Effects of Older Age and Multiple Comorbidities on Functional Outcome After Partial Hip Replacement Surgery for Hip Fractures

Lukman Shebubakar*, Errol Hutagalung**, Subroto Sapardan*, Bambang Sutrisna***

* Department of Orthopedics and Traumatology, Fatmawati General Hospital and Siaga Raya Orthopedics Hospital, Jl. Raya Fatmawati, Jakarta Selatan, Indonesia. ** Department of Orthopedics and Traumatology, Faculty of Medicine, University of Indonesia - dr. Cipto Mangunkusumo Hospital, Jakarta. *** Department of Clinical Epidemiology, Faculty of Public Health, University of Indonesia, Depok, Indonesia.

Correspondence mail to: lkmshe@gmail.com.

ABSTRACT

Aim: to assess clinical factors associated with partial hip replacement surgery failure and to develop a scoring system to predict it before treatment.

Methods: this was a historical cohort study of hip fracture cases underwent partial hip replacement in Siaga Raya Hospital, Jakarta between January 1997 and December 2006. Patients’ clinical assessment included sex, age at surgery, ambulatory state, the number of underlying disease or comorbidities, hemoglobin and serum albumin levels, type of fracture and elapsed time between the day of fracture and day of surgery. All patients underwent partial hip surgery. Functional outcome after surgery was assessed by Harris’ Hip Score (HHS). A score below 80 points was considered poor. Kaplan-Meier curve with log-rank test was deployed and Cox proportional hazard model was performed to identify independent risk factors associated with poor HHS after surgery.

Results: Harris hip score could be obtained from 123 patients during the study period. The patients’ mean age at surgery was 73 ± 9.8 years old. Cox regression analysis showed several risk factors for poor HHS after partial hip replacement procedures, i.e. age at surgery 75 years or more, the presence of two or more comorbidities, anemia and Low albumin. In adjusted model, the number of comorbidities, anemia and Low albumin were confirmed to be independent risk factors for poor HHS after surgery.

Conclusion: our present study showed that several clinical factors could be used to predict poor Harris hip score after partial hip replacement surgery. Independent risk factors were the number of comorbidities, the presence of anemia and Low albumin. Further studies are needed to confirm the prediction model in new, prospective cases.

Key words: hip fracture, partial hip replacement, prediction of failure, Harris hip score, comorbidities.

INTRODUCTION

Incidence of hip fracture is believed to increase due to increasing number of ageing people. In Indonesia, life expectancy in 2000 was 68 years for women and 65 years for men. In general, life expectancy of Indonesian people had been estimated to reach 67.5 years in 2007 and will increase to 69 years in 2012 and 70.3 years in 2020. Hip fracture incidence in Asia is estimated to increase from 600,000 in 1950 to 3,250,000 in 2050. In Siaga Raya Hospital, Jakarta, there were 341 cases of partial hip replacement surgery between 1997 and 2006.

Partial hip joint replacement or hemiarthroplasty is the most common surgical procedure for hip fracture aiming to return the patient’s functional ability to the state before the fracture. This aim is accomplished by replacing the femoral head with prosthesis. Sometimes, a patient would need second operation due to complication of first operation like an erosion of the acetabulum. Second operation is extremely difficult to perform and is associated with substantial risks. Intra- or post-operative complications were found in 50% of patients underwent conversion of partial to total hip replacement. In addition, mortality rate is higher in second surgery, especially for men.

Many experts have developed objective evaluation with scoring system to assess functional outcome after fracture. Harris’ Hip Score (HHS) is the most frequently used scoring system which had high validity and reliability. However, there have been no Indonesian versions scoring system to predict long-term surgical failure whenever a patient needs secondary surgery. This
kind of scoring would be advantageous for Indonesian patients who commonly have financial constrain. The purpose of the present study is to assess clinical factors associated with partial hip replacement surgery failure and to develop a scoring system to predict it before starting the treatment.

