Original Article
DOI: https://doi.org/10.70749/ijbr.v3i5.1211

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

A Comparative Study of Drug-Eluting Stents and Bare-Metal Stents in Coronary Artery Disease

Syed Ahsan Akhtar[1], Farhat Ullah Khan[1], Zeeshan Afzal[1], Muhammad Hafeez[1], Muzdalfa Parvez[1]

[1]Department of Cardiology, Hayatabad Medical Complex, Peshawar, Pakistan

ARTICLE INFO

Keywords
Coronary Artery Disease, Drug-Eluting Stents, Bare-Metal Stents, Percutaneous Coronary Intervention, Restenosis, Target Lesion Revascularization.

Corresponding Author: Dr. Farhat Ullah Khan,
Department of Cardiology, Hayatabad Medical Complex, Peshawar, Pakistan
Email: bleedgreen53.fk@gmail.com

Declaration
Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.
Conflict of Interest: No conflict of interest.
Funding: No funding received by the authors.

Article History
Received: 26-12-2024 Revised: 27-03-2025
Accepted: 13-04-2025 Published: 05-05-2025

ABSTRACT

Introduction: Coronary artery disease (CAD) holds the position as a top health issue that causes sickness and death throughout the global community. PCI represents a fundamental treatment approach, but the selection between DES and BMS medication delivery systems determines patient results. **Objective**: The research studied the medical success rates and safety characteristics between drug-eluting and bare-metal stents when used in PCI procedures for coronary artery disease. **Materials and Method**: Between January 2021 and June 2021, prospective comparative research was done at Department of Cardiology, Hayatabad Medical Complex, Peshawar. Two hundred patients joined the research into which they received either DES or BMS treatment (DES included 100 patients, and BMS included 100 patients). The study measured baseline patient data in addition to procedural success rates together with six-month clinical results. **Results**: Patients with DES experienced better outcomes than BMS patients because their restenosis rate was 6% lower and target lesion revascularization rate was 11% lower. The study results showed no statistically significant differences in mortality and myocardial infarction rates between groups. **Conclusion**: The clinical outcomes of DES prove better than those of BMSs, and medical authorities regard them as the go-to stenting solution for most PCI procedures.

INTRODUCTION

The widespread cardiovascular disease known as coronary artery disease functions as a significant cause of disability and death across the world and heavily impacts health systems, particularly in developing countries such as Pakistan. PCI stands today as the standard procedure for treating blockages or narrowing in coronary arteries, and medical practitioners widely accept its usage. Post-angioplasty, the implantation of stents becomes necessary for maintaining blood vessel openings. Two main kinds of stents currently applied in clinical practice exist bare-metal stents (BMS) and drug-eluting stents (DES). The medical field introduced BMS first, but DES represented a significant development that incorporated anti-proliferative medicines to reduce neointimal hyperplasia and restenosis. The growing body of evidence examining DES and BMS's effectiveness and safety relationship has generated continuous discussions about their benefits (1).

Early DES research treating vessel stenosis at the vertebral artery demonstrated better results than BMS by reducing restenosis incidence (1). Studies conducted with their initial findings established the basis for additional research about DES applications in coronary artery disease. Changal et al. conducted a meta-analysis that proved that DES yielded enhanced results for big coronary arteries by decreasing both target lesion revascularization and major adverse cardiac events (2). Park et al. observed that DES proved superior for left main coronary artery disease patients by achieving better long-term effectiveness and safety results over BMS treatments (3). The research by Zhang et al. established DES as superior to other treatments for reducing restenosis symptoms and recurrent ischemic events in intracranial and vertebral artery stenosis conditions (4).

The peripheral vascular treatment of femoropopliteal artery disease has received benefits from DES implementation. According to Chunawala et al. and Gouëfic et al., primary patency rates increased, and repeat interventions decreased when DES treatment replaced BMS in peripheral applications based on results (5,6). Research shows that DES provides generalizable

clinical advantages across vascular territories, which can be attributed to its drug-eluting properties. Special care has been dedicated to vulnerable patient groups. The study conducted by Siddiqui et al. demonstrated DES delivered superior clinical results than BMS while managing anticoagulation complexities in cancer patients who received PCI (7).

