CARDIOLOGY UPDATES NEWSLETTER

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IN THIS ISSUE

Dear Doctor,

Greetings from Micro Labs Limited. We are happy to bring you "Cardiology updates" which contains latest and interesting news in the field of Cardiology

Contribution of Lung ultrasound sonography B-lines score in the diagnosis of heart failure in acute exacerbation of chronic obstructive pulmonary disease

INTRODUCTION-Chronic obstructive pulmonary disease (COPD) is a significant public health concern due to its prevalence and severity. Acute exacerbations of COPD (AECOPD) often worsen the prognosis and accelerate progression to irreversible respiratory failure.[1] COPD and heart failure share risk factors and can coexist, with an estimated prevalence of up to 25% in COPD populations. HF is frequently undetected in COPD. Patients with COPD exacerbations may have higher rates of both diagnosed and undetected heart failure due to the severity of their condition and physiological stress, which can affect cardiac function.[2] A notable challenge in managing AECOPD is identifying concurrent heart failure (HF), as both conditions share similar symptoms such as dyspnea. Lung ultrasound sonography (LUS) B-lines quantification has emerged as a potential diagnostic tool for HF, but its efficacy in AECOPD remains underexplored. This study aimed to evaluate the diagnostic value of LUS B-lines quantification in detecting HF among AECOPD patients.[1]

METHODS-This was a prospective, cross-sectional multicenter cohort study and enrolled 380 patients. They were divided into two groups based on the final diagnosis of heart failure: 157 patients (41.4%) were classified into the heart failure group (HF group), while 223 patients (58.6%) were categorized into the non-heart failure group (non-HF group). The study enrolled patients aged 18 years and older who presented to the ED with AECOPD. AECOPD was defined as an acute event characterized by a worsening of respiratory symptoms beyond the usual day-to-day variations, necessitating a change in regular treatment. Data collected included demographic information, medical history, physical examination findings, and results from ECG, standard biological tests, BNP levels, and cardiac ultrasound. LUS was performed using a 5-MHz convex probe to assess B-lines in eight chest zones, with the LUS score calculated as the sum of B-lines. A LUS score ≥ 15 was considered indicative of HF. The final diagnosis of dyspnea was made by two senior emergency physicians based on comprehensive clinical evaluation. The diagnostic performance of the LUS score was assessed using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and receiver operating characteristic (ROC) curve analysis. Correlation between LUS score and the E/E' ratio, a marker of left ventricular filling pressure, was evaluated using Spearman's rank correlation coefficient.

RESULTS

Among HF patients, 56 (35.6%) had preserved ejection fraction (LVEF >45%). The mean LUS score was significantly higher in the HF group (26.8 ± 8.4) compared to the non-HF group (15.3 ± 7.1; $p < 0.001$). In the HF subgroup, patients with reduced ejection fraction (LVrEF) had a mean LUS score of 29.2 ± 8.7, while those with preserved ejection fraction (LVpEF) had a mean score of 24.5 ± 7.6, although this difference was not statistically significant ($p = 0.23$). The area under the ROC curve (AUC) for the LUS score in diagnosing HF was 0.71 (95% CI: 0.65–0.76), indicating moderate diagnostic accuracy (Figure 1). The LUS score thresholds were evaluated to determine the best sensitivity and specificity. A LUS score threshold of 5 showed the highest sensitivity (89% [85.9–92.1]) but low specificity (33% [28.3–37.7]). A LUS score threshold of 30 demonstrated the highest specificity (85% [81.4–88.6]) with lower

sensitivity (43% [38–48]). The optimal balance between sensitivity and specificity was observed at a LUS score threshold of 15, with sensitivity of 73% [68.5–77.5] and specificity of 62% [57.1–66.9]. A significant positive correlation was found between the LUS score and the E/E' ratio (R = 0.46, p = 0.0001), supporting the LUS score's association with left ventricular filling pressure and its utility in diagnosing heart failure.

