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Analysis of the Minimum Cost of Femoral Neck Fracture at the Klaten Islamic General Hospital

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Abstract

Femoral neck fracture is one of the most common orthopedic cases, particularly among the elderly. Management usually involves surgical interventions such as Open Reduction Internal Fixation (ORIF), Hemiarthroplasty, and Total Hip Arthroplasty. The high cost of surgery poses a challenge for both patients and hospitals, highlighting the need for pharmacoeconomic evaluation to determine the most cost-efficient alternative. This study aims to analyze the minimal cost of orthopedic surgery for femoral neck fractures at Klaten Islamic General Hospital using the Cost Minimization Analysis (CMA) method. An observational analytic study with a retrospective approach was conducted on 48 patients who underwent surgery between January and August 2025. The data analyzed included hospitalization costs, surgical procedures, medications, laboratory and diagnostic examinations, physician fees, and nursing services. The results showed that the average cost per patient was IDR 30,236,637 for ORIF, IDR 31,250,786 for Hemiarthroplasty, and IDR 39,436,763 for Total Hip Arthroplasty. The Kruskal–Wallis test indicated a significant difference in costs among surgical procedures ($p=0.000$; <0.05). The study concludes that ORIF is the most cost-minimal procedure, although all interventions provide equivalent clinical effectiveness. These findings may serve as a reference for hospital and healthcare providers in making clinical decisions related to cost efficiency.

Keywords: Femoral neck fracture, surgical cost, Cost Minimization Analysis, ORIF, Orthopedic

INTRODUCTION

Research Phenomenon

Femoral neck fractures represent a significant clinical and economic challenge, particularly among the elderly population, due to their high incidence and the substantial costs associated with surgical management (Leal et al., 2016; Hiligsmann et al., 2013). The increasing prevalence of these fractures, driven by aging populations and osteoporosis, has led to a growing demand for effective and efficient treatment strategies in both developed and developing countries (Filipov, 2018; World Health Organization, 2020). In Indonesia, the burden of femoral neck fractures is reflected in national health statistics, with a notable proportion of cases occurring in individuals over 60 years old, often accompanied by comorbidities that complicate treatment and recovery (Ministry of Health, 2023; Setiawan, 2018).

Research Problem

Despite advances in surgical techniques such as Open Reduction Internal Fixation (ORIF), hemiarthroplasty, and total hip arthroplasty, the high cost of these procedures remains a major concern for patients and healthcare providers (Wijaya, 2018; Rogmark & Leonardsson, 2016). The financial burden is exacerbated by prolonged hospital stays, intensive postoperative care, and the need for expensive implants and medications (Leal et al., 2016; Hiligsmann et al., 2013). Furthermore, there is limited local evidence on the comparative cost-effectiveness of these surgical interventions, particularly in the Indonesian healthcare context, where resource allocation and cost management are critical issues (Akbar et al., 2018; Dewi et al., 2019).

The lack of comprehensive pharmacoeconomic evaluations has hindered the development of evidence-based policies for optimizing treatment selection and cost efficiency in femoral neck fracture management (Abdullah et al., 2016; Nugraheni & Andayani, 2015). Previous studies have primarily focused on clinical outcomes, with insufficient attention to the economic implications of different surgical

approaches (Rogmark & Leonardsson, 2016; Leal et al., 2016). This gap underscores the need for robust cost analysis to inform clinical decision-making and policy development in orthopedic care (Hiligsmann et al., 2013; Dewi et al., 2019).

Research Objectives, Urgency, and Novelty

This study aims to analyze the minimum cost of orthopedic surgery for femoral neck fractures at Klaten Islamic General Hospital using the Cost Minimization Analysis (CMA) method, providing a detailed comparison of direct medical costs across different surgical procedures. The urgency of this research lies in its potential to guide hospitals and policymakers in selecting the most cost-effective interventions, thereby reducing the financial burden on patients and healthcare systems (Leal et al., 2016; Hiligsmann et al., 2013). The novelty of this study is its focus on local data from an Indonesian hospital, employing a rigorous pharmacoeconomic approach to address a critical gap in the literature and offering practical recommendations for improving cost efficiency in orthopedic surgery (Akbar et al., 2018; Dewi et al., 2019).

RESEARCH METHODS

Population, Sample, and Sampling Techniques

Population is a general area consisting of objects and subjects that have certain qualities and characteristics determined by researchers to be studied, and then conclusions are drawn (Sugiyono, 2018). The population used in this study was data on all patients diagnosed with femoral neck fractures at the Klaten Islamic General Hospital during the period from January 2025 to August 2025, totaling 58 patients.

