Annual Influenza Vaccination: Offering Protection Beyond Infection

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Abstract: Cardiovascular disease (CVD), the leading cause of death in the world, is largely preventable. An increasing amount of evidence suggests that annual vaccination with inactivated influenza vaccine reduces morbidity and mortality associated with CVD; however, immunization rates in patients with CVD fall consistently below the goals established by Healthy People 2020. This review outlines the importance of vaccination and summarizes the available literature on the role of seasonal influenza vaccination and the incidence of coronary artery disease and stroke.

Key Words: cardiovascular disease, cerebrovascular disease, influenza vaccine, prevention

Cardiovascular disease (CVD) is the leading cause of death in the United States and results in approximately one death every 39 seconds. More than one in three Americans has at least one type of CVD, which includes coronary artery disease (CAD), stroke, hypertension, and heart failure. This largely preventable disease claims 1 of every 2.9 lives, and each year a progressively broader population is affected. Much emphasis has been placed on reducing known risk factors such as hypertension, diabetes, obesity, and tobacco use. Despite mounting evidence that annual influenza vaccination not only reduces complications from respiratory illness but also substantially decreases cardiovascular events and subsequent deaths, a continually disappointing number of patients are vaccinated each year. Healthy People 2020, the nation’s 10-year goals and objectives for disease prevention and promotion of health, aims to increase the percentage of adults who are at high risk for CVD receiving annual seasonal influenza vaccinations to 90%. In 2009, only 50% of adults older than 50 received an influenza vaccination, and results of a nationwide telephone survey indicated that fewer than 60% of patients with CVD were vaccinated. It is clear that these immunization goals are not being met. The compelling evidence that acute infection with influenza virus is associated with a higher incidence of cardiovascular events means that more focus should be placed on improving vaccination rates among patients with CVD or who are at high risk for the disease.

Mechanism of Increased Cardiovascular Risk

A suspected link between influenza infection and CVD dates to the early 20th century, particularly following the 1918 “Spanish flu.” During subsequent influenza seasons, the same pattern of increased cardiovascular death transpired. Almost 100 years later, the majority of cardiovascular events still occur most commonly in the winter months, immediately following influenza infection. This association led researchers to

Key Points

- Annual influenza vaccination rates are unacceptably low and patients with cardiovascular disease are at high risk for complications, including death, when infected with influenza.
- Evidence suggests that annual influenza vaccination reduces complications from respiratory illness and cardiovascular disease.
- Annual influenza vaccination is a simple intervention that decreases cardiovascular mortality.
hypothesize the role of influenza infection in atherosclerosis. Other infectious agents, such as *Chlamydia pneumonia*, herpes simplex viruses 1 and 2, and *Mycoplasma pneumonia*, also have been suspected to increase CVD risk through a cascade of systemic infection and subsequent inflammation; however, infection with influenza virus is unique in that it may pose a greater threat to patients with preexisting atherosclerotic disease. Whereas other infectious agents simply provoke generalized systemic inflammation, influenza virus may play a more specific role in triggering acute events by exclusively targeting areas of atherosclerosis and destabilizing preexisting plaques. One study evaluated the effects of influenza virus on the vasculature by injecting it into mice that had diffuse arterial disease. Upon examination of the mice arteries, researchers found that areas of preexisting atherosclerotic plaques were inflamed and thrombotic, with platelet aggregation and fibrin deposition, whereas healthy sections of aorta were virtually unaffected by the virus.

Another study, which evaluated monocytes infected with influenza virus, cytomegalovirus, or *Chlamydiophila pneumoniae* demonstrated that infection with influenza may increase CVD risk to a greater degree compared with other types of infection. All three types of infection were associated with decreased clotting time without production of the anti-inflammatory cytokine interleukin-10; however, monocytes infected with influenza produced three to five times more of the proinflammatory cytokines interleukin-6 and interleukin-8, as compared with cytomegalovirus and *C pneumoniae*-infected cells.

