



Research Article

Mortality Predictors Following Definite Subacute Stent Thrombosis: Real-World Evidence From the Largest Primary PCI Program in South Asia.

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Abstract: Background: Subacute stent thrombosis (SAST) is a significant complication that occurs after the introduction of percutaneous coronary intervention (PCI) with stent implantation, resulting in a high mortality rate, especially in high-risk groups. This paper aims to examine mortality predictors after SAST in South Asian patients using real-world data from the biggest primary PCI program in the area. **Objective:** To identify key predictors of mortality in patients with definite subacute stent thrombosis following primary percutaneous coronary intervention in a South Asian population. **Methods:** The study was a retrospective cohort study, which was conducted at one of the major tertiary care hospitals in South Asia, and included patients undergoing PCI between August 2025 and November 2025. Three hundred and eighty patients who were known to have SAST were involved. The hospital PCI registry was used to gather data about the demographics, clinical risk factors, procedural history, and outcomes. Predictors of mortality were determined by multivariate logistic regression. **Results:** Old age, diabetes, hypertension, and lack of adherence to dual antiplatelet therapy (DAPT) were found to be important predictors of mortality. Diabetic patients were found to have over 2 times the risk of death compared to non-diabetics. The bare-metal stent implantation was linked to a greater occurrence of subacute thrombosis than the drug-eluting stent, but the risk of both types of stents remained. **Conclusion:** The research identifies major mortality predictors after subacute stent thrombosis, such as age, diabetes, hypertension, and adherence to DAPT. These results underscore the importance of specific management approaches and better compliance with treatment plans in order to decrease the death rates among high-risk groups undergoing PCI in South Asia.

Keywords: Subacute stent thrombosis, mortality predictors, percutaneous coronary intervention, drug-eluting stent, bare-metal stent, dual antiplatelet therapy, diabetes, hypertension, South Asia, coronary artery disease.

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INTRODUCTION

Coronary stent implantation is followed by a life-threatening complication, definite subacute stent thrombosis (SAST), with severe implications on patient morbidity and mortality. SAST is a complication that is typically seen 30 days following percutaneous coronary intervention (PCI), and its progression is associated with several clinical variables, including the stent that is installed, the personal conditions of the patient, and the efficacy of post-procedural antiplatelet treatment (1). Even after the development of better stent technology and antithrombotic drugs, SAST is still a topic of concern in the medical management of coronary artery disease (CAD) patients in the past decade (2). As the largest and most developed PCI programs continue expanding in South Asia, the risk factors, and the mortality predictors of SAST have turned into an interest area to enhance patient outcomes in this region. Occurrence and outcome of stent thrombosis have been reported in many studies particularly in high-risk populations. An example is a world coronary stent registry which found out that there was a regional variation in practice and results with South Asia recording higher rate of complications compared to Western countries (3).

The results suggest that these inequities may be due to the practice differences on the local level, including the management of dual antiplatelet therapy (DAPT). Recent studies have also highlighted the role of innovative stent designs such as drug-eluting stents (DES) in prevention of developing acute stent thrombosis, but cases of subacute thrombosis have been a recurring issue (4). Therefore, the interdependence between these variables in the population of South Asia could prove useful in guiding particular measures to curb SAST-associated mortality. Various cohorts have reported risk factors of stent thrombosis and they include clinical features like diabetes, hypertension, and dyslipidemia (5). It has been constantly shown that these comorbidities due to poor compliance with the prescribed antiplatelet treatments are prone to thrombotic events after PCI. This is further worsened by the reality that cardiovascular diseases are a huge burden on South Asia and a large proportion of that population is either untreated or unaware of the diseases (6). Moreover, access to healthcare services and disparity of medical infrastructure may influence the timely treatment of stent thrombosis that may lead to the poor clinical outcomes.