A sample is a portion of the total number and characteristics of the population. The sample used in this study consisted of patients with femoral neck fractures in 2025 who met the inclusion and exclusion criteria:

1. Inclusion Criteria
   a. Patients diagnosed with femoral neck fractures who have undergone orthopedic surgery at Klaten Islamic General Hospital.
   b. Patients aged 40 years and above.
   c. Patients who have undergone one of the following procedures: ORIF, hemiarthroplasty, or total hip arthroplasty.
   d. Patients with complete medical records, including details of surgical treatment costs.
2. Exclusion Criteria
   a. Patients with incomplete or missing medical records.
   b. Patients who experienced serious complications after surgery, such as severe infection.
   c. Patients with certain medical conditions that affect the cost analysis results, such as severe chronic diseases.

Research Instruments

The instrument used in this study was patient medical records, which included age, gender, length of stay, type of surgery, supporting examinations, medications, doctor services, and nurse services at the Klaten Islamic General Hospital. Patient medical records were collected and analyzed using SPSS to compare the costs between the surgical methods studied.

Research Variables

A variable is something used as a measure obtained by a research unit regarding a specific concept (Agustian & Saputra, 2019).

1. Independent Variable (free

   Independent variables are variables that influence other variables. In this study, the independent variables are the types of surgical procedures performed on patients with femoral neck fractures, consisting of:

   a. ORIF
   b. Hemiarthroplasty
   c. Total Hip Arthroplasty

2. Dependent Variables

Dependent variables are variables that are influenced by independent variables. In this study, the dependent variables are surgical costs, which include direct medical costs, namely

a. Hospitalization costs
b. Surgical procedure costs
c. Medication costs, Supporting examination costs, Doctor service costs, Nurse service costs

3. Descriptive Variables

These variables are not tested for direct relationships but are analyzed descriptively to provide an overview of patient characteristics. These variables include:

a. Patient age
b. Gender
c. Length of stay (LOS)

Tools and Materials

The tools used in this study were Microsoft Excel and SPSS. The materials used in this study were:

1. Medical records of patients with femoral neck fractures at the Klaten Islamic General Hospital.
2. Administrative data on patients with femoral neck fractures at the Klaten Islamic General Hospital.

Data collection techniques

The data used were taken from the medical records of patients who underwent femoral neck fracture surgery between January 2025 and August 2025.

Table 1.
Data Collection

Variable	Operational Definition	Data Source	Measurement Scale	Criteria
Direct medical costs	Total medical costs incurred by the hospital for patient care	Medical records	Nominal	Surgery costs, hospitalization, medication, supporting examinations, doctor services, nurse services
Type of procedure	Type of surgical procedure undergone by the patient	Medical records and hospital billing	Ratio	ORIF, Hemiarthroplasty, Total Hip Arthroplasty
Length of hospital stay	Duration of the patient's stay in the hospital from admission to discharge	Medical records	Ratio	Number of days hospitalized
Age	Age of the patient at the time of femoral neck fracture surgery	Patient identity data	Ratio	Age range 60 years and above
Gender	Gender of the patient with a femoral neck fracture	Patient identity data	Nominal	Male and Female

Data Processing

At this stage, the raw data that has been collected is processed and analyzed to become information. The steps are as follows:

1. Editing involves checking the completeness and consistency of the data that has been collected, both from medical records and cost documents. The aim is to ensure that there is no data that has been entered incorrectly or is illogical.
2. Coding involves assigning codes to quantitative data (type of procedure, type of medication, financing method) so that it can be analyzed quantitatively. This facilitates the input process into statistical software or spreadsheets.
3. Tabulation is compiling data in tabular form (cost tables per patient, tables of types of medical procedures and costs) to facilitate analysis. Tabulation can be done with the help of software such as Excel or SPSS.

Analysis of Results

The collected data will be analyzed descriptively and quantitatively to compare the total direct medical costs of each type of femoral neck fracture surgery. The analysis will be conducted using a cost minimization analysis approach, with the option of choosing treatments that have equivalent clinical effectiveness. The costs of each procedure group will be averaged and then compared to determine which intervention is the most cost-effective. The results of the analysis are presented in tables, graphs, and descriptive narratives.

