECG). All the data

was collected prospectively for the patients in group II for preoperative risk stratification using the scoring system. A retrospective chart review was conducted for the group I patients to collect the data for study

purpose. Apart from routine blood tests, we also obtained serum transferrin, serum albumin levels and HbA1c was recorded in diabetic patients. Our clinical evaluation included edema of the legs, any non-healing

wound in the same extremity or elsewhere in the body, local scars and infectious foci. After accumulating data for each patient, we developed a risk score for each patient in group II and they were categorized in to one

Table 1. Definition of preoperative risk factors in the scoring system.

Serial no	Variable	Definition
1	HbA1c	According to the American Diabetic association criteria
2	BMI	Weight in Kilograms/(Height in Meters) ²
3	Rheumatologic diseases	As diagnosed by a physician and documented in the records. This includes rheumatoid arthritis, psoriasis etc. Patient on immune suppressants or not
4	Open surgery	Previous open surgery in the same joint
5	Edema above the ankle	Look for edema above the ankle in the same limb
6	Non-healing ulcer	Non-healing wound in remote or same extremity
7	Intra articular steroid	History of intra articular injection within 6 months
8	Malignancy	Any prior history of systemic malignancy, as documented in the medical records
9	Malnutrition	The diagnosis of malnutrition was made if serum transferrin levels less than 200 mg/dL, serum albumin less than 3.4 g/dL, and total lymphocyte count (TLC) less than 1500 cells/mm
10	Local skin condition	A scoring system based on number of scars, position of the scar, skin bridge and Vancouver scar scale.
11	Smoker	Chronic smoker
12	Hypoxia	Secondary to COPD, chronic Asthma etc.
13	Cirrhosis	As diagnosed by a physician and documented in the records
14	Active infection	Active infection anywhere in the body including dental infection. This excludes ulcer.

Table 2. Preoperative variables and their assigned scores.

Serialno	Condition	Variables	Parameters	Assigned risk score
1	Diabetes	Hb A1c	6.5 – 7.4	1
			7.5 – 7.9	2
			8.0 – 8.5	4
2	Obesity	BMI (kg/m ²)	30 – 34.9	1
			>35	2
3	Inflammatory joint disease	On Immunosuppressants	Yes	1
			No	0
4	Revision surgery		Yes	1
			No	0
5	Edema above the ankle		Yes	1
			No	0
6	Non-healing wound		Remote	2
			Same extremity	4
7	Intraarticular steroid injection within 6 months		Yes	1
			No	0
8	Current malignancy		Yes	1
			No	0
9	Malnutrition	TLC < 1500	Yes	1
			No	0
10	Local skin condition	Multiple scars, lesions etc.	Case by case	0 to 4
11	Smoking		Yes	1
			No	0
12	Hypoxia	COPD, Asthma etc.	No O ₂ supplementation	1
			Continuous O ₂ supplementation	2
13	Cirrhosis		Yes	1
			No	0
14	Active infection	Anywhere in the body including dental	Yes	1
			No	0

of the three groups (A, B, C) based on the risk scores (Table 3). Once a medical comorbidity was identified, patients were seen and optimized by a medical consultant prior to elective arthroplasty, and the medical consultant continued to follow the patients during postoperative period as well. Patients in group I were also seen by a medical specialist for preoperative history and physical examination, but they did not have a risk stratification score assignment.

Patients who were in group A and group C were counselled to optimize the modifiable risk factors before proceeding with the surgery. The patients were regularly followed by a medical consultant for optimizing the modifiable risk factors and they were advised to come back after optimization of the risk factors for rescoring. We also conducted telephonic follow ups to encourage the patients to optimize the risk factors. Our aim was to bring down the score to below 4 to reduce the risk of periprosthetic joint infections in these patients.

