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Physiotherapy Management in Patients with Coronary Artery Disease 3VD Post Coronary Artery Bypass Grafting in ICCU: A Case Study

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Abstract: Post-Coronary Artery Bypass Grafting (CABG) patients are at risk of postoperative complications, including pain, respiratory disorders, decreased thoracic expansion, and functional mobility limitations due to surgical procedures and prolonged bed rest in the Intensive Cardiac Care Unit (ICCU). Therefore, physiotherapy during the acute rehabilitation phase is essential to support recovery and prevent further complications. **Objective:** This study aims to describe physiotherapy management in a patient with Coronary Artery Disease (CAD) three-vessel disease (3VD) post-CABG in the ICCU and to evaluate changes in pain, shortness of breath, thoracic expansion, and functional mobility after physiotherapy intervention. **Method:** This study used a case report design involving a 53-year-old male patient with complaints of sternotomy pain, shortness of breath, and postoperative mobility limitations. Data were collected through physiotherapy assessment, including vital signs, Numeric Rating Scale (NRS), Borg Scale, thoracic expansion measurement using a meterline, and functional ability using the ICU Mobility Scale. Data were analyzed descriptively by comparing clinical outcomes before and after three physiotherapy sessions. **Findings:** The results showed decreased resting pain from 5/10 to 3/10, reduced shortness of breath from 2/10 to 0/10, increased thoracic expansion, and improved functional mobility from score 1 to score 3 based on the ICU Mobility Scale. These findings indicate positive clinical progress during the acute rehabilitation phase. **Implication:** Early physiotherapy intervention through diaphragmatic breathing exercise, deep breathing exercise, active range of motion exercise, and gradual mobilization may support respiratory function, reduce pain, improve mobility, and assist early recovery in post-CABG patients in the ICCU. **Originality/Value:** This case report provides specific clinical evidence regarding comprehensive physiotherapy management in a CAD 3VD post-CABG patient during intensive cardiac care, particularly through measurable outcomes in the acute rehabilitation phase.

Keywords: Coronary Artery Bypass Grafting; Coronary Artery Disease; Physiotherapy; Early Mobilization; Cardiac Rehabilitation.

INTRODUCTION

Coronary Artery Disease (CAD) or coronary heart disease is a chronic cardiovascular disease characterized by narrowing or blockage of the coronary arteries due to the accumulation of atherosclerotic plaque, thereby disrupting blood flow to the myocardium

(Yao et al., 2025). CAD has become a major global health problem because it is one of the leading causes of morbidity and mortality worldwide (Han et al., 2022). In Indonesia, the prevalence of CAD based on doctor diagnosis reaches 1.5%, with the highest prevalence found in North Kalimantan at 2.2%, followed by the Special Region of Yogyakarta and Gorontalo at 2% each, DKI Jakarta at 1.9%, and Central Java at 1.6% (Pramudiana & Pristianto, 2022). Cardiovascular disease also contributes significantly to the national mortality rate in Indonesia (Ariansyah et al., 2025). In severe CAD cases, particularly three-vessel disease (3VD), Coronary Artery Bypass Grafting (CABG) is commonly performed to improve myocardial perfusion, reduce angina symptoms, and enhance patients' quality of life (Emamzadehashemi et al., 2024).

Several previous studies have discussed the postoperative complications experienced by patients after CABG surgery. Post-CABG patients are at risk of experiencing pain in the sternotomy area, impaired pulmonary function, decreased thoracic expansion, and reduced functional capacity due to surgical trauma and immobilization (Eghbali et al., 2025). Respiratory complications such as atelectasis, pulmonary edema, hypoxemia, and ineffective breathing patterns frequently occur during the early postoperative phase because of median sternotomy and reduced chest wall mobility (Reinhart et al., 2024)In addition, previous studies have also reported that post-CABG patients may experience sleep disturbances, anxiety, and depression, which can negatively affect the recovery process and worsen clinical outcomes (Eghbali et al., 2025). However, most previous studies primarily focused on general postoperative cardiac surgery complications and did not specifically describe comprehensive physiotherapy management during the acute rehabilitation phase in ICCU patients with CAD 3VD post-CABG.

