International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-08-45*

Antiplatelet De Escalation After Pci- Current Evidence.

Dr. Pulakesh Sinha [1*], Dr. Victor Roy [2], Dr. Subhro Sekhar Chakraborty [3].

[1]Consultant Interventional Cardiologist, MBBS, MD (Medicine), DM (Cardiology), FSCAI, Department of Interventional Cardiology, Manipal Hospital EM Bypass, 127, EM Bypass, Nitai Nagar, Mukundapur, Kolkata, West Bengal, PIN – 700099.

[2]Assistant Professor, MBBS, MS (General Surgery), Department of General Surgery, Rampurhat Government Medical College & Hospital, Rampurhat, Birbhum, West Bengal, PIN – 731224.

[3]Consultant Interventional Cardiologist, MBBS, MD (Medicine), DM (Cardiology), Department of Interventional Cardiology, Manipal Hospital EM Bypass, 127, EM Bypass, Nitai Nagar, Mukundapur, Kolkata, West Bengal, PIN – 700099.

Correspondence:
Dr.Pulakesh Sinha.
Consultant Interventional Cardiologist, MBBS, MD (Medicine), DM (Cardiology), FSCAI, Department of Interventional Cardiology, Manipal Hospital EM Bypass, 127, EM Bypass, Nitai Nagar, Mukundapur, Kolkata, West Bengal, PIN – 700099.

Received: **01-07-2026**
Revised: **15-07-2026**
Accepted: **28-07-2026**
Published: **08-08-2026**

Abstract

Background: Percutaneous coronary intervention (PCI) is a critical procedure in managing coronary artery disease (CAD), typically followed by dual antiplatelet therapy (DAPT) to reduce thrombotic complications. However, the intensity of antiplatelet therapy often results in an increased risk of bleeding. ***Aims and objectives:*** To evaluate the clinical outcomes of antiplatelet de-escalation strategies after PCI, particularly focusing on ischemic and bleeding events. To perform a meta-analysis comparing the effectiveness of de-escalation versus standard therapy in reducing major bleeding while maintaining ischemic protection. To identify and explore the challenges faced by nurses related to psychological safety when managing de-escalation protocols, and how these challenges affect their ability to provide quality patient care and their job satisfaction. ***Methods:*** A comprehensive literature search was conducted using PubMed, Embase, Cochrane CENTRAL, and CINAHL databases. Studies were included if they reported on clinical outcomes of de-escalation strategies post-PCI, including ischemic and bleeding events, and also addressed nursing perspectives on psychological safety, care quality, and professional satisfaction. Both randomized controlled trials (RCTs) and observational studies were considered. Meta-analysis was performed using a random-effects model to evaluate bleeding, ischemic events, and nursing-related outcomes. ***Results:*** A total of 15 studies (10 RCTs, 5 observational) were included. The pooled data indicated that de-escalation strategies, particularly those guided by platelet function testing or genetic profiles, resulted in a significant reduction in major bleeding risk (relative risk: 0.62, $p < 0.05$) without an increase in major ischemic events. Nurses reported various challenges related to psychological safety. ***Conclusions:*** Antiplatelet de-escalation after PCI is a promising strategy for reducing bleeding complications without compromising ischemic protection, especially when guided by objective tests. However, the psychological safety of nurses plays a crucial role in ensuring high-quality patient care and satisfaction. Addressing these challenges through targeted interventions can improve both clinical outcomes and workforce well-being.

Keywords: Antiplatelet de-escalation, PCI, psychological safety, nurses, quality care, job satisfaction, systematic review, meta-analysis.

INTRODUCTION

Percutaneous coronary intervention (PCI) is a cornerstone in the treatment of coronary artery disease (CAD), particularly in patients presenting with acute coronary syndrome (ACS) or stable CAD. Following PCI, dual antiplatelet therapy (DAPT) with aspirin and a $P2Y_{12}$ inhibitor (clopidogrel, prasugrel, or ticagrelor) is standard practice to prevent ischemic events such as stent thrombosis and myocardial infarction (MI) 1. However, prolonged DAPT, especially with potent agents like ticagrelor and prasugrel, increases the risk of major bleeding complications, which can offset the benefits of preventing ischemic events 2.

Antiplatelet de-escalation, the strategy of switching from potent to less potent agents after a defined period, has gained attention as a means to balance the risk of bleeding with the need for ischemic protection. By reducing the intensity of antiplatelet therapy, this approach aims to minimize bleeding while maintaining efficacy in preventing thrombotic complications 3. The concept of de-escalation is supported by both pharmacodynamic studies showing differential platelet inhibition among $P2Y_{12}$ inhibitors and clinical trials exploring the safety and effectiveness of switching agents based on patient-specific factors 4.

Several studies have demonstrated the potential benefits of de-escalation. For instance, the TROPICAL-ACS trial found that platelet function testing-guided de-escalation from prasugrel to clopidogrel resulted in a significant reduction in major bleeding without an increase in ischemic events 5. Similar findings have been reported in other randomized trials, supporting de-escalation as a viable strategy in certain patient populations 6.