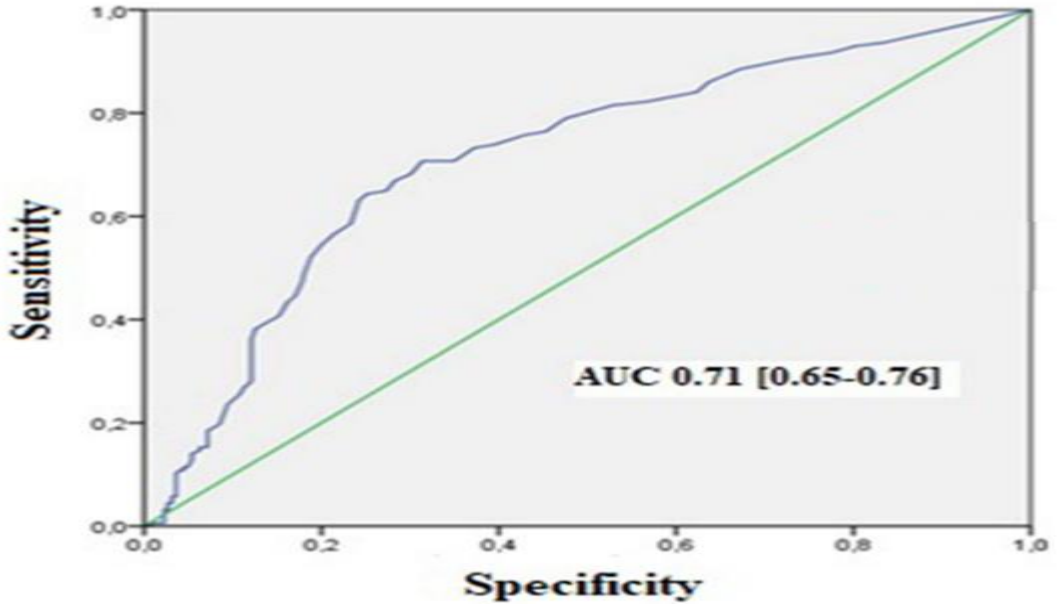

Figure 1. The diagnosis of heart failure in cases of acute exacerbation of COPD is based on the receiver operating characteristic curve of the lung ultrasonography score. Note: 0.65–0.76 is the area under the curve (0.71).

DISCUSSION-This study demonstrated that lung ultrasound (LUS) B-lines quantification is a valuable diagnostic tool for identifying heart failure (HF) in patients presenting with acute exacerbations of chronic obstructive pulmonary disease (AECOPD). The LUS score was found to have good diagnostic accuracy, with high sensitivity at lower thresholds and high specificity at higher thresholds. This supported the potential role of LUS in the emergency setting as a non-invasive, rapid diagnostic test for HF in AECOPD patients.[1] These findings align closely with those of Martindale JL et al. who also investigated the role of LUS in diagnosing HF among patients with acute dyspnea, including those with underlying COPD. Martindale et al. reported similar diagnostic performance, with LUS showing a sensitivity of 85% and specificity of 80% for HF diagnosis when using a comparable scoring system for B-lines.[3]

CONCLUSION-The current study concluded that LUS B-lines quantification should be considered as an early diagnostic tool in the ED for AECOPD patients suspected of having HF. Integrating LUS with clinical assessment and other biomarkers could enhance diagnostic accuracy and improve patient management.

The LUS score may aid in diagnosing HF in AECOPD patients, at least as a rule-in test.

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Relationship between Holter monitoring parameters and out-of-hospital major adverse cardiovascular events (MACEs) occurrence in STEMI patients

INTRODUCTION-Cardiovascular disorders are a primary cause of death globally, with acute ST-segment elevation myocardial infarction (STEMI) being one of the most severe forms of acute coronary syndromes.[1] Recent years have shown a significant increase in the survival rate following acute STEMI due to primary percutaneous coronary intervention (PPCI) and optimum medical care. Poor long-term cardiovascular outcomes, such as heart failure, arrhythmias, and cardiac death occur in certain people.[2] Assessing cardiovascular risk is essential for early intervention and better long-term results in patients receiving percutaneous coronary intervention (PCI) for acute STEMI. Continuous cardiac electrophysiological data was provided by 24-hour Holter monitoring, which makes it possible to identify autonomic dysfunction and arrhythmias that were missed by standard exams. To provide insights into the assessment of cardiovascular risk, this study aimed to investigate the association between Holter monitoring metrics and the incidence of major adverse cardiovascular events (MACEs) in patients with STEMI after PCI.[1]

