THE IMPACT OF PROLONGED BED REST AFTER PERCUTANEOUS CORONARY INTERVENTION IN TERMS OF VASCULAR COMPLICATIONS AND OTHER PATIENTS' OUTCOMES

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Abstract

Background: The use of Percutaneous Coronary Intervention (PCI) has achieved extensive importance in the management of Cardiovascular diseases, in order to minimize post-PCI complications. Patients are restricted to bed rest for various periods to prevent vascular complications. Prolonged bed rest may accompany patient's discomfort such as back pain, fatigue, dissatisfaction and other patient outcomes.

Objective: The aim of this paper was to highlight the effect of prolonged bed rest after the PCI procedure in terms of vascular complications and other patient outcomes, and to emphasize the importance of early ambulation post-PCI.

Method: Descriptive design has been used with multiple times measurement to assess the impact of prolonging bed rest after percutaneous coronary intervention. 30 patients were selected to describe selected patients' outcomes including low back pain, puncture site pain, fatigue, comfort, satisfaction, urinary discomfort, hematoma, and bleeding using visual analogue scale (VAS).

Results: This paper recommends that early ambulation after percutaneous coronary intervention is safe and practical, consequently leading to higher levels of satisfaction and comfort and lower level of fatigue, low back pain and urinary discomfort without jeopardizing patient safety.

Key words: Early ambulation, Patient outcomes, Percutaneous coronary intervention, Prolonged bed rest, Vascular complications.

Introduction

Cardiovascular diseases are considered the leading cause of death worldwide. They are responsible for 30% of all global deaths (WHO, 2011) so, there is a constant drive to develop innovative methods and devices that enable health care professionals to achieve diagnostic or therapeutic goals while reducing procedural related risks and enhancing patients' satisfaction (Bechara, Annambhotla & Lin, 2010).

Cardiovascular disease according to the American Heart Association is defined as any abnormal condition characterized by dysfunction of the heart and blood vessels. It includes many groups such as cerebrovascular diseases, peripheral arterial diseases, rheumatic heart diseases, and coronary artery diseases which account for 42% of all global deaths that are caused by cardiovascular diseases (WHO, 2011).

Beside drug therapy, invasive technology for the management of coronary artery diseases has improved considerably over the past two decades. One of these technologies is Percutaneous Coronary Intervention (PCI) which has become a routine diagnostic tool in cardiology departments worldwide, and has a substantial role in the management of coronary artery diseases, and is considered the most common invasive procedure used for this entity (Augustin, Quadros & Sarmento-Leite, 2010; Tongsai & Thamlikitkul, 2012; Schiks et al, 2008, Haj-Hassan, Hamdan-Mansour, Zeilani & Nabolsi, 2013).

Percutaneous coronary intervention procedures require an arterial access to reach coronary arteries and cardiac chambers and that is performed by insertion of device called a sheath in the selected artery. Although the procedure is generally safe, many vascular complications after removing of sheath do occur (Line, Guffey, VanRiper & Kline-Rogers, 2006).

In the USA; 3% of patients experience vascular complications after percutaneous coronary intervention (Dumont, 2007). These complications range from bleeding, ecchymosis, and hematoma (Sabo, Chlan & Savik, 2008) to more serious pseudoaneurysms and arteriovenous fistula (Konstance et al, 2004). Keep in mind that these vascular complications are responsible for increasing morbidity, length of stay, increase patient distress, and decrease patient comfort (Pracyk et al, 1998 & Konstance et al 2004).

Since the most common arterial access used in percutaneous coronary intervention procedures is femoral artery; effective control of femoral arterial access has received intense focus in the past decades (Hassan, Hasan-Ali & Ali, 2013; Bechara et al, 2010).

Traditionally, immobilization including prolonged bed rest for six hours or more after percutaneous coronary intervention has been used to reduce vascular complications (Schiks et al, 2008), but this prolonged bed rest reveals on the other hand, many complications related to patients' comfort level and general well-being (Chair, Ya, Choi, Wong, Sit &Ip, 2012).

Prolonged bed rest for six hours or more after percutaneous coronary intervention leads to increase the level of low back pain and urinary discomfort, and decrease the level of comfort and general well-being (Augustin et al, 2010 & Chair et al, 2012). Keep in mind that these complications contravene the international attempts to achieve diagnostic or therapeutic goals for percutaneous coronary intervention while reducing procedural related risks and enhancing patients' satisfaction (Bechara et al, 2010).

