



Original Research Article

Evaluation of Risk Factors For Acute Periprosthetic Infection Post Total Knee Replacement Iraqi Patients

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Abstract

Periprosthetic joint infection (PJI) is one of the most challenging complications after total joint arthroplasty, with an incidence of 1% to 4% after primary TKA. This complication poses challenges on many aspects, one of which is the difficulty in reaching a diagnosis.

Although variation exists, the majority of them rely on the results of joint aspiration or deep tissue culture; serologic tests, namely erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP); and the appearance of the joint during surgery (with regard to presence of purulence); presence or absence of a sinus tract; and the result of histologic analysis of tissue obtained during surgery (frozen section). Taken together, these findings suggest incorporating synovial WBC and PMN% results into a set of diagnostic criteria may improve the strength of those criteria for diagnosing PJI.

The Objective is To evaluate the risk factors for peri-prosthetic infection post total knee replacement for Iraqi patients.

This prospective study consists of 264 patients (51 males and 213 females) ages ranged from 49-75 years (mean 62 years) had been performed unilateral primary total knee replacement between January 2012 to September 2013 in the Nursing Home Hospital arthroplasty Department, in Baghdad, that are divided into three groups according to the primary pathology, Group I are 207 patients had primary osteoarthritis, Group II are 42 patients had rheumatoid arthritis, and Group III are 15 post-traumatic arthritis.

264 patients with 51 (19.3 %) males and 213 (80.6 %) females' patients had primary OA 207 case (74.8%), Rheumatoid arthritis 42 case (15.9%) and posttraumatic 15 cases (5.6%). These patients were allocated into 3 groups according to their primary pathology:

In Group I, 182 patients (non-diabetic), 4 patients had deep infection, whereas 3 of 25 diabetic patients developed deep infection. In Group II, 34 non diabetic patients, and 8 diabetic patients one and 2 patients had deep infection respectively. Group III, 12 non-diabetic and 3 diabetic patients had one patient each with documented deep wound infection. As a total number of documented acute deep infections during 6 weeks of TKR is 12 cases (4.5%). We conclude that: Diabetic patients are more risk in early postoperative infection than non-diabetic patients. Rheumatoid arthritis adds more incidence of infection to diabetic patients in the TKR. posttraumatic arthritis patients considered as a risk for early postoperative deep infection.

Key words: TKR, acute deep infection, diabetic, non-diabetic.

الخلاصة

التهاب حول المفصل الصناعي هو احد اهم المضاعفات التي تثير التحدي بعد عمليات تبديل المفصل الصناعي، احتمال حدوثها 1%-4% من مضاعفات عمليات تبديل المفاصل الصناعية وهي من الصعب تشخيص حدوثها. في معظم الحالات يتم الاعتماد على سحب سائل المفصل، زراعة الانسجة الداخلية، بعض الفحوصات المختبرية مثل معامل تخثر خلايا الدم الحمراء ومعامل البروتين سي إضافة الى مظهر المفصل اثناء العملية (من حيث وجود او عدم وجود خمج) او قنوات خمجييه إضافة الى التحليل النسيجي اثناء العملية. مع جمع هذه النتائج إضافة الى عدد الكرات البيض في المفصل يمكن ان نحصل على إمكانية تشخيص عالية لحالات التهابات حول المفصل الصناعي.

الهدف من البحث هو لتقييم عوامل الخطورة لحالات التهابات حول المفصل الصناعي بعد عمليات تبديل مفصل الركبة في العراق. تتألف هذه الدراسة المتريفة المرضى 264 (51 من الذكور والإناث 213) كانت أعمارهم تتراوح بين 49-75 سنة (متوسط 62 سنة) استبدال مفصل الركبة لجهة واحدة بين كانون الثاني/يناير 2012 إلى 2013 في أيلول/سبتمبر في " قسم تبديل المفاصل في مستشفى التمرض الخاص"، في بغداد،

