Quality of life after infection in total joint replacement

JL Cahill
Trauma and Orthopaedic Research Unit, The Canberra Hospital, Canberra, Australia

B Shadbolt
Centre for Advances in Epidemiology and Information Technology, The Canberra Hospital, Canberra, Australia

JM Scarvell
Trauma and Orthopaedic Research Unit, The Canberra Hospital, Canberra, Australia

PN Smith
Trauma and Orthopaedic Research Unit, The Canberra Hospital, Canberra, Australia

ABSTRACT

Purpose. To compare the health-related quality of life and functional outcomes of patients with and without periprosthetic infection after total joint replacement (TJR).

Methods. 62 uncomplicated TJRs and 34 TJRs complicated with deep infection were compared using a visual analogue scale for satisfaction, the Western Ontario and McMaster Universities Osteoarthritis Index, Assessment of Quality of Life, and Short Form-36.

Results. Patients with complicated TJR had significantly poorer satisfaction in outcome (p<0.0001) and disease-specific functional outcomes (p<0.0001). Six of the 8 health-related quality-of-life scores were also significantly poorer (p<0.05). These results persisted after controlling for age, sex, and follow-up period in a multiple regression analysis.

Conclusion. Infection following TJR reduces patient satisfaction and seriously impairs functional health status and health-related quality of life. When hospitals are balancing the costs of preventative measures with the costs of treating infection in TJR, the effect on patients’ quality of life must be considered. Our findings argue strongly for allocation of health care resources to minimise the occurrence of infection after TJR.

Key words: arthroplasty, replacement; infection; outcome assessment (health care); quality of life

INTRODUCTION

Infection is one of the most serious complications of total joint replacements (TJR). It is devastating for the patient and enormously costly for the health care system.1–3 It is difficult to eradicate; treatment often involves multiple operations, with higher rates of recurrence and complications, and greater costs.4–6 Although the infection rate in primary arthroplasty is low, it should not be overlooked,4,7,8 particularly when the increasing demand for TJR and the rate of revision are considered in the context of the economic and personal costs of infection. Although the economic costs of postoperative acute hospital episodes caused by infection have been documented,1 the quality of
life and functional outcomes after infection in a TJR are less known.

Uncomplicated TJRs may restore functionality and provide health-related quality of life similar to or better than the healthy aged population. Life quality is significantly improved after surgery in the areas of function, pain, and mobility. Some studies show greater gains being made with total hip replacement (THR) than total knee replacement (TKR). Although excellent outcomes are enjoyed with both procedures. Reduced physical function and increased pain have been reported in patients after revision TJR. However, these studies do not include the infected cases or do not identify infection as a separate issue. Research examining the general health and disease-specific outcomes after TJR complicated by infection is meagre.

We aimed to compare the outcomes of patients with or without infection after TJR. We hypothesised that health-related quality of life and disease-specific outcomes would be significantly reduced in patients with infection.

MATERIALS AND METHODS

This study was approved by the institutional and university ethics committees and all patients provided informed consent. Two groups of primary TJR patients (uncomplicated versus complicated with deep infection) were recruited (Table 1).

The uncomplicated group consisted of 118 osteoarthritic patients enrolled in the Australian Care Continuum and Health Outcomes Project between May 1995 and May 1996 who underwent TKR or THR (ICD-9 81.5, ICD-9 81.54). Of these 118 patients, 29 were deceased after 8 years (mortality rate, 25%), 12 could not be contacted (despite a thorough search that included the electoral roll) and were deemed lost to follow-up, 15 declined to participate because of concurrent medical illnesses and general infirmity, and the remaining 62 participated in the study.

The complicated group comprised 2 sources. The first was from an in-patient cost study conducted between July 1995 and July 2001. Of the 34 patients, 2 refused to participate, 2 were lost to follow-up, 15 were deceased (mortality rate, 44%), and the remaining 15 were interviewed. The second was from the clinical practice of local orthopaedic surgeons and included 19 patients. Treatment options for the 34 patients complicated with infection included antibiotics (n=6), washout/antibiotics (n=8), 2-stage revision (n=15), and excision (n=5).