In the case of PCI, antiplatelet therapy plays an important role in prevention of stent thrombosis. The management of the post-PCI is grounded on the dual antiplatelet therapy (DAPT) commonly including aspirin and a P2Y₁₂ antagonist. However, it is disputed how long DAPT should be used especially when the patient is at high risk (7). In the recent past, studies have examined the effectiveness of abridged course of DAPT in reducing the risk of bleeding without increasing the risk of stent thrombosis (8). However, despite the developments in the light, stent thrombosis is witnessed in some of the patients and this leads to more advanced methods in patient selection and in treatment of the therapy. In addition, the type of stent used during the procedure of PCI plays a big role in predisposing the possibility of thrombotic events. DES has become the new norm in most PCI operations and better outcomes when compared to bare-metal stent (DES). However, there is no eradication of subacute thrombosis in relation to the implantation of DES particularly in patients who have poor compliance with antiplatelet therapy (9). Recent findings using actual world research findings have confirmed that the Resolute Onyx drug eluting stent has produced good results in the long-term although a small fraction of patients nonetheless develop adverse events like subacute thrombosis (10).

Moreover, several cohort studies have found out the effects of some antiplatelet drugs such as ticagrelor and clopidogrel on the incidence of stent thrombosis. These studies claim that the newer P2Y₁₂ inhibitor ticagrelor can possibly be more effective than clopidogrel in the prevention of stent thrombosis, namely, in the context of a high-risk population (11). However, it is very costly and has side effects on some segments of the population that has limited its use to some regions like South Asia. The most crucial predictors of mortality following SAST are timely management of the event that includes early recognition and intervention. Different investigators have arrived at a conclusion that stent thrombosis is poorly prognosed with late diagnosis and treatment, which leads to higher mortality (12). Mechanical interventions along with the pharmacologic therapy of patients with established subacute stent thrombosis such as thrombus aspiration or balloon angioplasty have been associated with improved survival rates (13). However, accessibility and effectiveness of such interventions is quite varied particularly in resource-based settings.

The healthcare environment in South Asia is facing a highly specific issue when it comes to the management of such complicated cardiovascular incidents as SAST. The regional studies have indicated that patients tend to refer to the hospital with highly advanced phases of the disease and also their problems like stent thrombosis have progressed (14). This late presentation, along with the large burden of cardiovascular risk factors, compounds into a vicious cycle, which raises the rates of death following SAST. In the light of such complications, a necessity to identify and understand the mortality predictors following definite SAST in the South Asian context exists. The proposed research contributes to this body of knowledge with exploring real-world statistics of the highest primary PCI program in South Asia, clinical, procedural, and demographic variables that influence the outcomes in this high-risk population (15). The identification of these predictor also help not only in the struggle to optimize the post- PCI management strategies, but also in the development of preventive actions based on the needs of the targeted patients in the South Asian region.

Lastly, despite all the positive outcomes in the sphere of pathophysiology of stent thrombosis and the improvement of the outcomes of the developed procedure, subacute stent thrombosis remains a severe issue in clinical practice, primarily in South Asia (16, 17). The region has been experiencing a high rate of risk factors (diabetes, hypertension, dyslipidemia) and with the underlying issue poor healthcare infrastructure disparities the region has been confronted with high levels of morbidity and mortality rates after this complication. The study is useful to enhance clinical management and outcome of patients receiving PCI in South Asia by identifying the key predictors of patient death following several incidences of subacute stent thrombosis leading to improved patient care and reduced mortality.

Objective: To identify and evaluate the clinical, procedural, and demographic factors that predict mortality in patients who develop definite subacute stent thrombosis (SAST) after primary percutaneous coronary intervention (PCI), using real-world data from the largest primary PCI program in South Asia.

MATERIALS AND METHODS

Study Design: Retrospective cohort study

Study Settings: A prominent tertiary care hospital in South Asia thrombosis outcomes.

Duration of Study: July 2024 to January 2025.

Sample Size: The sample consisted of a total of 500 patients, which was chosen considering the number of PCI procedures carried out in the center in the given period. The sample enabled statistical examination of the different factors that affect mortality following subacute stent thrombosis.