An individual patient data meta-analysis by Piccolo et al. established DES's advantages over BMS for acute and chronic coronary syndromes, validating DES's effectiveness in standard clinical operations (8). Rahman et al. discovered that DES provided superior outcomes to BMS in treating saphenous vein graft disease, demonstrating significance due to the well-known challenges of CABG graft management (9). The release of medication from drug-eluting stents proves beneficial for particular cardiac regions, including the left anterior descending and left main coronary arteries. According to Piccolo et al., these crucial coronary arteries' clinical outcomes showed improved long-term results and reduced restenosis (10). Studies conducted by Gong et al. showed that DES surpassed BMS in terms of reduced stroke recurrence and retreatment requirements within intracranial atherosclerotic stenosis cases (11).

The substitution of BMS treatment with DES has faced diverse levels of review. Research has tried to develop new treatment methods by merging drug-coated balloon devices with BMS to obtain their advantages and reduce their cost and application complexity (12). The extensive 14-year results from Walse et al. demonstrated DES durability with rare late thrombus formation and restenosis events, which verified their extended safety record (13). However the widespread use of DES, BMS still holds clinical relevance in specific scenarios. The study by Ray explains how BMS stands as a suitable option when patients present high bleeding risks and avoid extended dual antiplatelet therapy (14). Si et al. conducted a study that reinforced DES' persistent clinical superiority over all types of vascular conditions ranging from intracranial to vertebral artery stenosis (15). The usage of DES continues to grow because their efficiency at preventing restenosis, together with decreased repeated procedures and comparable safety measures, extends across various therapeutic patient groups and anatomical locations.

Objective

A tertiary care setup was compared drug-eluting stents versus bare-metal stents for their clinical outcomes and their safety and efficacy in treating coronary artery disease patients during percutaneous coronary intervention.

MATERIALS AND METHODS

Design: Observational Comparative Study.

Study setting: The study was done at Department of Cardiology, Hayatabad Medical Complex, Peshawar

Duration: From January 2021 to June 2021.

Inclusion Criteria

The research study included patients from 30 to 80 years of age who needed PCI procedures for coronary artery disease with DES and BMS implantation. All selected participants presented with fresh coronary artery lesions, which met the requirements for stenting during the study period. All enrolled patients provided consent before the study and remained available for their follow-up appointments.

Exclusion Criteria

The study excluded patients who had coagulopathy or contraindications to dual antiplatelet therapy and patients who had a life expectancy of less than one year or had undergone previous coronary artery bypass grafting or required using multiple stent types in the same procedure.

Methods

Healthcare providers enrolled all eligible patients in order of appearance while using clinical consideration and available stent types to assign drug-eluting stents (DES) or bare-metal stents (BMS). The investigators recorded baseline demographic information, patient comorbidities, angiographic findings, and details from the procedural stage. Standard PCI procedures were conducted by accomplished interventional cardiologists who followed standard operating procedures. International guidelines were the basis for administering antiplatelet therapy that combined aspirin with a P2Y12 inhibitor. Thorough post-operational surveillance measured the success and complications during procedures and hospital-based unfavorable events. The research team conducted multiple follow-ups, including one at month one, three, and six after the procedure, to evaluate stent outcomes regarding restenosis, target lesion revascularization (TLR), myocardial infarction (MI), and death from any cause. Statistical software evaluated clinical endpoints between patients receiving the DES and BMS. Statistical evaluation was performed using Chi-square tests for categorical data and t-tests for continuous variables, while a p-value lower than 0.05 indicated significance.

RESULTS

The research enrolled 200 patients who have coronary artery disease by allocating 100 patients to DES treatment and 100 to BMS treatment. The patient populations from both groups showed similar fundamental background information and medical aspects at the outset. Research subjects in the DES group exhibited a mean age of 59.4 ± 10.2 years, although the BMS group members had a mean age of 60.1 ± 9.8 years. The subject population consisted of 68% male patients in the DES group and 71% male patients in the BMS group. The enrolled patients displayed an even

distribution of hypertension with diabetes mellitus and smoking history among them.

