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CORONARY ANGIOPLASTY IN MULTIVESSEL DISEASE: REAL-LIFE INSIGHTS AND CLINICAL IMPLICATIONS

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ABSTRACT:

Background: The study evaluates medium-term outcomes of coronary angioplasty in patients with multivessel coronary artery disease (CAD) in real-life conditions. While coronary artery bypass grafting (CABG) has been the gold standard for severe multivessel lesions, advancements in technology and pharmacology have made angioplasty a viable option. Functional revascularization, guided by fractional flow reserve (FFR), challenges the traditional notion of multivessel status, prioritizing functionally optimal over angiographically complete revascularization.

Methods: A retrospective analysis of patients with multivessel CAD admitted between January 2006 and December 2010 was conducted. Inclusion criteria comprised significant stenosis in at least two major coronary arteries, while those with prior CABG or angioplasty were excluded. Patient demographics, angiographic findings, and clinical outcomes were collected via phone interviews, medical records, and consultation.

Results: Key cardiac events during follow-up included all-cause mortality, recurrent revascularization (surgical or percutaneous), myocardial infarction (with or without Q wave), and cerebrovascular accident (CVA).

Conclusion: The study aims to provide insights into the efficacy and safety of coronary angioplasty as a treatment option for patients with multivessel CAD in real-world settings.
KEYWORDS: Coronary artery bypass grafting (CABG), Fractional flow reserve (FFR), Functional revascularization, Angiographic findings, All-cause mortality, Recurrent revascularization, Myocardial infarction, Cerebrovascular accident (CVA)

INTRODUCTION:

The prognosis for multivessel coronary artery disease is not good. The gold standard for treating severe multivessel lesions and stenoses of the left common trunk (TCg) is still coronary artery bypass grafting (CABG) (1-2)(De Cannière et al., 2001; Varani et al., 2008). The advancement of technology and the enhancement of the pharmacological milieu have made coronary angioplasty a viable and secure therapeutic option for patients with many vessels.

Reference	
[1]	De Cannière, D., Jansens, J. L., Knaepen, P. J., Wijns, W., & Cauwelaert, P. V. (2001).
	Early and late outcome after off-pump coronary Bypass Surgery in Patients with
	Triple vessel disease: a single-center experience. European Journal of Cardio-
	thoracic Surgery, 19(4), 449-455.
[2]	Varani, E., Balducelli, M., Aquilina, M., Vecchi, G., & Vecchi, G. M. (2008).
	Percutaneous coronary intervention or bypass surgery in multivessel disease?
	Journal of Cardiovascular Medicine, 9(7), 659-666.
[3]	Jiménez-Navarro, M. F., Alonso-Briales, J. H., Hernández-García, J. M., & Segura-
	Heras, J. V. (2006). Functional assessment of coronary artery disease by fractional
	Flow reserve: can it change the treatment approach in multivessel coronary artery
	disease? Revista Española de Cardiología (English Edition), 59(9), 915-921.

Moreover, the notion of multivessel status has been upset by functional revascularization based on FFr, which changes the treatment objective to functionally optimal revascularization without necessarily being angiographically complete (3)(JIMÉNEZ-NAVARRO et al., 2006).

Our proposal in this work is to assess the medium-term outcomes of coronary angioplasty in individuals with multiple vessels under "real-life conditions."

Methods and Patients:

This descriptive study looked back at multivessel patients admitted to our facility between January 2006 and December 2010. More than 70% stenosis on at least two major coronary epicardial trunks, such as the anterior interventricular (proximal or middle involvement), and more than 50% solitary or related stenosis on the TCG indicate multivessel status. Individuals who had already received coronary artery bypass grafting or angioplasty were not eligible. We determined the patients' angiographic and clinical profiles and examined the vital cardiac events that transpired during the follow-up. These details were gathered over the phone with the patient or attending physician and from hospitalization and consultation records. Observed were the following significant events: death from any cause, recurrent revascularization (surgical or

percutaneous), myocardial infarction (MI) with or without Q wave, and cerebrovascular accident (CVA).

