



## Original Article

## The Prevalence and Characteristics of Shoulder Pain in Female Patients with Coronary Artery Bypass Graft (CABG)

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### ABSTRACT

**Background:** Currently, cardiovascular disease is the most common cause of death in the world. The current study aimed to determine the prevalence and characteristics of shoulder pain in female patients with coronary artery bypass graft (CABG).

**Methods:** This cross-sectional study enrolled 136 women after (CABG) through easy access, and questionnaires were distributed to them. The subjects were asked to complete the questionnaire regarding the time of incidence and characteristics of their shoulder pain, their history of exercise, and their history of pulmonary, cardiovascular, and other diseases. The patients' intensity of pain was measured using the visual analog scale (VAS).

**Results:** In this study, 45 patients had shoulder pain. In nearly half of the patients, the pain began from the left shoulder, and one-third of the patients had pain in both shoulders. Onset of pain was sudden in more than 50% of cases.

**Conclusion:** One-third of patients who underwent CABG suffered from shoulder pain which appeared quickly and within less than a day. The pain was frequently in the left shoulder or between the shoulder areas. Since the age of patients in this study was 50+ years, if the pain persisted, the probability of incidence of frozen shoulder is high.

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### Introduction

The heart beats continuously to pump blood throughout the body and supply blood, oxygen, and other nutrients to body tissue. Coronary arteries are responsible for supplying what the cardiac tissue needs. Coronary artery stenosis causes a lack of oxygen and nutrient transport to the heart muscle, and prolonged oxygen and nutrient deficiency in the heart causes necrosis of part of the heart muscle and leads to myocardial infarction.

Being non-communicable, cardiovascular diseases are currently known as the most common cause of death in the world, and they will maintain this status in middle-income countries until 2030 [1]. The World Health Organization has introduced cardiovascular diseases as a modern epidemic. Such diseases are not limited to developed countries, but are also the main cause of death in the Middle East and in parts of Eastern Europe [2]. In Iran, more than 39.3% of deaths are caused by ischemic heart diseases [3-5], and coronary artery bypass graft (CABG) comprises 60% of all open heart surgeries [6]. Severe damage to the soft tissue, bones in the chest wall, and the anterior-upper arms and shoulders are likely to happen after CABG [7]. Pain, especially in the chest, is the most important complication occurring after CABG.

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It is referred to as post-CABG pain and is observed in 56% of CABG patients [8]. Pain causes protective spasms in the chest muscles and difficulty in taking deep breaths. Low-volume breathing is a predisposing factor for atelectasis. Pain also disrupts the effectiveness of coughing; mucus, therefore, accumulates in the lungs, and pulmonary infections may develop. Shoulder pain is another post-CABG complication. The most important cause of shoulder pain in patients who have undergone CABG is the position of the upper limbs, especially on the left, during surgery, through median sternotomy, and through their severe retraction to create enough space for the execution of open heart surgery [9].

Immobility can lead to impaired respiratory movements, weak coughing, atelectasis, difficulty in bowel movements, exhaustion, and sleepiness [10, 11]. Upper limb movements often help patients increase mobility, perform breathing exercises, and increase lung capacity [12]. Nevertheless, due to the risk of sternal nonunion or malunion, patients are recommended to avoid movements that stretch the sternum, including shoulder horizontal abduction and shoulder extension. Together, these factors can limit the range of motion of the shoulder joint and lead to permanent movement limitations in the elderly.

Despite the high prevalence of open heart surgery and the necessity of performing breathing exercises (including shoulder movements), according to the available published literature, no studies have investigated the prevalence of shoulder pain or its signs and symptoms, time of occurrence, and effect on patients' sleep patterns after surgery. Since learning about the syndrome is the main element in choosing an appropriate treatment for it, the present study was conducted to determine the prevalence and characteristics of shoulder pain in female Iranian patients who have undergone coronary artery bypass graft. The results may help include the upper limbs in breathing exercises and daily activities with a greater awareness and provide better answers to patients concerned about shoulder pain after CABG.

