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Clinical Outcomes of Various Two Stent Bifurcation Techniques in Treating Coronary Bifurcation Lesions at Pakistan Institute of Medical Sciences, Islamabad

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Author`s Contribution

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ABSTRACT

Objective: To determine the clinical outcomes of different two stent bifurcation techniques in the treatment of coronary bifurcation lesions, taking this as a challenge presented at the Pakistan Institute of Medical Sciences (PIMS), Islamabad.

Methodology: This descriptive cross-sectional was done at the Cardiology Department, PIMS, Islamabad, from September 2017 to February 2018. Individuals aged 20–60 years with true bifurcation lesions (> 50% stenosis diameter) in both parent/main vessel side branch ostia from lesions and with a diameter of >2.5 mm via visual approximation, silent ischemia, un-stable or stable angina, and denovo coronary bifurcation lesions of either gender were included. Patients were observed for clinical outcomes like cardiac death, stent thrombosis, nonprocedural MI, and during operation complications like edge dissection and side branch closure, recurrent myocardial infarction (MI), unstable angina, and MACE. All the information was collected via a study proforma, and the analysis was done using SPSS version 20.

Results: The study included 100 cases, with an average age of 40 years and a range of 20 to 60 years. Out of all 58 (58%) males and 42 (42%) females. Amongst all the procedures, the Kissing Stent Technique was most successful in treating coronary bifurcating lesions 93.3%. As per procedures, complications were found to be statistically significant (p = 0.011).

Conclusions: As per the study conclusion, kissing stent technique has been observed to be the most successful and least complicated technique in treating coronary bifurcating lesions.

Keywords: Coronary bifurcation, Kissing Stent Technique.

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Introduction

Coronary bifurcation lesions occur in approximately 15% to 20% of percutaneous coronary intervention (PCI)[1] it poses a significant problem for interventionists in terms of the percentage of successful procedures and the incidence of long-term events of the cardia and high rate of complications. When such lesions were treated using balloon angioplasty without the placement of the stent, there was a significant risk of sudden vascular closure.[2] Most of the coronary bifurcation lesions should be treated with a provisional side branch stent technique, according to the most recent guidelines, based on the findings of many randomized trials and databases.[3] With this plan, the main vessel is stented, where the side branch is only managed via implantations of the stents among cases of marked residual side branch stenosis after stenting of main vessel. Therefore, in order to properly

manage certain coronary bifurcation lesions, the stent needs to be placed in both of the parental vessel as well as the side branch. However, the side branch occlusion occurs in about 20% of cases after main artery stent implantation. It could be associated with rewiring failure peri procedural Myocardial Infraction and acute stent thrombosis increase incidence of Major Adverse Cardiac Events (MACE) in the cases having persistently occluded side branch. Predictors for side branch occlusion are osteal lesions, length of the side branch lesions (more frequently it occurs with long lesions more than 5mm) and the plaque shift. Greater plaque burden in occlusion of side branch vessels can be caused by the main vessel. Unstable plaques with high thrombus burden, as those seen in Acute Coronary Syndrome, are more likely to cause thrombus shift and side branch occlusion at the ostium. This is called snow-plow effect.[4,5,6]

Consequently, specific bifurcation stent approaches (like T-Stent technique the crush[7] the Culotte[8] and the Kissing Stent techniques) have been presented in the other many techniques in order to give the coverage of stent of the complete bifurcation area were used and have indeed been linked to encouraging angiographic and clinical outcomes.[9,10] However, the current study has been carried out to compare the clinical outcomes of various techniques in term of procedural success, and long & short term complication rates of the complications for the management of bifurcation lesions through different techniques.

Methodology

This descriptive cross-sectional study was conducted at the Department of Cardiology at the Pakistan Institute of Medical Sciences, Islamabad. The research was completed in one year, from September 2017 to February 2018. A non-probability purposive sampling technique was used. Individuals aged 20-60 years with true bifurcation lesions (> 50% stenosis diameter) in both parent/main vessel side branch ostia from lesions and with a diameter of >2.5 mm via visual approximation, silent ischemia, un-stable or stable angina, and denovo coronary bifurcation lesions of either gender were included. All the patients those having acute MI with in 24hrs and those who were not agreeing to participate in this study were excluded. A bifurcation lesion was defined according to Lefevre et al [11] and could be treated in the Lt anterior descending artery and the diagonal, circumflex artery, and obtused marginal branches; the right coronary artery and PDA/Postero Lateral artery; or the left main stem, circumflex artery, and Lt anterior descending artery in a right dominant system. After obtaining informed consent, all the individuals were given aspirin and clopidogrel, each at a dose of 300 milligrams, as a pretreatment. Heparin was administered at a dose of 1-1.5 mg/kg body weight, as is standard practise at the local hospital. IIb/IIIa inhibitors were used according to need. Clopidogrel has been prescribed for a year, whereas aspirin was taken for an unlimited amount of time. For PCI of these lesions, a variety of methods have been developed, frequently involving the use of numerous balloons and the implantation of two or more stents.

