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Original article

Assessment of Vietnamese nurse's knowledge and practice regarding patient's safety after coronary angiography or percutaneous coronary intervention

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Abstract: ***Background*:** Many clinical and paraclinical studies related to coronary artery disease have been done in Vietnam in recent years. However, there have been no studies on nurses' knowledge and practice regarding patient care after coronary angiography (CAG) or percutaneous coronary intervention (PCI). This study was conducted to assess nurses' knowledge and practice on patient's safety after CAG or PCI and its associated factors. ***Methods*:** A descriptive cross-sectional study was conducted from December 2019 to June 2020 at the Department of Internal Cardiology, Interventional Cardiology, Intravascular Intervention, and Intensive care unit/Coronary care unit in three general and specialist hospitals in Ho Chi Minh city, Vietnam. 167 nurses who have taken care of patients after CAG or PCI were included in the study through using convenient sampling technique. A translated self-administered questionnaire was utilised. This self-reported survey achieved 100% response rate. Statistical analysis was performed by the Chi-square test (X2). Statistical significance level was at $p<0.05$ to determine factors related to nurses' knowledge and practice. Prevalence ratio (PR) with 95% confidence interval (95% CI) were also used to measure the association. ***Results*:** The study findings revealed that only 36% of the study sample had a good knowledge while 78% of them had a good practice on patient's safety after CAG or PCI. There were association between educational level, working place with the knowledge (PR=1.87-1.92, $p<0.01$) and practice (PR=1.18-1.35, $p<0.05$) on patient's safety after CAG or PCI among Vietnamese nurses. Besides those factors, the number of years working in cardiac specialty were also found to have an association with the practice. A moderately positive correlation between the knowledge and the practice towards patient's safety after CAG or PCI has been identified in this study (PR=1.27, 95% CI [1.09 – 1.47], p=0.005). ***Conclusions*:** More than a half of the study sample had poor knowledge but performed good practice in some items of care for patients after CAG or PCI. There was positive association between the knowledge and practice about patient's safety after CAG or PCI among Vietnamese registered nurses. Educational training programs for staffs working in coronary angiography or percutaneous coronary intervention is recommended to develop.

Keywords: Patient safety; coronary angiography; percutaneous coronary intervention; knowledge; practice; staff nurse.

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1. INTRODUCTION

According to the World Health Organization (WHO) reports, coronary artery disease is the leading cause of death worldwide, with a greater number of people die each year from cardiovascular disease than from any other cause. It is estimated that 17.5 million people died from cardiovascular disease in 2016, constituting 31% of all global deaths. Of these deaths, 85% were attributed to heart attack and stroke [1]. This disease has been common in developed countries and tended to grow tremendously in developing countries, including Vietnam. In the United State (US), about 13,200,000 people suffer from coronary artery disease annually. In European nations, the incidence of coronary artery disease in the total population is estimated from 3.5 to 4.1%. According to the Vietnam National Heart Institute, the coronary artery disease rate has increased over the years, in 1991 it was 3%, 6.05% in 1996, and 9.5% in 1999. The coronary artery disease death rate accounts for 11 – 36% [2]. Cardiovascular disease currently becomes an important burden of disease in the age group 50 and over and greatly affects patients' socio-economic status if they do not receive early detection and timely treatment [3-5]. Approximately 250,000 cases each year are detected and experienced an increasing tendency due to population aging [6].

CAG or PCI are advanced and optimal procedures for patients with coronary artery stenosis. However, these techniques are the invasive procedures that render some complications on patients with early complications such as a sudden drop in blood pressure, arrhythmia, vessel perforation, infection, heart failure and so forth and with late complications such as thrombosis, recurrent stenosis after artery stent implantation [7]. Nurses working at cardiac units have expertise and mastery in providing care for patients need performing CAG or PCI. The process of taking care of patients begins from preadmission to discharging from hospitals which includes screening of patient's well-being, preparing for patients before the operation, assisting surgeons during a surgery and monitoring patients after a surgery [8]. Therefore, nurses with good knowledge and good practice in health care, health counseling, recognizing the dangers of patient and handling them quickly after coronary angiography or percutaneous coronary intervention is the most important factor [7, 9].

