



Research Article

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## ***Thirty Days' Post-Operative Complications Following Total Knee Replacement in King Abdul-Aziz Medical City, Riyadh Research (Allied Science)***

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### **ABSTRACT**

*Background* : Total Knee replacement is a surgical procedure, which consists mainly of replacing the damaged knee joint with a new artificial one. This procedure is done in two hours approximately. It is considered as the last treatment option for patients who have degenerative changes. *Methods*: In this study, we used a cross sectional retrospective chart review to evaluate the outcome of patients who underwent total knee replacement. The aim of this study is to describe the complications of total knee replacement, and to identify the pattern of these complications in our population. We will describe complications of the patients in relation to their comorbidities. *Results*: We reviewed 778 patients with a total of 949 total knee replacements. Among these patients, unilateral total knee replacements were done in most of them with almost equal number in right (n=305, 39%) compared to the left (n=303, 39%) and less often bilateral (n=171, 22.0%). Urinary tract infections (n=27, 3.5%) got highest rate among other complications followed by surgical site infections (n=25, 3.2%). Hypertension is the commonest comorbidity (n=487, 62.8%) followed by diabetes (n=346, 44.6%), while heart diseases was the least common comorbidity (n=57, 7.3%). *Discussion* : Patients with diabetes, hypertension or cardiovascular diseases were significantly at higher risk of developing perioperative urinary tract infection. We found that all total knee replacement post-operative complications increase proportionally with BMI. *Conclusion* : This study will provide the entire health care system with adequate information regarding their patients of the rate of each complication and also how can be dealt in a cost efficient way correlating with health care in general.

**Keywords:** Total knee replacement, Complications, Saudi Arabia

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### **INTRODUCTION**

Total Knee replacement is a surgical procedure, which consists mainly of replacing the damaged knee joint with a new artificial one. This procedure is done in two hours approximately [1,2,3]. Surgeons started performing the procedure in the 1970's and it became with time a common and cost effective procedure for quality of life [4]. It is

considered as the last treatment option for patients who have degenerative changes, and the most common cause of this surgical procedure is osteoarthritis [5, 6]. It is considered as one of the most common orthopedic procedures, with over a half million procedures being performed in the United States annually [5]. It was the 14<sup>th</sup> most common operation in 2009. In the United States, there are more than 4.5 million people currently living with one replaced knee joint at least and this makes 4.7% of the population at the age of 50 years old or older.

The rate of total knee replacement has increased significantly by 57% from 1997 to 2009 and females have done it more common by the percentage of 63% while males are 37% [5, 6]. Nowadays, due to better health care system which leads to increase ageing society as well as the sedentary lifestyle that leads to increase obesity epidemic in our population, the prevalence of osteoarthritis is increasing [7]. As a result, the procedure rates of TKR are expected to rise, some estimates a quadruple demand by 2030 [8, 9].

Regarding complication rate, in 1.82 million patients there were 6.1% reported complications while patients were in the hospital and 7.5% reported complications within 90 days of the operation [10]. Complications of total knee replacement vary among patients. However, some complications are classified as major systemic complications, like: cerebrovascular accident, pulmonary embolism and septic shock. Deep venous thrombosis, urinary tract infection and pneumonia are considered minor systemic complications. Other complications are classified as local complications and it's subdivided into major and minor. Major complications are like deep wound infection, organ space infection and peripheral nerve injury. Minor local complications for example are superficial wound infection and wound dehiscence [11].

Surgical site infections are considered one of the most common complications following total joint replacement, and there are many risk factors that could increase it, whether they are patient's related such as age, gender, BMI or patient's comorbidities. On the other hand, there are surgeon related risk factors like: use of DVT prophylaxis, allogeneic blood transfusion and the duration of the surgery [12]. It is well established that obesity is a risk factor of post-operative complication of total knee replacement [13]. The most common organism related to surgical site infection in total knee replacement is staphylococci [14]. Difference in complications rate between unilateral or bilateral total knee replacement appear with pulmonary embolism as a post-operative complication and also linked to patients undergoing bilateral knee replacement more than unilateral [15]. Other pulmonary complication such as pneumonia, atelectasis and pleural effusion can increase the length of the stay at the hospital, increase the cost and disrupt the rehabilitation of the patient [16].

