Nurturing the Seeds of Evidence-Based Practice: Early Ambulation Among Cardiac Surgery Patients

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Abstract

Background: Cardiovascular disorders continue to be the most prevalent cause of morbidity and mortality in the Philippines and worldwide. Surgical treatments used to manage cardiovascular disorders (unfortunately) have multiple complications. As part of the health care team, nurses need to develop interventions that are safe, scientifically grounded, and cost-effective in order to counteract these complications. One of the nursing interventions that can be implemented is early ambulation.

Aim: To search, appraise, and synthesize the best evidence surrounding early ambulation among cardiac surgery patients.

Methods: This study employed an evidence-based review method suggested by Melnyk and Fineout-Overholt (2005). Systematic literature search was done to the following databases: Cochrane, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Joana Briggs Institute (JBI), MEDLINE, National Guideline Clearinghouse (NGC), and Nursing/Academic edition. Post-operative patients who have undergone coronary artery bypass surgery (CABG), percutaneous coronary intervention (PCI), and transfemoral cardiac catheterization (TCC) are included in this study. The final review also included six articles.

Results and Discussion: Findings show that early ambulation among patients who underwent coronary artery bypass surgery (CABG), percutaneous coronary intervention (PCI), and transfemoral cardiac catheterization (TCC) improves patient care outcomes (i.e., reduce complications such back pain, puncture bleeding, and urinary discomfort, improves general well-being, and decrease health care costs). Parameters for early ambulation (ranges from 3 hours to 24 hours) and late ambulation (ranges from 12 hours to 48 hours) are used in the study reviewed. The non-randomized comparative study found that the complication rate in the early ambulation group is not increased compared to the late ambulation group (test for non-inferiority p= 0.002). Randomized controlled trial found out that early ambulation among cardiac surgery patients could reduce back pain (OR=0.19, 95% CI: 0.08-0.45, p<0.001), decrease urinary discomfort (OR=0.35, 95% CI:0.14-0.90, p=0.03) for very or unbearable urinary discomfort, and general-well being (p=0.0005 for vitality scale and p=0.014 for the total general well-being). Furthermore, early ambulation group reported decrease in hospitalization costs (less charge of $105 or Php 5,040).

Conclusion and Recommendations: This evidence-based practice (EBP) review ascertains that early ambulation among postoperative coronary artery bypass surgery (CABG), percutaneous coronary intervention (PCI), and transfemoral cardiac catheterization (TCC) patients could improve patient care outcomes such as reduction of complication rate, improvement of general well-being, and decrease of healthcare costs. This study, therefore, recommends the use of early ambulation among CABG, PCI, and TCC postoperative patients to complete the last two phases of evidence-based practice.

Key words: *early ambulation; late ambulation; early mobilization; late mobilization; cardiac disorders; surgery; evidence-based practice*

Introduction

The overarching impact of cardiovascular diseases (e.g. coronary heart disease, angina, heart failure, peripheral disease, etc.) in the Philippines and in other parts of the world remains to be a primary threat. World Health Organization [WHO] (2014a) reported that approximately 7.4 million die of heart-related diseases representing 31% of total deaths. Regardless, however, of whether the country is underdeveloped, developing, or developed, the burden of effect is tangible. For instance, in every 1000 deaths, 37 die due to cardiovascular diseases in the high income countries, 46 for upper middle income countries, and 43 for lower middle income countries (WHO, 2014). In the Philippines, cardiac-related diseases tolls 33% of the total mortality (WHO, 2014b). Philippine Statistics Authority (2012) predicted that five in every ten Filipinos would die due to cardiac-related diseases translated to 19 deaths per hour, lower than the United States of America (USA) which accounts one for every four deaths (Center for Disease Control and Prevention, 2015). Aside from the lives lost due to cardiovascular diseases, it impacts the economy due to subsequent rise in health care costs and loss of productivity. For example, USA reported $1 billion loss daily because of the cardiac-related diseases (Greenwell, 2015). This means that aside from global mortality due to cardiac disorders, it has economic toll too.

In response to this alarming global occurence, several surgical interventions have been utilized to treat cardiovascular diseases (Brunicardi, Andersen, Billiar, Dunn, Hunter, *et al.,* 2015). Some of these surgical interventions are Percutaneous Coronary Interventions (PIC), Coronary Artery Bypass Grafting (CABG), and TMR or Transmyocardial Laser Revascularization (Daniels & Nicoll, 2012). Although the prognosis is high, the complications may pose some threat such as pneumonia, thromboembolism, and other forms of hemodynamic instability (Daniels & Nicoll, 2012). These complications call for health workers to develop interventions that minimize the impact. Fast-track cardiac surgery may counteract these probable consequences. Probst, Cech, Haentschel, Scholz, and Ender (2014 p. 1) called fast-track cardiac surgery as the "global standard of care" because it combines medical and nursing interventions to hasten patient recovery. One of the fast-track cardiac surgery vital components is the institution of early ambulation.

