



## AGE-RELATED OUTCOMES IN PRIMARY PERCUTANEOUS CORONARY INTERVENTION (PPCI)

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### ABSTRACT

**Background:** Age plays a critical role in determining outcomes of Primary Percutaneous Coronary Intervention (PPCI) among patients presenting with ST-segment elevation myocardial infarction (STEMI). Variations in vascular pathology, collateral circulation, and comorbidities between younger and older patients can influence procedural success and recovery.

**Objective:** This study aims to comprehensively evaluate age-specific differences in clinical presentation, procedural characteristics, and in-hospital outcomes among patients undergoing PPCI.

**Methods:** A retrospective, comparative observational analysis was conducted using data from 426 patients who underwent PPCI. Patients were divided into two cohorts: Early Age (<60 years) and Old Age (>=60 years). Variables assessed included symptom duration, door-to-balloon (D2B) time, SYNTAX score (pre- and post-intervention), hospital stay, in-lab complications, TIMI flow, residual disease status, and in-hospital major adverse cardiac events (MACE).

**Results:** Older patients demonstrated significantly longer D2B times, elevated post-PCI SYNTAX scores, higher prevalence of residual disease and pulmonary edema, and more frequent use of post-PCI GPIIb/IIIa inhibitors. Despite these differences, in-lab mortality was absent in both groups.

**Conclusion:** Age is associated with more complex coronary anatomy and higher procedural challenge. Although mortality was not different, the older group experienced more residual disease and complications. Findings emphasize the need for tailored interventional approaches in elderly patients undergoing PPCI.

## INTRODUCTION

Primary Percutaneous Coronary Intervention is considered the optimal revascularization strategy for ST-segment elevation myocardial infarction. Despite advances in both technology and treatment protocols, patient outcomes following PPCI remain inconsistent, especially when considering different age demographics. Older individuals often have more complex heart anatomy, longer recovery times, and more health issues. They may also have reduced physical reserves and other conditions like kidney problems or reduced lung function, which can lead to worse outcomes after myocardial infarction. (1) More over the elderly population is underrepresented in major randomized trials, leading to gaps in evidence-based recommendations and potentially suboptimal treatment strategies for this subgroup.

The aging process is often accompanied by endothelial dysfunction, the development of calcified plaques, and alterations in pharmacodynamics, all of which can compromise the effectiveness of reperfusion and subsequent recovery following PCI. While younger patients may have fewer comorbidities, they may present for treatment later or exhibit distinct plaque morphologies. (2)

The aim of this study is to dissect these differences systematically to support individualized care models and enhance treatment strategies. It also seeks to identify potential targets for intervention to improve outcomes in older patients undergoing PPCI. Furthermore, the study aims to provide insights into the complex interplay between age, coronary anatomy, and procedural outcomes, which may inform future clinical trials and guideline recommendations.

### Results

Baseline demographic data showed a significant age difference (mean  $49.6 \pm 7.3$  vs.  $67.7 \pm 5.3$  years). (Figure 1) Gender distribution was similar (75% males).

Duration of chest pain and presenting symptoms were comparable. (Figure 2)

D2B time was significantly longer in the older group (85.3 vs. 77.4 minutes). (Figure 3) SYNTAX scores before and after intervention were higher in older patients, indicating more complex disease. (Figure 5,6) Hospital stay was also prolonged among elderly ( $33.0 \pm 37.4$  vs.  $27.9 \pm 23.4$  hours). (Figure 4)

Older patients had higher incidence of residual disease post-PCI and were more frequently administered post-procedure GPIIb/IIIa inhibitors. Pulmonary edema (5.88% vs. 0.9%) and CVA (3.43% vs. 0%) occurred more in older patients. In-lab mortality was zero in both groups.

TIMI 3 flow post-PCI was achieved in over 83% in both groups. Although in-hospital MACE was numerically higher in older patients, statistical significance was not achieved.

