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Managing the frail patient undergoing a percutaneous coronary intervention

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Abstract

Frailty describes an enhanced vulnerability to stressors due to a multisystem impairment, leading to a progressive decline in homeostatic reserve and resiliency. It has been associated with worse clinical outcomes following acute coronary syndrome (ACS) and coronary revascularization. Therefore, frailty status should be taken into careful consideration when treatment strategies are planned. Over the last few decades, the average life expectancy has progressively increased, which has resulted in an increasing number of elderly, frail patients presenting with coronary artery disease and requiring a percutaneous coronary intervention (PCI). Although traditional cardiac risk scores can help risk-stratify patients according to clinical end points, they might not help identify frail patients who may benefit from invasive or noninvasive therapy. Here, we describe a case of an 87-year-old man who was admitted to the emergency department with a non–ST-segment elevation myocardial infarction and evidence of multivessel coronary artery disease, with significant comorbidities, including chronic kidney impairment, peripheral artery disease, and chronic obstructive pulmonary disease. His frailty status was carefully evaluated and the risks and benefits of potential management strategies were taken into account by the heart team. He underwent successful staged PCI to his left main stem and right coronary artery with chronic total occlusion, and reported no symptoms on a subsequent follow-up and a significantly improved quality of life. ■ *Heart Metab*. 2018;76:27-31

Keywords: elderly; frailty; heart team; multivessel coronary artery disease; percutaneous coronary intervention

Introduction

An 87-year-old man presented to the emergency department of his local district general hospital with severe chest pain, on a background of crescendo angina despite optimal medical therapy (OMT) over the preceding 4 months. He denied any history of breathlessness, palpitations, syncope, or other cardiac symptoms. His cardiovascular risk factors included sex, age, dyslipidemia, hypertension, and significant peripheral arterial disease (PAD), with noncritical carotid artery disease, previous abdominal aortic aneurysmectomy, and a residual infrarenal aneurysm, for which he was undergoing regular follow-up visits. Furthermore, he also had a medical history of Hashimoto thyroiditis, iron deficiency

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Abbreviations

CABG: coronary artery bypass graft; **CKD:** chronic kidney disease; **COPD:** chronic obstructive pulmonary disease; **DAPT:** dual antiplatelet therapy; **NSTEMI:** non–ST-segment elevation myocardial infarction; **NSVT:** nonsustained ventricular tachycardia; **OMT:** optimal medical therapy; **PAD:** peripheral arterial disease; **PCI:** percutaneous coronary intervention

anemia (for which recent hematological and gastrointestinal investigations had been otherwise unremarkable), chronic obstructive pulmonary disease (COPD), and chronic kidney disease (CKD), with an estimated glomerular filtration rate of 30 mL/min/1.73 m^2.

He lived alone in sheltered accommodation, was able to walk independently with a cane, and was relatively independent in his daily activities, although at a progressively slower pace more recently, and requiring assistance with shopping and home cleaning.

On examination, he appeared frail, but not in cardiorespiratory distress, his vital signs were within the normal range, and cardiovascular examination was unremarkable other than a very mild ejection systolic murmur that was audible in the aortic valve area. He was euvolemic with no evidence of peripheral edema. Electrocardiogram (ECG) showed sinus rhythm with inferior Q waves, but no signs of acute ischemia. Chest radiography demonstrated a normal cardiac silhouette and clear lung fields, with no evidence of pulmonary congestion or consolidation. Routine bloods tests confirmed mild microcytic anemia, normal electrolytes, creatinine level of 2.18 mg/dL (normal range, 0.5 to 1.25 mg/dL), and peak troponin of 862.7 ng/dL (normal range <14 ng/dL).

Therefore, he was treated for non–ST-segment elevation myocardial infarction (NSTEMI), with dual antiplatelet therapy (DAPT), a high-dose statin, and low-molecular-weight heparin, and transferred to the coronary care unit. While on the cardiac monitor, he was noted to have frequent episodes of nonsustained ventricular tachycardia (NSVT), during which he remained asymptomatic and hemodynamically stable. An amiodarone infusion was initiated at this point with no further episodes of NSVT.

