

A population-based cohort study of blood pressure and mortality after percutaneous coronary intervention

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Watson J. A population-based cohort study of blood pressure and mortality after percutaneous coronary intervention. *Clin Cardiol J.* 2022; 6(3):28-30.

ABSTRACT

In Korea, revascularization techniques for coronary artery disease (CAD), such as Percutaneous Coronary Intervention (PCI), are becoming more common. However, research into blood pressure control targets in these patients is still lacking. The goal of this study was to see if there was a link between baseline blood pressure and all-cause mortality in CAD patients who had PCI. A population-based retrospective cohort research based on the Korean National Health Insurance System's national claims database, which covers the entire Korean population. A total of 38,330 patients having a history of PCI for CAD were enrolled in the study and were tracked

for all-cause death. The participants' baseline systolic and diastolic blood pressures (SBP and DBP) were measured, and they were divided into eight SBP and DBP groups. For each group, the hazard ratios (HRs) for all-cause death were calculated. For all-cause mortality, the trend of SBP and DBP in this cohort followed a J-curve relationship, with the nadir points at 119 and 74 mmHg, respectively. High SBP (160 mmHg) and high DBP (90 mmHg) were found to be strongly associated to death in people over 60. Low DBP (below than 70 mmHg) was also linked to death in people over the age of 60. In individuals who underwent PCI, there is a J-curve link between baseline blood pressure and all-cause mortality, and rigorous blood pressure lowering may be advantageous for these patients. Excessive BP lowering, particularly DBP, may, on the other hand, raise the risk of death in the senior population.

INTRODUCTION

In Korea, cardiac illnesses are one of the leading causes of death. The rate of Coronary Artery Disease (CAD) revascularization has been gradually rising. Furthermore, demand for percutaneous coronary intervention (PCI) and coronary artery bypass graft surgery increased from 40,035 to 74,993 instances between 2006 and 2017. As a result, the necessity of CAD care in patients with a PCI history is rapidly gaining traction. The ideal blood pressure target for patients with CAD is still unknown. In CAD patients, the target Systolic Blood Pressure (SBP) is 130 mmHg, and the target Diastolic Blood Pressure (DBP) is 80 mmHg, according to recently published guidelines in the United States, Europe, and Korea. Despite guideline recommendations, the optimum Blood Pressure (BP) target in patients with a CAD history is still debated, especially in light of the recent appearance of a new breakthrough hypothesis about the existence of a J-curve relationship between BP control and outcomes³. J-curve associations between blood pressure and outcomes such as all-cause mortality and myocardial infarction (MI) incidence in CAD patients have been observed in earlier studies. However, the majority of these findings came from post-hoc assessments of earlier research, making it difficult to apply them to real-world scenarios. As a result, more research is needed to discover the precise and appropriate level of blood pressure lowering for CAD patients.

Despite this, there is a lack of data and published studies on blood pressure and its relationship to other outcomes in CAD patients who have survived coronary artery revascularization procedures like PCI. The goal of this study was to determine the optimum blood pressure targets in this cohort by looking at the association between blood pressure control and all-cause mortality in patients who had PCI for CAD. Using the Korean National Health Insurance System (NHIS) database, we investigated the link between baseline blood pressure and death in PCI patients.

METHODS

Data and objects

The NHIS database contains complete medical data, including as diagnoses, procedures, prescription drugs, demographics, and personal information, all of which are coded using the International Classification of Disease 10th version (ICD-10) codes. Korean individuals who completed general health screening between 2005 and 2008 and had a history of PCI for CAD within two years of the screening test were included in the study. A total of 38,330 people were eligible to participate in the study. After receiving approval from their institution's Institutional Review Board, researchers can apply for the National Health Insurance data sharing programme.

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Received: 04-May-2022, Manuscript No. PULCJ-22-5012; Editor assigned: 06-May-2022, PreQC No. PULCJ-22-5012(PQ); Reviewed: 13-May-2022, QC No. PULCJ-22-5012(Q); Revised: 15-May-2022, Manuscript No. PULCJ-22-5012(R); Published: 29-May-2022, DOI: 10.37532/pulc.22.6(3).28-30.



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Authors must pay a data access fee and agree that other researchers will be able to access the data in the same way as the authors once it has been reviewed by the Korea National Health Insurance Sharing Service Institutional Data Access/Ethics Committee. The study was carried out in accordance with the Declaration of Helsinki's ethical guidelines. The Korea University Ansan Hospital's institutional review board gave its approval to this study. The ethics council of Korea University Ansan Hospital waived informed consent due to the retrospective nature of the study.

Definitions

During the general health screening for the individuals between 2005 and 2008, blood pressure was measured using automatic or digital monitors after resting for at least 5 minutes in a sitting position. And the baseline blood pressure was established. SBP was divided into eight subgroups in increments of 10 mmHg (100, 100–109, 110–119, 120–129, 130–139, 140–149, 150–159, and 160 mmHg) while DBP was divided into seven subgroups in increments of 10 mmHg (60, 60–69, 70–79, 80–89, 90–99, 100–109, and 100 mmHg). The Korean Health Insurance Review and Assessment Service procedure codes were used to determine the subjects' PCI history. M6551–M6554, M6561–M6566, M6571, and M6572 are the procedure codes that correspond to PCI. The first occurrence of mortality from any cause was the study's outcome measure. Covariate data that potentially affect the mortality of CAD patients were obtained to assess the baseline characteristics of the individuals. Age (60 years, 60 years), sex, smoking (non-smoker, ex-smoker, current smoker), alcohol intake (none; mild, less than 30 g/day; heavy, more than 30 g/day), exercise, annual income, and Body Mass Index are the covariate variables (BMI). Subjects' responses to standardised questionnaires administered during their national health screening were used to compile lifestyle data. Diabetes was diagnosed based on fasting blood glucose levels of 126 mg/dL measured during the health screening or ICD-10 codes (E11–E14) along with registered anti-diabetic drug prescriptions, and dyslipidemia was diagnosed based on total cholesterol levels of 240 mg/dL or ICD-10 code E78 and lipid lowering drug prescriptions.

