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Patient-perceived leg length discrepancy after total hip replacement: prevalence and impact on functional outcome

V. Wylde[1], A.W. Blom[1], S.L. Whitehouse[2], A. H. Taylor[3], G. T. Pattison[4], G. C. Bannister[1]

[1] Orthopaedic Surgery, Avon Orthopaedic Centre, Southmead Hospital, Westbury-on-Trym, Bristol, BS10 5NB

[2]Orthopaedic Research Unit, Queensland University of Technology, The Prince Charles Hospital, Brisbane, Queensland, Australia

[3] Orthopaedic Surgery, Nuffield Orthopaedic Center, Oxford

[4]Department of Orthopaedic Surgery, University Hospital, Coventry, CV2 2DX

Corresponding author
Miss Vikki Wylde
Bristol Implant Research Centre
Avon Orthopaedic Centre
Southmead Hospital
Bristol, BS10 5NB
Telephone: 0117 959 5906
Fax: 0117 959 5936
E-mail: V.Wylde@bristol.ac.uk

Abstract

The aim of this survey was to determine the prevalence of patient-perceived leg length discrepancy (LLD) after primary total hip replacement (THR) and its impact on functional outcome. All consecutive patients who had a primary, unilateral THR at one orthopaedic centre between April 1993–1996 were sent a questionnaire which included the Oxford hip score (OHS) and questions about LLD. A total of 1,114 patients returned completed questionnaires. Three hundred and twenty nine patients (30%) reported a LLD. Of these patients, 161 patients (49%) were bothered by the difference, 101 patients (31%) used a shoe raise and 13 patients (4%) thought that the surgery had not been worthwhile. Patients with a LLD had a significantly poorer OHS ($p<0.001$) and limped more frequently. This study found that a third of patients perceived a LLD at 5-8 years after THR and LLD had a significant negative impact on functional outcome.

Introduction

Total hip replacement (THR) is considered an effective surgical intervention for the relief of chronic pain and functional disability. Survivorship analysis and surgeon-based outcome measures suggest that outcomes after THR are excellent [1]. However, patient-reported outcome measures have uncovered a significant proportion of patients who experience a poor functional outcome after THR [2-4]. Patient factors that are predictive of a poor outcome include higher pre-operative pain and function disability, older age, and more co-morbidities [5,6]. A surgical aspect of THR which can lead to reduced functional outcome is leg length discrepancy (LLD) [7].

Leg length equality after THR is important to optimise hip biomechanics and LLD has several potential negative consequences for the patient, including sciatica, chronic back pain, hip dislocation, the need for a shoe raise and a limp [8,9]. LLD most commonly involves over-lengthening of the limb on the operative side because of a lengthening of the prosthetic head-neck distance [7]. The prevalence of LLD after THR is high, with only 6% of patients obtaining equal leg lengths after surgery [7]. However, the impact of this leg length inequality on patient-reported functional outcome is more ambiguous. Whereas research has found that LLD has no effect on functional outcome [10], a more recent study found that patients with LLD reported a poorer functional outcome that those patients with equal leg lengths [7]. Because of the disparity in the literature, the aim of this postal survey was to determine the prevalence of patient-perceived LLD after primary THR and its impact on mid-term functional outcomes.

Methods

During 2001, a postal audit survey was undertaken of all consecutive patients who had a primary, unilateral THR at one elective orthopaedic centre between April

1993–April 1996. Four questions were included in the survey to assess LLD. Firstly, patients were asked whether they thought their legs were the same length. Those patients who indicated that their legs were different lengths were then asked the following questions: 1.) Does the difference bother you? 2.) Do you use a shoe raise? 3.) Do you feel the operation was worthwhile? Patients indicated either yes or no for each question.

To assess functional outcomes after THR, the Oxford hip score (OHS) [11] was included in the questionnaire. The OHS is a patient-reported outcome measure that was developed to assess functional ability and pain from the patient's perspective. It is a site-specific questionnaire developed and validated for use in patients undergoing THR. The OHS consists of 12 questions about pain and physical limitations experienced over the past four weeks because of the hip. Each item has five response categories, giving a score of between 1-5 (low disability to high disability). Scoring involves summating the total for each item to produce a final score between 12-60, with a higher score indicating a greater level of functional disability. The frequency of limping was assessed using a question from the OHS, which asks respondents to indicate how often they limp by choosing one of the following response categories: never/rarely, sometimes/just at first, often/not just at first, most of the time or all of the time.

Statistics

Non-parametric tests were used in the statistical analysis because the assumptions of normality were not met when the data was tested with a Kolmogorov-Smirnov test. Mann-Whitney U tests were used to determine if there were significant differences in the OHS or age between unpaired groups. A Kruskal-Wallis test was used to determine if there was significant differences in the OHS with prosthesis used.