**METHODS**

**Study Design and Subjects**

This was a historical cohort study of hip fracture cases that underwent partial hip replacement in Siaga Raya Hospital, Jakarta between January 1993 and December 2005. Cases were recruited consecutively and collected from medical record database. Inclusion criteria were patients aged 45 years or more, having femoral neck or intertrochanteric fracture and underwent partial hip replacement surgery in Siaga Raya Hospital. Cases were excluded when there were a history of previous contra lateral hip fracture, pathological fracture caused by malignancy, post-surgical wound infection, and other comorbidities affecting lower extremities movement (such as stroke, knee osteoarthritis, or knee fracture).

**Pre-surgery Clinical Assessment**

Patients’ clinical assessment included sex, age at surgery, ambulatory state, the number of underlying disease or comorbidities, hemoglobin and serum albumin levels, type of fracture and elapsed time between the day of fracture and the day of surgery. Age at surgery was divided into two groups, i.e. ‘75 years or less’ and ‘more than 75 years’. Functional ambulatory states were categorized as ‘community ambulation’, (i.e. patients who are able to walk inside or outside home, with or without stick or walker) and ‘non-community ambulation’, which consisted of household ambulation (patients who are able to walk inside home only, with or without stick or walker), non-functional ambulation (patients who are able to walk in physiotherapy room), and non-ambulation (patients on wheelchair, might be able to move from bed to chair). The presence or absence of co morbid conditions was based on medical history obtained from the patients and later confirmed by consulting internal medicine physicians. Hemoglobin and serum albumin level was measured by a cell counter and semi-automated blood chemistry analyzer (Micro lab, Merck, Germany) using commercially available kits.

**Surgical Procedures**

Procedures were performed through posterior approach when patient in lateral position was under spinal anesthesia. All patients underwent unipolar hemiarthroplasty. In Intertrochanteric fracture 23/39 patients, the straight-stem hemiarthroplasty was cemented and 16/39 patients we used non cemented long-stem hemiarthroplasty. The calcar and trochanter mayor was reconstructed with wire. Posterior repair was done.

**Post-surgery Functional Assessment**

Functional outcome after surgery was assessed by using the Harris’ hip score. Briefly, this scoring system is a method to measure the degree of pain (44 points), function (47 points), range of movement (5 points) and deformity (4 points). The total score is 100. Harris hip score of 80 points or more was considered good whereas HHS of less than 80 points was considered poor.

**Statistical Analysis**

Characteristics of the study subjects were presented descriptively. Bivariate analyses using Chi-square test were performed to test the association of post surgical HHS with clinical characteristics prior to survival analysis. Non-parametric Kaplan-Meier analysis was used to determine the cumulative event rates of poor HHS according to clinical characteristics. Log-rank test was performed to test the difference between the Kaplan-Meier estimation curves for each clinical variable. A p value less than 0.05 was considered statistically significant in bivariate and log-rank analyses. Independent clinical variable associated with poor HHS were analyzed simultaneously by using the Cox proportional hazard regression models. Clinical variables were entered in the model if they give a p value less than 0.25. All statistical analyses were performed with Stata statistical software (released 9.2; Stata Corporation, TX, USA).

**RESULTS**

A total of 164 cases were collected during the study period. Forty-one among them died during follow-up, leaving 123 patients available for functional assessment using Harris hip score. The duration of observation was $61.1 \pm 29.58$ months (range: $14.1 – 110.9$ month). The patients’ mean age at surgery was $73 \pm 9.8$ years old, ranging from 45 to 89 years. Women were higher than men with a ratio of 3:1. Most patients (91.1%) were functional active before fracture (community ambulation). Bivariate analysis showed that ‘age at surgery’ and ‘albumin level’ were significantly associated with post surgical hip score (Table 1).

