Original Article

# Thirty-day Mortality and Morbidity After Total Knee Arthroplasty

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## Abstract

**Introduction: Total knee arthroplasty (TKA) is one of the most successful orthopaedic procedures to date. It is estimated that over 130,000 of TKAs are performed in the United States every year. Whilst the procedure is safe, it nevertheless carries a risk of perioperative mortality and morbidity. This study aimed to report the mortality rate within 30 days after a TKA, as well as to assess the incidence of early postoperative morbidities. Materials and Methods: We reviewed a total of 2219 TKAs performed by multiple surgeons in our centre from 1998 to 2001. All mortalities within 30 days of a TKA were recorded. Morbidities such as infection, thromboembolic phenomenon, and any re-admissions within 30 days of operation or 15 days of discharge were recorded. Results: The mortality rate within 30 days of a TKA was 0.27% (6 of 2219 patients). The incidence of early postoperative infection was 1.8%, of which 1.44% were superficial and 0.36% were deep infections. There were 3 cases (0.13%) of pulmonary embolism and 22 cases (0.99%) of deep vein thrombosis. Conclusions: The 30-day mortality rate, and the incidence of infection after TKA performed in our institution is comparable to other centres around the world, and further emphasises that TKA is a safe procedure. However, the small number of mortalities in this study does not allow us to identify a predominant cause of perioperative mortality.**

**Ann Acad Med Singapore 2007;36:1010-2**

**Key words: Deep vein thrombosis, Infection, Pulmonary embolism**

## Introduction

Total knee arthroplasty (TKA) for patients with knee arthritis that is unresponsive to conservative treatment is being increasingly performed all over the world. It is a safe procedure with a low risk of perioperative death. Improvements in surgical techniques, as well as the identification and treatment of comorbidities, have further reduced the incidence of postoperative deaths.

Many studies, of varying sample sizes, have reported the incidence of perioperative mortality ranging from 0.1% to 0.8%. The exact cause of death, and risk factors associated with mortality after TKA remain unclear at this point in time.

Early morbidities associated with TKA are mainly that of infection and thromboembolic phenomenon. The infection rates in other studies reported ranges from 1.6% to 2.6%. This study aimed to report the incidence of 30-day mortality after TKA in our local population, as well as to assess the incidence of early postoperative morbidities after a TKA.

## Materials and Methods

A review of 2219 total TKAs performed in our institution between 1998 and 2001 was conducted. Mortalities within 30 days of a TKA were recorded. Morbidities identified and recorded included infection, thromboembolic phenomenon, and any re-admission within 30 days of operation or within 15 days of discharge. The patients included in this study were operated on by multiple surgeons practising in our institution, and collated from multiple sources such as the Adult Reconstructive Service Knee Registry, Operating Theatre Management System (OTMS) Records, ISD Database, as well as our institution's Quality Management Morbidity Database. The spectrum of cases included primary TKAs and staged bilateral, simultaneous bilateral as well as revision knee arthroplasties. In all cases, implants were cemented using polymethamethylacrylate.

All patients were screened and optimised by anaesthetists in the preoperative anaesthetic clinic. Perioperative antibiotic prophylaxis was given for 24 hours after surgery, and no routine prophylaxis against venous thrombosis was

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used. We chose the cut-off of 30 days for mortality, as a longer cut-off time would have resulted in the inclusion of deaths and complications not related to the knee arthroplasty.[1]

## Results

### *Mortality*

Six of the 2219 (0.27%) arthroplasties performed resulted in deaths within 30 days. None of the deaths occurred intraoperatively. Two patients died on the second day after surgery, and the deaths were attributed to acute myocardial infarction. One patient died on the third day after surgery and a post-mortem confirmed acute pulmonary embolism as the cause of death.

One patient with rheumatoid arthritis and on long-term steroid treatment died on the 32nd postoperative day as a result of multiple complications, including acute chronic renal failure, proximal deep vein thrombosis (DVT), retroperitoneal bleeding secondary to anti-coagulation therapy, pneumonia and urinary tract infection.

