EARLY RADIOGRAPHIC LOOSENING IMPAIRS THE FUNCTION OF A TOTAL HIP REPLACEMENT

THE NOTTINGHAM HEALTH PROFILE OF 49 PATIENTS AT FIVE YEARS

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We made a study of 49 total hip arthroplasties at five years, comparing the Charnley hip score, the Nottingham Health Profile (NHP) score and the appearance on serial radiographs. Each of the three investigations was performed by an independent observer with no knowledge of the results of the other two studies.

The eight patients with radiographic signs of prosthetic loosening had significant reductions in function and quality of life as measured by the NHP questionnaire, but no differences in the mean Charnley hip scores. None of the eight patients had clinical signs of prosthetic loosening sufficient to recommend revision of their THR. The NHP is a relatively low-cost method of providing long-term follow-up of THR.

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There is no clear correlation between early radiographic loosening of a total hip replacement (THR) and the level of clinical symptoms (Carlsson and Gentz 1980; Paterson, Fulford and Denham 1986). There are several possible reasons: the radiographic criteria may not signify that the prosthesis is physically loose; early loss of fixation may produce no significant loss of function; or the methods of evaluating function may lack sensitivity and precision.

We have compared two methods of assessing pain and function, the Charnley hip score at clinical examination and a modified Nottingham Health Profile questionnaire (NHP) to study the correlation between early radiographic loosening and impaired functional capacity.

PATIENTS AND METHODS

From February 1984 to February 1985 a total of 74 patients had a THR in the orthopaedic department of the University Hospital in Lund, for osteoarthritis or failed nailing of an intracapsular femoral neck fracture. We studied this group, excluding patients with a previous osteotomy, hemiarthroplasty or THR and those who had had a trochanteric fracture treated by nail and plate. Routine follow-up included radiographic and clinical examination according to a standard protocol before discharge from hospital and at 3, 6, 12, 24 and 60 months.

By the five-year follow-up 11 patients had died and eight refused to attend. Two failed to return the NHP questionnaire and four did not complete it adequately. This left 49 patients and hips for the detailed study. There were 26 men and 23 women; their mean age at the time of operation was 68 years (44 to 86).

All the patients had either a Lubinus or a Scanhip metal-on-plastic THR with a 32 mm head implanted through a posterolateral approach. Cementing methods included careful cleaning of the femoral canal with a brush and pulsating lavage. The femoral canal was plugged to allow pressurisation of the vacuum-mixed radio-opaque cement, placed in retrograde fashion using a gun.

We performed three independent investigations: each of the radiographic, clinical and questionnaire assessments was done by a different author blinded to the outcome of the other assessments.

Radiographic evaluation. Serial radiographs of each hip, from the immediate postoperative films to those taken at the five-year review, were thoroughly studied according to a special protocol. The criteria for radiographic stem and socket loosening are shown in Table I, and are similar to the separation into definite, probable or possible long-stem loosening of Harris, McCarthy and O'Neill (1982). The criteria for definite or probable socket loosening were those recommended by Carlsson and Gentz (1984).

Charnley score. Clinical evaluation was according to Merle d'Aubigné and Postel as modified by Charnley (1972): pain, walking and motion were each graded on a six-point scale, in which six points were given for normality and one for the most severe impairment.

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Table I. Radiographic criteria for loosening of the stem and acetabular cup after THR

Grade of loosening	Signs
Femoral	
Definite	Migration within or outside the cement, including new cement-metal separation
	With or without Cement fracture Localised endosteal resorption
	Cement-bone lucencies around the whole prosthesis in AP and lateral views Progression after one year, eventually > 2 mm in width
Probable	Cement-bone lucencies progressing after one year, ≥ 2 mm in more than two of the seven zones
Possible	Lucencies progressing after one year, in one or two of the seven zones, < 2 mm
Cup	
Definite	Migration or other change of position
Probable	Unchanged position but radiolucencies ≥ 2 mm in the upper two quadrants

Nottingham Health Profile. The NHP is a two-part, self-administered questionnaire, developed in the UK to provide a standardised measure of perceived health problems (Table II; Hunt et al 1980; Hunt, McKenna and Williams 1981). It is short and simple and has been extensively tested in the UK for reliability and validity (Hunt et al 1980). Its translation into Swedish was difficult, but the translated version has also been tested using the same methods and similar subjects. There was a high degree of congruency between the British and Swedish results (Hunt and Wiklund 1987).

