A prospective observational study of falling before and after knee replacement surgery

Annette Swinkels1, John H. Newman2, Theresa J. Allain3

1Faculty of Health and Life Sciences, University of the West of England, Blackberry Hill, Bristol BS16 1DD, UK
2Avon Orthopaedic Centre, North Bristol NHS Trust, Southmead Hospital, Bristol BS10 5NB, UK
3Department of Care of the Elderly, North Bristol NHS Trust, Southmead Hospital, Bristol BS10 5NB, UK

Address correspondence to: A. Swinkels. Tel: (+44) 117 3288785; Fax: (+44) 117 3288437. Email: annette.swinkels@uwe.ac.uk

Abstract

Background: knee arthritis is a risk factor for falling. Increasing numbers of people are receiving total knee arthroplasty (TKA) but the natural history of falling before and after TKA is unknown.

Objective: to prospectively monitor falls in pre- and post-operative TKA patients and to identify independent risk factors for post-operative falling.

Design: a prospective observational study with a 1-year follow-up.

Participants: community-dwelling older people recruited from a regional orthopaedic centre.

Methods: consecutive patients added to the TKA waiting list who completed monthly falls diaries, pre-operatively and 1 year post-operatively. Data on knee status (WOMAC: pain, stiffness and function), balance confidence (the Activities Balance Confidence Scale-UK—ABC-UK) and mood (Geriatric Depression Scale—GDS) were collected at quarterly intervals.

Results: ninety-nine patients received a primary TKA. 24.2% fell in the last pre-operative quarter (24 patients reported 44 falls) and this decreased to 11.7–11.8% in the first four post-operative quarters. 45.8% of people who fell pre-operatively fell again in the first post-operative year. Higher pre-operative GDS scores and a history of falling were significant independent predictors of post-operative falling.

Conclusion: a recent history of falling is common in people undergoing TKA and ~45% of patients fall again in the year following surgery. Patients being considered for TKA should be asked about falls history and undergo falls risk assessment and intervention.

Keywords: total knee arthroplasty, falls, WOMAC, depression, balance confidence, elderly

Introduction

Total knee arthroplasty (TKA) is a common approach to the management of severe knee arthritis. In 2005, the National Joint Registry [1] reported 62,155 TKAs in England and Wales.

Current estimates indicate that ~33% of community-dwelling older people fall each year [2]. Knee arthritis is an established risk factor for falling with pain, stiffness and functional limitation being more relevant to falls risk than radiological changes [3]. Significant improvements in pain, function and proprioception have been reported following TKA [4–6]. These factors when combined would be expected to reduce the prevalence of falling in older people after TKA. However, some studies have shown proprioceptive/balance deficits following TKA and this could increase falls risk [7, 8]. A recent systematic review shows that no study has addressed falling as an outcome following TKA [4]. The specific questions we wished to address were:

• What proportion of patients fall before and after TKA?
• Does TKA change falls-related outcomes such as knee pain, knee function, balance confidence and mood?
• What are the pre-operative predictors for post-operative falling in TKA patients?

Patients and methods

Participants, aged 65 years and over, were recruited consecutively, as they were added to the waiting list for knee arthroplasty at the Avon Orthopaedic Centre, Bristol, UK. They were contacted by letter and invited to participate in a longitudinal study of falls before and after knee replacement surgery. Of the 277 people approached, 171 agreed to
A. Swinkels et al.

277 patients approached

171 agreed to participate (72M: 99F; 74.16 ± 5.23 yrs)

118 in final data set (46M: 73F; 73.5 ± 4.7 yrs)

99 Primary TKA  19 Revision TKA

75 declined (25M: 50F; 75.2 ± 5.7 yrs)
31 non-respondents (6M: 25F; 75.3 ± 7.1 yrs)

53 excluded from analysis:
24 Withdrawn, not eligible
23 operations cancelled/postponed due to health issues/patient choice
1 not TKR

11 Withdrawed before surgery (4M:7F; 78.9 ± 7.2 yrs)
Reasons:
2 Ankle surgery/stroke
9 No specific reason given

10 withdrew within 6 months post-op (6M:4; 6.7 ± 4.9 yrs)
Reasons:
4 post-op complications/health problems
3 Feeling better/no time
2 No explanation
1 Died

8 non-respondents (4M:4F; 73.1 ± 7.4 yrs)

Figure 1. Study flow.

take part in the study, 75 declined and 31 did not respond (see Figure 1).

Outcome assessment

On recruitment, participants completed a self-administered baseline questionnaire regarding falls in the preceding 4 months, prescribed and non-prescribed medications, co-morbid conditions, hearing and visual impairment and previous surgery. Falls data were collected prospectively, at monthly intervals, from the time of entry onto the waiting list and for 12 months after surgery. A fall was defined as unintentionally coming to rest on the ground, or at some other lower level, not as a result of a major intrinsic event such as a fit, faint or stroke [9]. Falls diaries were sent out monthly with a pre-paid envelope for the return of the previous month’s sheet. Participants who did not return their monthly falls diary were sent a written reminder.

