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COMPLICATIONS SURVEY OF PERCUTANEOUS CORONARY INTERVENTION: A CROSS-SECTIONAL STUDY

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ABSTRACT

The purpose of this research is to examine the perspectives of interventional cardiologists, and the annual incidence of each PCI complications. This study is based on a cross-sectional analysis conducted using the Google Forms. The technique for determining the research subject used in this study was non-random sampling with purposive sampling technique. The anonymity and confidentiality of the information collected is highly prioritized. Annual PCI incidence rates are as follows: 100 (13%) 100–199 (13%), 200–299 (35%) 300 and above (38%). With a mean score of 5.56 on a scale from 0 to 10, participants are very concerned about the possibility of PCI complications. Coronary perforation is the most concerning complication of PCI (83%). Annually, coronary artery dissection occurred between once and five times (73%), coronary perforation occurred between once and five times (50%), and hemodynamic collapse was occurred at one to five times (60.9%). Further, 78.3% of participants never used covered stents, while 32% of participants used balloon tamponade at least one to five times each year. Participating interventional cardiologists in our research have concerns about possible PCI complications. Perforations, dissections, hemodynamic collapse, no-reflow, and entrapment equipment are complications that operators must be ready to identify and control.

KEYWORDS:

Complications, Interventional cardiology, Percutaneous coronary intervention, Survey

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INTRODUCTION

Percutaneous coronary intervention (PCI) is now recommended for the treatment of patients with acute coronary syndrome and those who have chronic stable angina but are unresponsive to appropriate medication therapy. Improved antiplatelet medication, better instruments, safer stents, more cautious usage, and other innovations are all contributing to enhancing the safety of PCI procedures. However, significant periprocedural complications might still occur while PCI is performed. According to previous study, perforations of the coronary artery may occur up to 4.8% with more complex PCIs, with mortality rates as high as 10% to 15%.[1]

Hence, patient survival and overall healthcare expenditures might be significantly impacted by PCI complications. On the other hand, limited study has been done to investigate interventional cardiologists' perspectives, incidence, and approaches to managing PCI complications. The purpose of this study is to examine interventional cardiologists' perspectives on PCI complications and its incidence in Indonesia. To provide more ample training regarding more concerning PCI complications.

METHODS

The basis of this research is a cross-sectional study, utilizing Google Form application. Survey questions are based on common complications that may happen during PCI. Questions and response validated with construct validity.[2,3] The technique for

determining the research subject used in this study was non-random sampling with purposive sampling technique. There were 23 research subjects, namely cardiologists who have cardiac intervention expertise. The Google Form link is shared through social media, ensuring as many interventional cardiologists respond to the survey. Participants who took part in the survey agreed to be research subjects in this study. Furthermore, during the research process, the anonymity and confidentiality of the information collected is highly prioritized.

To describe the distribution of study participants and the incidence of PCI complication, we included questions about the career stage, estimated number of PCI procedures per year, and the estimated number of each PCI complication that occurs annually.

RESULT AND DISCUSSION

There was a total of 23 participants in the research, and 18 of them (78.3%) were interventional cardiologists with 7 years of experience, and 5 participants with a career span over 7 years. The annual cases of PCI range from 100 (13%) to 100–199 (13%), 200–299 (35%), and more than 300 (38%). (**Figure 1**)

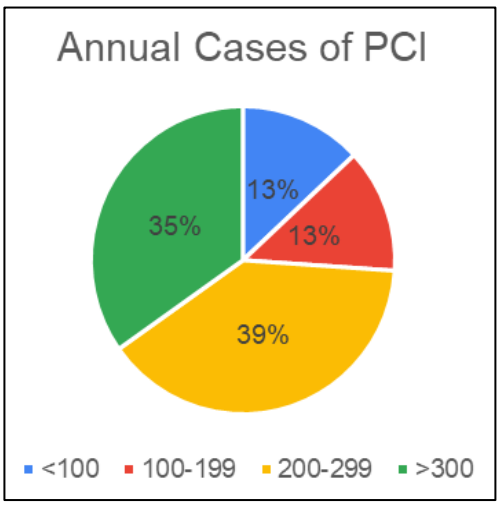

Figure 1. Annual Cases of PCI

Participants are quite concerned about potential complication of PCI, with an average score of 5.56 on a scale of 0-10. (**Figure 2**). According to participants, coronary perforation (83%) is the most concerning complication of PCI, followed by hemodynamic collapse (13%), and no reflow (4%). (**Figure 3**)