Statistical analysis

Subjects' baseline characteristics were divided into two categories: continuous and categorical variables. The number of incidents per 1000 person-years is how incident rates are expressed. The link between BP values and death rates in participants with a PCI history was investigated using Cox proportional models, which yielded Hazard Ratios (HRs) and 95 percent Confidence Intervals (CIs). Age, sex, lifestyle characteristics, BMI, and comorbidities were all used as covariates in the models. P values with two tailed P values of less than 0.05 were considered statistically significant. We also used SBP and DBP to derive spline curves with corrected HRs with 95% CIs.

RESULTS

The average age of the study participants was 62.0 years, with 41.7% under 60 and 58.3% over 60. The majority of the participants in the study were men, accounting for 72.4% of the total. Surprisingly, non-smokers (64.9%) and non-alcohol drinkers made up more than half of the participants (71.2%). 31.4% of the individuals had diabetes, 87.0% had hypertension, and 84.5 percent had dyslipidemia, according to their medical histories. According to the obesity standards in Korea, overweight was defined as BMI 23 kg/m² and obesity was defined as BMI 25 kg/m². In our study, 28.6% of the participants were overweight, and 44.7% were obese. The impact of blood pressure on these PCI patients, as well as the link between BP subgroups and HRs.

The reference intervals for SBP and DBP were 100–109 mmHg and 70–79 mmHg, respectively. SBP 100 mmHg demonstrated a significant connection with death rates in participants younger than 60 years old, with a J-curve pattern. Significant differences were found between the lowest and highest SBP groupings. Furthermore, the DBP in this age group was not significant. The high SBP and DBP groups, with SBP 160 mmHg and DBP 90 mmHg, were strongly associated to death among participants aged > 60 years. Furthermore, among people over 60, having a low DBP (less than 70 mmHg) was linked to a higher risk of death.

DISCUSSION

Although blood pressure lowering is successful in this patient population, it is critical to maintain proper blood pressure control, especially when considering age, due to the increased risk of mortality associated with excessive BP lowering. Because low DBPs pose a high risk of death in senior patients, it's crucial to use a less stringent target for diastolic BP reduction in this group. Comparison with other research and interpretation: The BP nadir, which had the lowest incidence of primary outcomes such as all-cause death and MI, was 136/85 mmHg, according to patients in the PROVE IT-TIMI (PRavastatin or atorVastatin Evaluation and Infection Therapy-Thrombolysis In Myocardial Infarction) study. The BP nadir, which had the lowest prevalence of primary outcomes such as all-cause mortality and non-fatal MI, was 145/80 mmHg in the PCI-treated group in an analysis of patients who underwent coronary revascularization among those who participated in INVEST (INternational VErapamil SR-trandolapril STudy). The SBP nadir, which had the lowest percentage of primary outcomes such as cardiovascular mortality, MI, and stroke in the ONTARGET (ONgoing Telmisartan Alone and in Combination with Ramipril Global Endpoint Trial), was around 130 mmHg. In general, the nadir BP had the lowest prevalence of primary outcomes in previous research, which tended to be greater than in ours. The BP nadir that had the least occurrence of all-cause death, non-fatal MI, and non-fatal stroke in the analysis of patients who participated in INVEST was 119/84 mmHg, which was similar to the results of this investigation. Furthermore, this study found that antihypertensive therapy for blood pressure control in patients with a history of PCI and blood pressure levels below the hypertension threshold may improve survival. This is in line with the findings of a previous meta-analysis, which found that decreasing blood pressure with antihypertensive medication may be beneficial in people with a history of cardiovascular disease but no hypertension.

Younger persons had the lowest mortality when their SBP was between 100 and 110 mmHg, while those over 60 had the lowest mortality when their SBP was between 120 and 130 mmHg. This matches the findings of a recent study in patients with CAD, in which the SBP values associated with the lowest all-cause mortality, cardiovascular mortality, MI, and other outcomes increased in the elderly. Setting BP control targets has long been a discussion between the "lower the better" idea and the "J-curve phenomenon" hypothesis. Many studies have demonstrated that high and low blood pressure levels increase mortality and cardiovascular adverse events. Previous meta-analyses, as well as the latest SPRINT research, have indicated that aggressive BP lowering to SBP 120 mmHg had a beneficial effect on mortality and other outcomes. The findings of this study revealed a significant prevalence of all-cause mortality in both the low SBP and DBP groups, implying a J-curve association between blood pressure and death in CAD patients who had had PCI. At the same time, the findings of this study imply that rigorous BP lowering with an SBP of less than 120 mmHg may improve survival in CAD patients who have had PCI.

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It's vital to remember that in Korean patients, the actual percentage of BP control with antihypertensive medicine is just about 70%. As a result, clinicians should not be afraid to actively control the blood pressure of patients who have had PCI. Despite the fact that there is a J-curve association between blood pressure and all-cause mortality, C-

-AD patients who have had PCI can benefit from aggressive blood pressure management. We only looked at all-cause death as an endpoint in this study. In addition to all-cause mortality, research into cardiovascular outcomes such as recurrent MI and stroke is needed.