Why Knees Fail in 2011: Patient, Surgeon, or Device?

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Abstract

The outcome of total knee arthroplasty (TKA) is influenced by multiple interconnected factors, including patient selection, implant design, and surgical technique. Total knee arthroplasty has been shown to be highly successful, with patient satisfaction rates reported from 85% to 95% with low rates of failure, but if failure occurs, its impact is significant. In 2003, 402,000 primary TKAs and 32,000 revision TKAs were performed in the United States, and the number of TKAs is expected to double by 2015. Recent data on modern implant designs and techniques have demonstrated a surprising number of early failures, although the true number of early failures is unknown. Patient medical comorbidities should be optimized preoperatively, while psychosocial issues and workers compensation are more nebulous yet contribute greatly to patient perceived outcomes. Understanding current failure mechanisms of primary TKA and how to prevent complications will be critical to help manage a potentially overwhelming TKA revision burden. This article discusses failure rates as well as factors from the patient, surgeon, and device, that contribute to TKA failure.

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Dr Fitzgerald has no relevant financial relationships to disclose. Dr Trousdale receives royalties from DePuy, Wright Medical Technology, and MAKO.

Presented at Current Concepts in Joint Replacement 2010 Winter Meeting; December 8-11, 2010; Orlando, Florida.

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doi: 10.3928/01477447-20110714-45
Problems after Knee Arthroplasty

The outcome of total knee arthroplasty (TKA) is affected by patient selection, implant design, and surgical technique (Figure). Total knee arthroplasty has been shown to be highly successful with patient satisfaction rates reported from 85% to 95% with low failure rates, but if failure occurs, its impact is significant. In 2003, 402,000 primary total knee and 32,000 revision TKAs were performed in the United States. The number of total knee revisions is expected to double by 2015. Understanding current failure mechanisms of primary TKA, and how to prevent complications will be critical to help manage a potentially overwhelming TKA revision burden. This article will discuss failure rates as well as factors from the patient, surgeon, and device, which all contribute to the TKA failure.

Rates of Failure
Long-term studies have demonstrated excellent survivorship rates for TKA. Rand and Bryan reported failure rates of condylar total knee prostheses implanted at the Mayo Clinic over a 20-year period and demonstrated 91% survivorship at 10 years, and 78% at 20 years. These rates improved for patients who were women, older at the time of surgery, and had not undergone previous knee surgery. Survivorship of patients older than 70 years at the time of surgery also increased to 94% at 10 years. Other factors that were attributed to increased survivorship were cruciate retaining and non-modular tibial designs, although these factors may be related to prosthesis design issues that have been improved with modern designs in 2011. We currently advise our patients that they have approximately a 1% cumulative chance per year of their total knee failing.

Why and When do Knees Fail?
Historically, reasons for TKA failure have been attributed to infection, loosening, instability, and patellofemoral complications. Surprisingly, data detailing failure mechanisms of modern TKA is relatively scant. Sharkey et al retrospectively reviewed reasons for 212 revisions over a 3-year period from 1997 to 2000 at a tertiary referral center. Failures were subdivided into early (<2 years) and late (>2 years), with 55% falling into the early group. Overall, the most common reasons for revision were polyethylene failure, aseptic loosening, instability, and infection. Not surprisingly, polyethylene wear and aseptic loosening were more common in the late group comprising >70% of all late revisions combined. The most common reason for failure in the early group was infection, comprising 25%. The early group also demonstrated a surprisingly high rate of aseptic loosening of 16.9%, which points to surgical technique as a major contributing factor to early revision since early loosening cannot be attributed to polyethylene wear.

Fehring et al retrospectively reported reasons for revision of 440 total knees at a tertiary referral center. They specifically looked at reasons for early failure, which they defined as revision within 5 years from the index arthroplasty. An alarming 64% of revisions fell into this early failure group over a 10-year period. Infection (38%) was the most common reason for early revision, followed by instability (26%), and failure of cementless fixation (13%). Both of these studies are limited by data from tertiary referral centers, clouding the true incidence of the mechanisms of TKA failure. They, however, demonstrate an alarming number of early failures, and indicate room for improvement in surgical technique.

Patient Factors
Patient factors significantly contribute to the TKA failure. Medical comorbidities such as obesity, diabetes, inflammatory arthropathy, tobacco use, lymphedema, immunosuppressive medications, and depression can all contribute to early post-
operative complications as well as long-term outcomes.\(^9\,^{13}\) Kang et al\(^{12}\) recently suggested HbA1C >8% as an independent risk factor for postoperative wound complications. Foran et al\(^{11}\) demonstrated a significantly higher revision rate in morbidly obese patients undergoing TKA compared to non-obese patients. Other patient factors, such as patient-surgeon relationship, patient expectations, psychosocial issues, and workers compensation add an additional layer of complexity to TKA outcomes.\(^{14}\) While not all patient factors are correctable in patients undergoing TKA; medical optimization of diabetes, cardiopulmonary disease, smoking cessation programs, weight control, and treatment of lymphedema should be pursued preoperatively to help mitigate the risk of complications following TKA.

**Patient, Surgeon, or Device?**

Failure of TKA is multifactorial with combined contributions attributable to the patient, surgeon, and device. Medical optimization of patient comorbidities such as cardiorespiratory disease, obesity, diabetes, and venostasis should be attempted to help mitigate the risk of perioperative complications.

Current implant design has improved greatly over the past 2 decades, but the rate of developing technology is largely uncontrollable by both patient and surgeon. Most TKA designs today, if implanted correctly, will have excellent long-term outcomes. Surgeons should choose an implant design that they are comfortable with putting in well that has a proven track record. Implant design and improved materials in the future should lead to further decreases in failure rates. However, surgeons should be cautioned against early adoption of new technologies that have not been proven over time.

Surgeons can do the most to limit factors that lead to early failure. Judicious use of perioperative antibiotics, good soft tissue handling techniques, and safe and efficient operative times can all help to decrease chances of early postoperative infection. Early loosening and instability, also directly attributable to surgical technique, can be limited with good cement technique and adherence to traditional arthroplasty balancing and alignment principles. Continued professional education through national meetings and literature review can also keep surgical technique up to date and help prevent the surgeon from repeating previous failures.

**REFERENCES**