DeLaune and Ladner (2011) defined ambulation as the ability to perform daily and routinary movements that facilitates the execution of activities of daily living. Aside from being used as measurement indicator of overall health status, early ambulation strengthens muscle tone, boosts vitality, and is often associated with positive psychological benefits (DeLaune & Ladner, 2011). Therefore, it stands to reason that early ambulation may provide added benefits to patients who have had cardiovascular surgeries. Despite the anticipated benefits, early ambulation is often omitted during nursing care (Kalisch, 2006). The seemingly steady prevalence, pervasive threat, intractable mortality, insurmountable pressure to nurses, and wide health disparities prompted the researcher to answer the Patient, Intervention, Comparator, and Outcome (PICO) question. The purpose of this is study is to search, appraise, and synthesize studies related to early and late ambulation in improving patient outcomes among cardiac surgery patients.

1.1 PICO question

Is early ambulation effective in improving patient care outcomes (i.e., postoperative complications, general well-being, & cost effectiveness) than late ambulation among postoperative cardiac patients?

Methods

2.1 Search Methods

This study is an evidence-based review that utilized the five critical steps in evidence-based practice suggested by Melnyk and Fineout-Overholt (2005). Only the first three steps were employed in this paper. An attempt to disclose the information before actual implementation of the review is aimed. The reason is that the author wishes for a rigorous scientific scrutiny to ensure the utmost patient safety that is, prior to the completion of the five evidence-based practice phases. The three steps are: (1) asking the burning clinical question through PICO format, (2) collecting the most relevant and best evidence to answer the

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clinical question, and (3) critical appraising the evidence that has been collected (Melnyk & Fineout-Overholt, 2005, p. 8). The last two steps namely (4) integration of evidence with clinical expertise, assessment of patient values, and checking of available resources and (5) evaluating the change will be reported after the publication and implementation of this evidence-based review.

After the selection of the PICO question (that served as the guide of the research aim), searching of the best evidence was instituted. The following electronic databases were searched: Cochrane Library, Cumulative Index of Nursing and Allied Health Literature (CINAHL), The Joanna Briggs Institute (JBI), MEDLINE, The National Guidelines Clearinghouse (NGC), and Health source: Nursing/ Academic Edition were searched as seen in Figure 1. Originally, the search terms "early", "ambulation", "cardiac" and "surgery" were used. However, each database was searched based on their operational features. On the Cochrane Library, MEDLINE, and The Joanna Briggs Institute, medical subject subheadings (MeSH) terms were used such as "accelerated", "mobilization", "heart", and "thoracic". MEDLINE features truncation (e.g. mobil$) and wildcards plus country-specific spelling were also put into consideration. The systematic search yielded 898,413 article hits using the time frame 2000-2015 as shown in Figure 1. This phase took six months to complete solely by the researcher.

The searching phase of the evidence-based review was divided into three processes: assessment of the title relevance, abstract weeding, and the reading of the entire article. At first, title hits were read, color coded, and classified based on relevance. Pink highlight means not relevant, green corresponds to somehow relevant, and orange represents that the article meets the inclusion criteria. Only green and orange were included to be part of the abstract weeding phase. After categorization, the articles were downsized to six hundred eighty-two (n=682).

Abstracts were read. Modified criteria for optimal grading by Guyatt, Gutterman, Baumann, Harris, Hylek, Philipps, *et al.* (2006) were also used. The said criteria were used, each given with weight of one point: simplicity, transparency, quality of evidence, sufficiency, explicitness, consistency, and clarity on the different approaches for different outcomes. Only those garnering 6 points and above were included in the next phase of the study. This phase cuts the included study to forty-three (n=43) articles.

Each of the forty-three articles was read in its entirety to clearly grasp the article. The following shows exclusion criteria: the treatment was done in the outpatient settings (n=18), correlational study (n=6), comparison of mobilization action, e.g. supine vs. leg elevation (n=4), early ambulation serves as the outcome criteria (n=2), and no access to the full-text (n=1). Finally, six articles were included in this evidence-based review as shown in Figure 1.

The appraisal and synthesis includes quality assessment. Code sheets were utilized with nine columns as follows: 1. Study citation, country, and funding source; 2. Purpose, question/ variables; 3. Design/ setting; 4. Subjects/ samples; 5. Findings; 6. Methods; 7. Data analysis/ results; 8. Implications for practice and

