Review Article

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Utilizing OPEP Devices, Reduce Post-operative Complications Related to Pulmonary Function following Coronary Artery Bypass Graft Surgery: Evidence-Based Study

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ABSTRACT:

Background: The most common and major cause of hospitalization-related morbidity, mortality, and expenses is postoperative pulmonary problems. Patients receiving CABG have a high risk of developing post-operative pulmonary problems. Members of the oscillatory positive expiratory pressure [OPEP] family may benefit from this treatment.
Objective: The purpose of this literature review is to enhance knowledge regarding the function of OPEP devices and their relationship to post-operative pulmonary complications following CABG.
Method: From January 2009 to December 2023, pertinent keywords will be employed for the research using the electronic databases PubMed, Medline and Google Scholar. Bibliographic information and associated research materials were managed using Zotero, an open-source reference management programme.
Result: databases including PubMed, Medline, and Google Scholar, where 12 studies that initially passed the inclusion criteria were examined and included. A total of 27,689 citations were evaluated in PUBMED, GOOGLE SCHOLAR, and MEDLINE between January 2009 and December 2023. Following the application of inclusion/exclusion criteria, which included full text and abstract screens, 27,677 articles were discarded throughout the data extraction process.
Conclusion: Research has demonstrated the effectiveness of OPEP devices in treating a variety of respiratory illnesses; however, less research has been done on the use of OPEP devices in patients after heart surgery. Thus, the study's objective is to assess the accuracy, desired outcome, and necessary knowledge of OPEP devices as well as their efficacy.
KEY WORDS: CABG, OPEP Devices, Pulmonary Complications.

BACKGROUND

One of the main causes of illness and mortality worldwide is cardiovascular disease. The World Health Organization (WHO) estimates that cardiovascular disease would claim the lives of 17.9 million people globally per year by the year 2030, or 23 million deaths [1]. Following heart, chest, and abdominal procedures, postoperative pulmonary complications

(PPCs) are a common occurrence. After CABG surgery, PPCs are common and occur in between 30 and 60 percent of cases. Hospitalization expenses, morbidity, and death are all greatly impacted by PPC complications [1].

Atelectasis, pleural effusion, pulmonary oedema, pulmonary infections such pneumonia and bronchitis, and respiratory insufficiency are some of these consequences. Pain and anxiety after surgery that stems from altered lung mechanics make it difficult to execute effective coughing and periodic deep inspiration, which leads to secretion buildup, alveolar collapse, and altered gas exchange [2].

While there is little evidence to support the effectiveness of respiratory physiotherapy, it is commonly used to prevent or lessen pulmonary problems after heart surgery. Following coronary artery bypass graft (CABG) surgery, postoperative breathing exercises in conjunction with physical therapy have been shown to be just as beneficial in lowering the risk of pneumonia, atelectasis, and other pulmonary complications as physical therapy alone, including early mobilization [3].

Furthermore, the therapist must expend a great deal of effort and time using these strategies. As a result, more people are using assistive technology to help with secretion removal. Many tools that support current physiotherapy procedures in enhancing secretion clearance and mobilisation have surfaced in recent years. These tools are less time-consuming for the therapist, safer, and provide patients more independence. Positive expiratory pressure (PEP) therapy is one kind of airway clearance technique that creates airway pressure above atmospheric pressure by means of imposed expiratory flow resistance [3,4].

PEP devices come in a wide variety of forms and produce PEP in three basic methods. The simplest way to produce PEP is to use a flow resistor, like an orifice. Over the past 20 to 25 years, OPEP therapy devices have gained popularity as an adjunct to fixed PEP treatment. When a patient exhales into the device, they work through a number of mechanisms that produce a sequence of brief flow occlusions. When the patient actively exhales through the device and inhales a little larger-than-normal tidal volume, a series of oscillatory airway pressure fluctuations are produced [5].

Acapella is flow-operated Oscillatory Positive Expiratory Pressure (OPEP) device is the Acapella, which is made up of a metal strip and counterweighted plug that are connected to a magnet. The magnet oscillates as the patient exhales into the device, causing oscillations in the air flow [6]. There are multiple Acapella* OPEP device versions available at the moment. Since it can be used on patients with significant airflow blockage and/or airway instability, the original blue version of the Acapella device may be more beneficial than other models that were on the market in 2003, according to Volsko et al [7].

