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Advances in cardiovascular care from risk assessment to intervention

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EDITORIAL

Advances in cardiovascular care from risk assessment to intervention

Cardiovascular disease (CVD) encompasses a broad spectrum of clinical entities that continue to represent a major global health burden [1]. Advances in epidemiology, risk stratification, diagnostic imaging, and therapeutic interventions have contributed to improved outcomes, yet critical gaps remain in both prevention and personalised management [2]. Recent clinical investigations have addressed diverse aspects of CVD, including the diagnostic accuracy of risk scoring tools, the prognostic value of lipid ratios and inflammatory biomarkers, the impact of pharmacologic and non-pharmacologic interventions, and the optimisation of procedural approaches [3–5]. These studies provide insights into pathophysiological mechanisms, refine patient selection strategies, and underscore the need for more targeted and cost-effective care models. The following summaries synthesise findings from contemporary research that collectively aim to inform clinical decision-making and improve cardiovascular outcomes.

Blood pressure fluctuations during office visits, such as a decline in systolic values over repeated measurements, have been proposed as potential markers for long-term cardiovascular risk [6]. In a large European male population followed for up to 60 years, researchers evaluated whether a significant drop in office systolic blood pressure (≥10 mmHg) during the same visit, termed the office white-coat effect tail (OWCET), was associated with increased mortality [7]. Although individuals with OWCET tended to have higher initial blood pressure levels, no significant associations were found with cardiovascular mortality, all-cause mortality, or non-cardiovascular deaths. These results were consistent across different European regions and remained unchanged after adjusting for established risk factors such as age, baseline blood pressure, body mass index, cholesterol levels, and smoking. The presence of OWCET did not enhance long-term risk prediction for fatal cardiovascular events.

Nocturnal blood pressure dipping is a key physiological mechanism linked to cardiovascular protection, yet its modulation through acute exercise remains unclear in treated hypertensive individuals [8]. In a randomised clinical trial involving 20 adults with medication-controlled hypertension, participants were assigned to either a single aerobic exercise session or a sedentary control condition [9]. The exercise group completed 40 min of moderate-intensity treadmill activity, while the control group remained seated for the same duration. Ambulatory blood pressure monitoring was used to assess 24-hour blood pressure patterns, including the nocturnal dip. No significant differences were observed between groups in systolic or diastolic blood pressure during rest, wakefulness, sleep, or over the full 24-hour period. Additionally, both absolute and relative nocturnal blood pressure dipping showed no statistically significant changes between exercise and control conditions.

Anthropometric and biochemical markers play a critical role in assessing cardiovascular risk, particularly in regions with high disease burden [10]. Data from 403 cardiovascular patients in Faisalabad, Pakistan, were analysed to evaluate associations between BMI, waist-related measurements, uric acid levels, and other biochemical parameters [11]. Obese patients showed notably higher BMI (+29%), waist circumference (+7%), and hip circumference (+8%) compared to non-obese counterparts. Uric acid levels were elevated in male patients (+11%), whereas female patients had higher total cholesterol (+8%) and triglycerides (+20%). Correlation and regression analyses revealed that uric acid was significantly associated with total cholesterol, triglycerides, liver enzymes, creatinine, and urea levels.

Fatty acids (FAs) are increasingly recognised for their role in modulating vascular inflammation and atherosclerosis, particularly in the context of hypertension. In a sample of 96 hypertensive patients, dietary intake (Figure 1) and serum levels of various FAs were assessed alongside inflammatory biomarkers and carotid intima-media thickness (cIMT) as a marker of early atherosclerosis [12]. Participants exhibited high caloric intake, elevated LDL cholesterol, and markers of systemic inflammation, including increased hs-CRP and fibrinogen levels. Significant inverse associations were found between dietary monounsaturated FAs (MUFAs) and serum omega-3 polyunsaturated FAs (n-3 PUFAs) with hs-CRP, suggesting a potential anti-inflammatory effect. Conversely, higher intake of MUFAs and serum saturated FAs (SFAs) were positively associated with increased cIMT, indicating a pro-atherosclerotic influence. Serum omega-6 polyunsaturated FAs (n-6 PUFAs) were inversely correlated with cIMT, supporting their protective role against early vascular damage.

