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Necessity of Routine Pre and Post Quantitative Coronary Angiography for all Percutaneous Coronary Interventions with Drug Eluting Stenting

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Abstract: ***Objective: Optimal stent expansion during PCI is critical in detecting immediate and long term outcome. Quantitative coronary angiography enhances the current practice to assess coronary lesion rather than visual estimation. In this study we attempt to analyze the routine Pre and post stenting QCA with multilevel parameters including longitudinal and luminal (radial)diameter for all the cases undergoing Percutaneous coronary intervention with drug eluting stent. The aims of QCA measurement is to select appropriate stent size , to decide necessity of preand post dilatation, to determine the adequacy stent deployment and to evaluate the Prevalence of stent under expansion during routine PCI. Methodology: In this study we analyzed the stents for adequate deployment in 54 patients who were undergoing percutaneous coronary angiography (PCI) with drug eluting stent in our catheterization laboratory, Institute of cardiology , Madras Medical College, Chennai.It is a prospective observational study conducted from November 2017 to April 2018. We used Direct quantitative coronary angiography automatic calculated system for measuring stent length and luminal diameter at multiple level before and immediately after deployment. We analyzed that the adequate stent deployment was supposed to be symmetrical and with no significant longitudinalshortening. Proforma was used to collect patient's details and record the Direct QCA analysis. Statistical Package for the Social Sciences SPSS version 16 was used to analyze the data. Results: A total of 54 subjects were included in the study, their mean age was 52 years and 76 %(40) were male. The Drug which used in the DES was Sirolimus. Left anterior descending artery (LAD) was most commonly stented artery, followed by Right coronary artery and circumflex respectively. The Mean ratio of the minimum luminal diameter to original stent diameter was 0.74. A ratio greater than 0.7 was achieved in 75.92% of the patients so that they had a better symmetry. By quantitative coronary angiography (QCA) 24%(13) of the stented lesions were having >30% radial shortening due to under expansion indicate residual stenosis while 75.92(41)% of the stents were adequately deployedby the method. The ratio of deployed stent length to the original stent length< 90% was considered as longitudinal shortening . from our study9.25% (5) of the patients had longitudinal shortening. Conclusion: we found there was a underexpansion dueto significant radial (minimum luminal diameter) diameter shortening considered as suboptimal deployment of DES in 24%(13) and longitudinal shortening of stent in 9.25% (5) of all the patients who underwent PCI from our study. It is statistically significant (p valve of <0.005)and needed further study. Even though various factors are associated with stent under expansion it is mandatory to do routine pre and post QCA for all the cases undergoing PCI to identify the cases with persistent intermediate lesion(underexpansion) to subject further functional evaluation to decide further management***

Keywords: Acute coronary syndrome(ACS),Quantitative coronary angiography (QCA), percutaneous coronary intervention (PCI), right coronary artery (RCA), left anterior descending artery (LAD), left circumflex coronary artery (Circ).IVUS-Intravascular ultrasound, FFR-Fractional flow reserve

1. Introduction

Optimal stent expansion during PCI is critical in detecting immediate and long term outcome. Quantitative coronary angiography enhances the current practice to assess coronary lesion rather than visual estimation. In this study we attempt to analyze the routine Pre and post stenting QCA with multilevel parameters including longitudinal and luminal diameters for all the cases undergoing Percutaneous coronary intervention with drug eluting stent. The QCA measurement is doing as a routine before stenting aimed to select appropriate stent size and to decide necessity of pre dilatation. The QCA measurements again at after stenting is used to decide the necessity of post dilatation and to assess adequacy stent deployment. From our study we also utilized QCA method to assess the Prevalence of longitudinal and radial under expansion of DES during routine PCI.