والتي تنقسم إلى ثلاث مجموعات وفق الأمراض الرئيسية، وكانت المجموعة الأولى 207 مرضى سوفان المفصل الأولية، المجموعة الثانية هي 42 مرضى بالتهاب المفاصل الرثوي، و"المجموعة الثالثة" 15 مرضى التهاب المفاصل ما بعد الإصابات. وكانت النتائج كما يلي: المجموعة الأولى 182 مرضى (غير المصابين بالسكري)، 4 منهم أصيبوا بالتهاب عميق بينما أصيب 3 من مرضى السكري. ما المجموعة الثانية فقد أصيب مرض واحد من مرضى السكري واثنان من غير السكري. أما المجموعة الثالثة فقد أصيب مرض واحد بالتهاب من كلا النوعين. نستنتج من ذلك ان مرضى داء السكري هم أكثر عرضة للإصابة بالتهاب العميق بعد العملية وكذلك المرضى المصابين بالتهاب المفاصل الرثوي والتهاب ما بعد الإصابة بعد اجراء عملية تبديل مفصل الركبة الصناعي.

Introduction

Infection is one of the most common complications affecting TKA patients, with reported frequencies of 2% to 3% in several large series. According to current Medicare data, 1.5% of patients develop a periprosthetic infection in the first 2 years after TKA [1].

Although variation exists, the majority of them rely on the results of joint aspiration or deep tissue culture; serologic tests, namely erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP); and the appearance of the joint during surgery (with regard to presence of purulence); presence or absence of a sinus tract; and the result of histologic analysis of tissue obtained during surgery (frozen section). Taken together, these findings suggest incorporating synovial WBC and PMN% results into a set of diagnostic criteria may improve the strength of those criteria for diagnosing PJI [2,3].

Materials and Methods

This prospective study of 264 patients (51 males and 213 females) ages ranged from 49-75 years (mean 62 years) had been performed unilateral primary total knee replacement between January 2012 to September 2013 in the Nursing Home Hospital arthroplasty Department, in Baghdad, that are divided into three groups according to the primary pathology, Group I are 207 patients had primary osteoarthritis, Group II are 42 patients had rheumatoid arthritis, and Group III are 15 post-traumatic arthritis.

Study Sample

Inclusion criteria:

All primary elective total knee arthroplasties registered in the total joint replacement unit in Nursing home hospital during this study.

Exclusion criteria:

1. Patient with revision TKA.
2. Morbid obesity (BMI >35)
3. Elderly > 80 years
4. Unicompartamental knee arthroplasties
5. Preoperative remote infection (UTI, local kin infection, and chest infection)

II. Diagnostic criteria

In acute infection when it occurs before 6 weeks and diagnosed by hematological investigations, ESR and CRP with aspiration of the synovial fluid which sent to:

- 1) Differential count which is more than 10000
- 2) Neutrophile percentage which is more than 90%.
- 3) Synovial aspirate which is sent for:
 - i) Blood agar culture for 5 days.
 - ii) Brain heart tissue media for 15 days.

In the chronic infection when occurred after 6 weeks and diagnosed accordingly to hematological investigations:

- 1) ESR and CRP when is elevated.
- 2) Synovial aspirate which shows:
 - a) Increase in WBC count more than 3000
 - b) Increase neutrophile percentage more than 70%.
- c) Synovial fluid culture and sensitivity with:
 - a) Blood agar plate; b) brain heart tissue media for 15 days, Which proves presence of the micro-organism in one of these cultures.

Diagnosis of deep periprosthetic infection was made if at least three of the following five criteria were present:

- (1) Abnormal serology (erythrocyte sedimentation rate > 60 mm/hour; C-reactive protein > 12 mg/dL).
- (2) Strong clinical and radiographic suspicion for periprosthetic infection such as periosteal elevation, focal osteolysis, hot and swollen joint, draining sinus.
- (3) Positive joint aspiration culture.

(4) Evidence of purulence during the subsequent surgical intervention.