Every 3 months, participants were sent an update questionnaire regarding changes in medication or health status, the Western Ontario and McMaster Osteoarthritis Index (WOMAC [10]), the Activities Specific Balance Confidence Scale-UK (ABC-UK [11]) and the Geriatric Depression Scale (GDS [12, 13]). Appendices 1 and 2 (available on Age and Ageing online) give details of patient characteristics and outcome measures used.

Data analysis

Data were analysed using Excel and SPSS (version 13, SPSS, Chicago, IL, USA) statistical software. Patients were classified as either ‘fallers’ (one or more falls) or ‘non-fallers’ based on data from monthly falls diaries. Changes in falling status were compared using Pearson’s chi-square tests. Binary Logistic Regression was conducted to identify independent pre-operative predictors of post-operative falls controlling for inequality of variables. See Appendix 3 (available on Age and Ageing online) for sample size explanation and details of all statistical tests.

The ethics committees of the North Bristol Hospital Trust (Southmead) and the University of the West of England, Bristol, gave approval for this study.

Results

Of the 118 patients recruited for this study, 99 received a primary TKA (mean age 73.4 ± 4.9 years, range 66–85, 36 males: 63 females) and 19 a revision TKA (mean age 74.0 ± 3.6 years, range 67–80 years, 10 males: 9 females). Outcomes following revision TKA may be poorer than those for primary TKA [14], we are therefore presenting the results of the primary TKA group only.

Fallers and falls

Overall, there was a 98.2% return rate for monthly falls diaries. 24.2% of patients fell in the pre-operative quarter compared to 11.7–11.8% in each of the four post-operative quarters. The annual post-operative falls rate was 24.2%. Table 1 shows pre-operative characteristics of fallers and non-fallers.
A total of 54.2% (13/24) of pre-operative fallers did not fall again in the first post-operative year; 45.8% (11/24) remained fallers. 17.3% (13/75) of non-fallers fell post-operatively. Overall, there was a significant switch in favour of pre-operative fallers becoming non-fallers in the first post-operative year (Pearson’s chi-square = 8.041, df = 1, P = 0.005). Separate comparison of quarterly data showed a significant change in the overall distribution of fallers/non-fallers in the last quarter of the first post-operative year (Pearson’s chi-square = 22.40, df = 1, P < 0.001) when 13 of 24 pre-operative fallers became non-fallers.

A total of 44 falls were sustained in the pre-operative quarter compared to 16, 22, 32 (two patients fell six times each this quarter) and 17 in each of the post-operative quarters. Details of pre- and post-operative falls (based on reference [15]) are shown in Table 2. In comparison with pre-operative values, there was a significant reduction in the number of falls in the first, second and fourth post-operative quarters of the first year following surgery (paired t-tests, P = 0.005, 0.052 and 0.001, respectively).

### Pre-operative and surgical predictors of falls

With the exception of gender, none of the pre-operative characteristics reported in the baseline questionnaire were independently predictive of pre-operative falling. Adjusted and non-adjusted odds ratios for this data can be found in Appendix 4 (available on Age and Aging online). Male gender was associated with decreased likelihood of pre-operative falling even when adjusted for pre-operative variables such as age and number of co-morbid conditions (adjusted OR 0.083, 95% CI 0.020–0.694, P = 0.022). Gender did not, however, influence the odds of falling post-operatively (adjusted OR 0.547, 95% CI 0.168–1.955, P = 0.375).

When adjusted for age and other pre-operative variables, the odds of a pre-operative faller becoming a faller in the first post-operative year are almost eight times those of a non-faller (adjusted OR 7.75, 95% CI 1.721–35.710, P = 0.008).

### Pain, stiffness and function (WOMAC)

Across the whole cohort, there were significant improvements in mean WOMAC scores over time [pain: ANOVA, F(4, 264) = 42.39, mean square error (MSE) = 8.05, P < 0.001; stiffness: F(4, 264) = 28.66, MSE = 1.52, P < 0.001; function: F(4, 240) = 37.46, MSE = 73.96, P < 0.001]. Mean post-operative scores were better than pre-operative scores at all time points (P < 0.001). Post-operative pain improved significantly between 3 and 6, and 9 and 12 months (P ≤ 0.044) and function between 3 and 12 months (P = 0.021). Similar overall improvements were seen in pre-operative fallers and non-fallers. However, fallers did not show the significant post-operative improvements between 3, 9 and 12 months which were apparent in non-fallers (P ≤ 0.038).

