The natural history of unexplained early poor function following total hip replacement

Bruce S. Watson · Paul J. Jenkins · James A. Ballantyne

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Abstract

Purpose The majority of patients experience a significant improvement in quality of life and function after total hip replacement (THR). It has recently been shown that age and good pre-operative function are the best predictors of post-operative function. When patients fail to achieve a satisfactory outcome, a cause is often identified. Where there is no identifiable cause, advice, follow-up and management is not clear. The aim of this study was to determine the long-term outcome of patients who had early poor function, but no identifiable cause.

Methods From a regional database, we identified 1,564 patients who underwent unilateral THR between 1998 and 2004 and who were without complication or subsequent bilateral procedure at six months. These patients were divided into two groups according to their Harris hip score (HHS) at this stage: group A consisted of 270 patients with a ‘poor’ result (HHS less than 70). Group B consisted of 1,294 patients with a ‘good’ or ‘excellent’ result (HHS 70 or above). The patients were reviewed at five years. One hundred and ten patients from group A and 980 from group B completed five-year follow-up without further identifiable complication.

Results Those with poor or fair function at six months were at an increased risk of developing an identified complication by five years including dislocation (OR 5.7, 95 % CI 1.8–18.2), deep infection (OR 9.8, 95%CI 2.9–37.7) and death (OR 1.6, 95 % CI 1.1–2.3). There was a greater rate of revision in group A versus group B (OR 5.7, 95 % CI 2.9–11). The overall function measured by the Harris hip score significantly improved in group A, but never reached that of those with good or excellent function at six months (HHS 76.2 versus 90.3, $P < 0.001$).

Conclusions Patients with poor function at six months, but no obvious cause, are at higher risk of developing complications by five years. This group may benefit from more regular arthroplasty review and intervention.

Keywords Total hip replacement · Total hip arthroplasty · Complication · Patient reported functional outcome · Infection · Dislocation · Mortality

Introduction

Ten percent of patients experience a poor result following total hip replacement (THR) [1–3]. The reason for poor function should be investigated with common causes being infection, loosening, dislocation, wear, limb length inequality, lumbar back pain, diagnostic error and soft tissue causes, such as muscle tightness and psoas impingement [4–7].

In many patients with an early poor outcome, no cause is identified after thorough investigation [8] and revision surgery is unlikely to be successful [4]. There is a paucity of literature available on the longer-term outcome in such patients. The aim of this study was to determine the long-term outcome following THR, where there has been poor early function without obvious cause.

Patients and methods

We examined the outcome of 1,793 patients who had undergone primary THR, at one district general hospital, between January 1998 and May 2004. There were 1,969 THRs undertaken in 1,793 patients. There were 176 staged or simultaneous bilateral procedures during the study period and these were therefore excluded. All the data was collected prospectively as part of a comprehensive arthroplasty surveillance

B. S. Watson · P. J. Jenkins (✉) · J. A. Ballantyne
Victoria Hospital, Hayfield Road, Kirkcaldy KY2 5AH, UK
e-mail: pjenkins2@nhs.net

audit at six months and five years postoperatively by two research nurses, who were present throughout the study. Demographic details were recorded at the pre-operative assessment. The Harris hip score was used to assess patient reported function [9].

The THRs were performed by one of seven consultant surgeons, or a trainee operating under their direct supervision. All patients were admitted the day before surgery. Low-molecular weight heparin was administered on the night before surgery and continued until discharge from hospital. Full-length graded elastic stockings were worn and early mobilisation was encouraged. Antibiotic prophylaxis comprised three intravenous doses (750 mg) of cefuroxime, the first with induction of anaesthesia, a second dose at eight hours and a third dose at 16 hours postoperatively. Either anterolateral or posterior approach was used for access, depending on the preference of the operating surgeon. All implants were cemented Lubinus SPII (Link) or Chamley (Depuy, Leeds, United Kingdom) femoral stems with an cemented UHMWPE acetabular implant.

