ELSEVIER

Physiotherapy

Physiotherapy xxx (2013) xxx–xxx

Factors associated with ambulatory status 6 months after total hip arthroplasty

M. Nankaku [a,*], H. Akiyama [b], R. Kakinoki [a], T. Nishikawa [a], Y. Tanaka [a], S. Matsuda [b]

[a] *Rehabilitation Unit, Kyoto University Hospital, Sakyo-ku, Kyoto, Japan*
[b] *Department of Orthopaedic Surgery, Faculty of Medicine, Kyoto University, Sakyo-ku, Kyoto, Japan*

Abstract

Objective To identify an assessment tool and its cut-off point for indicating ambulatory status 6 months after total hip arthroplasty (THA).
Design Cross-sectional study.
Setting Kyoto University Hospital.
Participants Eighty-eight patients who underwent unilateral THA.
Main outcome measure Lower-extremity muscle strength, hip range of motion and hip pain were measured 6 months after THA. The patients were divided into two groups according to their ability to walk 6 months after THA: an independent ambulation group and a cane-assisted ambulation group.
Results A stepwise multiple logistic regression analysis indicated that age and lower-extremity maximal load were significant variables affecting mid-term ambulatory status following THA. Receiver operating characteristic curve analyses revealed that ambulatory status following THA was indicated more accurately by leg extension strength (cut-off point = 8.24 N/kg, sensitivity = 92%, specificity = 82%, area under the curve = 0.93) than age.
Conclusion Lower-limb load force with a cut-off point of 8.24 N/kg is a reliable assessment tool for indicating ambulatory status 6 months after primary THA.

Keywords: Total hip arthroplasty; Gait ability; Lower limb load

Introduction

Total hip arthroplasty (THA) is an effective treatment for end-stage hip osteoarthritis. Studies have reported that most patients experienced a reduction in hip pain and improvement in physical function following THA compared with their preoperative condition [1–3].

Prior to surgery, assistive devices such as canes or crutches are commonly prescribed in an attempt to avoid hip pain and to compensate for lower-extremity weakness. Most patients also need to use an assistive device immediately after THA until their lower-limb impairments are fully recovered. However, many patients do not expect to need an assistive device following THA [4], and strive for unassisted ambulation with reduced pain and improved physical function during postoperative rehabilitation.

In general, gait disorder due to lower-extremity weakness is often managed by instructing the patient in the use of assistive devices. Studies have reported factors and discriminating criteria associated with the need for assistive devices after hip fracture, after stroke or in patients with osteoarthritis [5–7]. The removal of factors associated with the use of assistive devices following THA may be critical for the planning of effective rehabilitation interventions. Few studies have sought to investigate the relationship between physical function and use of assistive devices, especially for patients undergoing THA [8]. Although Slaven [9] reported that lower-extremity muscle weakness has been associated with the use of an assistive device following THA, there is no clear cut-off point for identifying the use of assistive devices following THA.

* Correspondence: Rehabilitation Unit, Kyoto University Hospital, 54 Kawahara-cho, Shogoin, Sakyo-ku, Kyoto 606-8507, Japan.
Tel.: +81 75 751 3571; fax: +81 75 751 3308.
E-mail address: nankaku@kuhp.kyoto-u.ac.jp (M. Nankaku).

0031-9406/$ – see front matter © 2013 Chartered Society of Physiotherapy. Published by Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.physio.2013.06.004

Please cite this article in press as: Nankaku M, et al. Factors associated with ambulatory status 6 months after total hip arthroplasty. Physiotherapy (2013), http://dx.doi.org/10.1016/j.physio.2013.06.004

The aims of this study were to investigate the factors related to the use of assistive devices following THA, and to identify cut-off points for indicating ambulatory status 6 months after THA.

Methods

Participants

Eighty-eight individuals (71 women, 17 men) who underwent primary THA for unilateral hip osteoarthritis participated in this study. Mean [standard deviation (SD)] age was 59.9 (11.6) years (range 35 to 80 years) and mean (SD) body mass index (BMI) was 22.5 (3.0) kg/m^2 (range 15.7 to 33.3 kg/m^2). The exclusion criteria were: (1) patients with symptoms such as pain or limited range of motion in the contralateral hip, knee and ankle during walking; (2) patients with a history of contralateral THA; (3) patients with a leg length discrepancy of more than 3 cm; and (4) rheumatoid arthritis. THA surgery was performed at the Department of Orthopaedic Surgery in Kyoto University Hospital between April 2009 and March 2011. All patients had undergone THA with an anterolateral approach, and were prescribed a 4-week rehabilitation programme that consisted of transfer training, muscle strengthening exercises and gait training in the hospital. All patients were followed-up for 6 months postoperatively.

All procedures in this study were approved by the ethics committee of Kyoto University Graduate School and Faculty of Medicine. The subjects were informed about the study procedures before testing, and provided written informed consent before participation in the study.

Assessment of postoperative physical function

Physical function in subjects was measured 6 months after THA. Hip pain at rest or during ambulation was evaluated on the operative side using the Japanese Orthopaedic Association hip score [10]. The passive hip flexion and abduction angle in a supine position was measured using a universal goniometer.

Maximum voluntary lower-limb muscle strength on the operative side was assessed using a hand-held dynamometer (Nihon Medix Co. Ltd., Matsudo, Japan) or an IsoForce GT-330 (OG Giken Co. Ltd., Okayama, Japan). Hip abductor strength was measured using a hand-held dynamometer during isometric contraction for 3 s with manual resistance. The subjects rested in a supine position with the hip and knee in neutral flexion/extension and the hip in neutral abduction/adduction. The force sensor was placed 5 cm above the lateral condyle of the femur, while another person fixed the contralateral pelvis and distal thigh with the hands. Knee extensor strength and lower-limb load force were assessed using an IsoForce GT-330 during isometric contraction for 3 s. With the patient in a sitting position with the hip at an angle of 90° and the knee at an angle of 60°, the force sensor was placed over the anterior part of the lower leg 5 cm above the lateral malleolus. Lower-limb load was measured with the patient sitting in the abovementioned position with the force sensor placed on the sole of the foot (Fig. 1). The seat position was adjusted for the length of the legs of each patient to allow him/her to push the pedal as hard as possible.

Fig. 1. Method for measuring lower-limb load. Lower-limb load is an isometric muscle contraction involving simultaneous extension of the hip and knee joint and ankle plantar flexion.

Torque was calculated by multiplying force by lever arm (distance between the force sensor and the greater trochanter for hip abductor strength; distance between the force sensor and the level of the tibial plateau for knee extensor strength) and expressed as a percentage of body weight (N m/kg). The values of lower-limb load force were normalised to body weight (N/kg). Previous studies have demonstrated the reliability of measuring hip abduction strength in the supine position and knee extension strength in the sitting position [11,12]. Inter-rater reliability analysis using the weighted kappa statistic was performed to determine consistency between the assessors in lower-limb load testing. Kappa values were 0.84 between Assessors 1 and 2 or 3 and 0.89 between Assessors 2 and 3.

Classification of ambulatory status following THA

Following direct interviews 6 months after THA, patients were classified into an independent ambulation group (those who could ambulate without any assistive devices in their daily living, including stair ascending/descending without handrails) and a cane-assisted ambulation group (the remaining patients, including those who required any assistive devices such as a walker, crutches or a cane).

Please cite this article in press as: Nankaku M, et al. Factors associated with ambulatory status 6 months after total hip arthroplasty. Physiotherapy (2013), http://dx.doi.org/10.1016/j.physio.2013.06.004