Results

Between April 1993- April 1996, 1,704 patients had a primary unilateral THR at one elective orthopaedic centre. Of these patients, 169 had died by the time of follow-up and therefore questionnaires were sent to the remaining 1,535 patients. After the initial mail-out and two reminder mail-outs, questionnaires were received from 1,375 THR patients, giving an overall response rate of 90%. In this study, data analysis was performed on the 1,114 THR patients who returned a completed OHS at the 5-8 year follow-up.

The demographics of patients with and without a perceived LLD are presented in Table 1. There was no significant difference in the age of patients with and without a perceived LLD ($p=0.53$). Three hundred and twenty nine THR patients (30%) reported that they thought their legs were different lengths. Of the 329 patients with a perceived LLD, 161 patients (49%) were bothered by the difference, 101 patients (31%) used a shoe raise and 13 patients (4%) thought that the surgery had not been worthwhile. In comparison, no patients who perceived their legs to be of equal length thought the operation had not been worthwhile.

The median OHS for patients with a perceived LLD was 22 (range 12-55), which was significantly worse that the median OHS of 18 (range 12-53) for patients who thought their legs were the same length ($p<0.001$), indicating that patients with a leg length inequality experienced a poorer functional outcome (Figure 1). The frequency of limping among patients with and without a LLD is displayed in Table 2. Limping was more prevalent in patients who perceived a LLD, with 31% of patients limping most or all of the time, compared to only 9% of patients without a perceived LLD.

The impact of the femoral stem on LLD, OHS and frequency of limping was analysed (Table 3). In total, 985 patients (88%) had one of three femoral stems: 740 patients received a CPT (Zimmer), 133 received an Exeter (Stryker) and 112 received a Charnley (DePuy). There was no significant difference in the median OHS between the three prostheses (p=0.7).

Discussion

This large-scale postal audit survey found the prevalence of patient-perceived LLD after THR to be 30%. This is in agreement with previous research findings that approximately a third of patients are aware of a LLD after THR [7,12]. Although nearly a third of patients perceived a LLD, only half of these patients report that they were bothered by the discrepancy. This finding is again in agreement with previous research which reported that half of patients with LLD were disturbed by the inequality [12]. A possible reason that only half of patients felt they were affected by the LLD is that the LLD was minimal in these patients and therefore had little impact upon their lives. Because no measure of the magnitude of LLD was included in this study it is not possible to test this hypothesis, although the extent of LLD has been found to correlate with the awareness of the problem, abnormal gait and the use of a shoe raise [12]. A shoe raise may be one device patients use to minimise the impact of LLD upon their functional ability. In the current study, the use of a shoe raise was common, with a third of patients with perceived LLD reporting that they used a shoe raise.

This study found that the prevalence of LLD, limping and the OHS appears not to be influenced by the femoral stem prosthesis and therefore may be due to other factors, such as pre-operative leg length. When LLD is present, it has a significant negative impact on functional outcome after primary THR. Patients who reported a perceived

LLD had a significantly worse OHS than those patients who thought their legs were the same length. Also limping was more prevalent among patients with perceived LLD, compared to patients without LLD. Similar results were obtained by Konyves and Bannister (2005), who found that patients with a lengthening of the operative leg had a poorer OHS that those patients with a shorter or equal leg length. However, another study that assessed 200 patients undergoing THR found that radiographic evidence of LLD did not correlate with patient function [10]. This lack of correlation between LLD and functional outcome in the study could be due to the use of the Harris Hip Score [13] and the SF-36 [14] to assess outcome. The Harris Hip Score is a surgeon-based tool and there is considerable evidence demonstrating a lack of agreement between surgeon and patient assessment of health status, particularly in subjective domains such as pain [15]. The SF-36 is a generic tool and as such lacks the specificity and sensitivity of other disease-specific or joint-specific questionnaires [16]. Therefore, the lack of correlation between LLD and functional outcome in the study by White and colleagues (2002) could be due to the questionnaires used to measure outcomes. A strength of the current study was the use of the OHS which is a joint-specific outcome measure and more sensitive to change than both generic and disease-specific measures of health [17].