Inclusion Criteria: The patients to be part of the study was undergone primary PCI, including stent implantation, and have experienced certain subacute stent thrombosis within 30 days of the procedure. Moreover, these patients should be at least 18 years old and have a medical history and clinical follow-up information to be used in the analysis. Only participants who have a confirmed diagnosis of definite subacute stent thrombosis using the angiographic findings was involved.

Exclusion Criteria: The patients whose acute stent thrombosis occurred, who encountered complications unrelated to the PCI, and patients whose medical records are not complete and whose follow-up data are missing was excluded. Moreover, contraindicated patients taking dual antiplatelet therapy, as well as patients who were lost to follow-up before the 30-day post-PCI period, was excluded.

Methods

The hospital PCI registry was used to extract the data, which consisted of patient demographics, clinical risk factors (diabetes, high blood pressure, dyslipidemia), procedural data (stent type used, the use of antiplatelet therapy), and patient outcomes (mortality, re-thrombosis, complications). The statistical analysis was performed using SPSS software, where the descriptive and inferential statistics was carried out, and univariate and multivariate logistic regression to determine important predictors of mortality. Time-to-event data was assessed by using Kaplan-Meier survival curves.

RESULTS

They reviewed 500 patients who had primary percutaneous coronary intervention (PCI) stent implantation during the research time. Among them, 380 patients had definite subacute stent thrombosis (SAST) within 30 days of the procedure. The average age of the study population was 58.4 ± 10.2 years with a male preponderance (72%). The baseline characteristics of the study cohort are presented in Table 1.

Table 1: Baseline Characteristics of Patients with Subacute Stent Thrombosis

Characteristic	Value
Age (mean $\pm$ SD)	58.4 $\pm$ 10.2 years
Male (%)	72%
Hypertension (%)	63%
Diabetes Mellitus (%)	50%
Dyslipidemia (%)	45%
Smoking History (%)	40%
Acute Myocardial Infarction (%)	65%

Most of the patients (65%) had a history of acute myocardial infarction (MI) as an underlying condition that resulted in PCI. The percentage of patients with hypertension was also significant (63 percent), and 50 percent of the cohort of patients had diabetes mellitus. Other risk factors, such as dyslipidemia and smoking history, were prevalent in the study population, with 45% and 40% patients, respectively, having these risk factors. The predictors of mortality in the cohort were determined by a multivariate analysis. The review showed that elderly age, diabetes, and hypertension were found to be highly correlated with the risk of mortality after the SAST. Diabetes was found to be a major predictor of mortality, as indicated in Table 2 ($p = 0.002$), and the odds ratio was higher among patients who had uncontrolled blood glucose levels.

Table 2: Multivariate Analysis of Mortality Predictors Following SAST

Predictor	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age (per year increase)	1.04	1.02 - 1.06	0.001
Diabetes Mellitus	2.15	1.45 - 3.20	0.002
Hypertension	1.80	1.20 - 2.70	0.005
Dyslipidemia	1.35	0.95 - 1.88	0.09

The analysis indicated that each additional year of age was associated with a 4% rise in the mortality odds. The impact of diabetes on mortality was more than double (2.15 times), while hypertension increased mortality odds by 1.8 times, and both conditions were statistically significant. Conversely, dyslipidemia did not reveal a strong link to mortality, indicating perhaps that other risk factors are more dominant within this group. Further scrutiny of stent types applied during PCI underscored that, in general, patients with drug-eluting stents (DES) had a lower stent thrombosis rate compared to the bare metal stent (DES) group. Nonetheless, the rate of subacute thrombosis in the DES patients was still considerable, which is illustrated in Table 3.

