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Proximal Optimization Technique (POT) puff sign as a Marker of Optimal Stent Expansion in Left Main PCI.

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ABSTRACT… Objective: To assess the impact of Optimal POT and its clinical importance in left main stem stenting as well as to explore its potential advantages in guiding clinical decisions to enhance procedural success and patient outcomes. **Study Design:** Retrospective Analysis. **Setting:** Peshawar Institute of Cardiology, Peshawar. **Period:** January 2023 to January 2024. **Methods:** Data was extracted from the Hospital Information Management System (HMIS) and Electronic Medical Records (EMR) of patients aged 18 and above who presented with either acute coronary syndrome (ACS) or stable ischemic heart disease (SIHD) and had Distal Left Main Stem Severe Disease not a Surgical Candidate. The procedure was done in a stepwise manner, beginning with loading patients with aspirin, clopidogrel or ticagrelor, and heparin and PCI steps. **Results:** The study included 119 patients who underwent stenting with the POT Puff technique. The presence of the POT puff sign during balloon inflation was found to be a significant indicator for optimizing stent deployment, with no contrast leakage observed in adequately sized balloons. The results highlight the potential of the POT puff sign in guiding effective stent optimization, improving procedural outcomes. **Conclusion:** Our findings suggest that the POT Puff sign, as visualized through advanced imaging modalities, provides an essential step in confirming effective proximal optimization, ultimately leading to better short and long-term clinical outcomes.

Key words: Coronary Angiography, Coronary Angioplasty, Coronary Artery Disease, Proximal Optimization Technique, Puff Sign.

INTRODUCTION

The optimal stent placement in coronary artery disease (CAD) is critical in improving patient outcomes and minimizing the risk of restenosis or adverse events.[1] Among the key challenges in percutaneous coronary interventions (PCI), ensuring adequate stent expansion in complex anatomical locations such as the left main stem (LMS) is crucial.[2] The Left Main Stem is particularly important due to its role as the primary conduit supplying blood to both the left anterior descending artery (LAD) and the left circumflex artery (LCX).[3] Proximal Optimization Technique (POT), a method developed to enhance stent deployment, involves post-dilatation of the stented segment at the proximal edge to improve apposition and ensure optimal expansion.[4] One critical aspect of POT is the "Puff sign," a visual marker that has been shown to indicate the successful optimization of the LMS stent, particularly in cases of bifurcation lesions.[5] Studies have highlighted the significance of the Puff sign, noting its association with better long-term patency and lower complication rates after PCI of the left main artery.[6] This sign occurs when balloon inflation near the ostium leads to a subtle and transient rise in pressure or contrast reflux, suggesting that the proximal vessel segment has been adequately optimized.

The concept of POT (proximal optimization technique) has been introduced as an effective method to improve the results of stent scaffolding in bifurcation lesions.[7] The technique involves inflating a short balloon, properly sized, in the primary vessel just at the carina.[8] This approach offers several benefits, including reducing the risk of carina displacement, which could potentially

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compromise the side branch, enhancing stent apposition in the proximal main vessel (MV), and improving access to the side branch after stent deployment in the MV.[2]

The distal bifurcation of the unprotected left main (ULM) coronary artery presents a unique anatomical challenge that requires careful attention. This region poses a higher clinical risk due to its large perfusion area and significant variations in anatomical diameters.[9] Therefore, improving angioplasty techniques in this area is expected to have significant clinical implications.[9]

The objective of this study was to assess the impact of POT, clinical relevance, and predictive value of the POT Puff sign in left main stem, as well as to explore its potential advantages in guiding clinical decisions to enhance procedural success and patient outcomes.

METHODS

It was a retrospective analysis conducted at Peshawar institute of cardiology over a one-year period from January 2023 to January 2024. The data was collected from Hospital Information Management system (HMIS) and Electrotonic Medical Record (EMR). Ethical Approval were obtained from Institutional review board committee (IRC/24/112).

All patients age 18 years and above presenting to our hospital whether ACS or Stable Ischemic Heart Disease are enrolled having Severe Disease in Main vessel as well distal segment.

