Abstract Highlights

The following highlights showcase groundbreaking research in cardiology, spotlighting key abstracts presented at the European Society of Cardiology (ESC) Congress 2024. From the impact of air pollution and ultra-processed foods on cardiovascular outcomes, to the development of novel risk strategies, the selected highlights provide an overview of the latest advancements in the field.

Organ Perfusion Pressure as a Predictor of Cardiogenic Shock Mortality

RISK of in-hospital all-cause death is lower in patients with a higher organ perfusion pressure (OPP) when hospitalised for cardiogenic shock, according to a recent study conducted in Italy and presented at the ESC Congress 2024.

Cardiogenic shock has a high mortality rate and management of this condition remains a challenge. Therefore, developing a comprehensive risk assessment strategy for patients with cardiogenic shock is crucial to improving outcomes.

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Researchers evaluated the use of OPP as a predictor of outcomes in cardiogenic shock. The trial consisted of 316 patients with cardiogenic shock enrolled in the multicentre Altshock-2 registry. The mean age was 64 years and 20% of participants were female. OPP was calculated as mean arterial pressure minus central venous pressure. Among the cohort, the mean left ventricular ejection fraction: 24±10%, the mean arterial pressure was 71±16 mmHg; and the mean central venous pressure was 12±6 mmHg. Based on the calculation previously mentioned, mean OPP was 59.1±17.3 mmHg.

Whilst in-hospital all-cause death occurred in 37% patients, a univariable analysis revealed that higher OPP was significantly associated with a reduced risk of in-hospital all-cause mortality, both when analysed as a continuous variable (hazard ratio [HR]: 0.981 per mmHg; 95% CI: 0.969–0.993; p=0.003) and when dichotomised (HR: 0.522; 95% CI: 0.354–0.770; p=0.001) based on the optimal cut-off value of 59.5 mmHg identified through receiver operating characteristic curve analysis (specificity 66.4%; sensitivity 53.8%; area under the curve: 0.61). An OPP greater than 59.5 mmHg was a significant predictor of reduced in-hospital all-cause mortality in patients with cardiogenic shock related to acutely decompensated heart failure (HR: 0.315; 95% CI: 0.151–0.660; p=0.002), but not in patients with cardiogenic shock related to acute myocardial infarction (HR: 0.628; 95% CI: 0.392–1.007; p=0.054). Higher OPP remained a significant predictor of in-hospital all-cause death after multivariable adjustment for significant clinical data, including age and Sequential Organ Failure Assessment score (HR: 0.984; 95% CI: 0.972–0.996; p=0.010).

It was also determined that higher OPP was significantly associated with improved long-term overall survival (p<0.001). Furthermore, higher OPP was not associated with worsening renal function 24 hours after the onset of cardiogenic shock, in-hospital length of stay, or the composite outcome of left ventricular assist device implantation or heart transplantation.

These findings highlight the importance of monitoring OPP, as it may serve as a valuable prognostic marker for improving long-term survival in patients with cardiogenic shock.

SGLT2 Inhibitors Reduce Ventricular Arrhythmias in Patients with Heart Failure

SODIUM-GLUCOSE cotransporter Type 2 inhibitors (SGLT2i) are a class of drugs primarily used to treat diabetes but have also demonstrated beneficial effects in heart failure patients; however, their impact on heart rhythm disorders, particularly atrial arrhythmias (AA) and ventricular arrhythmias (VA), remains unclear.

An abstract presented at the 2024 ESC Congress has detailed a retrospective multicentre study conducted by Carlos Minguito-Carazo, University Hospital of León, Spain, and colleagues. This study aimed to explore the effects of SGLT2i initiation on arrhythmic events in patients with heart failure with implantable cardiac defibrillators (ICD). The study analysed data from patients treated between 2015–2020, comparing arrhythmia occurrences 1 year before and 1 year after starting SGLT2i therapy.

A total of 195 patients, with a median age of 66.8 years and 18.5% being women, were included. These patients either had an ICD or a combined cardiac resynchronisation therapy device. The analysis focused on the prevalence of VAs, which include dangerous conditions like sustained ventricular tachycardia and ventricular fibrillation. Non-sustained ventricular tachycardia was also considered, though it is less clinically significant. AAs, specifically atrial fibrillation, were also monitored.

Additionally, the number of arrhythmic episodes per patient declined, indicating a protective effect of SGLT2i against VAs.