Analytical statistics

The program was used to examine the data that were gathered. For the qualitative variables, we computed relative and straightforward frequencies. For quantitative variables, we calculated the range, means, and medians.

The Student's t-test for independent series was used to compare two means on independent series. The Pearson chi-square test compared the fourth percentages on an independent series. Using the Kaplan-Meier method to establish survival curves, survival data free of cardiovascular events were examined. In univariate analysis, the log-rank test was used to compare survival curves; in multivariate analysis, Cox regression was used to look for prognostic markers for survival(Millan-Iturbe et al., 2018).

The significance threshold for each statistical test was set at 0.05. outcomes

The study population had a mean age of 60.7 ±10.6 years, with 125 males and 40 women (Table I). A significant percentage of diabetics (53.9%) were identified, and 78.2% of patients had multivessel status identified after acute coronary syndrome (ACS).

Clinical characteristics of the population

Parameter	Average %
Age average	60.7
Male	75%
Diabetes	53.9% ≥ 3
FDRCV	41%
ATCD IDM	4.8%
ATCD stroke	9.2%
CRI	10.9%
SCA	78.2%
Stable angina	11.5%
Average LVEF	52.4%

Acute coronary syndrome (sCa), chronic renal failure (IRC), myocardial infarction (idM), stroke (aTCd), left ventricular ejection fraction (FeVg), and cardiovascular risk factors (FdrCV) are all l isted.

The angiographic investigation made it feasible to find 518 significant coronary lesions. Of the lesions, one in four had calcification, 4.6% had chronic occlusions, 6.17% had thrombotic lesions, and 38.25% had complex lesions (classified as category B2 or C of the coronary classific ation).

Additionally, we found 72 bifurcation lesions,and 18 individuals had substantial TCg damage.

52.48% was the mean left ventricular ejection fraction. Coronary angioplasty was performed within a median of 11.7 ± 17.6 days.Just 54.5% of patients had total revascularization, defined as revascularization of all lesions within 30 days after coronary angiography(Gagnor et al., 2015). There were 518 lesions in all.

Following angioplasty, two patients developed MI associated with noreflow.

We observed one death that happened in the hospital stage related to a possible thrombosis of a stent on the iVa.

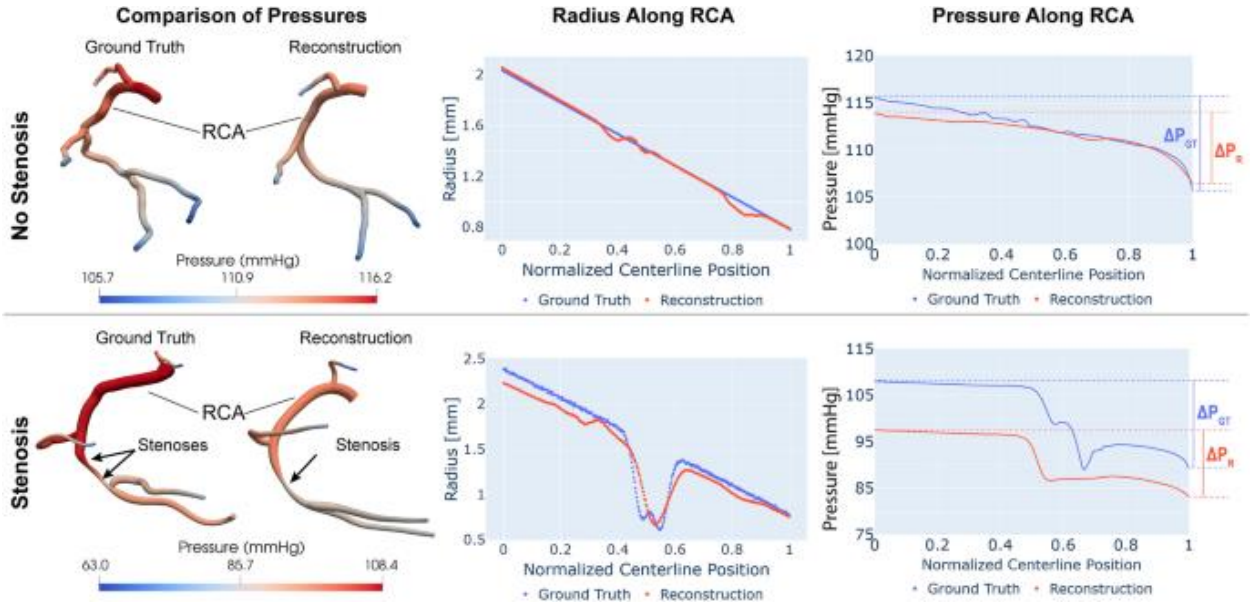
After an average follow-up of 22.4 months + 15.09, we noted ten deaths from cardiovascular causes. The rate of Figure 2a shows that the 5-year survival rate was 93%, and after four years, 50% of the patients had already experienced a major cardiac event. This means the survival rate without major cardiac events at four years was 53%. Figures 2, C–d show that in multivariate analysis, the only independent prognostic factors for the incidence of MaCCe were diabetes (p=0.003) and age over 70 (p=0.01); inadequate revascularization, on the other hand, was not linked to the occurrence of major cardiac events (p=0.74).