Inflammatory and hemodynamic factors may play a central role in the clinical expression and outcomes of coronary artery ectasia (CAE) associated with atherosclerosis. In a cohort of 165 patients with atherosclerotic CAE, individuals were categorised as symptomatic or asymptomatic to explore differences in biomarker levels, coronary flow, and cardiovascular events [13]. Symptomatic patients were more often male and had higher rates of hypertension, dyslipidemia, and smoking. They also exhibited significantly elevated levels of hs-CRP, IL-6, TNF-α, MMP-9, and GDF-15 compared to their asymptomatic counterparts ($p < 0.05$ for all). Corrected TIMI frame count (CTFC) was lower in symptomatic patients, indicating reduced coronary flow velocity. Over a two-year follow-up, symptomatic patients experienced a higher incidence of major adverse cardiovascular events (MACEs, $p < 0.01$).

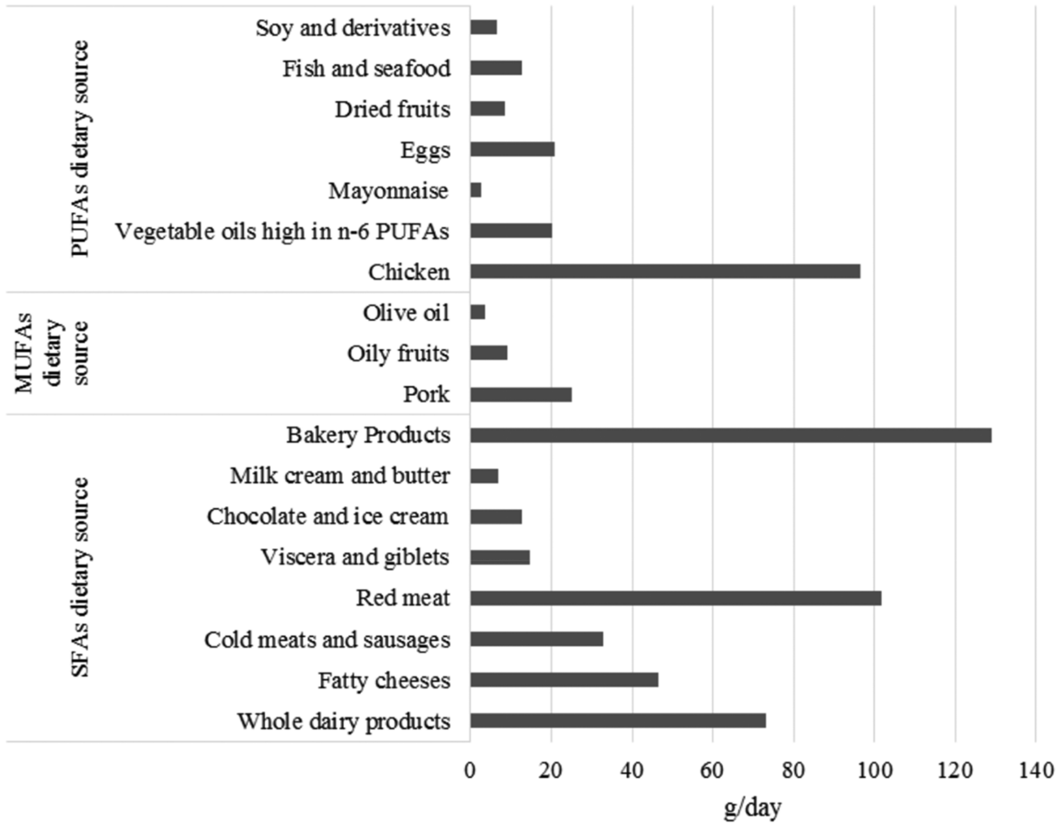

Figure 1. Dietary fat source profile in hypertensive patients. SFAs: saturated fatty acids; MUFAs: monounsaturated fatty acids; PUFAs; polyunsaturated fatty acids [12].

The triglyceride to HDL-cholesterol (TG/HDL-C) ratio has emerged as a potential marker for cardiovascular risk, but data remain limited in large male-dominant Asian populations. A cohort of 95,837 participants (nearly 80% male) was stratified into quartiles based on TG/HDL-C ratio and followed for a median of 13.97 years [14]. The study recorded 18,430 major adverse cardiac and cerebrovascular events (MACCEs), including myocardial infarction (MI), stroke, and all-cause mortality. Incidence rates for MACCEs, MI, and stroke rose progressively with increasing TG/HDL-C ratio ($p < 0.001$). Compared to the lowest quartile, those in the highest quartile had significantly elevated risks: HR 1.13 for composite MACCEs, 1.55 for MI, 1.21 for stroke, and 1.12 for all-cause mortality. Spline regression analysis revealed a nonlinear association between baseline TG/HDL-C ratio and each endpoint.