At six months there were 1,564 patients who had not suffered an early complication, had died or undergone a subsequent contralateral THR (Fig. 1). These were divided into poor function (Harris hip score less than 70; group A) and those with good to excellent function (Harris hip score 70 or more; group B) (Fig. 1). Those reporting a clinical problem such as pain or instability at six months were evaluated to detect

possible infection, instability or loosening. Plain radiographs were scrutinised for evidence of loosening and malalignment. Occult infection was sought by testing serial inflammatory markers (WCC, ESR, CRP) and joint aspiration where clinically indicated.

Six months after surgery 270 patients had a HHS of less than 70. These patients were designated 'group A' and the 1,294 patients with a HHS over 70 were designated as 'group B'. In group A 32 (30 %) were male and 75 (70 %) were female and the mean age was 65 years. In group B, 507 (39 %) were male and 787 (61 %) were female with a mean age of 67 years. There was no difference in body mass index (28.1 kg/m^2 versus 27.4 kg/m^2 , $p=0.061$). Paired functional data was not available for all patients, i.e. in group A there were 108 patients who did not have paired Harris hip scores and in group B there were 186 without paired data.

Data were checked for normality with the Shapiro-Wilk test. Categorical data were analysed with chi-squared tests, and odds ratios with 95 % confidence intervals were reported. The difference in age between groups was analysed with the Student *t*-test. The change over time in the Harris hip score was analysed using a repeated measures ANOVA. Age and gender were included as co-variables to adjust for the difference in distribution between groups. The repeated measures ANOVA considers the difference between groups, and the difference between the change scores between groups. Paired *t*-tests were

Fig. 1 Flow-chart representation of the selection process to establish the patient groups for study

used for post-hoc analysis of the change in Harris hip score at six months and five years. *P* values are reported for the effects of the covariates between groups, and for the interaction between group and time (effect on change score). Statistical analysis was performed using SPSS version 20 (SPSS Inc., Chicago, Illinois). Statistical significance was set at $p=0.05$ and two-tailed tests were used throughout. The standard deviation of the entire dataset Harris hip score at six months was 11.9. Therefore the minimum clinically important difference in HHS was selected as 6.5.

Results

In group A (poor early function) at five-year review, deep infection was confirmed in eight patients (3 %), dislocation in seven (2.6 %) and 37 (14 %) patients had died. Over the same time period, in group B, deep infection was confirmed in four (0.3 %), six suffered a dislocation (0.4 %) and 118 died (9 %). The prevalence of death (OR 1.6), deep infection (OR 9.8), dislocation (OR 5.7) and revision (OR 5.7) were all higher in group A compared with group B (Table 1).

Group A had a greater improvement in HHS over the timescale than group B ($p<0.001$) (Table 1). Their final function, however, did not reach that of group B. The influence of gender as a covariate was significant: females generally had poorer Harris hip scores at all time points ($p=0.033$). There was no difference in the rate of improvement in scores between gender ($p=0.541$). Increasing age was associated with poorer absolute Harris hip scores at both six months and five years ($p<0.001$) and also with change in HHS between these time points ($p<0.001$). In group A at five years, 12 (11 %) of the 110 patients had excellent results and 43 (39 %) had good results.

In those in group A, the five-year results were excellent in 12 (11 %), good in 43 (39 %), fair in 31 (29 %) and poor in 24 (22 %). In group B, the five-year results were excellent in 591 (60 %), good in 273 (28 %), fair in 94 (10 %) and poor in 22 (3 %) (overall difference in proportions between groups $p<0.001$). The overall five-year good to excellent results were 50 % in group A compared with 88 % in group B ($p<0.001$).

Discussion

This study demonstrates that 17 % of patients will have unsatisfactory results at six months, with no identifiable cause. Although most patients go on to have good outcomes, in keeping with the literature [10], those patients with poor early function have a higher risk of the discovery of a complication in the period between six months and five years (up to 25 %). Our study demonstrates that there is still a significant increase in function after six months for many of these patients, although the function at five years did not reach that of those with good early outcomes.