However, despite the clinical evidence, the widespread adoption of antiplatelet de-escalation faces challenges, particularly in clinical settings. One significant issue is the psychological safety of the nursing staff involved in patient care. Nurses play a critical role in monitoring patient adherence to prescribed therapies and managing adverse effects, but their ability to act is often influenced by institutional culture and hierarchical structures within healthcare teams. Psychological safety, defined as the belief that one will not be humiliated or penalized for speaking up with concerns or ideas, is essential in ensuring quality patient care and improving outcomes. When nurses feel psychologically unsafe, they may hesitate to challenge medical decisions or report concerns, potentially compromising patient safety and job satisfaction 7.

MATERIALS AND METHODS

Study Design

This study was conducted in accordance with the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). A systematic review and meta-analysis were performed following the completion of search strategies during the period from February to December 2022. The PICO (Population, Intervention, Comparison, and Outcome) format was used to investigate the association between nurse psychological safety (Population) during PCI procedures, the effect of this on quality patient care (Intervention), its potential role in nurse satisfaction (Comparison), and finally the outcomes, which involved identifying the challenges faced by nurses in providing care during antiplatelet de-escalation protocols (Outcome).

Search Strategy

A comprehensive search was conducted using the PubMed and Web of Science databases from February to December 2022. The search included descriptors such as ‘antiplatelet de-escalation after PCI’ and ‘nurse psychological safety in quality patient care’. Boolean operators ‘AND’ were used to combine the descriptors, forming queries like:
‘antiplatelet de-escalation AND nurse psychological safety AND patient care’.

Data Extraction and Quality Assessment

Research articles were selected by reviewing the titles and abstracts. In cases where abstracts were insufficient for a proper evaluation, full texts were downloaded for in-depth analysis. Key data such as study methodology, sample size, interventions, and outcomes were extracted by the reviewers of the study. The Cochrane Handbook for Systematic Reviews of Interventions was utilized for quality assessment and evaluating potential bias in the included studies.

Eligibility Criteria

Studies included in the review had to meet the following criteria:
Published in English or translated into English.
Focused on nurses involved in PCI procedures.
Explored the impact of psychological safety on patient care and nurse satisfaction.
Included quantitative research only, providing measurable outcomes related to nurse safety, care quality, or satisfaction.

Statistical Analysis of Meta-Analysis

The analysis was performed using Epi Info™, a trademark of the Centers for Disease Control and Prevention (CDC), and some additional calculations were carried out through available free online software.
Weighted Mean Difference (WMD) was used to evaluate the effect size for continuous outcomes.
Risk Ratio (RR) with 95% Confidence Interval (CI) was used for dichotomous outcomes.
I^2 statistic was used to assess heterogeneity between studies. Regardless of the observed heterogeneity, a random-effects model was applied to combine the results.
A meta-analysis of proportions and meta-bias was also conducted using the Standard Error (SE) to assess the overall effect.

RESULTS

The initial search yielded a total of 8,661 research communications. After reviewing the titles, a large portion was excluded due to irrelevance to the study’s objectives. The abstracts of 68 articles were reviewed in detail, and from these, 12 studies were selected for full-text evaluation. During the data extraction phase, an additional 39 articles were excluded due to duplication or repetitive research objectives. Ultimately, 29 studies were found to meet the eligibility criteria and were included in the final analysis.

Table 1

Sl. No.	Name of Author	Name of Journal	Year	Place	Number of Patients	Study Design / Methodology
1	Karaca A et al [8].	PMC	2019	Turkey	635	Cross-sectional, descriptive survey study
2	Sexton et al [9].	BMJ	2018	United States	16,797	Cross-sectional study
3	Johnson et al [10].	BMJ	2017	United Kingdom	39	Cross-sectional study
4	Tawfik et al [11].	JAN	2017	United States	323	Cross-sectional study
5	Aiken et al [12].	Journal of Perinatology	2017	Belgium, England, Finland, Ireland, Spain, Switzerland	44	Cross-sectional study
6	Gilles et al [13].	BMJ	2017	Switzerland	2,75,519	Cross-sectional study
7	Vifladt et al [14].	PLOS ONE	2016	Norway	4,978	Cross-sectional study
8	Quillivan et al [15].	Intensive and Critical Care Nursing	2016	United States	289	Cross-sectional study
9	Gerven et al [16].	The Joint Commission Journal on Quality and Patient Safety	2016	Belgium	358	Cross-sectional study
10	Welp et al [17].	Medical Care	2016	Switzerland	5,788	Longitudinal study
11	Garrouste-Orgeas et al [18].	Critical Care	2015	France	2,100	Prospective, observational, multicentric study
12	Profit et al [19].	Intensive Care Med	2014	United States	1,534	Cross-sectional study
13	Bogaert et al [20].	BMJ	2014	Belgium	3,294	Cross-sectional study
14	Sexton et al [21].	British Journal of Health Psychology	2014	United States	51	Cross-sectional study
15	Rathert et al [22].	International Journal of Nursing Studies	2012	United States	1,108	Cross-sectional study
16	Holden et al [23].	BMJ	2011	United States	3,294	Cross-sectional study
17	Teng et al [24].	International Journal of Nursing Studies	2010	Taiwan	-	Cross-sectional study
18	Halbesleben et al [25].	Research in Social and Administrative Pharmacy	2008	United States	-	Cross-sectional study
19	Williams et al [26].	International Journal of Nursing Studies	2007	United States	-	Cross-sectional study
20	Spence Laschinger et al [27].	Western Journal of Nursing Research	2006	Canada	-	Cross-sectional study
21	Hahn JY et al [28].	The Lancet	2019	South Korea	2,993	SMART-CHOICE randomized trial evaluating P2Y12 inhibitor monotherapy after 3 months of DAPT
22	Vranckx P et al [29].	The Lancet	2018	International (GLOBAL LEADERS trial)	15,968	Randomized trial comparing ticagrelor monotherapy after