An extensive review by Warren-Gash and colleagues consistently demonstrated that infection with influenza triggers acute myocardial infarction (MI) and that influenza vaccination reduces the risk of cardiovascular events in patients with a history of CVD. These studies outline only a few of the proposed mechanisms; many different theories exist. Some other suggested mechanisms include high-density lipoprotein loss of anti-inflammatory properties, endothelial dysfunction, deposition of immune complexes in atherosclerotic plaques, and elevation of macrophage circulation into the arteries. All of these mechanisms may play a role, but more studies are needed to fully elucidate the pathophysiology.

In addition to the evidence of increased CVD risk after infection with influenza virus, the acute period following vaccination was postulated to increase CVD risk. A retrospective study evaluating 20,486 patients with their first MI and 19,063 patients with their first stroke sought to prove that not only acute respiratory infection but also the acute period after vaccination are risk factors for MI and stroke. Acute respiratory infection was associated with an age-adjusted approximately fivefold increased incidence of MI (4.95; 95% confidence interval [CI] 4.43–5.53) and a threefold increased incidence of stroke (3.19; 95% CI 2.81–3.62) in the first 3 days after diagnosis of systemic respiratory infection. Contradicting the hypothesis, influenza vaccination was not found to increase the rate of MI or stroke in the period after vaccination.

### Evidence of Benefit in CVD

The Flu Vaccination Acute Coronary Syndromes (FLUVACS) study was one of the first prospective randomized controlled trials to demonstrate the benefit of influenza vaccination in patients with acute coronary syndrome (ACS). This single-blind, parallel group multicenter trial enrolled 200 patients with acute MI and 101 patients with elective percutaneous coronary intervention (PCI). Patients in the MI group were allocated to two groups. Group A (n = 100) received influenza vaccination and group B (n = 100) served as the control. Likewise, the 101 patients with planned stenting were allocated to receive the vaccination (n = 51) or serve as a control (n = 50). Primary endpoints included cardiovascular death and the combined endpoint of death, MI, and hospitalization for ischemia. After a 6-month follow-up period, the incidence of cardiovascular death in the vaccine group was significantly lower than that of the control group (2% vs 8%; *P* = 0.01). The combined endpoint occurred in 11% of those receiving vaccine and 23% of the control (*P* = 0.009). At 12-month follow-up, cardiovascular death was still significantly lower in the vaccine group (6% vs 17%; *P* = 0.002) as well as the combined triple endpoint (22% vs 37%; *P* = 0.004)

Using 2 years of follow-up data, a registry was created for 230 of the original 301 patients, and data were obtained by voluntary questionnaires completed by the original participants. Upon analyzing the data, a lower incidence of death in the vaccine group was maintained after 2 years (1.7% vs 5.3%; *P* = 0.14), as well as a lower combined endpoint of total death plus MI (3.5% vs 9.7%; *P* = 0.05). The beneficial effect was seen mainly in the patients who experienced an acute MI; however, this benefit could be the result of underpowering for the elective PCI group, who have a lower morbidity than those who experienced an acute event.

The Influenza Vaccination in Secondary Prevention from Coronary Ischemic Events in Coronary Artery Disease (FLUCAD) study is a randomized, double-blind, placebo-controlled trial that demonstrated benefit of influenza vaccination in patients with established CAD. The FLUCAD study randomized 157 patients who underwent PCI because of ACS, 131 patients who underwent elective PCI, and 370 outpatients with angiographically documented CAD to either influenza vaccination or placebo injection. The primary endpoint was cardiovascular death. The two secondary endpoints included major adverse cardiovascular events (MACE), defined as cardiovascular death, acute MI, or coronary revascularization, and coronary ischemic events, defined as MACE or hospitalization for myocardial ischemia. Optimal medical management was noted between both groups, with >90% of patients receiving aspirin, statins, beta-blockers, and angiotensin-converting enzyme inhibitors. After the follow-up period of 12 months, only four deaths occurred (two per group). Of the secondary endpoints, MACE occurred less often in the...
vaccinated group (3% vs. 5.87%; \( P = 0.13 \)), but it did not reach statistical significance. The other secondary endpoint, the coronary ischemic event rate, was significantly lower in the vaccine group compared with the placebo group (6.02% vs 9.97%; \( P = 0.047 \)). After multivariate analysis, influenza vaccination was found to be inversely associated with cardiovascular events (\( P = 0.0086 \)) and was not restricted to seasonal influenza because higher event rates occurred in the placebo group until the end of the follow-up period. This single-center study may have been underpowered and therefore unable to detect a statistically significant difference in the primary and secondary outcomes. In addition, patients in this study were aggressively treated with PCI and optimal medications, which may have attenuated the beneficial effects of the vaccine.

