The Effectiveness of Using Incentive Spirometry in Post Coronary Artery Bypass Patients

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Abstract

Nurses are advocates for their patients. It is our responsibility, along with other health care facilitators to get patients back to their highest level of functioning. As nurses, we care for patients preoperatively, intra-operatively, and postoperatively when they are having surgery or a procedure. Many factors and care plans are developed in providing care to patients. One piece of equipment that is still used as part of a plan of care nationwide in hospitals is the incentive spirometer (IS). Our main goal as a group was to research a hypothesis question from reading multiple research articles. As a group, we decided to research the effect IS has on post coronary artery bypass grafting patients after having this surgery performed. In our evaluation of this question, we wanted to find the most relevant research to answer the question, perform a critical appraisal of the evidence, integrate our own experiences as nurses, and make recommendations to utilize the evidence.
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Patients that undergo coronary artery bypass grafting (CABG) surgery, go through teaching preoperatively as well as postoperatively. As nurses, we try to prepare patients for what is to be expected through their hospital stay. One method that is taught preoperatively is the use of the incentive spirometry (IS). According to Overend, Anderson, Lucy, Bhatia, Jonsson, and Timmermans, “An incentive spirometer is a device that encourages, through visual and/or audio feedback, the performance of reproducible, sustained maximal inspiration” (2001, p. 3). They also state, “IS remains a widely used technique for the prophylaxis and treatment of respiratory complications in post surgical patients” (2001, p. 3). As a group, we decided to research the IS to see if it makes a difference in respiratory complications if it is used after open heart surgery. Our hypothesis question is: “Does the recommended use of the IS 10 times every hour while awake reduce the rate of respiratory complications such as pneumonia or pleural effusions in post open heart patients”? Since IS is still used 95% of the time in the United States after cardiothoracic surgery, we thought it was an appropriate topic to research (Overend et al., 2001, p. 3). Now, the question at hand is does the IS make a difference? Should doctors continue ordering this treatment for patients? Is there supportive evidence in the research?

Summary of Evidence

Respiratory complications are common in patients who have undergone coronary artery bypass grafting. “Up to 65% of patients may have atelectasis, and 3% may develop pneumonia” (Pasquina, Tramèr, & Walder, 2003, p. 1). According to Strider, Egloff, Burns, and Truwit (1994), atelectasis increases the risk of morbidity for these patients; therefore nurses must review
their practice to be sure every effective intervention is being done to avoid these respiratory complications. Currently nurses are instructed to encourage their post operative CABG patients to use incentive spirometry during the first few days of recovery. However, is there any evidence to support this practice?

Research has found “The addition of breathing exercises or incentive spirometry to a regimen of early mobilization and huffing and coughing did not make postoperative lung function improve more rapidly” (Jenkins, Soutar, Loukota, Johnson, & Moxham, 1989, pp 637-638). The results of another study showed, “that after heart surgery, treatment with IS was not significantly better than intermittent positive pressure breathing” and in fact “the rate of atelectasis was the same in both groups and similar to a group of patients who had neither of these treatments” (Gale and Sanders, 1980, p.478). In 2000, a comparison study showed no additional benefit on recovery of pulmonary function, prevention of complications, or length of hospital stay when IS was added to conventional chest physiotherapy in thoracic surgery (Harton, Grap, Savage, & Elswick, 2007). However, some research authors have suggested that, “proper instruction on the use of IS and careful patient supervision may promote IS effectiveness” (Harton et al., 2007, p.11).

Many factors can contribute to the decline of respiratory effort post CABG. Fatigue is a main factor post operative day one and emotional depression can have an impact on post operative day two or three (Gale and Sanders, 1980). “Since IS is a voluntary activity, the patient’s state of mind may well influence the effectiveness of the incentive in terms of volume inspired , the duration that full inspiration is held, and the frequency of goals achieved or attempted”(Gale and Sanders, 1980, p.479). Although incentive spirometry is still commonly
used in the clinical setting for patients who have undergone heart surgery, there is no strong evidence to support the validity of this practice.

**Critical Appraisal of the Evidence**

In the article by Strider et al., stacked Inspiratory spirometry and its effectiveness on reducing pulmonary shunts was evaluated (1994). The study’s 17 participants were chosen in a nonrandomized fashion. The study did show a slight reduction in pulmonary shunt after using the stacked Inspiratory spirometry, but there were limitations to this study. One limitation was the small sample size. Nieswiadomy states “there are very few instances in descriptive behavioral research when a sample size smaller than 30 or larger than 500 can be justified” (2008, p. 201). If more participants had been used, the data would have been more representative of the post CABG population. Another limitation was the population only included intubated patients. Results could have been different if patients were also studied after extubation (Strider et al., 1994).

The addition of using an incentive spirometer along with a regimen of early mobilization and huffing and deep breathing was evaluated by Jenkins et al. (1989). This study was comprised of 110 male postoperative CABG patients. The patients were divided into three groups, including one which was the control group. The results did not show a difference in lung function between any of the groups and the additional treatments used. An advantage to this study was the authors attempt to control the internal validity. The physiotherapists teaching the patients were closely monitored by two senior physiotherapists. This monitoring helped ensure the same techniques were being used with each patient. One limitation to this study was only
men were used. Further research is needed to know the effects of IS with female postoperative CABG patients (Jenkins et al., 1994).

