



# Is the modified Harris hip score valid and responsive instrument for outcome assessment in the Indian population with pertrochanteric fractures?

Karthik Vishwanathan\*, Keyur Akbari<sup>1</sup>, Amit J. Patel

Department of Orthopaedics, Pramukhswami Medical College and Shri Krishna hospital, Gokal Nagar, Karamsad, 388325, India

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## ABSTRACT

**Introduction:** The original Harris hip score (HHS) does not contain ability to perform squatting and sitting cross legged as items in the questionnaire and hence a need was felt to modify the Harris hip score so that it could stay relevant in functional assessment of Indian patients in the rural setting. Validity, responsiveness and ceiling floor effect of the Harris hip score after internal fixation of pertrochanteric fracture has not been previously described. The objective of the study was to investigate construct validity, responsiveness and ceiling floor effects of the modified Harris hip score (mHHS).

**Methods:** For evaluation of construct validity two hypotheses were formulated: first, there would be no difference in mHHS in cohort of patients treated with short or long proximal femoral nail and second, patients younger than 65 years will have higher mHHS compared to patients older than 65 years postoperatively. Proportion of patients obtaining lowest score of 0 point (floor effect) and those obtaining highest score of 100 points (ceiling effect) was evaluated at one, three and six months postoperatively. It is recommended that the proportion of ceiling and floor effect should be lower than 15% in order to deduce satisfactory internal and content validity of an outcome instrument. Responsiveness was evaluated using distribution based methods (effect size and standardised response mean) and anchor based method (area under the curve using receiver operating curve). Ability to perform cross leg sitting and squatting at six months postoperatively were chosen as two different external anchors. Effect size and standardised response mean values higher than 0.80 and area under the curve value higher than 0.70 are indicators of adequate responsiveness of an outcome instrument.

**Results:** Eighty one consecutive patients with pertrochanteric hip fractures and treated with long and short proximal femoral nail were included in this prospective observational study. Six patients were lost to follow-up due to mortality and complete functional outcome data was available in 75 patients (92.6%). The mean age was 68 years (range: 38–89 years). The mHHS at one, three and six months postoperatively was  $39.9 \pm 9.5$ ,  $61.6 \pm 14.7$  and  $81.0 \pm 15.9$  respectively. The improvement in mHHS was significant at all time intervals. In accordance with the hypothesis, there was no significant difference in mHHS at one, three and six months postoperatively in patients treated with short or long proximal femoral nail. In accordance with the hypothesis, patients younger than 65 years had significantly better mHHS at one, three and six months postoperatively as compared to patients older than 65 years. There were no floor or ceiling effects at one, three and six months postoperatively. mHHS showed adequate internal responsiveness (Effect size = 4.34; standardised response mean = 4.26) and adequate external responsiveness (Area under curve = 0.77 and 0.89) using different external anchors.

**Conclusion:** The mHHS has adequate construct validity, internal validity and responsiveness to evaluate functional outcome of intramedullary nail fixation in pertrochanteric hip fractures in the Indian population.

## 1. Introduction

The Harris hip score (HHS) is a joint specific score that is completed

by both the clinician and the patient and consists of 10 items covering domains of pain, function, functional activities, deformity and hip range of motion. The HHS was initially described for assessment of

**Abbreviations:** AUC, Area under the curve; ES, Effect size; HHS, original Harris hip score; Long PFN, long proximal femoral nail; mHHS, modified Harris hip score; SRM, standardised response mean; Short PFN, short proximal femoral nail; ROC, receiver operating curve

\* Corresponding author.

E-mail addresses: [karthikvg@charutarhealth.org](mailto:karthikvg@charutarhealth.org) (K. Vishwanathan), [keyur21088@yahoo.co.in](mailto:keyur21088@yahoo.co.in) (K. Akbari), [dramit2000@hotmail.com](mailto:dramit2000@hotmail.com) (A.J. Patel).

<sup>1</sup> Present address: CHARUSAT Hospital, CHARUSAT Healthcare campus, Changa, Petlad, 388421, India.