Other studies have highlighted the important role of physiotherapy interventions in phase I cardiac rehabilitation after CABG surgery. Deep breathing exercises and diaphragmatic breathing exercises have been shown to improve tidal volume, oxygenation, respiratory muscle activity, and chest wall mobility while reducing postoperative pain and pulmonary complications (Eghbali et al., 2025; Jafari et al., 2023; Reinhart et al., 2024). Furthermore, early mobilization and active range of motion (AROM) exercises are considered safe and effective interventions for improving functional independence, preventing complications due to prolonged bed rest, reducing length of hospital stay, and accelerating recovery in intensive care patients (Han et al., 2022; Singam, 2024). Nevertheless, detailed case-based evidence regarding the combined implementation of

breathing exercises, AROM exercises, and gradual mobilization in CAD 3VD patients post-CABG during intensive cardiac care remains limited. This indicates a literature gap regarding comprehensive and measurable physiotherapy management in ICCU settings.

Several studies have also emphasized the importance of early rehabilitation programs in improving postoperative functional outcomes after cardiac surgery. Early rehabilitation interventions are associated with improvements in physical function, mobility, respiratory efficiency, and quality of life in post-CABG patients (Emamzadehashemi et al., 2024; Han et al., 2022). However, there is still limited evidence specifically evaluating the short-term clinical outcomes of physiotherapy interventions in patients with CAD 3VD post-CABG during the acute phase of hospitalization in the ICCU. Most studies focus on long-term rehabilitation outcomes or broader cardiac rehabilitation programs rather than detailed physiotherapy management during critical care treatment. Therefore, further investigation through case-based studies is needed to provide a clearer clinical overview of physiotherapy implementation and patient responses during the acute postoperative period.

This study aims to present comprehensive physiotherapy management in a patient diagnosed with CAD 3VD post-CABG surgery during the acute care period in the ICCU. Specifically, this study evaluates the effects of diaphragmatic breathing exercise, deep breathing exercise, active range of motion exercises, and gradual mobilization on pain level, shortness of breath, thoracic expansion, and functional mobility. This study is expected to provide a clinical overview of the patient's recovery process and contribute additional evidence regarding physiotherapy management during early cardiac rehabilitation in intensive cardiac care settings.

The argument proposed in this study is that structured and closely monitored physiotherapy interventions during the acute postoperative phase may improve respiratory function, reduce pain and shortness of breath, increase thoracic expansion, and enhance functional mobility in patients with CAD 3VD post-CABG surgery. Breathing exercises are assumed to support pulmonary ventilation and relaxation, while AROM exercises and gradual mobilization are expected to prevent complications associated with immobilization and accelerate functional recovery during intensive cardiac care.

RESEARCH METHOD

The unit of analysis in this study was an individual patient with three-vessel Coronary Artery Disease (CAD 3VD) after Coronary Artery Bypass Grafting (CABG) surgery who

received physiotherapy management during the acute care period in the Intensive Cardiac Care Unit (ICCU). The patient was a 53-year-old male who was hospitalized at Dr. Kariadi General Hospital Semarang. The main clinical problems observed in this case included pain around the sternotomy incision area, shortness of breath, difficulty breathing, decreased thoracic expansion, and limited movement of the upper and lower limbs.

This study used a qualitative case report design. This design was selected because the study aimed to describe in detail the clinical condition, physiotherapy examination, intervention process, and patient outcomes in a specific post-CABG case. A case report approach is appropriate for presenting clinical phenomena that require comprehensive observation, especially in acute rehabilitation settings where patient responses to physiotherapy intervention need to be documented systematically.

The data sources in this study consisted of primary and clinical data obtained from the patient during hospitalization at Dr. Kariadi General Hospital Semarang. Primary data were obtained through direct physiotherapy examination, observation of the patient's clinical condition, and evaluation of functional ability. Clinical information was also obtained from the patient's medical condition, including the diagnosis of CAD 3VD post-CABG, postoperative complaints, vital signs, pain level, degree of shortness of breath, thoracic expansion, and mobility status.