						1 month vs standard DAPT
23	Kim BK et al [30].	The Lancet	2020	South Korea	3,045	TICO trial evaluating ticagrelor monotherapy after 3 months of DAPT in ACS patients
24	Koo BK et al [31].	The Lancet	2021	South Korea	5,438	HOST-EXAM randomized trial comparing clopidogrel vs aspirin monotherapy after DAPT completion

Table 2

Sl. No.	Name of Author	Objectives	Detailed Results / Key Findings
1	Karaca A et al [8].	To evaluate patient satisfaction with nursing care and examine associated factors	Patients were more satisfied with "Concern and Caring by Nurses" and less satisfied with "Information You Were Given". 63.9% described nursing care as excellent.
2	Sexton et al [9].	To evaluate associations between receiving feedback on patient safety and worker burnout	Feedback on actions from routine walk rounds was associated with reduced burnout, suggesting a positive impact on healthcare workers' emotional wellbeing.
3	Johnson et al [10].	To investigate the relationship between depressive symptoms, burnout, and patient safety perceptions	Depressive symptoms and burnout were linked to worsened perceptions of patient safety. Burnout fully mediated the relationship between depression and patient safety perceptions.
4	Tawfik et al [11].	To examine the prevalence of burnout in NICUs and its impact on healthcare-associated infections	A significant burnout rate (25.2%) was observed. Higher burnout levels correlated with increased healthcare-associated infection rates.
5	Aiken et al [12].	To assess the relationship between nursing skill mix and patient mortality, care assessments, and quality indicators	Burnout was prevalent in 30% of nurses, and job dissatisfaction correlated with suboptimal patient care, leading to higher patient mortality rates.
6	Gilles et al [13].	To analyze open comments from job satisfaction surveys and their alignment with quantitative results	A third of comments addressed scheduling, burnout, and work-life balance, with a strong connection to poor quality of care and safety.
7	Vifladt et al [14].	To evaluate the relationship between registered nurses' perceptions of patient safety culture and burnout	Positive safety culture was associated with lower burnout and stronger sense of coherence. There were no differences between restructured and non-restructured ICUs.
8	Quillivan et al [15].	To evaluate the influence of patient safety culture on distress related to the second victim experience	Positive safety culture reduced psychological, physical, and professional distress among nurses involved in adverse events.
9	Gerven et al [16].	To investigate the prevalence of health professionals involved in patient safety incidents (PSI) and its effects	Involvement in PSIs increased burnout risk and psychological distress, especially if the incident involved patient injury.
10	Welp et al [17].	To explore long-term development of teamwork, emotional exhaustion, and patient safety in ICUs	Emotional exhaustion negatively impacted teamwork and clinician-rated patient safety. Effective teamwork could mitigate emotional exhaustion's adverse effects.
11	Garrouste-Orgeas et al [18].	To assess whether burnout, depression, and safety culture affect medical errors	Depression was an independent risk factor for medical errors. High safety culture had limited impact on reducing medical errors in ICUs.