Cox regression analysis showed several risk factors for poor HHS after partial hip replacement procedures, i.e. age at surgery 75 years or more, the presence of two or more comorbidities, anemia and hypoalbuminemia. On the other hand, duration of fracture 9 days or more
served as protective factor (Table 2). In adjusted model, number of comorbidities, anemia and Low albumin were identified as independent risk factors for predicting poor HHS after surgery (Table 3).

DISCUSSION

Predicting functional outcome after hip replacement surgery has not gained much interest among orthopedic surgeons who are generally pretty much confident with their skills and surgical results. However, a procedure like partial hip replacement was not designed to be long-lived, and patients may need a conversion to total hip replacement sometime in their lifetime, which increase the patient’s morbidity and risk of death. If failure could be predicted before the first surgery, the patient might not be offered a partial hip replacement procedure; instead, the total hip replacement would be more suitable. Our current study is the first attempt to investigate clinical factors that will predict functional outcome after partial hip replacement surgery in Indonesia.

Age at operation was an important factor affecting HHS after surgery with a hazard ratio 2.54 (95% CI 1.51-4.25). However, this variable failed to show independent prediction of HHS in the adjusted Cox proportional hazard model. Age at fracture has been reported to be a major predictor of mortality; the risk of mortality increases by 4% with the increasing age.12 Other study showed that functional outcome did not differ with increasing age in patients without prior hip or knee pathology.13

The most important finding in our study is the role of comorbidities in predicting HHS after surgery. We found that patients with two or more co-morbidities have increasing risk of poor HHS after surgery. A study reported that patients with hip fracture had an average of 3.8 types of comorbidity.14 The number of disease seemed to be more important since analysis with single disease did not results in significant differences (data not shown). This observation is in line with a report in the United Kingdom which investigated the effect of

Table 1. Relationships Among Clinical Factors and Post Surgical Harris’ Hip Score (n=123)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Harris’ hip score</th>
<th>Total (χ² test)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt; 80 points</td>
<td>&lt; 80 points</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>18 (31.6)</td>
<td>13 (19.7)</td>
<td>31 (25.2)</td>
</tr>
<tr>
<td>Female</td>
<td>39 (68.4)</td>
<td>53 (80.3)</td>
<td>92 (74.8)</td>
</tr>
<tr>
<td>Age at surgery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 75 years</td>
<td>33 (59.7)</td>
<td>23 (34.9)</td>
<td>57 (46.3)</td>
</tr>
<tr>
<td>≥ 75 years</td>
<td>23 (40.3)</td>
<td>43 (65.1)</td>
<td>66 (53.7)</td>
</tr>
<tr>
<td>Ambulatory status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community ambulation</td>
<td>52 (91.2)</td>
<td>60 (90.9)</td>
<td>112 (91.1)</td>
</tr>
<tr>
<td>Non-community ambulation</td>
<td>5 (8.8)</td>
<td>6 (9.1)</td>
<td>11 (8.9)</td>
</tr>
<tr>
<td>Co-morbidities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 1 type</td>
<td>30 (52.6)</td>
<td>32 (48.5)</td>
<td>62 (50.4)</td>
</tr>
<tr>
<td>≥ 2 types</td>
<td>27 (47.4)</td>
<td>34 (51.5)</td>
<td>61 (49.6)</td>
</tr>
<tr>
<td>Type of fracture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck of femur</td>
<td>42 (73.7)</td>
<td>52 (758.8)</td>
<td>94 (76.4)</td>
</tr>
<tr>
<td>Intertrochanteric fracture</td>
<td>15 (26.3)</td>
<td>14 (21.1)</td>
<td>29 (23.6)</td>
</tr>
<tr>
<td>Duration of fracture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 9 days</td>
<td>22 (38.6)</td>
<td>37 (556.1)</td>
<td>59 (48.0)</td>
</tr>
<tr>
<td>≥ 9 days</td>
<td>35 (61.4)</td>
<td>29 (43.9)</td>
<td>64 (52.0)</td>
</tr>
<tr>
<td>Hemoglobin state</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>34 (59.7)</td>
<td>36 (54.6)</td>
<td>70 (56.9)</td>
</tr>
<tr>
<td>Anemia</td>
<td>23 (40.3)</td>
<td>30 (45.4)</td>
<td>53 (43.1)</td>
</tr>
<tr>
<td>Albumin level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal albumin</td>
<td>57 (100)</td>
<td>56 (84.9)</td>
<td>113 (91.9)</td>
</tr>
<tr>
<td>Low albumin</td>
<td>0</td>
<td>10 (15.5)</td>
<td>10 (8.1)</td>
</tr>
</tbody>
</table>