The aim of this study is to determine the incidence rates of mortality and morbidity for patients who underwent primary total knee replacement operation, and identify risk factors for thirty-day postoperative mortalities and complications by retrospectively studying of the patients who underwent total knee replacement at the National Guard Hospital, Riyadh from 1<sup>st</sup> of January 2000 until 31<sup>st</sup> of December 2014 through chart review. This study will contribute in comparing our results with international centers that uses standardized preventive measures. It is going to help in the assessment of which factors contributed to unexpected outcomes, following preventive measures in the future and improving compliance of using evidence based medicine.

## **METHOD**

In this study we used a cross sectional retrospective chart review to evaluate the outcome of patients who underwent total knee replacement at King Abdul-Aziz Medical City in Riyadh to review mortalities and all post-operative complications within 30 days after the surgery. The aim of this study is to describe the complications of total knee replacement, and to identify the pattern of these complications in our population. We will describe complications of the patients in relation to their comorbidities.

There were more than 13 different complications could be collected in 30 post-operative days. We classified complications in 6 different categories that included surgical site infections, urinary tract infections, hematological complications, gastrointestinal complications, respiratory complications, and cardiovascular complications. Hematological complication included heparin-induced thrombocytopenia and bleeding from wound. Gastrointestinal complications included lower GI bleeding, gastric ulcer, esophagitis, and exacerbate bowel syndrome. Respiratory complication included pneumonia, atelectasis and pleural effusion. Cardiovascular complications included deep vein thrombosis; pulmonary embolism, arrhythmia and myocardial ischemia. Complications were collected from patients' files and into Excel program. For the data analysis we used SPSS (version 20). Frequencies and percentages were calculated for categorical variables such as type of complications and gender. Fisher exact test was used to assess the

relationship between the categorical variables. Inferential statistics for comparison included Chi square to compare the proportion of positive complications by gender, age groups, side of replaced knee and to compare proportion of positive complications by comorbidities with a statistical significance if p value <0.05.

The study subjects were all the patients who underwent total knee replacement operation from 1st of January 2000 until 31st of December 2014. Our inclusion criteria have included all males and females from 50 to 100 years old, those who underwent primary total knee replacement in King Abdul-Aziz Medical City and looked into certain complications within 30 days after the operation. Our exclusion criteria were applied for patients who underwent primary operation outside the King Abdul-Aziz Medical City and came for a revision surgery or complications that happened after more than 30 days postoperative. Since the whole population was targeted to strengthen the study, non-probability consecutive sampling technique was used. Data were obtained through retrospective chart review.

## RESULTS

In this study, we reviewed 778 patients with a total of 949 total knee replacements. The mean age of the study population was calculated to be  $64.7 \pm 8$  years. Majority of the patient were in the age group from 60 to 69 year old (n=338, 43.4%). More than two thirds of the patients who underwent the surgeries were females (n=600, 77.5%). Highest BMI of a patient underwent a total knee replacement was 61.7 and lowest was 20.5, while the mean BMI of the study population was  $35 \pm 6.3$ . Only few patients had a normal BMI (n=25, 3.4%) and most of the patient were obese (n=573, 78.0%) or overweight (n=137, 18.6%). Hypertension is the commonest comorbidity (n=487, 62.8%) and diabetes run in less than half of the patients (n=346, 44.6%), while heart diseases found in less patients (n=57, 7.3%). Among these patients, unilateral total knee replacements were done in most of them with almost equal number in right (n=305, 39%) compared to the left (n=303, 39%) and less often bilateral (n=171, 22.0%). (Table1) Urinary tract infections (n=27, 3.5%) got highest rate among other complications followed by surgical site infections (n=25, 3.2%) (Table2).