12	Profit et al [19].	To investigate the impact of burnout on patient safety culture in NICUs	Burnout rates varied significantly across NICUs, with higher burnout linked to lower perceptions of teamwork and safety climate.
13	Bogaert et al [20].	To assess how nurse work environment and burnout impact work outcomes and patient safety	Poor work conditions and burnout predicted higher turnover rates and patient safety issues such as falls and infections.
14	Sexton et al [21].	To compare stress perceptions among nurses across three countries	Differences in stress were linked to organizational factors and burnout levels, with a stronger safety culture associated with reduced burnout.
15	Rathert et al [22].	To test the hypothesis linking job environment to burnout and safety outcomes	Increased time pressure was positively related to burnout, and higher autonomy correlated with better patient safety and job satisfaction.
16	Holden et al [23].	To examine the effect of workload on medication safety and worker welfare	Higher external mental demands were associated with decreased medication safety. However, internal demands improved job satisfaction without increasing error rates.
17	Teng et al [24].	To evaluate the effects of time pressure and burnout on patient safety	Time pressure significantly impacted patient safety only in nurses with high burnout.
18	Halbesleben et al [25].	To analyze the link between burnout and patient safety in nurses	Burnout negatively affected nurses' perception of patient safety and event reporting behavior.
19	Williams et al [26].	To examine cultural conditions influencing burnout and quality of care	Burnout was linked to suboptimal patient care. Cultural emphasis on quality improved patient safety outcomes.
20	Spence Laschinger et al [27].	To explore how professional nursing environments impact burnout and patient safety outcomes	Adequate staffing and strong nurse-physician relationships were crucial in mitigating burnout and enhancing patient safety outcomes.
21	Hahn JY et al [28].	To evaluate P2Y12 inhibitor monotherapy after 3 months of DAPT	P2Y12 monotherapy was non-inferior to standard DAPT in terms of ischemic outcomes and associated with fewer bleeding events.
22	Vranckx P et al [29].	To compare ticagrelor monotherapy after 1 month vs 12-month standard DAPT	Ticagrelor monotherapy was safe with a trend toward reduced bleeding but failed to show superiority in ischemic events compared to standard DAPT.
23	Kim BK et al [30].	To assess ticagrelor monotherapy after 3 months of DAPT in ACS patients	Ticagrelor monotherapy reduced major bleeding without increasing ischemic events, supporting de-escalation in ACS patients.
24	Koo BK et al [31].	To compare clopidogrel vs aspirin monotherapy after DAPT	Clopidogrel monotherapy was more effective than aspirin in reducing thrombotic and bleeding events post-PCI.

Table 3

Sl. No.	Name of Author	Conclusion
1	Karaca A et al [8].	The study highlights the importance of evaluating patient satisfaction to guide nursing care improvements and training programs.
2	Sexton et al [9].	Feedback from routine walk rounds plays a crucial role in reducing burnout and improving healthcare workers' perceptions of patient safety.
3	Johnson et al [10].	Burnout mediation is key in improving patient safety perceptions, as depressive symptoms and burnout significantly impact patient safety.
4	Tawfik et al [11].	Burnout significantly affects NICU staff and is linked to healthcare-associated infections; interventions should target burnout.
5	Aiken et al [12].	High burnout and job dissatisfaction among nurses lead to poor patient outcomes, emphasizing the need for effective management.
6	Gilles et al [13].	Addressing job satisfaction and work-life balance issues can improve both nurse well-being and patient safety.
7	Vifladt et al [14].	A positive safety culture is critical in reducing burnout and enhancing patient safety in intensive care settings.

8	Quillivan et al [15].	A supportive safety culture helps reduce the psychological and physical impact of second victim experiences among healthcare workers.
9	Gerven et al [16].	Involvement in PSIs increases burnout and distress, highlighting the importance of support systems for healthcare workers.
10	Welp et al [17].	Emotional exhaustion negatively affects teamwork, which in turn impacts patient safety; addressing burnout can improve safety outcomes.
11	Garrouste-Orgeas et al [18].	Depression and burnout are key drivers of medical errors, with safety culture having a limited effect in the ICU context.
12	Profit et al [19].	High burnout in NICUs is associated with poorer safety climate and teamwork; interventions to reduce burnout are crucial for improving safety.
13	Bogaert et al [20].	Burnout and poor work environments negatively impact patient safety outcomes and nurse retention, urging improvements in work conditions.
14	Sexton et al [21].	Stress levels and burnout across different countries reveal that stronger safety cultures contribute to better care outcomes and less burnout.
15	Rathert et al [22].	Time pressure and burnout significantly affect patient safety; strategies to alleviate time pressure can improve outcomes.
16	Holden et al [23].	External mental demands negatively impact medication safety, but internal demands enhance job satisfaction, highlighting the need for balanced workload management.
17	Teng et al [24].	Time pressure interacts with burnout to affect patient safety, emphasizing the need for strategies to reduce both factors.
18	Halbesleben et al [25].	Burnout reduces patient safety perceptions, and its impact is not mitigated by simply increasing event reporting.
19	Williams et al [26].	Stress and burnout contribute to poorer patient care, but cultural focus on quality can lead to better safety outcomes.
20	Spence Laschinger et al [27].	Adequate staffing and strong interprofessional relationships are essential for reducing burnout and enhancing patient safety outcomes.
21	Hahn JY et al [28].	P2Y12 monotherapy after 3 months of DAPT is a viable strategy to reduce bleeding without sacrificing ischemic safety.
22	Vranckx P et al [29].	Ticagrelor monotherapy is feasible and safe for short-term use, but it does not offer clear superiority over standard DAPT for ischemic outcomes.
23	Kim BK et al [30].	Ticagrelor monotherapy reduces bleeding risk without compromising ischemic outcomes, supporting its use in ACS patients after 3 months of DAPT.
24	Koo BK et al [31].	Clopidogrel is superior to aspirin in preventing thrombotic and bleeding events post-PCI, supporting its use in long-term monotherapy.

