T.C.
YEDİTEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF PHYSIOTHERAPY AND REHABILITATION

EXAMINATION OF PATIENTS UNDERGOING OPEN-HEART SURGERY IN TERMS OF QUALITY OF LIFE, FUNCTIONAL CAPACITY AND GRIP FORCES IN THE PRE- AND POST-OPERATIVE PERIODS.

MASTER THESIS

İrem ÇAYLAK YETÜT

ISTANBUL 2022

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DECLARATION

I hereby declare that this thesis is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree except where due acknowledgment has been made in the text.

22/06/2022
İrem Çaylak Yetüt

DEDICATION

TO MY UNIQUE, VALUABLE FAMILY…

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LIST OF SYMBOLS AND ABBREVIATIONS

CVD	Cardiovascular Disease
CHD	Coronary Heart Disease
CAD	Coronary Artery Disease
PAH	Peripheral Artery Disease
MI	Myocardial Infarctus
NO	Nitric Oxide
LDL	Low-Density Lipoprotein
BMI	Body Mass Index
CABG	Coronary Artery Disease
CPB	Cardiopulmonary Bypass
CR	Cardiac Rehabilitation
OHS	Open Heart Surgery
PFT	Pulmonary Function Test
FVC	Force Vital Capasity
FEV_1	Forced Expiratory Volume First Second
PEF	Peak Expiratory Flow
TUG	Time Up and Go Test
30s-CST	30 Second Chair Stand Test

ABSTRACT

Çaylak Yetüt İ. (2022) Examination Of Patients Undergoing Open-Heart Surgery In Terms Of Quality Of Life, Functional Capacity And Grip Forces In The Pre- And Post-Operative Periods.Yeditepe University, Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, Master Thesis. Istanbul

Our study was planned to examine the quality of life, functional capacity and comprehension of patients who underwent open heart surgery in the preoperative and postoperative periods. The study consisted of patients between the ages of 40 and 70 who underwent open heart surgery. The study consisted of 31 patients. The patients included in the study were evaluated in the pre-surgery, post-surgical discharge stage and first polyclinic control after discharge (3 weeks after discharge). Participants were evaluated for quality of life (SF-36), pain assessment, pulmonary function test, functional capacity measurement tests and hand grip strength. As a result of the evaluation, the highest quality of life values were reached in the SF-36 quality of life scale in the following up 3rd week period compared to other periods ($p<0.05$). In pulmonary function assessment, the highest value was found in the preop period and the lowest value was found in the porest period ($p<0.05$). In the functional capacity assessment tests, the follow-up 3rd week measurement in the time up and go (TUG) test was found to be lower than the other periods and the preop and postoperative discharge periods were found to be similar ($p<0.05$). In the 30-second chair test, which evaluates another functional capacity, the postop measurement was lower than the other periods, while the preop and follow-up 3rd week periods were found to be similar. In the test that evaluated the hand grip force, the highest value was found in the preop period and the lowest value was found in the postop discharge period ($p<0.05$). After open heart surgery, the quality of life, respiratory functions, functional capacity, hand grip strength of the person should be evaluated and longer-term follow-ups should be made.

Keywords: Open heart surgery, pulmonary function tests, cardiac rehabilitation, functional capacity.

ÖZET

Çaylak Yetüt İ. (2022) Açık kalp cerrahisi geçiren hastaların ameliyat öncesi ve ameliyat sonrası dönemlerde yaşam kalitesi, fonksiyonel kapasiteleri ve kavrama kuvvetleri yönünden incelenmesi. Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü, Fizyoterapi ve Rehabilitasyon Bölümü, Yüksek Lisans Tezi, İstanbul.

Çalışmamız açık kalp cerrahisi geçiren hastaların ameliyat öncesi ve sonrası dönemlerde yaşam kalitesi, fonksiyonel kapasiteleri ve kavrama yönünden incelenmesi amaçlanarak planlandı. Çalışmaya açık kalp ameliyatı geçiren 40-70 yaşları arasında hastalar oluşturmuştur. Çalışmaya 31 hastadan oluşmuştur. Çalışmaya dahil edilen hastalar cerrahi öncesi, cerrahi sonrası taburculuk aşaması ve taburculuk sonrası ilk poliklinik kontrolü (taburculuktan 3 hafta sonra) dönemlerde değerlendirildi. Katılımcılar, yaşam kalitesi (SF-36), ağrı değerlendirmesi, solunum fonksiyon testi, fonskiyonel kapasite ölçüm testleri ve el kavrama gücü değerlendirilmiştir. Değerlendirme sonucunda SF-36 yaşam kalitesi ölçeğinde follow up 3 rd week döneminde diğer dönemlere kıyasla en yüksek yaşam kalitesi değerlerine ulaşılmıştır ($p<0,05$). Solunum fonksiyon değerlendirmesinde en yüksek değer, preop döeneminde en düşük değere ise postop döneminde bulunmuştur ($p<0,05$). Fonksiyonel kapasite değerlendirme testlerinde time up and go (TUG) testinde follow up 3. week ölçümü, diğer periyotlardan düşük bulunmuş ve preop ve postop discharge dönemleri ise benzer olduğu görülmüştür ($p<0,05$). Diğer bir fonksiyonel kapasiteyi değerlendiren 30-second chair testinde postop ölçümü, diğer dönemlerden düşük bununla birlikte preop ve follow up 3.week periyotları ise benzer bulunmuştur. El kavrama kuvvetinin değerlendiren testte en yüksek değer, preop periyodunda ve en düşük değer ise postop discharge periyodunda bulunmuştur ($p<0,05$) Açık kalp ameliyatı sonrası kişinin yaşam kalitesi, solunum fonksiyonları, fonksiyonel kapasitesi, el kavrama gücü değerlendirilerek daha uzun süreli takiplerin yapılması gerekmektedir

Anahtar Kelimeler: Açık kalp cerrahisi, pulmoner fonksiyon testleri, kardiyak rehabilitasyon, fonskiyonel kapasite.

1. INTRODUCTION AND PURPOSE

Despite the developments in medical-surgical diagnosis and treatment methods, cardiovascular diseases are a group of life-threatening diseases that significantly affect the quality of life in our country and around the world every year. According to the research conducted by the Turkish Society of Cardiology, 330 thousand people are newly diagnosed with coronary heart disease (CHD) every year in Turkey (1). Cardiovascular diseases have an important place among chronic diseases. In the presence of risk factors such as advanced age, obesity, hypertension, smoking, hypercholesterolemia and diabetes mellitus, the risk of getting sick increases even more (2). Today, the most widely used method in the surgical treatment of heart diseases is open-heart surgery. Open heart surgery, coronary artery diseases, heart valve diseases, repair of congenital lesions, and heart transplantation are the treatment methods applied for transplantation (3).

After heart surgeries, many complications include cardiac, respiratory, and neurological development in patients. Cutting many important and large muscle groups during surgery, performing sternotomy procedures, chest wall, and muscle destruction cause the patient to experience pain in the early postoperative period (4). Anxiety, pain, and fatigue influence patients' recovery after surgery (5). In addition, the pain experienced after heart surgery also affects the morbidity and mortality of the person. Improvements in pain management reduce patients' need for ventilators and intensive care support at an early stage (4). In addition, in the post-cardiac surgical period, a decrease in respiratory muscle strength, oxygenation, and pulmonary function is widely observed. A significant decrease in functional capacity also occurs. In this context, cardiopulmonary rehabilitation in the acute period consists of various physiotherapy techniques aimed at helping to improve function earlier and reduce the incidence of complications.

Cardiac rehabilitation (CR) aims to rehabilitate the bio-psycho-social capacities of people with cardiac diseases and to include multidisciplinary rehabilitation components that enable them to maintain these capacities throughout life (6). CR is divided into 4 phases in terms of the time the patient is rehabilitated. Phase 1 rehabilitation program covers the intra-hospital period. When the patient's clinical values stabilize, the rehabilitation program is started. The Phase 1 CR process usually

starts in the intensive care unit and covers the period during which the patient will be admitted to the service and discharged (7). If no complications develop, phase 1 lasts 5-10 days.

The main objective of the Phase 1 rehabilitation program is to reduce the length of hospital stay, regulate the patient's clinical values to normal values, increase the capacity of respiratory muscle functions, eliminate secretion occurring in the airways, to prevent the development of pneumonia and atelectasis. Phase 1 rehabilitation components include patient education, positioning, mobilization, breathing exercises (intensive spirometer), respiratory control (slow and deep breathing, diaphragmatic breathing, pursed-lip respiration), bronchial hygiene techniques, respiratory muscle training, and thoracal expansion exercises (6,7).

Phase 2 rehabilitation covers the period of 3-6 weeks after discharge. It is considered the most important stage of CR (8). After the patient is discharged, he continues the in-home exercise training given in the hospital.

In CR, a comprehensive evaluation of the patient's physical, physiological, functional levels and interpretation of the evaluation findings have an important role in planning the program to be applied to the patient. It includes components such as anamnesis, inspection, palpation, evaluation of body components, electrocardiographic evaluation, laboratory evaluation results, respiratory evaluation, and CR outcome measures. SF-36 (quality of life), VAS pain score, pulmonary function test, functional capacity test (timed get up and walk test, 30 seconds get up and sit test), and handgrip strength are applied to evaluate parameters after cardiac surgery (9,10,11,12). With the data obtained as a result of these tests, information about the general health status of the patient can be obtained and the appropriate rehabilitation program can be applied to the patient.

The aim of the study was determined as the examination of patients who underwent open-heart surgery in terms of quality of life, functional capacity, and comprehension strength during the preoperative and postoperative periods.

There are two hypotheses in this study:

H0: There are no difference between preoperative, discharge stage and phase 2 early quality of life, pain, respiratory function, functional capacity, and handgrip strength

assessment results of patients who underwent open-heart surgery and were taken to a CR program.

H1: There are a difference between preoperative, discharge stage, and phase 2 early quality of life, pain, respiratory function, functional capacity, and handgrip strength assessment results of patients who underwent open-heart surgery and were taken to a CR program.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1. Cardiovascular Diseases

The cardiovascular system consists of heart and blood vessels (13), CHD heart and circulatory system disorders, and a series of heterogeneous diseases, usually caused by atherosclerosis (14). CHD is a chronic disease that develops slowly during life and occurs without symptoms for a long time. Usually, the only advanced disease causes symptoms, but the first symptom may be sudden death. It has been the leading cause of premature death worldwide for many years It is estimated that 23.6 million people will die from CHD each year by 2030 (15).

There are a wide variety of problems that can occur in the cardiovascular system. These are coronary artery disease (CAD), cerebrovascular disease (SVH), peripheral artery disease (PAH) and aortic atherosclerosis (16).

2.1.1. Coronary Artery Disease

Also known as CHD, it is a disease caused by reduced myocardial perfusion, which causes myocardial infarction (MI), angina or heart failure. Accounts for one-third of cardiovascular diseases (16). Coronary artery disease is typically manifested by angina, defined as crushing or pressure in the chest, which can spread to the medial direction of the left upper extremity, the neck or jaw, and is substernal pain of location. It results in palpitations, vomiting, nausea, sweating, syncope, and sudden death. (17).

2.1.1.1. Coronary Artery Pathogenesis

Atherosclerosis is a dynamic inflammatory process that can respond to medical treatment beyond an irreversible and progressive disease. Atherosclerosis is a disease of the muscular arteries (coronary and popliteal arteries) and elastic arteries (carotid, aorta and iliac arteries). It is a part of the disease group characterized by thickening of the vessel wall and loss of its flexibility.

A standard arterial wall consists of three layers. These layers are layintima, media and adventitia. The intima layer is arranged in a single row on the face facing the lumen. The intima layer consists of endothelial cells, the subendothelial matrix that supports them and the basement membrane. In some arteries, the surface area of the

intima thickens. Therefore, the arteries most prone to atherosclerosis are the branching points of the left main coronary artery, carotid arteries and distal abdominal aorta. The media layer, which is the middle layer, is in the middle and thickest layer of the artery wall. The adventitious layer's last layer is the outermost layer (18).

Endothelial cells located in the structure of the vessel form the important surface of the vessel in contact with blood and have very important functions that regulate the balance in the body well (due to their anti-inflammatory and anticoagulant properties). Therefore, endothelial activity disorder is associated with the pathogenesis of atherosclerosis. Due to the undamaged endothelium, the Nitric Oxide (NO) and prostacyclin are secreted and the endothelial surface is covered with heparin sulfate, which prevents the release of clot formation and leukocyte-binding factors and the oxidation of low-density lipoprotein (LDL) and provides regulation of vascular smooth muscle cells (19). Therefore, with its NO anti-inflammatory properties, it has a preventive effect on atherosclerosis at all stages. It has been shown that endothelial NO release decreases or increases destruction in conditions such as high blood pressure, diabetes mellitus, smoking or increased superoxide levels, which are known to facilitate atherosclerosis.

In the process of atherosclerosis, smooth muscle cells migrate from the media layer of the artery to the intima, and with a decrease in the content of contractile proteins, an increase in the number of synthetic organelles occurs. Endothelial dysfunction is the first basic step in the pathogenesis of atherosclerosis. In the process of response to damage, endothelial dysfunction disrupts the selectively permeable property of single-row endothelial cells and causes metabolic, mechanical, toxic and immunological events. Almost all the known risk factors (smoking, hypertension, diabetes, hypercholesterolemia) can lead to endothelial dysfunction.

Under normal conditions, the endothelial cell resists the adhesion of leukocytes. However, the damaged endothelium releases vasoactive substances into the environment, causing inflammation, platelet accumulation and vasoconstriction in the coronary artery, initiating atherosclerosis. With chronic hyperlipidemia, cholesterol, saturated fat and low-density lipoproteins begin to accumulate in the intima. Endothelial cell damage is one of the two main elements of atherosclerosis; It allows LDL and monocytes to pass under the endothelium. The first lesion manifestations of atherosclerosis occur with the oxidation of LDL, the conversion of monocytes into

macrophages to phagocytize them, and finally the formation of foam cells filled with fat particles. These processes also trigger a series of inflammatory events, leading to the accumulation of other inflammatory cells and cytokines in the environment (20).

The persistence of classical risk factors, the level of activity of the cells in the lesion and the balance between the production and destruction of enzymes, cytokines and mediators in the environment cause early lesions to progress to the advanced stages of atherosclerosis and the emergence of various lesion types (21).

2.1.1.2. Coronary Artery Disease Risk Factor

Many factors cause coronary artery disease. These factors are divided into two groups, modifiable and non-modifiable.

2.1.1.2.A. Irreplaceable Risk Factors

Age: Age is among the risk factors that cannot be changed in coronary artery disease as in every disease. The atherosclerotic structure in the vessels increases over time with age. It usually becomes more evident at the age of 65 and after. Most heart attacks occur after the age of 65 (22).