The limitations of the current study need to be acknowledged when interpreting the results. This study relied upon patients self-report of perceived LLD and did not include a clinical or radiographic assessment of LLD. Therefore, it is not known if the LLD was a true disparity or if it was a manifestation of general dissatisfaction. The prevalence of radiographically assessed over-lengthening of the operative leg has been reported to be 62% at 12-months after THR [7]. It is likely, therefore, that the prevalence of patient perceived LLD is an underestimate of the prevalence of anatomical LLD. However, the impact of unperceived LLD on functional outcome would be expected to

be negligible and thus its importance as an outcome measure is questionable. Therefore, patient self-report of perceived leg length inequality can be a useful method for obtaining large scale data on LLD, and could be an effective tool to be used in place of labour-intensive radiographical analysis and unreliable clinical measurements of LLD [9].

A second limitation of this study is that the survey questions did not ask patients to specify whether their operative leg was longer or shorter than the contralateral leg. Therefore, the prevalence of shortened and lengthen legs after THR can not be determined although previous research has found that patients were significantly more likely to detect a LLD if the leg was over-lengthen on the operative side [7].

This study also has several strengths. To the author's knowledge, this is the largest reported postal survey determining the prevalence of patient-perceived LLD after THR. Because the survey assessed perceived LLD at 5-8 years post-operative, this eliminated transient, apparent LLD from being included in the prevalence estimates. Sampling was not influenced by patient selection bias because all consecutive patients operated upon over a three-year period were included in the survey. Also the use of a validated joint-specific questionnaire to determine the impact of LLD on functional outcome lends specificity and sensitivity to the study.

In conclusion, perceived LLD is highly prevalent at 5-8 years after primary THR, affecting 30% of patients. Of the patients with perceived LLD, half were bothered by the LLD and over a third used a shoe raise to equalise leg lengths. Patients with perceived LLD experienced a significantly poorer functional outcome and reported more limping than those patients without LLD. This study highlights the importance of informing patients pre-operatively of the high risk of LLD after primary THR and the associated negative impact this may have on their outcome.

Table 1: Patient demographics

	No LLD (n= 785)	LLD (n = 329)
Age (years)		
Median	69	68
Side of surgery (%)		
Left	47	51
Right	43	49
Gender (%)		
Male	38	32
Female	62	68

LLD = leg length discrepancy

Figure 1: Box-plot of the median Oxford hip score in patients with and without perceived leg length discrepancy