Part I consists of 38 yes/no statements within the six categories of pain, physical mobility, sleep, energy, social isolation, and emotional reaction. The results reflect the degree of distress felt by patients in each of the categories. The answers are weighted for each category (McKenna, Hunt and McEwen 1981; Hunt and Wiklund 1987) to give 100 points for the maximum possible level of problems, and 0 for complete absence of problems. Part II contains single yes/no statements concerning daily function which may be affected by health: paid employment, jobs around the home, social life, sex life, family relationships, hobbies or interests, and holidays (Table II).

We sent the NHP questionnaire to all the patients five years after their THR with a covering letter and a prepaid reply envelope. We extended it with questions about their heart problems, dizziness, Parkinson's disease, hemiplegia, habitation and whether they were living alone. We also asked about pain, walking aids and walking distance. The patients did not know their radiographic results when they completed the questionnaire.

Statistical analysis. We used the chi-squared test with continuity correction to compare independent groups and the Mann-Whitney U test to compare pairs of independent

Table II. List of questions for yes/no answers in the British NHP (Hunt et al 1980)**Part I**

I'm tired all the time
I have pain at night
Things are getting me down

I have unbearable pain
I take tablets to help me sleep
I've forgotten what it's like to enjoy myself

I'm feeling on edge
I find it painful to change position
I feel lonely

I can only walk about indoors
I find it hard to bend
Everything is an effort

I'm waking up in the early hours of the morning
I'm unable to walk at all
I'm finding it hard to make contact with people

The days seem to drag
I have trouble getting up and down stairs
I find it hard to reach for things

I'm in pain when I walk
I lose my temper easily these days
I feel there is nobody I am close to

I lie awake for most of the night
I feel as if I'm losing control
I'm in pain when I'm standing

I find it hard to dress myself
I soon run out of energy
I find it hard to stand for long (e.g. at the kitchen sink, waiting for a bus)

I'm in constant pain
It takes me a long time to get to sleep
I feel I am a burden to people

Worry is keeping me awake at night
I feel that life is not worth living
I sleep badly at night

I'm finding it hard to get on with people
I need help to walk about outside (e.g. a walking aid or someone to support me)
I'm in pain going up and down stairs or steps

I wake up feeling depressed
I'm in pain when I am sitting

Part II

Is your present state of health causing problems with your . . .

Job of work? (i.e. paid employment)

Looking after the home? (e.g. cleaning and cooking, repairs, odd jobs around the home, etc)

Social life? (e.g. going out, seeing friends, going to the pub, etc)

Home life? (i.e. relationships with other people in your home)

Sex life?

Interests and hobbies? (e.g. sports, arts and crafts, do-it-yourself, etc)

Holidays? (e.g. summer or winter holidays, weekends away, etc)

groups in part I of the NHP. We used the Spearman rank-order coefficient to calculate correlations.

RESULTS

There was radiographic loosening of the stem in five hips, loosening of the cup in two hips and of both components

Table III. Details of eight hips with radiographically loose implants

Age at surgery (yr)	Sex	Cup loosening	Stem loosening
64	M		Definite – progressive zones
74	F		Definite – subsidence of 1 mm
44	M	Definite – migration	Definite – localised endosteal resorption and progressive zones
68	F		Definite – scalloping
71	M		Definite – progressive zones
65	F		Definite – localised endosteal resorption
71	F	Probable – progressive zones	
69	M	Probable – progressive zones	

in one hip (Table III). No hip had been revised, and at the clinical five-year follow up none was causing symptoms sufficient to recommend revision. The mean age at follow-up for the eight patients (4 men and 4 women) with radiographic loosening was 71 years (49 to 79) as compared with 74 years (55 to 91) for the 41 patients (22 men and 19 women) with no radiographic evidence of loosening.

We found no differences between the group with intact hips and those with radiographic signs of loosening in respect of demographic data, the presence of chronic disease, or the use of walking aids.

The mean pain score from the NHP was significantly greater (35) for the eight patients with radiographic loosening than for the 41 with no such signs (11) ($p = 0.03$; Table IV). We found no significant differences in the other categories of part I of the NHP: energy, physical mobility, sleep, emotion and social isolation.

Part II of the NHP showed that daily activities were influenced to a larger extent in those with loose prostheses (Table V), with significant differences for social life and holidays.

The differences in mean Charnley hip scores for pain (5.4 and 5.3 for intact and loose hips respectively), for walking ability (4.7 and 4.6) and for range of motion (5.0 and 4.9) were not significant.