To contribute to understanding the knowledge and practice of cardiac nurses on patient safety after CAG or PCI, we conduct a research entitled "Assessment of Vietnamese nurses' knowledge and practice and impact on patients' safety after CAG or PCI". This study was aimed to assess nurses' performance regarding patient's safety after CAG or PCI. It was carried out through evaluating nurses' knowledge and practice in term of patient's safety after CAG or PCI. According to the study, it is able to propose suitable solutions for each actual circumstance and facilitate working on ensuring patient's safety after CAG or PCI with high efficiency.

2. MATERIALS AND METHOD

2.1. Study design

A descriptive cross-sectional study was conducted from December 2019 to June 2020 on 167 nurses who care for patients after CAG or PCI at Cho Ray Hospital, University Medical Center 1 Hospital and Tam Duc Heart Hospital, Ho Chi Minh City.

2.2. Sample size calculation

The sample size of the study (n) was calculated using a single population proportion formula with assumptions of the proportion = 0.345 (based on the study of Mariam Feroze in 2017 [7]), 95% uncertainty interval, and margin of error (d) = 5%. From there, the minimum sample size for this study was at least 87 nurses. In fact, the final sample size obtained was 167 nurses.

2.3. Data collection procedure

Total population sampling technique was used for the selection of nurses to be included in the study, with the criteria of excluding those who are on business trips, maternity leave, and long-term leave during the data collection process.

Study subjects were thoroughly explained about the purposes and the meaning of the study. After nurses agreed to participate in the study, each individual would receive a self administered questionnaire and do a survey independently.

2.4. Data collection instrument

A structured, self-administered questionnaire was used to collect the necessary data. It consisted of different items regarding sociodemographic characteristics (7 questions), knowledge (10 questions), and practice (18 questions) on patient's safety after CAG or PCI. The patient's safety after CAG or PCI related questions were adapted from Mariam Feroze's study (2017) [7]. This instrument has been applied by many countries in order to measure nurses' knowledge and practice regarding patient safety after CAG or PCI [7, 10]. The questionnaire had initially used in Vietnam, then it was translated from English into Vietnamese and vice versa to guarantee the accuracy of the translation. A comparison between the original English version and the English version translated from Vietnamese was conducted to assure the similarity of meaning. Afterwards, the expert team including five cardiologists, interventional cardiologists and doctors directly working in the Department of Cardiology and Interventional Cardiology was invited to validate the content, feasibility, relevance, and clarity of the Vietnamese questionnaire. Cronbach's alpha is a measure used to assess the reliability, or internal consistency. In this study, Cronbach's alpha was 0.81, indicating a high reliability.

Regarding the chosen cut-off point for good total knowledge and good total practice assessment, if the cut-off point was 80% and over, the nurse would be considered to achieve good total knowledge and total practice, yet if the cut-off point was less than 80%, the nurse would be considered to have poor total knowledge and total practice [11-13].

2.5. Ethics

This study was approved by the ethics committee of Ho Chi Minh University of Medicine and Pharmacy in accordance with decision No. 553 DHYD - HDDD signed on 28th October, 2019 and approved by the ethics committee of

Cho Ray Hospital, University Medical Center 1 Hospital, and Tam Duc Heart Hospital.

2.6. Data analysis

Data collected in this study were entered into Epidata 3.1 software and statistical analysis were conducted using Stata version 14. Frequency and percentage were used to describe demographic characteristics, as well as the proportion of good knowledge and practice. Chi-square test (X^2) and Fisher's exact test were used to examine the relationship between demographic characteristics, good knowledge and good practice as well in caring for patients after coronary angiography or percutaneous coronary intervention. Statistical significance level was at $p<0.05$. The relationship between nurses' knowledge and practice was measured by the prevalence ratio accompanying statistically significant test at $p<0.05$.