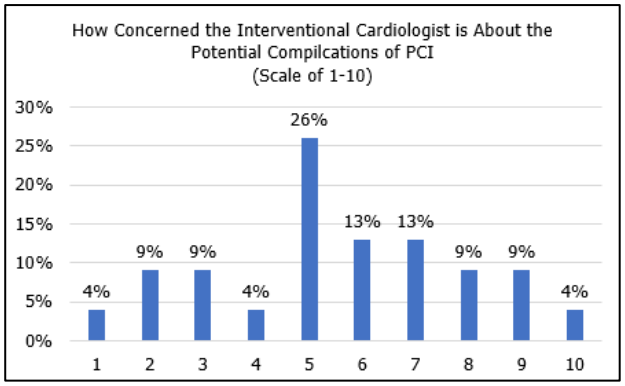

Figure 2. How Concerned the Interventional Cardiologist Is About the Potential Complications of PCI (Scale of 1-10)

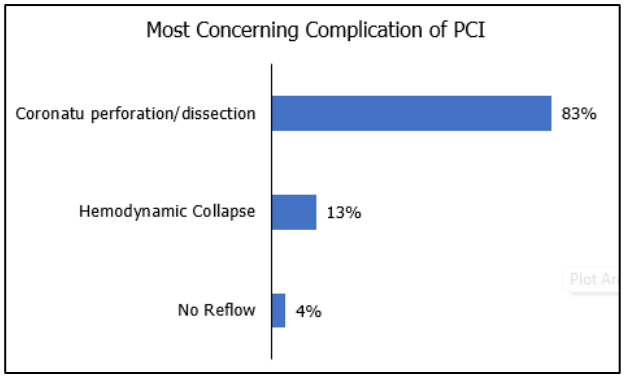

Figure 3. Most Concerning Complication of PCI

Perforations, dissections, hemodynamic collapse, no-reflow, and entrapped equipment are all potential outcomes of percutaneous coronary intervention (PCI) procedures, and operators must be prepared to diagnose and manage these complications.

Coronary dissection is the most concerning complication during PCI, according to 83% of participants. The incidence cases of coronary artery dissection caused by a PCI has been considered to be 0.1%, but the real number is probably underreported.[4] Coronary dissections were more common in the right coronary artery (50%) than in the left main artery (45%) in a retrospective 10-year cohort analysis of 56,968 individuals undergoing coronary angiography.[5] In PCI, dissections of the coronary arteries are more common when bigger catheters are used and the constant manipulation of coronary guidewires and other interventional devices within the artery. In cases of catheter-induced coronary artery dissection, prognosis is most strongly influenced by two factors: the size of the damaged arteries and the integrity of antegrade flow. Minor dissections may not need treatment, but those that are long or result in >50% stenosis with the decreased flow in a vessel of >2.5 mm is considered significant and should be treated.[6] Therefore, therapeutic plan will range from close observation to urgent balloon tamponade and permanent vascular occlusion depending on the size and location of the dissection.