The Charnley hip score for pain in the whole series correlated well with that from the NHP ($Rho = -0.512$; $p = 0.0004$; Fig. 1). That for walking ability correlated with the NHP score for physical mobility ($Rho = -0.77$; $p = 0.0001$; Fig. 2).

DISCUSSION

We applied strict criteria for radiographic loosening, but none of the eight patients with evidence of loosening had enough clinical symptoms to consider revision. We found, however, that all measurements of functional capacity were reduced in the group with radiographic loosening.

Both part I and part II of the NHP showed significant reductions, but the minor reduction in the mean Charnley hip score was insignificant. The functional capacity one year after THR has previously been evaluated with the NHP (Wiklund and Romanus 1991), but these authors did not study radiographs, assuming that radiographic failure is rare at this time. Their results, however, after THR measured by the NHP were much the same as ours despite the additional four years of follow-up. This indicates that such results are lasting unless loosening occurs.

We found a correlation between walking ability assessed with the Charnley score and physical mobility

Fig. 1
Correlation between Charnley pain score and NHP pain score ($Rho = -0.512$; $p = 0.0004$)

Fig. 2
Correlation between Charnley walking score and physical mobility on the NHP score ($Rho = -0.77$; $p = 0.0001$)

Table IV. NHP scores for intact and radiographically loose prostheses as mean (SD) compared with the mean scores reported by Wiklund and Romanus (1991) one year after THR

Category	Intact (n=41)	Loose (n=8)	p value	Wiklund and Romanus (1991)
Energy	20 (34)	45 (43)	0.08	20
Physical mobility	22 (27)	28 (24)	0.5	18
Pain	11 (20)	35 (39)	0.03	15
Sleep	14 (20)	24 (32)	0.5	19
Emotion	8 (18)	18 (19)	0.06	10
Social isolation	5 (14)	9 (13)	0.2	7

Table V. Proportion of patients with intact and loose implants complaining of health-induced problems in daily activities. Numbers in parentheses are patients who answered the relevant questions

NHP category	Intact (n=41)	Loose (n=8)	p value of difference
Working capacity	0 (30)	0.4 (5)	0.06
Housework	0.3 (39)	0.6 (8)	0.2
Social life	0.1 (39)	0.5 (8)	0.004
Family life	0 (39)	0.3 (8)	0.12
Sexual function	0.1 (31)	0.2 (6)	0.7
Hobbies	0.2 (38)	0.3 (8)	0.4
Holidays	0.1 (38)	0.5 (8)	0.013

assessed with the NHP, but it was evident that some patients with a low Charnley walking score are quite content with their physical mobility (Fig. 2). The relative scale provided by the NHP thus has advantages, notably in elderly patients.

Function is difficult to evaluate (Andersson and Nielsen 1972; Galante 1985; Gartland 1988), especially in elderly patients with poor general health (Devas and Irvine 1969) and the evaluation of the results of treatment is made difficult by discrepancies between objective and subjective opinions. The use of hip scores to evaluate the

results of THR is well documented (Harris 1969; Andersson 1972; Charnley 1972), but some scores take account of only a few aspects of function (Charnley 1972) and in some scoring systems, one element alone, such as pain, cannot depress the overall results to the level of failure (Ritter et al 1990).

The NHP measures the patient's evaluation of the functional, social and emotional impact of chronic disease. This questionnaire has been shown to distinguish groups with objectively different levels of health, and was designed to avoid distortion by minor illness (Jenkinson, Fitzpatrick and Argyle 1988). The NHP is self administered, with relatively few questions, and has been proposed as a useful adjunct to a clinical interview, as an instrument to detect changes of health status over time, and as a method of assessing the general status of health in individual patients. It has been applied in hip disease (Nilsson et al 1991; Wiklund and Romanus 1991) and one obvious advantage is that the surgeon is not involved in the evaluation. There is a special problem with senile patients, since they are unable to answer a questionnaire in a reliable and reproducible way, but this is true for most other scores; such patients may have to be excluded.

Our study, even with the small numbers included, indicates that patients with early radiographic loosening have a significant reduction in functional capacity as measured by the NHP. Pain was the factor most clearly related to loosening, which means that hip scores may be of less value if they do not focus on this aspect. Range of motion and walking ability were less related to loosening; these are also influenced by age, level of activity, and general health.

We conclude that the NHP can provide better discrimination than do most standard hip-scoring systems. It is suitable for investigating patients after THR. Such studies can easily be repeated to provide long-term follow-up at a low cost.

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