Prophylactic infection control program in nursing home hospital for patient with TKR:

In this study with regard to hospital's preoperative preparation, assessment in the outpatient clinic, inpatient ward's measures, theatre and postoperative care.

Preoperative Assessment Program

Each patient scheduled to have TKR was visit to our outpatient clinic

2 weeks before the index operation.

1. A medical officer performed clinical examination, blood and urine tests to screen for septic foci, including ESR, CRP titer, serum glucose level, HbA1C serum levels, serum albumin, renal function tests, and liver function tests in regards for diabetes.

2. Chest and knee X rays were taken.

3. The operation was postponed or cancelled if any septic source could not be cleared before the scheduled date of surgery.

4. Anesthetist also assessed the patient to determine their fitness for operation and explain the mode of anesthesia.

H. Examination including general health, nutrition & morbid obesity, severity of deformity, local skin condition and vascularity of limb (pulses).

Before operation, patient admitted to our ward 2-3 days for frequent bathing of body and limb where arthroplasty decided with soap and betadine and draping with occlusive drape of surgical site.

5. Each patient admitted in isolated room with limited visitors and health care providers limited one or two nurse, a physiotherapist, a resident doctor in orthopedic ward.

6. All diabetic patients in our study controlled their glucose level.

Intraoperative Measures Program

Intraoperative measures program for primary TKA was invariably performed for patients are listed below:-

A. Prophylactic antibiotic cover given with induction of anesthesia before applying tourniquet.

B. Hand washing of the surgical team by surgical soap.

C. Double gloves & water proof gowns

always used and routinely changed outer pair of gloves after draping.

D. Prepare the entire lower limb distal to the tourniquet with betadine twice.

E. Antibiotic impregnated cement. F. Irrigation pump with saline

G. Meticulous homeostasis secured.

Postoperative Program

All patient stay in our ward range from 3 - 6 days postoperatively receiving i.v antibiotics for 48-72 hours after intraoperative prophylactic dose, analgesia and anticoagulants therapy (12 hours postoperatively). Wound dressing care started 48 hour postoperatively when removing drains under sterile condition with hand-washing with sterile solution with limited nursing personnel and health care providers and visitors. Physiotherapy started at day 2-3 postoperatively in bed then out of bed on subsequent days with walker.

3 days after surgery search for:

1. A reddened or inflamed wound while in hospital requiring antibiotics;

2. A reddened or inflamed wound after leaving hospital requiring antibiotics from their surgeon.

3. An infection which required re-admission to hospital for further treatment or investigation;

4. A deep infection inside the joint requiring further surgery.

5. Further investigations by blood tests differential WBCs counts, ESR, CRP titer, and joint aspiration for culture, gram stain and differential WBC count if needed.

All documented acute deep infection cases were admitted, followed up and treated surgically.

Results

In each group of our study there were diabetic and non-diabetic patients to evaluate each risk in relative to primary TKA where 182 non diabetic patients and 25 diabetic in Group I (osteoarthritis group, 34 non diabetic and 8 diabetic patients in Group II (rheumatoid group), and 12 non diabetic and 3 diabetic in Group III (posttraumatic group) (table 1)

Table 1: Diabetic versus non-diabetic patients in each group

Primary pathology	Total No.	Diabetic patients	Non-diabetic Patients
OA	207	25	182
RA	42	8	34
Posttraumatic	15	3	12
Total No.		36	228

We follow up 264 patients with 51 (19.3 %) males and 213 (80.6 %) females (Table 2) with unilateral primary TKAs for a mean age of 62 years, patients had primary OA 207 case (74.8%), Rheumatoid arthritis. 42 case (15.9%) and posttraumatic 15 cases (5.6%). Patients were followed by postal questionnaire interview and examination of case.

