Prognotic Test for Mortality and Morbidity Using Procalcitonin and C-Reactive Protein Values in Elderly Patients Post Hip Joint Arthroplasty at Dr. Mohammad Hosein General Hosital Palembang

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Abstract

Background: Pelvic arthroplasty in the elderly is increasingly being performed, along with the increasing life expectancy in Indonesia. However, postoperative mortality must be taken into account.

Methods: Prospective cohort study of mortality and morbidity up to 30 days in 38 patients who met the inclusion criteria. The observation of changes in the value of Procalcitonin and C-Reactive Protein was carried out preoperatively, after surgery on day 2 and after surgery on day 7.

Results: There was no mortality. There was 18% redness output in the analyzed surgical wound. The cut off of Procalcitonin used Fisher's Exact test (RR = 3.088, p = 0.207), while the cut off of C-Reactive Protein used Fisher's Exact test (RR = 1.647, p = 0.678).

Conclusion: There was no significant relationship between procalcitonin levels and C-reactive protein and postoperative redness.

Keywords: mortality, arthroplasty, procalcitonin, c-reactive protein.

1. Introduction

Hip replacement surgery in the elderly or arthroplasty, is now increasingly being performed. This operation is performed for various reasons including hip fracture, avascular necrosis, osteoarthritis, etc.

Hip fractures generally occur in elderly people with osteoporosis, the ratio of women to men is 4 to 1. These fractures rarely occur at a young age, unless they occur with a mechanism of high energy trauma. If it occurs with a mechanism of low energy trauma, it is suspected of being a pathological fracture. 1. WHO says that around 200 million people suffer from osteoporosis worldwide. By 2050, it is estimated that the rate of hip fracture will increase 2-fold in women and 3 times in men[3].

It is known from the Center for Data and Information of the Ministry of Health of the Republic of Indonesia that the highest incidence of hip fracture in women is seen at the age of 95-99 years, which is 1680 cases and the lowest is at the age of 40-44 years with 8 cases[2]. Meanwhile, the highest incidence of hip fracture in males was seen at the age of 90-94 years as many as 718 cases and the lowest was at the age of 40-44 years with 10 cases[2].

Based on data from the Hospital Information System (SIRS) in 2010, the incidence of upper thigh fractures was recorded at around 200 / 100.000 cases in women and men over the age of 40 due to osteoporosis. WHO shows that 50% of these fractures of the upper thigh will result in lifelong disability and lead to a mortality rate of up to 30% in the first year due to complications of immobilization. This data does not include fractures of the spine and forearm and those who do not receive medical treatment at the hospital[3].

In the elderly, the 1-month mortality rate is high even after surgery, 21% in women and 37% in men[1].

Whereas a study conducted by Roberts, et al, on cases of femoral neck fractures from 1968 - 1998 recorded fatal events after 30 days reaching 31%[13]

At Fatmawati Hospital, Jakarta, from 1999 to 2008 there were 84 cases of hip replacement surgery, of which 14 cases were not due to hip fracture, a mortality of 16.9% was obtained with a mean observation time of 35.7 ± 3.34 months with different factors. influential were albumin value, female gender and fracture duration more than 7 days[14].

A study conducted by Paavolainen Pekka, *et al*. In 1980 - 1996 from 24.638 patients obtained a perioperative mortality of 0.16% where there was no significant difference between men and women[15].

Orthopedic surgery is an operation that is increasingly performed in the elderly with mortality 30 days postoperatively reaching 8.3%. Among the 1.6 million patients suffering from hip fracture per year with a 30-day postoperative mortality rate of 8.5 - 9.6% per year[4]. Prosthetic joint infections are one of the most serious complications in postoperative hip arthroplasty patients reaching 0.3- 1.7% [5]. C-Reactive Protein and Procalcitonin are two very useful laboratory tests in clinical practice[5]. Procalcitonin is a precursor to calcitonin. Its production is increasing due to acute conditions such as sepsis, trauma and surgery[4].

C- Reactive Protein is produced by hepatocytes in response to interleukin-6, increased in inflammation, infection and trauma, but its value is very low in normal conditions. C-Reaktive Protein is used to monitor post-implant surgery patients to detect infection[5].