The protocols for infection prevention continued to be the same for all the patients during the whole study period. Preoperative showering or cleansing with chlorhexidine soap on the night before and morning of the surgical procedure was done by each patient. The local preparation of the limb was done with chlorhexidine and preoperative hair removal was done immediately before the procedure with electric clippers. A first-generation Cephalosporin antibiotic was administered intravenously within 1 hour before the surgical incision and was continued for 24hrs postoperatively. All TKA were performed in operating rooms with vertical laminar flow with the surgical team members wearing helmet aspirator suits. Spinal-epidural anesthesia was used for all total knee arthroplasty cases unless contra-indicated. TKA was done with tourniquet through a standard medial parapatellar approach and all arthroplasties were cemented. Postoperative wound management consisted of changing the post-operative dressing on day 3 as indicated. All patients underwent a standard post-operative rehabilitation protocol. The prophylactic anticoagulation regimen consisted of administration of enoxaparin on postoperative day 1 and was continued for 2 weeks. Patients were followed up at 2 weeks, 6 weeks, 12 weeks, 6 months and 1 year after

surgery. The diagnosis of periprosthetic joint infection was made based on the criteria by the musculoskeletal infectious society (MSIS).¹²

Statistical Analysis

We used SPSS software (version 15; SPSS, Chicago, IL) for statistical analysis. We used descriptive statistics for analysis of baseline demographic variables including age, BMI, HbA1c, gender, smoking status, other risk factors and comorbidities. We used Student t-test for comparison of continuous variables and chi-square test for comparison of binomial data. Alpha level at 0.05 was considered significant for both numerical and binomial data.

Results

From the original cohort of 162 knees, only 150 had complete data and thus were analyzed. There were 108 females and 42 males in the study with a mean age of 60.86 ± 8.31 (range, 44 to 81 years). The average follow-up was 28 months. The incidence of diabetes mellitus for all patients was 32.66% (49 of 150) and 57.14% (28 of 49) of these patients had HbA1c above 7.5. The incidence of diabetes mellitus in group I was 31.66% (19 out of 60) and group II was 33.33% (30 out of 90). The mean HbA1c score of groups I and II was 6.61 ± 1.63 and 6.89 ± 1.01 respectively. In

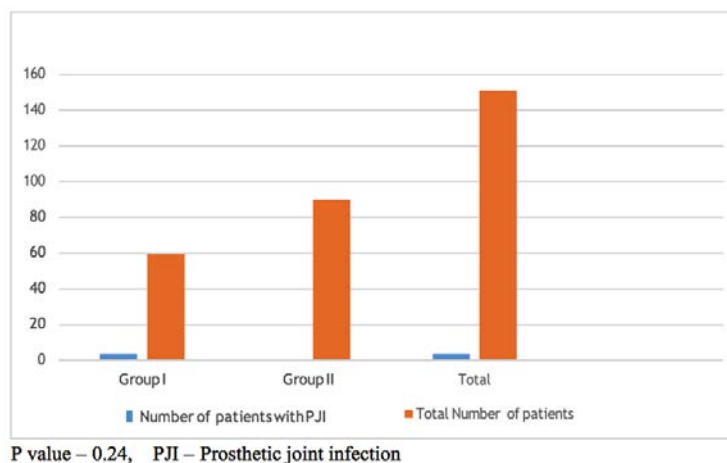


Figure 1. Chi square analysis of infection and groups.

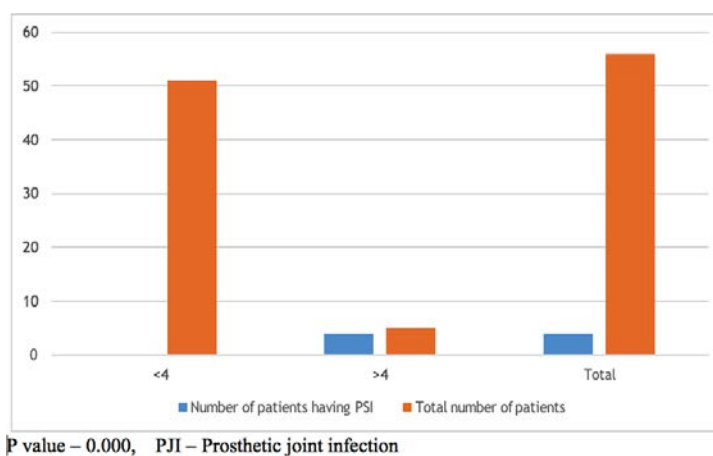


Figure 2. Chi square analysis for infection and scoring in group I.