Risk factors for poor outcome were female gender and increasing age and this is in keeping with previous studies documenting that a poor outcome following THR at six months is no better at two years [11]. Previous studies have also demonstrated that those with poorer preoperative functional status have higher expectations of THR [12], that there is a poor relationship between self-reported and performance-based physical function [13, 14] and that patients with musculoskeletal co-morbidities unrelated to their hip have less long-term functional improvement after THR [15]. These factors may explain a poorly functioning hip, with no identifiable cause. For those patients who developed a subsequent identifiable complication, it is likely that they did have a

Table 1 Demographic, five-year outcome and function in patients with fair or poor (group A) and good or excellent (group B) Harris hip scores at six-months assessment

Characteristic	Group A ($n=270$)	Group B ($n=1,294$)	<i>P</i> value
Male (n , % of group)	77 (29 %)	507 (39 %)	0.001 (chi-square)
Female (n , % of group)	193 (71 %)	787 (61 %)	
Age (mean [years], SD)	65.3 (13.2)	67.3 (9.7)	<0.001 (Student <i>t</i> test)
Late complications			OR, 95 % CI, <i>P</i> value (chi-square)
Deep infection (n , % of group)	8 (3 %)	4 (0.3 %)	9.8 (2.9–37.7), <0.001
Dislocation (n , %)	7 (2.6 %)	6 (0.4 %)	5.7 (1.8–18.2), 0.003
Revision (n , %)	20 (7.4 %)	18 (1.4 %)	5.7 (2.9–11.0), <0.001
Died (n , %)	37 (13.7 %)	118 (9.1 %)	1.6 (1.1–2.3), 0.027
Harris hip score	($n=110$)	($n=980$)	Mean diff (95 % CI), <i>P</i> value (ANOVA)
Six months (mean, SD)	57.7 (9.7)	87.7 (7.9)	30.0 (28.4–31.6), $p<0.001$
Five years (mean, SD)	76.2 (14.2)	90.3 (9.4)	14.1 (12.1–16), $p<0.001$
Difference (mean, 95 % CI)	18.6 (15.9–21.2)	2.6 (2.1–3.2)	16.0 (13.9–17.9), $p<0.001$

complication present that was not clinically detectable at six months [16]. Therefore patients with early poor function should be observed more closely. This finding may be useful when considering the redesign of arthroplasty review services. Other tools may also be useful in the early detection of a unit's change complication rate [17].

A main strength of this study is its prospective data collection as part of a regional arthroplasty audit project. Data were collected by two trained audit nurses thus reducing inter-observer variability. The main limitation was the reliance on an outcome indicator as the principal outcome measure (question of validity). One of the limitations of the HHS is that it does not compensate for individual patient characteristics based on age, health or concurrent medical co-morbidities that may affect the total score. For example, limitation in walking distance may be due to exertional dyspnoea although the score would imply that this is due to poor hip function. Patients with co-morbidities such as chronic back pain may score poorly on several areas of the score and this again may give a false impression of poor hip function. "Patients and Methods" and "Results" of the score do, however, objectively assess hip function and this may compensate for these weaknesses to a degree [9, 18]. The Harris hip score has been validated as a reliable indicator of hip specific function and has been shown to be a reliable and reproducible way for non-medical staff to evaluate function after THR [19]. The second main limitation in the study is the absence of paired data for a large number of patients in the study. Several factors contributed to the inability to measure HHS at five years in some patients; many patients could not be reached in order to arrange follow-up as they appeared to have moved from the region or changed their contact details during the study, while others indicated that concurrent medical problems and limited transportation prevented their attendance to the follow-up visit. In a few cases, patients refused examination of their hip at the review appointment. The lack of data does add a possible confounding factor to the study as the patients who did not attend the five-year review may simply have failed to attend due to factors related to poor hip function. However, it is also possible that they failed to attend due to significant improvement in HHS.

The management of patients with unexplained poor outcome following THR is challenging and involves either interventional or conservative approaches. THR revision surgery carries with it significantly higher complication rate than primary surgery and should therefore be considered with caution. It has also been reported that revision where no identifiable cause has been found resulted in poorer outcomes. A proportion of patients following THR will experience poor early results.

Every attempt should be made to ascertain the reason for this poor function and exclude infection and impingement. A high index of suspicion and review should be maintained in patients with poor early outcomes.

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