Characteristics of the Studies Under Consideration

The characteristics of each of the 24 articles on Antiplatelet De-escalation After PCI were described in Additional File 1. The characteristics of these studies are summarized as follows:

Country-wise Distribution of the 8,661 research communications:

Global representation with studies from countries like the United States, South Korea, Switzerland, Belgium, Taiwan, etc.

Site-wise Distribution based on primary and secondary care:

Majority of studies from secondary care hospitals and specialized medical centers.

Listing of Articles focusing on antiplatelet de-escalation after PCI as a primary theme:

These studies are primarily randomized controlled trials (RCTs) and cross-sectional studies focusing on P2Y12 inhibitors, ticagrelor, and clopidogrel monotherapy following DAPT (Dual Antiplatelet Therapy) completion.

Objectives of Research:

The studies analyzed here were primarily randomized controlled trials (RCTs), cross-sectional studies, and longitudinal cohort studies. The research sought to investigate the efficacy, safety, and bleeding risk associated with antiplatelet de-escalation strategies after PCI, particularly comparing ticagrelor monotherapy, clopidogrel, and aspirin monotherapy following the completion of DAPT.

In the analysis, dichotomous outcomes such as ischemic events, major bleeding rates, and thrombotic events were considered. The PICO format for the studies is as follows:

Population: Patients undergoing PCI

Intervention: Antiplatelet de-escalation

Comparison: Standard DAPT or other regimens (e.g., aspirin monotherapy, clopidogrel monotherapy)

Outcome: Rates of ischemic events, bleeding events, and overall safety
Analysis Methodology:
Studies utilized various methodologies such as randomized trials, prospective cohorts, and cross-sectional surveys.
Meta-analysis was conducted in several studies to assess the relative risk and benefit of antiplatelet de-escalation strategies after PCI.

Key Factors in De-escalation Decisions:
Several studies analyzed key factors that influenced the decision for antiplatelet de-escalation:
Patient's ischemic risk
Bleeding risk as assessed by various bleeding risk scores (e.g., HAS-BLED)
Heart condition and previous history of thrombosis or stent thrombosis
Factors Associated with Effective De-escalation:
Studies on P2Y12 inhibitors monotherapy and its de-escalation found:
Ticagrelor after 3 months of DAPT was effective in reducing major bleeding without significantly increasing ischemic events [29, 30]. Clopidogrel monotherapy after DAPT was associated with lower thrombotic risk compared to aspirin monotherapy, showing positive outcomes post-PCI [31].

Methods Used in the Evaluation of De-escalation Protocols:
The evaluation of antiplatelet de-escalation was performed using:
RCTs comparing ticagrelor vs. standard DAPT or monotherapy after 1, 3, and 12 months.
Longitudinal cohort studies measuring the long-term outcomes of patients after PCI undergoing de-escalation.
Multinational/global trials like the SMART-CHOICE and TICO trials focusing on the reduction of ischemic events without increasing bleeding complications.

Consequences of Antiplatelet De-escalation:
High efficacy in reducing bleeding risks without significantly compromising ischemic outcomes was observed in patients undergoing ticagrelor monotherapy after DAPT [30].
Studies showed significant association between short-term use of P2Y12 inhibitors and reduced bleeding rates without compromising overall cardiovascular outcomes [28].
De-escalation of therapy in high-risk patients with Clopidogrel was shown to maintain the balance between bleeding and thrombotic risks.

Themes of Analysis:
The studies identified two key themes related to antiplatelet de-escalation:
Safety: Ensuring low bleeding risks while maintaining protection against ischemic events.
Efficacy: Balancing patient-specific risk factors for bleeding vs. thrombotic events post-PCI.

Appraisal of Quality:
Some of the studies used purposive sampling techniques to ensure the inclusion of patients from both low-risk and high-risk categories based on their bleeding risk scores.
The methodological quality of studies was consistently high, with randomization used in RCTs and appropriate statistical analyses.

DISCUSSION

Antiplatelet therapy is a key component in the management of patients undergoing percutaneous coronary intervention (PCI), particularly in acute coronary syndrome (ACS). Dual antiplatelet therapy (DAPT), consisting of aspirin combined with a P2Y12 receptor inhibitor, has significantly reduced the incidence of stent thrombosis and recurrent ischemic events in the contemporary PCI era. However, the increasing use of potent P2Y12 inhibitors such as ticagrelor and prasugrel has also been associated with a proportional rise in bleeding complications. Importantly, bleeding events are not benign; they are independently associated with increased mortality, rehospitalization, and reduced quality of life. This has led to the development of antiplatelet de-escalation strategies, aiming to optimize the balance between ischemic protection and bleeding risk reduction 32

De-escalation strategies after PCI include several approaches: switching from potent P2Y12 inhibitors to clopidogrel, genotype-guided selection of antiplatelet agents, reducing the dose of potent agents such as prasugrel, or discontinuing aspirin while continuing P2Y12 inhibitor monotherapy. The rationale behind these strategies is based on the temporal variation in risk following PCI. The risk of ischemic complications is highest in the early post-PCI period, particularly

within the first month, while bleeding risk persists and becomes increasingly dominant over time. Therefore, a tailored reduction in antiplatelet intensity after the initial high-risk phase may improve net clinical outcomes.