Figure 1: Flowchart of literature process and results
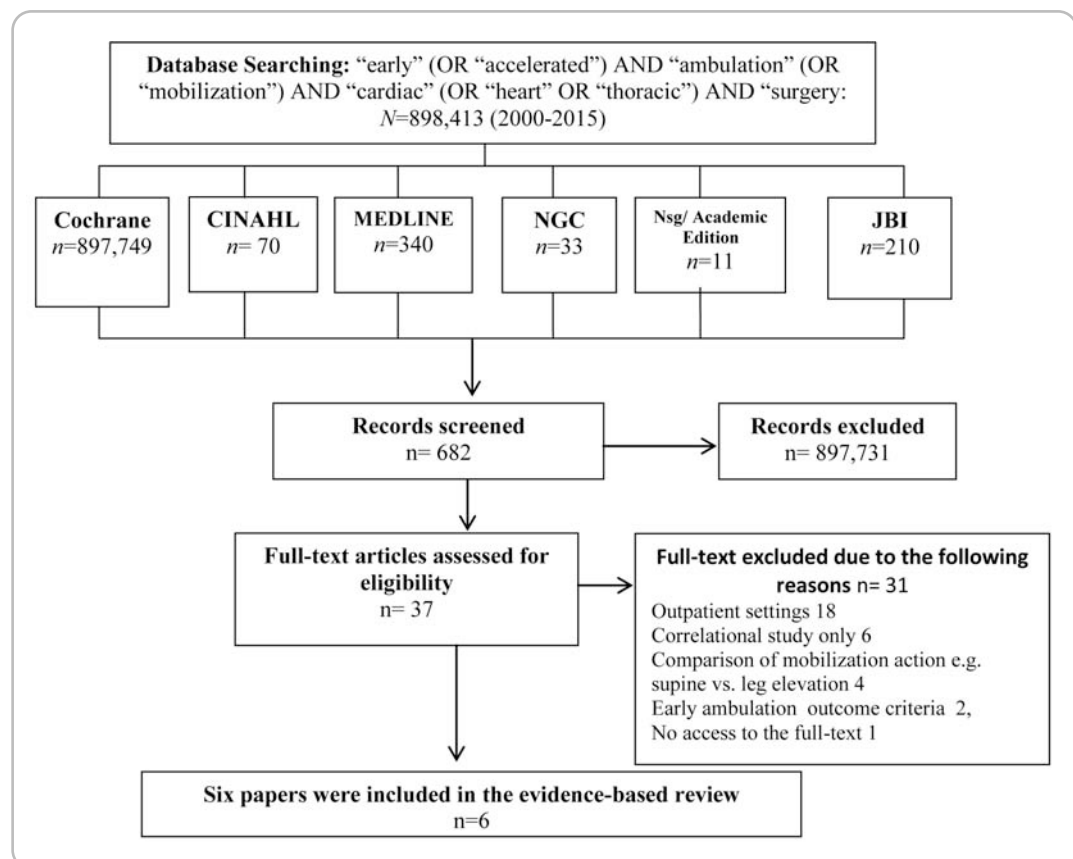
limitations; and 9. Decision for use as shown in Table 1. This is adapted from Schultz (2016) Evaluation of Quantitative Research Article tool.

2.2 Type of Studies.

Clinical guidelines (Brazilian Congress of Cardiology, 2007), systematic review and meta-analysis (Mohammady, Heidari, Sari, Zolfaghari, & Janani, 2014), randomized single-blinded controlled trial (Yu, Choi, Wong, Sit & Ip, 2012), open-observational (Kirkerby-Gastra, Sellevold, Stenseth, & Skogvoll, 2005), retrospective-observational studies (Kobrossi, Tamim, & Dakik, 2014), and non-randomized comparative study (Schiks, Schoonhoven, Aengevaeren, Nogarede-Hoekstra, Van Achterberg, *et al.,* 2008) were included in this study.

2.3 Type of Participants.

Postoperative patients who have undergone coronary artery bypass surgery (CABG), percutaneous coronary intervention (PCI), and transfemoral cardiac catheterization (TCA) were included in this evidence-based review.

2.4 Type of Interventions.

Early ambulation (ranging from 3 hours to 24 hours) and late ambulation (ranging from 12 hours to 48 hours) were used as an intervention in the selected studies.

2.5 Type of Outcome Measures

Effects of early ambulation to postoperative cardiac patients on general well-being, satisfaction level, mixed venous saturation, and complications such as venous thromboemolism, bleeding, hematoma, pseudoaneurysm formation, back pain, urinary comfort, and vasovagal collapse emerged as the patient outcomes.

2.6 Quality Appraisal

The American Heart Association level of evidence was used to appraise (Gibbons, Smith, & Antman, 2003). Since the evidence-based review included studies with different methodology, various quality assessment tools were utilized for: observational cohort and cross sectional studies, randomized controlled trial, and systematic review/ meta-analysis wherein such review used National Heart, Lung, and Blood Institute Quality Assessment Tool (National Institute of Health, 2014), and for the clinical guidelines the review used AGREE collaboration tool (Canadian Institutes of Health Research, 2013).

Results

3.1 Description of Studies

The evidence-based review involved five thousand fifty-one (N=5051) participants, with study size ranging between 31-4091 patients.   Two studies are conducted in European countries (Kirkeby-Garstra *et al.*, 2005; Schiks *et al.*, 2008), three from Asia (Mohammady *et al.*, 2014; Kobrossi *et al.*, 2014; *Yu et al.*, 2012), and one from the Latin America (Brazilian Congress of Cardiology, 2007).