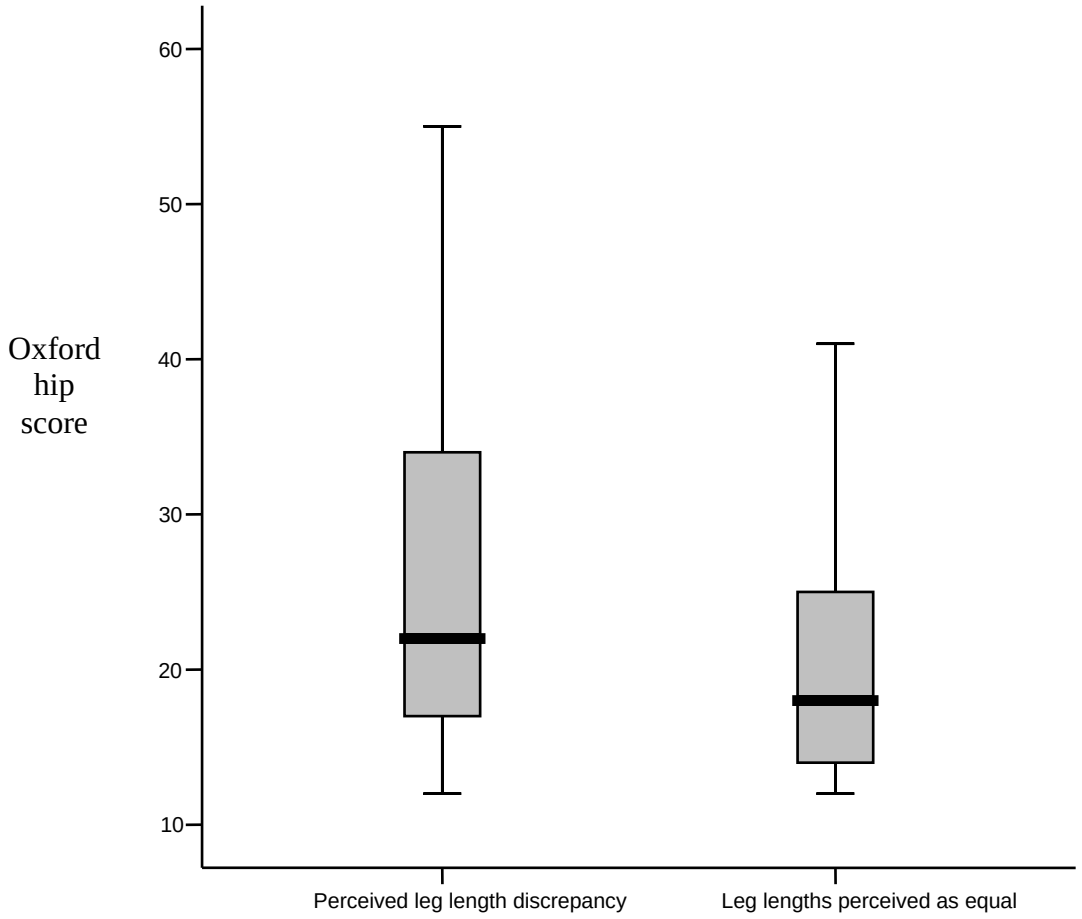

Table 2: Frequency of limping over the past four weeks

	No LLD (n= 785)	LLD (n = 329)
Rarely/never	59%	32%
Sometimes/just at first	28%	28%
Often/not just at first	4%	9%
Most of the time	6%	14%
All of the time	3%	17%

LLD = leg length discrepancy

Table 3: Median OHS, percentage of patients with leg length discrepancy (LLD) and percentage of patients with a limp by femoral stem prosthesis

	Median OHS (range)	% patients with LLD	% patients with limp*
CPT	19 (12-53)	31%	16%
Charnley	18.5 (12-51)	26%	12%
Exeter	20 (12-51)	26%	16%

* Defined as patients who indicated that they limped most or all of the time on the Oxford hip score (OHS).

References:

1. Ulf L. The Danish Hip Arthroplasty Register. *Acta Orthopaedica Scandinavica 2000;71-5:433-9.*

2. Nikolajsen L, Brandsborg B, Lucht U, Jensen TS, Kehlet H. Chronic pain following total hip arthroplasty: a nationwide questionnaire study. *Acta Anaesthesiol Scand 2006;50-4:495-500.*

3. Barrack RL, Paprosky W, Butler RA, Palafox A, Szuszczewicz E, Myers L. Patients' perception of pain after total hip arthroplasty. *The Journal of Arthroplasty 2000;15-5:590-6.*

4. Boutron I, Poiraudeau S, Ravaud JF, Baron G, Revel M, Nizard R, Dougados M, Ravaud P. Disability in adults with hip and knee arthroplasty: a French national community based survey. *Ann Rheum Dis 2003;62-8:748-54.*

5. Nilsdotter AK, Petersson IF, Roos EM, Lohmander LS. Predictors of patient relevant outcome after total hip replacement for osteoarthritis: a prospective study. *Ann Rheum Dis 2003;62-10:923-30.*

6. MacWilliam CH, Yood MU, Verner JJ, McCarthy BD, Ward RE. Patient-related risk factors that predict poor outcome after total hip replacement. *Health Serv Res 1996;31-5:623-38.*

7. Konyves A, Bannister GC. The importance of leg length discrepancy after total hip arthroplasty. *J Bone Joint Surg Br 2005;87-2:155-7.*

8. Austin MS, Hozack WJ, Sharkey PF, Rothman RH. Stability and leg length equality in total hip arthroplasty. *J Arthroplasty 2003;18-3 Suppl 1:88-90.*

9. Turula KB, Friberg O, Lindholm TS, Tallroth K, Vankka E. Leg length inequality after total hip arthroplasty. *Clin Orthop Relat Res 1986-202:163-8.*

10. White TO, Dougall TW. Arthroplasty of the hip. Leg length is not important. *J Bone Joint Surg Br 2002;84-3:335-8.*

11. Dawson J, Fitzpatrick R, Carr A, Murray D. Questionnaire on the perceptions of patients about total hip replacement. *J Bone Joint Surg Br 1996;78-2:185-90.*

12. Edeen J, Sharkey PF, Alexander AH. Clinical significance of leg-length inequality after total hip arthroplasty. *Am J Orthop 1995;24-4:347-51.*

13. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. *J Bone Joint Surg Am 1969;51-4:737-55.*

14. Ware JE, Jr., Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care 1992;30-6:473-83.*

15. Mantyselka P, Kumpusalo E, Ahonen R, Takala J. Patients versus general practitioners assessments of pain intensity in primary care patients with non-cancer pain. *British Journal of General Practice 2001;51:995-7.*

16. Fitzpatrick R, Dawson J. Health-related quality of life and the assessment of outcomes of total hip replacement surgery. *Psychology and health 1997;12:793-803.*

17. Ostendorf M, van Stel HF, Buskens E, Schrijvers AJ, Marting LN, Verbout AJ, Dhert WJ. Patient-reported outcome in total hip replacement. A comparison of five instruments of health status. *J Bone Joint Surg Br 2004;86-6:801-8.*