Figure-1: Sex distribution of patients

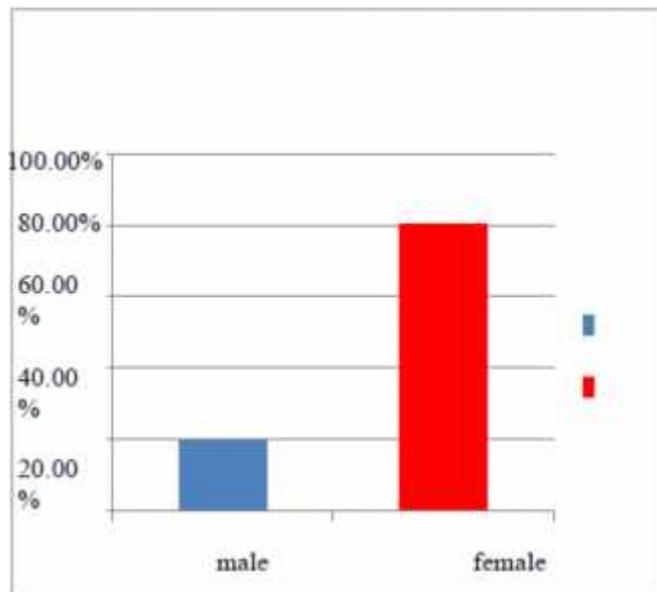
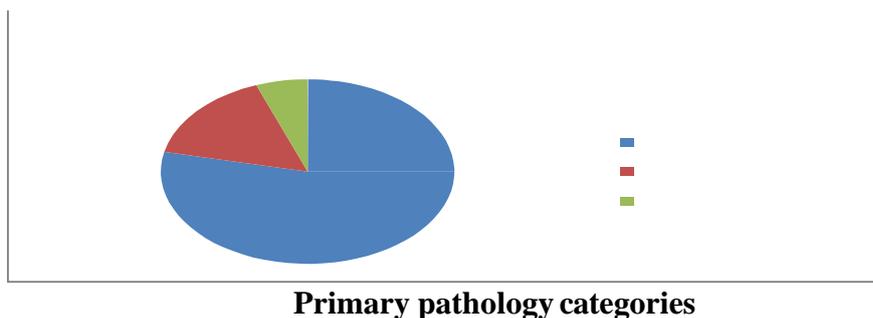


Figure 2: preoperative disorders of all patients



Primary OA Rheumatoid arthritis posttraumatic

Average time of operation 180 minutes (range from 90 –210 min).

Patients who documented as acute deep infection are as follows: (Table 2,3,4)

In Group I, of 182 patients primary OA (non-diabetic), 4 patients had deep infection, whereas 3 of 25 diabetic patients developed deep infection.

In Group II, of 34 rheumatoid arthritis non diabetic patients, and 8 diabetic patients one and 2 patients had deep infection respectively.

Group III, of 12 Posttraumatic non-diabetic and 3 diabetic patients had one patient each with documented deep wound infection.

Table 2: incidence of infection

Primary Pathology	Non-Diabetic	Infection	Diabetic	Infection	p-value	Number of infection
OA (207)	182	4 (2.1 %)	25	3 (12%)	0.002	7 (3.38%)
RA (42)	34	1 (2.9 %)	8	2 (25 %)	<0.0001	3 (7.14%)
Posttraumatic (15)	12	1 (8.3%)	3	1 (33.3%)	0.002	2 (16.6%)
Total number (264)	228	6 (2.6%)	36	6 (16.6 %)	<0.0001	12 (4.5%)

P-value was conducted according to chi-square test where < 0.005 regarded as significant difference.

As a total number of documented acute deep infections during 6 weeks of TKR is 12 cases (4.5%).

Seven of 12 infected TKRs had positive cultures; MRSA caused two of the infections.

Discussion

Prevention being better than cure, various methods was used to reduce the infection risk of TKR. The surgeons' and patients' efforts should continue to focus on prevention by optimizing hospital and surgeon aseptic techniques and addressing patient-specific risk factors.

Periprosthetic joint infection (PJI) is a major complication that occurs after up to 0.7 - 2% of total knee arthroplasties [2.]

Identification of patients at high risk for PJI after modern joint replacement is necessary and would allow establishing adequate measurements to help prevent it.