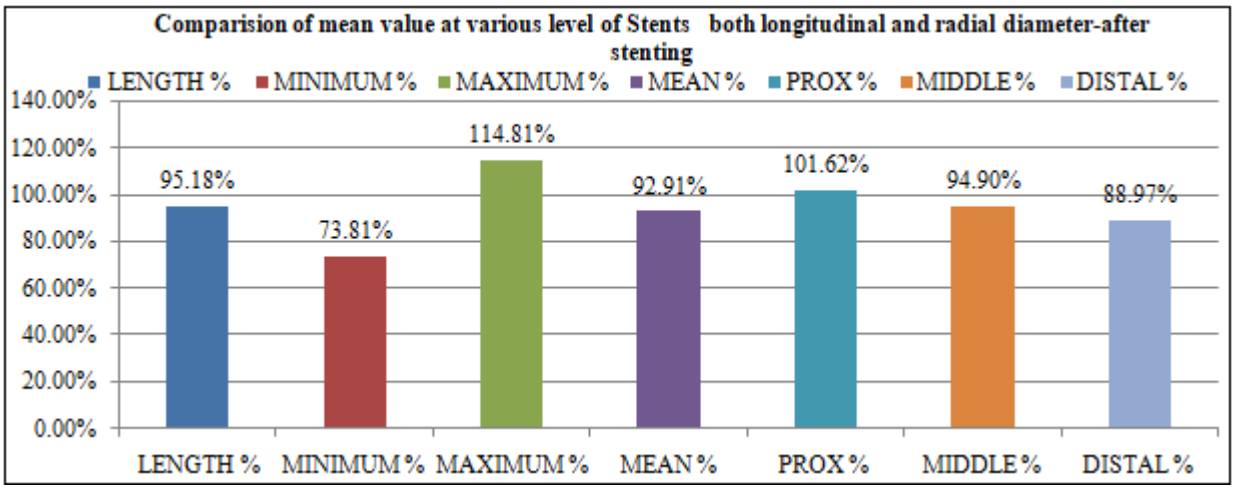
2. Methodology

In this study we analyzed the stents for adequate deployment in 54 patients who were undergoing percutaneous coronary angiography (PCI) with drug eluting stent at our catheterization laboratory, Institute of cardiology, Madras Medical College, Chennai. The study was conducted from January 2018 to March 2018 as a prospective observational study. The Percutaneous trans luminal coronary angioplasty (PTCA) planned after doing coronary Angiogram cases were included in this study. LMCA stenting and primary PCI were excluded. We used Direct quantitative coronary angiography automatic calculated system for measuring stent length and luminal diameters at multiple level before and immediately after stent deployment with or without dilatation. It is considered the stent was adequately deployed if the ratio of minimum luminal diameter to original stent radial diameter

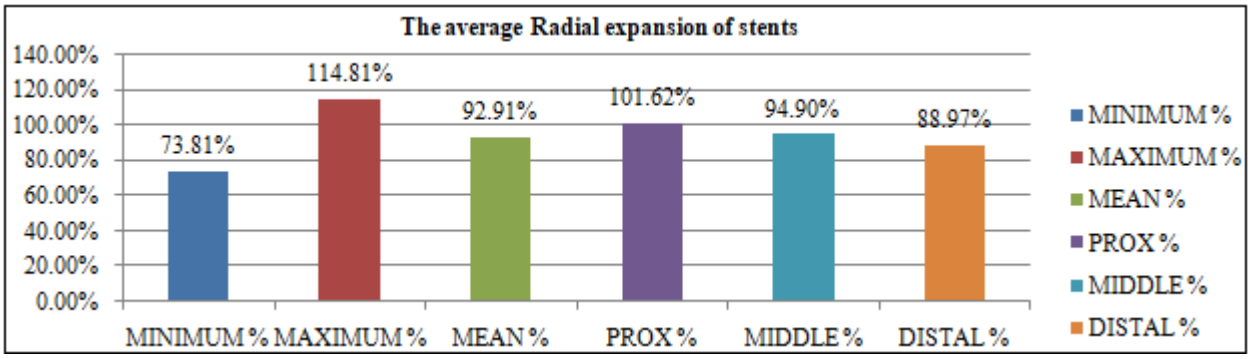
was above0.7 and the ratio of minimum measured stent length(longitudinal diameter) after deployment to the original stent length above 90%.We analyzed for adequate stent deployment was supposed to be symmetrical and with no significant longitudinal shortening. Proforma was used to collect patient's details and record the Direct QCA analysis. Statistical Package for the Social Sciences SPSS version 16 was used to analyze the data.