The patients of the 2 groups were contacted between July 2003 and February 2004. All 96 patients were sent a package containing the questionnaires, information sheet, and consent forms. Five patients were interviewed by telephone, 80 were interviewed face-to-face, and 11 completed the questionnaires without assistance. Missing data were completed by telephone interview.

Outcomes following TJR were measured using the visual analogue scale for satisfaction, the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), the Assessment of Quality of Life (AQoL), and the Short-Form 36 (SF-36).

The visual analogue scale used a 100-mm horizontal line marked ‘completely unsatisfied’ at one end and ‘completely satisfied’ at the other, regarding a question “Are you satisfied with your total joint replacement?” The patients were asked to mark the line at a point that represented their level of satisfaction with their TJR. The position of the mark was measured and converted to a score out of 100 where the lowest and highest possible scores were 0 (totally unsatisfied) and 100 (totally satisfied), respectively.

The WOMAC was administered as the disease-specific scale. It is a self-administered measure that assesses joint specific pain (5 questions), stiffness (2 questions), and physical function (17 questions). Lower scores are associated with less pain and stiffness and better physical functioning. Pain scores range from 0 to 20, stiffness from 0 to 8, and physical function from 0 to 68. An overall WOMAC score is obtained by normalising and weighting the subscale scores. The WOMAC is designed specifically to evaluate patients with osteoarthritis of the knee or hip. It has been validated and shown to be a reliable and responsive instrument for patients with osteoarthritis.
The AQoL is a multi-attribute utility tool that assesses health-related quality of life. Utility refers to the strength of people’s preferences for health states and the utility weights used in scoring the AQoL are obtained by the developers of the tool, from a representative sample of the Australian population using the time trade-off technique. The AQoL comprises 15 questions in 5 dimensions (illness, independent living, social relationships, physical senses, and psychological well-being). There are 4 levels of responses for each item and scores range from 1 to 4. To obtain utility values for the 5 dimensions, the raw scores for the items are transformed using the Statistical Package for Social Sciences (SPSS). The minimum AQoL utility score is 0.04, representing the worst possible health-related quality of life (health state worse than death), and the maximum value of 1.00 represents full health-related quality of life. A utility is computed for each AQoL dimension, so is the total AQoL utility score. The AQoL is an Australian instrument and has been validated on populations with chronic conditions in age ranges comparable to the population of the current study. The descriptive system has been shown to have content, construct, and criterion validity. The model employed by the developers to combine the utility scores from different dimensions has also been validated.

The SF-36 was administered as a generic health survey of functional health. It provides a profile of 8 dimensions of physical functioning, role/physical functioning, bodily pain, general health, vitality, social functioning, role/emotional functioning, and mental health. The raw scores are transformed into a 0- to 100 scale using an SPSS scoring algorithm, where higher scores represent higher levels of functional health. The results are reported as mean scores for each of the dimensions. The SF-36 has been widely validated on an Australian population and has been shown to have high reliability.

Statistical analyses were performed using SPSS. Descriptive statistics were used for the distribution of the data including mean and standard deviation (SD). A 2-tailed Student’s t test was used to compare the means of the 2 groups for satisfaction (measured by a visual analogue scale), functioning (measured by the WOMAC scales), health-related quality of life (measured by the AQoL utility and AQoL scale scores and the SF-36). Multiple regression analysis was used to determine if infection affected satisfaction, WOMAC, AQoL, and SF-36 scores whenever the effect of age, sex, and follow-up period were controlled. The coefficient of determination or the estimator of population correlation was represented by the $R^2$. Student’s t test was used to compare the uncomplicated group and normative data, and the complicated group and normative data for the SF-36 and WOMAC scale scores. Normative SF-36 data for persons aged between 65 and 74 years were used because the mean age for both groups in this study was 70 years. Comparative AQoL utility data for community, inpatient, and outpatient groups reported by the developers were used in this study. The mean AQoL utility for the community group was 0.71 (SD, 0.23), for the outpatient group it was 0.57 (SD, 0.29), and for the inpatient group it was 0.43 (SD, 0.30).