Prophylactic antibiotics administered immediately before the operation is one of the well-known interventions for this purpose, and can achieve adequate

bactericidal levels in any hematoma that accumulates. The two most prevalent organisms responsible for infection in TKRs are *Staphylococcus aureus* and *Staphylococcus epidermidis*. First generation cephalosporins usually provide excellent cover for the staphylococcal species. In our study, in our study antibiotics used against staphylococcal species and MERSA [4].

In our study we depended on surgical team disinfectants, wearing double orthopedic gloves, non-touch technique, preoperative hand washing, and prophylactic antibiotics that were consistent with the use of body exhaust suits.

Diabetes mellitus is a significant risk factor for infection in TKR .Our study confirmed that diabetes increased the risk of periprosthetic Joint infection following

primary knee replacement performed to treat osteoarthritis. Yang et al [8] reported a deep infection rate of 5.5% in 109 TKRs among 86 diabetic patients. England et al [9] encountered a 7% deep infection in 59 TKRs in 40 diabetic patients. Antibiotic-loaded cement was found to be effective in decreasing the infection rate in some studies only.

In a prospective randomized study of 340 primary TKRs, Chiu et al [11] found no deep infection in 178 that had been fixed with cefuroxime-loaded cement, while 5/162 (3.1%) ensued after using plain cement ($P=0.02$).

In another study, Chiu et al found no deep prosthetic infection in 41 diabetic patients treated with cefuroxime-loaded cement, but 5/37 (13.5%) in diabetic patients treated with plain cement [11].

In our study, generally there was higher risk of infection in diabetic patients (16.6%) than those who are non-diabetic (2.6%). Given the epidemic of diabetes, it is clear that this condition cannot be ignored in orthopedic practice. Potentially modifiable risk factors, including diabetes and diabetic control, should be targeted preoperatively in order to reduce the periprosthetic joint infection rate.

In our study, diabetic patients were found to have a four-fold higher risk of infection in their TKR.

In our study, generally there was three of 42 cases with rheumatoid arthritis (7.1%) had acute PJI, of these patients, one (2.9%) of 34 non-diabetic and two (25%) of 8 diabetic patients had acute PJI [9]. There was evident difference between the risks of infection for those patients who had preoperative rheumatoid arthritis with diabetes than same rheumatoid patients who were non-diabetic. These results were consistent with that of Momohara et al. There was high risk of 2 post-traumatic patients after TKA (16.6%) of 12 cases, yet the size of collection data was too small regarding this rate.

In two studies first by Weiss NG, Parvizi J et al, in sixty-two patients with a previous fracture of the tibial plateau were reviewed, A postoperative complication occurred in sixteen knees (26%). However, these

patients are at increased risk for perioperative complications, as evidenced by the high reoperation rate of 21% in this study [12] and the second by Papadopoulos EC, Parvizi J et al of posttraumatic arthritis, in 47 patients with a previous distal femoral fracture were reviewed, Three knees developed deep infection which was treated with debridement and retention of components in one knee, arthrodesis in another, and eventual amputation in one knee [10].

In our study there was evident difference between the risks of infection for those patients who had preoperative rheumatoid arthritis with diabetes those same rheumatoid patients who were non-diabetic. That was evident both clinically and statistically significant more than other groups (osteoarthritis and posttraumatic patients).

Statistical difference between diabetic and non-diabetic patients regarding risk of postoperative infection.

Conclusions

1. Prevention is better than cure in TKR, using the perioperative meticulous techniques.
2. Diabetic patients are more risk in early postoperative infection than non-diabetic patients.
3. Rheumatoid arthritis adds more incidence of infection to diabetic patients in the TKR
4. With proper standard practice, the infection rate is low after primary TKR
5. Special efforts to preserve the vascularity of the skin and subcutaneous tissues in posttraumatic arthritis, restore limb alignment, ensure correct component positioning, and achieve soft tissue balance may help minimize the problems.

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