Cardiovascular diseases (CVD) are defined according to the World Health Organization as a group of disorders of the heart and blood vessels. It includes coronary heart disease, cerebrovascular diseases, peripheral arterial diseases, and congenital heart disease. Cardiovascular diseases cause more than half of all deaths across the European Region (WHO, 2014).

Invasive diagnostic tests such as cardiac catheterization and other interventional procedures such as percutaneous transluminal coronary angioplasty (PTCA) are becoming done widely across cardiology departments (Haj-Hassan et al, 2013). Since their introduction in the 1970s, the number of percutaneous coronary intervention procedures has increased noticeably (Schiks et al, 2008). The procedures include insertion of different sized pieces called sheaths to femoral or radial artery to gain an access to the vascular system (Haj-Hassan et al, 2013) Then the cardiologist will inject special dye to allow for exploration of coronary circulation under X-ray guidance. However, the femoral site is considered as the most common site due its large diameter and easier accessibility, but unfortunately, it has higher complication (Nathan & Rao, 2012), therefore, there is an urgent need to develop ways and plans to reduce such complications, for reducing procedure related risks and increasing level of patient's satisfaction.

In post percutaneous coronary intervention, the complications are not infrequently reported. It has been outlined widely in the literature, that those complications include hematoma at puncture site (Stone & Campbell, 2012; Cosman, Arthur & Natarajan, 2010; Anderson, Bregendahl, Kaestel, Skriver & Ravkilde, 2005; Sabo, Chlan & Savik, 2008) and bleeding (Schiks et al, 2008; Cosman et al, 2010; Anderson et al, 2005; Chair et al, 2012; Rezaei-Adaryani, Ahmadi, Asghari-Jafarabadi, 2009).

The definition of hematoma varies across research articles; moreover its way of measurement is vague as well. Stone and Campbell (2012) mentioned this unclear issue, while Cosman et al (2011) reported that hematoma at vascular site is the most frequent complication. The authors defined

hematoma as an area of swelling of the underlying tissue at the vascular access site with or without associated bruising. Andersen et al (2005) stated that hematoma development is the most frequent complication for patients who underwent percutaneous coronary intervention or coronary angioplasty (CA). The aims were to determine the frequency of hematoma after percutaneous coronary intervention and coronary angioplasty, and to identify the predictors of its development. They include 463 subjects, of these 322 patients underwent coronary angioplasty, and 141 underwent percutaneous coronary intervention. From a total of forty -one patients who develop hematoma, 6 patients (1.3%)_developed hematoma larger than 10 cm, while 35 (7.6%) developed hematoma between 5-10 cm, moreover, the percentage of hematoma in coronary angioplasty group was 7.5 % which is less than percutaneous coronary intervention group (12.1%).. Further the most statistically significant risk factor was multi artery puncture (more than one time) which had odds ratio (3.4) and confidence interval CI (1.4-8.0) .The development of hematoma due to this risk factor was 1.7, and 7.9 for coronary angioplasty and percutaneous coronary intervention respectively. Other risk factors include female gender and use of low molecular weight heparin (LMWH).

Sabo et al (2008) tried to if determine patient's characteristics and co-morbidities contributed to vascular complications. The outcomes confirmed the previous study, that being female is associated with higher incidence of vascular complication. In addition, the body surface area was also statistically significant to hematoma development among percutaneous coronary intervention patients, odds ratio equal to 0.88 and 95% CI equal to (0.80-0.98)

The other most commonly seen complication was bleeding from the puncture site. Chair et al (2012) defined significant bleeding as "blood loss estimated at greater than 100 ml or bleeding that lead to further attempts to reestablish homeostasis by manual pressure", whereas, Schiks et al (2008) described bleeding as any loss of blood from puncture site needed for prolong bed rest or compression.

Moreover, Rezaei-Adaryni et al (2009) measured the bleeding by measuring the surface area of blood at the dressing site using a two dimensional ruler with 1 cm precision.

To reduce the complications (hematoma and bleeding) manual hard compression by nurses or using mechanical applications over puncture site is needed. Further, bed rest in the supine position for 2 to 24 hours is advised. Nevertheless, the length of bed rest after percutaneous coronary intervention varies, and may fluctuate from 2 to 24 hours. Prolonged bed rest without movement in the supine position is uncomfortable for most of the patients (Chair et al, 2012).

Due to such practices (manual compression and prolonged bed rest), most patients have some complaints or discomforts such as low back pain, urinary discomfort, low level of comfort, puncture site pain, low level of patient satisfaction (Chair et al, 2012; Rezaei-Adaryani, 2009). Those complaints have been outlined in recent literature (Sabo et al, 2008; Chair et al, 2012; Rezaei-Adaryani, 2009; Chair, Li & Wong, 2004; Augustin et al, 2010).