The Flutter OPEP device has an exterior that resembles a shortened tobacco smoker's pipe. It is slightly under 6 cm long, with a mouthpiece located close to the user, a plastic cover that is both protective and perforated at the distal end, and an interior that houses a plastic annular cone that holds a high-density stainless-steel ball. The angle at which the device is held determines how much effort is needed to start the ball vibrations that produce the OPEP waveform because the gadget is gravity-dependent. The oscillation's frequency and amplitude cannot be adjusted in any other way [8].

Moreover, the Quake OPEP gadget is compact, measuring only 10 cm in length and 5 cm in width. It has a curved exterior, with the outer housing bending at a right angle to connect to

the outer barrel that is farther away from the mouthpiece. The handle rotation velocity has an impact on the OPEP profile even if there isn't a separate PEP setting adjustment. Consequently, a low-frequency oscillation and a greater pulsatile expiratory pressure are produced by slowly turning the handle. Accelerating the handle rotation causes oscillations at higher frequencies and simultaneously reduces the peak pressure waveform of the expiratory pressure pulse [9].

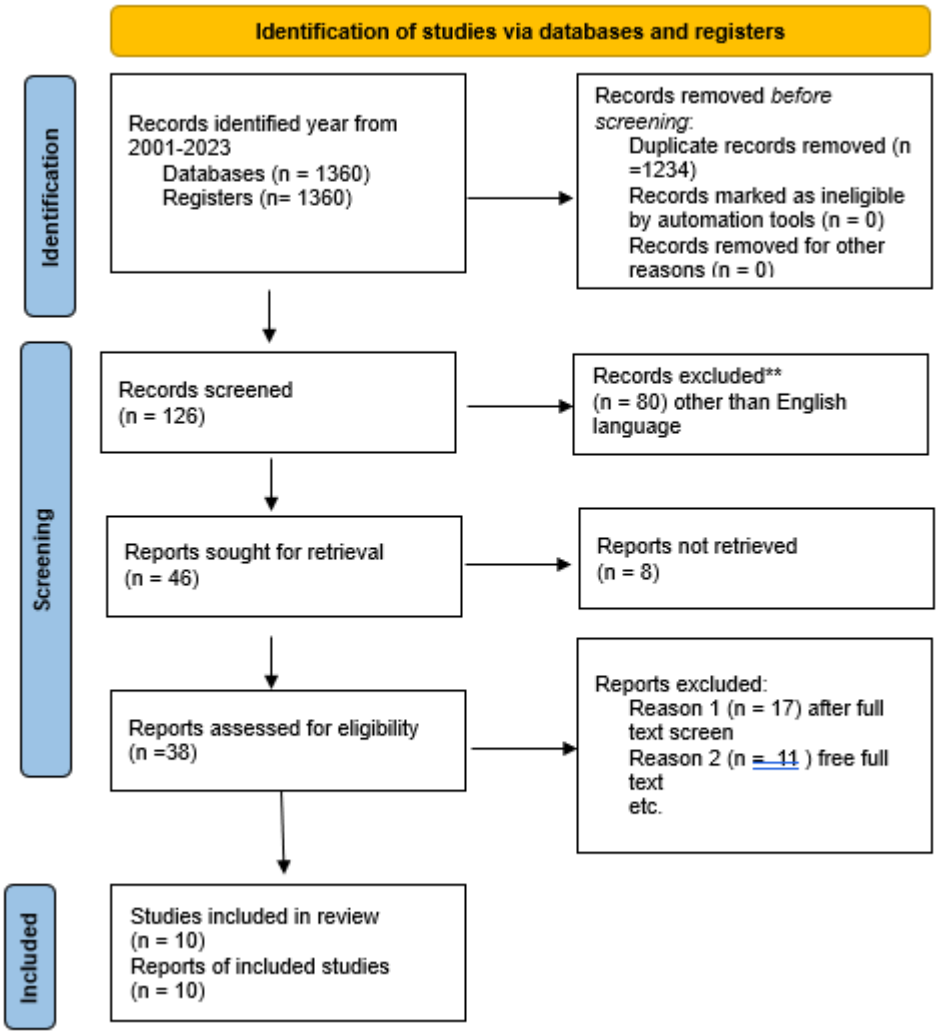
This study aims to give clinicians enough knowledge to assess the qualities and effectiveness of the many different mechanical mobilisation methods available, with an emphasis on OPEP devices. Nonetheless, its potential may help patients who have had heart surgery with their post-operative pulmonary problems. This study proposed that early post-operative respiratory outcomes for patients after CABG surgery could be improved by combining OPEP devices with traditional institutional chest physiotherapy.