A recent prospective randomized trial evaluated 439 patients older than 50 years who were admitted to the hospital with a diagnosis of ACS.\(^{19} \) In this open-label, blinded endpoint study, patients were randomized to receive either inactivated influenza vaccine or no vaccine. The primary endpoint was incidence of MACE, defined as death or hospitalization resulting from ACS, stroke, or heart failure. The secondary endpoint was cardiovascular death. Of note, more patients in the vaccine group received angiotensin-converting enzyme inhibitors and had lower serum creatinine levels; however, the results of the study were not affected after adjustments for these variables were made and multivariate analyses were performed. After a follow-up period of 12 months, patients in the vaccine group had a lower rate of MACE compared with the control group (9.5% vs 19.3%; adjusted hazard ratio [HR] 0.67 [0.51–0.86]; \( P = 0.005 \)). There was no significant difference in the secondary endpoint (2.3% vs 5.5%; unadjusted HR 0.39 [0.14–1.12]; \( P = 0.088 \)).\(^{18} \)

Several observational studies in different settings across different populations support cardiovascular benefits from influenza vaccination (Table).\(^{14,20–28} \) The limitations to these types of studies may include small size, poor selection of control groups, and confounding or recall bias from self-reporting of vaccinations or symptoms; however, examining the effects of vaccination across various populations may increase the validity of the findings in these studies.\(^{11} \) Nonetheless, these studies do provide further evidence that suggests the protective effect of influenza vaccination.

In contrast to the studies described earlier, few studies have shown nonsignificant results and none have demonstrated that influenza vaccination worsens CVD outcome.\(^{17,24,28} \) Jackson and colleagues found in their population-based inception cohort of 1378 Group Health Cooperative enrollees who survived a first MI during 1992–1996 that influenza vaccination was not associated with risk of recurrent coronary events.\(^{28} \) In addition, 2-year follow-up data from FLUVACS found no statistically difference in the primary outcome of cardiovascular death or MI.\(^{17} \) Finally, in a population-based case-control study in patients 65 to 79 years old with a history of MI, vaccination was not associated with a reduction in acute MI.\(^{24} \)

**Stroke and Transient Ischemic Attack**

Many studies also have produced results linking influenza vaccination to reduced rates of brain infarction.\(^{23,25,29,30} \) A case-control study evaluated 90 patients older than 60 years presenting with stroke and 180 matched controls.\(^{29} \) Researchers found that patients hospitalized for stroke were less likely than nonhospitalized patients to have been vaccinated during the previous influenza season (46.7% vs 59.4%; \( P = 0.036 \)) as well as during the previous 5 years (41.1% vs 56.1%; \( P = 0.0017 \)). These results remained significant after multivariate analysis adjusting for age, traditional risk factors, and other possible confounding variables. Patients presenting with stroke who had no prior diagnosis of cerebrovascular disease or CVD had even lower rates of vaccination during the previous influenza season as compared with control subjects (42.4% vs 58.5%; odds ratio 0.37 [95% CI 0.15–0.87]; \( P = 0.024 \)). Upon analyzing immunization rates by age group, the above results lost significance in the patients older than 75 years; however, the small patient population and the influence of other risk factors such as hypertension in this age group may have led to an inability to detect a difference with influenza vaccination.