METHODS-This prospective cohort study involved patients diagnosed with STEMI who subsequently underwent percutaneous coronary intervention (PCI). The primary goal was to evaluate the potential of 24-hour Holter monitoring indices in predicting MACEs, including cardiac death, over a three-year follow-up period. Patient with STEMI who were successfully treated with PCI within 24 hours of symptom onset were included. Holter monitoring was conducted 24-48 hours post-PCI, with the device worn continuously for 24 hours. The data recorded included Heart Rate (HR), Heart Rate Variability (HRV), Standard deviation of normal-to-normal intervals (SDNN), SDANN index, Deceleration Capacity (DC), Premature Ventricular Contractions (PVCs). Patients were followed for a period of three years, with the primary outcome being the occurrence of MACEs, which included cardiac death, recurrent myocardial infarction, and heart failure hospitalization. The secondary outcome was specifically cardiac death. Receiver Operating Characteristic (ROC) analysis assessed the predictive value of HRV indices, DC, and PVCs for MACEs and cardiac death.

RESULTS-The study population included 172 patients, of which 57 (33.1%) experienced MACEs during the three-year follow-up period. Notably, 20 patients (11.6%) suffered from cardiac death. Lower SDNN (odds ratio [OR]: 0.980; p=0.005) and SDANN index (OR: 0.982; p=0.009) were protective against MACEs. In other words, a higher HRV was associated with a reduced risk of adverse events. A higher minimum heart rate was associated with an increased risk of MACEs (OR: 1.075; p=0.005), suggesting that poor autonomic regulation contributes to worse outcomes. Patients with frequent PVCs had a significantly higher risk of MACEs

(OR: 2.685; p=0.016). For cardiac death, SDNN (OR: 0.957; p=0.001) and DC (OR: 0.702; p=0.017) were significant predictors, highlighting the importance of these metrics in long-term prognosis. SDNN had strong predictive power for both MACEs and cardiac death, with areas under the curve (AUC) indicating good discrimination. This suggested that HRV was a reliable marker for identifying high-risk patients. Kaplan-Meier curves demonstrated significantly poorer survival rates in patients with lower HRV (p<0.01) and higher PVC frequency (p<0.01), reinforcing the prognostic value of these indices. At the cut-off value of 19.315 ms, the SDANN index showed minimal efficacy in predicting MACEs, with an AUC of 0.531 (95% CI: 0.433–0.630), a sensitivity of 73.9%, and a specificity of 45.6%. According to these results, the SDNN index shows minimal predictive value, and the Slowest Heart Rate and SDNN were comparatively stronger predictors of MACE occurrence in this patient population (Figure 1A). Notably, at the cut-off of 65.875 ms, SDNN had an AUC of 0.752 (95% CI: 0.625–0.879), a high specificity of 90.8%, and a sensitivity of 55.0%, making it a significant predictor of cardiac death. With an AUC of 0.738 (95% CI: 0.621–0.854), a sensitivity of 50.0%, and an exceptionally high specificity of 86.8% at a 0.145 cut-off, DC4 again stood out (Figure 1B).