Thirteen patients had de novo lesions, one experienced late stent thrombosis, and thirty-two experienced in-stent restenosis, 87% of which happened on bare stents. During follow-up, 32 patients benefited from further revascularization(Lee et al., 2006).

Table 2: Angiographic and procedural characteristics

Total number of lesions: 518	
Calcified lesions	25.09%
Class B2 /C (ACC/AHA)	38.25%
Chronic occlusion	4.63%
Bifurcation lesions	13.89%
Complete revascularization	54.5%
Total number of stents: 379	
Number of stents/patient	2.29
Stent/patient length	44.28 mm
Number of bare stents	272 (71.39%)
Number of active stents	107 (28.6%)
Number of patients with ≥ 1 active stent	69 (41.18%)
Stenting mode - Balloon dilation	3.7%
- Pre-dilation	22.99%
- Direct stenting	67.64%
- Post-dilatation	3.74%

Average stent length (mm)	19.53 mm
The average diameter of stents (mm) is 2.94 mm	
Average inflation pressure	14.64 Atm



conversation

Multivessel individuals who underwent angioplasty for revascularization saw satisfactory immediate results; however, the medium-term outcomes were less clear-cut since one in two of the patients required hospitalization again for a significant cardiac event after four years. 41% of the patients in the study group had at least three cardiovascular risk factors, placing them at high cardiovascular risk. In contrast to previous research, it stood out for having a more significant percentage of diabetics (53.9%), which may indicate that Tunisian coronary artery disease is unique. It should be noted that 35.5% of patients in the sYnTaX trial (2)'s angioplasty arm had diabetes, with 27.88% of them using insulin.

In 78.2% of the patients in our work, multivessel status was identified after ACS. This contradicts the literature, which states that stable angina is the most common cause of multivessel status detection. As demonstrated by the sYnTaX study (2) and the auTaX study (4)(Hlatky et al., 2004), individuals who presented with a myocardial infarction were excluded from most of the studies(Van Wyk, 2009).

In the medium run, the combination of multivessel status and acute coronary syndrome has a harmful prognostic effect. A statistically significant difference was observed at six months, one year, and two years when the MaCCe-free survival of patients treated for stable angina was compared to those admitted for ACS without elevation of the TS segment in the auTaX registry (4). Class A or B1 lesions, accounting for 61.7% of lesions in our dataset, were the most common lesions (aCC/aHa categorization). The revascularization technique was chosen based partly on the lesions' simplicity, yet only 54.5% of cases had total revascularization. The

substantial percentage of patients who had their myocardial infarction investigated after it was too late accounts for the poor rate of complete revascularization by the 4th compared to the literature (5)(Lee et al., 2014). Subsequently, the angioplasty surgeon saw relatively intricate lesions irrigating areas without any recorded evidence of viability or ischemia. The investigations show that the multivessel lesions treated vary in complexity depending on the angiographic condition. Lesions in the auTaX research (4) were primary, with only 15% of chronic occlusion and 19% of bifurcation lesions.