## Methods

The present descriptive cross-sectional study selected its samples through convenience sampling and distributed questionnaires among 136 female patients with cardiovascular diseases who had undergone CABG. After providing their informed written consent, the subjects were asked to complete a questionnaire on the time of incidence and characteristics of their shoulder pain,

their history of exercise, and their history of pulmonary, cardiovascular, and other diseases. The study inclusion criteria consisted of being able to answer the items in the questionnaire either verbally or in written form and not using the upper limbs for grafting. The exclusion criteria consisted of a lack of cooperation in answering the questionnaire items, restlessness and impatience when completing the questionnaire, and withdrawal from the study.

During hospitalization, the patients' intensity of pain was measured using the visual analog scale (VAS), the questionnaire was completed, and examinations were performed to assess pain and tenderness and shoulder range of motion in all directions. To reduce the patients' anxiety, they were assured that the study had no effect on their treatment or recovery and was only a survey. Data on the patients' height, weight, blood pressure, shoulder and spine symmetry, duration of surgery and hospitalization, and type of vessel used were extracted from their records. The data was analyzed using SPSS software, version 17.

## Results

The present descriptive cross-sectional study was conducted on 136 female patients with heart disease who had undergone CABG; 45 (33.09%) of the patients suffered from shoulder pain. Table 1 presents the general details of the participants and their pain intensity. In all participants, the appearance of the shoulders, shoulder symmetry, and overall condition of the spine were normal. The mean length of hospital stay was  $8.89 \pm 2.24$  days, and all patients began experiencing shoulder pain less than one day after their surgery. A total of 33 (73.3%) of the subjects had no shoulder pain before surgery. After surgery, 46.7% ( $n=21$ ) of patients reported the onset of pain in the left shoulder. In 35.6% ( $n=16$ ) pain was felt in both shoulders, and in 11% ( $n=5$ ) pain started from the area between the shoulders. In only three cases (6.7%), pain began from the right shoulder. In more than half of the subjects ( $n=29$ , 64.4%), pain began suddenly; in others, it emerged over time. The mean VAS pain score was  $6.64 \pm 1.81$  a day after surgery. A total of 68.9% ( $n=31$ ) of the subjects experienced pain at all hours of the day and night, 13.3% ( $n=6$ ) in the morning, 13.3% ( $n=6$ ) at night, and 4.4% ( $n=2$ ) in the afternoon. In 44.4% of the patients, shoulder pain was not linked to any certain activity, but was felt with all sorts of activity, even at rest. A total of 53.3% of the subjects woke up from shoulder pain while others did not feel any pain during sleep. After

**Table 1:** General details of participants (N=45)

Variables	Mean±SD	Median	Minimum	Maximum
Age (year)	54.78±12.16	57	23	75
Height (Cm)	159.23±6.35	158	150	176
Weight (Kg)	66.93±10.50	65	48	100
BMI	26.36±4.08	26	20	38
Systolic pressure	12.64±1.26	12	11	15
Diastolic pressure	6.91±0.70	7	6	8
Shoulder pain intensity (by VAS)	6.64±1.81	6	3	10

VAS: Visual Analog Scale

their hospital discharge, 57.8% of the patients (n=30) visited a doctor for pain relief, and more than half of them (n=26) received medications to reduce pain. A total of 86.7% of the patients (n=39) did not have limited shoulder range of motion, two had limitations in abduction and external rotation, and four were limited only in abduction. Touching the shoulder revealed no abnormal symptoms such as warmth, muscle spasm, or pain in 41 patients (91.1%) and showed tenderness and pain around the joint in only four.

A total of 77.8% (n=35) of the patients had no heart disease before surgery, and in the rest, mitral valve replacement was the most prevalent history (n=5, 11.1%). A total of 28 (62.2%) patients had no history of non-cardiac diseases (such as stroke, Parkinson's disease, or thyroid disease), while among the remaining 17 patients, diabetes was the most prevalent disease (n=7, 15.6%).

As mentioned before, the upper limb arteries were not used for grafting in any of the patients. In 14 patients (31.11%) and 31 cases (68.89%), the internal thoracic artery and the saphenous veins, respectively, were used for grafting. Surgery duration ranged from two to six hours. In 57.8% of the patients (n=26), surgery lasted from three to four hours. The maximum duration of surgery was five to six hours (n=5, 11.1%), and in 14.31% (n=14) of patients, surgery lasted less than 3 hours. The duration of time spent the open heart ICU was one to six days; 28 cases (62.2%) spent one to three days and 17 cases (37.8%) spent four to six days in the open heart ICU. Almost all patients were discharged immediately after being transferred to the cardiac unit.