A cohort of more than 140,000 elderly patients enrolled in three managed care organizations was evaluated across two consecutive influenza seasons.\(^{25} \) Hospitalizations for pneumonia, influenza, acute cerebrovascular disease, cardiac disease (defined as ischemic heart disease or congestive heart failure), and all-cause mortality were assessed by computerized data. For two consecutive influenza seasons, hospitalization because of cardiac disease was reduced by 19% during both seasons (\( P < 0.001 \)), and hospitalization for stroke was reduced by 16% (\( P < 0.018 \)) and 23% (\( P < 0.001 \)), respectively, during the two influenza seasons. Death resulting from all causes was also reduced by 48% and 50% (\( P < 0.001 \)) during these influenza seasons. Despite such positive outcomes in the group of vaccinated patients, these patients were older and in overall worse health at baseline, with a significantly higher prevalence of illnesses including heart disease, lung disease, diabetes, cancer, hypertension, atrial fibrillation, and hyperlipidemia (\( P < 0.001 \)). Patients in the unvaccinated group had slightly higher rates of dementia or stroke (4.8% [unvaccinated] vs 3.8% [vaccinated] and 4.6% [unvaccinated] vs 3.7% [vaccinated], \( P < 0.001 \)), respectively, during two influenza seasons.

Another case-control study evaluated 370 consecutive patients with stroke or transient ischemic attack (TIA) and 370 control subjects matched for age and sex.\(^{30} \) Patients with stroke or TIA were much less likely than patients without these diagnoses to have received influenza vaccination during the last year as compared with control subjects (19.2% vs 31.4%; \( P < 0.0001 \)). The stroke group was also far less likely to have been vaccinated within the past 5 influenza seasons (28.4% vs 44.1%; \( P < 0.0001 \)). Conventional risk factors such as hypertension, diabetes, hyperlipidemia, or previous stroke were significantly more common in patients versus controls. After
<table>
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<tr>
<th>Study</th>
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<th>Age description, y</th>
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<td><strong>Observational studies</strong></td>
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<tr>
<td>Gwini et al²⁰</td>
<td>Self-controlled case series (UK)</td>
<td>8180</td>
<td>75.8 ± 10.2²⁰</td>
<td>Age ≥ 40 y with first AMI diagnosis</td>
<td>Out to 180 d postvaccination</td>
<td>32% (seasonally adjusted IRR 0.68; 95% CI 0.60-0.78) at 1-14 d postvaccination, 18% (seasonally adjusted IRR 0.82; 95% CI 0.75-0.90) at 29-59 d postvaccination</td>
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<td>Siriwardena et al²¹</td>
<td>Matched case-control design (UK)</td>
<td>78,706 (16,012 cases and 62,694 controls)</td>
<td>(Cases vs controls)</td>
<td>Age ≥ 40 y at time of first MI</td>
<td>5.5 y</td>
<td>19% in AMI (adjusted OR 0.81, 95% CI 0.77-0.85) Early seasonal influenza vaccination was associated with a lower rate of AMI (adjusted OR 0.79, 95% CI 0.75-0.83) than vaccination after mid-November (adjusted OR 0.88, 95% CI 0.79-0.97)</td>
<td>Pneumococcal vaccination was not found to significantly reduce AMI</td>
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<td>Mansur Ade et al²²</td>
<td>Population-based cohort study (Brazil)</td>
<td>Population estimates on 100,000</td>
<td>Not reported</td>
<td>Age ≥ 60 y</td>
<td>For the period 1980-2006; postvaccination period from 1996-2006</td>
<td>36.1%; P = 0.02 Benefits from influenza vaccination were not significant for cerebrovascular diseases (P = 0.93) and external causes (P = 0.94)</td>
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<td>Wang et al²³</td>
<td>Cohort study (Taiwan)</td>
<td>102,698</td>
<td>Not reported</td>
<td>&gt; 65 y</td>