The study included Class Ib and Class IIa evidences only. Class Ib level of evidence refers to benefits outweighing the risks and one study from single randomized trial or non-randomized trial while Class IIa represents that the benefit outweighs the risk but additional studies with focused studies are recommended (Gibbons, Smith, & Antman, 2003). As to the quality of evidence, all studies included are 'good' with an average rating of 85% ranging from 71% to 93%. The bases of these ratings involves the summing of the total yeses (i.e., meeting the prescribed standards by the adopted tool) divided by the total number of items.

3.2 Risk of bias in included studies

This section aims to provide a candid view of the studies included in this review. The study may be vulnerable to the following biases: publication, contamination, non-randomization, and outcome reporting. Publication bias is the non-inclusion of the unpublished studies (Melnyk & Fineout-Overholt, 2005). Evidence-based reviews that included published studies might be more favorable to the effect of the intervention due to non-reporting of unpublished studies (Melnyk & Fineout-Overholt, 2005). At the same time, the percentage of the studies had moderate to high quality (72 to 93%), which could have contaminated the outcome of the study. This process may lead to over- and underestimation of early ambulation effectiveness. Cochrane Collaboration (2011) postulated that researchers knowing the subjects may affect the outcome of the study because of non-randomization. Three studies (Kobrossi *et al.,* 2014; Schiks *et al.,* 2008; Kirkeby-Garsta *et al.,* 2005) might have methodological weakness since they are not blinded to the subjects during the conduct of the study. Finally, Cochrane (2011) defined this as "selective reporting" of the outcomes which might lead to distorted results (i.e., outcome reporting bias). Moreover, Brazilian Congress of Cardiology (2007) clinical guidelines and Mohammady *et al.* (2014) meta-analysis might have contributed to this result since the outcomes report is deemed selective. The clinical guideline is a ready-made output while the meta-analysis reported on the complications of early ambulation only.

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Table 1: Quality appraisal of selected studies

Study Citation, include country & funding source	Purpose Question/ Variables	Design Setting	Subjects/ Sample	Findings	Methods	Data Analysis Results	Implications for Practice and Limitations	Decision for Use(evidence table used)
Brazilian Congress of Cardiology (2007) / Guidelines for Perioperative Evaluation. Brazil, Gualandro D.M. Pinho, C., & Caramelli B. Brazil **Funding Source:** Brazilian Congress of Cardiology (Brazilian Society of Cardiology)	To provide a comprehensive evidence-based guidelines for patients undergoing cardiac surgeries. **Independent:** Early Ambulation **Dependent:** None noted	Evidence-based review **Setting:** Not noted	**Power analysis:** Not noted **Attrition:** Not noted	Recommendations for the perioperative prophylaxis of venous thromboem-oblism Low risk: early mobilization (Class I, level of evidence C)	The participants of these guidelines were chosen among health sciences specialists with hands on and academic experience, thus being characterized as clinical researchers. The basics of perioperative evaluation and the current recommendations were established in order to decrease perioperative complications. The adopted methodology and evidence levels were the same as those used in earlier documents by the Brazilian Society of Cardiology **Instrument:** Not-noted **Psychometrics:** Not noted	**Statistics:** Not-noted **Important Statistical findings:** Not noted	The guidelines stipulate that early mobilization could prevent complications such as thromboemoblism and is characterized as low risk.	**Level of Evidence:** Class I Level of Evidence A **Quality:** Good. (Agree Collaboration for Clinical Guidelines (86%)) **Potential Harm is implemented:** No **Feasibility of implemen-tation:** Yes **Decision:** Keep for use
Kirkeby-Garstad, I., Sellevold, O. F. M., Stenseth, R., & Skogvoll, E. (2005). Mixed venous oxygen desaturation during early mobilization after coronary artery bypass surgery. Acta anaesthesiologica scandinavica, 49(6), 827-834. Norway **Funding Source:** None Noted	The aim of the study was to investigate whether patients with coronary artery bypass grafting (CABG) exhibit decrease in mixed venous saturation during postoperative mobilization. **Independent:** Early Mobilization **Dependent:** Mixed venous oxygen saturation (SvO2)using ejection fraction (EF).	Open Observational Study **Setting:** Not noted	Three women and 28 men, mean age 62.4 ± 9.5 years. **Power analysis:** Not noted **Attrition:** Not noted	Patients with CABG exhibit a marked desaturation during early postoperative mobilization.	The Regional Board of Ethics in Medical Research approved the study protocol. A standardized 15-20 minutes mobilization sequence was performed on the morning of postoperative days 1 and 2. Sequential Steps: T1: resting in bed T2: sitting on bed with feet on the floor for 3 minutes T3: exercise, the patient stood up and 'walked on the spot' T4: sitting in the weighing chair for 3 min T5: exercise, the patient stood up and 'walked on the spot' T6: 10 minutes after returning to bed Subsequently monitoring the oxygen saturation. **Instrument:** ABL300 blood gas analyzer The Explorer TM Vigilance TM (Mean of three consecutive measurements) **Psychometrics:** Signal Quality Index	**Statistics:** Mean and Standard deviation ANOVA Paired t-tests with bonferroni correction **Important Statistical findings:** The mixed venous oxygen saturation (SvO2) values completely returned to baseline within 10 minutes after the patient returned to bed. SvO2 values higher on day 2 at time points T3 and T5 (P=0.024 and P=0.032) A significant reduction in CI from rest to exercise was found on both days (P=.008 day 1; P=0.036 day 2)	During early mobilization close monitoring of oxygen saturation is necessary. The study did not employ randomized controlled trial.	**Level of Evidence:** Class IIa, Level B **Quality:** Good (Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies by the National Heart, Lung and Blood Institute 12/14 yeses) **Potential Harm is implemented:** Yes **Feasibility of implementation:** Yes **Decision:** Keep for use