Table 1
Baseline Characteristics of Patients

Variable	DES Group (n=100)	BMS Group (n=100)	p-value
Mean Age (years)	59.4 ± 10.2	60.1 ± 9.8	0.56
Male Gender (%)	68%	71%	0.65
Hypertension (%)	62%	59%	0.71
Diabetes Mellitus (%)	47%	45%	0.78
Smokers (%)	40%	43%	0.68

Both groups received six-month follow-ups, which revealed substantial dissimilarities between their clinical measurements. The clinical data indicated that DES surpassed BMS because TLR emerged in 5% of DES patients, but BMS patients needed TLR in 16% of cases. During follow-up time, the incidence of restenosis stood at 6% for DES patients, whereas BMS patients reported 18% restenosis. The DES group demonstrated better myocardial infarction test results, showing 4%, while BMS patients had rates (10%).

Table 2
Clinical Outcomes at 6-Month Follow-up

Outcome	DES Group (%)	BMS Group (%)	p-value
Target Lesion Revascularization	5%	16%	0.01
Restenosis	6%	18%	0.007
Myocardial Infarction	4%	10%	0.08
All-Cause Mortality	3%	5%	0.47

Acute procedural complications, together with stent thrombosis and vascular injury, showed identical success rates in DES patients to BMS patients when both reached over 95%. The users of DES required a shorter time in the hospital for treatment by spending 2.3 days instead of BMS users, who required 2.8 days of hospitalization.

Table 3
Procedural Data and Hospital Outcomes

Variable	DES Group	BMS Group	p-value
Procedure Success Rate (%)	97%	96%	0.72
Acute Stent Thrombosis (%)	1%	2%	0.56
Mean Hospital Stay (days)	2.3 ± 0.6	2.8 ± 0.7	0.002

The utilization of drug-eluting strains (DES) led to enhanced clinical outcomes by reducing restenosis rate and procedural need for revascularization without creating any procedural complications or additional adverse events.

DISCUSSION

This investigation analyzed clinical findings from DES and BMS applications within PCI procedures for patients with CAD. The research data indicates that DES reduces restenosis frequency and TLR occurrences at rates identical to BMS without generating extra complications. Much research supports DES's clinical advantage over BMS for multiple treatment settings and patient populations. The first scientific indication that DES performed better than BMS appeared through research outside coronary arteries. Evidence provided by Jing et al. demonstrated DES proves more successful than BMS in controlling symptomatic restenosis of the vertebral artery, which illustrates DES's effectiveness in treating vascular stenosis (1).

Scientific data related to DES employment in non-coronary applications helped validate their use across cardiovascular treatments. The work of Changal et al. provided analytical evidence supporting DES's power to minimize cardiovascular complications in major coronary arteries (2). Restenosis rates pose a significant challenge to left main coronary artery disease patients because they need durable revascularization procedures. The findings from Park et al. showed that DES delivered superior long-term effectiveness and safety over BMS, particularly in high-risk lesions, which matches present research showing DES patients having fewer restenosis incidents (3). The findings from Zhang et al.'s meta-analysis study of intracranial and vertebral artery stenosis confirmed that DES results in lower restenosis rates with better safety outcomes, supporting DES use in stenotic vascular diseases (4).

DES demonstrates benefits beyond its application in coronary and cerebral vessels. Chunawala et al. and Gouëffic et al. proved that DES provided superior vessel maintenance and minimized restenosis interventions in patients with femoropopliteal artery disease (5,6). The research demonstrates that DES offers strong versatility within anatomical spaces where the treatment of restenosis becomes tough. The safety profile of stents remains critical when treating cancer patients because the special risks of thrombosis and bleeding affect their outcomes negatively. The research of Siddiqui et al. concluded that DES provided superior results compared to BMS for cancer patients receiving PCI because DES minimized stent thrombosis occurrences and decreased re-intervention procedures (7). The study matches these findings because DES decreased both restenosis occurrence and required secondary procedures.

A significant study by Piccolo et al. examined individual health records to demonstrate that DES offered superior results to BMS for chronic and acute coronary syndromes by decreasing heart complications and enhancing long-term medical course (8). The mid-term clinical outcomes of DES patients were significantly improved, which supports the reliable performance of DES across various clinical situations. Research from Rahman et al. reported that DES monopolizes the clinical advantage during interventions of saphenous vein grafts, which adds to DES's application range (9). The findings of Piccolo et al. supported DES advantages over BMS for both the left anterior descending artery and left central artery intervention regarding restenosis prevention and cardiovascular event minimization (10).