Gender: Gender-related differences have been consistently reported in individuals with coronary artery disease. The average age of women with coronary artery disease is 67-70 years, which is about 10 years older than the average age of men (23). Since estrogen may be a protective factor in the menopausal period in women, it is thought to protect from atherosclerosis during the period until menopause (24). After menopause, LDL increases in women and HDL levels stop.

Family History: Over the years, epidemiologists have recognized that genetic risk in coronary artery disease is responsible for 40% to 60% of predisposition to this disease (25).

2.1.1.2.B. Replaceable Risk Factors

Smoking: Smoking increases the risk of coronary artery disease by 2-4 times and the risk of death due to CAD by approximately 70%, regardless of gender and age (26).

Smoking is an important factor in early coronary atherosclerosis and accelerates atherosclerosis by increasing LDL oxidation and damaging coronary endothelial vasodilation (27).

Obesity: Over the past two decades, obesity has become a worldwide epidemic with a negative impact on both children and adults. Obesity has been associated with the development of CVD, including atherosclerosis and symptomatic CAD (28). Body mass index (BMI) is a common index used to determine obesity and overweight. Those whose BMI is greater than 30 are classified as obese. An increase in BMI in men under 65 years of age increases CVD mortality (29).

Hypertension: Hypertension is one of the most important risk factors globally (30). Hypertension is defined as blood pressure in the systemic arteries with a diastolic pressure above 90 mm/Hg and systolic pressure above 140 mm/Hg (31). Diastolic blood pressure is the strongest predictor of coronary artery disease in young and middle-aged people. The pathophysiology of high blood pressure, a risk factor for CAD, is complex, and the effect of blood pressure on the development of atherosclerotic plaque and the relationship between arterial stiffness and coronary perfusion are known. (32)

Physical Activity: It has been defined as physical inactivity, which is another important risk factor for the development of coronary artery disease. The definition of physical inactivity is determined as doing less than 150 minutes of activity in a week. (33). Dünyada her yıl yaklaşık 1,9 milyon ölümün fiziksel hareketsizliğe bağlı meydana geldiği tahmin edilmektedir (34). According to the American Heart Association, physical inactivity is among the preventable causes of many diseases. It has been reported that individuals with a high level of physical activity over the age of 40 have a lower risk of CVD compared to their peers (35). Individuals who are physically active and whose weekly calorie consumption is at least 1000 to 2000 have a low risk of developing coronary artery disease. International guidelines recommend that older adults engage in at least 2 and a half hours of moderate-intensity physical activity per week. However, almost 30% of the world's population does not meet this criterion (36).

Diabetes Mellitus: A disease of metabolism of carbohydrates, lipids and proteins, defined by the high level of hunger and satiety in plasma cells (37). Diabetes poses a major risk factor for developing cardiovascular disease, resulting in it being the most common cause of death in people with diabetes (38).

2.1.1.3.Surgical Methods for Coronary Artery Disease (Coronary Artery Bypass Graft Surgery)

CAD is one of the most common surgeries that require surgery for CVD. Coronary artery bypass grafting (CABG) is a procedure in which autologous arteries or veins are used as grafts by bypassing the partially or completely blocked coronary arteries by atherosclerotic material and aiming to restore blood flow (39). CABG is one of the effective surgeries in the treatment of CAD (40, 41).

A preoperative coronary angiogram is examined to determine whether the CABG procedure is suitable for the patient's coronary anatomy. Coronary arteries with clinically significant stenosis are considered potentially suitable for grafting. The most used bypass channels from CABG are the left internal thoracic artery and the large saphenous vein (42).

Coronary Artery Bypass Graft Surgery Indications: CABG provides permanent relief from chest pain, but the primary goal is to improve the survival of patients with coronary artery disease (39). Correct and appropriate patient selection for CABG is an important criterion for obtaining good results in surgery. The main factors to consider in determining whether CABG is indicated are as follows (43):

- The presence or absence of left ventricular systolic dysfunction,
- Stenosis of more than 50% of the left main coronary arteries,
- 70% or more stenosis in other vessels,
- Dysfunction of the left ventricle in addition to blockage in more than one coronary artery,
- Severe stenosis of the 3 main coronary arteries,
- Severe ventricular arrhythmias,
- Percutaneous coronary intervention failure or complication,
- History of CABG surgery,
- Asymptomatic / Mild Angina,
- Stable Angina,
- Angina does not respond to medical treatment.

Coronary Artery Bypass Graft Surgery Contraindications (44)

- Absence of signs of angina and ischemia,
- Coronary arteries are not suitable for graft anastomosis,
- Although there is a poor left ventricular function, only heart failure symptoms and signs are seen (left ventricular ejection fraction below 20-30%),
- Patients not accepting surgery.

2.1.2. Coronary Valve Disease

In recent years, significant advances have been made in understanding the natural structure, function, and biology of heart valves, the pathobiology of heart valve disease, and the clinical management. Clinical outcomes depend on the rate and degree of development of valve dysfunction and the quality of compensatory mechanisms (45).

Heart valve diseases include.

- Aortic valve stenosis
- Aortic valve failure
- Mitral valve stenosis
- Mitral valve insufficiency
- Mitral valve prolapsus

2.1.2.1. Coronary Valvular Disease Pathogenesis

The heart's valves are involved in keeping blood flowing in one direction from the heart to the lungs and other parts of the body. Valves must maintain their structure while opening and closing more than 3 billion times in a person's lifetime (46). Both types of valves control the atrioventricular valves (mitral valve and tricuspid valve) and seminal valves (aortic valve and pulmonary valve) that control the unidirectional flow of blood from the heart. During systole, with the contraction of the ventricles, blood is expelled from the semilunar valves of the pulmonary and aorta, while the closure of the tricuspid and mitral atrioventricular valves prevents the backflow of blood into the atrium. Similarly, during diastole, blood flows through the tricuspid and mitral valves as the ventricles fill, while closed semilunar valves prevent blood from returning to the heart (47). Valvular disease is characterized by stenosis and, therefore, obstruction of

further flow or insufficiency. Factors such as infection, trauma, ischemic diseases, genetics, degeneration, and rheumatic diseases can cause congenital or postpartum diseases in the heart valves (48). Degenerative valve disease or Calcific aortic valve disease is the most common cause of aortic stenosis in adults (49). Aortic stenosis and mitral regurgitation are the 2 most common valve lesions (50).

2.1.2.2 Coronary Valvular Disease Surgery

Isolated or combined with CABG surgery, aortic valve surgery is the most preferred intervention and accounts for 67% of all valve surgery procedures. The main purpose of heart valve surgery is to repair or replace the valve that has lost its function before irreversible damage to the myocardium occurs and serious symptoms occur in the patient. In this way, it is aimed to reduce the symptoms and complaints of the patient and return to daily living activities and prolong the life span (51).

2.1.2.2.A. Valve Repair

For a successful valve repair, it is important to know and evaluate the problematic mechanism. The type of valve repair varies according to the function of the valve and its cause.

2.12.2.B. Heart Valve Replacement

In cases where heart valve repair cannot be performed, it is the replacement of damaged valves and structures in stenosis, insufficiency or combined problems and artificial or biological valve replacement. Cerrahi girişim genel anestezi altında yapılır. Cardiopulmonary bypass is used during surgery (52).

Coronary valve surgical indications: The indications American college of cardiology/American heart association task force on clinical practice guidelines for valve replacement are as follows (53):

- Symptomatic patients with severe high gradients,
- Asymptomatic patients with severe disease and left ventricular ejection fraction of less than 50%,

- It applies to low-risk asymptomatic patients with very severe aortic stenosis.

2.1.3. Complications After Open Heart Surgery

Open heart surgery (OHS) is an operation that adversely affects many systems in the body and then carries the risk of developing serious complications.

2.1.3.1. Cardiovascular Complications

Cardiovascular surgeries, besides being lifesaving, are procedures that cause complex and various complications. In general, individuals with cardiovascular disease are elderly and patients with multiple comorbidities. Therefore, they are sensitive to the side effects of surgery (54).

- Although the prevalence of postoperative brain damage is high, the incidence of stroke is 10%.
- Bleeding, arrhythmia, recurrent heart attack,
- Damage to the nervous system during surgery
- Infection of the sternum incision,
- Kidney problems.

2.1.3.2. Pulmonary Complications

Pulmonary complications are an inevitable complication of cardiac surgery. It is known that patients who have undergone heart surgery have problems in their respiratory function after surgery. Pulmonary complications seen in 20% of patients undergoing cardiothoracic and upper abdominal surgery are a major cause of mortality and morbidity in the postoperative period.

Complications are as follows (55).

- Decreased lung expansion degree,
- Disruption of lung oxygenation
- Lung damage,
- Reduction in surfactant production,

- Decreased respiratory pattern due to pain and fear as a result of sternum incision and the development of atelectasis,
- Pleural effusion,
- Pneumonia,
- Prolongation of mechanical ventilation time,
- pulmonary edema, cardiogenic pulmonary edema, pulmonary embolism, phrenic nerve damage,
- Pneumothorax as a result of venous catheterization,
- Sternal wound infection,
- Phrenic nerve damage that occurs during the removal of the internal mammary artery for graft use.
- Lack of function of the diaphragm.

2.1.4. Cardiopulmonary Bypass

It is used in cardiac procedures such as a heart-lung machine or cardiopulmonary bypass (CPB), CABG, cardiac valve replacements, and septal defect repairs. (56).

The Heart-lung Machine performs the task of the heart and lungs by sending carbon dioxide-free and oxygen-enriched blood to other organs of the body. The system in which a motionless environment is provided by stopping the heart and lung during surgery is called CPB. Heart surgeries performed using this method are called OHS (57).

CPB can cause some changes in the body due to its mechanical components and interactions with blood. Most organs are affected by the mechanism of CPB, due to the constant flow rate between blood and artificial substances, hypthermia, contact, and anticoagulation. Complications can occur immediately after surgery, in the intensive care unit, or later. Despite technological advances, prolonged CPB increases the risk and complications. The most important complications of CPB are; low cardiac output, bleeding arrhythmias, renal failure, respiratory failure, and neurological or neuropsychiatric changes in fluid and electrolyte imbalance (58).

2.2. CARDIAC REHABILITATION

2.2.1. Definition and Purpose of Cardiac Rehabilitation

The World Health Organization defines CR as "the sum of the activities required to positively influence the underlying cause of the disease and provide the best possible physical, mental, and social conditions for patients to do through their own efforts " (59). In CR, the characteristics of each main component of rehabilitation are in accordance with current national guidelines and it is essential that the rehabilitation program is updated in accordance with the patient (60).

In the early 20th century, people with cardiovascular disease were advised to minimize physical activity after the operation, but later it was seen that this method affected the functional capacity of the patient, increased the length of hospital stay, and serious complications developed. As research on the harmful effects of long-term immobilization has increased, it has been found that early ambulation alleviates them (62).

CR programs are an important part of the standards of care in modern cardiology. CR has been shown to have a comprehensive effect on the patient's clinical outcomes, risk factors, psychological, nutritional, social factors and behavioral (63).

In addition to the post-operative administration of CR, there are components based on early detection of the disease process and implementation of interventions to prevent progressive prognosis.

Clinical studies have proven that CR can slow, stabilize and even moderately reverse the progression of atherosclerosis and reduce CVD (64, 65). The aim of CR is to control cardiovascular risk factors in cardiac diseases, develop and maintain functional capacity, increase the quality of life of the person, and reduce morbidity and mortality. The realization of all these goals is done according to the short and long-term goals planned in the rehabilitation program. In the short term, it is aimed for the patient to regain both psychosocial and functional daily life activities. In the long term, it aims to create desired daily life changes and sustain this throughout life and increase the quality of life (66).

2.2.2. Cardiac Rehabilitation Indication And Contraindication

Generally accepted indications for CR include:(67,68):

- Acute myocardial infarction,
- Stable angina pectoris,
- CABG surgery,
- Heart valve repair or replacement,
- Percutaneous transluminal coronary angioplasty,
- Heart transplant or heart-lung transplant,
- Coronary angioplasty or coronary stenting,
- Stable chronic systolic heart failure,
- Peripheral artery disease,
- Implantation of pacemakers or defibrillators,
- Dilated cardiomyopathy.

Generally accepted contraindications for CR include (69):

- Decompensated heart failure,
- Uncontrollable atrial or ventricular arrhythmia,
- Unstable patients, including those with unstable angina and severe pulmonary hypertension,
- Fever or acute systemic diseases,
- Tromboflebit,
- Acute pericarditis/endomyocarditis, other acute infections,
- Severe aortic stenosis,
- Critical obstructions of the left ventricular outflow tract,
- Severe obstructive cardiomyopathies,
- Patients who cannot be rehabilitated for physical, emotional or mental reasons.

2.2.3. Physiotherapy Evaluations Before and After Open Heart Surgery

In CR, evaluating the functional, physiological and physical capacity of the person, interpreting the findings of the person and preparing the appropriate treatment program for the patient is an important step of rehabilitation.

Before physiotherapy evaluations, the patient's file should be carefully examined and if there is a contraindicated condition, the evaluation should not be made until the patient's medical condition is stable (70).

Anamnez: It is the most important stage of the evaluation step. In this section, information about the patient's medical history, risk factors, family history, past treatments, results, drug history, comorbidity situations signs and symptoms are obtained.

The typical symptoms seen in heart disease are as follows.

- Chest pain
- Stick Finger, Reynaud Phenomenon
- Dizziness
- Shortness of breath (Dyspnea)
- Cyanosis
- Intermittent claudication
- Numbness and pain in the extremities
- Insomnia
- Oedema
- Hemoptysis

Assessment of Body Composition: BMI is one of the measurements used to determine overweight and obesity.

Evaluation of Vital Signs:

- Heart rate
- Blood pressure
- Respiratory frequency
- Saturation

Evaluation of Breathing: Pulmonary complications after cardiac surgery significantly affect the level of morbidity and mortality. In addition to the effects of anesthesia and intraoperative events, postoperative pain, postoperative activity restrictions and physical disorders may exacerbate pulmonary impairment (71). Therefore, the patient's respiratory system should be evaluated comprehensively before and after surgery. The pulmonary function test is often considered the basis of diagnosis in many categories of pulmonary disease. The person's respiratory type (thoracic abdominal, thoracoabdominal respiration or pursed lip respiration), depth, frequency, dyspnea, chest expansion, respiratory functions, evaluation of respiratory muscle strength and oxygen saturation should be determined and measured. Respiratory functions are evaluated with a spirometer according to The American Thoracic Society and European Respiratory Society criteria (72).

Functional Class and Functional Capacity Assessment: International guidelines have identified patients as an important component of estimating their risk of major postoperative morbidity and mortality, as the assessment of preoperative cardiopulmonary fitness or functional capacity (73).

2.2.4. Cardiac Rehabilitation Phases

CR classically consists of three stages.