Data collection was conducted over three physiotherapy sessions, starting from the initial observation and examination stage to the intervention and evaluation stage. The examination included assessment of general condition, inspection, palpation, auscultation, vital signs, pain level using the Numeric Rating Scale (NRS), degree of shortness of breath using the Borg Scale, thoracic expansion using a measuring tape, and functional activity using the ICU Mobility Scale. Physiotherapy interventions included diaphragmatic breathing exercise, deep breathing exercise, active range of motion exercise, and gradual mobilization, with close monitoring of the patient's hemodynamic responses and activity tolerance.

Data analysis was conducted descriptively by comparing the patient's clinical condition before and after physiotherapy intervention across three sessions. The analysis focused on changes in pain level, shortness of breath, thoracic expansion, and functional mobility. The results were interpreted narratively to describe the patient's clinical progress and to evaluate the potential contribution of physiotherapy management to early recovery after CABG surgery. This study was conducted after obtaining informed consent from the

patient and permission to use clinical data from the hospital while maintaining the confidentiality of the patient's identity.

CASE PRESENTATION

A 53-year-old patient was treated in the ICCU of Dr. Kariadi Central General Hospital with a medical diagnosis of Coronary Artery Disease (CAD) 3VD post-Coronary Artery Bypass Grafting (CABG), with complaints of pain at the incision site in the chest area and shortness of breath. The patient has a history of chest pain for the past year that comes and goes, especially during exercise or walking for 300 meters, which is often accompanied by shortness of breath and cold sweats. The patient went to the hospital and underwent a catheterization procedure. The results showed severe stenosis or blockage in three major blood vessels. Based on this condition, the patient was referred to Dr. Kariadi Central General Hospital for a CABG surgery procedure.

The patient also has a history of comorbid disease, namely Diabetes Mellitus. After undergoing surgery and being treated in the ICCU, the patient appeared conscious in a half-lying position in bed. The patient was attached to several medical devices, including a Central Venous Catheter (CVC), arterial line, Water Sealed Drainage (WSD), and urinary catheter. The patient is not yet able to change positions independently, such as turning right-left, sitting, or standing, due to pain and post-operative mobility limitations. The planned physiotherapy intervention program includes pain and breathing management using Diaphragm Breathing Exercise for relaxation and Deep Breathing Exercise to enhance thoracic expansion. In addition, mobilization management is carried out through active range of motion (AROM) exercises for the upper and lower limbs, gradual mobilization from lying to sitting, as well as muscle release techniques to reduce muscle spasms.

Ethical Consideration

This case report study has obtained informed consent from the patient for the use of clinical data and scientific publication. The patient's identity is kept confidential by not including personal information that could identify the patient. All examination procedures and physiotherapy interventions are carried out in accordance with the ethical principles of health services and patient safety standards in the ICCU.

PHYSIOTHERAPY EXAMINATION

General Condition and Inspection

At the initial examination, the patient appears conscious and compos mentis in a half-lying position. A sternotomy incision is visible on the chest area, and the breathing pattern is predominantly apical with minimal chest expansion. The patient is able to move the upper and lower limbs actively, but functional mobility is still limited.

Palpation

On palpation, no edema or pitting edema was found in the surgical incision area. There is spasm in the upper trapezius muscle. Expansion of the thoracic cage is palpably symmetrical on the right and left sides.

Auscultation

Auscultation of the lungs shows normal vesicular breath sounds in both lung fields.

Vital Signs Examination

From the palpation examination results, no edema or pitting edema was found in the incision area, there is spasm in the upper trapezius muscle, and thoracic cage expansion is symmetrical. On lung auscultation examination, vesicular breath sounds are normal. On vital signs examination, the results are as follows:

Table 1. Vital Sign Examination Results

Vital Sign	Results
Blood Pressure	100/71mmHg
Pulse	85 beats/minute
Respiratory Rate	25 breaths/minute
SpO2	97%
Temperature	36,4˚C

In the examination of pain level using the Numeric Rating Scale with a scale of 0-10. In the pain examination, the results were as follows:

Table 2. Pain Level Examination Results

Type of Pain	Results	Description
Resting Pain	5/10	Moderate Pain
Pressure Pain	5/10	Moderate Pain
Movement Pain	6/10	Moderate Pain

In addition to the pain examination, there is an examination of the degree of shortness of breath using the Borg Scale, with the results as follows:

Table 3. Results of Shortness of Breath Degree Examination

Score	Description
2/10	Slight Shortness of Breath

Examination of Thoracic Expansion development using a meterline with the results as follows:

Table 4. Thorax Expansion Examination Results

Measurement Points	Results
Axilla	1 cm
ICS 4	1 cm
Xiphoid Process	1 cm

In the examination of Functional Activity using the ICU Mobility Scale with the following results:

Table 5. Results of Functional Activity Examination

Class	Description
1	Any activity in bed, including rolling, bridging, active exercises or active assisted exercises, cycle ergometry but not moving over edge of bed or out of bed.

This study conducted an evaluation regarding the degree of pain using the NRS (Numeric Rating Scale), the degree of shortness of breath using the Borg Scale, thoracic expansion development using a meterline, and functional ability using the ICU Mobility Scale. Based on the physiotherapy examination results, several physiotherapy problems were identified as follows:

1. Pain in the sternotomy area after CABG surgery.
2. Mild shortness of breath with apical breathing pattern.
3. Decreased thoracic expansion.
4. Upper trapezius muscle spasm.
5. Decreased functional mobility after surgery.

PHYSIOTHERAPY INTERVENTION

The physiotherapy program was provided in three sessions during care in the ICCU with the aim of reducing pain, relieving shortness of breath, increasing thoracic expansion, and improving the patient's functional mobility:

1. Diaphragmatic Breathing Exercise

Position the patient in a semi-Fowler's position (30–45°) to enhance comfort and lung expansion. The patient is asked to place one hand on the abdomen and one hand on the chest to monitor the breathing pattern. Next, the patient inhales slowly through the nose for 3–4 seconds, emphasizing the movement of the abdomen while the chest remains minimally moved. After that, the patient exhales slowly through the mouth (pursed lips) for 4–6 seconds. The exercise is performed 8–10 repetitions per session, 2–3 times a day, adjusted according to the patient's condition, along with monitoring vital signs and pain response to prevent postoperative complications.

2. Deep Breathing Exercise

Position the patient in a semi-Fowler position (30–45°) to enhance lung expansion and comfort. The patient is instructed to slowly take a deep breath through the nose to maximal inspiratory capacity for approximately 3–5 seconds, hold it for 2–3 seconds, and then continue with a slow exhalation through the mouth for about 4–6 seconds. The exercise is performed 8–10 repetitions per session, 2–3 times a day, along with monitoring of vital signs and pain response to prevent postoperative complications.

3. Active Range of Motion (AROM) Exercise

The patient is positioned as comfortably as possible, then asked to perform slow and controlled active movements. In upper extremity, exercises include shoulder flexion–extension, abduction–adduction, as well as elbow and wrist flexion–extension, paying attention to pain limits and sternum stability. In lower extremity, exercises include knee flexion–extension, as well as ankle movements such as dorsiflexion and plantarflexion to help improve peripheral blood flow. Each movement is performed 8–10 repetitions per session with a frequency of 2–3 times a day, adjusted according to the patient's condition.

4. Gradual Mobilization

The mobilization given to the patient at the first and second sessions is being positioned sitting with support, and at the third session sitting on the edge of the bed with feet dangling.

5. Monitoring and Safety Parameters

During physiotherapy interventions, blood pressure, pulse rate, respiratory rate, SpO_2, pain scale, and degree of shortness of breath are monitored. Exercises are stopped if signs of hemodynamic instability are found, such as SpO_2 dropping below 90%, increased chest pain, severe shortness of breath, arrhythmia, hypotension, excessive increase in pulse rate, or if the patient appears intolerant to the activity.

OUTCOME MEASUREMENT

Evaluation was conducted on the degree of pain using NRS, the degree of shortness of breath using Borg Scale, thoracic expansion using meterline, and functional ability using ICU Mobility Scale.