Table 3. Three groups of patients according to the scores assigned for Group II patients.

Group A	Patients with score 4 and above	With modifiable risk factors, at very high risk of infection and strongly encouraged to optimize modifiable risk factors
Group B	Patients with score 4 and above	With non-modifiable risk factors, at very high risk of infection and recommended to avoid surgery.
Group C	Patient with score below 4	With modifiable risk factors, at moderate risk and counseled to optimize risk factors

our cohort, 28% (42 of 150 patients) of the patients had BMI of 30 to 34.9 so they acquired a score of 1, 12.66% (19 of 150 patients) patients had BMI \geq 35, so they acquired a score of 2. The mean BMI of groups I and II was 30.02 \pm 4.09 and 30.28 \pm 4.30 respectively. In all, 88.66% patients of the study group were either overweight or obese. Sixteen out of 150 (10.66%) patients were suffering from rheumatoid arthritis and 8 of them were on immuno-suppressants to control the disease activity (Table 4).

Examination of the local extremity revealed 12 patients had edema above the ankle when they were signed up for surgery. We identified 3 patients in group I with ulcers on their body based on retrospective chart review. Two of these patients had an active infection in the contra lateral lower limb and one patient had a venous ulcer in the same limb which had healed before surgery. None of the group II patients had any ulcers. Twenty out of 150 patients had received intra articular steroid injection within 6 months. Absolute lymphocyte count (ALC) was used to evaluate nutritional status. In our study 16 of 150 patients had clinically demonstrable nutritional deficiency, of which eight were in group II who had their ALC corrected before surgery (Table 4). Patients in group I didn't have their ALC corrected pre-operatively.

In the case of previous scars over the knee, the scoring system considers the number of scars, the position of the scar, can or cannot maintain a 5 cm skin bridge and Vancouver scar scale.¹³ A score of 1 emphasizes a healthy scar. Four patients in Group II had scored 2, which means either multiple scars or less vascularity. Fourteen of the 42 males and none of the females were chronic smokers. Six of these patients belonged to group I and eight belonged to group II. Eight patients were suffering from hypoxia, but none of them required oxygen supplementation. Among them, 7 patients had chronic obstructive pulmonary disease and one patient had idiopathic pulmonary fibrosis. There were 2 patients suffering from cirrhosis. Group I had 4 patients and group II had 3 patients with foci of infection (Table 4). Two patients had urinary tract infection, three had dental infection, and two had chest infection. All were treated with appropriate antibiotics pre-operatively.

None of the patients in group II had score more than 4 at the time of surgery. Nine out of 60 patients in group I were found to have a pre-operative risk score of above 4 based on retrospective chart review, out of which 4 got infected (Figure 2). The mean score was 7.11 \pm 1.76 for those who had scored above 4. Three of the four infected patients were females, all three were diabetics and had uncontrolled blood

sugar levels with HbA1C more than 8. One patient was suffering from rheumatoid arthritis and was taking immunosuppressant drugs during the perioperative period. Two patients had BMI greater than 35. All four cases were found to be infected one month after the procedure. The diagnosis of deep periprosthetic infection was made with serological and synovial fluid analysis along with histopathological examination. Two patients underwent revision knee replacement surgery after an interval of two months in spacer. The third patient was a 42-year-old rheumatoid arthritis patient, the organism identified was MRSA. She underwent implant removal and cement spacer placement but was subsequently lost to follow up. Fourth patient was a 75-year-old male with PJI from Klebsiella pneumonia for which explant and cement spacer placement. This patient died during the follow up from unrelated causes.

Time taken to optimize risk factors for group II was 49.19 \pm 20.80 days (min 28 and max 120). Seventeen patients who had scored above 4 in group II adhered to the protocol to reduce the score though 4 patients initially showed some hesitancy to follow the protocol. Obesity and smoking were two difficult factors to deal with, but ultimately, we succeeded in persuading those patients to follow the protocol. The average time taken for the surgery in group

Table 4. Summary of preoperative variables and number of patients involved.