Study Citation, include country & funding source	Purpose Question/ Variables	Design Setting	Subjects/ Sample	Findings	Methods	Data Analysis Results	Implications for Practice and Limitations	Decision for Use(evidence table used)
Kobrossi, S., Tamim, H., & Dakik, H. (2014) Vascular complications of early (3h) vs standard (6h) ambulation post-cardiac catheterization or percutaneous coronary intervention from the femoral artery. *International Journal of Cardiology.* 176, 1067-1069 doi.org/10.1016/j.i jcard.2014.07.137 Lebanon **Funding Source:** None declared	The study aimed to determine whether early (3 hours) ambulation post cardiac catheterization or percutaneous coronary intervention from the femoral artery. **Independent:** Ambulation **Dependent:** Vascular complications (bleeding, hematoma, pseudoaneurysm formation)	Retrospective observational study **Setting:** Not noted	All patients undergoing cardiac catheterization (CC) with percutaneous coronary intervention (PCI) from the femoral artery by one operator in the past two years. 262 patients 172 were ambulated after 3 hours 115 ambulated after 6 hours **Power analysis:** Not noted **Attrition:** Not noted	Both ear (3 hours) and standard (6 hours) ambulation after CC/PCI from the femoral artery has a similar and low rate of vascular complications.	The medical charts of the patients were reviewed retrospectively to obtain the clinical characteristics of the patients and the angiographic findings. For patients undergoing CC only, the vascular sheath was removed immediately after the procedure and the femoral artery was compressed manually for 15 min to establish homeostasis. For patients who had concomitant PCI, the vascular sheaths were removed by the cardiology fellows. **Instrument:** Arterial duplex scan **Psychometrics:** Not noted	**Statistics:** Mean Standard deviation Students t-test Chi square test **Important Statistical findings:** The 6h ambulation had a higher rate of peripheral vascular disease (2.6% vs. 0%, p=0.05). There were more significant CAD in 6h compared to the 3h (75%-60%, p=.01). The overall vascular complication rate in the whole study population was 2.7% and it was similar (2.7% vs 2.5%, p=.97).	The findings are important since it proves that as a whole it does not matter whether you start early or late in the ambulation along vascular complications. One operator bias was noted too.	**Level of Evidence:** Class I Level of Evidence B **Quality:** Good. (with 12/14 yeses on the NHBL Quality tool) **Potential Harm is implemented:** No **Feasibility of implementation:** Yes **Decision:** Keep for use
Mohammady, M., Heidari, K., Sari, A. A., Zolfaghari, M., & Janani, L. (2014). Early ambulation after diagnostic transfemoral catheterisation: a systematic review and meta-analysis. *International journal of nursing studies*, 51(1), 39-50. Iran **Funding Source:** None declared	To assess the effects of the duration of bed rest after transfemoral catheterization on the prevention of vascular complications and general discomfort, pain, urinary discomfort, and patient satisfaction. **Independent:** Ambulation **Dependent:** Vascular complications (bleeding, hematoma, pseudoaneurysm formation) Back pain and urinary comfort	Systematic review and meta-analysis **Setting:** Not noted	They identified studies from the following databases: MEDLINE, SCOPUS, Proquest dissertations, OPEN SIGLE, Persian medical databases, and CINAHL. This study includes 20 RCT involving total participants of 4091. **Power analysis:** Not noted **Attrition:** The studies included a range of attrition rate from 13%-26%.	There were no statistical differences between categories in the incidence of bleeding, hematoma, bruising, pseudoaneurysms, thrombus, or areteriovenous fistula. Patients had significantly less back pain after 2-4 hours bed rest compared to 6 hours. Urinary discomfort reported less when bed rest lasted 4 hours compared to 12-24 hours. Reduced bed rest time may significantly decrease the costs of hospital care.	Eight databases were included. Using the QUOROM statement flow diagram, 20 studies met the inclusion criteria. **Instrument:** Not applicable **Psychometrics:** Not applicable	**Statistics:** Dichotomous outcomes odds ratio Mantel-Hanzel fixed-effect model Sensitivity analysis **Important Statistical findings: Hematoma** Comparing 4 to 6 hours chi2= 0.19, df= 1 (P=0.66), F=0% Overall effect Z=0.14 (P=0.89) **Bleeding** Comparing 4 to 6 hours versus 12-24 hours Chi^2 = 0.21, df=1 (P=0.65), P=0% Overall effect Z-=0.61 (P=0.54)	The study is useful since it included RCT study only. It balances the pros and cons of early ambulation. **Limitation:** The study is susceptible to: • Sequence geration • Allocation concealment • Incomplete outcome data • Selective reporting	**Level of Evidence:** Class I Level of Evidence A **Quality:** Good. 7/8 National Heart, Lung, and Blood Institute Tool for Meta-analysis **Potential Harm is implemented:** Yes **Feasibility of implementation:** Yes **Decision:** Keep for use