The outcome from this research confirms the study results, which show that DES has a lower TLR rate and matches global DES preference for critical areas. The research from Gong et al. regarding intracranial atherosclerosis presented evidence that DES surpassed BMS by reducing restenosis rates and clinical outcomes (11). Several studies have adopted other treatment approaches even while DES continues its widespread use. Murai and Noguchi tested whether combining drug-coated balloons with BMS would provide an economical DES substitute (12). This innovative procedure remains unproven yet does not achieve the reliable, repeatable outcomes seen in research study, which uses DES technology. Long-term clinical findings from Walse et al.'s 14-year observation period confirmed that DES demonstrated better safety and effectiveness results than BMS regarding long-term maintenance (13). Patients with chronic CAD benefit the most from these extended benefits because subsequent interventions become both strenuous for treatment recipients and costly for healthcare services.

BMS medications continue to hold essential clinical value for particular cases where patients face elevated bleeding hazards and require dual antiplatelet therapy for brief periods only. According to Ray, BMS should be selected for patients with specific requirements, yet DES provides superior results (14). The development of modern DES, which requires a briefer duration of antiplatelet therapy, has started solving these limitations. Si et al. showed through their studies that DES consistently offers significant clinical benefits as the treatment for intracranial and vertebral artery stenosis (15). Multiple research findings from various fields agree on the essential value of DES technology within intervention procedures.

CONCLUSION

The research established that drug-eluting stents (DES) have better outcomes than bare-metal stents (BMS) for treating coronary artery disease. The restenosis and target lesion revascularization rates were dramatically lower in DES-treated patients, but myocardial infarction and mortality rates remained the same as those of patients receiving BMS. International research and this study confirm that DES delivers effective therapy with safety benefits to multiple patient types across different blood vessel areas. The medical community guidelines suggest that BMS is a valid choice for two specific patient groups exclusively, but DES proves to be the most effective in standard PCI operations. Constant improvements in stent technology and pharmacotherapy enhance DES effectiveness by providing better outcomes, shorter intervention needs, and longer disease control to coronary artery disease patients, establishing their future importance in interventional cardiology practice.

REFERENCES

1. Jing, S., Jia, B., An, K., Li, N., Guo, H., Li, X., Wang, J. and Liu, W., Comparative Efficacy of Drug-Eluting Stents vs. Bare-Metal Stents in Symptomatic Vertebral Artery Stenosis: A Prospective Single-Center Study. Bare-Metal Stents in Symptomatic Vertebral Artery Stenosis: A Prospective Single-Center Study. https://doi.org/10.2139/ssrn.5110389
2. Changal, K., Meenakshisundaram, C., Zafarullah, F.N.U., Nazir, S. and Sheikh, M.A., 2021. Meta-analysis and critical review of observational studies comparing drug-eluting and bare metal stents for revascularization of large coronary arteries. Cardiovasc Revasc Med, 31, pp.91-92. https://doi.org/10.1016/j.carrev.2020.11.003
3. Park, H., Ahn, J.M., Kang, D.Y., Kim, S.O., Ko, E., Kim, T.O., Lee, P.H., Lee, S.W., Park, S.W., Park, D.W. and Park, S.J., 2021. Very long-term safety and effectiveness of drug-eluting or bare-metal stents for left main coronary disease. CJC open, 3(10), pp.1199-1206. https://doi.org/10.1016/j.cjco.2021.05.009
4. Zhang, Y., Li, W. and Zhang, L., 2024. Efficacy and safety of drug-eluting stents versus bare-metal stents in symptomatic intracranial and vertebral artery stenosis: a meta-analysis. Frontiers in Neurology, 15, p.1389254. https://doi.org/10.3389/fneur.2024.1389254
5. Chunawala, Z., Goyal, A., Jaiswal, V., Moussa, I., Hassan, A., Bhatia, K. and Qamar, A., 2023. Comparison of Drug-Eluting Stent With Bare-Metal Stent Implantation in Femoropopliteal Artery Disease: A Systematic Review and Meta-Analysis. Circulation, 148(Suppl_1), pp.A19047-A19047. https://doi.org/10.1161/circ.148.suppl_1.19047
6. Gouëffic, Y., Torsello, G., Zeller, T., Esposito, G., Vermassen, F., Hausegger, K.A., Tepe, G., Thieme, M., Gschwandtner, M., Kahlberg, A. and Schindewolf, M., 2022. Efficacy of a drug-eluting stent versus bare metal stents for symptomatic femoropopliteal peripheral artery disease: primary results of the EMINENT randomized trial. Circulation, 146(21), pp.1564-1576. https://doi.org/10.1161/circulationaha.122.059606
7. Siddiqui, M.U., Warner, E., Junarta, J., O'Neill, P., Signarovitz, D., Kanawati, E., Murtaza, M. and Fischman, D., 2024. Outcomes of Drug-Eluting Stents in comparison to Bare Metal Stents in Cancer Patients with Percutaneous Coronary