Harton et al. researched the percentage of preoperative IS volume achieved using IS after cardiac surgery (2007). This study included 92 cardiac surgery patients, male and female, from all racial and ethnic backgrounds. The sample size was adequate and represented the population that was being studied. Each participant received standardized pre- and postoperative IS teaching, which helped improve the study’s internal validity. The results showed participants reached 75% of their preoperative volumes by hospital discharge. One limitation of this study is that it is inconclusive of how long it would take a participant to reach 100% preoperative volume. The researchers did state a longitudinal study would be appropriate to further investigate this question. Another limitation of this study was participants were not monitored every time they used the IS. This could have led to a variation in the relationship of the number of times the IS was used and the postoperative volume (Harton et al., 2007).

The use of IS after cardiac surgery was compared to the use of intermittent positive pressure breathing (IPPB) in an article by Gale & Sanders (1980). There were 109 postoperative cardiac patients that were divided into two groups, IS treatment and IPPB treatment. The results of the study did not show a significant difference between the IS treatment and the IPPB treatment in preventing atelectasis. These treatments were administered by an on-call respiratory therapist. It was not stated if close monitoring of the respiratory therapists was done. Inconsistencies in the method of treatment could be a limitation to this study. Another limitation to this study was the treatments were only performed four times per day. Previous research has
suggested IS should be used up to ten times per hour. The researchers also suggested “more frequent treatment might be effective” (Gale & Sanders, 1980, p. 479).

Pasquina et al. performed a systemic review on the effectiveness of respiratory physiotherapy after cardiac surgery (2003). Their review included 18 trials from nine countries. The conclusion from this review was there is no significant benefit of respiratory physiotherapy in postoperative cardiac patients. The authors found many limitations in the studies reviewed. One limitation was the quality of the studies. The authors stated “In only a few trials was the follow up of patients adequately reported and data analyzed according to intention to treat” (Paquina et al., 2003, p. 4). Another limitation was the inconsistencies in the studies using a control group. Only four of the trials used a control group and each of these used a different type of physiotherapy treatment. “Based on these trials, it was therefore difficult for us to determine the efficacy of different methods of respiratory physiotherapy” (Pasquina et al., 2003, p. 4).

Integration of the Evidence

Much of the evidence regarding the effectiveness of IS against pulmonary complications in post CABG patients seems ambiguous. In a prospective randomized study of one-hundred and ten men undergoing a CABG procedure, it was found that there was no significant patient benefit with the addition of IS to coughing and deep breathing (C&DB) techniques and early mobilization (Jenkins et al., 1989, p.634). Even in the shadow of research ambiguity, the use of IS remains an integral part of post operative nursing care and a frequently used technique for prophylaxis of respiratory complications nationwide. As previously mentioned, 95% of hospitals in the United States that perform cardiothoracic or abdominal surgeries still utilize IS as a part of post operative care (Overend et al., 2001, p.972). The West Michigan Cardiothoracic Surgeons
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(WTCS) on the Cardiovascular Unit at Spectrum Health order IS in conjunction with C&DB and early ambulation as a standard plan of care for their post CABG patients. Nurses on this unit are trained to assist patients with these techniques as early as twelve hours post procedure. Patients are instructed to use the IS and C&DB hourly while in bed and are mobilized up to their chair for meals and assisted to ambulate in the unit hallways four times a day. Patient compliance with treatment is a determining factor to the success of treatment and pain control plays a major role in patient compliance. While pain is a subjective experience and relative to the individual, most post CABG patients arrive to the unit with a lot of pain. These patients experience incisional pain, acute pain related to invasive lines and chest tubes, and musculoskeletal pain from intra-operative positioning. Cardiovascular nurses are trained to expect and manage these types of pain with prescribed analgesics, splinting techniques, and patient positioning in order to facilitate WMCTS’ prescribed activities. While the evidence that we as group have reviewed indicates no specific benefit to IS and C&DB exercises, as a cardiovascular nurse of ten years on this unit, I have personally witnessed the difference in the recovery of post CABG patients compliant with the prescribed course of treatment. Patients compliant with this course of treatment seem to recover quicker and have fewer complications. Therefore in compliance with WMCTS’ recommendations, cardiovascular nurses on this unit continue to incorporate these methods in their patient’s plan of care.

**Recommendations to Utilize the Evidence**

After a review of the evidence, we as nurses can take two separate paths. The evidence seems to be inconclusive according to the studies reviewed. The majority of the studies show that the use of the IS after cardiac surgery does not prove to be significantly beneficial. Nurses could
decide to not teach the use of the IS to their cardiac patients based on the evidence. If the evidence were correct, we would not see a difference in the recovery of our patients using the IS and the patients not using the IS.

The other path, the path we believe is correct, would be to continue to teach and encourage the use of the IS following cardiac surgery. If we continue to do the teaching, we must be very conscious of how we teach each patient. We must ensure that our teaching is uniform for each patient and that we encourage correct and frequent use of the IS. Some members of our group have years of experience with cardiac surgical patients. They believe that they have noticed a difference in those patients who use the IS and are compliant with care. By providing correct education and encouraging frequent use and compliance, we believe that the use of the IS should still be incorporated into post cardiac surgical patients.
References