According to Chair et al (2004), back pain is common among post cardiac catheterization patients, and explained that this is due to prolonged bed rest ranging from 3- 24 hours. In their study, the authors aimed to identify factors associated with back pain after percutaneous coronary intervention. They found that turning privilege (hourly positioning to supine, right lying, left lying related to lower level of back pain ($p = 0.001$), as well as age. The older subjects reported lower level of pain compared with younger ones. ($p = 0.04$) Finally, with p value equal to 0.006, the body weight was statistically significant, which means that the back pain is more frequent in heavier subjects.

In a randomized control trial (RCT) done by Augustin et al (2010) in Brazil, the results uncovered that the shorter bed rest was better than prolonged bed rest regarding back pain. The pain was reported in 22% versus 39% ($p = 0.001$), for shorter bed rest and prolonged bed rest respectively.

Understanding factors that are related to low back pain post percutaneous coronary intervention may help the nurses to apply appropriate nursing intervention to improve and promote patients' comfort (Chair et al, 2004).

Another randomized control trial was done by Rezaei-Adaryani et al (2009) to assess the effect of changing position and early ambulation on specific patient outcomes including level of comfort, satisfaction, and fatigue. Patients' outcomes were assessed after percutaneous coronary intervention six different times., The results revealed that the level of comfort, satisfaction and fatigue were statistically significant with p value less than 0.001. The authors conclude that longer duration in bed after percutaneous coronary intervention, showed lower level of comfort and satisfaction, and the level of fatigue was be higher.

Urinary discomfort is another patient complaint. Chair, Thompson & Li (2007) stated that most patients have uneasiness to urinate in bed while they are in a supine position using urinal or bedpan. The authors compared the level of urinary discomfort between patients who ambulated at 4 hours and 12-14 hours after cardiac catheterization Further, the results revealed that both groups were statistically different on urinary discomfort ($p = 0.006$). They conclude that prolonged bed rest will result in higher level of urinary discomfort. Five years later, a study done by Chair et al (2012) confirmed the previous result.

In conclusion, vascular complications are common among patients undergoing percutaneous coronary intervention; multi artery puncture and female gender were mentioned repeatedly in the literature as risk factors. Patient outcomes such as back pain, urinary discomfort, satisfaction and comfort have been assessed frequently, especially in the first few hours that fellow percutaneous coronary intervention. The optimal bed rest time varies across literature, because prolonged bed rest can negatively affect those outcomes, a lot of studies confirm the safety of early mobilization compared to late mobilization in terms of bleeding and hematoma, in addition to better patient outcomes.

Understanding these complications and patients' outcomes may help nurses and other health care providers afford the patients with suitable nursing interventions individually (Chair et al, 201) without jeopardizing patient safety.

Significance of the study

Percutaneous coronary intervention is widely used for diagnosis and management of cardiac diseases and considered a key clinical tool for this entity (Augustin et al 2010; Tongsai et al 2012; Schiks et al, 2008, Haj-Hassan et al, 2013). This produces many serious vascular complications (Line et al 2006). One method to prevent these vascular complications is prolonged bed rest (Schiks et al, 2008), but this affects negatively on patient comfort level and general well-being (Augustin et al, 2010 & Chair et al, 2012). These factors motivated health care professionals for many years to establish a protocol after percutaneous coronary intervention considering patient comfort as well as patient safety(Bechara et al, 2010). Therefore this study is extending global studies that aimed to establish such a protocol.

Keep in mind that it is important to base nursing practices on high level evidence to improve the care given to individuals undergoing percutaneous coronary intervention, so nurses need to engage in developing evidence to support guidelines (Rolley, Davidson, Salamonson, Fernandez & Dennison, 2008).

The results of this study will be used in building of evidence based practice that aims to improve patient outcomes after percutaneous coronary intervention which will be reflected positively on patients as well as the health care system in Jordan.

The purpose of the study

The purpose of this study is to investigate the impact of prolonged bed rest after percutaneous coronary intervention on patients' outcomes.

Research questions

• Is prolonged bed rest after percutaneous coronary intervention considered a golden method to prevent vascular complications?

• What is the effect of prolonged bed rest after percutaneous coronary intervention on other patient outcomes?