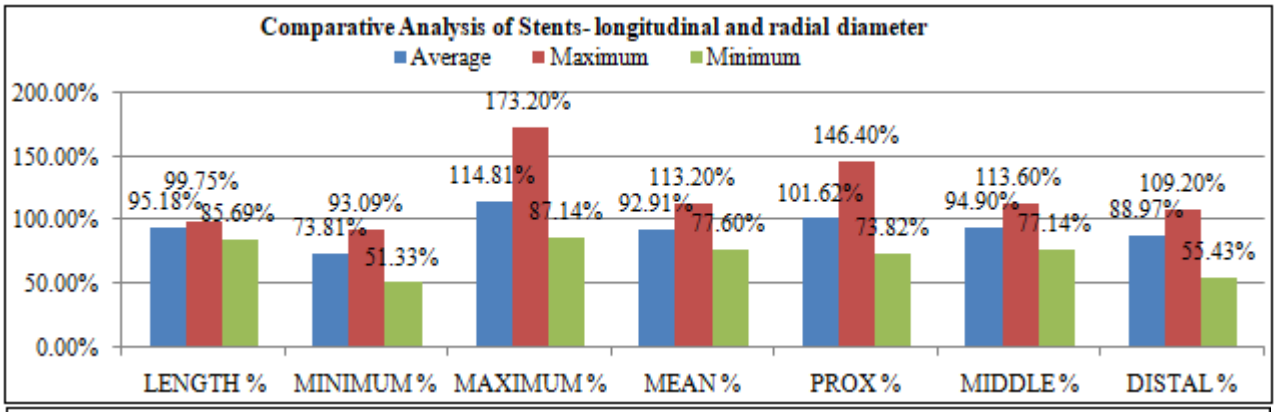
3. Results

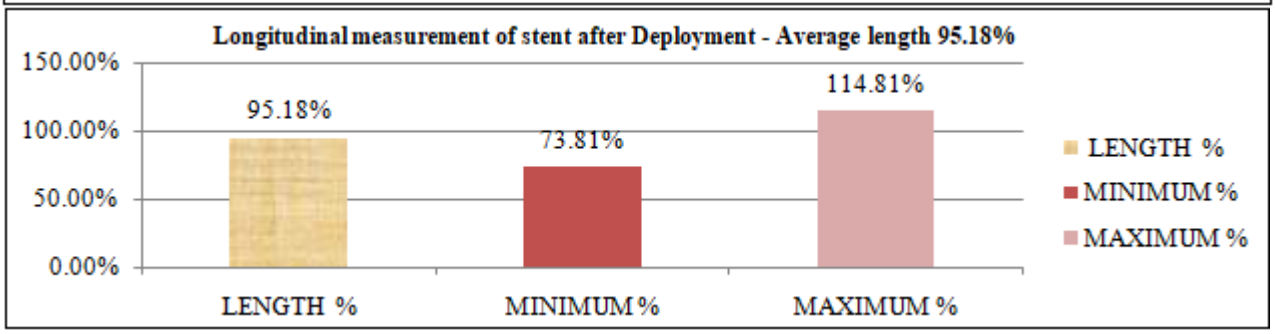
A total of 54 subjects were included in the study, their mean age was 52 years and 76 %(40) were male. Risk factors alone for Diabetes alone were 7 %(4), Hypertensives alone were 11%(6), only the risk factor of Smoking were 13%(7) and with multiple risk factors found in 69%(37) . Acute coronary syndrome were 93%(50) , Non ACS 7%(4) , STEMI were 78%(42) , NSTEMI and unstable angina were 15%(8). Drug eluting was used and the main drug in DES was Sirolimus. Left anterior descending artery (LAD) 69%(37)was most commonly stented artery, followed by Right coronary artery 24% (13)and circumflex 7%(4) respectively. The Average Mean ratio of the minimum luminal diameter to original stent diameter was 0.74. A ratio greater than 0.7 was achieved in 75.92% (41) of the patients so that they had a better symmetry. By quantitative coronary angiography (QCA) 24%(13) of the stented lesions were having greater than 30% radial shortening indicate residual stenosis while 75.92(41)% of the stents were adequately deployed by the method. The rate of deployed stent length to the original stent length > 90% achieved in 90.75%(49) of the patientsand 9.25%(5) had< 90% considered as longitudinal shortening .we have done pre dilatation in 98% patients undergoing PCI with the range from less than 10 atm (19%) to maximum of more than 15 atm (30%) and post dilation in 85% of the cases range from less than 10 atm (9%) to maximum of more than 15 atm (15%).