Evaluation of the degree of pain using NRS (0/10)

Table 6. Pain Degree Evaluation Results

Types of Pain	T1	T2	T3
Resting Pain	5/10	4/10	3/10
Pressure Pain	5/10	5/10	4/10
Movement Pain	6/10	5/10	4/10

Based on the results of pain measurement using the NRS, there was a decrease in pain from T1 to T3. Resting pain decreased from 5/10 to 3/10, pressure pain decreased from 5/10 to 4/10, and movement pain decreased from 6/10 to 4/10.

Evaluation of shortness of breath degree using the Borg Scale (0/10)

Table 7. Results of Shortness of Breath Degree Evaluation

Score	T1	T2	T3
	2/10	1/10	0/10

Based on the measurement results using the Borg Scale, the degree of shortness of breath decreased from 2/10 (slightly short of breath) to 0/10 (no shortness of breath).

Thorax Expansion Evaluation using Meterline

Table 8. Thorax Expansion Evaluation Results

Measurement Points	T1	T2	T3
Axilla	1 cm	1,2 cm	1,5 cm
ICS 4	1 cm	1,2 cm	1,5 cm
Xiphoid Process	1 cm	1 cm	1,2 cm

Based on the results of Thorax Expansion measurement using a Meterline in the table above, it shows an increase from T1-T3 at the Axilla from 1 cm to 1,5 cm. At ICS 4 from 1 cm to 1,5 cm and at the Proc. Xiphoideus from 1 cm to 1,2 cm.

Evaluation of Functional Activity using the ICU Mobility Scale

Table 9. Results of Functional Activity Evaluation

Class	T1	T2	T3
	1	2	3
	Any activity in bed, including rolling, bridging, active exercises or active assisted exercises, cycle ergometry but not moving over edge of bed or out of bed.	By means of a hoist, passive transfer, slide transfer with no standing or sitting at the edge of the bed.	Patient can be assisted by staff but needs to be actively sitting with some trunk control.

Based on the evaluation results using the ICU Mobility Scale, there was an improvement in the patient's functional mobility ability from a score of 1 at T1 to a score of 2 at T2 and further increased to a score of 3 at T3. This indicates an improvement in the patient's mobilization ability from being limited to bed activities to being able to sit actively with assistance and better trunk control.

DISCUSSION

Post-operative patients after Coronary Artery Bypass Grafting (CABG) are at risk of experiencing various cardiopulmonary, respiratory, and musculoskeletal complications due to surgical procedures in the thoracic area. One common complication is a decrease in pulmonary functional capacity and ventilation disorders due to sternotomy pain, decreased physical activity, and respiratory muscle weakness. This condition can cause breathing patterns to become shallow and ineffective, thereby hindering the patient's recovery process (Putri et al., 2024).

In addition, post-operative bed rest can also cause a decrease in muscle strength and overall functional ability (Mentari & Rahayu, 2022). Therefore, phase I cardiac rehabilitation in the hospital plays an important role in preventing post-operative complications as well as helping to accelerate the recovery of patient function through interventions such as breathing exercises and early mobilization (Afxonidis et al., 2021).

Based on the evaluation results in this case, the physiotherapy intervention program showed improvements in pain parameters, respiratory function, thoracic expansion, and the patient's functional ability. At the initial examination, the patient experienced moderate pain in the sternotomy incision area with a pain NRS score of 5/10 at rest, 5/10 on pressure, and 6/10 during movement. After being given Deep Breathing Exercise and Diaphragmatic Breathing Exercise interventions for three sessions, the pain decreased to 3/10 at rest, 4/10 on pressure, and 4/10 during movement. This reduction in pain indicates that breathing exercises can help relax muscles, improve breathing patterns, and reduce tension due to postoperative pain.