Conversely, in the sYnTaX trial (2), the aTC-treated lesions were complicated, comprising 24.2% occlusions and 72.4% bifurcation lesions. Class B2 lesions comprised most of the (6)(Park et al., 2010) lesions in the ARTS II trial. The percentage of utilization of active stents in our series is still modest (28.6%) despite the impressive outcomes reported with them in the revascularization of complex lesions (bifurcations, chronic occlusions, and common trunk stenosis). Extremely tight supervision over their use has been necessitated by issues with active stent cost and certain patients' inability to comply with Clopidogrel therapy. After a year, the death rate in our series was 4.8%. Our rate, which is among the highest in the literature, appears to be associated with both the high rate of individuals with diabetes included in our work and the high frequency of sCA. There is ample evidence to suggest that diabetes negatively affects the long-term outcomes of multivessel angioplasty. Multivessel diabetic patients benefit better from surgical revascularization than from angioplasty with active stents, according to the FreedoM trial (7)(Valgimigli et al., 2007). One thousand nine hundred diabetic patients were enrolled in the trial and were randomized to receive coronary artery bypass grafting or angioplasty for revascularization. In the stent group, the five-year death rate was 26.6%, while in the surgical arm, it was 18.7% ($p = 0.049$). The low rate of myocardial infarction ($p<0.001$) supported the benefit of coronary bypass surgery(Sionis, 2005).

Over 70 years of age was an independent predictor of mortality in our series ($p=0.008$). Numerous recent investigations on coronary angioplasty in patients with multiple vessels discovered a noteworthy rise in mortality that correlated with the patient's age. (2). The one-year survival rate in the Japanese Credo-Kyoto registry (8)(Jurado-Román et al., 2013) was 89.4% for patients over 75 and 96.7% for individuals under 75. individuals under 75 years of age had a 3-year follow-up survival rate of 92.6%, whereas individuals beyond 75 had a survival rate of 74.6%. The survival rate without MaCCe in our investigation was found to be inconsistent: it was lower in studies using active stents (arTs ii (6), sYnTaX (2), auTaX (4)) and higher in studies using bare stents (arTs i (9)(Cui et al., 2019), Mass ii (10)(Brueren, 2005). Using a hybrid approach: Any comparison with data from the literature is limited when integrating both bare and active stents. Due to the variability of clinical and epidemiological data and the exclusion of MI and unstable angina from most studies, even though they account for the most frequent admissions in our series, comparing our results with those of extensive studies is challenging. Most MaCCe (21%), measured by new revascularizations, occurred during our patients' follow-up. All studies that have examined multivessel have found this to be the case, most notably the arts I study (9), which found that at one year, the rate of new revascularizations in the stent group was 16.8%, and at five years, it was 30%. The rate of major cardiovascular events in patients treated with an active stent was significantly greater than that of the bypass patient group. Still, it remained lower than that seen with the bare stent, according to the recently published 5-year

results of the sYnTaX research. Most of these group differences can be explained by the angioplasty arm's greater revascularisation rate (11)(Loeb et al., 2000). The study also validated the interest of the sYnTaX score. Compared to patients in the intermediate risk or highest tertile, those in the lowest risk category had a greater survival rate without significant cardiovascular events. The significance of this score in the revascularization approach of multivessel coronary artery disease is confirmed by the fact that it appears to be an independent prognostic factor of major cardiovascular events and stent thrombosis at five years (12)(Lettieri et al., 2009).

According to statistics that align with the literature, diabetics had a higher incidence of cardiac severe events throughout follow-up (13)(Aragão et al., 2018). Restenosis is still a significant risk associated with angioplasty in people with diabetes. For multivessel diabetics, bypass surgery is the recommended revascularization approach; nonetheless, diabetic patients are at considerable risk regardless of the technique they select. Active stents are crucial when angioplasty is selected for this population, and revascularization shouldn't overshadow the still-crucial components of secondary prevention. Our findings are a reflection of our routine clinical practice. They are based on several factors, including a high percentage of diabetic patients—many of whom are unbalanced—who typically seek medical attention after an ACS, a low rate of total revascularization, and a low usage of active stents(Appleby et al., 2010).