3. RESULTS

3.1. Demographic characteristics and knowledge on patient safety after coronary angiography/ percutaneous coronary intervention of nurses

Table 1. Demographic characteristics and levels of total knowledge on patient safety after coronary angiography/ percutaneous coronary intervention of nurses (n = 167)

Characteristic	Number	Percentage (%)
Gender		
Male	48	28.7
Female	119	71.3
Age group		
22 – 25 years	18	10.8
26 – 35 years	113	67.7
36 – 45 years	36	21.5
Marital status		
Single/Divorced	73	43.7
Married	94	56.3
Level of education		
Intermediate	93	55.7
College	22	13.2
University and Postgraduate	52	31.1
Years of nursing experience		
< 1 years	5	3.0
1 – 5 years	53	31.7
6 – 10 years	63	37.7
More than 10 years	46	27.6
Years of working in the cardiology department		
< 1 years	7	4.2
1 – 5 years	77	46.1
6 – 10 years	41	24.6
More than 10 years	42	25.1
Faculty employment		
Internal Cardiology	70	41.9
Interventional Cardiology - Intravascular Intervention	71	42.5
ICU/CCU	26	15.6
Level of total knowledge		
Less than 50%	7	4.2
50 - 79%	100	59.9
80% and more	60	35.9
Level of total practice		
Less than 50%	0	0
50 - 79%	37	22.2
80% and more	130	77.8

ICU/CCU: Intensive care unit/Coronary care unit

Table 1 shows that most of the participants were female (71.3%). The mean age of nurses was 31.1 ± 4.6 years, with the youngest age was 23 years and the oldest was 43 years, in which the age bracket of 26-35 years accounted for the highest proportion (67.7%). A majority of nurses in this study were married (56.3%). A greater number of nurses accomplished the intermediate level (55.7%). Nurses had experience for years divided into two groups: from 6 to 10 years and from 1 to 5 years, both constituted 37.7%. With regard to years of working in the cardiology department, nurses had experience from 1 to 5 years, making up 46.1%. Nurses have worked at the Departments of Interventional Cardiology - Intravascular Intervention (42.5%) and Internal Cardiology (41.9%). Also, the study's results depict that 59.9% of nurses scored 50 – 79% of the total knowledge score on patient safety after CAG or PCI. Nurses achieving

at least 80% of the total knowledge score made up 35.9%, yet only 4.2% scored less than 50% of the total knowledge score on patient safety after CAG or PCI. Regarding total practice, the nursing group had a good general practice of patient safety after coronary angiography or percutaneous coronary intervention ≥ 80%, accounting for the majority (77.8%). Next is the group of nurses with rather general practice at 50 - 79%, accounting for 22.2%. No record of good general practice level was less than 50%.

3.2. Relationship between knowledge and demographic characteristics

Table 2. The relationship between knowledge and demographic characteristics (n = 167)

Characteristic	Nurses' knowledge		p value	PR 95% CI
	Good n (%)	Poor n (%)		
Gender				
Female	44 (37.0)	75 (63.0)	0.657	1.11 (0.70 – 1.76)
Male	16 (33.3)	32 (66.7)		1
Age group				
22 – 25 years	9 (50.0)	9 (50.0)		1
26 – 35 years	37 (32.7)	76 (67.3)	0.120	0.65 (0.38 – 1.12)
36 – 45 years	14 (38.9)	22 (61.1)	0.426	0.78 (0.42 – 1.44)
Marital status				
Single	32 (44.4)	40 (55.6)		1
Married	27 (28.7)	67 (71.3)	0.122	0.65 (0.37 – 1.11)
Divorced	1 (100)	0 (0)	0.731	2.25 (0.06 – 13.47)
Level of education				
Intermediate	27 (29.0)	66 (71.0)		1
College	4 (18.2)	18 (81.8)	0.331	0.63 (0.24 – 1.61)
University and Postgraduate	29 (55.8)	23 (44.2)	0.001*	1.92 (1.29 – 2.87)*
Years of nursing experience				
5 years and less	23 (39.7)	35 (60.3)		1
6 – 10 years	18 (28.6)	45 (71.4)	0.203	0.72 (0.43 – 1.19)
More than 10 years	19 (41.3)	27 (58.7)	0.865	1.04 (0.65 – 1.67)
Years of working in the cardiology department				
5 years and less	28 (33.3)	56 (66.7)		1
6 – 10 years	13 (31.7)	28 (68.3)	0.857	0.95 (0.55 – 1.63)
More than 10 years	19 (45.2)	23 (54.8)	0.184	1.36 (0.86 – 2.13)
Faculty employment				
Internal Cardiology	19 (27.1)	51 (72.9)		1
Interventional Cardiology - Intravascular Intervention	36 (50.7)	35 (49.3)	0.006*	1.87 (1.19 – 2.93)*
ICU/CCU	5 (19.2)	21 (80.8)	0.442	0.71 (0.29 – 1.71)