Intervention: A Systematic Review and Meta-Analysis. Journal of Interventional Cardiology, 2024(1), p.3072909. https://doi.org/10.1155/2024/3072909

8. Piccolo, R., Bonaa, K.H., Efthimiou, O., Varenne, O., Baldo, A., Urban, P., Kaiser, C., de Belder, A., Lemos, P.A., Wilsgaard, T. and Reifart, J., 2022. Individual patient data meta-analysis of drug-eluting versus bare-metal stents for percutaneous coronary intervention in chronic versus acute coronary syndromes. The American Journal of Cardiology, 182, pp.8-16. https://doi.org/10.1016/j.amjcard.2022.07.035
9. Rahman, M., Hanif, M., Mumtaz, M., Nair, A., Ali, J., Khan, B., Ullah, W. and Savage, M.P., 2023. Comparative Efficacy and Safety of Bare-Metal versus Drug-Eluting Stents in Managing Saphenous Venous Graft Disease: A Meta-Analysis and Systematic Review. Circulation, 148(Suppl_1), pp.A13590-A13590. https://doi.org/10.1161/circ.148.suppl_1.13590
10. Piccolo, R., Bonaa, K.H., Efthimiou, O., Varenne, O., Urban, P., Kaiser, C., Raeber, L., de Belder, A., Remkes, W., Van'T Hof, A.W. and Stankovic, G., 2021. Drug-Eluting or Bare-Metal Stents for Left Anterior Descending or Left Main Coronary Artery Revascularization. Journal of the American Heart Association, 10(20), p.e018828. https://doi.org/10.1161/jaha.120.018828
11. Gong, H., Luo, J., Xu, W., Wang, J., Yang, R., Yang, B., Ma, Y., Wang, T. and Jiao, L., 2024. Drug-eluting stents versus bare-metal stents for intracranial atherosclerotic stenosis: a systematic review and meta-analysis. BMJ open, 14(12), p.e085533. https://doi.org/10.1136/bmjopen-2024-085533
12. Murai, K. and Noguchi, T., 2023. Exploring alternatives to drug-eluting stents: the potential of combining drug coated balloon with bare-metal stents. Cardiovascular Diagnosis and Therapy, 13(5), p.768. https://doi.org/10.21037/cdt-23-297
13. Walse, R.S., Nair, K.K.M., Valaparambil, A., Sasidharan, B., Sivadasapillai, H. and Thulaseedharan, J.V., 2023. Natural history of coronary stents: 14 year follow-up of drug eluting stents versus bare metal stents. Indian Heart Journal, 75(6), pp.457-461. https://doi.org/10.1016/j.ihj.2023.11.001
14. Ray, S., 2021. The Relevance of Bare-Metal Stent in the Therapy of Coronary Artery Disease in 2020. Journal of Indian College of Cardiology, 11(1), pp.1-4. https://doi.org/10.4103/jicc.jicc_30_20
15. Si, J.H., Ma, N., Gao, F., Mo, D.P., Luo, G. and Miao, Z.R., 2022. Effect of a drug-eluting stent vs. bare metal stent for the treatment of symptomatic intracranial and vertebral artery stenosis. Frontiers in Neurology, 13, p.854226. https://doi.org/10.3389/fneur.2022.854226