CONCLUSION

Medium-term outcomes from multivessel angioplasty are inconsistent and include many new revascularizations. Diabetes and advanced age both independently predicted the development of MaCCe. The decision-making process for treating multivessel coronary artery disease is based on a multidisciplinary strategy based on clinical and angiographic scores. To ensure that the patient receives the best possible therapy, the "Heart team" approach needs to be promoted.

References:

Appleby, C. E., Mackie, K., Džavík, V., & Ivanov, J. (2010). Late outcomes following percutaneous coronary interventions: results from an extensive, observational registry. *Canadian Journal of Cardiology*, *26*(7), e218-e224.

Aragão, I., Peixoto, E., Peixoto, R., Simões, S., Marcolla, V., Spritzer, T., Ferreira, P., Santos, C., Macêdo, T., & Anjos, I. (2018). PO155 Primary Percutaneous Coronary Intervention and Biological Sex Influence. Independent Risk Factors For Death And Major Events After Immediate and Medium-Term Follow-Up. *Global Heart*, *13*(4), 415-416.

Brueren, B. R. G. (2005). Percutaneous coronary interventions in the real world: lessons from the nineties.

Cui, K., Lyu, S., Song, X., Liu, H., Yuan, F., Xu, F., Zhang, M., Wang, W., Zhang, M., & Zhang, D. (2019). Drug-eluting stent versus coronary artery bypass grafting for diabetic patients with multivessel and left central coronary artery disease: a meta-analysis. *Angiology*, *70*(8), 765-773.

De Cannière, D., Jansens, J.-L., Goldschmidt-Clermont, P., Barvais, L., Decroly, P., & Stoupel, E. (2001). Combination of minimally invasive coronary bypass and percutaneous transluminal coronary angioplasty in the treatment of double-vessel coronary disease: two-year follow-up of a new hybrid procedure compared with "on-pump" double bypass grafting. *American Heart Journal*, *142*(4), 563-570.

Gagnor, A., Tomassini, F., Cerrato, E., Rolfo, C., Gambino, A., Giolitto, S., Favro, E., Bollati, M., Tizzani, E., & Varbella, F. (2015). Unprotected Left-Main Coronary Angioplasty in the Elderly

in a High Volume Catheterization Centre without On-Site Surgery Facilities: Immediate and Medium Term Outcome—The Old-Placet Registry. *Advances in Vascular Medicine*, *2015*.

Hlatky, M. A., Boothroyd, D. B., Melsop, K. A., Brooks, M. M., Mark, D. B., Pitt, B., Reeder, G. S., Rogers, W. J., Ryan, T. J., & Whitlow, P. L. (2004). Medical costs and quality of life 10 to 12 years after randomization to angioplasty or bypass surgery for multivessel coronary artery disease. *Circulation*, *110*(14), 1960-1966.

JIMÉNEZ-NAVARRO, M. F., ALONSO-BRIALES, J., HERNÁNDEZ-GARCÍA, J. M., Curiel, E., Kühlmorgen, B., GÓMEZ-DOBLAS, J. J., GARCÍA-PINILLA, J. M., Robledo, J., & De Teresa, E. (2006). The usefulness of fractional flow reserve in multivessel coronary artery disease with intermediate lesions. *Journal of Interventional Cardiology*, *19*(2), 148-152.

Jurado-Román, A., López-Melgar, B., García-Tejada, J., Hernández-Hernández, F., Velázquez-Martín, M. T., Albarrán-González-Trevilla, A., Rubio-Alonso, B., Díaz-Anton, B., Andreu-Dussac, J., & Tascón-Pérez, J. C. (2013). Percutaneous coronary intervention in Porto-ostial lesions. Immediate and medium-term results in a real-world cohort. *International Journal of Cardiology*, *168*(3), 3067-3069.