*: Statistically significant at $p \leq 0.05$

Abbreviations: ICU/CCU: Intensive care unit/ Coronary care unit; PR: prevalence ratio; CI: confidence interval

Cut-off point ≥80%: good total knowledge

Cut-off point <80%: poor total knowledge

There were statistically significant correlations between knowledge of nurses on patient safety after CAG or PCI and demographic characteristics, namely level of education and working unit ($p<0.05$). Respondents who have already achieved university and postgraduate educational level were 1.92 times more likely to have better knowledge regarding patient safety after CAG or PCI than those with intermediate level (95% CI 1.29 – 2.87, p=0.001), and nurses working at the Department of Interventional Cardiology - Intravascular Intervention were 1.87 times more likely to have better knowledge regarding patient safety after CAG or PCI than those working at the Department of Internal Cardiology (95% CI 1.19 – 2.93, p=0.006).

There were no statistically significant correlations between knowledge of nurses on patient safety after CAG or PCI and demographic characteristics, namely gender, age group, years of nursing experience, and years of working in the cardiology department ($p>0.05$).

3.3. Relationship between practice and characteristics

There were statistically significant correlations between practice of nurses and some demographic characteristics, such as level of education, years of nursing experience, years of working in the cardiology department, and working unit ($p<0.05$). Respondents who have already achieved university and postgraduate educational level were 1.18 times more likely to have better practice regarding patient safety after CAG or PCI than those with intermediate level (95% CI 1.02 – 1.37, p=0.022). Those having at least 10 years of nursing experience and at least 10 years of working in the cardiology department were 1.20 times (95% CI 1.01 – 1.43, p=0.034) and 1.28 times (95% CI 1.09 – 1.49, p=0.002) more likely to have better practice regarding patient safety after CAG or PCI than those with less than 5 years of nursing experience

and working in the cardiology department, respectively. On the other hand, nurses working at the Department of Interventional Cardiology - Intravascular Intervention were 1.35 times (95% CI 1.14 – 1.59, p<0.001) to have better practice regarding patient safety after CAG or PCI than those working at the Department of Internal Cardiology. There was statistically significant correlation between knowledge and practice of nurses regarding patient safety after CAG or PCI. Nurses with good knowledge would have good practical skills 1.27 times higher than nurses with poor knowledge (p=0.005; 95% CI=1.09 - 1.47).

There were no statistically significant correlations between practice of nurses regarding patient safety after CAG or PCI and nurses' gender as well as age group (p>0.05).

Table 3. The relationship between practice and characteristics of nurses (n = 167)