**RESULTS**

The mean scores for the 4 measurements (satisfaction, WOMAC, AQoL utility, and SF-36) are shown in Table 2. Satisfaction with the outcome of the TJR was significantly lower in the group complicated by infection ($p<0.0001$). 80% of patients in the uncomplicated group were completely satisfied with their TJR, whereas only 23% in the complicated group were so, and 18% were completely unsatisfied (Fig. 1).
The disease-specific (WOMAC) outcome scores for the uncomplicated group were approximately double those in the complicated group. Pain, stiffness, and function scores were all significantly poorer in the complicated group (p<0.0001).

The overall health-related quality of life (AQoL utility) was significantly lower for the complicated group (p<0.0001); 12% of the patients in the complicated group had their health state rated equivalent to or worse than death, whereas only 2% of the patients in the uncomplicated group did so (Fig. 2). Individual scale scores were also lower in the complicated group, in terms of AQoL independent living (p<0.0001), and social relationships (p<0.0001), but not significantly for physical senses (p=0.490) and psychological well-being (p=0.247). In the respective uncomplicated and complicated groups, there were ceiling effects for independent living (44% vs 15%), social relationships (52% vs 24%), and the physical senses (36% vs 47%).

Six of the 8 SF-36 scale dimensions were significantly poorer in the complicated group. The lowest possible score (floor effect) was reported in 4 of its dimensions by a substantial percentage of patients in the complicated group: physical function (18% vs 11%), role limitations-physical (59% vs 59%), role limitations-emotional (15%) and social functioning (12%). In the uncomplicated group, there were floor effects in 2 of the dimensions, but they were less marked: role limitations-physical (32%) and role limitations-emotional (11%). The ceiling effects were more pronounced in the uncomplicated than complicated group: role limitations-physical (39% vs 11%), bodily pain (19% vs 0%), social functioning (45% vs 27%) and role limitations-emotional (66% vs 65%).

After adjusting for age, sex, and follow-up period using multiple regression analysis, infection was still associated with poorer health outcomes for both satisfaction (R^2=0.311, p<0.0005) and all WOMAC outcomes: pain (R^2=0.192, p=0.001), stiffness (R^2=0.252, p<0.0005), function (R^2=0.325, p<0.0005), and the total normalised WOMAC score (R^2=0.276, p<0.0005).

After adjustment, patients in the complicated group also had significantly poorer quality-of-life scores for the AQoL utility (R^2=0.229, p<0.0005), and for the following SF-36 scales: physical functioning (R^2=0.256, p<0.0005), bodily pain (R^2=0.181, p=0.001), role limitations-physical (R^2=0.122, p=0.018), and mental health (R^2=0.120, p=0.019). There was a lower level of vitality for patients in the complicated group but not significantly (R^2=0.095, p=0.058). There was no significant difference in social function (R^2=0.021, p=0.113), role limitations-emotional (R^2=0.059, p=0.234), and general health (R^2=0.039, p=0.455).

When compared with WOMAC normative data, both complicated and uncomplicated groups had significantly poorer health outcomes (higher WOMAC scores) in terms of pain (both p<0.0001), stiffness (p=0.0025 and p=0.0214, respectively) and function (both p<0.0001) scores (Fig. 3).

The overall health-related quality of life for the complicated patients was significantly poorer than that of the community (p<0.0001) and outpatient (p=0.003) groups, as reflected by mean AQoL utility.
scores. However, AQoL utility for the complicated patients was not significantly different to the inpatient group (p=0.292). There was no significant difference in mean AQoL utility between the uncomplicated and outpatient groups (p=0.114) or community groups (p=0.056).

When compared with the normative data for the SF-36 scale scores, the health-related quality-of-life scores for the complicated group were significantly lower in 6 of the 8 dimensions (Fig. 4): physical functioning (p<0.0001), role limitations-physical (p<0.0001), bodily pain (p<0.0001), vitality (p=0.016), social functioning (p=0.0027) and mental health (p=0.017). There was no significant difference in general health (p=0.843) and role limitations-emotional (p=0.753). In the uncomplicated group, only physical functioning (p<0.0001) was significantly inferior to the normative data.