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Study Citation, include country & funding source	Purpose Question/ Variables	Design Setting	Subjects/ Sample	Findings	Methods	Data Analysis Results	Implications for Practice and Limitations	Decision for Use(evidence table used)
Schiks, I., Schoohoven, L., Aengevaeren, W., Nogareded-Hoekstra, C., van Achterberg, T., & Verheught, F. (2008) Ambulation after femoral sheath removal in percutaneous coronary intervention: a prospective comparison of early vs. late ambulation. *Journal of Clinical Nursing*, 18, 1862-1970 The Netherlands **Funding Source:** None declared	To investigate if ambulation four hours after sheath removal can replace ambulation 10 hours or more after sheath removal with regard to puncture site complications after percutaneous coronary interventions (PCI) on to examine patient comfort in both groups. **Independent:** Ambulation **Dependent:** Puncture site complications: hematoma, bleeding, false aneurysm, and arteriovenous fistula. Secondary end points were occurrence of vasovagal collapse after mobilization, back pain & problems with voiding. Patient's well-being	A non-randomized comparative study. **Setting:** Radboud University Nijmegen Medical Center	The patients included in this study were admitted at a hospital for PCI. 531 patients completed the protocol. Patients who underwent an elective PCI procedure and/or fractional flow reserve (FFR) measurement by femoral approach. All patient had a six French sheath. **Power analysis:** Not noted **Attrition:** The studies included a range of attrition rate from 13%-26%.	The study shows that early ambulation four hours after femoral sheath removal is feasible and safe in patients after uncomplicated PCI. The incidence of puncture site complications did not increase and patient comfort was similar.	Percutaneous coronary intervention was performed by femoral approach. Registered nurses of the ward removed the sheath and homeostasis was achieved by manual compression. After bed rest with a compression bandage for four hours, the patients in early ambulation group were ambulated. The patients in the control group stayed in bed till the next morning. Primary study endpoint was the comparison of puncture site complications: hematoma, bleeding, false aneurysm, and arteriovenous fistula. Secondary end points were occurrence of vasovagal collapse after mobilization, back pain and problems with voiding. Ambulation: 1. Patient sat on a chair for 10 minutes. 2. Patient walked on the ward with a nurse. **Instrument:** Activated clotting time (ACT) **Psychometrics:** Not applicable	**Statistics:** t-tests Chi-square tests Mann-Whitney U tests **Important Statistical findings:** Puncture site complications occurred in nine patients (2.7%) in the early ambulation group and six patients (3.0%) in the control group. The complication rate in the early ambulation group is not increased compared to the control group (test for non-inferiority p=.0002).	The study proved the nurses may ambulate post-PCI patients because there is no statistical significance on complications. **Limitation:** • No randomization • No blinding • The information about puncture site complications would be more complete if there were data about puncture site complications after discharge from the hospital. • Patient groups differed on several risk factors. • There was a change in heparin protocol 10 weeks into the study. • Patients with ACT values below 275 second were included. • Single center evaluation.	**Level of Evidence:** Class I Level of Evidence B **Quality:** Good. (13/14 yeses on the Quality assessment tool by NHLBI) **Potential Harm is implemented:** Yes **Feasibility of implementation:** Yes **Decision:** Keep for use
Yu, M., Choi, K. C., Wong, E. M. L., Sit, J. W. H., Ip, W. Y., Belgi, A., ... & Korkmaz, A. A. (2012). Effect of early ambulation after transfemoral cardiac catheterization in Hong Kong: a single-blinded randomized controlled trial. *Anadolu kardiyoloji dergisi: AKD= the Anatolian journal of cardiology*, 12(3), 222-230. Hong Kong **Funding Source:** None declared	The purpose of the study was to investigate the effect of early ambulation after cardiac catheterization (CC) on patients' back pain, puncture site vein, vascular complications, urinary discomfort, general well-being and satisfaction level. **Independent:** Ambulation **Dependent:** Patients' back pain, puncture site vein, vascular complications, urinary discomfort, general well-being and satisfaction level.	Randomized single-blinded controlled trial. **Setting:** One regional hospital in Hong Kong.	Overall, 137 participants were randomly assigned to experimental (63 participants) or control (74 participants) group according to a computer generated random list. **Power analysis:** Not noted **Attrition:** The studies included a range of attrition rate from 13%-26%.	He major finding of the study was that 4 hours ambulation after CC could reduce back pain, urinary discomfort and increase general well-being of the patients. However, effect of early ambulation on puncture site pain, puncture site bleeding, and the satisfaction level were not significantly different between the two groups Only one patient in the control group experienced puncture site bleeding after CC.	Early ambulation is defined as 4 hours and late ambulation is 12 to 24 hours. After passing the inclusion criteria and was divided randomly between experimental and control group. Patients in the experimental group were asked to ambulate according to the schedule: -standing at the bedside for 1 minute -walking n the room for 2 minutes each hour for 3 consecutive hours -and the dependent variables are assessed **Instrument:** Questionnaire **Psychometrics:** Bleeding and hematoma assessment tool Pain assessment tool Urinary discomfort tool General well-being tool Patient satisfaction tool	**Statistics:** Independent t-tests Mann-Whitney U test Pearson Chi-square test **Important Statistical findings:** General estimation equation models revealed that the experimental group has significantly larger increase in the vitality subscale (p=0.0005) and the total general well-being (p=.0014) scores after CC. The experimental group experienced milder back pain than the control group, especially after 8 hours (p=0.001) and in the next morning (p=.002). General multiple logistic regression showed that the experimental group was also less likely experiencing much difficulty or unable to urinate at all than the controls after adjusting for the potential confounding variables (OR=0.22, 95% CI (0.06-0.74), p=0.015).	This study proves the efficacy and efficiency of early ambulation in improving patient care outcomes. **Limitation:** • Sample size is small. • Selection bias	**Level of Evidence:** Class I Level of Evidence B **Quality:** Good. (10/14 yeses on the Quality assessment tool by NHLBI) **Potential Harm is implemented:** Yes **Feasibility of implementation:** Yes **Decision:** Keep for use