A subsequent transthoracic echocardiogram showed a nondilated left ventricle (LV), left ventricular hypertrophy (LVH) with inferior wall hypokinesis and lateral wall akinesis, moderate LV systolic dysfunction with an ejection fraction of 45%, grade I LV diastolic dysfunction, moderate mitral regurgitation with posterior mitral valve leaflet tethering, mild aortic valve (AV) stenosis (AV maximum velocity, 2.59 m/sec; mean gradient, 13 mm Hg), mild AV regurgitation, normal atria dimensions, mild tricuspid valve regurgitation, and normal right ventricular size and function.

He underwent an urgent coronary angiography, which revealed severe three-vessel coronary artery disease (CAD), with critical left main stem stenosis, chronic total occlusion of both the left circumflex artery and the right coronary artery (RCA), and an unobstructed left anterior descending (LAD) artery, which provided retrograde collaterals to the RCA *(Figure 1)*. Due to these findings, combined with the patient's comorbidities and cardiovascular risk factors, he was referred to the local tertiary center for consideration for PCI vs coronary artery bypass graft (CABG) surgery. Following discussions with the Heart Team, his overall perioperative risk was deemed too high, with additive and logistic European System for Cardiac Operative Risk Evaluation (EuroSCORE) scores of 16% and 60.1%,

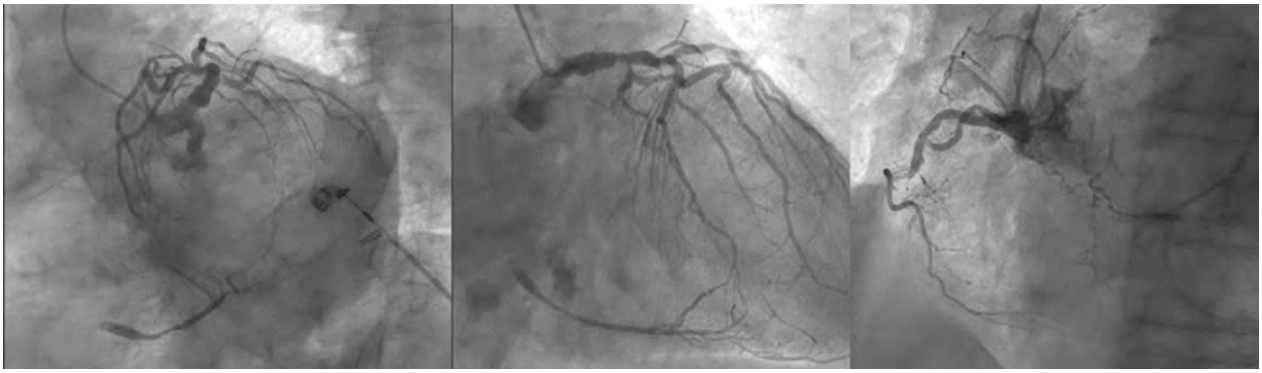

Fig. 1 *Coronary angiography showing critical left main stem stenosis, unobstructed left anterior descending artery with collaterals to the distal right coronary artery, chronic total occlusion of the left circumflex (left and mid panels) and chronic total occlusion of right coronary artery (right panel).*

respectively, a EuroSCORE II of 10.1%, a Society of Thoracic Surgery risk score of 45.1% for morbidity and mortality and 7.7% for mortality.

He underwent urgent PCI to his left main stem using the left radial artery approach, with predilatation using a 3.0 x 12 mm noncompliant balloon, implantation of a 3.5 x 24 mm drug-eluting stent, followed by postdilatation with a 4.5 x 12 mm noncompliant balloon, with excellent final angiographic results *(Figure 2, left panel)*. The patient was then discharged 2 days later on DAPT, with stable renal function and a plan for an outpatient review 4 to 6 weeks later following a dobutamine stress echocardiogram for further assessment of his viable LV inferior wall. This exam showed reversible inferior wall ischemia, for which a staged PCI for the chronic total occlusion of the RCA was advised, following a careful evaluation of the potential risks and benefits and a discussion with the patient. The RCA PCI took place with a dual right femoral and left radial approach. Successful retrograde recanalization of the RCA via the septal collaterals was achieved via a reverse controlled antegrade and retrograde subintimal tracking (CART) technique following a failed attempt with an antegrade approach. After predilatation of the proximal and mid–RCA with a 3.0 x 15 mm noncompliant balloon, 4 overlapping drug-eluting stents were implanted from the RCA ostium to the distal segment, with good angiographic results *(Figure 2, right panel)*. Periprocedural nephropro-