Methodology:

Search strategy

The search strategy employed a comprehensive approach utilizing multiple reputable databases and platforms to identify pertinent articles. Google Scholar, PubMed, Pedro and ResearchGate were selected as the primary search engines. The inclusion of diverse sources aims to ensure a thorough and well-rounded exploration of scientific evidence related to REDUCE POST OPERATIVE COMPLICATIONS OF PULMONARY FUNCTION AFTER CORONARY ARTERY BYPASS SURGERY USING OPEP THERAPY

Study selection: This is an Evidence-Based Study that was carried out following the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines.



In the screening process 1,360 studies with potential relevance were initially identified. Following a preliminary review of titles and abstracts 1,234 articles were excluded, leaving 126 articles. Subsequently 80 articles are other than English language, 11 articles underwent payment, and 17 articles were then excluded based on full text articles criteria, resulting in the inclusion of 10 articles in this study.

Ten of the six reports were RCT parallel group trials, two were comparative study and two were experimental; the studies were published between 2001 and 2023. TWO studies were characterized by excellent methodological quality, while the remaining EIGHT exhibited good quality based on Pedro criteria. The literature on the efficacy of OPEP therapy revealed a combination of both varied quality and outcomes. In certain RCTs, OPEP devices was employed as an adjunct to other treatments, making it challenging to assess the specific impact of OPEP devices.

The Ten included studies comprised a total of 522 patients with CABG and the duration of intervention was first day after surgery to seventh day. A range of comparisons were used

including conventional therapy (eg, CABG medication regimen) and OPEPE devices like acapella, flutter and quake. Nine studies found that OPEP devices demonstrated greater effectiveness compared to a control group receiving alternative or conventional treatments or combined treatment. Additionally, one study concluded that Carrying out PEEP therapy after coronary artery bypass surgery with EzPAP incentive spirometer allows the restoration of volumetric and velocity respiratory values at the moment of patient discharge from the hospital, whereas after vibrational PEEP therapy the Acapella device restores only volumetric values, and in the patients of the control group, recovery does not occur.

There are several reports that alternative types of vibration and oscillation can facilitate air removal and improve lung function in various clinical settings. So far, no clinical studies have evaluated the effect of positive vasodilator pressure with Acapella (Smiths Medical Inc, Carlsbad, California) in patients undergoing coronary artery bypass grafting. Oscillating airflow is initiated on exhalation through the patient interface by the breaking and reforming of the magnetic field, thereby intermittently occluding the passing air flow. The expiratory resistance and oscillation profile can be adjusted by means of an adjustable dial that changes the distance between the magnet and the metal strip.

Flutter is a form of PEP in combination with the high frequency oscillation that uses oscillating PEP. As the ball in the flutter rolls and moves up and down, it produces an opening and closing cycle. This results in the creation of oscillations in expiratory pressure and airflow. It has three advantages of the flutter: First it vibrates the airways resulting in loosening off the sputum from the walls [4,5]. **Sabnam Kapadia** et al. came to the conclusion that Flutter device should be amalgamated as a routine practice along with other CPT techniques in CABG patients which can have positive results in airway clearance and thereby improving PEFR [4,5].

The Quake device is a cylindrical apparatus that functions using manual rotation, namely via the use of the hand. Nevertheless, the generation of high-frequency oscillations and the production of low expiratory pressure are achieved by rapid handle rotation. Using oscillatory positive expiratory pressure [OPEP] has enhanced airway clearance by about twofold, indicating a significant advantage [4,6]. **Ahmed Gamal Fouad Amin et al.** observed enhancement in ABG values in the present research might be attributed to using the Quake device, which falls under the oscillating positive expiratory pressure devices. This device generates robust vibratory pulses during exhale and inhalation, inducing powerful percussive pulses. In addition to its role in lowering mucus viscoelasticity, it also aids in maintaining airway patency to avoid collapse, thus improving airflow and ultimately enhancing alveolar ventilation [4,6].

CONCLUSION

The current study came to the conclusion that using OPEP devices may help reduce post-pulmonary complications following CABG. It also provided insight into how OPEP-based therapies may eventually fit more broadly into the range of ACTs that clinicians can use to treat pulmonary complications by highlighting noteworthy advancements in device attributes and performance, including important clinical evaluations.

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