Phase I: Refers to inpatient rehabilitation during hospitalization. 5-10 days.

Phase II: Early period after discharge. It refers to physical activity and patient education monitored by the outpatient, under the supervision of a doctor. Patient continues the exercise program that is constantly followed. It is 2-12 weeks.

Phase III: Patient education is continued and accurate information is provided about the person's disease. It is 3-9 months.

Phase IV: It is the preventive stage. It is the period when positive changes are continued, lifestyle should be changed and maintained for a lifetime (74).

2.2.4.1. Phase 1 Cardiac Rehabilitation and Purpose

Physical ability level consists of two main components: musculoskeletal and cardiopulmonary system. Physical activity includes body composition, cardio-respiratory ability, muscle strength and flexibility. The level of physical activity, especially after bed rest, significantly reduces cardiovascular tolerance and increases physical weakness. Maintaining and improving pulmonary capacities and muscle strength in patients after cardiac surgery form the foundations of early-stage phase 1 rehabilitation (6).

It is known that CR is indicated for patients with acute MI, chronic stable angina, heart valve repair or replacement, CABG surgery, chronic heart failure, and patients who have had a heart transplant. The patient to be treated is expected to be stable in terms of vital signs, electrocardiography and hemodynamics after cardiac surgery. This period varies between 24-48 hours (7).

Phase I rehabilitation program, which is one of the most used protocols in general, is considered as the most important phase of rehabilitation. As a result of the placement of median sternotomy and thoracic drainage tubes, these patients have a reduction of up to 30% in their pulmonary volume and capacity. Therefore, the inclusion of a well-defined program of breathing exercises for postoperative cardiac surgery patients is important in the phase I rehabilitation program. Phase 1 CR covers the period starting from the coronary intensive care unit until the patient's discharge from the hospital after the patient's condition stabilizes. Under normal conditions, this process takes about 2 weeks (6,7).

The purpose of Phase 1 CR can be listed as follows**;**

- To ensure the mobilization of the patient at the earliest time and thus reduce the duration of intensive care and hospital stay.
- To teach the process of adapting to a healthy lifestyle by providing patient and family education.
- Facilitating and accelerating the patient's adaptation to the acute event and the hospital environment.

- To adjust the physical activity plan suitable for the patient by considering the patient's heart rate and blood rate parameters and the duration, intensity and frequency of the exercise.
- Supporting the patient in a bio-psycho-social sense.
- Reduce the risk of thrombus.
- Maintaining existing muscle tone.
- Reduce orthostatic hypertension.
- Provide range of motion.
- -Improve respiratory function.
- -Preventing atelectasis and pneumonia (75).

2.2.4.1.1. Phase 1 Cardiac Rehabilitation Applications

Phase 1 CR consists of patient education, positioning, mobilization/early mobilization, breathing exercises, bronchial hygiene techniques, and respiratory muscle training.

2.2.4.1.1.A. Patient Education

An important component of the CR program is patient education. By increasing the patient's knowledge and compliance with rehabilitation, patient education reduces anxiety and facilitates physical recovery. Patients recovering from a sudden cardiac event should learn to live with a chronic illness and should be conscious. Even patients who do not have CHD but are in CR due to another cardiovascular disease need long-term rehabilitation as part of their lives. It is the responsibility of the CR team to provide patients and their families with therapy and education that will prepare them to cope with a new lifestyle should be explained why physiotherapy is needed, how it will feel and how long it will be applied, and patients who will be operated with median sternotomy should be taught how to protect the operation incision area (76).

Patients who cannot learn to live within the therapy program may return to their pre-ill lifestyles, face the risks of pre-illness lifestyles, and face the risk of premature death. Patient education for a healthier lifestyle is essential at every stage of cardiac rehabilitation. (77).

2.2.4.1.1.B. Positioning

This stage is very important as it is the first contact with the patient. For patients who are not in stable condition, positioning may sometimes be the only treatment. Positioning improves ventilation-perfusion compliance and increases oxygenation. In patients with unilateral lung involvement presenting with acute respiratory failure, an increase in oxygenation has been shown when the healthy lung is positioned to the bottom (78).

For hemodynamic measurement after cardiac surgery, patients are given a 0º straight position on their back. In critically ill patients, undesirable effects such as inability to tolerate a straight position on the back, impaired breathing and increased pain occur. Raising the bedside is known to have a therapeutic effect, especially on respiratory function (79,80). Functional residual capacity is highest during standing upright, second in a sitting position and lowest in a supine position. However, the side-lying position cannot be used in the phase I CR period due to thoracotomy in patients undergoing cardiac surgery. The patient should be warned not to move their arms above 90 degrees due to sternum incision during bed rest and not to move their trunks with support from their hands and arms.

The placement of lung segments in gravity-assisted positions facilitates the excretion of secretions. Thus, it prevents airway closure and prevents the accumulation of secretions. Proper positioning prevents contracture, produces significant changes in vital signs, and can reduce the development of spasticity. A change of position every 2 hours resulted in a significant reduction in mechanical ventilation time, intensive care unit length of stay and incidence of pneumonia. An upright position on the back at 45 degrees allows for comfortable and optimal breathing. The elevated lying position improves lung volumes, reduces breathing work, and reduces the frequency of ventilator-related pneumonia in patients in the weaning process (81,82).

2.2.4.1.1.C. Mobilization / Early Mobilization

The rehabilitation process begins after the patient is informed about the purpose of rehabilitation. The first goal is to start the rehabilitation protocol as soon as possible. Due to the disadvantages and harmful effects of immobility and rest in cardiac surgery patients, early mobilization and early ambulation should be gradually taught and encouraged as early as possible. It prevents cardiovascular, respiratory, metabolic,

musculoskeletal, genitourinary, gastrointestinal, neurological and psychological complications caused by long-term immobilization and helps patients to return to their daily life activities in a short time and become self-sufficient (83).

At this stage, the mobilization content should be arranged such as in-bed exercises (active-passive range of motion exercise), bedside sitting and short-distance walking (84). The rehabilitation program that starts at the moment the patient is taken to the service is planned in the phase 1 rehabilitation program of passive, active and active-assistive exercise, eating, toilet needs, short distance walking, stair climbing in the supine position, sitting position and standing.

The program, which lasts 5-10 minutes at the beginning of the rehabilitation program, is increased to 20-30 minutes at the end of phase I. In the intensive care phase, the range of motion exercises, which are started with approximately 10 repetitions on the day of the operation, is increased as the service phase is started. Before starting rehabilitation, the patient's pulse, blood pressure, respiratory frequency, saturation, muscle and joint limitations, dizziness, general appearance and symptoms are evaluated. Before and after each exercise phase, heart rate and blood pressure are recorded.

Cardiac surgery physiotherapy applications are as follows (74,84,55):

<u>Rehabilitation Applications in Supine Position:</u>

- Toe flexion and extension.
- Active ankle dorsiflexion and plantar flexion.
- Active ankle eversion and inversion.
- Knee-hip flexion-extension, shifting the foot over the sheet.
- Hip abduction and adduction.

<u>Rehabilitation Applications in Sitting Position:</u>

The patient should be sitting in a chair at a height that can bring the knee to 90° flexion relative to the hips and floor.

- Toe flexion and extension.
- Knee flexion and extension.
- Hip flexion. One leg is up and down alternately with the other leg.
- Neck flexion and extension movements.

<u>Rehabilitation Applications in Standing Position:</u>

If tolerated, 5 minutes of standing and walking in place are given from the post-op day 1. After the post-op day 1, the walking time in the corridor is gradually increased.

- Neck flexion and extension movements.
- Shoulder circumduction.
- Lateral trunk rotations.
- Active dorsiflexion and plantar flexion in the ankle.

2.2.4.1.1.D. Breathing Exercises and Intensive Spirometer

Under general anesthesia after surgery, the tracheobronchial cilial activity of the patient decreases. Inconclusion depression of the central nervous system in the respiratory center, a superficial breathing pattern occurs. Intubation, on the other hand, increases secretion production by stimulating the mucous membrane and leads to secretion accumulation. Inconclusion sternotomy and the placement of thoracic and mediastinal drainage tubes, many patients experience a decrease in pulmonary volume and capacity (86). Another important component that restricts breathing is incision pain. Incision pain causes superficial breathing. Thus, lung expansion is restricted and a good secretion excretion cannot be performed as a result.

Breathing exercises increase ventilation, oxygenation, inspiratory capacity, tidal volume, mobility of the thoracic cage and the effectiveness of the coughing reflex, facilitate the excretion of secretions in the bronchial airways, improve gas exchange and reduce hyperinflation. As a result of all this, respiratory function improves, exercise tolerance and quality of life increases (76).

After cardiac surgery, various respiratory physiotherapy is required to increase the breathing volume of the person, provide good oxygenation to the body and to reduce respiratory complications. Cardiopulmonary rehabilitation programs aim to support the healing process after cardiac surgery and reduce the negative impact of surgery (87,88). After cardiac surgery, extubated, spontaneous breathing and cooperative patients can start breathing immediately within the scope of the phase I CR program (89).

Breathing exercises; consist of pursed-lip breathing, maximum inspiratory hold breathing, diaphragmatic, segmental, low-frequency and glossopharyngeal breathing techniques.

Another breathing exercise technique, the intensive spirometer, is based on maintaining maximum inspiration, is designed to suspiration natural sighing and provides visual feedback and aims to increase lung expansion. During the application of the intense spirometer, at least 30 seconds should be rested between maneuvers, as alkalosis due to hyperventilation may develop. It should be done a minimum of 5-10 times every hour that the patient does not sleep. It is used to prevent or reduce atelectasis after surgery and to improve airway hygiene (90).

Deep breathing exercises and the use of intensive spirometers are methods that increase lung expansion with a challenging vital capacity above 20 mL/kg. The main purpose is to increase intra-alveolar pressure or to increase lung volume by reducing pulmonary pressure by improving transpulmonary pressure capacity (91).

The pulmonary rehabilitation program is as follows (92);

- If the patient has secretion in the early period, deep and regional breathing exercises are given for secretion mobilization.
- To perform diaphragmatic breathing, the patient is instructed to take a slow, deep breath through the nose, work on rhythmically inflating the abdomen, expel air through half-open lips, and see how the abdomen descends. The patient will be encouraged to continue to practice this protocol for 6 to 10 diaphragmatic breaths several times a day.
- Pursed-lip breathing is a breathing exercise that aims to evacuate the air in 4-6 seconds by pursing the lips while taking deep breaths through the nose and exhaling deeply through the mouth.
- Intensive spirometry is planned as 10 repetitions every hour that the patient is awake, starting from post-op day 1.
- Mobilization exercises including thoracic extension and neck and shoulder rotations should be trained.

2.2.4.1.1.E. Bronchial Hygiene Techniques

Mucociliary activity and cough are important components in cleaning the airways of the person. Viscous secretion, presence of tracheostomy tube, neuromuscular disorders, pain, immobility and inadequate humidification after cardiac surgery impair mucociliary activity and lead to secretion accumulation. The goal here

is to reduce secretions that block the airway and prevent respiratory infections. As a result, the collapsed regions of the lung expand again, increasing gas exchange and reducing the inflammatory response (93).

It is applied in people who have secretion with bronchial hygiene techniques and who have insufficient coughing ability. The most preferred methods in bronchial hygiene techniques are positioning, cough, postural drainage methods, and manual techniques (percussion, shaking and vibration). Respiratory techniques (prediction of positive airway pressure, and autogenic drainage.

Postural drainage: This technique is a positioning method that uses gravity to facilitate the progression of secretion from the periphery to the central airways. In this technique, secretion is removed by cough and forced expiration (94).

Manual techniques: It is a technique that which the physiotherapist uses her hands and involves applying certain forces in this way. Commonly used techniques are manual techniques such as percussion, shaking, and vibration.

- Percussion is applied in the inspiration and expiration phase by the physiotherapist by turning his hand into a dome; the transmission of energy waves through the chest wall ensures the movement of the secretion.
- Vibration and shaking are lighter treatments than percussion and are performed only during the expiratory phase of respiration (95).

Respiratory techniques: Active breathing techniques cycle consists of many different breathing cycles. These are breath control, forced exhalation technique, thoracic expansion exercises.

- Breath Control consists of breathing at tidal volume using a model in which the patient uses the diaphragm at respiratory frequency and volume.
- Thoracic expansion exercises consist of three or four repetitions of breathing along with a slow, deep inhalation through the nose. A pause of about 3 seconds at the end of inspiration followed by a passive exhalation.
- The forced exhalation technique is one or two challenging expirations and a tidal volume breathing action called "Huff". This exercise is most effective

when the length of the Huff and the force of contraction of the expiratory muscles are maximal and minimize the collapse of the airways (96,97).

2.2.4.1.2.F. Respiratory Muscle Training

The decreased force in the respiratory muscles is due to many reasons, such as the patient's stay in the intensive care unit and surgical applications. The main clinical problem in the intensive care unit in patients with respiratory muscle weakness is prolonged weaning time (inability to leave mechanical ventilation). Adherence to mechanical ventilation for more than 24 hours after surgery initiates diaphragmatic atrophy. For this reason, respiratory muscle training aims to increase functional capacity and respiratory muscle strength in adult patients undergoing cardiovascular surgery (98).

Physiotherapists aim to improve the function of the respiratory muscles by providing the patient with in-practice muscle training. Inspiratory muscle training has been shown to improve respiratory muscle function and may help reduce dyspnea during exercise (95). Respiratory muscle training responds to stimuli just like skeletal muscles. Numerous studies have shown that phase I cardiac rehabilitation practices include the benefits of inspiratory muscle training in post-surgical patients, increased respiratory function, shortened hospital stay, improved quality of life, and exercise capacity (99).

2.2.4.2. Phase 2 Cardiac Rehabilitation and Purpose

Phase II cardiac surgery program refers to programs aim to improve the functional capacity of the patient after cardiac surgery and prevent future cardiac diseases. It covers approximately 2-12 weeks after discharge. Patients are under close follow-up at this stage (100).

2.2.4.2.1. Phase 2 Cardiac Rehabilitation Applications

It is the period in which intensive aerobic exercise training takes place in order to increase cardiovascular endurance. Programs that are often designed to meet individual needs combine appropriate training and exercise.

3. MATERIALS AND METHODS

3.1.Subject

Our master's thesis titled " examination of patients undergoing OHS in terms of quality of life, functional capacity and grip forces in the pre- and post-operative periods'' was conducted at Istanbul University Department of Cardiovascular Surgery between October 2021 and June 2022. The study consisted of patients between the ages of 40 and 70 who had undergone OHS. We evaluated our patients in three periods: preop, postop discharge (7-10. day) and follow up at the 3rd week. Our study was conducted in accordance with the Declaration of Helsinki. All volunteers who participated in the study were informed verbally and in writing and their Informed Consent Form was given and their written consent was obtained (Appendix-1). The study was accepted by Yeditepe University Non-Interventional Clinical Research Ethics Committee on the date of 15.03.2022 with the application number 202202150 (Appendix- 2).