Previous research also mentioned that Deep Breathing Exercise and Diaphragmatic Breathing Exercise are effective in reducing pain in postoperative patients as well as helping improve breathing patterns due to pain (Jannah et al., 2024). Physiologically, deep breathing exercises can stimulate the parasympathetic nervous system, thereby providing a relaxation effect and helping to reduce pain perception in post-cardiac surgery patients (Eghbali et al., 2025)

In addition to pain, the patient in this case also experienced mild shortness of breath with a Borg Scale score of 2/10 and a decrease in thoracic expansion of 1 cm at all measurement points. This condition is consistent with the characteristics of post-sternotomy patients who generally experience limited pulmonary ventilation due to pain, surgical trauma, and decreased chest wall mobility. After the gradual administration of breathing exercises, the shortness of breath score decreased to 0/10 and there was an increase in thoracic expansion in the axilla area and ICS 4 from 1 cm to 1.5 cm, while at the xiphoid process it increased to 1.2 cm. These results indicate an improvement in respiratory function and pulmonary ventilation after physiotherapy intervention.

Deep breathing exercises are known to increase tidal volume and alveolar ventilation, thereby helping to overcome restrictive lung function disorders caused by median sternotomy and preventing pulmonary complications such as atelectasis and pulmonary edema in the acute phase after cardiac surgery (Reinhart et al., 2024). In addition, breathing exercises also activate the main respiratory muscles and improve chest wall mobility, thus contributing to increased thoracic expansion (Li et al., 2025). Consistent implementation of breathing exercises has also been reported to be effective in preventing postoperative pulmonary complications (Jafari et al., 2023).

In terms of functional ability, at the initial examination the patient was at a score of 1 on the ICU Mobility Scale, meaning they were only able to perform limited activities in bed. After a gradual mobilization intervention over three sessions, the patient's functional ability increased to a score of 3, meaning the patient was able to actively sit on the edge of the bed with assistance and better trunk control. This improvement indicates that early mobilization has a positive impact on the recovery of the patient's functional ability post-CABG.

Prolonged bed rest after heart surgery is known to cause a decrease in cardiac output, muscle weakness, reduced physical capacity, and increased risk of secondary complications such as deep vein thrombosis, pneumonia, and pressure ulcers (Jalili et al., 2025). Therefore, early mobilization becomes one of the important strategies to prevent deconditioning due to immobilization.

Early rehabilitation has been proven to improve patients' functional independence and shorten hospital stays(Han et al., 2022). In addition, an optimal rehabilitation program is also important to prevent long-term activity limitations in post-CABG patients, because some patients still experience dependence in daily activities up to one year after surgery if they do not receive adequate rehabilitation (Emamzadehashemi et al., 2024).

During the implementation of physiotherapy interventions in the ICCU, the patient was also closely monitored for blood pressure, pulse rate, respiratory rate, SpO_2, pain level, and activity tolerance to ensure the safety of the exercises. No signs of hemodynamic instability or complications were found during the rehabilitation program. This indicates that providing gradual breathing exercises and early mobilization under proper supervision is safe for post-CABG surgery patients in the ICCU.

STUDY LIMITATION

This study has several limitations that need to be considered. First, this case report involves only one patient, so the results obtained cannot yet be generalized to all patients with Coronary Artery Disease (CAD) post-Coronary Artery Bypass Grafting (CABG). Second, the duration of physiotherapy intervention in this study was relatively short, conducted over only three therapy sessions during the acute care phase in the ICCU, and thus cannot depict the effectiveness of the intervention in the long term. Third, this study has not conducted follow-up after the patient was discharged from the ICCU or hospital, so the progression of the patient's functional condition during the subsequent rehabilitation

phase cannot be evaluated comprehensively. Therefore, further research with a larger number of subjects, longer intervention duration, and long-term follow-up evaluation is needed to strengthen the findings related to the benefits of physiotherapy in post-CABG patients.

CONCLUSION

Physiotherapy interventions, including diaphragmatic breathing exercises, deep breathing exercises, active range of motion (AROM) exercises, and early mobilization in Coronary Artery Disease (CAD) 3VD patients post-Coronary Artery Bypass Grafting (CABG) in the ICCU, show improvement in clinical conditions during the acute rehabilitation phase. This improvement is seen in reduced pain levels, decreased shortness of breath, increased thoracic expansion, as well as enhanced patient functional mobility after the interventions were given. These findings indicate that physiotherapy management can support early recovery, help prevent postoperative complications, and improve functional independence in post-CABG patients undergoing intensive cardiac care.

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