Variables	Classification	Number of patients where scoring system was used (Group II patients)	Number of patients where scoring system was not used (Group I patients- data from retrospective chart review)
Body mass index	30–35	26	16
	>35	10	9
Diabetes	6.5 – 7.5	6	3
	7.5 – 8.0	8	5
	> 8	3	2
Rheumatological diseases	No immunosuppressant medicines	5	3
	On immunosuppressant medicines	4	4
Edema above the ankle		7	5
Non-healing wound Remote	Same extremity	3	3
		0	0
Intra articular steroid within 6 months interval		13	7
Current malignancy		1	0
Malnutrition (ALC < 1.5)		8	8
Local skin conditions	Score 1	5	5
Multiple scars and lesions	Score 2	4	0
Smoker		8	6
Cirrhosis		0	0
Active infection (UTI, dental etc.)	Score 4	3	4
Hypoxia		4	4

I was 1.55 ± 0.3 hours and $1.55 \pm .28$ hours in group II respectively. We did not find any statistical significance with the surgical time and infection between the two groups (p 0.668). The average blood loss of group I and group II were 650.2 ± 350.63 mL and 620.05 ± 276.05 mL respectively. 6.67% patients were infected in group I. There were no infections in group 2.

Discussion

PJI is a dreaded complication of any arthroplasty procedure with significant costs to the health care system in addition to mortality and morbidity of the patient. Studies have revealed that incidence of revision surgeries secondary to a PJI ranked highest following a TKR (0.4% to 4%) and 3rd highest following a hip arthroplasty (0.3% to 2.2%).^{2,3,14} Replacement arthroplasties have been projected to raise by 673% to 3.48 million in 2030 for TKR and increase by 174% to 573,000 for THR.² With this exponential rise in the incidence of procedures, PJI will be an anticipated complication which can get magnified in future, so there is an urgent and increased necessity for the orthopedic surgeons to curtail these complications. To decrease these complications, various strategies¹⁵⁻¹⁷ have been implemented in the past two decades including pre-op optimization of risk factors, administration of appropriate antibiotics, ideal aseptic skin preparation technique, aseptic operative environment, early diagnostic and intervention methods, introduction of two staged revision. But most of these existing strategies mainly emphasized on the intra and post-operative methodology. Our present study focused on identifying the pre-operative risk factors and modifying them, to decrease periprosthetic joint infection.

Mayo clinic has developed a scoring system named *The Mayo Prosthetic Joint Infection risk score* for stratifying pre-operative risk factors considering the sex, BMI, diabetes mellitus, prior arthroplasty, immunosuppression, ASA score, antibiotic prophylaxis and procedure duration.⁷ This score developed from a previously reported case control study of 339 cases of PJI. The risk factors were developed from multivariable modelling and included into the baseline score. In addition to this, they also added a new scoring system for 1-month post-surgery by incorporating wound complications. This scoring system is mainly a statistical scoring model and some of the variables like procedure time and BMI were given confusing scores. Both procedure

time less than 2 hours and BMI less than 25 were given zero score which was not only purely statistical but also not supported with adequate evidence. Our scoring system emphasizes mainly on pre-operative variables which have more of clinical implications and to establish the statistical significance, we compared two groups one of which utilized the scoring system, and the other did not.

Marchant et al in 2009 showed that uncontrolled DM is associated with more than 3-fold increase risk of stroke, two fold increase surgical related infections, and two fold in mortality.¹⁶ They recommended that the sugar levels should be less than 200 mg/dl postoperatively¹⁶ [15] and HbA1C should be less than 7%.¹⁷ In our study cohort, the incidence of Diabetes Mellitus in group II was 33.33% and group I was 31.66% and 57.14% (28 of 49) of the diabetic patients had HbA1c above 7.0. The diabetic patients in group II were counselled and were seen by a diabetologist to help optimize HbA1c so that the risk score can be brought below 4. Obese patients with $BMI \geq 35$ are at higher risk of PJI after TKA with a hazard ratio of 1.47.⁵ Bozic et al (2012) revealed that obesity has a hazard ratio of 1.73 for PJI and perioperative mortality following THR, in Medicare patients.⁶ In our study, 17.64% of the patients in group II had $BMI > 35$. These patients were counselled for weight reduction by diet, exercise, and bariatric surgery consultation.