Following adjustment for age, gender, number of co-morbid conditions and pre-operative scores (for post-operative comparisons), there were no differences in


A. Swinkels et al.

Table 2. Characteristics of pre- and post-operative falls

<table>
<thead>
<tr>
<th></th>
<th>Pre-operative falls (3 months pre-operative)</th>
<th>Post-operative falls (first year post-operative)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>experiencing more</td>
<td></td>
<td></td>
</tr>
<tr>
<td>than one fall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total no. of falls</td>
<td>44</td>
<td>87</td>
</tr>
<tr>
<td>No. of fallers</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside</td>
<td>20</td>
<td>47</td>
</tr>
<tr>
<td>Outside</td>
<td>17</td>
<td>40</td>
</tr>
<tr>
<td>Not stated</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Causes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsicb</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Extrinsicc</td>
<td>15</td>
<td>55</td>
</tr>
<tr>
<td>Non-bipedal</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Unclassifiable</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Injuries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No injuries</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Cuts and/or bruises</td>
<td>31</td>
<td>40</td>
</tr>
<tr>
<td>Fractures</td>
<td>2 (neck of femur, neck of humerus)</td>
<td>6 neck of humerus, clavicle, neck of femur (2), wrist (colles), ribs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other injuries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 avulsion finger tip</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 shoulder/thumb sprains</td>
</tr>
<tr>
<td>Medical help</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>41</td>
<td>72</td>
</tr>
<tr>
<td>Yes</td>
<td>3 hospital</td>
<td>15 (8 hospital, 4 GP, 1 district nurse, 1 health visitor, 1 walk-in centre)</td>
</tr>
</tbody>
</table>

*Cumulative data for the first year following surgery. A total of 16, 22, 32 and 17 falls were sustained in the 1st– 4th post-operative quarters, respectively.

bRelated to subject specific factors.

cRelated to environmental factors.

dFalls from a sitting or lying position.

eUnclear or missing information.

In fallers, depression scores >5 were 36.4% (pre-operative) and 31.8%, 22.7%, 36.4% and 42.8% in each successive post-operative quarter. Corresponding values for non-fallers were consistently lower at 19.1% and 11.6%, 12.6%, 15.5% and 19.0%.

Following adjustment for all pre-operative falls risk factor variables (age, gender, co-morbid conditions etc), a one-point increase in pre-operative GDS significantly increased the odds of becoming a post-operative faller by 26.8% (OR 0.98, 95% CI 1.022–1.573, P = 0.031).

There was a significant positive correlation between GDS and WOMAC pain scores pre-operatively and at all post-operative time intervals (Spearman’s rank correlation coefficient):
Falls before and after knee replacement surgery

A total of 24.2% of people undergoing TKA fell in the 3 months before surgery. Post-operative falls rates were 11.7–11.8% per quarter in the first year.
A. Swinkels et al.

- TKA led to improvement in balance confidence but this was not maintained in patients with a history of falling pre-operatively.
- TKA led to a reduction in depression symptomatology in non-fallers but not in people who had fallen pre-operatively.
- Post-operative falling was predicted by depression symptomatology and a pre-operative history of falling.

Acknowledgements

Our sincere thanks to all participants and also to Dr Paul White for his advice on statistical analysis; Denise Roy, Lead Assessment Nurse in Orthopaedics, for help with study design; Hayley Johnson for assistance with data inputting and Orthopaedic Consultants and administrative staff at the Avon Orthopaedic Centre, Bristol, UK, for their collaboration in this study.

Conflicts of interest

There are no conflicts of interest in this study.

Funding

This study was funded by the Faculty of Health and Life Sciences, University of the West of England, Bristol, UK.

Supplementary data

Supplementary data are available at Age and Ageing online.

References

Inequalities in health at older ages: a longitudinal investigation of the onset of illness and survival effects in England

ANNEMCMUNN¹, JAMES NAZROO², ELIZABETH BREEZE¹

¹Department of Epidemiology & Public Health, University College London, 1-19 Torrington Place, London, WC1E 6BT, UK
²School of Social Sciences, Roscoe Building, Brunswick Street, University of Manchester, Manchester, M13 9PL, UK

Abstract

Background: previous studies have suggested a decline in the relationship between socioeconomic circumstances and health or functioning in later life, but this may be due to survival effects.

Objective: to examine whether wealth gradients in the incidence of illness decline with age, and, if so, whether this decline is explained by differential mortality.

Methods: the study included participants in the first two waves of the English Longitudinal Study of Ageing (ELSA), a large national longitudinal study of the population aged 50+ in England, who reported good health, no functional impairment, or no heart disease at baseline. Wealth inequalities in onset of illness over 2 years were examined across age groups, with and without the inclusion of mortality. Outcome measures were functional impairment, heart disease, self-reported health, and all-cause mortality (in conjunction with self-reported health and disability) or circulatory-related mortality (in relation to heart disease).

Results: wealth predicted onset of functional impairment equally across age groups. For self-reported health and heart disease, wealth gradients in the onset of illness declined with age. Selective mortality contributed to this decline in the oldest age groups.

Conclusions: socioeconomic inequality in developing new health problems persist into old age for certain illnesses, particularly functional impairment, but not for heart disease. Selective mortality explains only some of the decline in health inequalities with age.

Keywords: health inequalities, ageing, selective mortality