Two patients developed deep joint infections and sepsis leading to death 7 and 12 weeks after surgery. Methicillin-resistant *Staphylococcus aureus* (MRSA) was isolated in both patients, and one of them had co-infection with *Pseudomonas aeruginosa* as well.

The mean age of the 6 patients who died was 68.3 years (range, 56 to 82). Five were female and 1 was male. One patient had undergone a revision knee arthroplasty while the remaining 5 had had a primary unilateral knee arthroplasty.

### *Morbidity*

*Re-admissions*: There were a total of 17 (0.76%) re-admissions within 30 days of surgery or within 15 days of discharge. Ten were re-admitted for infection, of which 9 were superficial infections treated successfully with a short course of antibiotics. One of them had a deep infection and subsequently died 12 weeks from sepsis. One patient each was re-admitted with the diagnosis of DVT, postoperative stiffness of the knee, Bactrim-induced (given for urinary tract infection) vomiting, and fracture neck of femur**.** The records of 3 patients were not traceable.

*Infection*: Forty patients (1.8%) developed infection within 30 days of a TKA. Of these, 32 (1.44%) were superficial infections; mainly stitch abscesses or erythema with raised erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP). These were successfully treated with short courses of antibiotics. Eight patients (0.36%) developed deep infections that required re-operations. The number of re-operations varied from a single stage arthrotomy and washout for 4 of the patients to up to 6 re-operations for 1 patient who eventually had an arthrodesis of the knee. In most of the deep infection cases, the organism identified was either MRSA or *P. aeruginosa*. Four of the patients underwent an arthrotomy and washout based on clinical signs and symptoms of deep infection but had negative tissue cultures, possibly due to empirical antibiotic administration prior to the washout. Duration of antibiotic treatment also varied with the number of re-operations required, ranging from 2 weeks to 3 months (Table 2).

*Pulmonary embolism and deep vein thrombosis*: There were 3 cases (0.13%) of pulmonary embolism. One of the cases died suddenly on the third postoperative day and the diagnosis of pulmonary embolism was confirmed on post-mortem. The remaining 2 patients had the diagnosis confirmed with VQ scan and spiral CT scan. Both of them were treated successfully with anti-coagulation therapy.

Twenty-two cases (0.99%) of DVT were identified and confirmed with duplex ultrasonography. Only 7 of them (0.31%) had proximal DVT, whereas the remaining were distal DVT. All patients were treated with anti-coagulation therapy with no further adverse sequelae.

Table 1. Summary of Results

| | |
|---|---|
| Total no. of patients | 2219 |
| 30-day mortality | 6 (0.27%) |
| Re-admissions (30-day) | 17 (0.76%) |
| Infection | 40 (1.8%)<br>• 32 superficial (1.44%)<br>• 8 deep (0.36%) |
| Deep vein thrombosis | 22 (0.99%) |
| Pulmonary embolism | 3 (0.13%) |

Table 2. Details of Patients With Deep Infections

| No. | Organism | Antibiotic regime | Re-operations | Outcome |
|---|---|---|---|---|
| 1. | MRSA | Vancomycin 3 weeks<br>Oral Clindamycin +<br>Fusidic acid 4 weeks | 3 | Arthrodesis |
| 2. | *P. aeruginosa*<br>MRSA | Vancomycin and<br>Ceftazidime x 2 months | 4 | Died |
| 3. | Nil isolated | Cefazolin x 2 weeks | 1 | Resolved |
| 4. | Nil isolated | Ceftriaxone x 1 week<br>Oral Augmentin x 1 week | 1 | Resolved |
| 5. | MRSA<br>*A. Baumanii*<br>*P. aeruginosa*<br>*Enterococcus* | Vancomycin,<br>Unasyn and<br>Ciprofloxacin<br>x 2 months | 3 | Excision arthroplasty |
| 6. | Nil isolated | Cefazolin 1 week<br>Oral Augmentin,<br>Cloxacillin 2 weeks | 1 | Resolved |
| 7. | Nil isolated | Cefazolin 1 week<br>Oral augmentin<br>1 week | 1 | Resolved |
| 8. | MRSA | Vancomycin<br>x 3 months | 6 | Arthrodesis |