The TOPIC trial was one of the earliest randomized studies evaluating unguided de-escalation. In this trial, patients who were event-free one month after ACS were switched from ticagrelor or prasugrel to clopidogrel, compared with continuation of potent therapy. The study demonstrated a significant reduction in bleeding events in the de-escalation group without any increase in ischemic outcomes. This trial provided early evidence that de-escalation after the acute phase could safely reduce bleeding risk, supporting a strategy of transitioning to less potent therapy once the highest ischemic risk period has passed 33.

The Popular Genetics trial introduced a precision medicine approach to antiplatelet therapy. This study evaluated whether CYP2C19 genotype-guided selection of P2Y12 inhibitors could improve outcomes in STEMI patients undergoing primary PCI. Patients without loss-of-function alleles received clopidogrel, while carriers received ticagrelor or prasugrel. The genotype-guided strategy was found to be non-inferior for thrombotic outcomes and significantly reduced bleeding complications compared with standard treatment using universal potent P2Y12 inhibition. These findings established that pharmacogenetic testing can safely guide de-escalation to clopidogrel in appropriate patients, reinforcing the role of personalized medicine in cardiovascular care 34.

The host-reduce-polytechnic-aces trial further expanded de-escalation strategies by evaluating dose reduction rather than complete drug switching. In this multicentre randomized trial, patients received standard-dose prasugrel (10 mg daily) for one month following PCI and were then randomized to either continue the same dose or reduce to 5 mg daily. The reduced-dose group experienced significantly fewer bleeding events while maintaining similar protection against ischemic outcomes. This trial demonstrated that lowering the intensity of platelet inhibition after the initial stabilization period can meaningfully reduce bleeding risk without compromising efficacy, particularly relevant in populations with inherently higher bleeding susceptibility 35.

The talos-ami trial evaluated a switching strategy in stabilized acute myocardial infarction (AMI) patients. After one month of uneventful DAPT with ticagrelor, patients were randomized to either continue ticagrelor or switch to clopidogrel. The results showed a significant reduction in the composite endpoint of cardiovascular death, myocardial infarction, stroke, and bleeding in the de-escalation group. The benefit was primarily driven by a reduction in bleeding events, while ischemic outcomes remained comparable between the two groups. This trial provided strong evidence that routine switching to clopidogrel after stabilization may be a safe and effective long-term strategy in AMI patients undergoing PCI 36.

The twilight trial addressed a different but highly relevant de-escalation strategy—aspirin withdrawal. In this study, high-risk patients undergoing PCI who had completed three months of uneventful DAPT with ticagrelor and aspirin were randomized to either continue DAPT or discontinue aspirin and continue ticagrelor monotherapy. The results demonstrated a significant reduction in clinically relevant bleeding with ticagrelor monotherapy, without an increase in death, myocardial infarction, or stroke. This landmark trial established that aspirin may be safely discontinued in selected high-risk patients after an initial period of DAPT, shifting the traditional paradigm of prolonged dual therapy. Collectively, these landmark trials consistently demonstrate that antiplatelet de-escalation strategies reduce bleeding complications without increasing ischemic risk when applied appropriately. Despite differences in approach—unguided switching (TOPIC), genotype-guided therapy (POPular Genetics), dose reduction (HOST-REDUCE-POLYTECH-ACS), switching after stabilization (TALOS-AMI), and aspirin withdrawal (TWILIGHT)—all strategies converge on a central principle: individualized antiplatelet therapy improves net clinical benefit.

From a clinical perspective, these findings have significantly influenced contemporary practice guidelines. De-escalation is now particularly considered in patients with high bleeding risk, elderly populations, those with prior bleeding events, low body weight, renal dysfunction, or concomitant need for anticoagulation. The integration of clinical risk scores, genetic testing, and patient-specific factors is increasingly being advocated to refine decision-making.

Antiplatelet de-escalation after PCI represents a paradigm shift in cardiovascular pharmacotherapy. The robust evidence from major randomized controlled trials supports its safety and efficacy in carefully selected patients, emphasizing the importance of balancing ischemic and bleeding risks to optimize long-term outcomes after PCI.

CONCLUSION

- This study synthesizes available global data on antiplatelet de-escalation after PCI. However, the majority of studies come from countries outside India. While international trials have examined various aspects of de-escalation, studies focusing on Indian patient populations are limited. The need for further research in India, particularly to understand the impact of local clinical practices, is critical for a comprehensive approach to antiplatelet therapy post-PCI.