However, the prevention of coronary dissection during PCI is of paramount importance, and this may be achieved by identifying and addressing modifiable risk factors and using appropriate preventive treatments. The catheterization process needs to be carried out with caution. Catheters of the right size and shape should be used without performing deep insertion of the artery; noncoaxial alignment of the catheter should be avoided; and injections should be avoided when the pressure waveform decreases or when the catheter is positioned over an atherosclerotic plaque. Some risk factors are not modifiable, such as the existence of a complicated lesion or the presentation of an acute myocardial infarction. Risk detection and early diagnosis of dissection will expedite the delivery of decisive treatment in either scenario. Distinguishing catheter-induced coronary artery dissection from other angiographic findings is also crucial. Persistent intraluminal smooth flap or extraluminal linear or spiral extravasation of contrast media, with or without decreased antegrade flow, are hallmarks of a true dissection.[7]

The failure to properly handle life-threatening complications during PCI might have dire consequences. Participants reported that PCI complications annually, such as coronary artery dissection occurred between once and five times per year (73%), coronary perforation occurred between once and five times (50%), coronary air embolism

was never experienced (52.2%), no flow was observed after stent implantation occurred between once and five times (56.5%), equipment entrapment was never experienced (69.6%), and lastly a complication of hemodynamic collapse was occurred at one to five times annually by 60.9% and up to ten times annually by 21.7% of participants.(**Figure 4**)

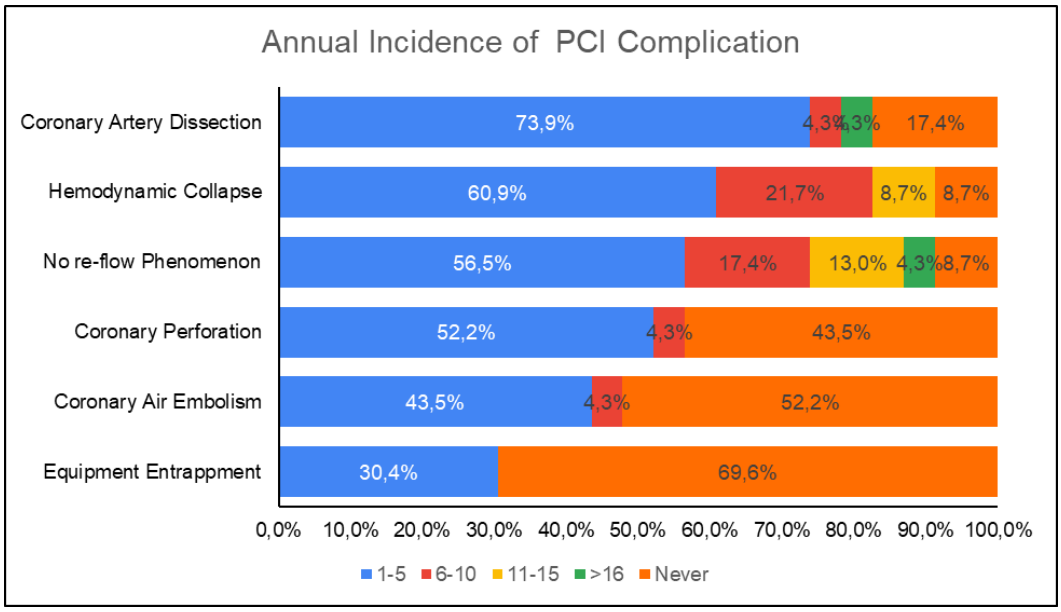

Figure 4. Annual Incidence of PCI Complication

A coronary perforation happens when a dissection or intimal rupture extends outward and penetrates the artery wall entirely. According to previous study, perforations of the coronary artery occur in 0.19–1.46% of PCI operations and as high as 4.8% with CTO interventions. There is a fivefold increase in the chance of in-hospital mortality, with some studies reporting rates as high as 10% to 15%.[1]

Perforations in the main vessel might be life-threatening. Balloon tamponade the perforation, identify and treat pericardial tamponade, and call for more PCI operators and cardiac surgeons all at the same time as initial care. In cases of serious perforations with active streaming into the pericardium, the best way for closing the perforation while preserving vascular patency is to immediately implant a covered stent. In cases of minor perforations, balloon tamponade solely may be effective. In cases of less severe perforations, bare-metal or standard drug-eluting stents may be chosen over covered stents because of their greater long-term patency rates. If percutaneous methods fail, cardiac surgery may need to be performed immediately.[8] In our study we found that, 61% of balloon tamponades were never used and 39% were used between once and five times a year, whereas 78% of covered stents were never used and 22% were used between once and five times a year.

