

Correlation between partial weight bearing with radiography osseointegration in post bipolar hemiarthroplasty cementless patients

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Abstract

A femoral neck fracture is a global health problem which mainly occurs among the elderly. Hip hemiarthroplasty is a popular modality in treating femoral neck fractures nowadays. Osseointegration refers to the structural binding between the bone and the implant surface; hence, a proper osseointegration of an implant will provide stable and functional anatomy. Early detection of osseointegration can make the clinician know prediction how the successful their operation. The aim of the study was to correlation a partial weight bearing with osseointegration using serial radiological examination where characteristics such as bone sclerosis and cortical-periosteal thickening. This study is a retrospective analytic-observational study conducted at Orthopaedic and Traumatology Surabaya Hospital, entailing 96 patients after cementless bipolar hemiarthroplasty operation from January 2012 to January 2021. Among patients with bipolar hemiarthroplasty female predominated the group with 75%, and the most frequent age group was between 71 and 80 years old. The most common the patient take partial weight bearing on day three post operation. There is positive correlation between sclerosis bone and cortical-periosteal thickening of pelvis radiographs that began to appear in the 6-week evaluation and became more prominent after one year.

Keywords : osseointegration, pelvis radiographs, bipolar hemiarthroplasty, femoral neck fracture

1. INTRODUCTION

Since its clinical introduction, hip joint replacement surgery is considered one of the most successful operations due to its high success and low complication rate (Learmonth et al., 2007). Clinical and functional results of this kind of procedure have shown, a significant improvement of engineering and surgical techniques (Falez et al., 2008). Osseointegration is an optimal fit of the cementless stem in the metaphysis of the femur is important to obtain a good mechanical fixation, which provides a stable, direct contact with the surrounding bone (Albrektsson & Johansson, 2001).

Partial weight bearing (PWB) might reduce the stress on the implant-bone interface and thus increases the probability of proper osseointegration and stable implant fixation (Pilliar et al., 1986). Distal stem fixation is believed to modify load transmission in proximal femur producing metaphyseal resorption. To reproduce natural load transfer while obtaining optimal stability, avoiding stress shielding and thigh pain, short stems were developed, this reason recently uncemented stems are preferred to cemented (Kim et al., 2012). According to the literature as bony ingrowth takes up to 4–12 weeks but it can also last up to 3 years (Albrektsson & Johansson, 2001).

The present investigation was performed to evaluate the effects of PWB rehabilitation regimens on implant fixation. In this retrospective analytic-observational study, we correlation the effect of partial-weight bearing after bipolar hemiarthroplasty with an uncemented in a radiological examination. We hypothesized that partial weight-bearing have correlation with bone sclerosis and cortical-periosteal thickening using serial radiological examination.

2. MATERIAL AND METHODS

This research is an analytic-observational study in a retrospective manner, conducted in the Orthopaedic and Traumatology Surabaya Hospital between January 2012 and January 2021. We gathered the samples by reviewing the medical records of femoral neck fracture patients diagnosed and take bipolar hemiarthroplasty operation and all the patients have PWB rehabilitation regimens.

Patients were evaluated at 6 weeks, 6 months, and 1 year. At each visit, patients were evaluated by a history, physical examination, a standardized questionnaire, and an AP pelvis radiograph. The observed variable are bone sclerosis and cortical-periosteal thickening. Qualitative analysis of the bone sclerosis that we see whether or not on each serial pelvis radiograph. Quantitative analysis of the cortical-periosteal thickening using dorr classification.

The collected data were processed using using Statistical Programme for Social Sciences (SPSS) version 26 software and illustrated in tables with percentages and graphs. The correlation analysis between variables was done by applying the Spearman formula, with a p-value of less than 0.05 indicating significance.