3.1.1. Power Analysis and Sample Size

The G power program was used to determine the required number of participants. The first assessment means of the challenging vital capacity value (101) in the study (101), which was referenced to evaluate the two-way hypothesis with 95% power and 0.05 Type-I error, was 90.1, the standard deviation was 17.2; the second evaluation means was 77.6 standard deviation 16. According to these statistical data, the number of patients required for the study was found to be 26. Considering the possibility of patients dropping out of the study, it was decided to include 31 patients by adding 5 more patients, which is 20% of the number of 26 patients.

3.1.2. Inclusion Criteria

- Undergoing OHS,
- Not being mentally retarded,
- Age between 40-70 years,
- To be hemodynamically stable,
- No walk disability,

- Not having an advanced visual defect,
- Patients who agreed to participate in the study.

3.1.3. Exclusion Criteria

- Aortic dissection and aneurysm diagnoses,
- Patients at high risk (those with ejection fraction below 35%),
- The presence of neurological, pulmonary and musculoskeletal diseases that restrict participation in exercise training,
- Patients who cannot be operated verbally and/or audibly,
- Patients who do not have psychological and/or perceptual cooperation.

3.1.4.Number of Participants

According to the study inclusion criteria, 31 patients were evaluated. During the study, 2 patients died, 2 patients did not continue to work in the late period, and 1 patient was excluded from the study because they returned to intensive care. As a result, a total of 26 patients were evaluated.

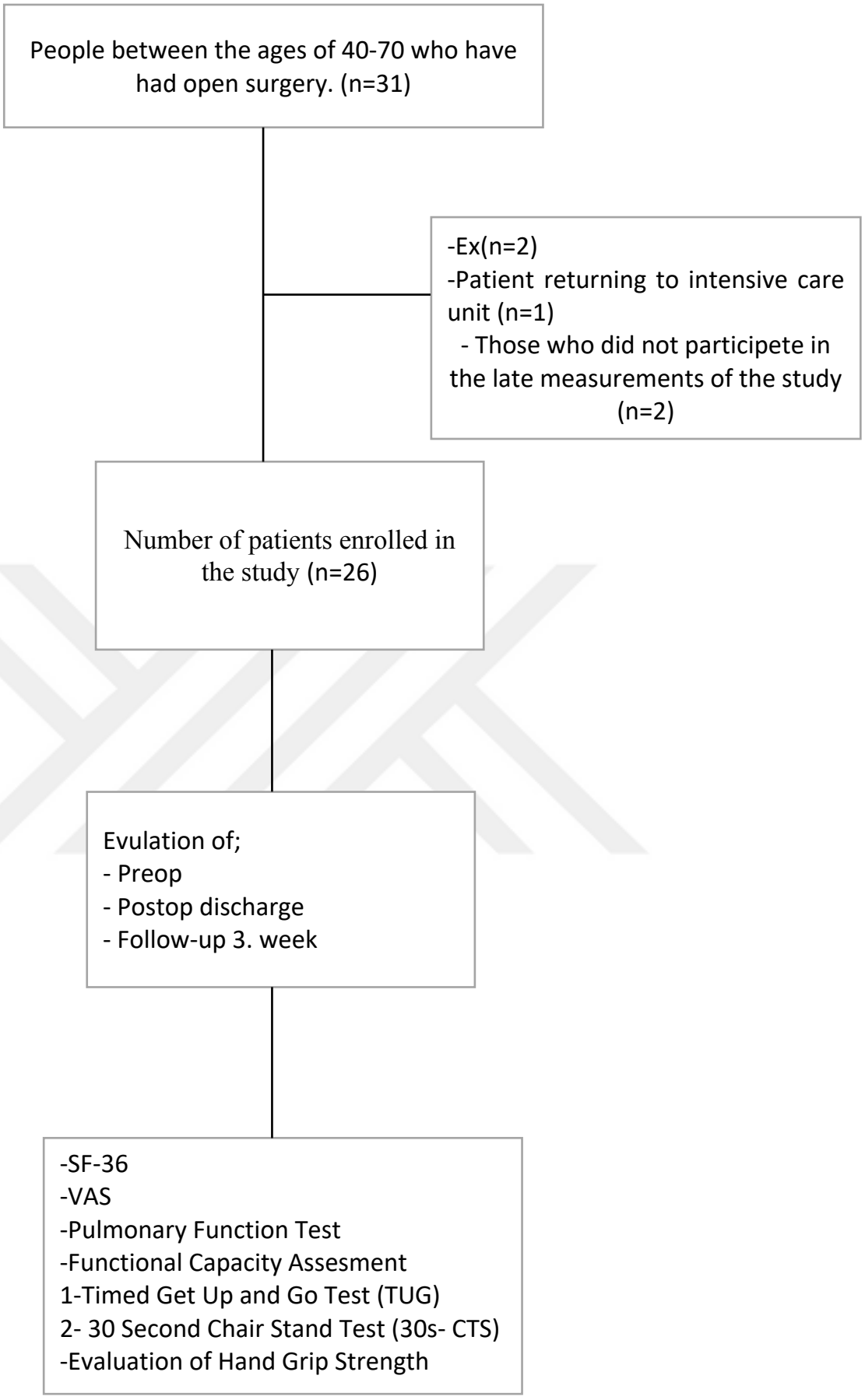

Figure 3. 1. Flow chart of the study

3.2. EVALUATION METHODS

3.2.1. Evaluation Protocol

The patients to be included in the study were evaluated in the pre-surgery, post-surgical discharge stage and the first polyclinic control after discharge (approximately 3 weeks after discharge). The study was explained to the patients who were recruited according to the inclusion criteria. Short Form (SF-36), Pain assessment (VAS), Pulmonary function test, functional capacity tests (timed get up and go test, 30 seconds stand and sit test) and handgrip strength assessment tests were applied to the subjects, whose validity and reliability have been proven in the literature.

The evaluations we planned in the preop period were applied to the patients. The patients were taken to the phase 1 cardiopulmonary rehabilitation program, including intensive care and service, until the post-op discharge day, and appropriate training was given, and the patient was re-evaluated at the discharge stage. Until the follow up 3rd week evaluation, the patients were called by phone to see if they applied the rehabilitation protocols that were trained. The patients were re-evaluated on the follow up 3rd week discharge from the service clinic.

3.2.2. Evaluation of Demographic and Clinical Information

The information of the people to be taken to the study with the Demographic Information Form was collected with the form (Appendix-3). The content of the form includes age, height (cm), gender, weight (kg), BMI, surgical applications, clinical diagnosis, treatment applications, drug history, duration of participation in the rehabilitation program, duration of stay in the intensive care unit, type of surgery (coronary artery bypass grafting, valve operation and other cardiac surgeries), intubation time, chest circumference measurement, respiratory type assessment, habits (smoking, alcohol, exercise), education status.

3.2.3. Comorbidity Assessment

It is an evaluation consisting of 19 comorbidity scores. Patients with a higher risk of death from comorbid disease in the comorbidity disease score may be

randomized separately from patients at lower risk. The disease score was developed to evaluate the effect of the number and severity of comorbidities on short and long-term morbidity and mortality by giving points for each disease (102) (Appendix-4).

3.2.4. Quality of Life Assessment (SF-36)

SF-36 is a test consisting of 36 items that must be filled in by the patient himself in order to obtain information about the person's health status with the evaluation. Physical function consists of 8 parameters: body pain, limitation due to physical problems, emotional well-being, limitation due to emotional problems, energy/fatigue, social function, and general health perception. Each question item has numbers next to the checkboxes. The measurement is provided by changing the number of the option marked by the patient according to a certain trajectory. The validity and reliability of the SF-36 Quality of Life Scale, which is easy to evaluate and interpret, are satisfactory. (103) (Appendix-5).

3.2.5.Pain Assessment (VAS)

The visual analog scale (VAS) is used to convert some values that cannot be measured numerically into numerical form. In a scoring system that will be evaluated over 10 points, the patient is asked to say a number for his/her own condition as 0 - no pain, 10 - unbearable pain. Pain conditions at night, activity and rest were evaluated separately (104) (Appendix-6).

3.2.6. Pulmonary Function Tests

The Pulmonary Function Test (PFT) is a group of tests that measures how well a person's lungs are working. This includes how well people can breathe and how effectively their lungs can oxygenate the rest of your body. PFT is performed with spirometer device. Spirometer is an instrument that can measure the changes in flow or volume during inhalation or exhalation as a derivative of time. Spirometer: It is routinely used in preoperative evaluations in the diagnosis of obstructive and restrictive pulmonary diseases, to determine the severity of the disease and its response to treatment.

In our study, respiratory functions were evaluated with Medical International Research Spirodoc® Spiro device, which was checked for quality (Figure 1).

Figure 3. 2. Medical International Research Spirodoc® Spiro

Patients were evaluated according to guidelines for the American Thoracic Society and the European Respiratory Society in their work on lung function tests. Patients were informed about the procedure before the test.

Evaluation Procedure:

- Sitting position was preferred to prevent falls due to syncope and to be safe.
- A chair was chosen that is comfortable, upright and has arms on which the patient can lean his back.
- A clip was used to prevent the participant from breathing through his nose during the test.
- The filtered spirometer, which is disposable for each patient, takes the mouthpiece between the lips and holds it tightly.
- The participant was asked to take the mouthpiece between the lips and teeth and hold it tightly without allowing air leakage.
- The participant was asked to breathe in and out 3 times at his own breathing rate, followed by a difficult expiratory maneuver after an inspiration. After at least 6-15 seconds of giving the person the air, they were asked to take a deep breath again and the test was terminated. (Figure 2)

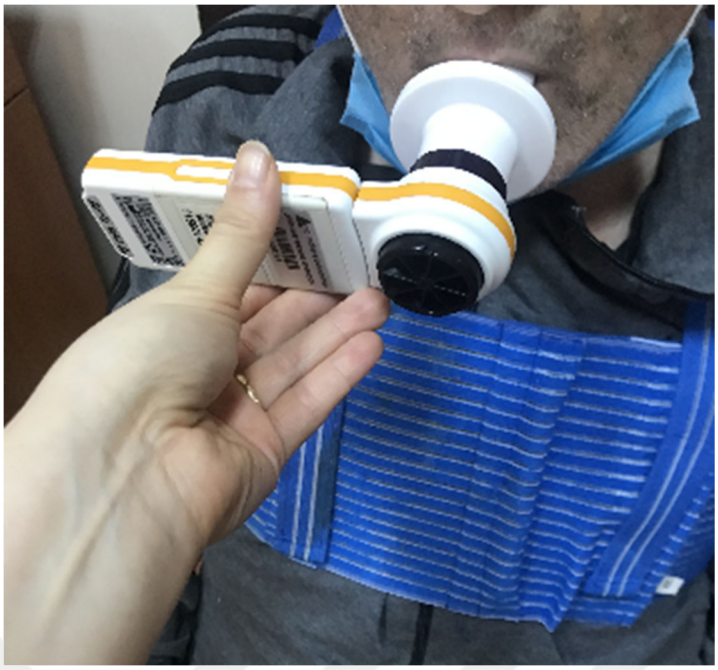

Figure 3.3. Spirometer Measurement Moment

The highest score was noted after the test was repeated 3 times. The test was terminated in cases such as inability to grasp the lips completely and leakage of air around them, not fast and strong expiration, speaking, coughing and sneezing during the test. Between the 3 repetitions of the test, the participants were given 5 minutes to rest. Not tested more than 5 times (105) (Appendix-7).

In spirometric measurements, it is determined whether the disorder is an obstructive, restrictive, or mixed type. The most commonly used parameters for PFT evaluation are force vital capacity (FVC), forced expiratory volume (FEV_1) in the first second, Tiffeneau ratio FEV_1/FVC forced expiratory flow between 25% and 75% of vital capacity (FEF_{25-75}), peak expiratory flow (PEF).

- *FVC (force vital capacity)*: It is the volume of air that comes out with a forceful and forceful expiration after a deep and rapid inspiration. A healthy person can exhale 80% of their lung volume in 6 seconds or less. In people with severe obstruction, the exhalation time can be up to 20 seconds. The most important indicator of restriction is the decrease in vital capacity. Diseases such as pneumothorax, asthma, sarcoidosis, idiopathic pulmonary fibrosis, cystic fibrosis, and thorax deformities reduce vital capacity (106).

- *FEV_1 (forced expiratory volume first second):* FEV_1 is the volume of air exhaled in the first second of forced expiration. In healthy people, approximately 70-80% of the lung capacity can be removed in the first second of the expiry, while this rate decreases in obstructive pulmonary diseases.

- *FEV_1/FVC (Tiffeneau ratio):* Although it is used to distinguish between obstruction and restrictive diseases, it is a parameter used to detect the presence of that construction. In a healthy individual, its normal value is 70–80%, but with age, the rate decreases due to the fact that FEV_1 decreases faster than FVC. As the severity of the obstruction increases, the expiratory time may be extended, and the FVC maneuver may take 15–20 seconds.

- *FEF_{25-75} (Force expiratory current between 25% and 75% of vital capacity):* It is the average current velocity at 50% of FVC. It gives information about obstruction in medium and small diameter bronchi. It begins to decrease in the early stages of obstructive disease. FEF_{25-75} helps to show airway obstruction in a period when FEV_1/FVC ratio is at a limit. As the degree of restrictive diseases increases, indirect decreases in FEF_{25-75} can be observed.

- *PEF (Peak Expiratory Flow):* Measured with maximum exhalation maneuver following maximum inspiration. It gives information about obstructions in the large airways. It is often associated with FEV_1 measurements.

Interpretation of Spirometric Tests:

In PFT, the determined reference values are accepted as the expected value and the measured pulmonary function parameter is expressed as a percentage of the expected value. Parameters measured in PFT in healthy individuals vary depending on physical characteristics such as age, gender, height, race, and weight. In spirometric measurements, whether the disorder is obstructive, restrictive or mixed can be evaluated by looking at % of the numerical values of FEV_1, FVC, FEV_1 / FVC and FEF_{25-75} according to their reference values (107).

Table 3.1. Normal values of lung function tests:

Test	**Normal Values (%)**
FEV_1	>80
FVC	>80
FEV_1/FVC	>80
FEF_{25-75}	>70

Table 3.2. FEV_1 degree of obstruction

Degree	**FEV_1 expected %**
Mildly	FEV_1 %80
Moderately	%50≤ FEV_1 <%80
Severe	%30≤FEV_1 <%50
Very Severe	FEV_1 <%30

Table 3.3. Degree of restriction according to FEV_1

Degree	**FEV_1 expected %**
Mildly	>70
Moderately	60-69
Severe	50-59
Severe	35-49
Very Severe	<35

3.2.7. Functional Capacity Assessment

Time up and go test, 30 seconds get up and sit test was used to evaluate functional capacity.