3.3 Interventions

Generally, early ambulation time ranges from 3 hours to 24 hours after patient has been stabilized while the late ambulation ranges from 12 hours to 24 hours. For example, among 260 percutaneous coronary interventions (PCI) and cardiac catheterization (CC) postoperative patients, 172 patients were ambulated after 3 hours and 115 patients after 6 hours (Kobrossi *et al.*, 2014). Yu *et al.* (2012) utilized a longer early ambulation time (4 hours) among 137 patients dividing 63 in the experimental group and 74 in the control group after cardiac catheterization. Schiks *et al.* (2008) attempted to stabilize the patient first (after removal of the sheath) and were [early] ambulated 4 hours after. Mohammady *et al.* (2014) involving 20 randomized controlled trial (RCTs) equates bed rest and late ambulation. Whereas four compared 2 hours bed rest vs. 4 hours (h) bed rest, eleven compared 1.5-4h bed rest vs. 6h bedrest, and finally, five compared 4-6h bed rest vs. 12-24h bed rest. With major operative cases like coronary artery bypass grafting (CABG), more conservative early ambulation was done for Day 1 postoperative (Kirkey-Garstad *et al.,* 2005). Lastly, Brazilian Congress of Cardiology (2007) made no pronouncement on the time of early ambulation in their protocol.

3.4 Effects of Interventions

As to the postoperative cardiac patient outcomes, three studies (Mohammady *et al.*, 2014; Kobrossi *et al.*, 2014; Schiks *et al.*, 2008) determined vascular complications after early ambulation namely: hematoma, bleeding, false aneurysm, and arteriovenous fistula. Secondary end points were considered too, such as patient comfort, expedited release from the hospital (Kobrossi *et al.*, 2014), vasovagal collapse, back pain, urinary problems (Mohammady *et al.*, 2014; Yu *et al.*, 2012; Schicks *et al.*, 2008), mixed venous oxygen saturation using ejection fraction (Kirkeby-Garstra *et al.*, 2005), and lastly, general well-being and satisfaction level (Yu *et al.*, 2012) which are deemed favorable to early ambulation.

Phillips (2008) pointed out possible complications of cardiac surgeries namely stroke, hypotension, excessive bleeding, and myocardial infarctions and cardiac rhythm aberrations. This is more pronounced in cases of coronary artery bypass surgery (CABG). Kirkeby-Garstad *et al* (2005) provided information regarding one of their subjects who developed ventricular tachycardia and excessive bleeding post-CABG. He was reoperated at Day 1 and resumed the study on Day 2, on and off ventricular tachycardia and cardioversion happened, and demised at Day 17. Oddly, only 1 out of 31 subjects on the study developed the complications (Kirkeby-Garstad *et al* 2005). The same is true with Yu *et al.* (2012) who discovered that only one of 137 developed puncture site bleeding.

