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The Effect of Comorbid Conditions on Mortality in Patients Undergoing Percutaneous Coronary Intervention

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ABSTRACT

Introduction: Percutaneous coronary intervention (PCI) forms a standard treatment approach for coronary artery disease (CAD), while comorbid conditions produce considerable effects on patient results. Research determines how comorbidities affect the survival rates of patients who receive PCI. **Objective**: The research aims to determine how comorbidities affect the death rates of patients who receive PCI both during hospitalization and in the long-term. **Materials and Method:** A retrospective cohort research took place at Department of Cardiology, Hayatabad Medical Complex, Peshawar from January, 2022 to June of 2022. The study examined a total of 150 PCI patients' medical information including their diagnoses of heart failure and chronic kidney disease and COPD. The research used mortality data in combination with the Charlson Comorbidity Index (CCI) for measuring patient outcomes. **Results**: The mortality rate in hospitals reached 5.3%, while patients who had both heart failure and chronic kidney disease experienced the highest risk factors. Long-term mortality data computed 3.6% death amongst all patients, though COPD and kidney disease combination increased fatality rates. **Conclusion:** Healthcare providers need a unique treatment approach to care for PCI patients before their procedure because their coexisting illnesses raise the possibility of hospital deaths and reduced long-term survival chances.

INTRODUCTION

PCI serves as the primary treatment method for coronary artery disease (CAD) to improve medical results along with symptom relief. The success of Percutaneous Coronary Intervention depends on multiple linked factors, but existing medical conditions determine the overall outcomes. PCI procedures for the increasing number of elderly patients with complex coronary artery disease require a detailed understanding of medical factors that affect patient death rates (1). The current in-hospital mortality prediction tools demonstrate inadequate inclusion of patients' additional health problems, resulting in diminished prediction accuracy (1). Medical procedures requiring special strategies must be implemented when treating patients at high risk who need elective PCI for left main and multivessel disease conditions (2). Several long-term health issues found in this complex patient population enhance safety hazards during procedures and reduce patients' time to improve their survival duration (2).

The Charlson Comorbidity Index proves it's for measuring elderly PCI patients' comorbidity burden because it demonstrates specific relations between survival risks and bad results (3). Through the assessment tool, CCI medical experts have identified diabetes mellitus combined with renal impairment and cancer-related diseases together with systemic disorders as the main factors affecting cardiovascular patient outcomes. Multiple chronic disease conditions present at the same time represent a significant warning sign which predicts PCI patients experience substandard outcomes and die after their procedures (4). Risk models improve discrimination capabilities against patients by including multimorbidity factors, yet they produce better clinical decisions for patient care intensity and medical team surveillance (4). The combination of COPD with other multiple health conditions leads to significant changes in post-PCI outcomes. Patients with COPD show both severe systemic inflammation and physical disability

and blood clotting problems that result in poor cardiovascular health (5).

Research evidence shows that COPD independently increases PCI patient mortality rates in the long term, so it needs specific pre-treated assessments and following procedure treatment protocols (5). Heart failure functions as a primary factor that contributes to worsened results during PCI. PCI treatment yields life-saving benefits to specific heart failure patients yet exposes them to higher risks of treatment-related complications and admission back to hospitals, especially if their ejection fraction is low or they have advanced symptoms (6). Patient outcome from PCI procedures strongly depends on their health conditions related to nutritional status. Patients who experience malnutrition as an age-related health issue show significantly higher death rates during PCI procedures (7). A lack of proper nutrition weakens immune function by delaying healing time and creating an increased susceptibility to infections that makes procedural risks grow worse and affects recovery duration (7). Risk factor modification, particularly for malnutrition, must be a component in the pre-procedural evaluation routine.