3.2.7.1. Timed Get Up and Go Test (TUG)

The TUG test is a simple, integrated, and widely used measure of clinical performance-based lower extremity function, walking speed, and dynamic balance. The patients were asked to get up from the 43 cm highchair and walk the specified distance of 3 meters and sit back down. The walking distance was recorded. (4). The patient is given a trial test once. The test is then performed two times and the two measurements are averaged. If the patient uses a walking aid such as a canedian, there is no harm in using it during the test. TUG is easy to learn and apply. The test takes less than 2 minutes with the instruction provided. It has been shown to be applicable, reliable and valid for measuring physical performance in cardiac surgery patients (108,109). (Appendix-8).

3.2.7.2. 30 Second Chair Stand Test (30s-CST)

30s-CST is a test that evaluates the patient's sitting and getting up activity, lower extremity strength and dynamic balance. The number of times the patient sits and gets up within 30 seconds gives the score of the test. Sitting and getting up less than 10 times in 30 seconds indicates lower extremity weakness. Fiziksel performansı ölçmek ve değerlendirmek için uygulaması kolay geçerli ve güvenilir olduğu gösterilmiştir (110, 111) (Appendix-9).

3.2.8. Evaluation of Hand Grip Strength

The assessment of handgrip strength was made 3 times from the dominant hand with the Jamar Hydraulic Hand Dynamometer (Figure 2) and the measurements were noted. This instrument is a very frequently used and most reliable clutch force measurement tool.

Measurement of handgrip and finger grip forces is the standard position proposed by the American Society of Hand Therapists (ASHT).

- Sitting in a straight-backed chair with the feet flat on the floor.
- The shoulder is adducted and neutrally rotated.
- Elbow flexed at 90 degrees, forearm in a neutral position.
- The wrist between 0- and 30-degrees extension and between 0- and 15-degrees ulnar deviation. (Figure 3)

Studies have reported that grip strength is correlated with upper extremity muscle strength, general body muscle strength, and pulmonary muscle strength (112,113) (Appendix-9).

Figure 3.4. Jamar Hydraulic Hand Dynamometer

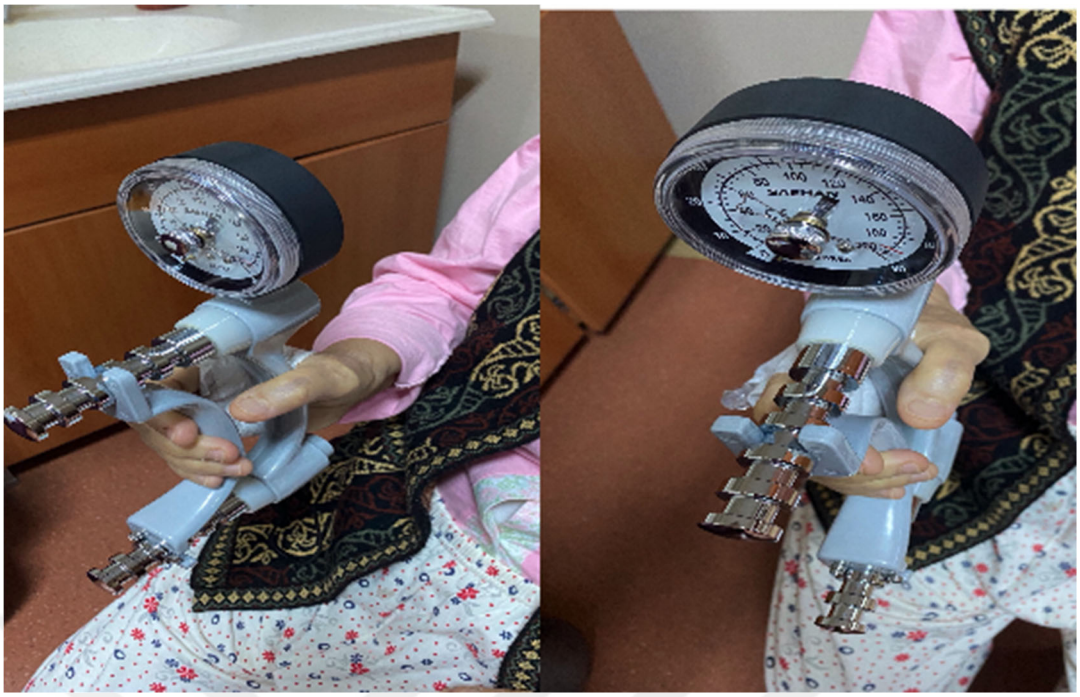

Figure 3.5. Measurement of handgrip strength the dominant hand with the Jamar Hydraulic Hand Dynamometer.

a) Hand Grip Strength preparation moment. b) Hand grip strength measurement moment.

3.3 Rehabilitation Program

Phase 1 in-hospital and phase 2 post-discharge period programs of cardiac rehabilitation protocol applied to patients who underwent OHS were applied. Physiotherapy and rehabilitation program was applied to the patients 2 times a day, in the morning and afternoon. The physiotherapy program was implemented by physiotherapists working in the hospital.

Patients were given quality of life assessment (SF-36), Pain assessment (VAS), PFT, functional capacity tests (TUG, 30 s-CST) and evaluation of hand grip strength tests on the preoperative day. On the day of the Postop discharge, the evaluation tests were repeated. During the discharge phase, the importance of the phase 2 rehabilitation program was explained and trained. At the end of the 3rd week, evaluation tests were performed again on the first polyclinic control day (the day of suturing). Thus, preop, postop, postoperative and postoperative patients were evaluated 3 times.

3.4. Statistical Analysis

In calculating the sample size of this study, which was conducted to "compare the pre-operative-post-operative results of quality of life, pain score, left function test, function hand capacity and hand grip measurements", Power was determined by taking at least 80% and Type-1 error 5% for each variable. Shapiro-Wilk ($n<50$) and Skewness-Kurtosis tests were examined whether the continuous measurements in the study were distributed normally or not, and parametric tests were applied because the measurements were normally distributed. Descriptive statistics for continuous variables in the study; expressed as mean and standard deviation. In the comparison of "preoperative, postoperative and late periods", ANOVA test was used for repeated measurements. Following this analysis, "Bonferroni post-hoc test" was used to determine the periods that make up the difference. Pearson correlation coefficients were calculated to determine the relationship between measurements. In the calculations, the statistical significance level was taken as $p<0.05$ and SPSS (IBM SPSS for Windows, ver.26) statistical package program was used for the analysis.

4. RESULTS

Our evaluation is based on the evaluation of quality of life, pain, pulmonary function test, functional capacity and hand grip strength of people who have undergone OHS (n=26) between the ages of 40-70.

Our evaluation period consisted of patients who had undergone OHS during preop, postoperative discharge day and follow-up 3rd week periods.

Demographic characteristics of the patients are given in Table 4.1 and Table 4.2. Accordingly, the mean age of the patients was 59, the mean weight was 74.8 kg and the mean BMI was 25.8.

The results in terms of gender, smoking and type of operation are presented in table 4.1b. Accordingly; 65% of the patients are male and 54% are smoking.

Table 4.1. The demographic characteristics of Participants

	Mean	Std.Dev	Min.	Max
Age (y)	59,04	9,47	40,00	70,00
Weight (kg)	74,85	13,41	48,00	102,00
Body Mass Index (m^2/kg)	25,83	3,53	19,20	32,90
Intubation Time (h)	5,19	2,38	2,00	12,00
Pump Time (min)	162,31	39,62	107,00	255,00
Hospital Stay: Intensive Care (day)	3,19	,98	1,00	5,00
Hospital Stay: Service (day)	5,42	1,06	4,00	8,00
Charlson Comorbidity Index	3,54	1,56	1,00	8,00

Table 4.1. The demographic characteristics of Participants

		N	**%**
Gender	Female	9	34,6%
	Male	17	65,4%
Smoke	Yes	14	53,8%
	No	12	46,2%
Operation Type	AVR	5	19,2%
	AVR+MVR	3	11,5%
	CABG*3	2	7,7%
	CABG*4	8	30,8%
	CABG*5	1	3,8%
	MVR	4	15,3
	MVR+CABG*2	1	3,8%
	Perikardiektomi	1	3,8%
	Pulmoner arter trombektomi	1	3,8%
Ejection fraction	%37-%55	12	46%
	%57-%68	14	53,7%

The correlation analysis between the personal information of the patients is given in Table 4.3. A statistically significant positive (66.4%) relationship was found between the "Age" and the "Charlson Comorbidity Index" of the patients ($p<0.05$). In this context; As "age" increases, so does the "Charlson Comorbidity Index." Apart from this, no statistically significant relationship was observed in the remaining correlation coefficients.

Table 4.2. Correlation analysis between patients personal information

		Age	**Weight**	**BMI**
Intubation Time (h)	r	,290	-,216	-,218
	p.	,150	,290	,284
Pump Time (min)	r	,118	-,108	-,090
	p.	,565	,598	,661
Hospital Stay:Intensive Care (day)	r	,068	-,107	-,118
	p.	,741	,602	,565
Hospital Stay:Service	r	-,010	,103	-,023
	p.	,963	,617	,910
Charlson Comorbidity Index	r	,664**	-,339	-,309
	p.	,000	,090	,124

p<0,05 **p<0,01 r: Pearson correlation coefficient

In Table 4.4, the comparison results of "SF-36 test" values according to "preop, postop discharge and follow-up 3rd week" periods are given. Accordingly, A statistically significant difference was observed between the measurement periods of "Physical Functioning, Emotional Well-being, Social Functioning, Pain" ($p<0.05$). Accordingly, the "follow-up 3rd week" measurement was found to be different from all periods. The highest value was seen in the "Follow-up 3rd Week" period and the lowest value was seen in the "Preop" period. Similarly, A statistically significant difference was observed between the measurement periods of "role limitations due to emotional problems and Role limitations due to physical health" ($p<0.05$). Accordingly, The "follow-up 3rd Week" measurement was found to be higher than other periods, making the difference. The "preop and postop discharge" periods were found to be similar. A statistically significant difference was observed between the "Energy/Fatigue and General Health" measurement periods ($p<0.05$). Accordingly, The "preop" measurement was found to be lower than other periods, making the difference. The "Postop discharge and Follow-up 3rd Week" periods were found to be similar.

Table 4.3. Comparison results of "SF-36 test" values by "Periods"

	Period	Mean	Std. Dev.	F (1-25)	Effect Size	*p.
Physical Functioning	Preop	19,23c	24,97	300,108	,923	**,001**
	Postop discharge	50,96b	22,00			
	Follow up (3rd w)	75,96a	19,29			
Role limitations due to physical health	Preop	10,19b	23,04	45,445	,645	**,001**
	Postop discharge	19,23b	26,75			
	Follow up (3 rd w)	47,12a	37,63			
Role limitations due to emotional problems	Preop	6,53b	13,22	86,663	,776	**,001**
	Postop discharge	17,10b	24,00			
	Follow up (3rd w)	54,86a	34,14			
Energy/Fatigue	Preop	41,90b	23,57	351,072	,934	**,002**
	Postop discharge	59,54a	26,88			
	Follow up (3 rd w)	68,92a	21,35			
Emotional well-being	Preop	45,54c	16,69	742,656	,967	**,001**
	Postop discharge	66,27b	21,41			
	Follow up (3 rd w)	73,23a	16,03			
Social Functioning	Preop	30,37c	17,65	301,214	,923	**,001**
	Postop discharge	50,48b	23,52			
	Follow up (3 rd w)	65,81a	20,06			
Pain	Preop	35,98c	27,67	260,146	,912	**,001**
	Postop discharge	57,21b	24,22			
	Follow up (3 rd w)	74,62a	21,24			
General Health	Preop	36,15b	18,35	476,688	,950	**,001**
	Postop discharge	60,67a	19,84			
	Follow up (3 rd w)	66,73a	13,73			

*Statistics of the difference between periods (ANOVA in Repeated/Repeated Measurements)
a,b,c: Bonferroni shows different groups according to the Post-Hoc test.

In Table 4.5, the comparison results of "Visual Analog Scale" values according to "preop, postop discharge and follow-up 3rd week" periods are given. Accordingly; "A statistically significant difference was observed between the Rest and Activity measurement periods ($p<0.05$). Accordingly, The "Postop discharge Activity" measurement was found to be higher than the "Follow up 3rd Week - Activity" measurement. The "Preop-Activity" measurement was found to be similar to the other two periods. Again, A statistically significant difference was observed between the "night" measurement periods ($p<0.05$). Accordingly, the "Postop discharge - Night" measurement was found to be higher than the "Follow up 3rd week - Night" measurement.

Table 4.5. Comparison results of "Visual Analog Scale" values by "Periods"

	Period	**Mean**	**Std. Dev.**	**F (1-25)**	**Effect Size**	***p.**
Rest	Preop	1,88ab	2,88	47,873	,657	**,001**
	Postop discharge	3,35a	2,02			
	Follow up (3 rd w)	1,50b	1,86			
Activity	Preop	2,65ab	3,36	54,697	,686	**,001**
	Postop discharge	3,54a	2,08			
	Follow up (3 rd w)	1,92b	1,79			
Night	Preop	2,65ab	3,51	53,236	,680	**,001**
	Postop discharge	3,65a	2,10			
	Follow up (3 rd w)	1,73b	1,85			

*Statistics of the difference between periods (ANOVA in Repeated/Repeated Measurements)
a,b,c: Bonferroni shows different groups according to the Post-Hoc test

In Table 4.6, the comparison results of "Pulmonary Function Tests (PFT)" values according to "preop, postop discharge and follow-up 3rd week" peridots are given. Accordingly, A statistically significant difference was observed between the measurement periods "FVC, FEV 1, PEF%FEV_1 and FEF_{25-75}" ($p<0.05$). Accordingly, all measurements were found to differ from each other in all periods. The highest value was seen in the "Preop" period and the lowest value was seen in the "Postop discharge" period.

Table 4.6. Comparison results of "Pulmonary Function Tests" values by "Periods"

	Period	Mean	Std. Dev.	F (1-25)	Effect Size	*p.
FVC	Preop	1,91a	,44	534,680	,955	,001
	Postop discharge	1,41c	,39			
	Follow up (3rd w)	1,70b	,37			
FEV_1	Preop	1,79a	,52	348,653	,933	,001
	Postop discharge	1,27c	,34			
	Follow up (3rd w)	1,58b	,49			
PEF	Preop	2,48a	,93	217,208	,897	,001
	Postop discharge	1,94c	,72			
	Follow up (3rd w)	2,22b	,73			
%FEV_1	Preop	86,44a	8,72	2245,623	,989	,001
	Postop discharge	81,65c	10,12			
	Follow up (3rd w)	84,40b	8,77			
FEF_{25-75}	Preop	2,04a	,59	336,178	,931	,001
	Postop discharge	1,64c	,49			
	Follow up (3rd w)	1,81b	,50			

*Statistics of the difference between periods (ANOVA in Repeated/Repeated Measurements)
a,b,c: Bonferroni shows different groups according to the Post-Hoc test.