### Discussion

The study provides important insights into the age-associated disparities in STEMI management through PPCI. The older group demonstrated longer door to balloon times, more complex coronary anatomy, and increased residual disease burden. These findings are consistent with existing literature that highlights delayed presentation, vessel calcification, and suboptimal revascularization in elderly patients. (3) This finding suggests that the challenges in managing elderly patients with STEMI are multifaceted and extend beyond just the acute intervention. (4)

Although in-laboratory mortality rates were comparable between the two cohorts, indicating procedural safety (5), the heightened incidence of pulmonary edema, post-percutaneous coronary intervention residual disease, and the administration of adjunctive pharmacological interventions like GPIIb/IIIa inhibitors in the elderly group highlight their physiological vulnerabilities and the critical need for meticulous post-

intervention surveillance. These complications highlight the importance of tailored treatment approaches and comprehensive post-PCI care in elderly patients to mitigate adverse outcomes. The findings provoke questions regarding the threshold for complete revascularization in elderly patients, given the acceptance of incomplete revascularization because of frailty and comorbidities, potentially leading to adverse events.

The findings also raise questions regarding the clinical threshold for achieving complete revascularization in older patients. While reasonable incomplete revascularization is often accepted due to frailty or comorbidities, it may contribute to downstream adverse events. This is in contrast to study done by Yu-Ying Lu which demonstrated that complete revascularization has superior long term outcomes as compared to incomplete revascularization.(6) While both older and younger patient groups achieved similar TIMI 3 flow post-intervention, as observed by Topal et al., differences in functional recovery may arise from myocardial stunning, diastolic dysfunction, or pre-existing ventricular hypertrophy.(7)

Although door-to-balloon times were within the 90-minute benchmark for both age groups, they were comparatively longer in the older population. This finding aligns with research by Safaa et al., which also indicated extended door-to-balloon times in elderly individuals. From a clinical standpoint, comparable door-to-balloon intervals across age groups suggest the efficacy of standardized hospital protocols in minimizing procedural delays. Nevertheless, age-related physiological factors beyond logistical considerations may still contribute to outcome variations (8, 9)

In summary, this study reinforces that chronological age should be integrated with anatomical and physiological parameters for procedural planning. Recognizing the importance of age-related factors, such as

endothelial dysfunction and the development of calcified plaques, is crucial in tailoring treatment strategies. Multidisciplinary discussions involving geriatric cardiology may further enhance outcomes in older patients undergoing PPCI. This approach ensures that the comprehensive needs of elderly patients, including frailty and comorbidities, are carefully considered to optimize care and minimize potential complications. Inclusion of geriatric patients in clinical trials and further research is needed to refine risk stratification models and to evaluate the long-term impact of tailored treatment strategies for older STEMI patients.

### **Conclusion**

Age significantly influences the outcomes of Percutaneous Coronary Intervention in patients with ST-elevation myocardial infarction. While both younger and older patient groups achieved similar mortality rates and reperfusion success, the elderly cohort experienced greater procedural complexity and a higher incidence of in-hospital complications. Consequently, future clinical protocols should incorporate assessments of frailty, lesion complexity, and post-procedural management strategies to optimize care for elderly patients presenting with STEMI.