RESULTS AND DISCUSSION

Patient Profile Analysis

Research on the topic of Pharmacoeconomic Analysis (CMA) and Quality of Life Outcomes of Patients with Femoral Neck Fractures at the Klaten Islamic General Hospital during the period from January 2025 to March 2025. The study was conducted from January to March 2025, and data were collected from 58 patients who met the inclusion criteria, namely:

1. Patients diagnosed with femoral neck fractures who had undergone orthopedic surgery at Klaten Islamic General Hospital.
2. Patients aged 60 years and above.
3. Patients who underwent one of the following procedures: ORIF, hemiarthroplasty, or Total Hip Replacement.
4. Patients with complete medical records, including details of surgical treatment costs.

Patient Characteristics Based on Gender

Patients with femoral neck fractures at Klaten Islamic General Hospital were classified based on gender to determine the percentage and frequency in comparison between females and males. The gender characteristics of patients diagnosed with femoral neck fractures at Klaten Islamic General Hospital can be seen in the table below.

Table 2.
Shows the characteristics of patients with femoral neck fractures based on gender.

Gender	Number	Percentage (%)	Number	Percentage (%)
Male		19		32,8
Female		39		67,2
Total		58		100

It can be seen that the percentage of women is higher than that of men, as shown by the

ratio of women to the total number of patients, which is 39 (67.42%), and men to the total number of patients, which is 19 (32.8%). Women have a higher risk than men due to a decrease in estrogen hormones, which play an important role in maintaining bone strength and density (Wijaya, 2018).

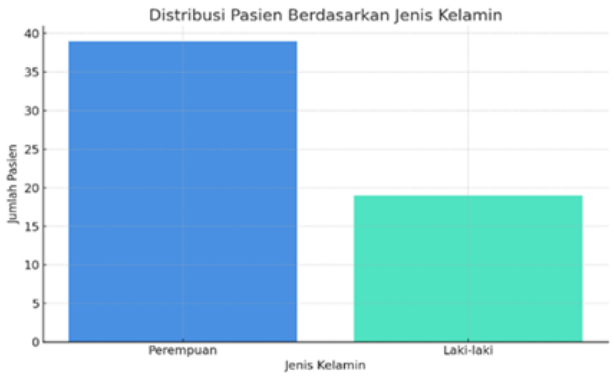
This phenomenon is in line with global epidemiological findings showing that women, especially those who have entered postmenopause, have a higher risk of bone fractures due to a decrease in bone mineral density (osteoporosis). The decrease in estrogen levels after menopause contributes significantly to bone fragility, increasing the likelihood of fractures even from minor trauma. In addition, age, comorbidities such as diabetes and hypertension, and a sedentary lifestyle also increase the risk in women.

Although men have higher bone mass physiologically, the number of cases of femoral neck fractures remains significant (32.8%). This can be attributed to other risk factors such as work accidents, high-risk physical activities, and a lack of awareness of osteoporosis prevention in men. In the Indonesian context, the low rate of osteoporosis screening among men and the lack of bone health education may contribute to this incidence.

With the predominance of cases in women, hospitals need to consider a more focused approach to prevention and rehabilitation of female patients, including nutrition education, physical exercise programs, and access to anti-osteoporosis therapy. From a pharmacoeconomic perspective, pharmacological interventions such as bisphosphonates or hormone therapy need to be analyzed for cost-effectiveness to ensure long-term funding efficiency.

Statistically, this distribution can also be used as a basis for further analysis using non-parametric tests such as Kruskal-Wallis to examine the relationship between gender and the type of intervention performed. By integrating this data into a model of therapy cost and effectiveness analysis, researchers can provide more comprehensive recommendations to policymakers and clinicians.

Thus, Table 2 not only presents descriptive data but also opens up space for multidisciplinary exploration covering clinical, epidemiological, and health economic aspects. Gender-based analysis such as this is very important in supporting health policy planning that is more responsive to the needs of the population.



The graph shows that female patients (67.2%) dominate those with femoral neck fractures compared to male patients (32.8%). This is consistent with the literature, which states that elderly women have a higher risk of fractures due to a decrease in estrogen, a hormone that plays an important role in maintaining bone density. In addition to hormonal factors, women also tend to have lower bone mass than men, which exacerbates the risk of fractures in old age. In the context of health services, the high incidence rate among women is an important consideration in prevention strategies, such as education about bone nutrition, physical activities that support bone strength, and regular osteoporosis screening.