Characteristic	Nurses' practice		p value	PR 95% CI
	Good n (%)	Poor n (%)		
Gender				
Female	92 (77.3)	27 (22.7)	0.794	0.98 (0.82 – 1.16)
Male	38 (79.2)	10 (20.8)		1
Age group				
22 – 25 years	14 (77.8)	4 (22.2)		1
26 – 35 years	84 (74.3)	29 (25.7)	0.743	0.96 (0.73 – 1.25)
36 – 45 years	32 (88.9)	4 (11.1)	0.338	1.14 (0.87 – 1.50)
Marital status				
Single	56 (77.8)	16 (22.2)		1
Married	73 (77.7)	21 (22.3)	0.986	1.00 (0.70 – 1.44)
Divorced	1 (100)	0 (0)	1.000	1.29 (0.03 – 7.46)
Level of education				
Intermediate	71 (76.3)	22 (23.7)		1
College	12 (54.6)	10 (45.4)	0.099	0.71 (0.48 - 1.06)
University and Postgraduate	47 (90.4)	5 (9.6)	0.022*	1.18 (1.02 – 1.37)*
Years of nursing experience				
5 years and less	44 (75.9)	14 (24.1)		1
6 – 10 years	44 (69.8)	19 (30.2)	0.458	0.92 (0.74 – 1.15)
More than 10 years	42 (91.3)	4 (8.7)	0.034*	1.20 (1.01 – 1.43)*
Years of working in the cardiology department				
5 years and less	61 (72.6)	23 (27.4)		1
6 – 10 years	30 (73.2)	11 (26.8)	0.948	1.00 (0.80 – 1.27)
More than 10 years	39 (92.9)	3 (7.1)	0.002*	1.28 (1.09 – 1.49)*
Faculty employment				
Internal Cardiology	49 (70.0)	21 (30,0)		1
Interventional Cardiology - Intravascular Intervention	67 (94.4)	4 (5.6)	<0.001*	1.35 (1.14 – 1.59)*
ICU/CCU	14 (53.9)	12 (46.1)	0.186	0.77 (0.52 – 1.13)
Knowledge				
Good n (%)	54 (90.0)	6 (10.0)	0.005*	1.27 (1.09 – 1.47)*
Poor n (%)	76 (71.0)	31 (29.0)		1

**: Statistically significant at p ≤ 0.05*
Abbreviations: ICU/CCU: Intensive care unit/ Coronary care unit; PR: prevalence ratio; CI: confidence interval
Cut-off point ≥80%: good total knowledge and practice
Cut-off point <80%: poor total knowledge and practice

4. DISCUSSION

4.1. Knowledge of nurses on patient safety after CAG or PCI

Regarding the total knowledge of nurses on patient safety after CAG or PCI, the study's results indicate that participants mainly had poor total knowledge, accounting for 64.1% while the percentage of nurses with good total knowledge was only 35.9%. In fact, nurses working at public hospitals are regularly offered the up-to-date knowledge towards CAG/PCI. Therefore, they acquire better total knowledge than nurses working at private hospitals. Actually, this point is considered as a limitation in our research since the three study locations where the sample was taken are heterogeneous in terms of kind of medical facilities (public and private healthcare), so it is necessary to discuss some possible ways to overcome these limitations in future studies. More importantly, comparisons between study locations have not been approved by the Ethics in Biomedical Research. Simultaneously, to avoid false positives (good knowledge/ practice assessment, but the reality may not be good), this study chose threshold ≥80% to ensure accuracy. As a result, the total knowledge in this study is still low.

Our research has overcome some limitations by performing the studies in three specialty heart and interventional cardiovascular hospitals in Ho Chi Minh City compared to previous studies. These hospitals are the frontline heart hospitals in the southern region of Vietnam with relatively distinct public and private models, therefore, there is an existence of extrapolation value compared to previous studies [7, 14-16].

Compared to the study of Mariam Feroze and his colleagues (2017) [7], which evaluated the knowledge and practice of nurses on patient safety after CAG or PCI, most of respondents in their study achieved good knowledge. This is inconsistent with our results. The reason is due to the dissimilar measurement method.

4.2. Practice of nurses on patient's safety after CAG or PCI

Nearly 80% of nurses achieved good total practice on patient safety after CAG or PCI. Nurses in each hospital are responsible for at least 150 to more than 1000 patients per month. Therefore, they are competent at the practice towards taking care of patients following the doctor's medical instructions or based on their own practical work experience. The practice assessment of our study was conducted in the same way as the author Feroze. However, this study's result is different from that of Feroze due to the distinction from two studies' chosen cut-off points of good practice level [7]. The practice assessment method used in this study was a 3-point Likert scale, which is distinguish from the first study using this questionnaire (2011). The study of Arathy employed the nurses and patients observation method for practice evaluation, thus there has a significant difference in comparison with this study results [10]. Most nurses have better total practice than total knowledge, which reflects the current situation and working regulations of nurses in Vietnam that they always follow the doctor's medical instructions. Once the doctors have given their medical instructions, they will guide the nurses on how to perform to achieve the best results for patients, therefore nurses mostly perform better practice of patient care. This state occurs nearly on a daily basis. Concurrently, nurses also have better knowledge regarding questions concerning the practice of patient care.