Kissing balloon angioplasty is a typical procedure for bifurcations wherein the 2 balloons being simultaneously inflated to stop plaque from migrating into the side branch. Using such a stent for the main branch and therefore only stenting a side branch when appropriate is a procedure known as provisional side branch stenting. Patients underwent multiple-stent procedures, including the crush stent technique, Culotte Stenting procedure, and Kissing Stenting method, to allow maximum apposition to the vascular wall with efficient drug delivery in situation of drug-eluting stents. During the procedure time, as well as 12 to 18 hours afterward, measurements of Troponin-T or Troponin-I and the CK-MB mass were taken. The major marker that was used was troponin-T. It was determined that the marker elevations were substantial if they were more than or equal to three times the normal upper limit. An electrocardiogram with 12 leads was performed prior to the procedures, as well as 12 and 18 hours later. For patient safety reasons, total deaths and MACE were recorded. Patients were observed for primarily outcome which includes cardiac death, stent thrombosis, nonprocedural MI and during operation complications like edge dissection and side branch closure. Patients were followed up until 6 months to look for complications, i.e., recurrent myocardial infarction (MI), unstable angina, and MACE. All the information was collected via study proforma, and the analysis was done using SPSS version 20.

Results

In our study, 100 cases as per the inclusion criteria were studied. The mean age of study patients was 40 ± 20 years ranging from 20 to 60 years. Most of the patients 70 (70%) were above 40 years of age. while about 30 (30%) were below 40 years of age. In our study, there were 58

(58%) males and 42 (42%) females. In our study, 100 cases as per the inclusion criteria were studied.

There have been used different techniques for treatment of coronary bifurcating lesion. The choice of techniques used were based on the operator's expertise and the lesion characteristics, e.g., T Stent Technique was used in 30% of the study population, the Crush Stent Technique was used in 18% of the cases, the Cullotte Stent Technique was done in 22% of the cases, and the Kissing Stent Technique was done in 30% of the study subjects. (Table I)

Among all procedures, the Cullotte stenting approach was less successful in treating coronary bifurcating lesions 27.3% while the Kissing stenting approach was most successful in treating coronary bifurcating lesions 93.3%. (Table II)

Complications were found statistically significant as per procedures (p=0.011), particularly as the edge dissection was higher 8.0% in the culotte stenting approach, and in the T stenting method and crush method 6.0% and 5.0%, respectively. Recurrent MI and Side branch closure were higher T stent technique, while thrombosis almost equal in all techniques only lower in kissing stent technique. (Table III)

Table I: Distribution of patients according to various techniques used(n=100)

Various Techniques	N	Percentage
T Stent Technique	30	30%
Crush Stent Technique	18	18%
Culotte Stent Technique	22	22%
Kissing Stent Technique	30	30%

Table II: Outcome in Patients with Different procedures (n=100)

Outcome of procedure	Total Number of Patients	Successful	Unsuccessful
T Stent Technique	30	23 (76.7%)	7 (23.3%)
Crush Stent Technique	18	15 (83.3%)	3 (16.7%)
Culotte stent technique	22	6 (27.3%)	16 (72.7%)
Kissing Stent Technique	30	28 (93.3%)	2 (6.7%)