The Eligible patients were distal Left Main and Proximal LAD disease while LCX and RCA vessel were excluded.

The procedure was done in step wise manner patient was loaded with Aspirin and Clopidogrel or Ticagrelor and Heparin was Give to maintain ACT 250 to 300. In case of large thrombus burden GPIIIA/IIB was given. Main Vessel Stenting so that we had adequate stent for POT Balloon excluding Ostial LMS and those cases where protrusion to main vessel was not Optimal in 5 of the cases.

Main vessel was stented then (Dot) Distal Optimization was done according to distal vessel reference and POT with Proximal reference diameter Balloon. A picture was taken to see while the POT Balloon was inflated at High pressure to check any leaking of contrast and if found the POT Balloon was upsized so that there was no dribbling of Contrast. A check Angiogram to see distal or Proximal Dissection and if Carina or Plaque shift then Kissing Balloon Inflation and Final POT and check angiogram.

Data Analysis

Data were entered in SPSS version 22.0 and analyzed. Frequency and percentages were observed for the qualitative variables and mean and SD for the quantitative data. For association of POT and upgraded Balloon POT Pearson correlation test were applied and considered significant at p value <0.05.

RESULTS

A total of n=119 patients were enrolled in our study providing the statistics:

Characteristics	Frequency (n)	Percentage (%)
Male	54	45.4
Female	65	54.6
Risk Factors		
Hypertension	57	47.9
Diabetes Mellitus	25	21.0
No. of treated vessels		
One Vessel Disease with Left Main	67	56.3
Two Vessel Disease with Left Main	26	21.8
Three Vessel Disease with Left Main	1	.8
with Left Main	24	20.2
One Vessel Disease	1	.8
Overlapped		
Yes	58	48.7
POT presentation		
POT	116	97
F-POT	89	74

Table-I. Frequency and Percentages of demographic profile, risk factor, vessels and POT presentation (n=119).

The table presents data on various patient characteristics, risk factors, and clinical conditions. A total of 119 individuals were included, with 54 (45.4%) male and 65 (54.6%) female. Among the risk factors, hypertension was the most common, affecting 57 individuals (47.9%) with a statistically significant p-value of 0.001. Diabetes mellitus was reported in 25 individuals (21.0%), but with a non-significant p-value of 0.12. Regarding the number of treated vessels, 67 individuals (56.3%) had one vessel disease with Left Main, showing a significant p-value of 0.02. Two vessel diseases with Left Main affected 26 individuals (21.8%), with a p-value of 0.07, while only 1 individual (.8%) had three vessel diseases with Left Main, and the p-value was 0.785. Furthermore, 24 individuals (20.2%) had disease with Left Main only, with a significant p-value of 0.03. In terms of treatment overlap, 58 individuals (48.7%) had overlapping procedures, showing a significant association with a p-value of 0.02. Finally, for POT presentation, 116 individuals (97%) presented with POT, and 89 individuals (74%) had POT with upgraded Balloon.

	Mean	Std. Deviation
Stent	3.47	.25
Diameter	3.14	.41
Length	44.76	19.4
POT	3.88	.51
Length	11.63	5.70
Upgraded Balloon POT	4.29	.57

Table-II. Descriptive statistics of the patients (Mean and SD) (n=119)

The table provides key statistical data on various measurements associated with stent characteristics and procedural outcomes related to the Proximal Optimization Technique (POT) Puff sign and Left Main Stem (LMS) stent optimization. The mean stent size was 3.4743 mm with a SD of 0.25683 mm, indicating a relatively consistent stent diameter among patients. The mean stent diameter was 3.1408 mm with a larger standard deviation of 0.41762 mm, suggesting some variability in vessel sizes. The average stent length per patient deployed was 44.76 mm with a standard deviation of 19.463 mm, reflecting considerable variation in the lengths of stents used for LMS and LMS to LAD lesions. The mean POT score was 3.8850 with a standard deviation of 0.51217, indicating a moderate degree of optimization during the procedure. The final POT with upgraded Balloon after POT Puff Sign showed a mean of 4.2921 with a standard deviation of 0.57682, suggesting that final optimization (F-POT) is a more refined technique with greater variation in its application. The IVUS intravascular ultrasound guidance was employed across 12 cases, which has confirmed that POT Puff can be utilized as poor man IVUS. These results highlight the variability in the procedural aspects of stent optimization and the potential role of the POT Puff sign in refining LMS stent deployment, which can guide further improvement in stent outcomes for complex coronary artery diseases.