In Table 4.7, the comparison results of the "Function Evaluation Test" values according to the "preop, postop discharge and follow-up 3rd week" peridots are given. Comparison results of the values were given according to the "pre, post, and late period" periodes of the values. Accordingly, A statistically significant difference was observed between the "Time Up and Go Test (TUG)" measurement periods ($p<0.05$). Accordingly, the "Follow up 3rd week" measurement was found to be lower than other periods, making the difference. The "Preop and Postop discharge" periods were found to be similar. Again, A statistically significant difference was observed between the "30 Second Chair Stand Test" measurement periods ($p<0.05$). Accordingly, The "Postop discharge-30 Second Chair Stand Test" measurement was found to be lower than other periods. The "Preop and Follow up 3rd week" periods were found to be similar.

Table 4.4. Comparison results of "Function Evaluation Test" values by "Period"

	Period	**Mean**	**Std. Dev.**	**F (1-25)**	**Effect Size**	***p.**
Time Up and Go Test (TUG)	Preop	15,98a	6,27	113,865	,820	,005
	Postop discharge	22,21a	16,98			
	Follow up (3rd w)	13,86b	4,81			
30-Second Chair Stand Test	Preop	8,85a	3,16	297,672	,923	,020
	Postop discharge	7,58b	2,69			
	Follow up (3rd w)	8,62a	3,02			

a,b,c: Bonferroni shows different groups according to the Post-Hoc test.

In Table 4.8, the comparison results of the "Hand Grip Strength Test" values according to the "preop, postop discharge and follow-up 3rd week" peridots are given. A statistically significant difference was observed between the "Hand Grip Strength Test" measurement periods ($p<0.05$). Accordingly, The "Hand Grip Strength Test" measurement was found to be different from each other in all periods. The highest value was seen in the "Preop" period and the lowest value was seen in the "Postop discharge" period.

Table 4.8. Comparison results of "Hand Grip Strength Test" values by "Period"

	Period	**Mean**	**Std. Dev.**	**F (1-25)**	**Effect Size**	***p.**
Hand Grip Strength Test	Preop	29,40a	10,11	205,596	,892	,001
	Postop discharge	23,70c	9,09			
	Follow up (3rd w)	25,77b	9,20			

a,b,c: Bonferroni shows different groups according to the Post-Hoc test.

5. DİSSCUSSİON

Our study aimed to evaluate preop, postoperative discharge and follow up 3rd week periods in terms of quality of life, pain, respiratory functions, functional capacities and hand strength measurements of people who have undergone OHS. For this purpose, we included 26 patients between the ages of 40-70 who had undergone OHS in our study. In our study, a significant difference was found between quality of life, pain, pulmonary function test and functional capacities in the preoperative and postoperative period.

When examined in terms of demographic characteristics in our study, the majority of our patient population consisted of male patients. Koch, C. and colleagues reported that women often needed cardiac surgery than men because women were more prone to systemic diseases due to menopause (23). Of the 26 patients we included in our study, 9 were female and 17 were male. We think that the high number of male patients may be due to the low number of patients participating in the study. It is known that increased body mass index is an association between cardiovascular anastasis (28). Wilson et al. have shown that BMI-determined obesity is associated with an increased incidence of cardiovascular disease in men and women ages 35–75 (114). In our study, the BMI was found to be the lowest 19.20 kg/m 2, the highest 32.90 kg/m 2 and the mean was 25.83 kg/m^2. Our patients are in the overweight category according to the BMI classification determined by the World Health Organization (29). Of the 26 patients who participated in our study, 14 were smoking and 12 were not. Although smoking is effective in the formation of atherosclerotic substances, it is an important risk factor in cardiovascular diseases. In a study by Masudkabir F. et al., they said that smoking is an important risk factor for coronary diseases and that quitting smoking after CABG significantly reduces long-term mortality and the risk of developing additional diseases (115).

In our study, a statistically significant relationship was found in comorbidity scores as the age of our patients increased ($p<0.05$). In this context; As “age” increases, “Charlson Comorbidity Index” also increases. Apart from this, there was no statistically significant relationship with age in parameters such as intubation time, pump time, and length of hospitalization. With increasing age, people face multiple chronic diseases. With the success of cardiovascular surgery procedures, these patients reach advanced

ages and cause a significant increase in the rates of comorbid diseases. In the study conducted by Şahin et al., it was emphasized that the majority of the elderly cardiovascular patient population has comorbid conditions and that this problem is increasing day by day with the aging population (116). Apart from the 3 patients who participated in our study, all the remaining patients had one or more comorbidities (hypertension, diabetes mellitus, prostate cancer, hypothyroidism, breast cancer, atrial fibrillation) and harvests between 40-70 years were included in the study and the mean age of the patients was 59.04 years.

After OHS, many complications including cardiac, respiratory and neurological develop in patients. Previous studies have indicated that decreased physical capacity of patients before OHS are associated with an increased incidence of morbidity and mortality during prolonged hospital stay and prolonged mechanical ventilation (1). Although there is a significant improvement in general health and well-being from the postoperative recovery period, preoperative low functional status may persist or deteriorate after surgery in the majority of cases. The SF-36 quality of life a questionnaire is one of the most comprehensive standardized questionnaires developed to assess patients' functional status, well-being, and activities of daily living. In the study conducted by Elliott, D et al., they evaluated the health status of patients who underwent cardiac surgery 4 weeks before surgery, at discharge from the hospital and at 6 months after discharge. There was an increase in SF-36 health status and functionality in 6 months after discharge, but deterioration in all subparameters of SF-36 was observed in the early postoperative period (9). Unlike this study, in our study, the Follow up 3rd week measurement was found higher than all other periods between the Physical Functioning, Emotional Well-being, Social Functioning, Pain measurement periods of SF-36 and had the lowest value in the preop period. This can be thought to follow the increased physical functions, emotional status and social functionality of the patients after surgery in the postoperative periods. Our study was limited in follow- up 3rd week measurements, and if our patients are evaluated prospectively, we think that we can see a common increase in all sub-parameters of SF-36. In the study in which Güzelhan et al. evaluated the quality of life with SF-36, they found a significant increase in the physical functioning, physical role, social functioning parameters of SF-36 in the evaluation of the postoperative 30th day, 3

months and 6 months later (117). In another study conducted by Colak Z. et al., they were evaluated using SF-36 before and 1 year after cardiac surgery. In their evaluation in the 1st year after surgery, a significant improvement in physical functioning and social functioning parameters and an increase in quality of life were observed as in our study. In our study, it was seen that there was an increase in the measurements of the 3rd week after discharge and the long-term effects should be examined (118).

In our study, the pain and postoperative discharge period values of the patients, which we evaluated with VAS, increased compared to the preoperative period, and the follow-up 3rd week values were found to be the lowest among all periods. These results can be considered to be due to a challenging and exhausting condition of the cardiac surgery process during the hospital process. In the literature, pain, dyspnea, fatigue, breathing and sleep disorders peak before and two weeks after OHS and may continue for up to four months after discharge (119). Cutting many important and large muscle groups during surgery, performing sternotomy procedure, chest wall and muscle destruction cause the patient to experience pain in the early postoperative period (4). In the systematic review conducted by Bignami E. et al., it was stated that factors such as sternotomy, vascular catheters, drainages and thoracotomy caused pain in the cardiac surgery patient and that he experienced intense pain during the first two days after surgery (120). In another study, De Menezes et al. compared pain intensity, respiratory and peripheral muscle strength in the preoperative and postoperative period on patients undergoing heart surgery and showed a significant increase in pain intensity in the postoperative period (121). In our study, similar to work, it was seen that there was an increase in the patient's pain in the postoperative period compared to the preop period.

The decrease in lung volumes and oxygenation that occurs after OHS is very common. The effects of the use of median sternotomy, hypothermia and cardiopulmonary bypass for myocardial protection adversely affect lung function. Urell et al. evaluated the pulmonary function of the patients they evaluated before and 2 days after OHS. While preoperative lung volumes were appropriate or just below predictive values, lung function decreased by approximately 50% on the second postoperative day after OHS and postoperative lung volumes were found to be less than 40% of predictive values (122). Similar to our study, preop and postoperative

evaluations were performed after OHS, and they supported our study and revealed a decrease in respiratory function as a result.

FVC, FEV1, PEF, % FEV1, FEF25-75 values, which are the sub-parameters of the pulmonary function test of our patients, decreased in the postoperative discharge period compared to the preoperative period, and the lung capacity of the preoperative period could not be reached in the follow-up 3rd week period. Procedures such as median sternotomy, cardiopulmonary bypass, topical cooling for myocardial protection created during OHS make OHS patients prone to postoperative pulmonary complications, resulting in monotonous shallow breathing patterns, impaired respiratory mechanics, decreased lung complicity and impaired gas exchange that reduce lung volumes. These factors are common causes of atelectasis after OHS. Postoperative atelectatic changes are usually temporary. However, sometimes postoperative pulmonary complications may progress and have serious clinical consequences. Decreasing lung volumes after atelectasis also affects expiratory flow rates. In the study conducted by Westerdahl et al., they evaluated pulmonary function measurements before and 1 year after surgery in 150 patients who underwent valve surgery, coronary artery bypass grafting or combined surgery. They found that one year after surgery, forced vital capacity and forced expiratory volume at 1 second were significantly reduced compared to preoperative values (71). In another study, Leela T. and colleagues noted that there was a significant decrease in lung volumes on the first postoperative day and then gradually improved, and that with this, the discharge period values did not fully return to preoperative values, which made physiotherapy applications aimed at increasing lung volumes an integral part of postoperative care after OHS (123). In this evaluation, where we have obtained similar results, it may be valuable to apply respiratory physiotherapy before and after surgery at every stage. Some studies in the literature have emphasized the necessity of respiratory muscle training aimed at improving respiratory muscle strength in patients undergoing cardiovascular surgery and thus reducing the possible risks of increased respiratory function capacity. They have suggested that the inclusion of respiratory muscle strength training in CR programs may be a good strategy for improving clinical functional manifestations in heart patients associated with an increase in exercise performance (124).

Preoperative cardiopulmonary exercise tests can be used to classify patients according to high or low preoperative risk before surgery. Although cardiopulmonary exercise tests are important in determining what physiological disabilities are caused by and in preoperative evaluation, they require significant time with specialized equipment, personnel, and to both conduct and analyze the test. TUG, which is more accessible and easier to apply, is known to be a good test in assessing functional mobility (125). Steinmetz C et al. included 230 patients who underwent CABG surgery in their study, and the patients were given cardiopulmonary exercise tests and TUG measurements at the beginning, the day before surgery, at the beginning and end of cardiac rehabilitation. At the end of the study, a significant decrease was observed in the application times of TUG tests at the beginning and end of cardiac rehabilitation (4). In our study, similarity between preop and postoperative discharge periods was found in this study, and shorter TUG duration was found in the follow-up 3rd week period compared to the other two periods. In the same way, the 30 second chair stand test, in which we evaluate the functional capacity, is a test used to measure both the lower extremity strength and the balance in elderly individuals. In our study, the postoperative discharge period was lower than the other two periods. In other words, the lower extremity muscle strength decreased after surgery, and in the results of the follow-up 3rd week period, the lower extremity strength in the preop period approached again but could not reach. The inability of patients to capture the results of the p reop period may not be sufficient to show a positive result in the 30-second get up and sit test of physical therapy until the day of discharge in the hospital. However, many studies indicate the impact of early mobilization on functional performance. In addition, in terms of functional capacity, incision pain and fear in the lower extremities in patients who received saphenous graft after surgery, especially after CABG surgery, can be shown as the cause of long and heavy walking during the postoperative test in patients.

In our study, hand muscle strength decreased significantly after surgery and follow-up 3rd week could not reach preop level. In our study, we think that sternum incision has an effect on the reduction of hand muscle strength. We think that there is a decrease in hand muscle strength because patients avoid flexion of 90 degrees and above due to the stitches in their sternums during the postoperative discharge period,

and activities such as pushing and pulling an object using their arms and lifting the upper extremity themselves from bed. Cheung et al. He said that hand grip strength can be measured by using peripheral muscle strength in the upper extremities using a dynamometer, and grip strength correlates with the level of cardiac dysfunction. They recommended the use of exercises such as isometric hand grip training, which is a good training protocol for patients (112). In a randomized controlled trial conducted by Chen et al., patients who had undergone OHS and were placed in a routine physiotherapy program evaluated hand strength and TUG test on the 5th day of the postop. Accordingly, they found that the treatment group completed higher hand grip strength and less time in the timed-up test compared to the control group (126). Unlike this study, in our study, it was found that patients had lower hand strength in the postoperative discharge period compared to the preoperative period in hand strength measurement. We think that this may be because the incision and bone union in the sternum region of the patient take time, and the patient avoids the use of the upper extremity due to fear of movement.

In the post-open-heart surgery period, it may be important to reduce the pain of the incision site of the patients until the discharge stage and to provide physiotherapy training to increase the upper extremity strength and functionality. In the literature, data comparing the peripheral muscle strength of the upper extremity before and after surgery in people who have undergone OHS are insufficient.

In terms of clinical outcomes, it is very important for the quality of life and functionality of the person to reduce the pain in the incision area and to give aerobic exercises to the patient in the postoperative period in order to increase the upper and lower exercise forces.

Our study had several limitations.

1. The patients we included in our study were a homogeneous group of participants with different forms of surgery, though it could affect the outcome.

2. Assessments should only cover the follow up^{3rd} week early period and not the late period.

Conclusion

- In our patient group, it was reached that the comorbid situation increased with the increase in age.

-SF-36 quality of life scale, it was found that the person's physical function, mental health, pain, social function, physical role and emotional role improved in the follow-up 3rd week period after surgery compared to the previous periods.

- In the pain assessment, the highest level of pain in activity and night condition was reached during the postoperative discharge period and it was seen that the follow-up was continuing in the 3rd week.

-The value in the preop period, which is the highest measurement in the respiratory function test, could not be reached in the other two periods.

- In the TUG test where the functionality of the patients was measured, the highest value was obtained in the following up 3rd week period, and in the 30 sec chair stand test measurement, the result in the preop period was reached in the follow up 3rd week.

- Patients could not recover the hand grip strength they had during the preop period at the 3rd week.

We think that it is important that the physiotherapy treatment plan to be applied after the post-operative 3rd week of patients undergoing open heart surgery is aimed at reducing pain, increasing upper and lower extremity strength, and improving respiratory functions.