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functional outcome after mold arthroplasty for posttraumatic arthritis<sup>1</sup>. The HHS has been used to evaluate functional outcome after pertrochanteric hip fracture<sup>2–4</sup> and intracapsular fracture neck of femur<sup>5</sup>. Construct validity of an outcome instrument shows that all the domains of the instrument are indeed measuring what they are supposed to measure. Responsiveness of an outcome instrument is defined as the sensitivity of the instrument to detect clinically relevant change over a period of time<sup>6</sup>. Floor and ceiling effect pertains to the proportion of patients achieving minimum possible score and the maximum possible score respectively<sup>6</sup>. Validity and responsiveness are context specific terms and the evidence is applicable to a particular condition and specific intervention only<sup>7</sup>. The HHS is a valid and reliable outcome instrument to assess functional outcome after total hip replacement<sup>8</sup>. The cohort of patients undergoing surgical treatment for hip fractures is complex<sup>9</sup> due to factors like cognitive impairment and co-morbidities and hence investigation is required to assess whether outcome instruments like HHS or mHHS which have been shown to be valid and responsive in cohort of patients with non-traumatic hip conditions continue to demonstrate validity and responsiveness in cohort of patients with proximal femur fracture. The responsiveness and floor ceiling effects of the Harris hip score has been described in intracapsular neck of femur fracture<sup>5,10</sup>. However, though commonly used to assess functional outcome after intertrochanteric hip fractures, there is no report on validity, responsiveness and floor ceiling effect of either the Harris hip score or the modified Harris hip score after pertrochanteric fracture. Sitting in cross leg position and squatting on toes are essential activities for patients in the rural setting in the Indian sub-continent<sup>11</sup>. The original Harris hip score does not contain ability to perform squatting and sitting cross legged as items in the questionnaire and hence a need was felt to modify the Harris hip score so that it could stay relevant in functional assessment of Indian patients in the rural setting.

The objective of the present study was to investigate construct validity, responsiveness and ceiling floor effects of the modified Harris hip score (mHHS) relevant to the Indian population with pertrochanteric fractures.

## 2. Methods

### 2.1. Ethics committee approval, inclusion and exclusion criteria

This prospective study was conducted in a university teaching hospital after obtaining approval from the Institutional research ethics committee. Patients with intertrochanteric fracture presenting to our hospital from 1st November 2014 to 1st May 2016 and treated with long or short proximal femoral nail were included in the study. Patients gave written informed consent to participate in the study.

### 2.2. Data collection

Data pertaining to the age, gender, type of implant (long or short proximal femoral nail), interval between injury and surgical intervention (in days), side affected, type of anaesthesia (general anaesthesia/spinal anaesthesia), co-morbidities, type of fracture (AO classification), pre-injury walking status, duration of operative procedure (in minutes) and amount of intra-operative blood loss (in millilitre) was collected and saved onto Microsoft Excel worksheet. Clinical and radiological follow-up was undertaken at one month, three months and six months after the surgical intervention.

### 2.3. Functional outcome assessment

At each follow-up at one, three and six months, functional outcome was assessed using the modified Harris hip score (Table 1). Two items pertaining to socks/shoes and sitting from the original Harris hip score were replaced with squatting and sitting cross legged respectively. This was done as patients in the Indian rural setting do not wear shoes and

**Table 1**  
shows the domains and items of the modified Harris hip score.

Domains and items	Points
<b>Pain</b>	
None or ignores it	44
Slight, occasional, no compromise in activities	40
Mild pain, no effect on average activities, rarely moderate pain with unusual activity, may take diclofenac	30
Moderate pain, tolerable but makes concessions to pain, some limitation of ordinary activity and work: may require occasional pain medicine stronger than diclofenac	20
Marked pain, serious limitation of activities	10
Totally disabled, crippled, pain in bed, bedridden	0
<b>Function: Gait.</b>	
<b>Limp</b>	
None	11
Slight	8
Moderate	5
Severe or not able to walk	0
<b>Support</b>	
None	11
Cane for long walks	7
Cane most of the time	5
One crutch	3
Two canes	2
Two crutches or not able to walk	0
<b>Distance walked</b>	
Unlimited	11
Six blocks	8
Two or three blocks	5
Indoors only	2
Bed and chair	0
<b>Functional activities</b>	
<b>Stairs</b>	
Normally without using a rail	4
Normally using a rail	2
In any manner	1
Unable	0
<b>Squatting</b>	
With ease	4
With difficulty	2
Unable	0
<b>Sitting cross legged</b>	
With ease	5
With difficulty	3
Unable	0
<b>Public transportation</b>	
Able to use	1
Unable to use	0
<b>Hip range of motion (Clinician assessed)</b>	
Flexion (maximum = 140°)	
Abduction (maximum = 40°)	
Adduction (maximum = 40°)	
External rotation (maximum = 40°)	
Internal rotation (maximum = 40°)	
<b>Range of motion scale (sum of the range of motion)</b>	
211–300	5
161–210	4
101–160	3
61–100	2
31–60	1
0–30	0
<b>Absence of deformity (Clinician assessed)</b>	
• Less than 30° fixed flexion contracture – Yes/No	
• Less than 10° fixed abduction – Yes/No	
• Less than 10° fixed internal rotation in extension – Yes/No	
• Less than 3.2 cm limb length discrepancy – Yes/No	
If all 4 yes	4
If less than 4 yes	0

socks. The modified Harris hip score was scored from 0 (worst functional outcome and maximum pain) to 100 points (best functional outcome and least pain). Like the original Harris hip score, the interpretation of outcome using the modified Harris hip score was as

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