Discussion

Lesions of the coronary artery bifurcation provide a specific problem in the field of the cardiological interventions.[11] Interventions for bifurcations are linked to a higher risk of both short-term and long-term consequences,[11] with the restenosis at the side branch (ostium) continuing to be the most problematic issue. The common strategy at the present is stenting the important line with the temporary side branching stenting. But occasionally, into side branch the stenting may need the use of a two-stent procedure. In an effort to get around the drawbacks of present methods, newer dedicated bifurcation stents have indeed been suggested. Such stents have shown impressive outcomes in previous publications; however, the effectiveness and safety of such tools won't be known for sure until ongoing and future trials are concluded.[12] This study has been done to assess the clinical outcomes of different two stent bifurcation techniques in the treatment of coronary bifurcation lesions and 100 patients presenting with Acute Coronary Syndrome (ACS), Stable Angina and recent MI were studied, their mean age of study patients was 40 ± 20 years and males were in majority 58%, while females were 42%. On the other hand, Mohsin M et al[13] reported that the mean age of the patients was 52.27 ±13.33 and consistently they reported that the males were in majority 180 (90.0%) and females were 20 (10.0%). In the study by Deniz G et al[14] reported that the mean age of the study subjects was 60.06±0.34 of females and 59.28±0.34 years of the males and inconsistently they

Table III: Complications according to various techniques (n=100)

Complications	Procedures					p-value
	T- ST	Crush ST	*Culotte ST*	Kissing ST	Total	
Edge dissection	5	6	8	1	20	0.011
	5.0%	6.0%	8.0%	1.0%	20.0%	
Thrombosis	2	3	2	1	8	
	2.0%	3.0%	2.0%	1.0%	8.0%	
Recurrent MI	7	1	2	1	11	
	7.0%	1.0%	2.0%	1.0%	11.0%	
Side branch closure	5	1	3	1	10	
	5.0%	1.0%	3.0%	1.0%	10.0%	
No complications	11	7	7	26	51	
	11.0%	7.0%	7.0%	26.0%	51.0%	
Total	30	18	22	30	100	
	30.0%	18.0%	22.0%	30.0%	100.0%	

reported that the females were in majority as compared to males. Above difference in average age and genders may because of the difference in the study samples sizes and selection criteria.

In this study, according to the choice of techniques, T Stent Technique was used in 30% of study population, Crush Stent Technique was used in 18% of the cases, Cullotte Stent Technique was done in 22% of the cases, and kissing Stent Technique was done in 30% of the study subjects. In the line of this series Wang R et al[15] reported that 37% were treated by the provisional stenting, 7% receive T-stenting, 19% underwent crush stenting, 15% treated by culotte stenting, 12% with the DK crush, and 9% treated by the dedicated bifurcation stent. Final kissing balloon was done in 70% of the cases.[15] Furthermore in this study in all the procedures, T stenting technique success rate was 76.7%, crush technique was succeeded in the 83.3% cases and Kissing Stent Technique was most successful in treating coronary bifurcating lesions 93.3% with very lower rate of complications, while Cullotte Stent Technique was successful in treating coronary bifurcating lesions with success rate of 27.3%.

In the comparison of this study, Morris PD et al[16] reported that the SKS procedure for managing unsecured LMS bifurcation illness doesn't distort the stents, has been linked to favorable hemodynamics, coverage of the tissues exposed struts, as well as a reduced rate of the restenosis performed by the contemporary stents. While Kervinen K et al[17] reported that that the individuals who had coronary bifurcation lesions and who were managed with either the crush or the culotte stent approach had similar clinical outcomes after a follow-up period of 36 months. Although in another previous study, the crush approach was used with paclitaxel-eluting stents, there was an 8% risk of TLR after a follow-up period of 36 months.[18] On the other hand, Chen SL et al[19] concluded that, the double kissing crush stenting technique has been shown to be related with a decreased rate of goal lesion revascularization. Individuals who have complex bifurcations could have their revascularization improved by using the appropriate stenting technique, which is based on the intricacy of the lesions.[19] Whereas Zheng XW et al[20] conducted the comparative study and they observed that, after a year of follow-up, the therapeutic and angiographic outcomes of the bifurcation stenting procedures (culotte and crush) were found to be satisfactory. Above various studies showed varying outcomes according to various stenting techniques. This study also has numerous limitations, including a small sample size and a single center study; as a result, the finding cannot be suggestive as finally conclusive, but rather, additional large-scale studies are recommended to prove the findings.

Conclusion

In our study, the kissing stenting technique was most frequently chosen technique and was observed to be the most successful and least complicated technique in treating coronary bifurcating lesions. Due to decreased rates of angiographic restenosis, this approach is an interesting option for bifurcation stenting in achievable and even challenging bifurcation lesion anatomies.

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