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**Figure 1: Age (years)**

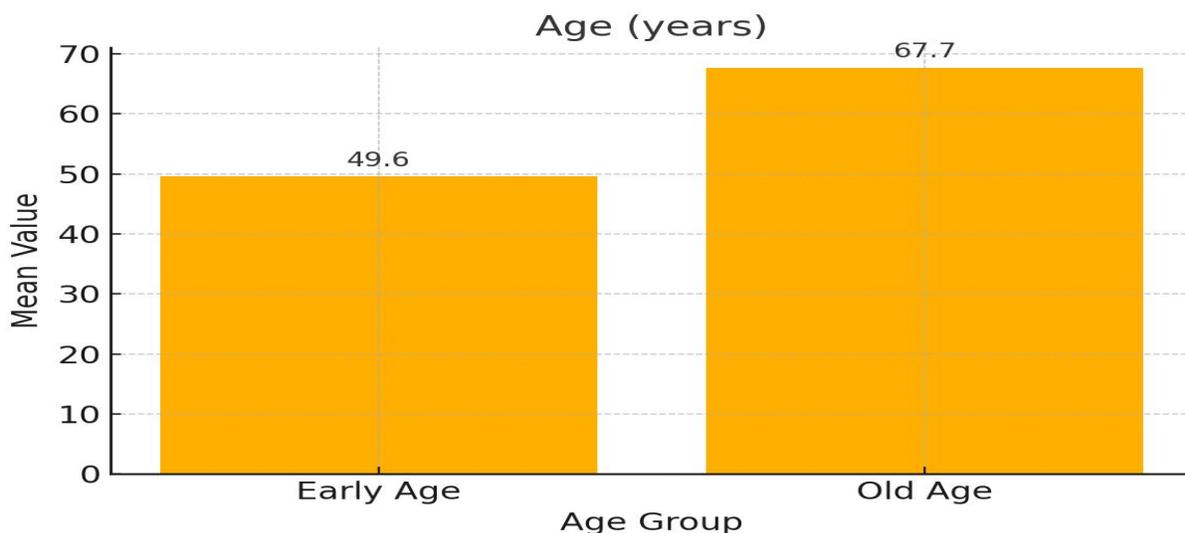


Figure 2: Chest Pain Duration (hours)

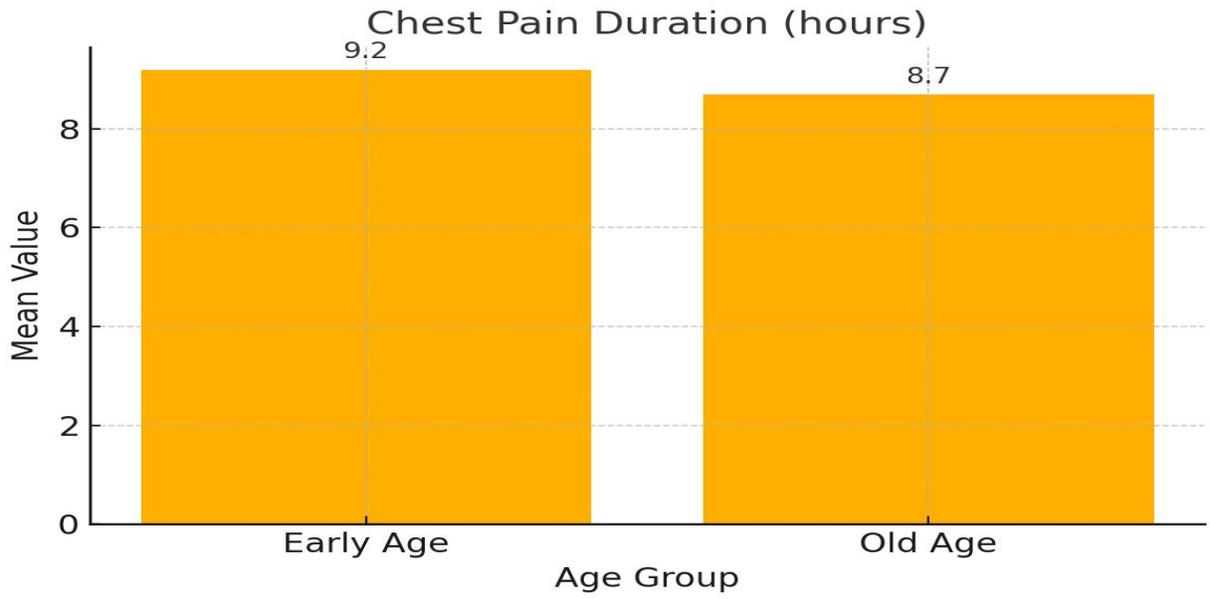


Figure 3: D2B Time (mins)