The mean value of longitudinal diameter(length) ratio of deployed stents was 95.18% and the MLD ratio was 92.91%.The mean luminal diameter ratio at proximal, mid and distal level of stents are 101.62%,94.90%,and 88.97%.







4. Discussion

In this study we assessed that the stents were deployed adequately with symmetrical expansion without significant longitudinal shortening measured by Direct Quantitative coronary angiography .The Mean ratio of the minimum luminal diameter to original stent diameter ratio greater than 0.7 was achieved in 76%(41) of the patients so that they had a better symmetry. When evaluating coronary lesion the radial diameter and length of stenosis are only two of many characteristics to consider. By using QCA method 24%(13) of the stented lesions were having greater than 30% radial shortening and 9.25% (5)with longitudinal shortening indicate residual stenosis. Our success rate of deployment 76% was compared with standard success rate of stent deployment range from 61% to 92% based on AHC/ACC coronary lesion classification from TYPE A lesion have procedural success rate 92% and low complication rate, TYPE B lesion have a 72% success rate with 10% complication and TYPE C lesion have only a 61% success rate with 21 % complications which are associated with the characters of lesion such as 1.lenght of lesion more than 20 mm 2.Excess tortuosity 3. Diffuselesion 4. Heavy calcification 5. Excess thrombus burden6.Ostial lesion7.severity of stenosis grade including total occlusion with duration more than 3 months 8.proximal or bifurcating lesion and 9.Degenerated venous graft with friable lesion.

In our study we found that among the significant numbers of stents 24%(13) showed suboptimal expansion and needed further intervention after subject to special investigation such as 3D-QCA,FFR or by IVUS guided stent implantation is regarded as an effective tool for adequate stent expansion which are not readily available in all the centers where they are doing routine PCI and are not considered as class 1 recommendation.

It is mandatory to do routine Pre & Post Stenting QCA for all the patients undergoing PCI with DES and considered as class 1 recommendation in all the centers doing routine PCI in all over the world.

5. Limitation of our study

It is a small prospective observational study. The functional severity of the coronary stents depends not only on the anatomical severity of stenosis but also based on the factors like location of stenosis and mass of viable myocardium distal to the stenosis. We did not take account of these factors in our study. It can be further studied with nowadays increasing availability of special investigation like FFR/IVUS for better functional assessment to plan further intervention if there is persistent under expansion grade severe.

6. Conclusion

Routine QCA measurement is advised for all the PCI procedures with DES necessarily before pre dilation or stenting for selection of adequate stent size. It is also advised to do QCA measurement after stentingeither before or after post dilatation for assessing the stentoptimal expansion .Our study showed24%(13) of the patients with significant radial shortening with suboptimal deployment suggestive of residual stenosis and it is statistically significant (p value of <0.005). 9.25% (5) showed significant longitudinal shortening. Despite the adequate optimum pressure stent deployment with pre and post dilatation the persistent under expanded residual stenosis

are subjected to further functional assessment to decide further management .

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