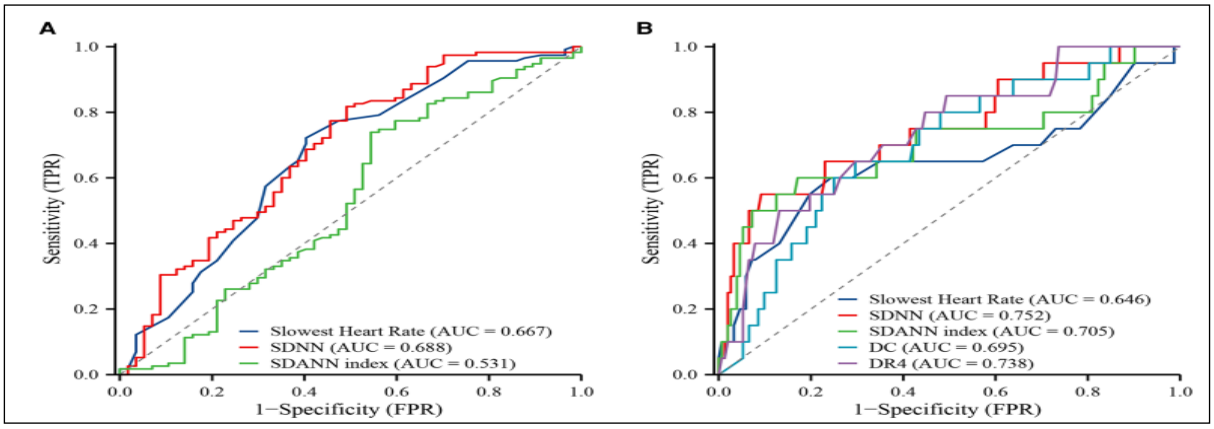

Figure 1. ROC curves for the 24-hour Holter monitoring parameters that indicate the risk of cardiovascular death and MACEs in patients with STEMI. MACEs in (A); cardiac death in (B).

DISCUSSION-According to the findings of the study, MACEs were linked to a higher lowest heart rate.[1] This result was in line with earlier study conducted by Antoni ML et al. which hypothesized that a higher minimum heart rate could be a sign of either increased sympathetic activity or decreased parasympathetic (vagal) tone.[3]

CONCLUSION-The study concluded that HRV metrics, DC, and frequent PVCs derived from 24-hour Holter monitoring can help identify STEMI patients at high risk for MACEs after PCI. This information was crucial for clinicians aiming to improve long-term patient outcomes through early intervention and tailored post-discharge management strategies.

In STEMI patients, HRV, DC measures, and numerous PVCs discovered during 24-hour Holter monitoring were linked to an increased risk of MACEs. Clinicians can detect patients who are at risk early on with the use of these measurements, enabling prompt interventions.

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Association between Predischarge Peak Atrial Longitudinal Strain and NT-proBNP Levels as predictors of major cardiac events (MACE) in patients after Acute Heart Failure hospitalization

INTRODUCTION- Heart failure (HF) remains a significant global health issue, contributing to considerable morbidity and mortality. The post-acute heart failure (AHF) period is particularly critical, with a high risk of rehospitalization and cardiovascular mortality due to residual hemodynamic congestion.[1] Although it has a narrow specificity, N-terminal-pro-brain natriuretic peptide (NT-proBNP) is a widely recognized marker of congestion. Speckle tracking echocardiography (STE) measures peak atrial longitudinal strain (PALS), which is a marker of intracardiac pressure and heart failure prognosis.[2] This study investigates the predictive value of predischarge peak atrial longitudinal strain (PALS) and N-terminal pro-hormone brain natriuretic peptide (NT-proBNP) in forecasting major adverse cardiac events (MACE) within 90 days post-hospitalization in patients with AHF.[1]

METHODS-This single-center, prospective observational cohort study included patients aged 18 years or older who were hospitalized for AHF, either as a new or recurrent episode, regardless of the heart failure phenotype. Patients with heart failure with preserved ejection fraction (HFpEF), heart failure with mildly reduced ejection fraction (HFmrEF), and heart failure with reduced ejection fraction (HFrEF) were all eligible for inclusion. The study included echocardiographic assessments and plasma NT-proBNP measurements within 24 hours before discharge. PALS was measured using speckle-tracking echocardiography to assess left atrial reservoir function, and NT-proBNP levels were quantified using an enzyme-linked immunosorbent assay. Patients were followed for 90 days post-discharge to monitor the occurrence of MACE, defined as rehospitalization or cardiovascular mortality. Statistical analyses included receiver operating characteristic (ROC) curves, Kaplan-Meier survival analysis, and Cox regression modeling to identify independent predictors of MACE.

RESULTS-This study included 67 patients, with a mean age of 56.88 ± 14.57 years. The cohort was predominantly male (65.7%). Of the patients, 59.7% were admitted due to recurrent heart failure, while 40.3% were new cases. Most patients (61.2%) had heart failure with reduced ejection fraction (HFrEF), while 23.9% had HFpEF, and 14.9% had HFmrEF. Hypertension was the most common comorbidity (62.7%), followed by dyslipidemia (44.8%), smoking (43.3%), diabetes mellitus (34.3%), and coronary artery disease (23.9%). During the

