EDITORIAL

An Overview of Current Advances in Contemporary Percutaneous Coronary Intervention

Mohammad Alkhalil1,2,*

1Cardiothoracic Centre Freeman Hospital, Newcastle UK; 2Translational and Clinical Research Institute, Newcastle University, Newcastle-upon-Tyne, UK

The role of percutaneous coronary intervention (PCI) in the management of patients with coronary artery disease (CAD) has evolved since its first inception 40 years ago [1]. It has become the standard of care for patients with non-complex CAD [1]. More recently, PCI was compared to coronary artery bypass graft (CABG) in more complex anatomy such as left main coronary (LMS) disease, and previously, in multi-vessel coronary disease [2-4]. Importantly, results from these studies have demonstrated that PCI was not only an alternative approach to CABG but was even proposed as a preferred revascularization mode in a selected group of patients [2]. Moreover, using state-of-the-art contemporary PCI strategy has reduced adverse cardiovascular events and improved clinical results [5]. The translation of technological progress to clinical practice has certainly contributed to the success of PCI.

Additionally, the increase in our understanding of CAD has enabled us to obtain more sustainable results in challenging anatomy. Such combination was effective in the management of chronic total occlusion, LMS, including bifurcation disease and the use of calcium modification therapies. Furthermore, the use of physiology and intravascular imaging in the assessment of coronary plaque has transformed our management in patients with CAD [6]. The current thematic issue in the journal focuses on the contemporary role of PCI in the management of patients with CAD.

Assessment of coronary physiology using fractional flow reserve (FFR) or resting indices has transformed the way of coronary revascularization [7]. Moreover, functional assessment of coronary stenoses provided significant insights into the prognosis of patients with coronary artery disease, including those considered at high risks, such as diabetes and chronic kidney disease [8, 9]. Interestingly, there was a sex-based difference in FFR, particularly in stenoses subtending large myocardium, and more evident in women undergoing deferred revascularization [10]. Recently, FFR-guided percutaneous coronary intervention (PCI) was compared to CABG in the FAME 3 trial [4]. The 1-year incidence of the composite primary endpoint, which included repeated revascularization, was 50% higher in patients randomly assigned to undergo FFR-guided PCI compared to those assigned to undergo CABG (10.6% versus 6.9%) [4]. Importantly, there was no difference in the incidence of hard clinical outcomes, such as death, myocardial infarction, or stroke [4].

Advances in PCI technologies have enabled operators to tackle more challenging coronary disease subsets with great success [11, 12]. The management of chronic total occlusion (CTO) has substantially improved over the recent years, with a success rate of more than 90% of cases in some series [11]. Factors related to operator expertise and exchange of knowledge led to the development of algorithms and consensus documents that provided tailored treatment strategies for patients with CTO [13]. Certain angiographic characteristics would determine the level of complexity and the adopted strategy to approach CTO. This includes proximal cap morphology, occlusion length, quality of the distal vessel, characteristics of the collateral circulation, and presence of calcium. The latter feature is known to be associated with worse adverse events and requires additional tools to optimally prepare coronary lesions [12]. In fact, a heavily calcified lesion was an independent predictor of 10-year mortality regardless of the revascularization strategy [14]. Calcium modification using intravascular lithotripsy (IVL) provides an additional tool to the armamentarium when managing patients with calcified coronary arteries. The safety of IVL was recently reported in the Disrupt CAD III study with procedural success exceeding 92% [15].

Collectively, this has allowed assessing the role of PCI in high-risk lesions such as LMS disease. Historically, CABG was considered the ‘gold standard’ in treating LMS. Recent advances in PCI, including the use of intravascular imaging, have highlighted the safety of this approach coupled with the advantage of being less invasive and associated with quicker recovery [16]. Importantly, the degree of coronary complexity should be factored in the decision-making [16]. In a recent individual patient data meta-analysis of four randomized clinical trials, including almost 4,400 patients, there was no difference in all-cause mortality after 5 years between CABG and PCI (10.2% versus 11.2%) [17]. A trend favoring CABG was observed in patients with LMS and three-vessel disease, although it did not reach statistical significance [17]. On the other hand, heterogeneity in treatment effect was evident favoring PCI in patients presenting with the acute coronary syndrome [17]. This supports the role of other non-anatomical factors that are associated with unstable coronary presentation [18].

*Address correspondence to this author at the Department of Cardiothoracic Services, Freeman Hospital, Freeman Road, Newcastle-upon-Tyne NE7 7DN, United Kingdom; Tel: +0191 233 6161 E-mail: mak-83@hotmail.com
Acute myocardial infarction incites changes that affect the myocardium at risk. Moreover, other regional and systemic responses have been documented using blood biomarkers and novel imaging tools [19, 20]. Importantly, these changes provided incremental prognostic information about the future risk faced by patients [19, 20]. Some of these techniques are immediately accessible in the catheterization laboratory providing information about the severity of infarct, potential regression, and an opportunity to risk stratify patients towards new treatment [21-26]. Similarly, non-invasive imaging tools may be used to identify patients who are considered high-risk for different treatment pathways [27, 28]. The development of new pharmacological therapies targeting inflammation, lipid, and thrombosis pathways is becoming a reality [18]. The introduction of novel imaging techniques would allow tailoring these therapies, aggregating benefits from PCI procedures.

In conclusion, contemporary PCI has significantly evolved since the first attempt four decades ago. Advances in technology have allowed a better understanding of the extent and nature of CAD and ways to manage it using a minimally invasive approach.

REFERENCES