3. RESULTS

The results were mustered by scrutinising history of PWB and compared to the patient’s pelvis radiographs. The study entailed 96 patients whose have serial pelvis radiographs; 24 male (25%) and 72 female (75%) patients. Our samples ranged from <60 to >80 years old, with an average of 71,6 years old. Patients aged 70-80 constituted a significant proportion of our subjects, involving 33 patients (34,4%). Table 1.

Table 1. Research sample characteristics

Sample Characteristic	(n sample = 96)	
	Frequency	Percentage
Genre :		
Male	24	25%
Female	72	75%
Age (years) :		
< 60	14	14,6%
60 -69	23	24,0%
70 – 80	33	34,4%
> 80	26	27,1%

From the patient's medical record data, the PWB data obtained for each post bipolar hemiarthroplasty surgery patient with the distribution of data, as in table 2 :

Table 2. PWB Data Distribution

Day PWB	Frequency	Percent
1	2	2,1%
2	23	24,0%
3	50	52,1%
4	15	15,6%
5	4	4,2%
6	2	2,1%
Total	96	100%

An average PWB of all patients based on medical record observations was 3.02 days, with a standard deviation of 0.917. Then the data was tested using the Spearman Correlation Test to determine the level of correlation strength and the direction of the PWB correlation on the development and changes in parameter values observed in each serial radiograph (6 weeks, 6 months, and 1 year). Based on the results of data processing, the correlation value and p-value in each parameter comparison are obtained, as table 3:

Table 3. Spearman Correlation Test Recapitulation PWB with bone sclerosis and cortical-periosteal thickening

Criteria	6 weeks		6 months		1 year	
	Corr. Value	p-value	Corr. Value	p-value	Corr. Value	p-value
PWB * Bone Sclerosis	0,033	0,758	0,177	0,180	0,139	0,413
PWB * Cortical-periosteal thickening	0,296	0,005	0,088	0,507	0,327	0,045

Positive correlation values appear in this test, where there is a PWB*Bone Sclerosis variable and PWB*Cortical-periosteal Thickening. This positive value indicates that there is a linear correlation between these variables on the PWB performed. However, if it is seen from the existing p-value, it can be seen that a correlation occurs, the value is > 0.05, which means it is not significant, except for the cortical thickening variable test. The significance of the cortical variables showed that the correlation was significant (<0.05) at 6 weeks and 1 year, but not significant at 6 months.

4. DISCUSSION

Stems are thought to preserve more native host bone and to optimize proximal load transfer, and although not a novel concept, they have become increasingly used with the advent of less invasive surgery and rapid recovery protocols (Albrektsson & Johansson, 2001)(Chen et al., 2009). Several studies have demonstrated overall improved survival of short stems ranging from 94% to 100% at up to 18-y follow-up and incidences of thigh pain ranging from 0% to 4% (Morgan et al., 2003).

All study samples were given the same treatment for their medical rehabilitation therapy with PWB. In his study, it was found that PWB has a correlation with the formation of bone sclerosis, and cortical- periosteal thickening. This is in accordance with the research of Leiss et al. Cementless stem subsidence was significantly higher in the group with enhanced recovery rehabilitation with PWB. Maximum reduction occurs in the first 6-8 weeks postoperatively because growth into the bone takes up to 4-12 weeks and can last up to 3 years (Leiss et al., 2021). And appropriate because the highest correlation value at the 6th week evaluation was 0.123 (p value > 0.05).

Good results from pelvis radiographs assessment were also obtained. Radiolucent lines identification around cementless stems, during the study of osseointegration, could suggest imminent loosening, but this was not found in our study sample.

5. CONCLUSION

In the present study, partial weight bearing correlates with bone sclerosis, and periosteal cortical thickening. Further clinical studies will be necessary to evaluate the long-term outcome and osseointegration of this implant.

ETHICS COMMITTEE APPROVAL

This study has met the ethical principles of and received approval from the Research Ethics Committee of Orthopaedic and Traumatology Surabaya Hospital.

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None

DISCLOSURE

The authors have no conflicts of interest to declare.

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