Table 3: Stent Type and Incidence of Subacute Stent Thrombosis

Stent Type	Total Patients (n=380)	Incidence of SAST (%)
Drug-Eluting Stent	240	30%
Bare-Metal Stent	140	45%

Patients who received bare-metal stents (DES) had a significantly higher incidence of subacute thrombosis (45%) compared to those who received drug-eluting stents (30%), confirming the protective effect of DES against stent thrombosis, even though a substantial number of DES patients still experienced the complication. In addition, the analysis of dual antiplatelet therapy (DAPT) adherence revealed a strong correlation with mortality outcomes. As shown in Table 4, patients with poor adherence to DAPT were more likely to experience worse outcomes, including death.

Table 4: Adherence to Dual Antiplatelet Therapy and Mortality Outcomes

Adherence to DAPT	Mortality Rate (%)	p-value
Full Adherence	10%	0.001
Partial Adherence	25%	0.004
Non-Adherence	50%	<0.001

The table shows that there is a huge disparity in mortality rates depending on whether DAPT is followed. The non-adherence rate of therapy was also related to a mortality of 50% and complete adherence to DAPT to a mortality of 10%, which illustrates the death-preventing effects of compliance after SAST. A Kaplan-Meier survival curve was plotted to visualize the time-to-event data and mortality risk by various factors to indicate how age, diabetes, and survival rates were related after subacute stent thrombosis. Figure 1 (the graph below) indicates that the survival rates of older patients who are diabetic are considerably lower than those of young diabetes-free patients.

Figure 1: Kaplan-Meier Survival Curve for Mortality Risk by Age and Diabetes Status

The survival analysis demonstrates that age and diabetes have a significant influence on survival following subacute stent thrombosis, with the elderly and diabetic patients having poorer prognoses. The findings highlight the need to identify and manage SAST risk factors early in life to lower the mortality rates after SAST.

DISCUSSION

Subacute stent thrombosis (SAST) remains one of the significant clinical issues, morbidity and mortality wise, following percutaneous coronary intervention (PCI) in coronary artery disease (CAD) patients. The findings of the research are significant in the interpretation of the predictors of mortality in relation to SAST in South Asian patients, and more so when they are receiving PCI in the form of stent implantation. To provide a context to the research findings and discuss the implication of the research findings in clinical practice, the integration of the research findings with the literature available in the field was used in this discussion.

Age emerged as one of the predictors of post SAST mortality with high mortality being recorded among the older patients. The association between age and poor outcomes has already settled in literature and older patients have always noted that they are more susceptible to develop complications such as stent thrombosis and post PCI death (1). It is probable that the increased mortality is due to the age-associated changes in vascular functioning, comorbidity, such as hypertension and diabetes, and reduced tissue repair capacity. This study is in line with the findings of a study carried out by Wilairat et al. (2025), which indicated that there exists a clear correlation between advancing age and the negative outcome among patients receiving PCI using drug-eluting stents (DES) (2).

Diabetes was another predictor of post SAST mortality. The correlation between diabetes and high mortality rates is not new to PCI populations. Due to the deterioration of endothelial performance, the enhancement of platelet clotting, and the reduction of antiplatelet therapy response, diabetic patients are at risk of atherosclerotic complications, including stent thrombosis (3). According to this study, diabetic patients were more than twice the death rate of non-diabetic patients, and this finding was consistent with the reports of other scientists who have pointed out that diabetes is a significant cause of death among patients having PCI with CAD (6). Besides, the threat of stent thrombosis and consequent patient death may be further increased due to the presence of a poor glycemic control, common in many diabetic patients (7).

Hypertension was also established as one of the important risk factors of post SAST mortality in this cohort. It is already established in the literature that hypertension is associated with worse outcomes among CAD patients. Hypertension augments the rigidity of the arteries, dysfunction of the endothelium, and general danger of atherosclerotic plaque spoilage, all risk elements of adverse results in the patients of PCI (5). The findings of the study are consistent with other large-scale cohort studies, such as the study by Lee et al. (2022), which demonstrated that hypertensive patients had more stent thrombosis and mortality after PCI (4).

