

# Spirometric values and chest pain intensity three days post-operative coronary artery bypass graft surgery



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**Aim:** Coronary artery bypass graft surgery (CABG) is proved to have ventilatory complications and reduction in spirometric values. This study aimed to examine the hypothesis that reduction of post-operative chest pain intensity would be associated with improvement in the spirometric values for patient underwent CABG.

**Materials and method:** 26 cardiac patients recruited for this study. Their convenience to the study inclusion criteria decided their eligibility. Through 3 days after elective CABG their spirometric values were measured along with their perception to chest pain intensity using 0–10 numeric rating scale. Collected data were recorded and analyzed statistically.

**Results:** Chest pain intensity showed progressive significant ( $P = 0.0001$ ) reduction through the 3 days post-operative. On the other hand spirometric values also showed progressive improvement through the 3 days post-operative. This improvement was significant for all measured spirometric values except for the ratio of forced expiratory volume in the 1st second to the forced vital capacity ( $P = 0.134$ ). There was no significant relationship between the chest pain intensity and spirometric values. This was applied to all measured spirometric values and to the 3 days postoperative.

**Conclusion:** The current study findings rejected the examined hypothesis that reduction of post-operative chest pain intensity would be associated with improvement in the spirometric values for patient underwent coronary artery bypass graft surgery. There was no significant relationship between the chest pain intensity and any of the spirometric values at any of the 3 post-operative days.

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**Keywords:** Coronary artery disease, Saudi Arabia, Coronary artery bypass graft surgery, Spirometric values, Pulmonary complications, Chest pain intensity, Numeric Rating Scale, Risk-related factors

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## Introduction

Coronary artery disease is a common health problem in Saudi Arabia. [1,2] Coronary artery bypass graft (CABG) surgery is the revascularization procedure for patients with coronary artery disease.[3] Post-operative pulmonary complication, in the form of restrictive pattern of ventilatory function with reduction in the spirometric values, is well known after CABG [4–9]. Different risk factors have been noted. Mennella and Zangrillo (2011) categorized risk factors into patient-related factors, procedure-related factors and postoperative care-related factors [10]. Patient-related risk factors include old age especially those above 70 years [11,12], morbid obesity [13,14], smoking [12,15,16], diabetes [17], and symptomatic lung diseases [10,18,19]. Procedure-related risk factors include anesthesia [10,20,21], type of cardiac surgery [4], surgical incision [22], use of topical cooling [10,21], and cardiopulmonary bypass machine [21–24]. Postoperative care-related factors include use of pain control and narcotic medications [10,24]. The hypothesis behind post-operative chest pain as a related factor of post-operative ventilatory complications and reduced spirometric values is that pain causes chest wall dysfunction which limits the voluntary actions of the chest wall respiratory muscles and causes breathing to become rapid and shallow [4,25].

Spirometry is a fundamental and essential part of pulmonary function tests and provides the most information. In spirometry, a device called a spirometer measures specific lung volumes and capacities [26]. Spirometry has been shown to be valid, reliable, and reproducible for cardiac surgery patients [27–29].

The universal pain numeric rating scale (NRS), on which patients rate their current pain intensity from 0 (no pain) to 10 (worst possible pain), has become the most widely used instrument for pain screening [30]. The NRS is a short, easy-to-administer, validated measure of pain intensity [31,32].

This study aims to examine the hypothesis that reduction of post-operative chest pain intensity is associated with improvement in spirometric values for patients who have undergone coronary artery bypass graft surgery.

## Methodology

This study was approved by the College of Applied Medical Sciences, King Saud University. Saudi cardiac patients listed for elective coronary

### Abbreviations

CABG	coronary artery bypass graft
NRS	numeric rating scale
VC	vital capacity
FVC	forced vital capacity
FEV <sub>1</sub>	forced expiratory volume in the 1 <sup>st</sup> second
MVV	maximum voluntary ventilation

artery bypass graft (CABG) surgery at King Abdulaziz Cardiac Center, King Abdulaziz Medical City, Riyadh, Saudi Arabia were recruited for this study. Inclusion criteria were: ages between 45 and 69 years; a diagnosis of coronary artery disease; patient undergoing elective CABG for the first time through median sternotomy; a body mass index  $\leq 35\%$ ; lifelong non-smokers or have stopped smoking for at least eight weeks before the surgery; free from respiratory dysfunction; free from chest pain before CABG; and weaned from mechanical ventilator post-operative after less than 24 h. Convenient method was used to enroll patients into the study.

Patients who met the above inclusion criteria and who agreed to participate in the study were included. The 26 patients who were included in the study signed a consent form. Prior to surgery, researchers explained the aim of the study to patients and gave assurances there would be no positive or negative consequences in the health services they received or in their treatment plan as study participants. Patients received the usual pain management medications and rehabilitation protocol. Study participants were instructed on how to use the NRS 0–10 points to score their perceived intensity to chest pain with 0 indicating no pain and 10 indicating worst possible pain. Study participants were also instructed on how to follow the American Thoracic Society standardized instructions for spirometric measurements [33]. Researchers approached patients immediately post-operation, after weaning from mechanical ventilators and upon receiving permission of the surgeon in charge. For three successive immediate post-operative days, researchers used data sheets to record patient scores for chest pain and spirometric values of vital capacity (VC); forced vital capacity (FVC); forced expiratory volume in the first second (FEV<sub>1</sub>); ratio of FEV<sub>1</sub>/FVC; and maximum voluntary ventilation (MVV).

### Data analysis

Collected data were analyzed statistically using SPSS soft program version 17. Demographics of the patients were expressed in mean and standard deviation (SD) for continuous variables and

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