Procalcitonin is a marker of infection that is found in normal serum in low concentrations. In clinical studies it is known that increased levels of procalcitonin occur in patients with sepsis, inflammation and after major surgery[5]. From previous research, it is known that the C-Reactive Protein value reaches the highest value up to 33 times the normal value on the 3rd day after hip fracture surgery and will slowly decline again. Meanwhile, the value of procalcitonin will reach the highest value on the first day after hip fracture surgery up to 3 times compared to pre surgery and then the value will decline again[5].
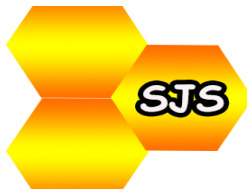
The course of research

An analytic observational study with a cohort design was conducted in the orthopedic surgery division of the Mohammad Hoesin Central General Hospital in Palembang from February to June 2017. There were 38 patients, women and men who met the inclusion criteria.

Characteristic	Pre Op	Post Op	p*	Pre Op	Post Op	p*
		Day 2			Day -7	
Procalcitonin*	9.33 (1.79-61.22)	9.33 (1.00-66.56)	0.700	9.33 (1.79-61.22)	11.12 (0.89-61.89)	0.567
CRP*	38.42 (15.71-666.96)	76.33 (18.21-486.12)	0.042	38.42 (15.71-666.96)	46.75 (15.29-700.71)	0.734

* Wilcoxon test, p = 0.05
** Median (Min-Max)

The majority of respondents were female as many as 23 people (60.5%) and male gender as many as 15 people (39.5%). The mean age of the patients was 65.95 ± 6.75 years with an age range of 60-83 years.

The diagnosis of fracture in the majority sample was femur neck fracture as many as 24 people (63.1%), where the left femur neck fracture was 13 people (34.2%) and left femur neck fracture was 11 people (28.9%). In addition, the diagnoses found included 6 right hip OA (15.8%), 3 left hip OA (7.9%), 2 left hip AVN (5.2%) and hip left AVN, Intertrochanter fracture of the right femur and intertrochanter fracture of the left femur were 1 person (2.6%) each.

With statistical analysis using the *Wilcoxon* test (abnormal data distribution using the *Saphiro Wilk normality* test), the p value of procalcitonin levels before surgery and the second day after surgery was 0.700 (p > 0.05), which means that there is no difference in preoperative procalcitonin levels. and 2 days after surgery where there was an increase in procalcitonin levels 2 days after surgery but it was not significant, besides that the p value of procalcitonin levels before surgery and the 7th day after surgery was 0.567 (p > 0.05) which means that there is no difference in levels. procalcitonin before surgery and 7 days after surgery, it is clear that 7 days after surgery procalcitonin levels have decreased but not significant.

Likewise with CRP levels, with statistical analysis using the *Wilcoxon* test (abnormal data distribution using the *Saphiro Wilk* normality test), the p value of CRP levels before surgery and the second day after surgery was 0.042 (p < 0.05) which means that there is The difference in CRP levels before surgery and 2 days after surgery where there was a significant increase in CRP levels 2 days after surgery, besides that the p value of CRP levels before and 7 days after surgery was 0.734 (p > 0.05) which means that there is no There is a difference in CRP levels before surgery and 7 days after surgery, this explains that 7 days after surgery the CRP levels have started to decrease but is not meaningful.