Lifestyle and dietary interventions are increasingly explored as strategies to improve cardiovascular health in shift workers. Eighteen male rotating shift workers were randomly divided into two groups and followed over one year using repeated 24-hour heart rate monitoring [15]. Nutritional counselling was delivered every two months, focusing on correcting dietary habits identified through food diaries, alongside encouragement to increase endurance and resistance training. Group A showed a reduction in heart rate during both day (75 to 73 bpm) and night (72 to 70 bpm), while group B experienced an increase during the day (72 to 76 bpm) and a decrease at night (69 to 66 bpm). All changes were statistically significant ($p < 0.001$). These findings suggest that regular, structured guidance on nutrition and physical activity may contribute to improved heart rate control in shift workers. However, the benefits appear to depend on sustained motivation and the frequency of intervention.

Achieving optimal lipid control remains a challenge in patients at very high cardiovascular risk, even with access to advanced therapies. The PERI-DYS registry followed 1565 patients across 70 sites in Germany, assessing LDL-C changes and lipid-lowering therapy (LLT) patterns over 12 months [15]. Overall, LDL-C dropped from 91.0 mg/dL to 71.5 mg/dL, but only 33.1% of patients reached the target of <55 mg/dL as per ESC/EAS guidelines. Goal attainment varied widely, from 16.3% in patients without statins or PCSK9-mAb to 50.5% in those receiving combination therapy. LLT intensity was modified in 22.3% of cases, with more patients experiencing intensification (14.8%) than reduction (9.3%). Predictors of LLT intensification included high baseline LDL-C, younger age, and absence of ezetimibe at baseline, while statin intolerance reduced the likelihood of intensification.

Minimising radiation exposure while maintaining diagnostic accuracy is a key objective in coronary artery calcium (CAC) scoring, especially for screening in lower-risk populations [16]. In a prospective study of 200 patients undergoing CT coronary angiography, CAC scores were compared between a standard protocol (80 mAs, 120 kVp, ADMIRE 3) and a low-dose protocol using reduced tube current and voltage (16 mAs, 100 kVp, ADMIRE 5) (Figure 2) [17]. CAC scores from the low-dose protocol