* Unadjusted

Table 2. Cox Regression Analysis for Hazard Ratio of Poor Post Surgical Hip Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>HR*</th>
<th>CI 95%</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex</td>
<td>1.21</td>
<td>0.67-2.19</td>
<td>0.52</td>
</tr>
<tr>
<td>Age at surgery ≥ 75 years</td>
<td>2.54</td>
<td>1.51-4.25</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Non-community ambulation</td>
<td>1.64</td>
<td>0.70-3.86</td>
<td>0.253</td>
</tr>
<tr>
<td>Comorbidities ≥ 2 types</td>
<td>3.32</td>
<td>1.93-5.72</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Type of fracture</td>
<td>1.40</td>
<td>0.81-2.44</td>
<td>0.231</td>
</tr>
<tr>
<td>Duration of fracture ≥ 9 days</td>
<td>0.50</td>
<td>0.30-0.82</td>
<td>0.006</td>
</tr>
<tr>
<td>Anemia</td>
<td>2.35</td>
<td>1.44-3.85</td>
<td>0.001</td>
</tr>
<tr>
<td>Low albumin</td>
<td>3.06</td>
<td>1.55-6.07</td>
<td>0.001</td>
</tr>
</tbody>
</table>

* Unadjusted
comorbidity on 30-day and 1-year mortality rate. In that study, patients with 3 or more comorbidities are more likely to die in the first 30 days (HR: 2.5; 95% CI 1.6 – 3.9) and one year (HR: 2.4; 95% CI 1.9 – 3.1).\(^{15}\)

Ageing process, the presence of chronic disease and disuse together will disturb the function of muscle, vestibular system, vision, proprioceptive, cognitive and awareness. Those functional disturbances may cause static imbalance and gait alteration that eventually will increase the risk of fall.\(^{16}\) The presence of comorbidity is usually a reason to delay surgical procedure. Logistic regression analysis showed that there was no association between mortality rate and surgical delay more than one day after adjusting with the patients’ risk factors.\(^{17}\)

Anemia has been associated with functional mobility after hip fracture surgery. A study has found that anemia during physiotherapy session was an independent risk factor for ‘unable to walk’ in the third day post surgery after adjustment with type of procedure, medical complication and functional level before fracture.\(^{18}\) It was also suggested that lower hemoglobin level is associated with lower survival rate, but this is not universal.\(^{19}\) The association between serum albumin level on admission and lower functional outcome has been reported before.\(^{20}\) A recent study showed that a better functional outcome was associated with albumin gain during hospital stay.\(^{21}\)

None of the fracture-related characteristics (e.g. type of fracture and longer duration of fracture) were associated with poor Harris hip score after surgery. Surprisingly, longer duration of fracture was associated with better outcome. However, this finding must be interpreted cautiously since no theoretical background could explain this observation. Most reports in developed countries used a cutoff of 2-4 elapsed days (or 24 to 96 hours) from the fracture to operation day.\(^{22,23,24,25}\)

**CONCLUSION**

Our present study showed that several clinical factors could be used to predict an unfavorable outcome, designated by Harris hip score lower than 80 points, after partial hip replacement surgery. Independent risk factors for poor Harris hip score after surgery were the number of comorbidities, the presence of anemia and low albumin level. Further studies are needed to confirm the prediction model in new prospective cases.

**REFERENCES**

4. Siaga Raya Hospital, Jakarta. Medical Record Data.