4.3. Relationship between knowledge/practice and demographic characteristics

There was no statistically significant correlation between knowledge of nurses and their gender. The analysis of good practice relationship also indicated similar results. Our result is consistent with author Arathy's study (2011) and author Nahla Shaaban's one (2015), both male and female nurses working in the faculties of Internal Cardiology and Interventional Cardiology obtain the same knowledge and practice level towards patient safety [10, 17]. The hospital always organizes educational, training programs on patient safety alternately for all nurses working in the cardiology and interventional cardiology departments, so there is no difference in knowledge and practice between genders. At the same time, there is no difference in knowledge and practice among age groups. However, the study entitled "Nurses' knowledge on patient's safety after diagnostic cardiac catheterization in Azadi Teaching Hospital in Kirkuk City" indicates opposite results when expressing gender related to nurses' knowledge. This can be explained by the fact that the study of author Faisal Sameen (2018) only conducted in one hospital and the sample size is small, so the results cannot be representative of other countries [15].

Other global studies have found a statistically significant correlations between age group, working experience and knowledge. People aged 26-30 years, whose work experience less than 5 years tended to achieve higher knowledge and practice than other groups, which is deemed as a huge difference with our study [7, 10]. This study did not find any statistically significant correlations between age group and nurses' knowledge and practice. Simultaneously, our study did not find a correlation between working experience in the cardiology department and nurses' knowledge, which is similar to that of Faisal Sameen (2018) [15, 17]. This can be explained by the fact that a majority of cardiac nurses at the three chosen hospitals have not been trained in the content entitled "Enhancement of nursing skills and nursing competency in caring for patients with cardiovascular intervention" granted by Ho Chi Minh City Interventional Cardiology Division. Therefore, studied nurses in prior research have better knowledge and practice at their younger age than their older age.

There were statistically significant correlations between practice of nurses and their years of nursing experience, as well as years of working in the cardiology departments. Nurses who work in cardiology departments for long periods of time are more likely to practice better. This is mainly because nurses' knowledge and experience have been accumulated over time. The author has not found any previously published research that assessed the relationship between practice of nurses and their years of nursing experience or years of working in the cardiology departments.

There were statistically significant correlations between nurses who completed university plus postgraduate degrees and who completed intermediate degree. In particular, the former were 1.18 times more likely to have better knowledge than the latter. This conclusion is consistent with the statement that qualification has a significant influence on the nurses' knowledge from author Feroze. Yet, our study has overcome the limitations of Feroze's study through detecting increased levels of knowledge among education level groups [7]. Studied nurses had low knowledge of questions concerning clinical signs, complications, and direction of treatment. These are the knowledge that nurses with university level are disseminated, whose foundation was formed from the units of anatomy, physiology, and pathophysiology – immunology, along with absorbing the theoretical as well as practical knowledge of basic nursing and in-patients healthcare. Nurses with intermediate level are also trained in the same units as those with university level, yet the training period is shorter, so the courses are not intensive with only units of "anatomy – physiology" in place of many basic units. Therefore, nurses with university level have a greater ability to acquire knowledge when working after graduation, especially for complex diseases such as cardiovascular disease. Nurses who achieved university and postgraduate educational level are more deeply trained and

are better able to absorb knowledge. At the same time, nurses with higher level of education are often prioritized when there have training courses provided by leading domestic experts, or these nurses can be even sent to study abroad in developed countries, to improve their experience in caring for patients who have coronary artery disease. Because of the complex of coronary artery disease, it requires qualified nurses who are knowledgiable and practical for taking care of patients in the cardiologic unit. For this reason, the hospitals may consider in recruiting murses that have university and postgraduate educational levels for working in the department.

Being different from the study of Feroze, our study found that there were no statistically significant correlations between marital status and nurses' knowledge as well as their practice on patient safety after CAG or PCI.