Methodology

Design

Descriptive design has been used with multiple times measurement. The main purpose of using this design is to assess the impact of prolonging bed rest after percutaneous coronary intervention on patients' outcomes (low back pain, puncture site pain, fatigue, comfort, satisfaction, urinary discomfort, hematoma, and bleeding).

Setting

This study has been conducted in the Jordan University Hospital.

Sampling

The target population was all Jordanian patients who underwent percutaneous coronary intervention, while the accessible population was all Jordanian patients who underwent percutaneous coronary intervention in the Jordan University Hospital. Convenience sampling has been used for a select 30 participants who met the inclusion criteria.

Inclusion criteria was any patient age of 18 years or older who underwent diagnostic percutaneous coronary intervention via femoral approach and received a dose of unfractionated heparin (100 unit\kg) during the procedure.

While the exclusion criteria was any patient with aortic failure, use of low molecular weight heparin, unfractionated heparin, or glycoprotein IIb\IIIa inhibitors within the previous 24 hours before the procedure or after the procedure; those who had history of hemorrhagic diathesis (bleeding tendency), had a history of chronic low back pain, had diastolic or systolic blood pressure higher than 100 and 180 mm Hg respectively pre or post procedure, or who developed any vascular complications during percutaneous coronary intervention.

Instruments

Six instruments have been used in this study, These instrument are five Visual Analogue scales (VASs); each one consisting of a 100-mm long line, and two dimensional ruler with 1 cm precision.

Five Visual Analogue Scales, each one consisting of a 100-mm long line was used to assess the following subjective data: low back pain, puncture site pain, fatigue, comfort, satisfaction, and urinary discomfort.

The Visual Analogue Scales consist of a 100-mm long line with the left anchor representing "no pain, n fatigue, no comfort, no satisfaction, no urinary discomfort", and the right anchor representing "the worst possible pain, the highest possible fatigue, the highest possible comfort, the highest possible satisfaction, the highest possible urinary discomfort". Keep in consideration that Visual analogue scale is frequently used to assess subjective feelings such as pain, comfort, and fatigue (Rezaei-Adaryani et al, 2009; Chair et al, 2007).

Also, a two dimensional ruler with 1 cm precision was used to measure the hematoma and bleeding; this method is frequently used in the literature ((Rezaei-Adaryani et al, 2009; Chair et al, 2007).

Hematoma was detected by observing the presence of skin discoloration at the puncture site then measuring the distance between its borders with this ruler, and bleeding was detected by observing the dressing on the puncture site then measuring the distance between its borders with the same ruler.

Data collection procedure

For eligible patients who underwent percutaneous coronary intervention; demographic data which included gender, age, smoking status, weight, and height were collected firstly Secondly, the patient was assessed after two hours of bed rest for the following variables (level of low back pain, level of puncture site pain, level of fatigue, level of comfort, level of satisfaction, level of urinary discomfort, amount of hematoma if present, and amount of bleeding if present). Keep in consideration that this assessment aimed to make baseline information about the patient's outcomes.

Thirdly, the same variables were assessed again after four hours of bed rest, and finally, the same variables were assessed again after six hours of bed rest.

Ethical consideration

This study has been approved by the academic research committee of the faculty of nursing in the University of Jordan; also it was approved by the institutional review board of the Jordan University Hospital. Furthermore, consent form was signed by all participants before the beginning the study, and data collector informed the subjects that the information will be used for the purpose of this study only, and that was explained to all subjects before beginning the study.

The subject was assured that he or she has the right to refuse participation or to withdraw from the study any time; all information will be kept in a locked cabinet at the facility of nursing, with researcher having sole access alone, through which the above confidentiality will be maintained.

Data analysis plan

Data analysis was carried out using the Statistical Package for the Social Science, SPSS 16.0 for windows. Descriptive analysis (mean, frequency, and percentage) were used for analyzing the demographic data In addition paired-samples T test was used to detect if there was a significant difference between the means of the variables that were assessed after four hours of bed rest and the means of the variables that were assessed after six hours of bed rest.

The result

Demographic data:

A total of 30 subjects participated in this study. Table 1 shows the demographic data. The mean age of the subjects was 59.9 years; 57% of subjects were male and 43% were female the mean of their weight was 85.8 kg and height 165.1cm. Finally around 57% were smokers.

Table 1: Demographic data of participants (N=30).

Gender Male / Female	Smoking Yes / No	Age	Weight	Height
17 (57%) / 13(43%)	17 (57%)/ 13(43%)	59.9 (11.9)	85.8 (16.4)	165.1 (8.6)

Table 2: Comparison of the patients' outcomes at three different time intervals (N=30).