Patient Characteristics Based on Age

The classification of patients with femoral neck fractures at Klaten Islamic General Hospital is based on age to determine at what age femoral neck fractures occur more frequently and to determine the effect of age on femoral neck fractures at Dr. Moewardi General Hospital in Surakarta, as shown in the table below:

Table 3.
Shows the characteristics of patients with femoral neck fractures based on age.

Age group (years)	Number	Percentage (%)
61-70	15	25,9
71-80	24	41,4
81-90	12	20,7
91-100	7	12,1
Total	58	100,00

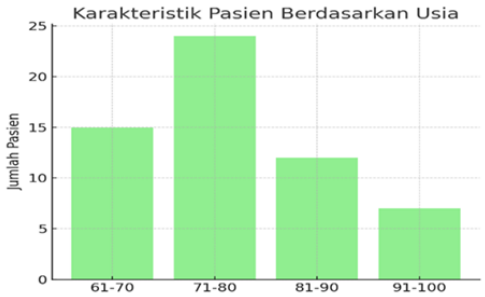
The highest percentage was seen in the 71-80 age group with 24 cases (41.4%), and the lowest in the 91-100 age group with 7 cases (12.1%).

Based on the peak age for femur fractures, it is in adults over 60 years of age (DepKES, 2020). There are several risk factors for fractures, namely age, gender, body mass index (BMI), patient injury history, history of medication use such as corticosteroids, and osteoporosis (Filipov, 2018). Age and gender are the two main risk factors associated with the occurrence of femoral neck fractures. The incidence increases significantly in the elderly, mainly due to the process of osteoporosis, which causes bones to become brittle and prone to fracture.

Physiologically, the aging process causes a decrease in bone mass and bone microarchitecture quality, thereby increasing the risk of fractures even from minor trauma such as falling from a standing position. Progressive decline in bone mineral density (BMD), especially in postmenopausal women, contributes to the increased incidence of femoral neck fractures in the elderly. In addition, comorbidities such as hypertension, diabetes, and visual impairment also increase the risk of falls and injuries in the elderly.

The age distribution in this table also has important implications for health service planning, particularly in terms of hospital resource allocation, rehabilitation strategies, and pharmacoeconomic policies. Older patients tend to have longer hospital stays, higher risks of postoperative complications, and more intensive rehabilitation needs (Leal et al., 2016). Therefore, a multidisciplinary approach involving orthopedic surgeons, geriatricians, physical therapists, and pharmacists is essential to optimize clinical outcomes and cost efficiency. From a pharmacoeconomic perspective, interventions such as bisphosphonate administration, calcium and vitamin D supplementation, and fall prevention programs need to be analyzed for cost-effectiveness to ensure that the interventions provided are not only clinically effective but also economically efficient (Hiligsmann et al., 2013). Given the high proportion of patients aged 71–80 years, preventive and educational interventions should focus on this group to reduce the incidence of fractures in the future.

Table 2 not only presents demographic data but also serves as an important basis for epidemiological, clinical, and health economic analyses. A deep understanding of the age distribution of patients enables more targeted and sustainable intervention planning in efforts to reduce the burden of disease and improve the quality of life of the elderly.



The graph shows that the largest distribution of patients is in the 71-80 age group (41.4%), followed by the 61-70 age group (25.9%), the 81-90 age group (20.7%), and the smallest distribution in the 91-100 age group (12.1%). These data indicate that the risk of femoral neck fractures increases with age. This data underscores the importance of a preventive approach in the elderly population, including modifying the home environment to be safe from the risk of falls, using walking aids, and rehabilitation and family education programs to support the mobility and safety of the elderly.

Analysis of Types of Surgical Procedures

Types of surgical procedures

Types of surgical procedures performed on patients with femoral neck fractures at Klaten Islamic Hospital. Types of orthopedic surgery performed by surgeons. Some of the most common types, according to Fallon (2020), are as follows: Arthroscopy, Bone fracture repair, Arthroplasty, Repair of damaged tissue, and Corrective surgery. The grouping of surgical services performed at Klaten Islamic General Hospital is classified based on the type of procedure for patients with femoral neck fractures to determine the cost of the procedure that must be paid by the patient during surgery. The characteristics of patients based on the type of procedure at Klaten Islamic General Hospital can be seen in Table 3 below:

Table 4.
Patient characteristics based on the type of procedure

Type of Procedure	Number	Percentage (%)
ORIF	13	22,4
Total Hip Arthroplasty	23	39,7
Hemiarthroplasty	22	37,9
Total	58	100,0

It is known that 58 patients underwent femoral neck fracture surgery at Klaten Islamic General Hospital. Based on the type of procedure, total hip arthroplasty was performed on 23 patients (39.7%), while ORIF was performed on 13 patients (22.4%), which was the smallest number. The results of the analysis of the grouping of types of procedures were used to determine the cost of each patient as a reference for analyzing the costs of patients with femoral neck fractures at Klaten Islamic General Hospital.