Early ambulation has no significant difference when it comes to vascular complications to that of late ambulation. No significant difference was found to early and late ambulation on puncture site/ vascular complications (Mohammady *et al.*, 2014; Yu *et al.*, 2012; Schiks *et al.*, 2008). In addition, Yu *et al.* (2012) found out that the complications including hematoma, bleeding, false aneurysm, and arteriovenous fistula in not increased after early ambulation (test for non-inferiority p= 0.002). Scientific literatures with the highest level of evidence like randomized controlled trial (Yu *et al.,* 2012) also found out that it could reduce back pain (OR=0.19, 95% CI: 0.08-0.45, p<0.001), urinary discomfort (OR=0.35, 95% CI:0.14-0.90, p=0.03) for very or unbearable urinary discomfort, and general well-being (p=.0005 for vitality scale and p=0.014 for the total general well-being). Systematic reviews/ Meta-analysis (Mohammady *et al.,* 2014) support early ambulation too. As for the early ambulation group, they reported less back pain, urinary discomfort (standard mean difference 0.27; 95% CI: -2.37, -0.59), and decreased costs during hospitalization (early ambulatory patients have less hospital charges of $105 dollars roughly around PhP 5,040 at the time of the writing). Finally, the group of experts developed the Brazil Perioperative guidelines (Brazilian Congress of Cardiology, 2007) and recommended early ambulation (Class I, level of evidence C), that is classified as low risk. How they arrived in this conclusion is not clearly stipulated in the guideline. However, they added that early ambulation decreases incidence of venous thromboembolism.

Discussion

Findings from the evidence-based review show that early ambulation among cardiac surgery patients (i.e., CABG, PCI, & TCC) improves patient care outcomes such as reduction of complication rate, increase in general well-being, and lessens health care costs. From an economic standpoint, prolonged immobilization might pose decrease in productivity because of inability to resume work. This is an indirect effect due to prolonged hospitalization. It must be noted that instead of working and earning money for the family, patients would stay inside the hospital and inevitably increase financial burden because of health care costs. At the same time, being admitted

in the hospital compounds their expenditures often called the direct effect. They may need to buy more food, rent a house, double travel expenses, buy medications, and pay professional fees while their relatives are hospitalized. When hospitalization is fast-track, these could halt. Therefore, potential economic benefits of early ambulation are projected.

As Daniels and Nicoll (2012) enumerated the complications associated with cardiac surgeries, this study alludes that early ambulation might not be the cause. Early ambulation counteracts the complications which could be attributed to the improvement of blood flow to the peripheries. To wit, blood caries oxygen, glucose, and other essential nutrients which is important to the cellular functioning of the body. If the patient would stay in bed for a long period of time, this causes sluggish blood flow, potentially depriving essential nutrients to those of other vital organs such as the brain which may cause the patient not to think clearly, decrease wound healing time, and slows the recovery process. Rion and Kautz (2016 p. 159) called early ambulation as "the walk to save" because it averts multiple complications such as atelectasis, pneumonia, and hemodynamic instability. Similarly, early ambulation promotes muscle mass strengthening and ventricular remodeling due to promotion of muscular contraction and relaxation.

From a psychological standpoint, early ambulation promotes the functioning of the cognitive faculty since it opens the patient to interpersonal relationship with other people. For instance, when a postoperative cardiac patient would use the hallway to walk, the patient would be exposed to other patients, bystanders, and health workers. Mingling may cause the person to develop more appropriate coping mechanism, divert attention, delays negative emotions, and improves overall relationship with other people bringing positive emotions. This is often associated with faster recovery (Ostir, Berges, Ottenbacher, Clow, & Ottenbacher, 2008). These multiple feedback loops starts with the patient- early ambulation. Freedom from financial constraints, promotion of blood flow, and involvement to social life, ultimately, improves patient outcomes. The findings concur with Kalisch, Lee, and Dabney (2013) saying that inpatient mobilization improves outcomes in four levels: physical (it decreases complications such as pain, deep vein thrombosis, & fatigue), psychological (it averts anxiety, depression, & distress), social (since it promotes quality of life and independence) and organizational (because early ambulation reduces length of hospital stay, mortality risk, and costs.

4.1 Strengths and Limitations

The study covers a multitude of databases to reduce publication bias. Attempts were done to access all relevant article hits. If full-text is not available in the database, authors were written to request a copy of their article. The researcher sought help from the expert librarian to cull all the necessary articles. Overall, the result of the evidence-based review is grounded on strong science, systematic searching, and the lack of homogeneity among studies.

The possible methodological limitation of the paper includes the dearth of highest level of evidence concerning early ambulation in cardiac surgeries. Some studies may be suffering from methodological flaws, concealment, and low generalizability. Although biases were avoided, still, significant grey literatures may have been overlooked.

4.2 Conclusions

This evidence-based practice (EBP) paper ascertains that early ambulation improves patient outcomes (i.e., reduction of complication rate, improves general well-being, and lessens health costs) among postoperative coronary artery bypass surgery (CABG), percutaneous coronary intervention (PCI), and transfemoral cardiac catheterization (TCC) patients. Postoperative cardiac surgery (PCI & TCC) patients can be ambulated from 3 hours to Day 1 while major cardiac surgery like CABG can be ambulated 24 hours to Day 2. This review highlights that health workers have the capacity to create scientific and cost-effective interventions. Finally, the study recommends the use of early ambulation among CABG, PCI, and TCC postoperative patients to complete the last two phases of evidence-based practice.

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