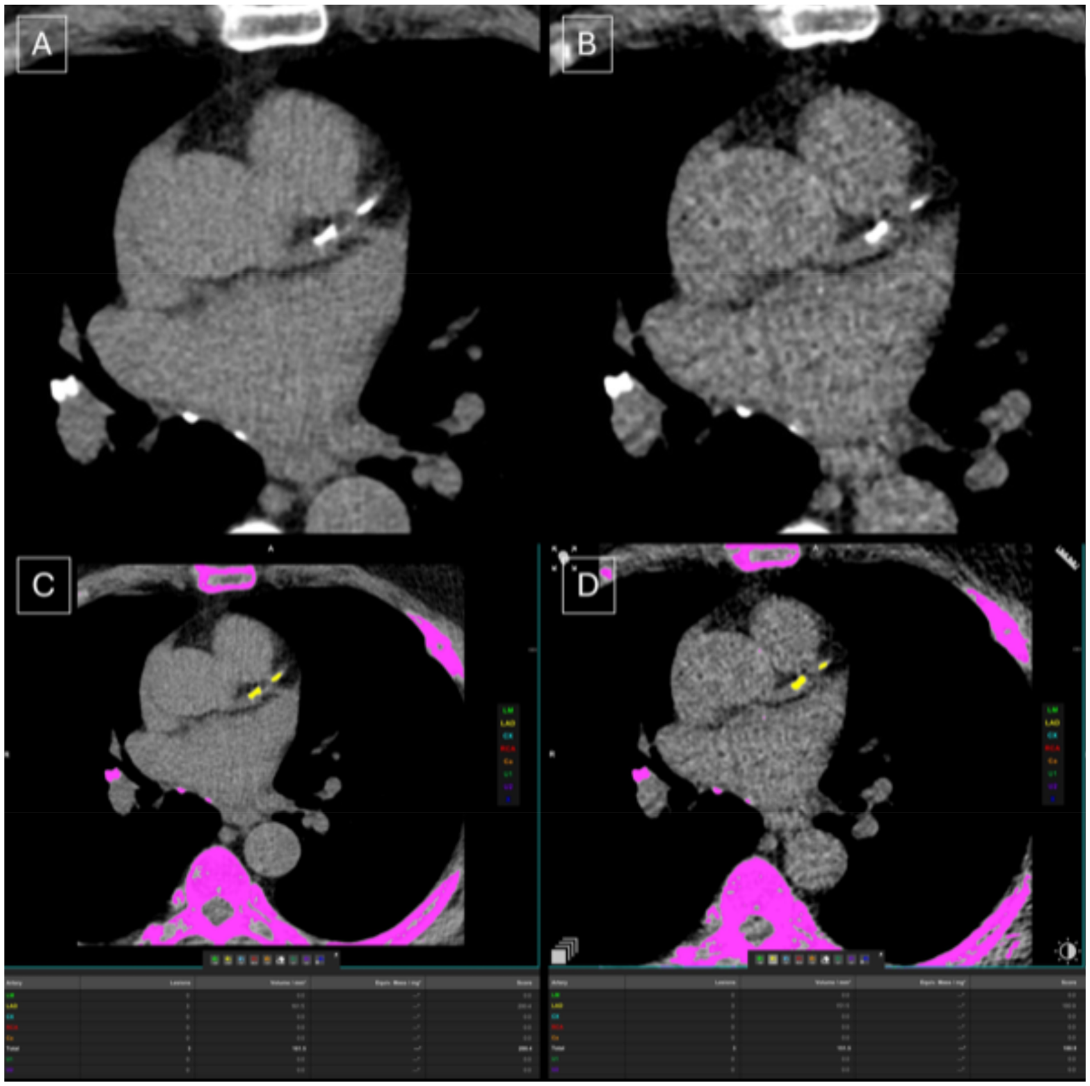

Figure 2. Axial images (a and B) depict the calcification in the left anterior descending artery in a 58-year-old male patient in the derivation cohort using standard protocol and using low tube current-low kilovoltage peak protocol respectively. Panels C and D show the corresponding coronary artery calcium scores of 200.4 and 180.9 respectively [17].

correlated strongly with those from the standard protocol ($r = 0.99$; $p < 0.001$), and a correction formula was derived and validated to further align the two methods. In the validation cohort, corrected low-dose CAC scores showed excellent agreement with standard values, with an intraclass correlation coefficient of 0.997 and strong concordance in risk stratification (weighted kappa = 0.94). The low-dose protocol achieved an 88.9% reduction in radiation exposure ($p < 0.0001$), without compromising accuracy.

Accurate early identification of acute coronary syndrome (ACS) in the emergency setting remains a clinical priority. A predictive correlation study evaluated the performance of a 13-item ACS checklist in 300 emergency department patients over one year. Sweating and shortness of breath were significantly associated with an increased likelihood of confirmed ACS, while palpitations were linked to a reduced likelihood [18]. Weighted regression analysis was used to assign severity-based coefficients to key symptoms, improving the checklist's discriminatory capacity. The weighted version demonstrated a significant increase in diagnostic accuracy, raising the area under the curve (AUC) from 55% to 70%. It also outperformed the unweighted checklist in differentiating true ACS cases ($p < 0.001$). While promising, this tool is not intended to replace clinical judgement or standard diagnostic pathways but may aid in risk stratification.

Minimally invasive approaches are gaining attention in coronary surgery for their potential to enhance postoperative recovery and patient comfort. In a cohort of 356 patients undergoing off-pump coronary artery bypass grafting (OPCAB), outcomes were compared between left anterior thoracotomy (LAT) and median sternotomy (MS) [19]. LAT was associated with significantly lower postoperative pain on days 1, 3, and 7, as measured by the Visual Analog Scale ($p < 0.001$). Patients in the LAT group also experienced shorter ICU and total hospital stays ($p = 0.011$ and $p < 0.001$), suggesting a faster recovery trajectory. Quality of life, evaluated through the SF-36 questionnaire, showed superior physical domain scores at 1