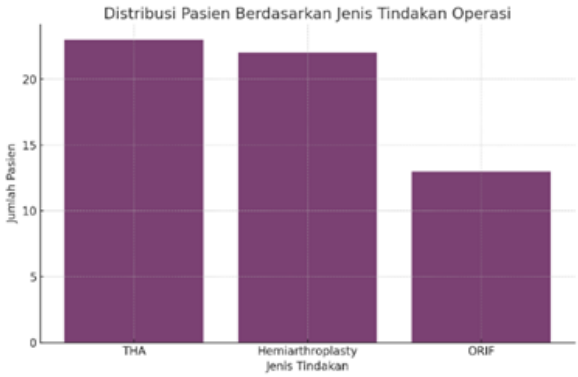
The choice of surgical procedure for femoral neck fractures is greatly influenced by the patient's age, activity level, comorbidities, and fracture stability. THA is generally

recommended for patients with a longer life expectancy and high activity level, as it provides better functional results and a lower risk of revision compared to hemiarthroplasty.

Hemiarthroplasty is often chosen for older patients or those with complex medical conditions, as the procedure is shorter and has a lower risk of bleeding (Parker & Gurusamy, 2010). ORIF is usually considered for younger patients with fractures that can still be anatomically repaired. However, in the elderly population, ORIF carries a high risk of non-union and avascular necrosis due to impaired vascularization of the femoral head, so its use is more limited. Therefore, the lower proportion of ORIF in this table reflects a more conservative and evidence-based clinical approach to geriatric patients.

This approach also has important implications for pharmacoeconomic analysis and hospital management. THA and hemiarthroplasty procedures have higher initial costs compared to ORIF, but may provide better long-term outcomes and reduce the need for revision or repeated hospitalizations (Rogmark & Leonardsson, 2016). The choice of procedure also affects the length of hospital stay, the need for rehabilitation, and the risk of postoperative complications such as infection, dislocation, or thromboembolism. Therefore, a multidisciplinary approach involving orthopedics, geriatrics, clinical pharmacy, and physical therapy teams is essential to optimize clinical and economic outcomes (Leal et al., 2016).

Statistically, the data in this table can be analyzed using the Kruskal–Wallis test to examine the relationship between the type of action and other variables such as age, gender, or clinical outcome. This analysis can reinforce evidence-based recommendations in selecting the most appropriate surgical intervention for each patient group. Table 3 not only presents descriptive data but also serves as an important basis for clinical decision-making, health policy planning, and cost-effectiveness evaluation in the management of femoral neck fractures.



The choice of treatment is greatly influenced by the patient's age, the severity of the fracture, the condition of bone vascularization, as well as the patient's life expectancy and activity level. THA is chosen for younger patients or active elderly patients with a long life expectancy because it provides better functional results and a lower risk of reoperation. Hemiarthroplasty is more commonly used in elderly patients with limited activity, as the procedure is simpler and the duration of surgery is shorter. ORIF is chosen for patients with fractures that can still be reduced anatomically, especially in younger patients with strong bones and good vascularization.

Patient Characteristics Based on Length of Hospital Stay

The Length of Stay (LOS) data for 30 inpatients at Klaten Islamic General Hospital can be seen in Table 5 below:

Table 5.
Patient Characteristics Based on Length of Hospital Stay

Type of Procedure	Duration	Percentage (%)

ORIF	63 hari	21,65
Total Hip Arthroplasty	115 hari	39,52
Hemiarthroplasty	113 hari	38,83
Total	291 hari	100,0