DISCUSSION

Functional and health-related quality-of-life outcomes after infection are devastating for the patient. Infection had a great impact on physical functioning and ability to live independently and perform activities of daily living. Our research possibly underestimates the extent of the problems experienced by patients with infection in these areas, as demonstrated by the substantial floor effect for the SF-36 scales for physical function and role limitations-physical; in the complicated group 18% and 58% of the patients, respectively, reported the lowest possible scores. Our study adds further weight to previous studies that have documented poorer functional outcomes after revision knee and hip arthroplasty due to infection.22,38,39

Infection also affects mental health and social relationships, though not to the same extent as for physical aspects. This impact on social functioning indicates that psychological and social factors are important for this group and contribute to overall quality of life. For what is primarily a physical condition, the impact of an infection on mental health is notable. This effect has not previously been reported, although the interplay between physical and mental health is complex and aspects of this association have been discussed before.40–42

Our study found high levels of satisfaction with uncomplicated TJR. The substantial ceiling effect for the uncomplicated group for satisfaction reflects the notion that, for the recipient, TJR is a successful procedure and is consistent with other studies.43,44 which contrasts with the poor levels of satisfaction reported after TJR infections. The substantial floor effects in the complicated group for
satisfaction indicates that the measurement was not able to determine the extent of the dissatisfaction. Dissatisfaction levels with revision TJR have been reported though not to the same extent as in this study.

The overall quality of life in patients complicated with infection was poor. This in part reflects the heterogeneity of this group in terms of how the infection was managed. The complicated group was deliberately not focused on any single method of management in order to reflect the general situation. 12% of the patients in the complicated group had their health state rated equivalent to or worse than death. This is a substantial proportion who had either an excision arthroplasty or were on long-term antibiotics due to unresolved, active infection. Patients who had their infection resolved or controlled (with a retained prosthesis) fared better, but were significantly worse than those in the uncomplicated group. No patients in the uncomplicated group had health state worse than death and only one equivalent to death. Health state worse than death had been previously reported in patients following a major stroke, but not after complicated TJR.

For TJR patients complicated with infection, their health-related quality of life did not return to the levels experienced by the healthy aged population (outpatient and community groups), but was equivalent to that of hospital inpatients. This indicates that the burden of an infection is similar to the burden experienced by acute hospital inpatients.

Outcomes for the uncomplicated group support community expectations, namely, that TJR will restore the quality of life and function nearly to that of a healthy aged population. In the uncomplicated group the SF-36 physical function dimension approached that of the normative group but a significant difference remained. The disease-specific outcomes for the uncomplicated group were also below normative values. For the uncomplicated group, mental health, role limitations-emotional, and general health of the SF-36 were actually higher than the healthy aged population but not significantly so.

Functional status of patients with infection did not return to the levels experienced by the healthy aged population. One study comparing the functional outcomes (as measured by the WOMAC) to normative outcomes 12 months after uncomplicated THR also found functional levels were significantly below those reported for the reference group.

A limitation of this study was the lack of preoperative data for the infected group. Most such patients were transferred from community practice and preoperative data were therefore not available, so that prospective longitudinal comparisons could not be made. The high number of patients in the uncomplicated group who declined to participate (15/118) and were lost to follow-up (12/118) was a reflection of the ageing nature of this population due to physical frailty and concurrent medical illness. There was no suggestion of joint-related decline in function. There was a lack of controls in relation to co-morbidities, though we attempted to collect this data retrospectively. Nonetheless, retrospective collection through medical records was not comprehensive and thus flawed. Because of the small sample size, the ability to infer meaningful conclusions with respect to co-morbidities was limited. A larger study is required to determine the relationship between co-morbidities and outcome after TJR infections.

CONCLUSION

Previous reports of clinical outcomes and in-hospital costs underestimate the disastrous consequences of infection. When hospitals balance the costs of preventative measures with the costs of treating infection in TJR, effect on patients’ quality of life must be considered. Our findings argue strongly for the allocation of health care resources to minimise the occurrence of infection after TJR.

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