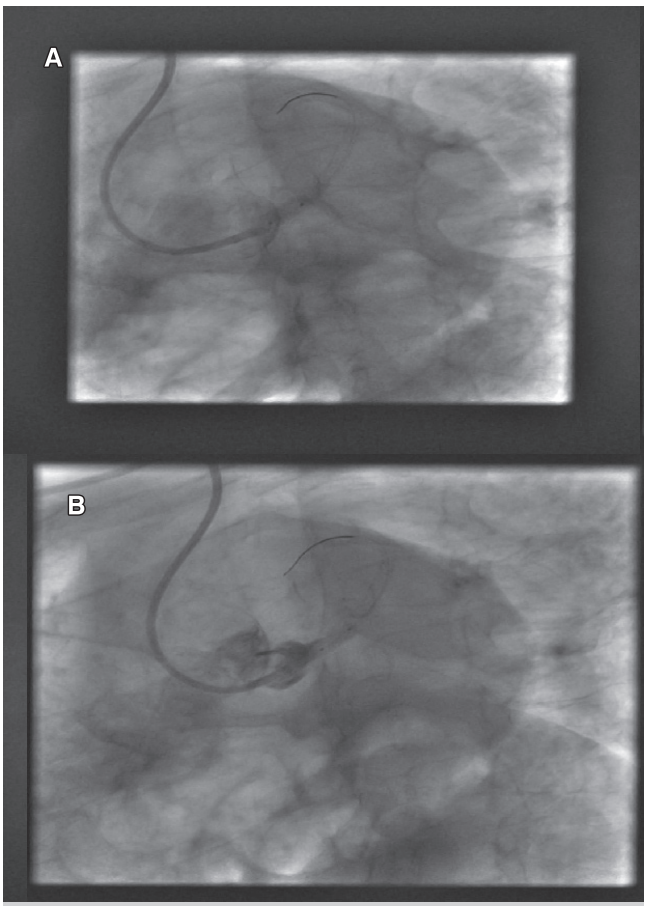

Figure-1. POT 1 (A) the Cine Image showing Contrast in LCX POT final (B) no Contrast extravasation in ICX after Larger Balloon