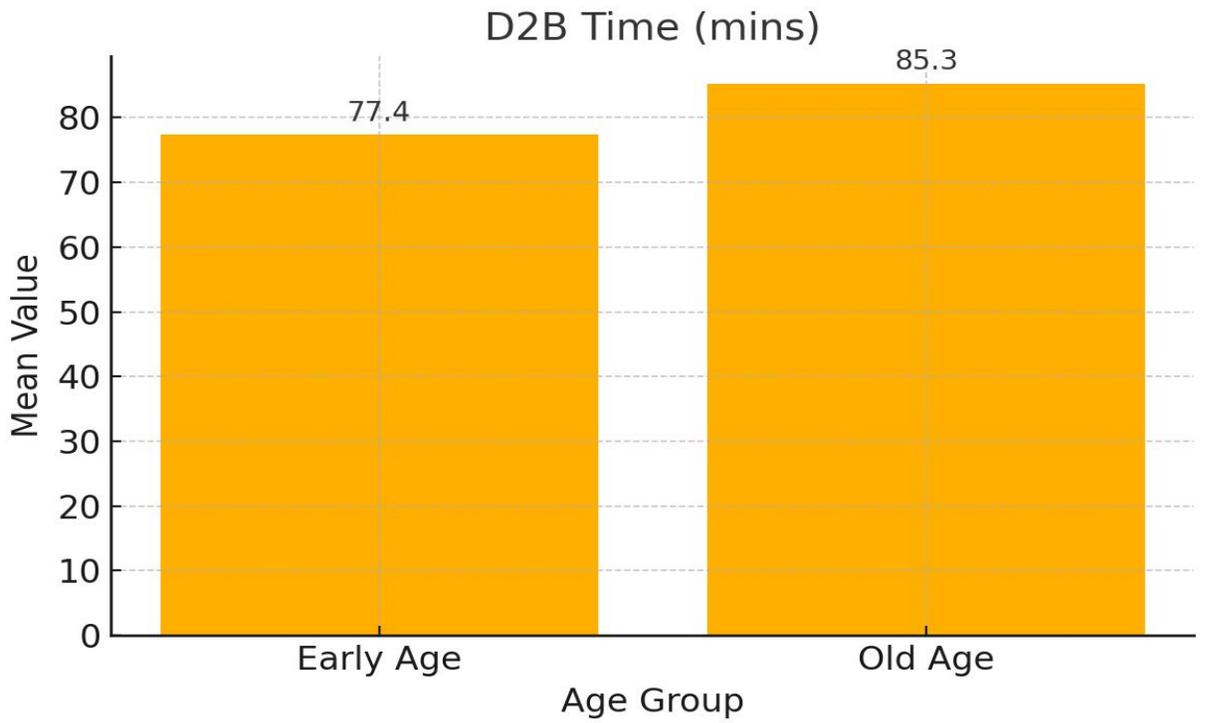
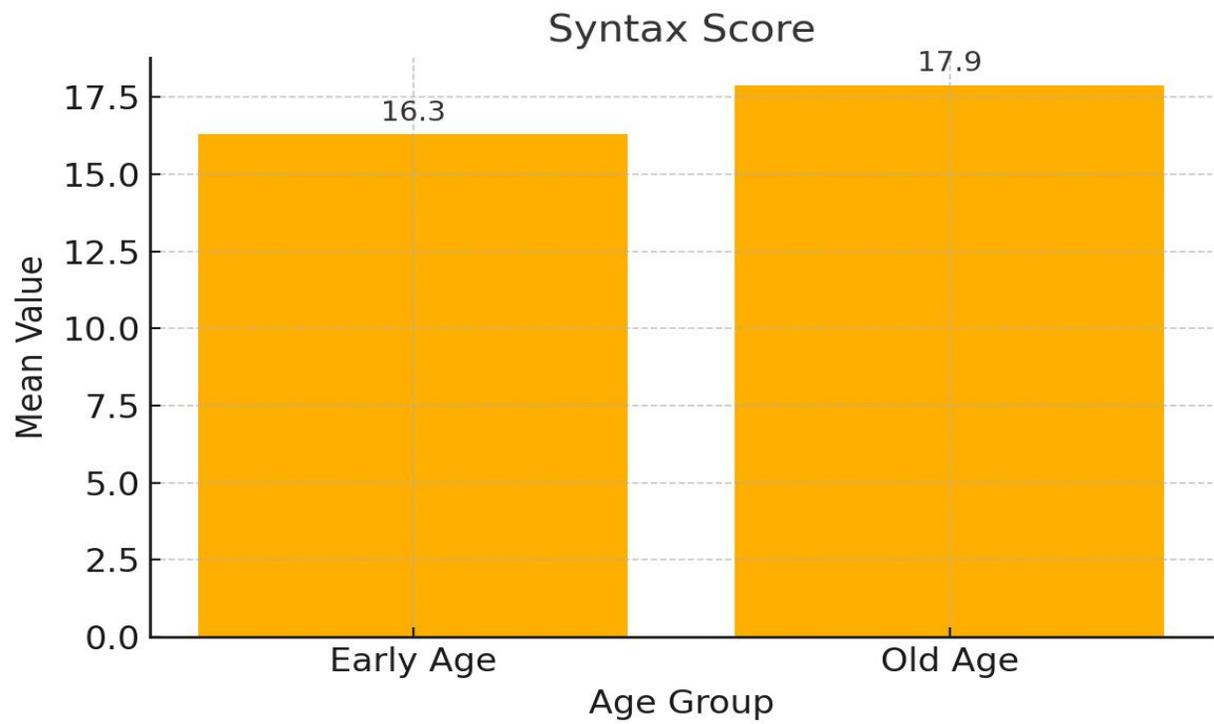