A systematic review and meta-analysis by Ravi et al found that patients with Rheumatoid arthritis have 5.5% independent attributable risk for developing PJI, with hazard ratio of 1:18 after TKA.¹⁸ This relation is explained by the use of immune-suppressive drugs and steroids for the treatment. In our study, the incidence of Rheumatoid arthritis was 10.67%, out of which 6 were on Immuno-suppressant drugs. In routine practice the immune suppressants would be discontinued one week prior to surgery and prolong it to 1 to 2 weeks post operatively and steroids should be tapered accordingly to the clinical response.¹⁹ A recent study revealed that the risk of PJI in patients undergoing revision arthroplasty was 9% more than those of primary surgery.²⁰ In our study all surgeries were primary total knee arthroplasties.

Many studies have shown the association of pre-operative malnutrition with PJI. Studies have shown that a pre-op TLC count $< 1500/mm^3$ had a fivefold increased frequency and a low albumin level had 7 times increase in the risk of developing PJI.²¹ The diagnostic criteria used for diagnosing malnutrition were, serum transferrin < 200 mg/dL, serum albumin < 3.4 gm/dL

and total lymphocyte count $< 1500/cum^3$ 21.²² In our study group, 16 patients out of 150 were diagnosed to be malnourished. Patients in group 2 received counselling by a dietician to improve their nutritional status before proceeding with surgery but none of the patients in group 1 received any counselling.

Various studies have found association of malignancy with higher risk of infection.⁵ Bozic et al have revealed a hazard ratio of 1.59 in infections associated with metastatic tumors.⁵ The Mayo clinic case control study has observed that the systemic malignancy has a 3.1 (1.3 to 7.2) ratio, and 95% confidence interval with $P < 0.01$ with PJI.⁷ Reasons for increase in infection can be due to co-existing malnutrition, immunosuppression and immunosuppressive drugs. Our study had one patient with a metastatic tumor around knee joint, who was optimized for surgery and didn't develop any infection.

Papavasiliou et al in their study found that recent intraarticular steroid injection increased risk of joint infection.²³ They found that 22.2% patients had surgical wound complications. In our study 34 patients received intraarticular steroid injections and of these 20 patients received injections within 6 months. In group 2 the surgery was delayed for 6 months from injection but not in group 1.

Wilson et al showed that the patients who had ulcers of the skin and peripheral vascular disease (PVD) have increased risk of infection.²⁴ In our cohort we identified 6 patients with chronic ulcers in the lower limb. One patient was suffering from varicose vein and ulcer in the same extremity. Group II patients were treated by vascular surgeon with angiogram, antibiotics and local wound care and the surgery was delayed until the wound healed. In group I even though the scoring system was not implemented all three patients were treated with antibiotics by the surgeon. One ulcer was completely healed and another one was partially healed at the time of surgery. In the third patient the ulcer was not found to be healing in the contralateral limb and proceeded with surgery.

In TKA, because the fascial perforators arise from the medial side, the most lateral incision giving appropriate exposure should be used. Several different skin incisions have been described; however, in the revision case the approach is usually predetermined by the previous incisions. In some cases, a new incision may be made if the previous skin incisions prevent reasonable access to the joint. Transverse scars should be crossed perpendicular to the scar, with minimal compromise to the junction zone.²⁵

In the case of previous scars, the scoring system considers the number of scars, the position of the scar, can or cannot maintain a 5cm skin bridge and Vancouver scar scale.¹³ Five patients in each group scored one which emphasis a healthy scar. Four patients in Group II had scored 2 which means either multiple scars or less vascularity.