Percentage of patients experiencing any VA dropped from

52.3% to 30.3%

Arrhythmias, excluding non-sustained ventricular tachycardia, also significantly decreased from

21.5% to 8.7%

However, this positive effect did not extend to AAs, the incidence of atrial fibrillation and its burden remained largely unchanged, with no statistically significant differences observed. While SGLT2i treatment appears to offer protection against life-threatening VAs, its effect on atrial rhythm disturbances remains limited. Nonetheless, this study highlights the potential of SGLT2i to reduce the incidence of dangerous VAs in patients with heart failure with ICDs, though their impact on AAs requires further investigation.

> **The study found a significant reduction in VA after the introduction of SGLT2i therapy**

The study found a significant reduction in VA after the introduction of SGLT2i therapy. The percentage of patients experiencing any VA dropped from 52.3% to 30.3%. More clinically relevant arrhythmias, excluding non-sustained ventricular tachycardia, also significantly decreased from 21.5% to 8.7%.

Noise Exposure Linked to Poorer 1-Year Survival After Myocardial Infraction

A LINK between environmental noise exposure and risk of myocardial infraction (MI) has been shown in a study presented at the ESC Congress 2024.

The observational, longitudinal study collected data from a French observatory (RICO) between 2004–2009. It aimed to investigate the association between environmental noise exposure and with prognosis after a MI and analyse the relationship between residential environmental noise exposure and 1-year prognosis after MI, with the outcome being defined by major adverse cardiovascular events (MACE).

Medical data was collected from 864 patients hospitalised for an acute MI and registered in the database between 1 January 2004, and 31 December 2008. Participants who survived at least 28 days post-MI were followed for 1 year to assess the incidence of MACE, which included cardiac death, re-hospitalisation for heart failure, recurrent MI, emergency revascularisation, stroke, and angina.

Environmental noise levels were measured both daily (LAeq,24h) and at night (Lnight), and the annual averages were considered for analysis. The study also accounted for exposure to outdoor air pollutants, specifically nitrogen dioxide (NO_2) and particulate matter (PM10), within the 30 days preceding a MACE.

Results showed that 29% of the patients experienced a MACE during the 1-year follow-up, with cardiac death being the most frequent outcome, occurring in 32% of these cases. One of the key findings was that for every 10 dB(A) increase in Lnight, the hazard ratio for MACE increased by 25%, even after adjusting for air pollutants and other confounding factors. This association was particularly pronounced among older patients and varied by gender.

The study authors noted that this is the first time that a significant link was revealed between nighttime noise exposure and

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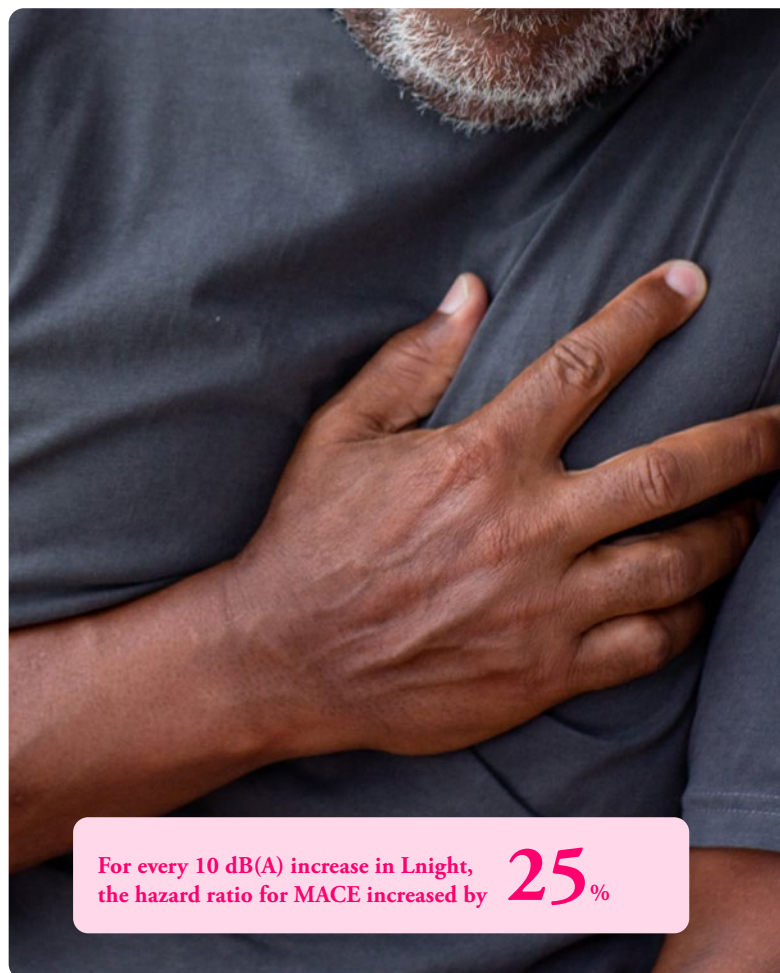
1-year survival prognosis after a first MI. They also emphasised that if confirmed by larger, prospective studied, these results could lead to new environment-based secondary prevention strategies for patients recovering from MI.