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7.APPENDIX

7.1. Appendix 1. Informed Consent Form

Bilgilendirilmiş Olur Formu

Sayın Gönüllü

Bu katıldığınız çalışma bilimsel bir araştırma olup, araştırmanın adı 'Açık kalp cerrahisi geçiren hastaların ameliyat öncesi ve ameliyat sonrası dönemlerde yaşam kalitesi, fonksiyonel kapasiteleri ve kavrama kuvvetleri yönünden incelenmesi' dir.

Bu araştırmanın amacı, açık kalp ameliyatı sonrası kardiyak rehabilitasyon programına alınan hastaların ameliyat öncesi ve sonrası erken dönem SF-36 yaşam kalitesi, VAS ağrı skoru, solunum fonksiyon testi, fonksiyonel kapasite testi, el kavrama kuvvet ölçümü yapılarak hastaları değerlendirmektir. Araştırmaya katılan gönüllü sayısı 31 olacaktır.

Araştırmada 3 aşama bulunmaktadır. Araştırma hastaneye yatışın ilk günü size ait demografik bilgilerin sorgulanacağı değerlendirme formu ve SF-36 yaşam kalitesi, VAS ağrı skoru, solunum fonksiyon testi, fonksiyonel kapasite testi, el kavrama kuvvet ölçümü yapılacaktır. Araştırmanın ikinci aşamasında açık kalp ameliyatı sonrası yoğun bakımda kalınan süre boyunca uygulanacak olan, karın ve göğüs solunum egzersizleri, yatak içi aktif ve pasif eklem açıklığı egzersizleri, öksürme teknikleri eğitimi verilecek ve uygulanılacaktır. Taburculuk günü SF-36 yaşam kalitesi, VAS ağrı skoru, solunum fonksiyon testi, fonksiyonel kapasite testi, el kavrama kuvvet ölçümü yapılacaktır. Araştırmanın üçüncü aşamasında taburculuk sonrasında dikiş almaya gelinen günde (7-10 gün) SF-36 yaşam kalitesi, VAS ağrı skoru, solunum fonksiyon testi, fonksiyonel kapasite testi, el kavrama kuvvet ölçümü yapılacaktır.

Bu araştırma ile ilgili olarak size ait demografik bilgilerin sorulacağı değerlendirme formu ve size sorulan soruları eksiksiz cevaplamak, testleri sizden istenildiği gibi yapmak sizin sorumluluğunuzdadır.

Bu araştırmada sizin için değerlendirme sırasında testleri uygularken öksürük, nefes darlığı, baş dönmesi, göğüs ağrısı, aşırı yorgunluk gibi riskler ve rahatsızlıklar söz konusu olabilir; bu durumlarda değerlendirme sonlanacaktır.

Araştırmaya bağlı bir zarar söz konusu olduğunda, bu durumun tedavisi sorumluluğu araştırmacı tarafından yapılacak, ortaya çıkan masraflar tarafımızca karşılanacaktır. Araştırma sırasında sizi ilgilendirebilecek herhangi bir gelişme olduğunda, bu durum size veya yasal temsilcinize derhal bildirilecektir.

Bu araştırmada yer almak tamamen sizin isteğinize bağlıdır. Araştırmada yer almayı reddedebilirsiniz ya da herhangi bir aşamada araştırmadan ayrılabilirsiniz; bu durum herhangi bir cezaya ya da sizin yararınıza engel duruma yol açmayacaktır. Araştırmacı bilginiz dâhilinde veya isteğiniz dışında uygulanan değerlendirme uyum sağlamama durumunda sizi araştırmadan çıkarabilir. Araştırmanın sonuçları bilimsel amaçla kullanılacaktır; çalışmadan çekilmeniz ya da araştırmacı tarafından çıkarılmanız durumunda, sizle ilgili tıbbi veriler de gerekirse bilimsel amaçla kullanılabilecektir.

ONAM FORMU

Yukarıda amacı ve yöntemi okudum 'Açık kalp cerrahisi geçiren hastaların ameliyat öncesi ve ameliyat sonrası dönemlerde yaşam kalitesi, fonksiyonel kapasiteleri ve kavrama kuvvetleri yönünden incelenmesi' başlıklı çalışma bana İrem ÇAYLAK tarafından sözlü olarak açıklandı. Çalışma ile ilgili tüm sorularıma tatmin edici cevap aldım.

Eğer bu araştırmaya katılırsam araştırması ile aramda kalması gereken bana ait bilgilerin gizliliğine bu araştırma sırasında büyük özen ve saygı ile yaklaşacağına inanıyorum. Araştırma sonuçlarının eğitim ve bilimsel amaçlarla kullanımı sırasında kişisel bilgilerimin özenle korunacağı konusunda bana yeterli güven verildi.

Çalışmanın yürütülmesi sırasında herhangi bir sebep göstermeden araştırmadan çekilebilirim (ancak araştırmacıyı zor durumda bırakmamak için araştırmadan çekileceğimi önceden bildirmemin uygun olacağının bilincindeyim). Ayrıca tıbbi durumuma herhangi bir zarar vermemesi koşuluyla araştırmacı tarafından araştırma dışı da tutulabilirim.

Araştırma için yapılacak harcamalarla ilgili parasal sorumluluk altına girmiyorum. Bana bir ödeme de yapılmayacaktır.

Bana yapılan tüm açıklamaları ayrıntılarıyla anlamış bulunmaktayım. Kendi başıma belli bir düşünme süresi sonunda adı geçen bu araştırma çalışmasına 'katılımcı' olarak yer alma kararı aldım. Bu konuda yapılan daveti hiçbir baskı ve zorlama olmaksızın kendi rızamla katılmayı büyük bir memnuniyet içerisinde kabul ediyorum. Bu formun imzalı bir kopyası bana verilecektir.

Gönüllünün

Adı- Soyadı:

Adresi- Tel:

Tarih ve İmza:

Açıklamaları yapan araştırmacının,

Adı- Soyadı:

Adres- Tel:

Tarih- İmza:

Tanık:

Adı- Soyadı:

Adres- Tel:

Tarih-İmza:

7.2. Appendix 2. Ethical Approval

YEDİTEPE ÜNİVERSİTESİ
GİRİŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR
ETİK KURULU

Versiyon No 2.0
13.02.2022
Sayfa 1 / 2

KARAR FORMU

15.03.2022

ETİK KURUL BİLGİLERİ		
	Etik Kurulun Adı	Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu
	Açık Adres	Yeditepe Üniversitesi Kayışdağı Kampüsü, Tıp-Mühendislik Binası, Sağlık Bilimleri Enstitüsü, İnönü Mah. Kayışdağı Cad. 326A, 26 Ağustos Yerleşimi 34755 Ataşehir, İstanbul
	İnternet Sayfası	http://goetik.yeditepe.edu.tr/
	Telefon	0216 578 00 00
	E-posta	goetik@yeditepe.edu.tr

DEĞERLENDİRİLEN BELGELER	
Islak imzalı başvuru dosyası, CD'si ve elektronik başvuru	☒
Araştırma başlığı ve araştırmacıların isimleri	☒
Başvuru dilekçesi	☒
Başvuru Formu- Araştırmanın;	☒
• Niteliği	☒
• Önemi ve özgün değeri	☒
• Amaç ve hedefleri	☒
• Yöntemi	☒
• Yönetimi	☒
• Yaygın etkisi	☒
• Araştırma bütçesi (Mevcutsa)	☒
• Süresi ve uygunluğu (Zaman cetveli)	☒
• Kaynakları	☒
Bilgilendirilmiş Gönüllü Olur Formu (yapılan araştırmaya özel olarak hazırlanmış)	☒
Taahhütname-1 Araştırmanın yapılacağı kurumdan izin alma sorumluluğunun araştırmacılara ait olduğuna dair taahhüt	☒
Taahhütname-2 Dünya Tıp Birliği Helsinki Bildirgesinin son versiyonunun ve Sağlık Bakanlığı'nın ilgili tüm kılavuzlarının okunmasına dair taahhüt	☒
Taahhütname-3 Daha önce yapılmış etik kurul başvuruları mevcut olup olmadığına dair taahhüt	☒
Taahhütname-4 Araştırma sırasında araştırma bütçesinde yer almayan ve gönüllünün kendisine veya Sosyal Güvenlik Kurumuna ek yük getirecek hiçbir işlem uygulanmayacağına dair taahhüt	☒
Taahhütname-5 COVID-19 hastalarında tedavi yaklaşımları ve bilimsel araştırmalar genelgesi okunmasına dair taahhüt	☒
Taahhütname-6 Milli Eğitim Bakanlığı Araştırma Uygulama İzinleri konulu yazının okunmasına dair taahhüt	☒
Araştırmacıların her birisine ait özgeçmiş formu	☒
Ek belgeler (Varsa kullanılan ölçek izinleri vb.)	☒

KARAR BİLGİLERİ	
Başvuru Numarası	202202150
Toplantı Tarihi	11.03.2022
Toplantı Yeri	Çevirim içi (Google Meet)
Karar No	2

Araştırmanın Başlığı	Açık kalp cerrahisi geçiren hastaların ameliyat öncesi ve ameliyat sonrası dönemlerde yaşam kalitesi, fonksiyonel kapasiteleri ve kavrama kuvvetleri yönünden incelenmesi
Araştırmacılar	Fzt. İrem Çaylak Yetüt, Dr. Öğr. Üyesi Çiğdem Yazıcı Mutlu, Dr. Öğr. Üyesi Yasemin Şahbaz, Prof. Dr. Türkan Tansel

BAŞVURU NUMARASI: 202202150

KARAR 15.03.2022

☒ **KABUL**	☐ **RET** ☐ *KAPSAM DIŞI (GİRİŞİMSEL)* ☐ *BİLİMSEL VE/VEYA ETİK KURALLARA AYKIRI* ☐ *BİR SORUMLU ARAŞTIRMACININ (TEZ İSE TEZ DANIŞMANI), BİR TOPLANTIYA **İKİ (2) ADETTEN FAZLA ÇALIŞMA BAŞVURUSUNDA** BULUNMASI* ☐ *KURUM İÇİ BAŞVURULARINDA **KURUMSAL E-POSTA HESABI** İLE GİRİŞ YAPILMAMIŞ OLMASI* ☐ *ŞARTLI KABULDE BELİRTİLEN REVİZYONLARIN ZAMANINDA VE/VEYA İSTENİLDİĞİ ŞEKİLDE YAPILMAMIŞ OLMASI*

Yeditepe Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu adına
Prof. Dr. Didem Özdemir ÖZENEN
Başkan

Araştırmanın Başlığı	Açık kalp cerrahisi geçiren hastaların ameliyat öncesi ve ameliyat sonrası dönemlerde yaşam kalitesi, fonksiyonel kapasiteleri ve kavrama kuvvetleri yönünden incelenmesi
Araştırmacılar	Fzt. İrem Çaylak Yetüt, Dr. Öğr. Üyesi Çiğdem Yazıcı Mutlu, Dr. Öğr. Üyesi Yasemin Şahbaz, Prof. Dr. Türkan Tansel

7.3. Appendix 3. Evaluation of Demographic and Clinical Information

Grup No:	

Hasta Değerlendirme Formu

İlk değerlendirme tarihi: .../.../...

Son değerlendirme tarihi: .../.../...

Ad Soyadı:

Cinsiyet:	Yaş:	Meslek:	Kilo:	Boy:	VKİ:

Tanı:					
Hikâye:					
Geçirdiği Operasyonlar:					
Gördüğü Tedaviler:					
İlaç Öyküsü:					
Spirometre ölçümleri:	Pre-op		Post-op		Post-op geç
Ejeksiyon Fraksiyonu:		Entübasyon Süresi:		Kullanılan Greft:	
Operasyon tipi:	İzole Bypass	Bypass+Kapak		Kapak	

Hasta protokol no		Servis oda no:	
Hastanın yoğun bakımda kalış süresi:			
Hastanın serviste kalış süresi:			
Hastanın gördüğü fizik tedavi gün süresi			
Alışkanlıklar: (gün/ay/yıl)	Sigara:	Alkol	Egzersiz
Eğitim Durumu:			
Hasta iletişim bilgileri:			

7.4. Appendix 4. Charlson Comorbidity Index

Charlson Komorbidite İndeksi

Charlson Comorbidity Index

Hastanın Adı Soyadı: ..... Tarih: ...../...../.....

Charlson Komorbidite İndeksi

		var	yok
1	Miyokard enfarktüsü	❑1	❑0
2	Konjestif kalp yetmezliği	❑1	❑0
3	Periferik vasküler hastalık	❑1	❑0
4	Serebrovasküler hastalık	❑1	❑0
5	Demans	❑1	❑0
6	Kronik Akciğer Hastalığı	❑1	❑0
7	Konnektif doku hastalığı	❑1	❑0
8	Peptik ülser hastalığı	❑1	❑0
9	Hafif düzeyde karaciğer hastalığı	❑1	❑0
10	Diyabet	❑1	❑0
11	Hemipleji	❑2	❑0
12	Orta-şiddetli böbrek hastalığı	❑2	❑0
13	Son organ hasarı yapan diyabet	❑2	❑0
14	Herhangi tümör varlığı	❑2	❑0
15	Lösemi	❑2	❑0
16	Lenfoma	❑2	❑0
17	Orta-şiddetli karaciğer hastalığı	❑3	❑0
18	Metastatik solid tümör	❑6	❑0
19	AIDS	❑6	❑0

Charlson ME, Pompei P, Ales KL, MacKenzie CR (1987) J Chronic Dis 1987;40(5):373–83

Modifiye Charlson Komorbidite İndeksi

		var	yok
1	Koroner arter hastalığı	❑1	❑0
2	Konjestif kalp yetmezliği	❑1	❑0
3	Periferik vasküler hastalık	❑1	❑0
4	Serebrovasküler hastalık	❑1	❑0
5	Demans	❑1	❑0
6	Kronik Akciğer Hastalığı	❑1	❑0
7	Konnektif doku hastalığı	❑1	❑0
8	Peptik ülser hastalığı	❑1	❑0
9	Hafif düzeyde karaciğer hastalığı	❑1	❑0
10	Diyabet	❑1	❑0
11	Hemipleji	❑2	❑0
12	Orta-şiddetli böbrek hastalığı	❑2	❑0
13	Son organ hasarı yapan diyabet	❑2	❑0
14	Herhangi tümör varlığı	❑2	❑0
15	Lösemi	❑2	❑0
16	Lenfoma	❑2	❑0
17	Orta-şiddetli karaciğer hastalığı	❑3	❑0
18	Metastatik solid tümör	❑6	❑0
19	AIDS	❑6	❑0

40 yaşından sonra her 10 yıl için ilave 1 puan eklenir.

Beddhu S, Bruns FJ, Saul M, Seddon P, Zeidel ML (2000) Am J Med. 2000 Jun 1;108(8):609–13

Toplam Puan: .....