The patients' physical conditions during sleep showed no consistent patterns before surgery, but after surgery, 75.6% of them lied on their back for sleeping (Table 2). An interesting finding of this study was that none of the patients were used to sleeping on their left side before the surgery. A total of 62.2% (n=28) of the patients had no pulmonary disease before surgery, while others (n=17, 37.8%) had some degree of pulmonary disease.

Examining the patients' histories of physical activity showed that 51.1% had no history of physical activity. In the remaining patients, walking was the most frequent

type of activity performed (22.2%, n=10) among others (jogging, fitness, cycling, and aerobic exercises).

## Discussion

According to the results of this study, one-third of patients who underwent CABG experienced shoulder pain which appeared quickly, less than a day after surgery, and usually affected the left shoulder or the area between the two shoulders; medications were used to reduce it. Despite the rapid onset of pain, most patients had no limited shoulder range of motion. Nevertheless, due to the old age of the participants, if pain persisted, the incidence of frozen shoulder was likely high.

In the first phase of cardiac rehabilitation after CABG, shoulder exercises are used to improve ventilation, increase chest mobility and blood flow, and repair the sternum [12]. As reported by Shaw et al., limited shoulder range of motion is caused by the particular position of the body during CABG, and exercise therapy has no effect on the shoulder range of motion after this surgery [13]. According to a study by Eisenberg et al., of the 217 studied patients who underwent CABG, only three had pain in the left shoulder, and two of these three also had a limited range of motion [8]. Nevertheless, in the present study, about one-third of the patients experienced shoulder pain after CABG.

The mean VAS pain score was reported higher than 5 by participants completing the questionnaire, and a large number of participants experienced pain at all hours of the day and night and with the performance of any kind of activity. Eisenberg et al. showed that post-CABG pain has a high prevalence and a negative effect on mood and active daily activities [8]. Considering the duration of this type of surgery, it can be concluded that the pain is caused by inflammatory lesions of the soft tissues after the tension and stretching imposed during surgery. However, a case study has shown that the spinal accessory nerve is damaged during CABG, and the prolonged stretching and tension of the upper limbs is a potential mechanism at play. The EMG analysis showed an injury in the left upper trapezius muscle. The

**Table 2:** Frequency distribution of sleep patterns before and after CABG

Sleep Pattern	Before Surgery	After Surgery
	Frequency (%)	Frequency (%)
Prone	3 (6.7%)	0 (0%)
Lying on the right, left, back, and prone	2 (4.4%)	2 (4.4%)
Supine	9 (20%)	34 (75.5%)
Lying on the right, left, and supine	9 (20%)	3 (6.7%)
Lying on the right and left	10 (22.2%)	3 (6.7%)
Lying on the right	12 (26.7%)	3 (6.7%)
Total	45 (100%)	45 (100%)

CABG: Coronary Artery Bypass Graft

researchers therefore conclude that, in the event of muscle pain or weakness in the shoulder after CABG, injuries to this muscle should be taken into consideration [14]. As reported by another study, the isolated injury of the spinal accessory nerve after CABG led to weakness in the right shoulder, droopy shoulders, and difficulty in raising the arm forward. Electrical stimulation and exercise were used for this patient for six months to improve symptoms [15]. In the present study, despite the rapid onset of pain and high prevalence of shoulder pain, most patients had no limitations in shoulder movement and did not have droopy shoulders, suggesting the absence of direct muscle or nerve injuries.

Most patients in this study used medications to reduce pain, and drug interactions may have caused unwanted side effects; however, rehabilitation treatments lack side effects. According to a study by Jones et al., cardiac rehabilitation improves physical activity, enhances recovery and health, helps modify lifestyle, returns self-confidence to the patients, and improves the patients' knowledge about cardiac diseases [16]. Given the minimum one-week hospitalization required for these patients, this period can be best used for training shoulder movements and physiotherapy treatments for reducing pain. For example, a study by Sultan Zadeh et al. showed that the use of TENS (Transcutaneous Electrical Nerve Stimulation) reduces post-CABG pain as well as drug use and its complications [10]. Some researchers have examined the effects of stroking massages on the lower and upper limbs and the back of patients after CABG during their hospital stay and have reported a significant reduction in pain in them compared to the controls [17, 18]. Using foot reflexology massage in patients who underwent CABG also reduced their pain significantly [19]. According to the results of this study and the other studies discussed, rehabilitation treatments are recommended to be used for reducing pain more quickly (including shoulder pain) and for minimizing the use of analgesics.

