Adult Immunisation Mitigates Cardiovascular Risk from Viral Triggers

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> The interplay between viral infections and subsequent cardiovascular events presents a significant clinical dilemma for primary care and specialist physicians. Emerging evidence indicates that adult immunisation strategies may offer a pathway to mitigate this risk by modulating the inflammatory cascade triggered by common viral pathogens.

KEY TAKEAWAYS

- The Pivot: Immunisation is increasingly recognised not only for infection prevention but also for its potential to reduce downstream cardiovascular complications.
- The Data: Specific vaccines, such as influenza and pneumococcal, have demonstrated reductions in major adverse cardiovascular events (MACE) in at-risk populations.
- The Action: Clinicians should consider adult immunisation as a component of comprehensive cardiovascular risk reduction, particularly in patients with pre-existing cardiovascular disease.

Viral infections are established triggers for acute cardiovascular events, including myocardial infarction, stroke, and heart failure exacerbations. The mechanisms involve direct viral effects on cardiac tissue, systemic inflammation, endothelial dysfunction, and plaque instability. For example, influenza infection is associated with a transient but significant increase in the risk of acute myocardial infarction, with studies showing an elevated risk for up to one week post-infection.1 Similarly, pneumonia, often virally initiated or complicated by bacterial superinfection, is linked to increased cardiovascular morbidity and mortality.2

The immune response to viral pathogens involves the activation of innate and adaptive immune systems, leading to the release of pro-inflammatory cytokines such as IL-6, TNF-alpha, and CRP. These mediators can exacerbate pre-existing atherosclerotic disease, promote thrombosis, and impair myocardial function. Vaccination aims to induce protective immunity, thereby reducing viral load, attenuating the inflammatory response, and potentially preventing the cascade of events that lead to cardiovascular complications.3

Mechanisms of Cardiovascular Risk Reduction

The protective effect of adult immunisation against cardiovascular events is multifaceted. Firstly, by preventing or reducing the severity of viral infections, vaccines directly limit the acute inflammatory burden on the cardiovascular system. For instance, influenza vaccination has been shown to reduce the incidence of influenza-associated hospitalisations, which in turn reduces the risk of subsequent cardiovascular events. A meta-analysis of randomised controlled trials demonstrated that influenza vaccination reduced major adverse cardiovascular events (MACE) by 36%

(Relative Risk 0.64, 95% CI 0.53-0.78) in patients with cardiovascular disease.4

Secondly, vaccines may exert indirect cardiovascular benefits by modulating the immune response. Pre-existing immunity from vaccination can lead to a more controlled and less dysregulated inflammatory response upon exposure to the pathogen, thereby mitigating the systemic pro-inflammatory state that contributes to plaque rupture and thrombosis. This is particularly relevant for individuals with underlying cardiovascular risk factors or established cardiovascular disease, where the inflammatory insult from an infection can tip the balance towards an acute event.5

The pneumococcal vaccine also demonstrates cardiovascular benefits. Observational studies have indicated that pneumococcal vaccination is associated with a reduced risk of myocardial infarction and stroke, particularly in older adults and those with chronic medical conditions. A large cohort study found that pneumococcal vaccination was associated with a 17% lower risk of myocardial infarction (HR 0.83, 95% CI 0.77-0.89) and a 10% lower risk of stroke (HR 0.90, 95% CI 0.85-0.95) over a median follow-up of 5 years.6 While these are observational data, the biological plausibility aligns with the concept of reducing infection-related systemic inflammation.

Beyond influenza and pneumococcus, other viral infections, such as SARS-CoV-2, have also been linked to increased cardiovascular risk. The COVID-19 pandemic highlighted the direct and indirect cardiovascular sequelae of viral infections, including myocarditis, arrhythmias, and thrombotic events. Vaccination against SARS-CoV-2 has been shown to reduce the incidence of severe COVID-19 and its associated complications, including cardiovascular complications. A study published in 2023 reported that individuals who received at least one dose of an mRNA COVID-19 vaccine had a 41% lower risk of developing myocarditis compared to unvaccinated individuals following SARS-CoV-2 infection (HR 0.59, 95% CI 0.46-0.77).7

The evidence supports a growing understanding that adult immunisation is not merely a tool for infectious disease prevention but also a strategy with broader implications for cardiovascular health. Further research is needed to fully elucidate the precise mechanisms and to identify specific patient populations who may derive the greatest cardiovascular benefit from targeted vaccination strategies.

CLINICAL IMPLICATIONS

The accumulating evidence on the cardiovascular benefits of adult immunisation necessitates a re-evaluation of current clinical practice. General practitioners and specialists alike should integrate vaccination status into routine cardiovascular risk assessments, particularly for patients with established atherosclerotic disease or multiple risk factors. It is no longer sufficient to view vaccines solely through the lens of infectious disease prevention; their role in mitigating systemic inflammation and preventing acute cardiovascular events is becoming increasingly clear. This shift requires a proactive approach to vaccine recommendations, moving beyond reactive responses to outbreaks.

From an industry perspective, the expanded understanding of vaccine benefits beyond primary infection prevention opens new avenues for research and development. Pharmaceutical companies developing vaccines may consider designing trials with cardiovascular endpoints, which could broaden the market and reinforce the value proposition of their products. This could also lead to new guidelines from bodies like the American Heart Association or the European Society of Cardiology, explicitly recommending certain vaccinations as part of comprehensive cardiovascular care, similar to how statins or antiplatelet agents are prescribed.

> For patients, this means a more holistic approach to their health. Understanding that a simple flu shot or pneumococcal vaccine can reduce their risk of a heart attack or stroke could significantly improve vaccine uptake. Clinicians need to communicate these benefits clearly, framing immunisation as a protective measure against cardiovascular events, not just against the flu. This reframing could empower patients to take a more active role in their preventive health, ultimately leading to better population-level cardiovascular outcomes and reduced healthcare burdens associated with acute cardiac events.

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