7.5. Appendix 5. SF-36

SF-36 (Kısa Form 36)

Hastanın Adı Soyadı: ..... Tarih: ../../..

Aşağıdaki sorular sizin kendi sağlığınız hakkındaki görüşünüzü, kendinizi nasıl hissettiğinizi ve günlük aktivitelerinizi ne kadar yerine getirebildiğinizi öğrenmek amacındadır. Size en uygun yanıtı verin.

B1

1) Genel olarak sağlığınız için aşağıdakilerden hangisini söyleyebilirsiniz?

Mükemmel	Çok iyi	İyi	Orta	Kötü
❑1	❑2	❑3	❑4	❑5

B2

2) Bir yıl öncesi ile karşılaştırdığınızda şu anki genel sağlık durumunuzu nasıl değerlendirirsiniz?

	Çok daha iyi	Biraz iyi	Hemen hemen aynı	Biraz daha kötü	Çok daha kötü
Bir yıl öncesinden	❑1	❑2	❑3	❑4	❑5

B3

Aşağıdaki sorular bir gün içinde yapabileceğiniz işlerle (aktivitelerle) ilgilidir. Sağlığınız bu aktiviteleri kısıtlıyor mu? Eğer kısıtlıyorsa, ne kadar?

	Evet, Çok Kısıtlı	Evet, Biraz Kısıtlı	Hayır, Hiç Kısıtlı Değil
3) Koşmak, ağır kaldırmak, ağır sporlara katılmak gibi ağır etkinlikler	❑1	❑2	❑3
4) Bir masayı çekmek, elektrik süpürgesini itmek ve ağır olmayan sporları yapmak gibi orta dereceli etkinlikler	❑1	❑2	❑3
5) Market poşetlerini kaldırmak veya taşımak	❑1	❑2	❑3
6) Birkaç kat merdiven çıkmak	❑1	❑2	❑3
7) Bir kat merdiven çıkmak	❑1	❑2	❑3
8) Eğilmek, diz çökmek, çömelmek, diz çökmek	❑1	❑2	❑3
9) Bir kilometreden fazla yürümek	❑1	❑2	❑3
10) Birkaç yüz metre yürümek	❑1	❑2	❑3
11) Yüz metre yürümek	❑1	❑2	❑3
12) Kendi başına banyo yapmak ve giyinmek	❑1	❑2	❑3

B4

Son 4 hafta boyunca bedensel sağlığınızın sonucu olarak, işiniz veya diğer günlük etkinliklerinizde, aşağıdaki sorunlardan biriyle karşılaştınız mı?

	Evet	Hayır
13) Çalışma yaşamınızda veya diğer aktivitelerinizde geçirdiğiniz zamanı kısalttınız mı?	❑1	❑2
14) Arzu ettiğinizden daha az şeyi mi tamamlayabildiniz?	❑1	❑2
15) Çalışma veya diğer yaptığınız işlerin çeşidinde kısıtlama yaptınız mı?	❑1	❑2
16) Çalışma yaşamınızda veya diğer aktivitelerinizi yapmakta güçlük çektiniz mi? (Aşırı efor - çaba sarf ettiniz mi?)	❑1	❑2

B5

Son 4 hafta boyunca, duygusal sorunlarınızın (örneğin çökkünlük veya kaygı) sonucu olarak işiniz veya diğer günlük etkinliklerinizle ilgili aşağıdaki sorunlarla karşılaştınız mı?

	Evet	Hayır
17) Çalışma yaşamınızda veya diğer aktivitelerinizde geçirdiğiniz zamanı kısalttınız mı?	❑1	❑2
18) Arzu ettiğinizden daha az işi mi tamamlayabildiniz?	❑1	❑2
19)İşinizle veya diğer aktivitelerinizle ilgili işleri her zamanki kadar dikkat vererek yapamadınız mı?	❑1	❑2

www.ftronline.com

SF-36 (Kısa Form 36) Sayfa-2

B6 20) Son 4 hafta boyunca bedensel sağlığınız veya duygusal sorunlarınız, aileniz, arkadaş veya komşularınızla olan olağan sosyal etkinliklerinizi ne kadar etkiledi?

Hiç Etkilemedi	Çok Az	Orta Derecede	Epeyce	Çok Fazla
❑1	❑2	❑3	❑4	❑5

B7 21) Son 4 hafta içinde vücudunuzda ne kadar ağrı oldu?

Hiç Olmadı	Çok Az	Hafif	Orta	Çok	Pek Çok
❑1	❑2	❑3	❑4	❑5	❑6

B8 22) Son 4 hafta boyunca ağrınız, normal işinizi (hem ev işlerinizi hem ev dışı işinizi düşününüz) ne kadar etkiledi?

Hiç Etkilemedi	Biraz etkiledi	Orta Derecede	Epey Etkiledi	Çok Etkiledi
❑1	❑2	❑3	❑4	❑5

B9 Aşağıdaki sorular sizin son 4 hafta boyunca neler hissettiğinizle ilgilidir. Her soru için, sizin duygularınızı en iyi karşılayan yanıtı, son 4 haftadaki sıklığını göz önüne alarak seçiniz.

	Sürekli	Çoğu zaman	Epey zaman	Bazen	Ara sıra	Hiç bir zaman
23) Kendinizi yaşam dolu olarak hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6
24) Çok sinirli biri oldunuz mu?	❑1	❑2	❑3	❑4	❑5	❑6
25) Hiçbir şeyin sizi neşelendiremeyeceği kadar moraliniz bozuk ve kötü oldu mu?	❑1	❑2	❑3	❑4	❑5	❑6
26) Kendinizi sakin ve huzurlu hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6
27) Çok enerjik oldunuz mu?	❑1	❑2	❑3	❑4	❑5	❑6
28) Kendinizi kalbi kırık ve üzgün hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6
29) Kendinizi yıpranmış, bitkin hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6
30) Mutlu, sevinçli bir insan oldunuz mu?	❑1	❑2	❑3	❑4	❑5	❑6
31) Yorgunluk hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6

B10 32) Son 4 hafta boyunca bedensel sağlığınız veya duygusal sorunlarınız sosyal etkinliklerinizi (arkadaş veya akrabalarınızı ziyaret etmek gibi) ne sıklıkta etkiledi?

Sürekli	Çoğu zaman	Bazen	Ara sıra	Hiç bir zaman
❑1	❑2	❑3	❑4	❑5

B11 Aşağıdaki her bir ifade sizin için ne kadar doğru veya yanlıştır? Her bir ifade için en uygun olanını işaretleyiniz.

	Kesinlikle doğru	Çoğunlukla doğru	Emin değilim	Çoğunlukla yanlış	Kesinlikle yanlış
33) Ben diğer insanlara göre daha kolay hastalanıyorum	❑1	❑2	❑3	❑4	❑5
34) Tanıdığım kişiler kadar sağlıklıyım.	❑1	❑2	❑3	❑4	❑5
35) Sağlığımın kötüleşmekte olduğunu sanıyorum.	❑1	❑2	❑3	❑4	❑5
36) Sağlığım mükemmeldir.	❑1	❑2	❑3	❑4	❑5

7.6. Appendix 6. VAS

VAS Skor	Preop Değerlendirme			Postop Değerlendirme			Postop geç Değerlendirme		
	İstirahat	Aktivite	Gece	İstrahat	Aktivite	Gece	İstrahat	Aktivite	Gece

7.7. Appendix 7. Pulmonary Function Test

Solunum Fonksiyon Testi

Parametreler	1.Ölçmü (Pre-op)	2.Ölçüm (Post-op)	3.Ölçüm (Post-op geç)
FVC			
FEV_1			
PEF			
$\%FEV_1$			
FEF_{25-75}			

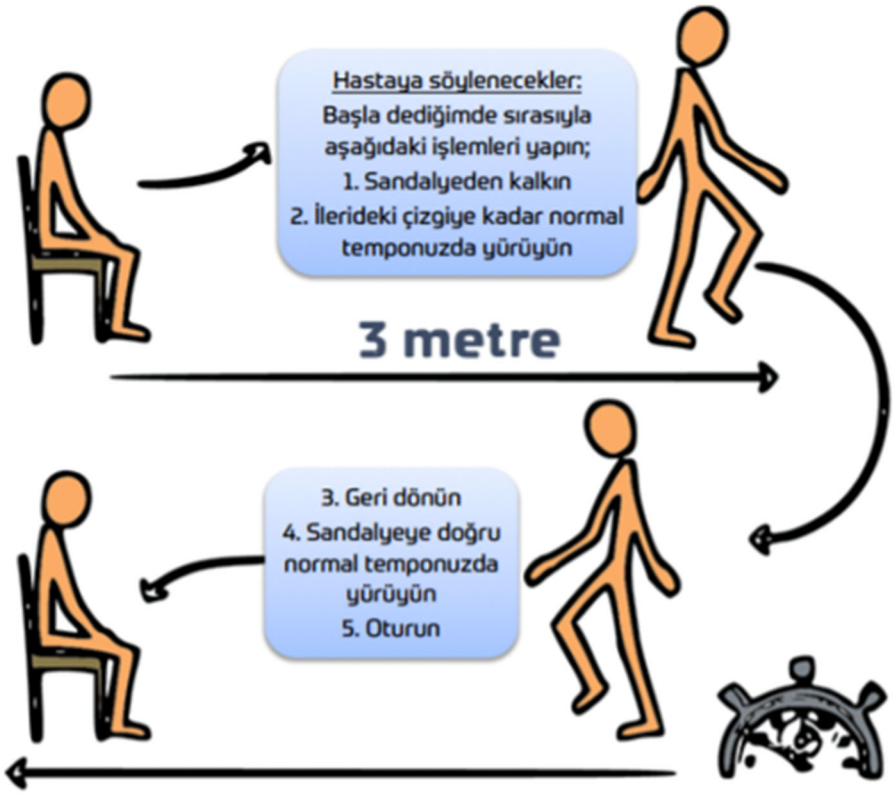
7.8. Appendix 8. The Time Up and Go

Zamanlı Kalk Ve Yürü Testi

The Timed Up and Go (TUG) Test

Hastanın Adı Soyadı: ..... Tarih: ../../..

Yaşlılarda düşme riskini ve mobiliteyi değerlendiren testin uygulanışı için bir sandalye ve bir kronometre gereklidir. Test hastanın herzaman kullandığı ayakkabı ile yapılır ve eğer ihtiyaç duyuyorsa yürümeye yardımcı araçlarını kullanabileceği söylenir. Sandalyenin önündeki 3 metrelik alan belirlenir. Hastadan sandalyeden kalkıp bu mesafeyi yürüyüp tekrar oturması istenir. Geçen zaman testin sonucunu verir.



Geçen Süre: ..... saniye

Yaşlı bir birey bu testi 12 saniyeden daha uzun sürede tamamlıyorsa düşme riski vardır

Var olanları işaretleyin:

❑ Yavaş ve değişken tempo	❑ Denge kaybı
❑ Kısa adım aralığı	❑ Kol sallama kısa ya da yok
❑ Duvara tutunuyor.	❑ Ayaklarını sürüyor
❑ Kalıp gibi dönüyor	❑ Yürüme araçlarını düzgün kullanmıyor

ftronline

7.9. Appendix 9. 30-Second Chair Stand Test

30 Saniye Kalk Otur Testi

30-Second Chair Stand Test (30s-CST)

Hastanın Adı Soyadı: _____ Tarih: ____/____/_____

Hastanın oturup kalkma aktivitesini, alt ekstremite gücünü ve dinamik balansını değerlendiren bir testtir. Hastanın 30 saniye içinde oturup kalkma sayısı testin skorunu verir.

Gerekli ekipmanlar:

Oturma yüksekliği 44 cm civarı olan ve yaslanma yeri olan bir sandalye (mümkünse kollukları olmayan), kronometre. Test tekrarının aynı sandalye ile yapılması önerilir. Sandalyenin oturup kalkma sırasında yer değiştirmemesi için duvara dayanması önerilir. Hasta sandalyeye oturduğunda ayakları yere değmeli. Daha konforlu ve hızlı oturup kalkma yapabilmesi için ayakların diz hizasının gerisinde kalması önerilir. Hasta sandalyeye oturur. Kollarını şekilde görüldüğü gibi çaprazlayıp her 2 omuzuna dokunur. Testten önce hastanın bir iki deneme yapmasına izin verilir. Gerekiyorsa nasıl yapacağı gösterilir. Hasta sandalyeden kalktığında kalça ve dizler tam fleksiyona gelmeli hasta dik bir şekilde durmalı ardından tekrar oturmalı, oturduğunda kalçaları sandalyeye tamamen temas etmelidir. Hasta 30 saniye boyunca bu şekilde oturup kalkar.

Hastaya okunacak yönerge:

Teste başladığınızda yapabildiğiniz en hızlı şekilde oturup kalkın. Ancak dengenizi bozacak kadar kendinizi aşırı zorlamayın. Ellerinizi karşı taraf omuzlarınıza değecek şekilde çaprazlayın. Ayaklarınızı omuz hizanıza göre yere koyun. Ben "başla" dediğimde tam oturur pozisyondan tam kalkar pozisyona ve sonra tekrar oturur pozisyona gelecek şekilde 30 saniye boyunca oturup kalkın. Hazırsanız başlayalım. "Başla"

Kesme değer:

30 saniyede 10'dan daha az oturup kalkma alt ekstremite güçsüzlüğüne işaret eder.

Jones CJ, Rikli RE, Beam WC (1999) Res Q Exerc Sport. 1999 Jun;70(2):113-9

Hastanın 30sn otur kalk sayısı: _____

7.10. Appendix 10. Hadgrip Strength Test

Handgrip Strength Test (HGST)

Hastanın Adı Soyadı: ..... Tarih: ..../..../.....

Bu testin amacı el ve ön kol kaslarının maksimum izometrik kasılma gücünü test etmektir. Testin yapılabilmesi için el kavrama dinamometresi gereklidir (Jamar™, Camry™, Smedley™ gibi).

Dinamometre Örnekleri

Kavrama gücü hasta sandalyede otururken değerlendirilmelidir. Dirsekler gövdeye yakın ve 90° fleksiyonda tutulur. El bileği nötraldedir. Ölçüm yapılacak kişiden dinamometreyi kavrayarak yapabileceği en kuvvetli şekilde sıkması istenir. Test sonucu üç ölçümün ortalaması hesaplanarak belirlenir.

Ölçüm için norm değerler: 20-69 yaş erkeklerde 47-40kg (sol el 2 kg daha az) kadınlarda 30-24kg (sol el 1,5-2kg az)

	Sağ (kg)	Sol (kg)
1. Ölçüm	.....	.....
2. Ölçüm	.....	.....
3. Ölçüm	.....	.....
Ortalama	.....	.....

Massy-Westropp et al. Hand Grip Strength: age and gender stratified normative data in a population-based study BMC Research Notes 2011, 4:127