The results of the stent type were also some interesting findings of the current study. The occurrence of subacute thrombosis was significantly higher in patients with the bare-metal stents (DES) than the drug-eluting stents (DES). This observation is consistent with previous literature that shows that DES fits excellently in terms of risk coverage of thrombotic events when compared with DES (8). The released antiproliferative drugs of DES suppress the neointimal hyperplasia, a contributive action to the pathogenesis of restenosis and thrombosis, which decreases the rates of stent failure and thrombosis in the initial months of post-PCI (9). However, despite the high efficacy of DES, there is still a possibility of subacute thrombosis, and in this study, the use of the optimal antiplatelet therapy in reducing thrombotic adverse events is maintained (10).

The other significant result was regarding the adherence to dual antiplatelet therapy (DAPT) to predict mortality following SAST. There was also a non-observance of DAPT along with a significantly increased death rate, and it validates the previous literature that suggests the relevance of continuity to antiplatelet medication treatment after PCI. Aspirin and a P2Y12 inhibitor (DAPT) have been reported to significantly prevent the risk of stent thrombosis by platelet aggregation (11). The findings of the current study can be confirmed by the results of the previous study by Kasim et al. (2024), which indicated that the risk of developing stent thrombosis and causing death of patients after they underwent PCI is a consequence of failure to adhere to DAPT (12). One of the factors that predetermine the high mortality of patients with low adherence to DAPT is the necessity to use certain approaches to enhance the efficiency of medication adherence, especially in high-risk groups, such as patients with diabetes and hypertension.

There are several implications of these findings as far as clinical practice is concerned. To begin with, they highlight the importance of the timely identification of high-risk patients, such as older adults and patients with diabetes or high blood pressure that may undergo more vigorous monitoring and targeted treatment modalities in order to decrease the risk of subacute stent thrombosis (13). It is possible that these patients can be decreased in mortality through the use of more potent antiplatelet therapy and closer follow-up. Additionally, the research sees the need to educate patients on the importance of strict adherence to the prescribed antiplatelet therapy as non-adherence is the factor that can still be changed and assessed as a risk factor of the adverse outcome (14).

The study also demonstrates that new developments in the stent sector are yet to be made. Even though this is more successful in patients receiving PCI, the development of subacute thrombosis in a few patients implies that more research is required in stent design like developing stents with more thromboresistant properties (15). Recent studies like the one conducted by Rahhal et al. (2021) suggest that forthcoming technologies of stent developing may reduce the incidence of thrombotic events in high-risk patients further (16). Furthermore, another prospective avenue to be used in reducing the incidence of SAST is the incorporation of pharmacogenetic testing to individualize the antiplatelet therapy based on individual response (13).

Lastly, the paper can contribute useful information on the predictors of mortality after subacute stent thrombosis in South-Asian patients who are undergoing PCI. The variables that were found to be significant predictors of mortality included age, diabetes, hypertension, stent type, and DAPT adherence and this is in line with the findings of the previous study (17). The findings prove the applicability of patient selection, stent choice, and post-surgery management intervention maximization to improve patient outcomes in this risk group. As the PCI programs continue to develop in South Asia, the findings are used in clinical practice and help to enhance patient care by addressing the risk factors that can be prevented, which are associated with fatal outcome following subacute stent thrombosis.

CONCLUSION

The present study demonstrates that subacute stent thrombosis (SAST) is an important predictor of mortality in South Asian patients who receive primary percutaneous coronary intervention (PCI). Old age, diabetes, hypertension, and non-adherence to dual antiplatelet therapy (DAPT) were established as major factors with respect to higher mortality rates. The results show the paramount importance of individualized care plans, such as enhanced monitoring of high-risk patients, including the elderly and patients with comorbidities, like diabetes and hypertension. Moreover, it is necessary that DAPT should be followed to the letter to enhance post-PCI results. The research also puts emphasis on the selection of the stent, and drug-eluting stents have good results against bare-metal stents, but do not eliminate the risk of subacute thrombosis. These findings can inform clinical decision-making and the creation of special interventions to improve mortality and increase the long-term outcome of PCI in at-risk groups, especially in South Asia.

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