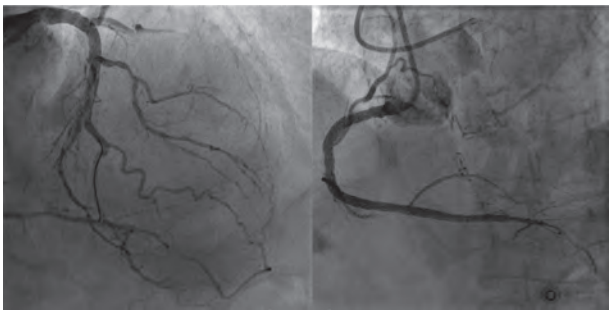

Fig. 2 *Angiographic results following a staged percutaneous coronary intervention to the left main stem (left panel) and right coronary artery (right panel).*

tection was ensured with adequate intravenous hydration, with maintenance of stable renal function. Medical management was suggested for the chronic total occlusion of the left circumflex artery.

The patient was discharged successfully and has remained asymptomatic at subsequent follow-up visits, reporting a significantly improved quality of life.

Discussion

We report a complex case of a frail 87-year-old man, initially presenting acutely with an NSTEMI and evidence of severe multivessel CAD that also involved the LMS, in the context of significant comorbidities, including moderate LVSD, CKD, COPD, and significant PAD, who then underwent a successful staged PCI.

Current guidelines recommend primary or urgent PCI for patients admitted acutely with an ST-segment elevation myocardial infarction (STEMI) or an NSTEMI, respectively.[1,2] Over the last few decades, with an aging population and a progressive increase in cardiovascular risk factors, an increasing number of elderly patients are receiving invasive revascularization.[3] However, these patients are at an increased risk of ACS-related complications, such as bleeding, infections, heart failure, renal failure, and stroke, and the evidence for potential benefits of invasive treatment is limited.[4] A recent meta-analysis[3] that investigated the association between frailty, ACS treatment, and clinical outcomes showed that frailty was independently associated with increased mortality following ACS (adjusted all-cause mortality hazard ratios [HR] for patients with frailty of 1.54-5.39). More importantly, older people with frailty were significantly less likely to receive guideline-indicated ACS care, including PCI, with rates ranging from 6.7% to 43.7% vs 30.4% to 69.5%.[3]

Importantly, recent studies comparing OMT with percutaneous or surgical coronary revascularization for NSTEMI patients >75 years old demonstrated a reduced risk of death and major cardiac events with invasive therapy.[5-7] Crucially, in subjects admitted with STEMI, mortality and morbidity from heart failure, dysrhythmia, and postmyocardial infarction, the complications are significantly reduced with invasive treatment, regardless of the patient's age and despite the increased risk of bleeding in this category.[8] Therefore, this result contradicts the historical clinical practice of a more conservative approach for this patient subset due to the combination of increased risk factors and a relatively short life expectancy.

In addition, a relevant heterogeneity exists within the elderly population, with particular regards to clinical presentation, coronary anatomy, frailty, comorbidities, cognitive impairment, and estimated quality of life, all of which may have a significant impact on procedural and clinical outcomes and should there-

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fore be taken into account when evaluating the risks and benefits of OMT vs coronary revascularization in these patients.[3] There is increasing evidence that the potential clinical outcomes in the elderly undergoing invasive coronary treatment following ACS are more related to physiological age than chronological age and that patient frailty constitutes one of the most significant determinants in this regard.[9]

Frailty is a complex syndrome characterized by reduced resilience to stressors and increased physiological vulnerability, with a progressive loss of reserve and physiological function,[10] which has been associated with a significantly higher risk of hospitalization, morbidity, and mortality post–PCI, including a prolonged recovery period, more frequent and severe postoperative complications, such as bleeding, stent restenosis and thrombosis, stroke, and heart failure.[11] This is most likely attributable to the increased inflammatory activation and impaired coagulation cascades observed in this patient subset.[11]