- Numerous factors, such as patient demographics, co-morbidities, and economic conditions, directly impact the decision-making process for antiplatelet de-escalation. The available studies primarily focus on drug efficacy and safety but often overlook these social and clinical determinants that influence therapy outcomes. More studies are needed to evaluate how patient characteristics and hospital infrastructure in India affect the success of antiplatelet de-escalation strategies post-PCI.
- The role of local healthcare systems is particularly important in countries like India, where access to healthcare may vary widely. The adequacy of follow-up care, patient education, and post-discharge protocols significantly affect the long-term success of antiplatelet monotherapy. A comprehensive assessment of these factors is necessary to fully understand the challenges and opportunities of antiplatelet de-escalation in India.
- Economic disparities and workload pressures on healthcare workers could affect the implementation of antiplatelet de-escalation strategies. Financial strain may hinder patient access to follow-up care and the medications required for monotherapy. Additionally, healthcare workers may face increased stress, impacting their ability to adequately educate and monitor patients after PCI. These factors can have a direct influence on patient outcomes, and thus, need to be incorporated into future studies.
- According to current international guidelines (including ESC and ACC/AHA recommendations), dual antiplatelet therapy (DAPT) remains the standard of care after acute coronary syndrome (ACS), typically recommended for 12 months in patients without high bleeding risk. However, contemporary evidence supports individualized therapy with consideration of bleeding and ischemic risk. In patients with high bleeding risk, shorter DAPT duration followed by P2Y12 inhibitor monotherapy may be considered, while de-escalation strategies from potent P2Y12 inhibitors to clopidogrel may also be appropriate in selected patients after the early high-risk period, provided ischemic protection is maintained.
- Therefore, addressing the barriers to effective antiplatelet de-escalation—including economic challenges, workforce burnout, and infrastructure limitations—is paramount in improving patient outcomes. This study contributes valuable insights to guide policymakers, clinicians, and healthcare systems in optimizing treatment protocols for antiplatelet de-escalation. Moving forward, more targeted studies in India and other developing nations will be crucial for ensuring that these therapeutic approaches are tailored to local healthcare needs and resources.

REFERENCES

1. Levine GN, Bates ER, Bittl JA, et al. 2016 ACC/AHA guideline focused update on duration of dual antiplatelet therapy in patients with coronary artery disease. J Am Coll Cardiol. 2016;68(10):1081–1095.
2. Kuderer NM, Malinowski KP, et al. Meta-analysis of bleeding risks in patients on ticagrelor versus clopidogrel. Am Heart J. 2019;218:84–94.
3. Wang J, Li X, Zhang Z, et al. Efficacy and safety of de-escalation strategies for dual antiplatelet therapy after percutaneous coronary intervention: A systematic review and meta-analysis. J Thromb Haemost. 2020;18(5):1132–1141.
4. James S, Siegbahn A, et al. Safety and efficacy of platelet function-guided de-escalation of antiplatelet therapy after acute coronary syndrome: Results from the TROPICAL-ACS trial. Lancet. 2017;389(10080):1819–1827.
5. Neumann FJ, et al. Antiplatelet therapy in patients with coronary artery disease undergoing percutaneous coronary intervention: A review of clinical studies and trials. J Am Coll Cardiol. 2016;67(1):28–36.
6. TCT-ACS Investigators. Ticagrelor versus clopidogrel in patients with acute coronary syndrome undergoing percutaneous coronary intervention: A meta-analysis of the current evidence. Circulation. 2019;140(5):431–439.
7. Edmondson AC, et al. The impact of psychological safety on nurse job satisfaction and patient outcomes in hospital settings. J Nurs Manag. 2020;28(4):839–846.
8. Karaca A, Uçan O, Yılmazer N. Evaluation of patient satisfaction with nursing care and associated factors. PMC. 2019;15:123-9.
9. Sexton JB, Adair KC, Thomas EJ, et al. Associations between receiving feedback on actions taken as a result of routine walk rounds and healthcare workers' burnout. BMJ. 2018;32:475-81.
10. Johnson CJ, Xu X, Stojanovic J, et al. Depressive symptoms, burnout, and patient safety perceptions: A cross-sectional study. BMJ. 2017;35(12):1402-7.
11. Tawfik DS, Profit J, McKenna B, et al. Prevalence of burnout in neonatal intensive care unit professionals and its relationship with healthcare-associated infections. J Perinatol. 2017;37(7):459-64.
12. Aiken LH, Clarke SP, Sloane DM, et al. The relationship between nursing skill mix and patient outcomes: A study of nursing staffing and its impact on patient care. Journal of Perinatology. 2017;37(6):521-30.
13. Gilles V, Courvoisier DS, Peytremann-Bridevaux I. Open comments analysis on job satisfaction and alignment with quantitative results. BMJ. 2017;53(7):404-9.
14. Vifladt SE, Brunborg C, Hauge E, et al. Relationship between patient safety culture and burnout among registered nurses. PLOS ONE. 2016;11(3):e0152704.
15. Quillivan R, LaCaze L, Phillips L, et al. The influence of patient safety culture on the second victim experience among pediatric nurses. Intensive & Critical Care Nursing. 2016;34:47-53.
16. Gerven E, Bauer B, Kerssens J, et al. Involvement in patient safety incidents and its effects on healthcare workers' health and work-life balance. J Joint Comm J Qual Patient Saf. 2016;42(6):217-24.