However, beyond individual comorbidities, treatment strategies themselves warrant careful consideration in patients with high comorbidity burdens. Exercise-based cardiac rehabilitation delivers outcomes equal to or better than PCI for long-term morbidity and mortality rates when treating patients with chronic coronary syndrome, confirming the value of personalized healthcare approaches (8). Research shows that older adults who require complex PCI interventions have elevated mortality risk because of their frailty and polypharmacy state, together with limited physiological capabilities that interact with existing medical problems (9). Multiple research analyses confirm that COPD and similar conditions worsen outcomes under PCI and CABG and CABG treatments, so physicians must assess risks using comorbidities as key criteria (10). Long-term mortality after PCI becomes worse when patients have hypertension, particularly when blood pressure remains uncontrolled (11).

Diseases affecting peripheral vessels along with CAD represent examples of systemic vascular pathology that produces adverse effects on PCI results (12). The combination of concurrent multiple cardiac interventions, including transcatheter aortic valve implantation and interventional treatment, produces increased mortality risk within patients (13). PCR outcomes strongly relate to the health-related quality of life (HRQoL) assessments. People with multiple diseases typically show decreased HRQoL before PCI, which leads to worse mortality rates along with more adverse post-treatment effects. Risk assessment requires demographic and psychosocial information about patients, given how different HRQoL measurements and outcomes affect age groups and sex groups, according to research (14). The analysis of patient nutritional status proves essential because it affects both immediate procedures and determines extended survival rates of individuals experiencing acute coronary syndromes during PCI treatment (15). Clinical evidence confirmed that various medical conditions work together to decide the procedural outcomes for PCI patients. Pre-PCI assessment with post-procedural care must include precise diagnostic and management of comorbidities because this approach optimizes survival outcomes while improving the quality of life among this compromised patient group.

Objective

The purpose of this study was to determine how multiple health problems influence both short-term mortality in hospitals and extended mortality in patients who receive percutaneous coronary intervention to improve both risk identification and clinical results.

MATERIALS AND METHODS

Design: Retrospective Cohort Study.

Study setting: The study conducted at Department of Cardiology, Hayatabad Medical Complex, Peshawar.

Duration: The study research lasted six months, beginning from January, 2022 to June of 2022.

Inclusion Criteria

The research included all PCI patients who received either elective or urgent procedures at PIMS from January to June of 2024. The research included participants 18 years or older with CAD diagnosis and confirmed through medical assessment. The study respected patients with diagnosed associated conditions like diabetes, hypertension, chronic kidney disease, chronic obstructive pulmonary disease, and heart failure because the research examined these conditions' effects on post-PCI mortality.

Exclusion Criteria

The research excluded patients whose medical documentation was incomplete, along with those who received CABG instead of PCI, as well as patients who had PCI contraindications such as severe allergic reactions to contrast agents and active infections. The present study excluded terminal patients and those who received palliative care because it concentrated specifically on patients who had the potential for recovery.

Methods

The electronic medical records maintained at the Pakistan Institute of Medical Sciences (PIMS) delivered patient information about PCI participants undergoing intervention from January 2024 to June 2024. The data collection process incorporated demographic data, clinical healthcare records, and registered information

about patients who suffered from diabetes, hypertension, chronic kidney damage, COPD, and heart failure. Medical records at the Pakistan Institute of Medical Sciences provided mortality information which included all deaths that occurred in hospital care and those that happened within 30 days of discharge. All patients received evaluation through the Charlson Comorbidity Index, which assessed their combined medical conditions. Mortality rates served as the primary outcome measure for the study, while MACE consisting of stroke re-infarction and readmission were identified as secondary outcomes. SPSS version 25 carried out the statistical analysis. The research used descriptive statistics to present patient information, while the multivariate logistic regression analysis determined relationships between coexisting health conditions and survival outcomes. The findings reached statistical significance when the p-value reached an amount lower than 0.05.

RESULTS

The research included 150 patients who received PCI treatment at the Pakistan Institute of Medical Sciences (PIMS) throughout the period of January 2024 to June 2024. The study participants mainly consisted of male patients who averaged 62 years of age between 45 and 85 years. Among the study participants, hypertension was the most prevalent diagnosis at 68%, while diabetes mellitus affected 55% and hyperlipidemia affected 50%. Table 1 includes data about the comorbidities that participated in the study.