MRSA: methicillin-resistant *Staphylococcus aureus*

## Discussion

TKA has become one of the most successful joint arthroplasties, with survival of implants reported to be as high as 98% at 20 years.[2] Mortality rates have also decreased due to improvements in perioperative management and newer anaesthetic agents and techniques. Sharrock et al[3] reported a drop in mortality rate, from 0.41% of TKAs performed in the period 1981 to 1985, to 0.10% between 1987 and 1991.[3] Parvizi et al[1] reviewed 22,540 patients in the Mayo Clinic and reported a 30-day mortality of 0.21%. Certain risk factors, such as cardiac comorbidities and advanced age, simultaneous bilateral knee arthroplasties, and the use of cemented implants were associated with increased risk of mortality. Gill et al[4] analysed 3048 consecutive TKAs performed by a single surgeon in private practice and reported 30- and 90-day mortality rates of 0.36% and 0.46% respectively.

Taylor et al[5] reviewed all Medicare patients who underwent TKA in the United States between 1993 and 1994, and found that patients operated on in low-volume institutions, defined as those performing less than 25 TKAs per year, had a higher mortality rate of 0.73% compared to mortality rates of 0.43% in high-volume institutions which performed more than 199 procedures a year.

In our study, the 30-day mortality of 0.27% is comparable to the mortality rate of 0.21% at the Mayo Clinic, and is lower than those reported by other studies. The average age of our patients who died was 68.3 years, the youngest being 56 years old and the oldest 82 years old. All had received cemented implants. None of the patients who underwent simultaneous bilateral TKAs died. This could be due to selection bias as generally only younger patients with no significant comorbidities were selected for simultaneous procedures.

The infection rate in the first 30 days in our study was 1.8%, and is comparable to the infection rate reported in other studies. Salvati et al,[6] in a study of 886 knee arthroplasties, reported an infection rate of 2.6%. Peersman et al[7] reported an early infection rate of 1.8%, with the predominant infective organisms being *S. aureus*, *S. epidermidis*, and Group B *Streptococcus.*[7] Wilson et al[8] reported a deep infection rate of 1.6%, and again the predominant organisms were *S. aureus* and *S. epidermidis*. All surgeries in that study were performed in laminar flow theatres and using body exhaust systems.

Our study had an overall infection rate of 1.8%, with a deep infection rate of 0.36%. The most common causative organism was MRSA, followed by *P. aeruginosa*. In our series, patients who developed deep infections were treated aggressively with washouts and in some cases, removal of articular inserts was performed. All surgeries in our series were also performed in laminar flow theatres.

The incidence of pulmonary embolism in our study was 0.13%, and that of symptomatic DVT was 1%, which is comparable to other studies.[9] No routine anticoagulation was used except in high-risk patients with previous history of DVT. However, all patients used anti-thromboembolic stockings in the early postoperative period. Khaw et al[10] performed a prospective study of incidence of fatal pulmonary embolism in 499 patients undergoing 527 knee arthroplasties and reported 1 death on the 22nd day and no other deaths within 90 days of surgery (0.19%). All patients in that study used anti-thromboembolic stockings and no prophylactic anticoagulation was used as well. A more recent study by Howie et al[11] found the incidence of venous thromboembolic disease after TKA to be 1.79% at 3 months, with an incidence of pulmonary embolism of 0.15% despite prophylaxis.

Through this study, we find our mortality rate, and incidence of morbidities such as thromboembolic phenomenon and infection after TKA performed in our institution to be comparable, if not lower, than those of other studies. Due to the small number of deaths in our study, it is not possible to draw conclusions as to the risk factors for mortality within 30 days of surgery. Whilst the exact risk factors associated with mortality after TKA remain unclear and at times controversial, greater awareness of these risk factors will help to further improve the safety of this procedure.

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