The study's lead author and researcher Mirabelle Plomb, University of Besancon, France, concluded that the findings highlight the need for consideration on environmental noise as a serious factor in the recovery of patients with heart attack. Reducing noise pollution, especially at night, might be a vital step in improving outcomes for these patients.

Arterial Stiffness Predicts Cardiovascular Events in Post-Heart Attack Patients

A STUDY presented at the ESC Congress 2024 revealed that arterial stiffness, measured by pulse wave velocity (PWV) and augmentation index (Aix), is a strong predictor of major adverse cardiovascular events (MACE) in patients that have suffered a heart attack.

The study followed 114 post-infarct patients (89 male with an average age of 62.5 years) over a median period of 16.2 years and aimed to evaluate the prognostic relevance of PWV and Aix. Both measures of arterial stiffness were calculated using the oscillometric based pulse wave analysis method (Arteriograph), which sought to determine the optimal PWV and Aix cut-off values for predicting MACE. This included outcomes such as all-cause death, non-fatal heart attack, ischaemic stroke, hospitalisation for heart failure, and coronary revascularisation.

The results revealed a significant correlation between PWV and Aix values, with 140 MACE events occurring in the 16.2 years of follow-up period. The study established optimised cut-off values for predicting MACE: PWV at 9.83 m/s and Aix at 34.8%. Patients with elevated arterial stiffness, were found to have a significantly lower event-free survival rate as indicated by higher PWV and Aix values, which was demonstrated by a Kaplan-Meier analysis. A multivariate cox regression analysis confirmed PWV and Aix as an independent predictor of MACE.

The findings emphasise the importance of measuring arterial stiffness in post-heart attack patients to improve individual risk stratification. Elevated PWV, in particular, emerged as a key marker for predicting future adverse cardiovascular events, highlighting its clinical relevance in managing very high-risk cardiovascular patients.

"**Patients with elevated arterial stiffness were found to have a significantly lower event-free survival rate**"

Ultra-Processed Foods Linked to Cardiometabolic Multimorbidity Risk

A 20-YEAR observational study conducted in Attica, Greece, presented at the ESC Congress 2024 has found a significant association between the consumption of ultra-processed foods (UPF) and an increased risk of cardiometabolic multimorbidity, defined as the co-occurrence of Type 2 diabetes and cardiovascular disease (CVD).

Researchers sought to explore the effects of UPF intake on cardiometabolic health in the Mediterranean region, where traditional diets are often considered protective. The study recruited 3,042 men and women free of cardiovascular disease between 2001–2002. Participants' diets were assessed using a validated food frequency questionnaire, with UPF intake categorised using the NOVA classification system. UPFs were further classified into subgroups, including bread and cereals, sweets and desserts, artificially sweetened beverages, spreads and sauces, processed meats, and savoury snacks.

231 cases of cardiometabolic multimorbidity were recorded in total over the 20-year period

Over the 20-year period, a total of 231 cases of cardiometabolic multimorbidity were recorded. Participants reported a median UPF consumption of 26.6 servings per week, contributing approximately 40% of their total daily energy intake.

The findings revealed a clear dose-response relationship between UPF consumption and cardiometabolic multimorbidity. As UPF intake increased, so did the risk of developing both diabetes and CVD. Individuals in the highest tertile of UPF consumption (44.7 servings per week) had a 14.7% incidence of multimorbidity, compared to 9.5% in the lowest tertile (11.8 servings per week). After adjusting for various factors, each standard deviation increase in UPF consumption was associated with a 26% higher risk of multimorbidity (odds ratio [OR]: 1.26; 95% CI: 1.17–1.85).

Notably, specific subgroups of UPFs had varying effects. Consumption of artificially sweetened beverages (OR: 1.06; 95% CI: 1.02–1.13) and spreads and sauces (OR: 1.06; 95% CI: 1.02–1.13) was linked to a higher risk of multimorbidity, while an inverse association was found for breads and cereals (OR: 0.95; 95% CI: 0.92–0.98).