Table 1

Distribution of Comorbid Conditions in Study Population

Comorbidity	Number of Patients (n=150)	Percentage
Hypertension	102	68%
Diabetes mellitus	82	55%
Hyperlipidemia	75	50%
Chronic kidney disease	45	30%
Chronic obstructive pulmonary disease (COPD)	38	25%
Heart failure	28	19%

The study recorded 5.3% in-hospital deaths (8 patients) during the observation period. The reported patients with multiple health problems among the total group of 148 represented two individuals who battled diabetes, hypertension, and heart failure simultaneously. The research demonstrated that patients with heart failure and chronic kidney disease experienced greater mortality risks after undergoing PCI (heart failure OR = 2.85 95% CI: 1.12-7.26 and chronic kidney disease OR = 2.43 95% CI: 1.07-5.53) according to multivariate analysis ($p < 0.05$). Table 2 presents a summary of the variables that increase mortality risk during hospital care.

Table 2

Risk Factors for In-Hospital Mortality in PCI Patients

Risk Factor	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Heart failure	2.85	1.12 - 7.26	0.03
Chronic kidney disease	2.43	1.07 - 5.53	0.03
Diabetes mellitus	1.56	0.83 - 2.93	0.18
Hypertension	1.45	0.75 - 2.81	0.27

Patients with increased values on the Charlson Comorbidity Index faced greater health risks. A CCI score of at least 4 pointed out with strong accuracy the risk of dying as both short-term and long-term mortality predictors. Patients showing lower CCI scores below 4 demonstrated statistically lower mortality levels compared to other patients. Patients with a CCI score value of 4 or higher had post-PCI mortality of 9.2 percent, while individuals with a CCI score lower than 4 presented a 2.1 percent risk of death.

The mortality of 140 patients from the initial hospitalization was recorded up until 30 days following discharge from the hospital. The long-term mortality rate was 3.6%. People who had COPD combined with chronic kidney disease suffered from the highest death rates throughout their expected survival period (8.9% and 7.4%, respectively), as shown in Table 3.

Table 3

Long-Term Mortality (30-Day Post-Discharge) by Comorbidity

Comorbidity	30-Day Mortality Rate (%)
Chronic obstructive pulmonary disease (COPD)	8.9
Chronic kidney disease	7.4
Diabetes mellitus	2.3
Hypertension	2.1
No significant comorbidity	0.8

The research data shows that heart failure, together with chronic kidney disease and COPD, significantly affects death rates during hospital stays and throughout extended survival periods following PCI procedures. The information from the CCI score shows that patients with more comorbidities experienced adverse outcomes.

DISCUSSION

The data from this study demonstrates how comorbidities shape patient outcomes after percutaneous coronary intervention PCI procedures. Global cardiovascular disease continues as the primary reason for morbidity and mortality. Studying how comorbid conditions affect PCI treatment results remains vital for enhancing patient care and increasing survival chances. The study confirms previously published research, which shows that patients with more health conditions experience inferior results post-PCI. Research findings confirmed the 5.3% in-hospital death rate, while

previous studies showed that patient comorbidity profiles determined malarial mortality numbers. The mortality rate among PCI patients experiences yearly declines because of technological improvements, yet patients with comorbidities still represent a leading cause of mortality in such cases.

The study revealed heart failure combined with chronic kidney disease as the main mortality risk factors following PCI because disease sufferers experienced increased mortality rates in hospitals. The research confirms previous investigations that have verified the adverse effects of heart failure and CKD after PCI procedures (1, 6). Heart failure generates an excessive health load on the cardiovascular system that worsens in its advanced phases during PCI procedures. The limited ability of the body to compensate during procedures becomes substantially more problematic when there is both heart-ventricular dysfunction and reduced cardiac output. The elevated mortality rate among these patients stems from both arrhythmias and fluid overload issues and unstable hemodynamic conditions, which develop throughout and after the PCI procedure.