In current practice, the phenotypic frailty models[12] and the frailty index of multiple deficits by Rockwood et al[9] are the most commonly used approaches for assessing patient frailty. The former approaches include the Fried model and the International Association of Nutrition and Aging frailty scale (FRAIL), which are similarly both based on 5 physical indicators; the Fried model is based on grip strength, exhaustion, unintended weight loss, slow gait speed, and low physical activity, while the FRAIL model is based on fatigue, resistance, ambulation, illnesses, and loss of weight.[12] They are favored by physicians caring for the elderly because of their relatively simple bedside use. The Rockwood Clinical Frailty Scale,[11] derived from the Canadian Study of Health and Aging Clinical Frailty Scale (CSHA-CFS), consists of a 9-point scale, from 0 (very fit) to 9 (terminally ill), and it is based on impaired mobility, function, and self-rated health.

A number of studies have been conducted to evaluate the association between frailty, as assessed by the above-mentioned frailty scores, with mortality in patients undergoing PCI, presenting with or without ACS. In a prospective cohort study[13] of 628 patients of at least 65 years of age undergoing PCI, participants were assessed for frailty (Fried criteria), comorbidities, and quality of life: at least 60% of these subjects were deemed frail or intermediately frail, and importantly, the 3-year mortality was 28% for frail patients and 6% for nonfrail patients, with a strong association between frailty and mortality / myocardial infarction (HR, 2.61; 95% CI, 1.52-4.50). Similarly, in another study[14] that included 745 patients undergoing PCI, frail patients required longer hospitalizations after PCI and presented increased rates of 30-day mortality (HR, 4.8; 95% CI, 1.4-16.3; *P*=0.013) and 1-year mortality (HR, 5.9; 95% CI, 2.5-13.8; *P*<0.001), and frailty, as assessed by the CSHA-CFS score, was a predictor of length of hospital stay and mortality, independently of age, sex, and comorbidities.

Interestingly, other studies have often led to conflicting results on the role of frailty in clinical outcomes post–PCI, demonstrating no significant association between frailty and mortality. A recent meta-analysis[3] that included a total of 8 studies and 2332 patients (mean age, 69 years; male sex, 68%; follow-up duration, 30±28 months) concluded that frailty was a significant predictor of all-cause mortality following PCI, with a 2.97-fold increased risk of all-cause mortality (95% CI, 1.56-5.66; *P*=0.001). Importantly, a significant heterogeneity in the pooled HRs was identified, which was mainly due to the different frailty scores used and clinical presentations. Subsequent subgroup analyses demonstrated that both the Fried score and CSHA-CFS were significant predictors of mortality with pooled HRs of 2.78 and 5.99, respectively.

Our patient presented with a FRAIL score of 3, based on fatigue, resistance, and illness, which put him in the frail category of the scoring system. Similarly, based on his CSHA-CFS score of 6, he was deemed moderately frail, as he required help with outside activities and with cleaning his house, as well as minimal assistance with indoor activities. However, the patient was extremely keen to maintain his relative independence and therefore very determined to undergo coronary revascularization. The decision on staged vs "one-time" multivessel PCI was dictated based on the patient's age, frailty, comorbidities, and relevant angiographic findings. In a recent meta-analysis[15] on 1090 patients of at least 60 years of age presenting with NSTEMI and evidence of multivessel CAD, the primary composite end point of myocardial infarction and cardiac death during a 3-year follow-up was not significantly different between the staged and the "one-time" revascularization strategies (7% vs 9.5%; *P*=0.110), and multivariate analysis showed the benefit of staged PCI on the primary events in the elderly (HR, 0.638; 95% CI, 0.408-0.998; *P*=0.049), with a propensity score matched cohort analy-

sis demonstrating that staged PCI was associated with lower rates of primary events (6.1% vs 10.4%; *P*=0.046) and myocardial infarction (3.4% vs 7.4%; *P*=0.037) at 3 years.

Conclusions

The current case report demonstrated successful staged multivessel PCI in a frail patient presenting with NSTEMI, for whom careful consideration was given to multiple factors with a potential impact on clinical outcomes, including age, frailty, comorbidities, and angiographic findings. Older patients referred for PCI should be systematically assessed for frailty status, which should play a crucial role on the final decision of invasive vs noninvasive strategies in this patient subset. ■

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