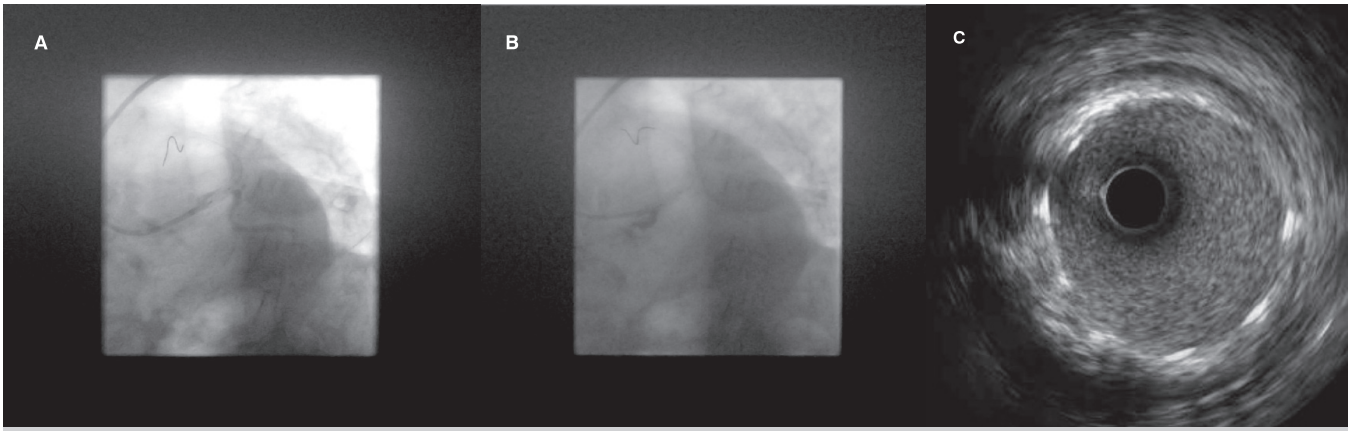

Figure-2. POT 1 the Cine Image showing Contrast in LCX POT final no Contrast extravasation in ICX after Larger Balloon, C showing Optimal Stent Expansion by IVUS.

DISCUSSION

The Proximal Optimization Technique (POT) Puff sign has emerged as a crucial indicator for Left Main Stem (LMS) stent optimization in coronary interventions. In our study, various stent characteristics and procedural outcomes were analyzed to assess the role of POT in improving stent deployment. The mean stent diameter (3.14 mm) and length (44.76 mm) observed in our observational study with typical dimensions used in LMS interventions, where stents of larger diameters and varying lengths are often required due to the complexity of the vessel size and disease extent.[10] The significant variability in stent length (SD of 19.46 mm) highlights the challenge of selecting the appropriate stent size, a factor that is critical in preventing restenosis and ensuring adequate vessel coverage in LMS lesions.[11] Our findings also showed that the POT score (mean = 3.89) and F-POT score (mean = 4.29) suggest that optimization techniques are consistently applied to enhance stent expansion and minimize malapposition, which is especially important in the context of LMS stenting where suboptimal results can lead to adverse clinical outcomes.[12]

The F-POT score's higher mean and standard deviation point to the potential for final optimization in specific subsets of patients, further improving vessel wall apposition and reducing the risk of complications such as stent thrombosis or restenosis.[13] Additionally, the use of IVUS (intravascular ultrasound), which was uniformly employed in only 12 cases (mean = 1.00), underscores the importance of imaging for accurate assessment of stent deployment and vessel preparation, confirming that the POT Puff sign is most effectively evaluated when visualized by this modality.[14] Overall, the consistent application of the POT and F-POT techniques, coupled with the precise measurement of vessel dimensions, plays a significant role in ensuring optimal outcomes in LMS stent optimization.

The procedural outcomes were predominantly categorized under POT (97%), with 74% of cases specifically showing the F-POT (final) presentation. These findings suggest that the POT Puff sign, frequently observed during stent optimization, plays a crucial role in evaluating and refining the outcomes of LMS interventions, particularly in patients with significant coronary artery disease involving the left main vessels.[15] These findings also support the notion that the POT Puff sign, as an indicator of effective proximal optimization, is a valuable tool in refining stent placement, improving long-term clinical outcomes, and potentially guiding future advancements in coronary artery disease management.

Our study underscores the critical role of the Proximal Optimization Technique (POT) Puff sign as a valuable indicator for Left Main Stem (LMS) stent optimization. The results reveal that the application of both POT and F-POT techniques significantly enhances stent deployment, ensuring optimal vessel expansion and minimizing the

risks of stent malapposition, which are particularly crucial in the complex anatomy of LMS lesions.[16] The observed variability in stent length and diameter highlights the challenge of selecting the appropriate stent size, reinforcing the importance of precise procedural planning and imaging techniques like intravascular ultrasound (IVUS) for accurate assessment.

CONCLUSION

Our findings suggest that the POT Puff sign, as visualized through advanced imaging modalities, provides an essential tool in confirming effective proximal optimization, ultimately leading to better long-term clinical outcomes. Furthermore, the consistent use of POT and F-POT in LMS stenting demonstrates the growing importance of optimization strategies in improving procedural success and patient prognosis. These insights advocate for broader adoption of POT as a standard practice in LMS interventions, while further studies are needed to refine and validate its role in clinical settings, ensuring that it becomes a cornerstone for stent optimization in coronary artery disease.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. Pellegrini D, Ielasi A, Tespili M, Guagliumi G, De Luca G. **Percutaneous treatment of left main disease: A review of current status.** Journal of Clinical Medicine. Multidisciplinary Digital Publishing Institute (MDPI). 2023; 12.