Smoking decreases tissue oxygenation and impairs neutrophil defenses and hence delays wound healing.²⁶ Thompsen *et al* observed that longer period of smoking cessation decreased the incidence of post-op complications in a systematic review and meta-analysis.²⁷ Also, smoking is associated with a higher rate of developing infection after TKA.²⁰ Our study had total of 14 smokers out of which 6 patients were ex-smokers. Smokers in group II were advised to cease smoking but in group I the patients were not strictly advised to give up smoking. Out of 6 patients in group I, five continued to smoke and one quit smoking when we interviewed them retrospectively. However, we couldn't reduce the score for smoking in group II since the patients did not cease smoking, but we could attain a smokeless period peri operatively.

Oxygen is important for cell metabolism, especially energy production by means of ATP, and is critical for nearly all wound-healing processes. It prevents wounds from infection, induces angiogenesis, increases keratinocyte differentiation, migration, and re-epithelialization, enhances fibroblast proliferation, collagen synthesis, and promotes wound contraction.²⁸ There are no studies available in literature to show the direct association between hypoxia and PJI. In our cohort 7 patients had chronic obstructive pulmonary disease and one patient had idiopathic pulmonary fibrosis with oxygen saturation less than 60% on room air, who was managed with bronchodilators and post-op O₂ therapy as advised by pulmonologist. In our study there was one patient with cirrhosis of liver. Because malnutrition, impaired immunity, coagulopathy, and metabolic bone disease often develop secondary to liver cirrhosis, these patients are at increased risk of complications following major orthopedic surgery, such as arthroplasty.²⁹

The presence of active infection in the body has been shown to lead to significantly higher rates of PJI after TJA.³⁰ There are also several longitudinal studies and case reports which indicate that the presence of active systemic or local tissue infection may result in hematogenous or direct seeding of

the implant following TJA.³¹ Various guidelines make sure that the patient has no other remote or concurrent infections such as a urinary tract infection and those with remote infections should be optimized by eradication of the infection prior to elective arthroplasty with appropriate antibiotic therapy.¹⁴ Group II had 3 patients and group I had 4 patients with foci of infection and all were treated with appropriate antibiotics preoperatively.

In group II, no patients developed infections after total knee joint arthroplasty (Figure 1). Here P value is (0.000) less than significant level, so we can conclude that interventions for optimizing the preoperative risk score are effective (Wilcoxon signed rank test). Even though the scoring system was not applied to group I patients, the surgery was delayed for 5 of the patients for controlling diabetes and foci of infection. Despite the control of above mentioned two variables, 4 patients developed PJI in group I (P=0.000). A review of the chart showed that all the infected patients from group I would have scored above 4 and were not optimized. The mean score was 7.11±1.76 for those who have scored above 4 in group II before optimization of the risk factors. Time taken to optimize risk factors for group II was 49.19±20.80 days (min 28 and max 120). Some patients initially showed significant hesitancy to follow the protocol, obesity and smoking being the two difficult factors to optimize. Four patients were symptomatically better after reduction of weight hence were unwilling for surgery. Ten patients didn't come back for follow up because they continued to be noncompliant and couldn't withstand the optimization protocol implemented.

Major limitation of our study was the smaller sample size and some of the variables are not present in the scoring criteria. Some of the important variables such as demographic criteria, screening for MRSA, ASA score, and preoperative anemia were not included in this model. There is no consensus in the literature regarding the HbA1c cut off value that should be used for preoperative risk stratification. Some of the variables like HbA1c, ALC and ulcers were indirectly optimized in group I during preoperative evaluations and thereby couldn't avoid the confounding factor. The strengths include prospective risk stratification of one group of patients using a scoring system and direct comparison with a similar group which didn't have risk scoring there by validating the scoring system.

Conclusions

In conclusion, this is a useful scoring system for both surgeons and patients where they can modify the risk factor by simple treatment alternations and life style modifications. Preoperative risk stratification using an objective scoring system and optimizing the risk factors before proceeding with arthroplasty surgery can significantly reduce the prosthetic joint infections.

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