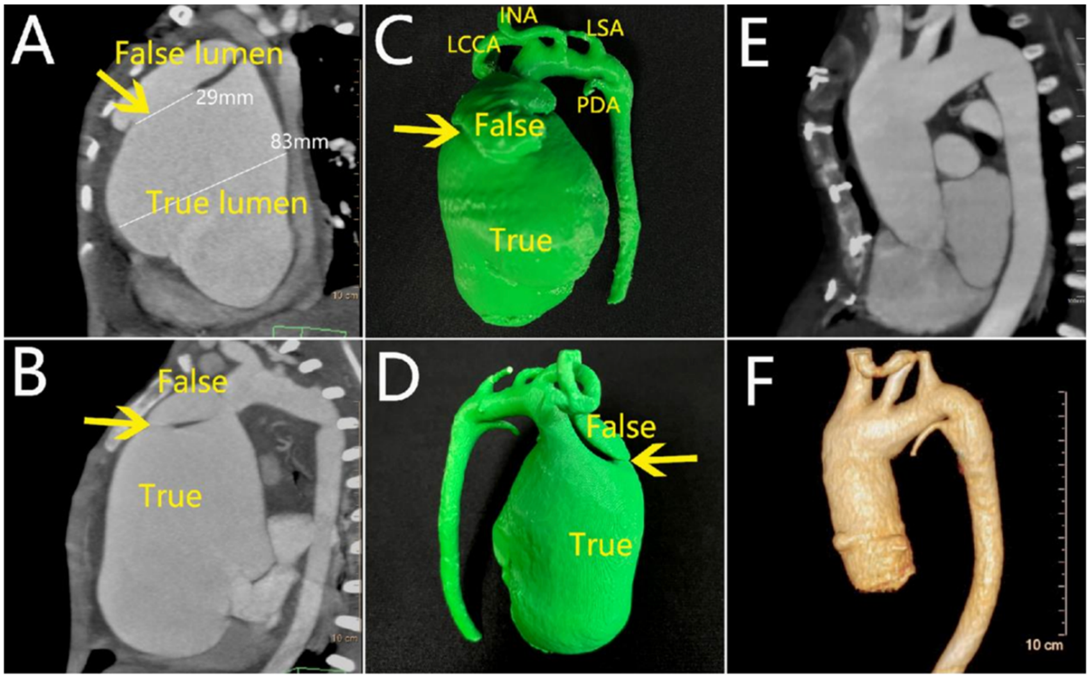

Figure 3. Preoperative 3D printing and postoperative follow-up imaging of a 3-year-old child with aortic dissection. (A,B) Maximum intensity projection (MIP) multiplanar reconstructions demonstrate an ascending aortic dissection aneurysm with a maximum diameter of 83 mm and a dissection entry point of 29 mm. (C,D) 3D-printed models provide a tangible, visual representation of the extent of aortic dissection and the relationship with adjacent vessels. (E,F) One-year follow-up MIP and volume-rendered images show good aortic remodelling. INA, innominate artery; LCCA, left common carotid artery; LSA, left subclavian artery; PDA, patent ductus arteriosus [23].

and 3 months postoperatively in the LAT group, although no significant difference was noted in mental health domains.

Preventing the no-reflow phenomenon after percutaneous coronary intervention (PCI) remains a major therapeutic goal, particularly in high-risk populations such as patients with type 2 diabetes mellitus (T2DM) and acute myocardial infarction (AMI) [20]. Among 829 T2DM patients undergoing PCI within 24 h of AMI onset, this observational cohort study evaluated whether chronic dapagliflozin use influenced the occurrence of no-reflow. Dapagliflozin users were defined as those on the drug for at least one year at a daily dose of 10 mg [21]. No-reflow was identified angiographically in the absence of mechanical obstruction or residual stenosis. Multivariate logistic regression showed that dapagliflozin use significantly reduced the odds of no-reflow in both STEMI (OR = 0.030, $p = 0.001$) and NSTEMI (OR = 0.112, $p = 0.043$) patients. Other predictors of no-reflow in STEMI included lower estimated glomerular filtration rate and higher SYNTAX score I.

In this issue of Acta Cardiologica, several focus images highlighting interesting cases have also been reported (Figure 3) [22–27].

Disclosure statement

No potential conflict of interest was reported by the author(s).

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