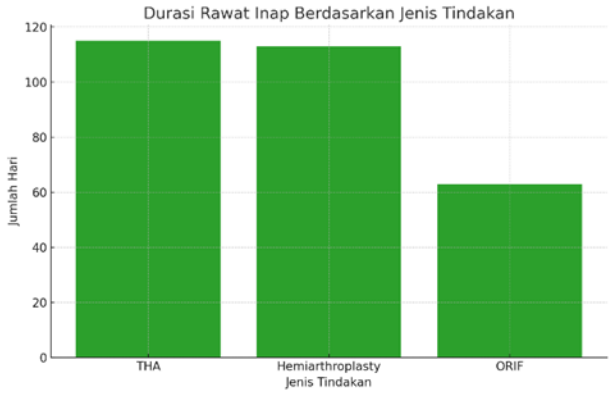
It is known that the number of patients with femoral neck fractures at Klaten Islamic General Hospital was 58 patients with the longest length of stay (LOS) for total hip arthroplasty with an LOS of 115 days (39.52%), ORIF procedures had an LOS of 63 days (21.65%), and Hemiarthroplasty procedures had an LOS of 113 days (38.83%). These data indicate the number of calendar days patients spent in the hospital as inpatients. LOS is used to evaluate the efficiency and effectiveness of hospital services. Length of Stay (LOS) is the time required for a patient to receive treatment while in the hospital, as defined by the Joint Commission (Harahap et al., 2022). Factors that influence LOS include the patient's clinical condition (such as complications or comorbidities), the type of care provided, the patient's age, and other factors such as the quality of hospital services.

Length of hospital stay is an important indicator in evaluating the efficiency of health services and hospital costs. THA and hemiarthroplasty procedures, although providing better long-term functional results, are often associated with longer recovery times, especially in geriatric patients with comorbidities such as diabetes, hypertension, or mobility disorders (Leal et al., 2016). Factors such as the risk of complications, the need for intensive physical therapy, and adaptation to prostheses also contribute to longer hospital stays (Rogmark & Leonardsson, 2016).

ORIF procedures have a shorter hospital stay, which is 63 days for all patients undergoing the procedure. This can be attributed to a more conservative and minimally invasive surgical approach, although in the elderly population, ORIF carries a high risk of non-union and avascular necrosis, which may necessitate reoperation in the future. Despite the shorter hospital stay, the long-term effectiveness of ORIF in elderly patients needs to be carefully evaluated. From a pharmacoeconomic perspective, the length of hospital stay has a direct impact on the total cost of care, including room costs, medications, medical procedures, and healthcare personnel. A study by Hiligsmann et al. (2013) shows that surgical interventions with longer hospital stays tend to have higher total costs, although they may provide better functional benefits.

Statistically, this data can also be analyzed using the Kruskal-Wallis test to see if there are significant differences in length of stay between types of procedures. Further analysis, such as multivariate regression, can be used to identify factors that influence length of stay, such as age, gender, and comorbidities.

Table 4 not only provides a descriptive overview of the length of hospital stays, but also opens up space for more in-depth clinical and economic analysis. This information is very important in supporting data-driven decision-making by clinicians, hospital managers, and health policymakers alike.



The graph showing the length of hospital stay for patients with femoral neck fractures at Klaten Islamic General Hospital indicates that the Total Hip Arthroplasty group had the longest stay at 115 days (39.52%), followed by Hemiarthroplasty at 113 days (38.83%) and ORIF at 63 days (21.65%). These results illustrate that patients undergoing arthroplasty tend to require a longer duration of care compared to ORIF. The length of hospitalization reflects the complexity of the procedure and the need for rehabilitation, and has a direct impact.

Operating Cost Analysis

The cost of orthopedic surgery for femoral neck fractures varies depending on several factors, including the hospital, type of procedure, and class of care. The calculation of treatment costs using the CMA (cost minimization analysis) method is by comparing the cost components in this study, including hospitalization costs, surgery costs, medication costs, supporting examination costs, doctor services, and nurse services.

The overview of orthopedic surgery costs for femoral neck fractures at the Klaten Islamic General Hospital, which was covered by 58 patients, shows that 13 patients underwent ORIF procedures costing Rp. 377,537,336, 23 patients underwent Total Hip Arthroplasty procedures costing Rp. 915,788,993, and 22 patients underwent Hemiarthroplasty procedures costing Rp. 684,607,078.

This difference shows that joint replacement surgery, particularly THA, requires greater resources in terms of treatment duration and complexity. The hospitalization cost for THA reached IDR 108,108,120, which is much higher than ORIF (IDR 42,827,200) and hemiarthroplasty (IDR 88,310,700). The cost of medication is also a major contributor to overall expenditure, with the highest value for ORIF at IDR 174,578,513. This can be interpreted as an indication that ORIF patients may require more intensive pharmacological therapy, both for pain management and infection control.