In order to be comparable with previous studies, we also present a graph with the mean levels of procalcitonin and C reactive protein. The mean procalcitonin level in preoperative patients was 13.356 ± 12.886, then on the second postoperative day, the mean procalcitonin level in the patient increased 11.8% to 15.143 ± 16.033, while the 7th day decreased again by 1.21% to 14.96 ± 14.321.
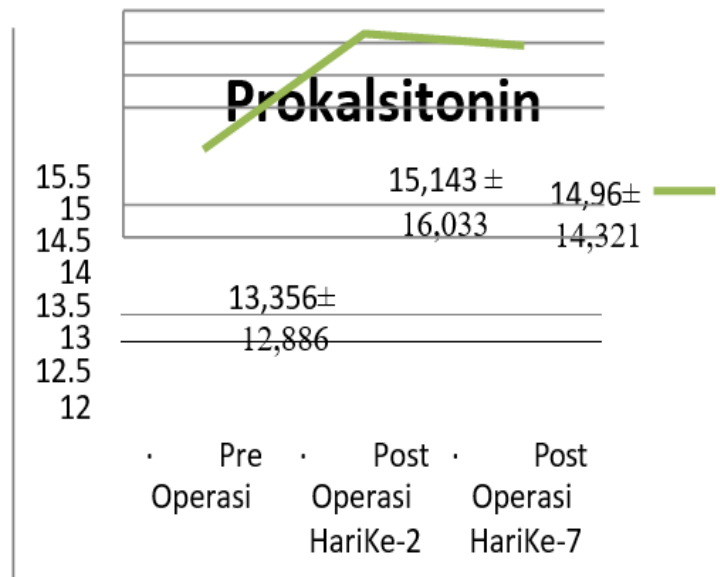
In addition to procalcitonin levels, in this study the mean C reactive protein levels of the patients were 96.017 ± 146.669, then on the second postoperative day the mean levels of C reactive protein in the patients increased 16.66% to 115.20 ± 103.309 while on the 7th day it decreased. back 1.77% to 113.16 ± 162.086.
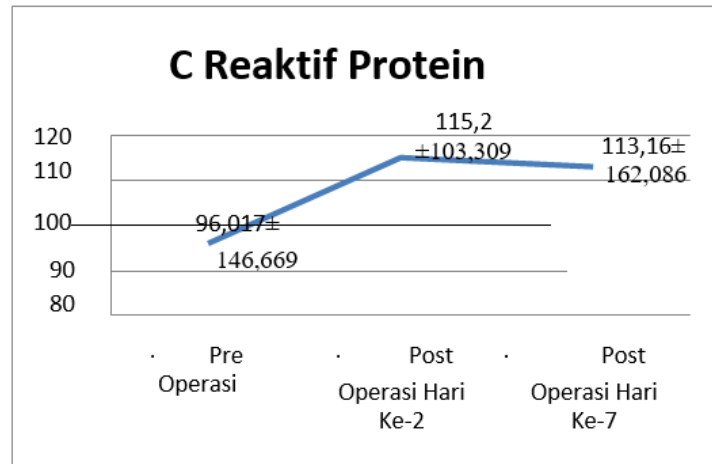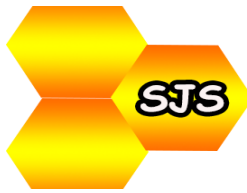
Relationship between procalcitonin levels and outcome of mortality and patient morbidity

Before analyzing the relationship between procalcitonin levels and mortality and morbidity outcomes, we first look for the cut-off point of procalcitonin levels. Because in the 30-day postoperative study there were no dead patients, the relationship between procalcitonin levels and mortality outcomes could not be analyzed. The morbidity in this study was finding redness in the postoperative wound. So first we look for the cutoff point of procalcitonin levels. With the ROC curve, the cutoff point value of procalcitonin levels on the 7th day post surgery was equal to[13.]

From the Fisher Exact test, it was concluded that there was no significant relationship between procalcitonin levels and postoperative redness. The RR value of procalcitonin level with postoperative redness outcome was 3.088, which means that procalcitonin levels ≥13 were 3.088 times more at risk of outcome (postoperative redness but not significant (RR = 3.088, p = 0.207).

Correlation of C Reactive Protein Levels with Outcome of Mortality and Morbidity

Before analyzing the relationship between C-Reactive Protein levels with mortality and morbidity outcomes, we first look for the cut-off point of C-Reactive Protein levels. Because in the 30-day postoperative study there were no dead patients, the relationship between C-Reactive Protein levels and mortality outcomes could not be analyzed. The morbidity in this study was

finding redness in the postoperative wound. So first we look for the cutoff point for the C-Reactive Protein content. With the ROC curve, the cutoff point value for C-Reactive Protein on the 7th day of post operation was 51.75.

From the Fisher Exact test, it was concluded that there was no significant relationship between CRP levels and postoperative wound redness. The RR value of CRP levels with postoperative redness outcome was 1.647, which means that CRP levels $\geq$ 51.75 were more at risk of 1.647 times the outcome (postoperative redness but not significant (RR = 1.647, p = 0.678).

Other

One respondent underwent a readmission after 2 weeks of arthroplasty surgery in another hospital for indications of dyspepsia and lumbar pressure ulcers due to prolonged immobilization. This patient was treated for dyspepsia by internal medicine colleagues and treatment for pressure ulcers by general surgeons, the patient was treated for 1 week and then discharged.

One respondent experienced prolonged hospitalization due to postoperative dislocation arthroplasty as evidenced by postoperative control photographs, closed repositioning, with the result of failure to reposition. It was decided to do open repositioning and continued with bed rest for 2 weeks. Then the patient is discharged.

One respondent experienced cardiac arrest and respiratory arrest, performed intubation and cardiopulmonary resuscitation, after surgery the patient was treated in the intensive care room for 2 days then transferred to the normal care ward.

2. Discussion

Postoperative arthroplasty mortality rates in the elderly vary widely, it is known from previous studies.

In this study, there was no postoperative mortality 30 days so that the analysis could not be done. Although the characteristics of comorbid history of diabetes reached 22 people, comorbid

hypertension reached 24 people, and patients with comorbid both reached 12 people. After the surgery was planned, all the patients had optimized the patient's condition and even some patients experienced a delay in admission because of this.