Patients who have heart failure commonly have developed coronary artery disease (CAD) throughout the years, resulting in more difficult PCI outcomes. Early and comprehensive preoperative assessment, together with advanced optimization strategies, need to be performed on these patients because CABG surgery plus earlier interventions might serve as suitable therapeutic options. This study demonstrates that PCI outcomes suffer the most significant impact from patients with chronic kidney disease among all measured comorbidities. The medical mortality risk for PCI patients with CKD is elevated because of ascending drug metabolism problems and a higher incidence of contrast-induced nephropathy, together with worsened atherosclerosis. Inflammation processes from Chronic Kidney Disease patients make their cardiovascular diseases advance rapidly, leading to increased severe complications following PCI procedures (6). The medical issues faced by CKD patients combine bleeding complications with infections, while impaired wound healing slows recovery and heightens death risks.

Healthcare providers must select appropriate contrast agents and properly adjust hydration and medication for preoperative patient care to minimize renal function risks. The research data confirmed that multiple health disorders reveal a strong potential for patient death following PCI treatment. The results from analyzing the Charlson Comorbidity Index (CCI) demonstrated that patients scoring at least four had significantly elevated risks of mortality both during hospitalization and following PCI recovery.

Studies confirm that PCI patients experience worse clinical outcomes when their comorbidity index increases (3, 4). Several concurrent diseases strengthen their impact on patients by reducing their ability to function appropriately, diminishing their recovery reserves, and heightening their vulnerability to developing serious health issues, including infections as well as thrombosis and organ failure. A thorough assessment of additional medical conditions should become part of preoperative processes to direct suitable clinical choices and follow-up care after procedures.

The research established COPD as a key condition that shaped long-term death rates. COPD exists as a common condition among patients with cardiovascular disease because smoking co-exists as a risk factor, yet the condition elevates cardiovascular complications independently. Systemic inflammation and endothelial dysfunction from COPD lead to increased chances of poor outcomes following PCI because they accelerate atherosclerosis progression (5). Healthcare practitioners should consider the limited oxygen transport capability in COPD patients because it creates extended treatment time needs, and respiratory emergencies and death become more likely. Healthcare providers must evaluate PCI suitability for individual patients by assessing COPD status because this condition continues to affect more people, especially among older patients. This study established that Diabetes mellitus and hypertension had less impact on mortality when compared to heart failure, but these comorbidities worsened patient outcomes.

Research shows that diabetes functions as an established threat to cardiovascular complications that result in unfavorable PCI results. The mortality impact on hospitalized patients from diabetes appeared less important than those from heart failure or CKD within study population. Management improvements for diabetes treatment, such as optimized glycemic control and advanced antidiabetic therapies, explain this finding. The development of complications during PCI depends on hypertension as an equally important contributor to the progression of CAD. Proper care for blood pressure control before procedures can minimize hypertension complications which the patient sample displayed. The 3.6% long-term mortality rate observed in this investigation demonstrates why healthcare providers must account for multiple health conditions when caring for patients after PCI. Patients with COPD and CKD face the most severe long-term death risks, which demonstrates that these conditions both affect treatment results shortly after PCI and create difficulties during recovery periods. Organizational multidisciplinary medical care needs to continue beyond PCI procedures, especially for patients in high-risk positions.

CONCLUSION

The research demonstrates that comorbidities create major threats to both short-term and long-term survival chances for patients who receive percutaneous coronary intervention (PCI). Patients with heart failure, chronic

kidney disease, and chronic obstructive pulmonary disease, alongside a high score on the Charlson Comorbidity Index, expressed the most significant risk of unfavorable results. Such medical conditions create higher mortality hazards, demonstrating why preoperative evaluation must be performed thoroughly and why personalized management strategies need development. Healthcare monitoring, together with prompt heart failure and CKD treatment for PCI patients, improves their survival chances due to their multiple medical complications. Risk assessment system development benefits from including comorbidities because it results in more precise patient forecasts and facilitates better clinical treatment choices. To achieve superior short-term and long-term treatment outcomes, physicians must evaluate all patient healthcare conditions before PCI procedures to achieve superior short-term and long-term treatment outcomes.

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