The cost of supporting examinations such as radiology and laboratory tests shows significant variation. Overall, these data indicate that THA is the procedure with the highest cost burden; however, further analysis is needed in the context of clinical effectiveness and patient quality of life. Previous studies have shown that although the initial cost of THR is higher, this procedure can provide better functional outcomes and reduce the need for revision in the long term (Rogmark & Leonardsson, 2016).

Direct Medical Cost Analysis

Direct medical costs are costs directly related to patient health care, doctor consultation fees, nursing fees, inpatient room rental fees, medical equipment costs, and laboratory costs (Scaria et al., 2015). Direct medical costs in this study include all cost components incurred during the treatment and surgery of patients with femoral neck fractures at the Klaten Islamic General Hospital. These components consist of hospitalization costs, surgical procedure costs, medication costs, supporting examination costs, doctor services, and nursing services.

Based on the data processing results, there were variations in costs for each type of surgical

procedure undergone by patients, namely Open Reduction Internal Fixation (ORIF), Hemiarthroplasty, and Total Hip Arthroplasty (THA). These cost differences were mainly influenced by the length of hospitalization, the complexity of the surgical procedure, the type and amount of medication used, and the intensity of supporting examinations.

Hospitalization costs are one of the largest components because they are calculated based on the number of days the patient is hospitalized. The longer the patient is hospitalized, the higher the costs will be. In addition, surgical costs also contribute significantly, especially for patients undergoing THA, as it requires more complex medical equipment and the use of high-value prosthetic implants.

Medication costs include antibiotics, analgesics, and other supportive medications used during treatment. In hemiarthroplasty and THA procedures, medication costs tend to be higher than in ORIF due to the need for more intensive post-operative therapy. Supporting examination costs are also an important factor, including radiology, laboratory, and other diagnostic support examinations required before and after surgery. Doctor and nurse services are calculated based on standard hospital service rates. These two components vary according to the patient's class of care and the intensity of the services provided.

Cost Analysis Using the CMA Method

Cost analysis using the CMA method to compare two or more health interventions, including drugs, that provide the same, similar, or equivalent results or can be assumed to be equivalent. Since the treatment results of the interventions are (assumed to be) the same, only one aspect needs to be compared, namely the cost. Analysis by comparing costs (Indonesian Ministry of Health, 2021). CMA method calculations are based on the following formula:

$$\text{CMA} = \frac{Total\ Cost}{Number\ of\ Patient}$$

In a minimal cost analysis study of patients undergoing femoral neck fracture surgery at Klaten Islamic General Hospital from January 2025 to March 2025, cost data were sourced from a review of data in the income section of Klaten Islamic General Hospital. The data obtained included details of outpatient care costs, long-term patient administration costs, doctor consultations, hemodialysis packages, and clinical pathology laboratory costs, which met the inclusion criteria for the study. The following are the results of the cost analysis using the CMA method for patients with femoral neck fractures at Klaten Islamic General Hospital from January 2025 to March 2025:

Table 6.
Cost Analysis Results Using Cost Minimization Analysis (CMA)

Type of Procedure	Cost (RP)	Number of Patients	CMA (RP)
ORIF	377.537.336	13	29.041.334
Total Hip Replacement	914.086.593	23	39.742.895
Hemiarthroplasty	684.607.078	22	31.118.504

Source: Processed research data, 2025

Table 5 shows the expenses incurred by 58 patients who underwent femoral neck fracture surgery at Klaten Islamic General Hospital in this study. The cost of surgery, based on the type of procedure, using the CMA (Cost Minimization Analysis) method, was calculated as the

average per patient obtained from the medical costs

incurred divided by the number of patients, meaning that the cost per patient for ORIF procedures was IDR 29,041,334, for Total Hip Replacement procedures was IDR 39,742,895, and for Hemiarthroplasty procedures was IDR 31,118,504.

These results show that the cost of orthopedic surgery for femoral neck fractures, based on the type of procedure using the CMA (Cost Minimization Analysis) method at the Klaten Islamic General Hospital, indicates that the cost of ORIF surgery is the lowest at Rp 29,041,334. The analysis used to determine the medication with the lowest cost to the patient was the CMA (Cost Minimization Analysis) method, where the total medical costs incurred by the patient are divided by the number of cases occurring for each therapy (Akbar et al., 2018).