Thirteen percent of respondents ranked hemodynamic collapse as the second most

concerned PCI complication. There is a wide range of potential triggers for hemodynamic collapse during PCI. After excluding obvious explanations such as equipment failure or catheter dampening, the operator should think about the underlying causes of the patient's rapid hypotension.[9] Support from co-workers may be necessary to treat the root cause of the hemodynamic collapse, integrate medical treatment or resuscitative attempts. In cases of prolonged cardiogenic shock, device selection should take into account providing temporary mechanical assistance, such as using an Intra-aortic balloon pump.[10]

No reflow is the third most concerning complication of PCI, according to 4% of participants. There are cases when PCI fails to improve coronary flow despite a very patent epicardial artery.[11] This no-reflow phenomena occur most often in the context of ST-segment-elevation myocardial infarction, PCI of deteriorated vein grafts, and atherectomy, and may be caused by endothelial dysfunction, microvascular blockage, or arteriolar spasm. Dissection, air embolism, spasm, pseudo-lesion development, intramural hematoma, and thrombosis are all conditions that might mimic the angiographic findings of no-reflow and must be ruled out. In order to resolve a true no-reflow, several pharmaceutical options have been proposed, such as adenosine, nitroprusside, nicardipine, and verapamil are the most often utilized pharmacological drugs. In situations that did not respond to standard pharmaceutical interventions, intracoronary epinephrine administration was also reported to be useful.[12]

Covered stents were never deployed by 78.3% participants, whereas 32% deployed covered stent at least one to five times annually. On the other hand, balloon tamponade was never deployed by 59.1% participants, while 32% deployed at least one to five times annually. (**Figure 5**)

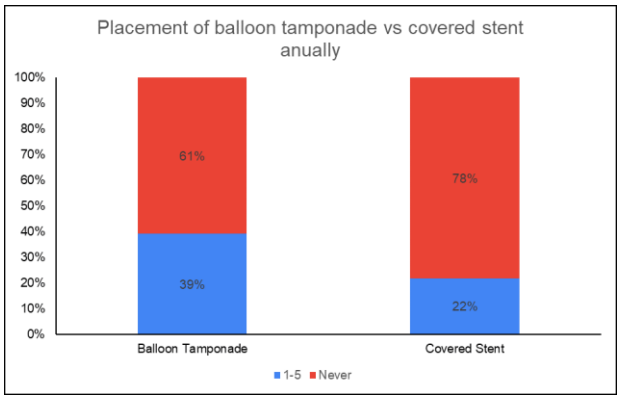

Figure 5. Annual Incidence of PCI Complication

Maintaining open lines of communication with the patient and their family is also essential. Hospitals that advocate for complete transparency in reporting problems and adverse events report higher levels of patient and family satisfaction and a decrease in claims for malpractice. The Seattle Percutaneous Coronary Intervention Complication Conference recommended a baseline set of tools and supplies to have on hand if issues arise during PCI. This comprises a "complications kit" or "cart" with extra tools and supplies in case of an emergency.[8]

However, there exists several limitations in our study. Google Form link is distributed via social

media, so it may not encompass the perception of the whole interventional cardiologist community. There may also be recall bias as participants may not accurately remember incidence of PCI complications. Furthermore, this study is unable to determine whether there is causality regarding interventional cardiologists' perception and their PCI complication incidence. We suggest future studies to include secondary data for a more detailed data regarding PCI complications.

CONCLUSIONS

The interventional cardiologists who took part in our study are concerned about potential complications of PCI. According to participants, the most feared complications of PCI, sequentially were coronary dissection or perforation, hemodynamic collapse and no reflow. Adhering to complication management protocols and having access to more experienced operators might reduce the burden and improve health outcomes for patients. Management of complications calls for forethought, prompt diagnosis, a wide range of treatment options, skill with effective methods, multi-disciplinary cooperation, and open communication with the patient.

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