90-day follow-up period, 22 patients (32.8%) experienced MACE. Of these, 21 patients (31.3%) were rehospitalized due to worsening heart failure, and one patient (1.5%) died from sudden cardiac death at home. The analysis revealed significant differences between patients who experienced MACE and those who did not, particularly in terms of left atrial volume index (LAVi), left ventricular volume index (LVVi), and predischarge NT-proBNP levels, which were higher in the MACE group. Additionally, the MACE group had lower PALS and LVEF values. ROC curve analysis identified PALS <12% and NT-proBNP >750 pg/mL as optimal thresholds for predicting MACE (Figure 1). PALS had an area under the curve (AUC) of 0.816, with a sensitivity of 77.3% and a specificity of 75.6%. NT-proBNP had an AUC of 0.856, with a sensitivity of 81.8% and a specificity of 77.8%. There was no significant difference between the AUCs of PALS and NT-proBNP (P = 0.553). When both PALS <12% and NT-proBNP >750 pg/mL were combined, the specificity increased to 93.3%, though sensitivity decreased to 63.4%. Kaplan-Meier survival curves demonstrated that patients with PALS <12% had significantly lower survival free of MACE compared to those with PALS ≥12% (43.3% vs. 86.5%; P < 0.001). Similarly, patients with NT-proBNP >750 pg/mL had lower survival rates compared to those with NT-proBNP ≤750 pg/mL (35.7% vs. 89.7%; P < 0.001). Only 17.6% of patients with both low PALS and high NT-proBNP levels were free from MACE during the follow-up period. Cox proportional hazards models identified NT-proBNP >750 pg/mL (adjusted HR: 12.696, 95% CI: 3.446–46.771, P < 0.001) and PALS <12% (adjusted HR: 4.617, 95% CI: 1.394–15.287, P = 0.012) as significant independent predictors of MACE. Additional independent predictors included a history of coronary artery disease (CAD) and diabetes mellitus (DM).

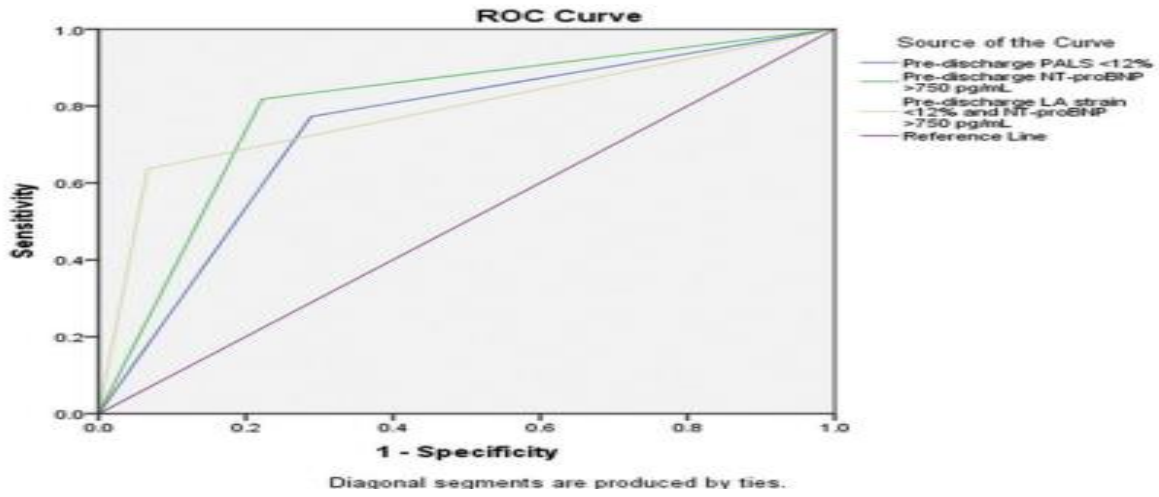

Figure 1. NT-proBNP (nucleotide prohormone brain natriuretic peptide) >750 pg/mL, PALS <12%, and a combination of both NT-proBNP and PALS > 750 pg/mL were compared in terms of receiver operating characteristic curves among patients. NT-proBNP = N-terminal prohormone brain natriuretic peptide, PALS = Peak atrial longitudinal strain, and ROC = Receiver Operating Characteristic

DISCUSSION-The current study underscored the utility of predischarge PALS and NT-proBNP levels as independent predictors of short-term adverse outcomes in patients with AHF.[1] Similar to this, Park et al. analysed the predictive power of PALS in a large cohort of patients with acute heart failure (AHF) using data from the AHF registry in Korea (2009–2016).