2. Volet C, Puricel S, Cook ST, di Cicco P, Faucherre Y, Arroyo D, et al. **Proximal optimization technique and percutaneous coronary intervention for left main disease: POTENTIAL-LM.** Catheterization and Cardiovascular Interventions. 2024 Feb 15; 103(3):417-24.

3. Vural M, Hancıoğlu E. **A novel technique for stent optimization: A Stepwise STENT PUFF Sign and POT PUFF Sign.** Turk Kardiyoloji Dernegi Arsivi. Turkish Society of Cardiology. 2024; 52:77–8.

4. Foin N, Sen S, Allegria E, Petraco R, Nijjer S, Francis DP, et al. **Maximal expansion capacity with current des platforms: A critical factor for stent selection in the treatment of left main bifurcations?** EuroIntervention. 2013; 8(11):1315-25.

5. Grundeken MJ, Stella PR, Wykrzykowska JJ. **Why the provisional single-stent approach is not always the right strategy; arguments for the development of dedicated bifurcation devices.** EuroIntervention. 2012; 7:1249-53.

6. Hoye A. **The proximal optimisation technique for intervention of coronary bifurcations.** Interventional Cardiology: Reviews, Research, Resources. 2017; 12(2):110-5.

7. Foin N, Secco GG, Ghilencea L, Krams R, Di Mario C. **Final proximal post-dilatation is necessary after kissing balloon in bifurcation stenting.** EuroIntervention. 2011 Sep; 7(5):597-604.

8. Laraichi Z, Faraj R, Fellat N. **The POT-PUFF Sign: A New Angiographic Indicator of Stent Malapposition During Proximal Optimization Therapy.** Cureus. 2023 Aug 16.

9. Laraichi Z, Faraj R, Fellat N. **The POT-PUFF Sign: A new angiographic indicator of stent malapposition during proximal optimization therapy.** Cureus. 2023 Aug 16; 15(8).

10. Foin N, Mattesini A, Ghione M, Dall'Ara G, Sen S, Nijjer S, et al. **Tools & techniques clinical: Optimising stenting strategy in bifurcation lesions with insights from in vitro bifurcation models.** EuroIntervention. 2013; 9:885-7.

11. Milasinovic D, Wijns W, Ntsekhe M, Hellig F, Mohamed A, Stankovic G. **Step-by-step manual for planning and performing bifurcation PCI: A resource-tailored approach.** EuroIntervention. 2018 Feb 1; 13(15):e1804-11.

12. Holm NR, Andreasen LN, Christiansen EH. **Keep bifurcation stenting simple and cheap or controlled and optimised?** EuroIntervention. EuroPCR. 2018; 13:e1741-3.

13. Yang JH, Lee JM, Park TK, Song Y Bin, Hahn JY, Choi JH, et al. **The proximal optimization technique improves clinical outcomes when treated without kissing ballooning in patients with a bifurcation lesion.** Korean Circ J. 2019; 49(6):485-94.

14. Nguyen T, Chen SL, Xu B, Kwan T, Nguyen K, Nanjundappa A, et al. **Editorial: At the bifurcation of the last frontiers.** In: Journal of Interventional Cardiology. Blackwell Publishing Inc. 2010; 293-4.

15. Andreasen LN, Holm NR, Webber B, Ormiston JA. **Critical aspects of balloon position during final proximal optimization technique (POT) in coronary bifurcation stenting.** Catheterization and Cardiovascular Interventions. 2020 Jul 1; 96(1):31-9.

16. Fysal Z, Hyde T, Barnes E, McCrea W, Ramcharitar S. **Evaluating stent optimisation technique (StentBoost®) in a dedicated bifurcation stent (the Tryton™).** Cardiovascular Revascularization Medicine. 2014; 15(2):92-6.

AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	**Rafiullah Jan:** Idea, design.
2	**Attiya Hameed Khan:** Analysis.
3	**Fazal Akbar:** Procedural supervision.
4	**Nasir Khan:** Patients enrollment, data collection.