Patient in age group (50-59-year-old) had less respiratory complications (n=2, 0.9%) than patient in age group (>70-year-old) (n=10, 4.6%). Respiratory complications with UTI are the most common complications in patients >70-year-old. In patients with normal BMI, there was one incidence of respiratory complication and one UTI. Commonest complication in overweight patients was UTI (n=7, 5.1%), while commonest in obese patients was surgical site infection (n=18, 3.1%). Regarding patient gender, incidence of UTI in females (n=21, 3.5%) was more by 15 cases compared to males (n=6, 3.4%) with almost equal percentages. Cardiovascular complications in males (n=5, 2.9%) were almost double the complications rate in females (n=9, 1.5%). We found that infections in surgical site found in males more than females. In bilateral total knee replacement, cardiovascular (n=9, 5.3%) and respiratory (n=8, 4.7%) complications were more than unilateral. Other complications were more in unilateral TKR (Table3).

All patient who had hematological complications (n=6) found to have hypertension (n=6, 1.2%) and one of them had heart disease (n=1, 1.8%). The most common comorbidity in patient with cardiovascular complications (n=14) was hypertension (n=8, 1.6%) and less than half of patient who had cardiovascular complications found to have heart disease (n=4, 4%). Among patients who had respiratory complications (n=18) there was one labeled as a heart disease patient (n=1, 1.8%) and two third of them have hypertension (n=12, 2.5%). As mentioned earlier that hypertension was the commonest comorbidity in our population (n=487, 62.8%), although in gastrointestinal complications most of the patient found to be hypertensive (n=7, 1.4%). Among diabetic patient (n=346, 44.6%) surgical site infections (n=13, 3.8%) and urinary tract infections (n=19, 5.5%) had a higher rate to occur compared to hypertensive patients (Table4).

We found that there is no difference in complications compared to age group except for respiratory complications that increase with age and reaching its maximum rate in patient >70-year-old (P value <0.05). There was no significant difference between males and females' complications rate. A significant difference in cardiovascular complications was found between unilateral and bilateral total knee replacements (P value <0.05). (Table5) Patients with heart disease found to have more cardiovascular complications compared to diabetic and hypertensive patients (P value <0.05). Patients with comorbidities (diabetes, hypertension and heart disease) are more susceptible to have UTI than healthy patients (P value <0.05) (Table 6).

## DISCUSSION

Total knee replacement is considered nowadays as one of the most common orthopedic procedures to be done, and as any procedure, it has its own risks and complications. We tried in our study to review the most common complications

faced in these kinds of procedures. Our study population was 774, with a female dominance, which is supported in the literature. Six hundred of our populations were females. Most of our study populations were between the ages of 60-69 years old. Few patients had a normal BMI while majority of them were obese (78.0%). 171 cases had Bilateral total knee replacement. The most common complication in our study population is urinary tract infection followed by surgical site infection. According to a study, which was done in Australia, showed that complications post total joint replacement were related to obese and old patients, and both of them had high risk of cardio-pulmonary complications. Comparing to our study, the most common complication related to obese patients was surgical site infection while the old age (70+) respiratory complication was the most common. Another paper showed that obese patients had high incidence of wound complications [17]. According to G. Wallace et.al, in which they compared the relationship of BMI in period of 6 months post-operatively, showed that an increase in BMI would increase the risk of having thromboembolic event from 2% to 3.3% and also increase the risk of wound infection from 3% to 4.1% [18]. Compared to our study most of the cardiovascular complications 9/13 were in the obese patients. We documented 18 (2.3%) cases of respiratory complications, which included pneumonia, atelectasis and pleural effusion. A Study in Korea showed that there were 37 (11%) documented cases of respiratory complication, which included, pleural effusion, pneumonia and atelectasis.