The study included 3,818 patients and found that those with PALS values between ≥8.8% and <16.5% had a 1.357 times higher hazard ratio (HR) for rehospitalization or all-cause mortality compared to those with higher PALS values. Patients with PALS values <8.8% had the highest risk of adverse outcomes, with an adjusted HR of 3.818.[3]

CONCLUSION-This study concluded that predischarge PALS and NT-proBNP serve as valuable, independent predictors of MACE in AHF patients, with potential implications for risk stratification and management strategies. These measures could be integrated into routine clinical practice to enhance short-term outcome prediction and guide therapeutic decision-making.

Before discharging, like NT-proBNP levels, PALS is an independent predictor of short-term MACE following AHF hospitalization.

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Case report on Complete Percutaneous Coronary Revascularization: A Refined Approach to address Left Ventricular Dysfunction in Severe Coronary Artery Disease

INTRODUCTION- Heart failure (HF) is a prevalent condition that often coexists with coronary artery disease (CAD), with an estimated prevalence of 50%-65%.[1] The most frequent cause of heart failure (HF) and left ventricular systolic dysfunction (LVSD) is coronary artery disease (CAD). For these individuals, revascularization with coronary artery bypass grafting (CABG) lowers all-cause mortality as compared to medication treatment alone.[2] Recent studies have shown that CAD has overtaken other conditions like hypertension and valvular heart disease as the most common cause of HF. The severity of CAD correlates with a higher risk of developing HF, particularly in patients presenting with reduced or preserved ejection fraction. The 2021 Expert Consensus Pathway recommends coronary revascularization for appropriate patients, but the choice between percutaneous coronary intervention (PCI) and coronary artery bypass surgery (CABG) depends on the patient's overall condition and the complexity of the coronary occlusions. For patients who are not suitable candidates for surgery due to complex coronary anatomy or other comorbidities, hemodynamic-supported complex PCI has emerged as an alternative.[1] This case report elucidated the successful use of complex percutaneous

coronary intervention (PCI) with mechanical circulatory support (MCS) using the Impella device as an alternative to surgical revascularization in a high-risk patient with severe coronary artery disease (CAD) and reduced left ventricular ejection fraction (LVEF).

CASE REPORT-A 64-year-old male with a medical history of hypertension, smoking, and chronic alcohol use was admitted to the hospital with complaints of worsening scrotal and lower extremity swelling. The patient reported progressive dyspnea over the past few weeks, which significantly limited his daily activities. He also mentioned a recent history of fatigue and orthopnea but denied any chest pain. On physical examination, the patient had bilateral pitting edema in the lower extremities and mild scrotal edema. His vital signs were stable, with a slightly elevated heart rate and blood pressure. Laboratory tests revealed elevated troponin levels, indicative of myocardial injury, and a significant increase in pro-BNP levels, suggestive of HF. An electrocardiogram (ECG) showed signs of left ventricular hypertrophy and non-specific ST-T wave changes. A transthoracic echocardiogram was performed, revealing severe global hypokinesis with a left ventricular ejection fraction (LVEF) of approximately 20%. Given the significant reduction in LVEF, coronary angiography was indicated and revealed multivessel coronary artery disease, including chronic total occlusion (CTO) of the right coronary artery (RCA) with collateral circulation from the left coronary system. Additional significant stenoses were identified in the left anterior descending (LAD) and circumflex arteries (Figure 1). The MRI demonstrated viable myocardium in the RCA, circumflex, and most of the LAD territories, except for a non-viable segment in the distal apical septal region. Given the severity of the CAD and the patient's significantly reduced LVEF, the heart team initially considered surgical revascularization via CABG. However, due to the patient's poor left ventricular function and suboptimal target vessels for bypass grafting, the surgical risk was deemed excessively high. Consequently, the patient was not considered a suitable candidate for CABG. After a thorough evaluation by the multidisciplinary heart team, the decision was made to proceed with a staged percutaneous coronary intervention (PCI) strategy, utilizing the Impella CP device for hemodynamic support due to the complexity of the case and the high risk of periprocedural complications. The first stage of the intervention involved multivessel PCI with Impella CP support. The LAD and circumflex arteries were treated with drug-eluting stents, and rotational atherectomy was performed on the heavily calcified segments of the LAD. A few days later, the patient underwent a second procedure to address the chronic total occlusion (CTO) of the RCA. Two drug-eluting stents were successfully placed in the RCA, resulting in complete revascularization. Following the PCI procedures, the patient experienced a marked improvement in symptoms. His NYHA classification improved from Class III to Class I, indicating a significant reduction in heart failure symptoms. At a three-month follow-up visit, repeat echocardiography showed substantial improvement in LVEF, increasing from 20% to approximately 45%-50%. The patient reported a significant improvement in his quality of life, with the ability to perform daily activities without the limitations he had previously experienced. No complications or adverse events were noted during the follow-up period, and the patient remained free of angina.