Requirements Analysis Testing

Normality Test

The purpose of the normality test is to determine whether the data from the research sample comes from a normally distributed population or not. The normality test is performed using the Liliefors test technique or, in the SPSS 27.00 program, better known as Shapiro-Wilk. The criteria for the normality test are that the data is normally distributed with a significance probability value > 0.05.

From the results of data processing using SPSS version 27.00, it is known that the number of samples (N) used in this study for the variable of surgery costs was 58 respondents. The normality test produced a significance probability value of 0.022.

The basis for decision-making in normality testing is to compare the significance probability value of the test results with the error rate set by the researcher (Priyatno, 2014). In this study, the error rate used was 5% or 0.05.

The significance value for the operating cost variable is 0.022. This value is clearly smaller than the error rate of 0.05 (0.022 < 0.05). Based on these criteria, it can be concluded that H0 (null hypothesis), which states that the data is normally distributed, is rejected. Thus, the data for the operating cost variable is declared to be non-normal.

Homogeneity Test

It is known that testing with Levene's statistic obtained a significance of 0.082 > 0.05. Thus, the research data above is homogeneous and indicates that the Postoperative Cost data have homogeneity or the same variance.

In this study, a homogeneity test was conducted to ensure that the data analyzed met the basic assumption of variance analysis, namely the equality of variance between groups. This test is very important because a violation of the homogeneity assumption can cause the statistical test results to be invalid (Field, 2013).

The test was performed using Levene's Test for Equality of Variances, which is a robust method for testing the equality of variances, especially when the data are not normally distributed. Based on the results obtained from the SPSS version 27.00 output, the Levene Statistic value was 0.082 with degrees of freedom (df1 = and df2 = 45), and a significance value (Sig) of 0.082.

Bivariate Analysis Testing

In this study, bivariate analysis was performed to determine the difference in surgical costs based on the type of surgery performed on patients. Before determining the test method to be used, tests of normality and homogeneity were performed. The test results showed that the data were not normally distributed (p < 0.05), so parametric tests such as ANOVA could not be used. Therefore, an alternative method was chosen, namely the non-parametric Kruskal-Wallis test, which is more suitable for data that do not meet the assumptions of normality and homogeneity (Ghozali, 2018).

Based on the results of the Kruskal-Wallis test in this study, a Kruskal-Wallis value of 21.431 was obtained with a degree of freedom (df) = 2 and a significance value of 0.001. Because the p-value was < 0.05, it can be concluded that there was a statistically significant difference between the surgical procedure groups in terms of surgical costs. This indicates that the type of surgical procedure performed on patients has a significant effect on the amount of costs that must be incurred.

The results of the Kruskal-Wallis test analysis show a significant result. Value of 0.001, which is less than 0.05. From these results, H0 is rejected, meaning that there is a significant difference in the types of treatment for the cost of orthopedic surgery for femoral neck fractures at the Klaten Islamic General Hospital. These results are consistent with the research conducted by Munawaroh et al. (2020). The type of treatment at the hospital will affect the costs incurred by patients, because an increase in the length of treatment will increase the patient's medical costs, such as the cost of drugs, medical equipment, procedures, support, and hospitalization. Therefore, efforts to reduce the length of hospitalization can lower hospital care costs.

CONCLUSION

Based on the results of the study, it was found that the Open Reduction Internal Fixation (ORIF) procedure was the least expensive option for treating femoral neck fractures at Klaten Islamic General Hospital, with an average cost per patient of Rp 29,041,334. Although there are significant differences in cost between ORIF, hemiarthroplasty, and total hip arthroplasty, all three procedures provide equivalent clinical effectiveness. These findings emphasize the importance of health economic analysis in clinical decision-making, particularly in choosing cost-effective interventions without compromising clinical outcomes. The practical implication of this study is that hospitals and healthcare providers can use the results of this analysis as a reference in designing more efficient cost management and surgical procedure selection policies, thereby reducing the financial burden on patients and institutions.

However, this study has several limitations, including a limited sample size from a single hospital and a relatively short time period, so generalizing the results to a broader population should be done with caution. In addition, this study only analyzed direct costs without considering indirect costs or the quality of life of patients after surgery in depth. For further research, it is recommended that a multi-center study with a larger sample size be conducted, as well as an analysis that includes indirect costs and long-term outcomes, such as quality of life and patient satisfaction levels. Further research could also explore factors that influence cost variations, such as comorbidities, length of hospital stay, and postoperative complications, in order to provide more comprehensive recommendations for the management of femoral neck fractures in various healthcare settings.

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