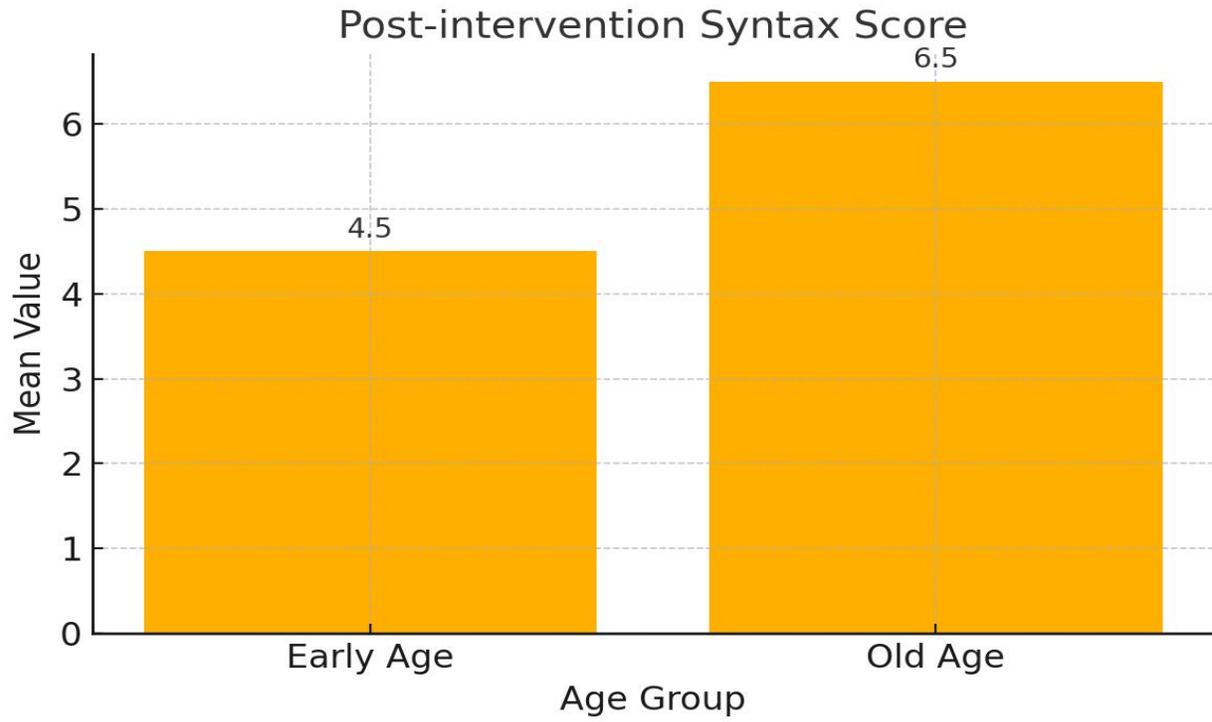
Figure 4: Hospital Stay (hours)



Figure 5: Syntax Score



**Figure 6: Post-intervention Syntax Score**



	Early Age	Old Age
Male	167	153
Female	55	51