Patients' outcomes	After two hours	After four hours	After six hours	*P value
Level of low back pain	21.6	36.7	49.9	< 0.001
Level of puncture site pain	32.3	22.1	16	0.001
Level of fatigue	34.9	47.5	57.9	<0.001
Level of comfort	58.6	51.1	44.5	0.001
Level of satisfaction	63.1	59.2	50.6	0.001
Level of urinary discomfort	31.8	48.8	64.3	<0.001
Hematoma (cm)	0.70	0.87	0.93	0.161
Bleeding (cm)	0.93	1.13	1.30	0.057

* The p values refer to the difference between the four and the six hour only.

Comparison of the patients' outcomes at different time intervals:

This comparison presented in Table 2 shows the mean values of the patients' outcomes at three different time intervals, at 2, 4, and 6 hours after bed rest respectively.

The level of low back pain increased between the three intervals considerably. This increase was statistically significant between the second interval (4 hours) mean value equal to 36.7 and the third interval (6 hours) mean value equal to 49.9, with p value less than 0.001. Moreover, the level of fatigue also increased markedly among the three different intervals, which was also statistically significant between the second interval (4 hours) mean value equal to 47.5 and the third interval (6 hours) mean value 57.9 with p value less than 0.001. Finally, urinary discomfort also increased, which was also statistically significant between the second interval (4 hours) mean value equal to 48.4 and the third interval (6 hours) mean value equal to 64.3, with p value less than 0.001.

The puncture site pain decreased among different intervals, ranging from 32.3 to only 16. The satisfaction level is decreased among the three intervals. This reduction was statistically significant between the second interval (4 hours) mean value equal to 59.2 and the third interval (6 hours) mean value equal to 50.6, with p values equal to 0.001. Moreover, the comfort level is decreased among the three intervals. This reduction was statistically significant between the second interval (4 hours) mean value equal to 51.1 and the third interval (6 hours) mean value equal to 44.5 , with p values equal to 0.001.

The patients as expected, experience vascular complications such as bleeding and hematoma, but the occurrence of those vascular complications were not statistically significant among the second and third intervals.

Discussion

Previous study showed that extended bed rest in the supine position is hard for many patients who have undergone percutaneous coronary intervention (Chair et al., 2003). The results of this study showed that regarding the levels of low back pain, fatigue and urinary discomfort, there were significant differences between the second and third intervals.

The main findings of this study were that the amount of patient outcomes are related to the duration of bed rest. The longer the patients are required to remain in complete bed rest in supine position after percutaneous coronary intervention without ambulation, the higher the levels of low back pain, fatigue and urinary discomfort they will experience.

On the other hand, the results of this study revealed that regarding the puncture site pain, satisfaction and comfort level, all are decreasing with time. There were statistically significant differences between the second and the third intervals. We can conclude that the longer the patients are required to remain in complete bed rest in supine position after percutaneous coronary intervention without ambulation, the lower the puncture site pain, satisfaction and comfort level they will experience. This conclusion has been confirmed previously by Reazaei-Adaryani et al (2009).

The findings also show that the patients experience vascular complications at the puncture site such as bleeding and hematoma, but these findings did not statistically significantly increase or decrease between the second and the third intervals. This result agrees with the previous literature that confirmed no difference in comparing of vascular complications among patients with early versus late ambulation.

Implementation

The findings of this study will be used in two approaches; research and practice. These finding will help the researcher to investigate more about these complications, and these findings also will help the nurses to develop evidence-based policy regarding bed rest post percutaneous coronary intervention, instead of anecdotal evidece.

Limitation

The first limitation in this study is the design, so we recommend performing further studies with more powerful design (e.g., randomized controlled trial). The second limitation in this study is the sample and setting, with small sample size, so we recommend enlarging the sample and enroll more hospitals in future studies.

Conclusion and recommendations

Based on the statistically significant results, we recommend early mobilization after percutaneous intervention, rather than late, which is not common in Jordanian hospitals in general. This change in practice aims to alleviate some patients' outcomes such as low back pain, fatigue, and urinary discomfort, in addition to improving the level of comfort and satisfaction. Also the new proposed change will not affect the levels of both bleeding or hematoma or jeopardize patient's safety.

To sum up, the longer the patients are required to remain in complete bed rest in supine position after PCI without ambulation, the higher the levels of low back pain, fatigue and urinary discomfort, and the lower level of satisfaction and comfort, without affecting the level of hematoma and bleeding.

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