In laboratory tests, different results were obtained from previous studies. It was found that the mean increase of preoperative and postoperative procalcitonin on day 2 was only 1.13 times, this is different from previous research by Sandra Battisteli entitled Serum C Reactive Protein and Procalcitonin Kinetics in Patients Undergoing Elective Total Hip Arthroplasty where procalcitonin levels increased to 3 fold on the postoperative examination on the 3rd day. Meanwhile, the 7th postoperative examination found a very small decrease, still far from the preoperative value. In some respondents there was not even an increase in levels after surgery but at the time of postoperative day 7 the value of procalcitonin increased. It could be because the inflammatory response still occurs even after surgery has been performed.

Meanwhile, the results of the examination of C Reactive protein levels showed an increase in levels of only 1.19 times the preoperative value and on the 7th day the C Reactive protein value was still 1.17 times higher than the preoperative value. This is different from previous studies where the value reached 33 times the preoperative value and on the 7th day the value was still 26 times the preoperative results. Unfortunately there is no explanation regarding the preoperative diagnosis in previous studies.

In addition to the above research, there is also a study conducted by Jason White, et al, entitled C-Reactive protein level after total hip and total knee replacement, where the results of C Reactive Protein increased up to 20 times on the second postoperative day. The results have decreased until the 14th postoperative day, although they still haven't reached the preoperative level.

In 4 respondents there was a very high preoperative value and decreased at the time of postoperative day 2 and had an increase again on the 7th postoperative day. These results are completely unexpected, with estimates whether these patients are experiencing other infections but not detected such as infections of the urinary tract, skin or oral or because this patient is a patient diagnosed with joint arthrititis where there has been a previous inflammatory process.

The C reactive value of this protein is also in line with the procalcitonin value obtained. Where also the value of procalcitonin increased on the 7th postoperative day. Which should be expected to decline again in the post operation day 7.

Three out of four of these patients had the comorbid Diabetes Mellitus which might make these patients prone to infection.

During postoperative patient care, the wound output was reddish, whereas we did not find any drain with pus production or secretions coming out of the surgical scar. So, we took this surgical wound redness as an outcome of morbidity which was then analyzed against the cut-off value of C reactive protein and procalcitonin levels. Where it was found that procalcitonin levels above 13 are 3 times more risky. Meanwhile, if adjusted for the cut of CRP level, the outcome was only 1.65 times and insignificant.

From the total number of patients who experienced redness of 7 people, only 3 people had comorbid Diabetes Mellitus, so it can be concluded that patients with good planning and optimization of blood sugar preoperatively, the surgical wound can be treated well. The success of operation and good postoperative conditions cannot be separated from the factors of good equipment sterility, adequate operating room conditions, and the ability of the operator to operate.

Patients' complaints that we found until the 30th day after surgery were joint pain when moving the pelvis and walking, feeling afraid to step and move the legs. Eighty percent of patients still use walking aids ranging from walkers to canes. Some patients do home physiotherapy by calling the therapist from the hospital to the house, some others claim to only continue the exercises as taught by physiotherapy, assisted by their families at home.

3. Conclussion

In this study, there was no patient mortality after hip joint replacement surgery until the 30th day, this shows that the preparation of the patient, the preparation of equipment and operator preparation as well as supporting facilities and infrastructure at the Mohammad Hoesin Central General Hospital, Palembang is very good. It should be maintained and even improved.

The results showed that the levels of Procalcitonin and C reactive protein were different from previous theory and research, that there would be a very far increase from the levels before surgery and the levels after surgery on day 2. Likewise, the decrease in levels of Procalcitonin and C reactive protein at postoperative day 7 as well. there was no significant reduction as in the theory and previous studies. Meanwhile, as we know, all respondents received the same treatment, namely hip replacement surgery which is expected to activate the acute inflammatory response. We need to consider whether there are genetic differences between people in Indonesia in general and other people in other places in terms of genetics or differences in environmental hygiene and daily food, which results in us being aware that many infectious factors around us are indeed high, which the body has already responded to. these infectious factors even without causing any complaints, however, to find out this, further studies are needed.

Only 18% of all respondents had a morbidity outcome in the form of redness in the surgical wound, while no other morbidity outcome was found. None of the respondents met the criteria for surgical wound infection. The results of the output analysis of the cut-off procalcitonin and C-reactive protein cut-off levels were not significant. It can be concluded that in this study, procalcitonin levels and C reactive protein levels cannot be used as predictors of morbidity in the outcome of surgical wounds that occur.

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