The researchers emphasised the need to re-evaluate the impact of foods based on their nutritional roles rather than solely their processing levels, particularly within specific cultural and dietary contexts.

Assessing Albumin-Bilirubin Score in Patients with Chronic Heart Failure

LIVER dysfunction, one of the most common comorbidities, is known to be associated with worse clinical outcomes in patients with chronic heart failure (CHF).

The albumin-bilirubin (ALBI) score was recently developed in order to assess liver function in an effective and convenient way; however, the prognostic significance of this score is yet to be clarified. Recent research presented at the ESC Congress 2024 aimed to shed light on the significance, hoping to improve assessment of liver function for clinicians in the future.

In order to investigate the clinical significance of the ALBI score on outcome prediction in patients with CHF, the Japan-based team examined 1,567 symptomatic CHF patients (median age: 74; interquartile range [IQR]: 64–82 years; mean left ventricular ejection fraction: 49±15.9%; median N-terminal pro-brain natriuretic peptide: 801 [IQR: 372–1,820] pg/mL) in a multicentre registry with 27 Japanese sites between January–December 2023. ALBI scores were calculated, and patients were divided into three groups according to the ALBI grade: ALBI score ≤-2.60 (Grade 1; n=691), ALBI score >-2.60 and ≤-1.39 (Grade 2; n=864), ALBI score >-1.39 (Grade 3; n=12). The team's primary outcome of interest was a composite of all-cause death and hospitalisation due to worsening heart failure.

The researchers found that during a median follow-up period of 537 (IQR: 285–701) days, the primary outcome occurred in 267 patients (17%). Higher ALBI scores were significantly related to increased incidence of the primary outcome (P for trend <0.001). Multivariable Cox regressions showed that a higher ALBI score was independently associated with higher risk of the primary outcome (hazard ratio: 2.8; 95% CI: 2.08–3.77; P<0.001), including after adjustment for the Meta-Analysis Global Group in Chronic (MAGGIC) heart failure risk score as an established risk prediction

> **"The team's primary outcome was a composite of all-cause death and hospitalisation due to worsening heart failure"**

model, N-terminal pro-brain natriuretic peptide, aspartate aminotransferase, and platelet counts. Addition of the ALBI score to the MAGGIC score significantly increased c-index from 0.70 (95% CI: 0.66–0.74) to 0.73 (95% CI: 0.69–0.76) (P<0.001). The net reclassification improvement afforded by the ALBI score was 26% for the primary outcome (P<0.001).

The team concluded that liver dysfunction assessed by the ALBI score was independently associated with worse clinical outcomes in CHF. Additionally, using this score in tandem with the existing risk prediction models increased the ability to predict outcomes. This research highlights the potential of the ALBI score in clinical practice when assessing patients with CHF.

Novel Risk Score Predicts Mortality in Patients with Heart Failure

FRAILTY or congestion in patients with heart failure (HF) is strongly associated with clinical outcomes. This research, presented at the ESC Congress 2024, aimed to develop a risk prediction model for all-cause mortality in heart failure patients with preserved ejection fraction (HFpEF) by incorporating frailty and congestion assessments. These assessments are often overlooked in current models.

The researchers analysed data from 1,212 patients (81±9 years; 55% female) enrolled in the PURSUIT-HFpEF study, a multicentre registry tracking in patients with HFpEF hospitalised for acute decompensation. Clinical Frailty Scale (CFS), blood test results, and estimated plasma volume status (ePVS), which was calculated using the Duarte formula, were evaluated. Patients were followed for a median of 713 days to record all-cause mortality.

The cohort was split into derivation and validation groups at a 2:1 ratio. A stepwise model selection based on the Bayesian Information Criterion (BIC) was applied to 51 clinical parameters, including CFS and ePVS, to identify independent predictors of mortality. The resulting model, which incorporated age, sex, CFS, NT-proBNP, and ePVS, was tested for accuracy using time-dependent receiver operating characteristic curves.

During follow-up, all-cause death was observed in 315 patients (25.9%). Age, sex, CFS, NT-proBNP, and ePVS were selected as independent predictors of all-cause death. The risk model performed well, with an area under the curve of 0.79 in the derivation cohort and 0.70 in the validation cohort for predicting 1-year mortality. A risk score cut-off value of 6 provided 74.9% sensitivity and 74.4% specificity.

In conclusion, the novel model incorporating frailty (CFS) and congestion (ePVS) effectively predicted mortality in patients with HFpEF and could be a useful tool for risk stratification in clinical practice.

> "The novel model incorporating frailty (CFS) and congestion (ePVS) effectively predicted mortality"

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