One point that makes this research outstanding against previous studies is to assess the relationship between working unit and nurses' knowledge/practice. This study found that nurses working at the interventional cardiology department achieved 1.87 times higher in the good knowledge of patient safety and 1.35 times higher in the good practice than the nursing group working in the internal medicine. Our study found no statistically significant difference between the knowledge/practice of nurses who work at the intensive care unit - coronary care unit and the internal cardiology department. This can be explained by the fact that only Tam Duc Heart Hospital has a coronary care unit, so there have not enough evidence to compare and form any relationship.

4.4. Relationship between knowledge and practice on patient's safety after CAG or PCI

Our study found a statistically significant correlation between knowledge and practice of nurses. Nurses with good knowledge were 1.27 times more likely to achieve good practice compared to nurses with poor knowledge. At the same time, our study showed a moderate positive correlation between good knowledge and good practice. This result is consistent with the study of Feroze (2017) when the results showed a moderate positive correlation between good knowledge and good practice of nurses about patient safety after CAG or PCI [7].

Since postoperative care among patients with cardiovascular diseases is of the utmost importance, in which the complications after the procedure can be early detected and treated, so that patients can recover and return to full normal activities, which is associated with postoperative care and practice. The nurses' knowledgible and clinical requirements must be qualified [18]. As a result, nurses working in the departments of cardiology and interventional cardiology should be meticulously recruited to avoid possible medical incidents during the process of patients' care and recovery. It is required that nurses with university and postgraduate level, along with accumulating working experience at the cardiology department should be selected to directly care for patients. Concurrently, new and inexperienced nurses should be arranged to support and improve working experience to become a patient's primary care team in the future. The hospitals also need to update the latest and in-depth knowledge regularly to change the improper thinking of nurses. From there, the nurses' competence in taking care of patients' wellness would be enhanced, so that nurses can perform some independent actions in line with their functions and duties appropriately, and counsel the physicians on the patients' condition to decide the optimal care and treatment for patients. The study results actually suit the Vietnamese culture entitled "Learning with practice", which implies having good knowledge without practice would not improve one's skills and vice versa, without good knowledge, when people practice, they only follow a path or the instructions of others without understanding its meaning. This study results offer insights into the vital role of nurses in the care of patients after CAG or PCI. Thus, nurses should actively learn more knowledge by themselves, especially seek and absorb new knowledge. This will act as a premise and boost their practical skills. As a result, patients will be taken care of effectively and safely.

With regard to our strengths, this is a multicenter study, which conducted at Vietnam reputable hospitals. The questionnaire was translated from English into Vietnamese and vice versa by experts with high English proficiency. Following that, the questionnaire was assessed for content validity by five cardiologists and interventional cardiologists, who are doctorate and master of nursing, along with doctors who directly worked in the Department of Cardiology and Interventional Cardiology and had research works related to this topic. Apart from that, a high Cronbach's alpha (0.81) ensures a strong relationship between the investigated variables in this study. Therefore, the questionnaire used in this study is coherent and valid [19]. However, regarding our limitations, since our research topic has still been new, there have not much literature to compare and the sample size at each hospital has been inconsistent. Furthermore, our study has not well controlled confounding variables, which are the differences between private and public healthcare system.

Conclusion

The proportion of cardiac nurses with good total knowledge and good total practice on patient safety after CAG or PCI were 35.9% and 77.8%, respectively. There was statistically significant correlation between knowledge and practice of nurses. Nurses with good knowledge were 1.27 times more likely to achieve good practice compared to nurses with poor knowledge regarding patient safety after CAG or PCI. It is recommended that cardiac nurses should participate in continuous training courses about nursing skills and competency in caring for patients with cardiovascular intervention to improve knowledge and practice regarding patient safety after CAG or PCI.

LIST OF ABBREVIATIONS

CAG: Coronary angiography; CCU: Coronary Care Unit; CI: Confidence Interval; ICU: Intensive Care Unit; PR: Prevalence ratio; PCI: Percutaneous coronary intervention; US: United States; WHO: World Health Organization.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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