It has been shown that the age at which most people with coronary artery disease require CABG is over 55 [17, 19, 20], and these patients are also prone to different musculoskeletal disorders. Most patients with idiopathic frozen shoulder are women aged 50 to 70 years [21]. In one study, Jamal Uddin et al. reported the incidence of frozen shoulder in patients undergoing cardiothoracic surgery as 35% [22]. They found that frozen shoulder is more prevalent among women and older adults than among men and younger individuals, and diabetic patients also showed a higher prevalence of this condition. In the present study, 39 of the 45 participants had no limitation in their shoulder range of motion; however, the limitations in abduction and external rotation in others due to their high mean age ( $54.78 \pm 12.16$ ) can be indicative of the high incidence of frozen shoulder in the case of not moving the shoulder to all directions due to pain. Frozen shoulder pain is felt almost permanently in the shoulder and gets worse at night and in cold weather. In the present study, most patients experienced pain at all hours of the day and night. Having a history of cardiac disease and/or diabetes comprised a risk factor for the

incidence of frozen shoulder [23]. Three of the seven patients in this study who had a history of diabetes had limitations in shoulder range of motion. The incidence of frozen shoulder, therefore, appears to be high among this group of patients. Furthermore, the results of this study indicated that only 9% of participants slept on their backs before undergoing CABG. After surgery, however, 34% lied on their back for sleeping (the most frequent sleeping pattern). This sleep pattern is evidently associated with the least amount of shoulder motion and may contribute to the incidence of frozen shoulder.

A study by Dehdari et al. showed that continuous education plays an important role in promoting behaviors and performing proper exercises [24]. According to a study by Abbasi et al., after undergoing CABG, patients paid more attention to measures such as exercise, quitting smoking, and following doctors' orders so as to maintain their health, alter their lifestyle, lose weight, and adhere to their diet and medical regimen [25]. In the present study, half of the participants had no history of physical activity before the onset of cardiac disease, and in those with a history of physical activity, walking was the most prevalent activity performed. Even those who performed other activities did not specifically move their shoulder joints, and physiotherapy after CABG was their first regular exercise regimen. Given that most of the patients constantly slept on their back after CABG, the risk of complications such as bedsores, limitation of motion in the spine, back pain, etc. should be more thoroughly considered. Proper exercise programs can be used to improve patients' physical performance and prevent such complications [20].

ICU is a stressful environment for patients and their relatives. Patients experience high levels of anxiety during their stay in this unit, because most of them are critically ill and need specialized care. Moreover, they are not expected to live much longer [26]. More than half of the patients in the present study spent one to three days in the ICU, and one-third of them stayed four to six days. Cardiac surgeries, especially CABG, are associated with high levels of anxiety [27] and can manifest themselves as pain or physical and motor problems [28]. On the other hand, according to Choiniere et al., patients who underwent cardiac surgeries experienced more pain after earlier discharged from ICU, because they received less analgesic drugs [29]. In this study, most of the patients (77.8%) had no history of cardiac diseases; therefore, the sudden onset of shoulder pain in them may have been due to the cumulative effect of anxiety and the tension and stretching imposed during surgery. It has been shown that cardiac rehabilitation programs can reduce depression and anxiety after CABG. Interestingly, these rehabilitation programs lead to lower anxiety levels in women than in men [30].

## Conclusion

To conclude, almost one-third of the patients in this study who underwent CABG experienced shoulder pain. The time, place, and manner of the onset of pain (within

less than a day from the surgery, abruptly and normally in the left shoulder) in a large number of the participants may be indicative of the effects the position of the left shoulder during surgery and the prolonged duration of surgery has on the incidence of this pain.

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**Conflict of interest:** None declared.

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