Bilateral total knees replacement means the replacement of both knees for one patient, and it could be done in a single session or staged in 2 different surgeries. In our study we call it bilateral for two knees replacement in one surgery. Higher mortality rate was found in bilateral knee replacement as it is reaching from 3% to 12% [19]. In our study there was no mortality found during the 30 days postoperatively. A study was done in Mayo Clinic Rochester, Minnesota showed that in bilateral total knee replacement postoperative complications' rate increased compared to unilateral total knee replacement, especially in elderly patients [20]. Another study in New York showed that patients going for bilateral total knee replacement have less chance to get a surgical infection compared to those going for stage bilateral or single total knee replacement [ 21]. In our study that there was surgical site infection rate in bilateral total knee replacement was 1.3% compared to 3.3% in right and 3.6% in left unilateral total knee replacement, although there was no significant difference (P value<0.05). We found in our study that there is a significant difference in cardiovascular complications (deep vein thrombosis; pulmonary embolism, arrhythmia and myocardial ischemia) between unilateral and bilateral total knee replacement (P value<0.05). In New York they proved that bilateral knees replacement has a higher rate of pulmonary embolism and deep vein thrombosis [22].

There was no effect of gender seen on the postoperative complications in our study. We found that males and females found to have almost the same rate of complications with no significant difference (P value >0.05). In Chicago, they found that males have higher rate of death, surgical site infection and cardiac arrest compared to females (P value<0.05) and females have higher rate of urinary tract infection and blood transfusion compared to males (P value<0.05) [23]. In our study there was a significant difference between diabetics and non-diabetic patients in the rate of urinary tract infection (P value<0.05). In France, they found that diabetic patients undergoing total knee replacement have a higher rate of deep infections compared to non-diabetic [24]. We found that patients with hypertension or cardiovascular disease are more prone to develop urinary tract infection compared to a healthy patient (P value<0.05). Another study was done in Chicago showed that patients with hypertension and cardiovascular disease are at higher risk to develop a urinary tract infection post a total joint replacement (P value<0.05) [25].

One of the limitations to our study is that it was conducted in one center with a different surgeon, surgical techniques and post-operative protocols. Length of the stay was not documented in our study and it could be a risk post-operative complications. We recommend doing the study as a multicenter and with unified post-operative surgical protocol.

## CONCLUSION

Patients with diabetes, hypertension or cardiovascular diseases were significantly at higher risk of developing perioperative urinary tract infection (P value<0.05). Respiratory complications found more in elderly patient more than 70 years compared to younger patients (P value<0.05). We found that all total knee replacement post-operative complications increase with proportionally with BMI. There is a significant difference in cardiovascular complications (deep vein thrombosis; pulmonary embolism, arrhythmia and myocardial ischemia) between unilateral and bilateral total knee replacement (P value<0.05).

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**Table1.** Patients' demographics

		Count (N%)
Age	50 - 59	221 (28.4%)
	60 - 69	338 (43.4%)
	70+	219 (28.1%)
Gender	Male	174 (22.5%)
	Female	600 (77.5%)
BMI	Normal	25 (3.4%)
	Overweight	137 (18.6%)
	Obese	573 (78.0%)
Hypertension	Non-hypertensive	289 (73.2%)
	hypertensive	487 (62.8%)
Diabetes	Non-diabetic	430 (55.4%)
	diabetic	346 (44.6%)
Heart diseases	No heart disease	719 (92.7%)
	Heart disease present	57 (7.3%)
Side of Knee replaced	Right	302 (38.8%)
	Left	302 (38.8%)
	Bilateral	171 (22.0%)

**Table2.** Post-operative complications

Complication	No	Yes
	Count (N%)	Count (N%)
Hematological complication	772 (99.2%)	6 (0.8%)
Cardiovascular complication	764 (98.2%)	14 (1.8%)
Respiratory complication	760 (97.7%)	18 (2.3%)
Gastrointestinal complication	769 (98.8%)	9 (1.2%)
Surgical site infection	753 (96.8%)	25 (3.2%)
UTI	751 (96.5%)	27 (3.5%)