Korotkikh, A., Babunashvili, A., Kaledin, A., Akhramovich, R., Derkach, V., Portnov, R., Kartashov, D., & Kazantsev, A. (2023). Distal radiation access as an alternative to conventional radial access for coronary angiography and percutaneous coronary interventions (according to the TENDERA trial)—C*urrent Problems in Cardiology*, *48*(4), 101546.

Lee, M. S., Kapoor, N., Jamal, F., Czer, L., Aragon, J., Forrester, J., Kar, S., Dohad, S., Kass, R., & Eigler, N. (2006). Comparison of coronary artery bypass surgery with percutaneous coronary intervention with drug-eluting stents for unprotected left central coronary artery disease. *Journal of the American College of Cardiology*, *47*(4), 864-870.

Lee, W.-C., Tsai, T.-H., Chen, Y.-L., Yang, C.-H., Chen, S.-M., Chen, C.-J., Lin, C.-J., Cheng, C.-I., Hang, C.-L., & Wu, C.-J. (2014). Safety and feasibility of coronary stenting in unprotected left primary coronary artery disease in the actual world clinical practice—a single center experience. *PloS one*, *9*(10), e109281.

Lettieri, C., Savonitto, S., De Servi, S., Guagliumi, G., Belli, G., Repetto, A., Piccaluga, E., Politi, A., Ettori, F., & Castiglioni, B. (2009). Emergency percutaneous coronary intervention in patients with ST-elevation myocardial infarction complicated by out-of-hospital cardiac arrest: early and medium-term outcome. *American Heart Journal*, *157*(3), 569-575. e561.

Loebe, M., Potapov, E. V., Hummel, M., Weng, Y., Bocksch, W., & Hetzer, R. (2000). Medium-term results of heart transplantation using older donor organs. *The Journal of heart and lung transplantation*, *19*(10), 957-963.

Millan-Iturbe, O., Sawaya, F. J., Lønborg, J., Chow, D. H., Bieliauskas, G., Engstrøm, T., Søndergaard, L., & De Backer, O. (2018). Coronary artery disease, revascularization, and clinical outcomes in transcatheter aortic valve replacement: real-world results from the East Denmark Heart Registry. *Catheterization and Cardiovascular Interventions*, *92*(4), 818-826.

Park, D.-W., Kim, Y.-H., Yun, S.-C., Lee, J.-Y., Kim, W.-J., Kang, S.-J., Lee, S.-W., Lee, C.-W., Kim, J.-J., & Choo, S.-J. (2010). Long-term outcomes after stenting versus coronary artery bypass grafting for unprotected left central coronary artery disease: 10-year results of bare-metal stents and 5-year results of drug-eluting stents from the ASAN–MAIN (ASAN Medical Center–Left MAIN Revascularization) Registry. *Journal of the American College of Cardiology*, *56*(17), 1366-1375.

Sionis, D. G. (2005). The Use of Drug-Eluting Stents in Everyday Clinical Practice: Can the Results of Randomised Trials be Achieved in the "Real World"? *Hellenic J Cardiol*, *46*, 124-127.

Valgimigli, M., Dawkins, K., Macaya, C., de Bruyne, B., Teiger, E., Fajadet, J., Gert, R., De Servi, S., Ramondo, A., & Wittebols, K. (2007). The impact of stable versus unstable coronary artery disease on 1-year outcome in elective patients undergoing multivessel revascularization with sirolimus-eluting stents is a subanalysis of the ARTS II trial. *Journal of the American College of Cardiology*, *49*(4), 431-441.

Van Wyk, J. (2009). The synergy between percutaneous coronary intervention with TAXUS and cardiac surgery study: a surgical perspective: SYNTAX study. *SA Heart*, *6*(4), 230-235.

Varani, E., Balducelli, M., Aquilina, M., Vecchi, G., Hussien, M. N., Frassineti, V., & Maresta, A. (2008). Single or multivessel percutaneous coronary intervention in ST-elevation myocardial infarction patients. *Catheterization and Cardiovascular Interventions*, *72*(7), 927-933.