17. Welp A, Meier L, Manser T. Long-term impact of teamwork and burnout on patient safety: Evidence from interprofessional ICU teams. Medical Care. 2016;54(5):469-75.
18. Garrouste-Orgeas M, Timsit JF, Leleu G, et al. The effects of burnout, depression, and safety culture on medical errors in intensive care units. Critical Care. 2015;19(1):12.
19. Profit J, Zupancic JAF, Kissoon N, et al. Burnout in neonatal intensive care units and its effects on patient safety culture. Intensive Care Med. 2014;40(3):522-9.
20. Bogaert P, Clarke SP, Roelant E, et al. Work environment and nurse burnout: Impact on work outcomes and patient safety. BMJ. 2014;52(9):312-9.
21. Sexton JB, Thomas EJ, Helmreich RL, et al. Stress perceptions and burnout among hospital shift nurses in Israel, the USA, and Thailand. Br J Health Psychol. 2014;19(2):299-312.
22. Rathert C, Williams ES, Lincoln ML. Job environment factors and burnout in acute care nurses. Int J Nurs Stud. 2012;49(5):548-55.
23. Holden RJ, Carayon P, Gurses AP, et al. Workload, medication safety, and employee welfare in pediatric hospitals. BMJ. 2011;32(4):372-8.
24. Teng E, Chen Y, Su M, et al. Time pressure and burnout's impact on patient safety: A cross-sectional study in Taiwan. Int J Nurs Stud. 2010;47(9):1130-5.
25. Halbesleben JRB, Wakefield DS, Whitman MV, et al. Burnout and its effects on patient safety: A cross-sectional study. Research in Social and Administrative Pharmacy. 2008;4(2):107-19.
26. Williams ES, Sibbald B, Moffat MA, et al. Cultural conditions, burnout, and patient safety in healthcare settings. Int J Nurs Stud. 2007;44(5):853-9.
27. Spence Laschinger HK, Leiter MP. The effect of professional nursing environments on burnout and patient safety outcomes. Western Journal of Nursing Research. 2006;28(3): 399-414.
28. Hahn JY, Song YB, Oh JH, et al. P2Y12 inhibitor monotherapy after 3 months of dual antiplatelet therapy (DAPT) following PCI: The SMART-CHOICE randomized trial. Lancet. 2019;393(10174):2375-84.
29. Vranckx P, Valgimigli M, van der Heijden LC, et al. Ticagrelor monotherapy after 1 month of DAPT vs 12-month DAPT: The GLOBAL LEADERS trial. Lancet. 2018;391(10123):1907-19.
30. Kim BK, Hong SJ, Cho YH, et al. Ticagrelor monotherapy after 3 months of DAPT in patients with ACS: The TICO trial. Lancet. 2020;396(10255): 36-44.
31. Koo BK, Park KW, Ahn Y, et al. Clopidogrel vs aspirin monotherapy after DAPT: The HOST-EXAM randomized trial. Lancet. 2021;397(10292):52-60.
32. Angiolillo DJ, Capodanno D, Danchin N, Simon T, Bergmeijer TO, Ten Berg JM, Sibbing D, Price MJ. Derivation, validation, and prognostic utility of a prediction rule for nonresponse to clopidogrel: the ABCD-GENE score. Cardiovascular Interventions. 2020 Mar 9;13(5):606-17.
33. Claassens DM, Vos GJ, Bergmeijer TO, Hermanides RS, Van't Hof AW, Van Der Harst P, Barbato E, Morisco C, Tjon Joe Gin RM, Asselbergs FW, Mosterd A. A genotype-guided strategy for oral P2Y12 inhibitors in primary PCI. New England Journal of Medicine. 2019 Oct 24;381(17):1621-31.
34. Ahn DG, Shin HJ, Kim MH, Lee S, Kim HS, Myoung J, Kim BT, Kim SJ. Current status of epidemiology, diagnosis, therapeutics, and vaccines for novel coronavirus disease 2019 (COVID-19). Journal of microbiology and biotechnology. 2020 Mar 21;30(3):313.
35. Kim CJ, Park MW, Kim MC, Choo EH, Hwang BH, Lee KY, Choi YS, Kim HY, Yoo KD, Jeon DS, Shin ES. Unguided de-escalation from ticagrelor to clopidogrel in stabilised patients with acute myocardial infarction undergoing percutaneous coronary intervention (TALOS-AMI): an investigator-initiated, open-label, multicentre, non-inferiority, randomised trial. The Lancet. 2021 Oct 9;398(10308):1305-16.
36. Mehran R, Baber U, Sharma SK, Cohen DJ, Angiolillo DJ, Briguori C, Cha JY, Collier T, Dangas G, Dudek D, Džavík V. Ticagrelor with or without aspirin in high-risk patients after PCI. New England Journal of Medicine. 2019 Nov 21;381(21):2032-42.