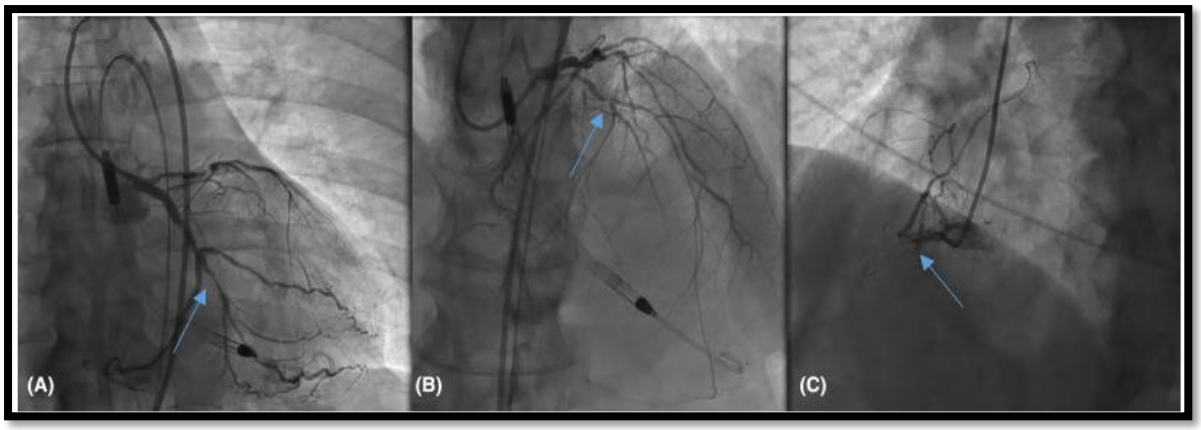

Figure 1. The left (A, B) and right (C) coronary systems exhibit multivessel coronary artery disease. This includes subtotally occluded proximal calcified LAD, 70%–80% proximal, and 70% mid left circumflex stenosis, as well as chronic total occlusion of the right coronary artery, which fills with collaterals from the left coronary system.

DISCUSSION-In the present case, complete revascularization was achieved using multivessel PCI and chronic total occlusion (CTO) PCI with Impella support, resulting in significant improvement in the patient's symptoms and left ventricular ejection fraction (LVEF).[1] This outcome aligned with the findings from recent studies, by van den Buijs DMF et al. which showed that the use of Impella in these high-risk PCI patients provided adequate hemodynamic support, leading to improved outcomes, including a reduction in major adverse cardiac events (MACE) and mortality. The comparison highlighted that Impella-assisted PCI not only improves LVEF but also serves as a viable alternative to surgical revascularization in patients who are not suitable for surgery due to complex coronary anatomy or other high-risk factors.[3]

CONCLUSION-This case highlighted the potential benefits of complete percutaneous coronary revascularization in patients with severe CAD and left ventricular dysfunction who were not candidates for surgical revascularization. The use of advanced PCI techniques, supported by MCS, can lead to substantial improvements in cardiac function and quality of life. As the complexity of patient profiles and coronary anatomy increases, the role of high-risk PCI, particularly in surgically turned-down patients, will likely continue to expand.

Complex percutaneous coronary intervention (PCI) supported by the Impella device can be a viable and effective alternative to surgical revascularization for high-risk patients with severe coronary artery disease (CAD) and reduced left ventricular function.

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