**Table3.** Complications by Age, BMI, Gender and Side

	Hematological complication	Cardiovascular complication	Respiratory complication	Gastrointestinal complication	Surgical site infection	UTI
Age						
50 – 59	0 (0.0%)	1 (0.5%)	2 (0.9%)	4 (1.8%)	9 (4.1%)	10 (4.5%)
60 – 69	4 (1.2%)	7 (2.1%)	6 (1.8%)	4 (1.2%)	12 (3.6%)	7 (2.1%)
70+	2 (0.9%)	6 (2.7%)	10 (4.6%)	1 (0.5%)	4 (1.8%)	10 (4.6%)
BMI						
Normal	0 (0.0%)	0 (0.0%)	1 (4.0%)	0 (0.0%)	0 (0.0%)	1 (4.0%)
Overweight	4 (2.9%)	4 (2.9%)	4 (2.9%)	1 (0.7%)	5(3.6%)	7 (5.1%)
Obese	2 (0.3%)	9 (1.6%)	13 (2.3%)	8 (1.4%)	18 (3.1%)	17 (3.0%)
Gender						
Male	2 (1.1%)	5 (2.9%)	5 (2.9%)	2 (1.1%)	4 (2.3%)	6 (3.4%)
Female	4 (0.7%)	9 (1.5%)	13 (2.2%)	7 (1.2%)	21 (3.5%)	21 (3.5%)
Side of replaced knee						
Right	2 (0.7%)	2 (0.7%)	4 (1.3%)	4 (1.3%)	10 (3.3%)	13 (4.3%)

Left	3 (1.0%)	3 (1.0%)	6 (2.0%)	4 (1.3%)	11 (3.6%)	7 (2.3%)
Bilateral	1 (0.6%)	9 (5.3%)	8 (4.7%)	1 (0.6%)	4 (1.3%)	7 (2.3%)

**Table4.** Complications by comorbidities

	Hypertension		Diabetes		Heart diseases	
	No	Yes	No	Yes	No	Yes
<b>Hematological complication</b>	0 (0.0%)	6 (1.2%)	1 (0.2%)	5 (1.4%)	5 (0.7%)	1 (1.8%)
<b>Cardiovascular complication</b>	6 (2.1%)	8 (1.6%)	8 (1.9%)	6 (1.7%)	10 (1.4%)	4 (7.0%)
<b>Respiratory complication</b>	6 (2.1%)	12 (2.5%)	11 (2.6%)	7 (2.0%)	17 (2.4%)	1 (1.8%)
<b>Gastrointestinal complication</b>	2 (0.7%)	7 (1.4%)	4 (0.9%)	5 (1.4%)	8 (1.1%)	1 (1.8%)
<b>Surgical site infection</b>	7 (2.4%)	18 (3.7%)	12 (2.8%)	13 (3.8%)	20 (2.8%)	5 (8.8%)
<b>UTI</b>	3 (1.0)	24 (4.9%)	8 (1.9%)	19 (5.5%)	21 (2.9%)	6 (10.5%)

**Table5.** Comparison between Age, Gender and Side with complications (P. value)

	Age	Gender	Side of Knee replaced
<b>Hematological complications</b>	.283 <sup>a</sup>	.523 <sup>a</sup>	.853 <sup>a</sup>
<b>Cardiovascular complications</b>	.173 <sup>a</sup>	.231 <sup>a</sup>	.001 <sup>*</sup>
<b>Respiratory complications</b>	.026 <sup>*</sup>	.586 <sup>a</sup>	0.059
<b>Gastrointestinal complications</b>	.414 <sup>a</sup>	.985 <sup>a</sup>	.728 <sup>a</sup>
<b>Surgical site infections</b>	0.367	0.43	0.739
<b>UTI</b>	0.174	0.974	0.365

**Table6.** Comparison between comorbidities and complications (P. value)

	Hypertension	Diabetes	Heart diseases
Hematological complications	0.058 <sup>a</sup>	.055 <sup>a</sup>	.380 <sup>a,b</sup>
Cardiovascular complications	0.661	0.895	.002 <sup>a,*</sup>
Respiratory complications	0.729	0.623	.768 <sup>a</sup>
Gastrointestinal complications	.348 <sup>a</sup>	.506 <sup>a</sup>	.663 <sup>a,b</sup>
Surgical site infections	0.331	0.448	.014 <sup>a,*</sup>
UTI	.004 <sup>*</sup>	.006 <sup>*</sup>	.003 <sup>a,*</sup>