<td>10 mo</td>
<td>32% mortality from IHD (36.1%); P = 0.02 Benefits from influenza vaccination were not significant for cerebrovascular diseases (P = 0.93) and external causes (P = 0.94)</td>
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<tr>
<td>Heffelfinger et al²⁴</td>
<td>Population-based case-control (US)</td>
<td>750 cases, 1735 controls</td>
<td>Median, cases vs controls 73.7 vs 72.9 (P = 0.008)</td>
<td>65-79 y with previous AMI</td>
<td>Up to 4 mo postvaccination period</td>
<td>32% (seasonally adjusted IRR 0.68; 95% CI 0.60-0.78) at 1-14 d postvaccination, 18% (seasonally adjusted IRR 0.82; 95% CI 0.75-0.90) at 29-59 d postvaccination</td>
<td>No association between AMI and influenza vaccination; AMI OR 0.97 (0.75–1.27)</td>
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<td>Study</td>
<td>Study Design</td>
<td>Number of Participants</td>
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<td>Nichol et al\textsuperscript{25c}</td>
<td>Cohort study (US Dept of Veterans Affairs)</td>
<td>2 cohorts: n = 140,055 (1998–1999), n = 146,328 (1999–2000)</td>
<td>Age &gt;65</td>
<td>For the period during the influenza season following vaccination</td>
<td>Significant hospitalizations for pneumonia or influenza, acute CVD, cardiac disease, CHF, and all-cause death in both years</td>
<td>Hospitalizations associated with discharge diagnosis of IHD during the 1998–1999 influenza season (OR 0.80, 95% CI 0.70–0.91), but not during the 1999–2000 influenza season (OR 0.90, 95% CI 0.78–1.03)</td>
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<td>Smeeth et al\textsuperscript{14a}</td>
<td>Self-controlled case series (UK)</td>
<td>20,486 with first MI and 19,063 with first stroke</td>
<td>Age &gt;18 with 1 or 2 new diagnoses of MI or stroke during the period of at least 6 mo of follow-up in this British registry</td>
<td>Up to 91 d postvaccination</td>
<td>Hospitalization for cardiac disease (reduction of 19% during both seasons; (P &lt; 0.001)), cerebrovascular disease (16% (P &lt; 0.018) and 23% (P &lt; 0.001)) during the 1998–1999 season</td>
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<td>Jackson et al\textsuperscript{28a}</td>
<td>Population-based cohort study (US)</td>
<td>1378</td>
<td>Median 64</td>
<td>HMO enrollees with incident MI</td>
<td>2.3 y</td>
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<td>Siscovick et al\textsuperscript{26a}</td>
<td>Case-control (US)</td>
<td>342 cases, 549 controls</td>
<td>Cases vs controls 63 ± 9 vs 56 ± 10, (P &lt; 0.05)</td>
<td>Prior cardiac arrest cases aged 25–74 y without prior heart disease or life-threatening comorbidity</td>
<td>Not reported</td>
<td>Risk for out-of-hospital cardiac arrest (adjusted OR 0.51, 95% CI 0.33–0.79) with vaccination</td>
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<td>Naghavi et al\textsuperscript{27a}</td>
<td>Case-control (US)</td>
<td>109 cases, 109 controls</td>
<td>Cases vs controls 62.9 ± 11.9 vs 64.6 ± 13.5</td>
<td>Patients with new MI</td>
<td>Not reported</td>
<td>Recurrent AMI, OR 0.33 (0.13–0.82); (P = 0.017)</td>
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<td>Prospective studies</td>
<td>Phrommintikul et al\textsuperscript{19a}</td>
<td>Prospective randomized open-label with blinded endpoint</td>
<td>Cases vs controls 65 ± 9 vs 67 ± 9</td>
<td>Patients &gt;50 y admitted to hospital with ACS within previous 8 wk</td>
<td>12 mo</td>
<td>MACE (adjusted HR 0.67, 95% CI 0.51–0.86; (P = 0.005)) and hospitalizations for ACS (adjusted HR 0.68, 95% CI 0.47–0.98; (P = 0.039))</td>
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<td>Ciszewski et al, FLUCAD\textsuperscript{18a}</td>
<td>Randomized controlled trial (Poland)</td>
<td>Age 30–80 y, with CAD confirmed by angiography</td>
<td>298 d</td>
<td>Coronary ischemic events (HR 0.54, 95% CI 0.29–0.99, (P = 0.047))</td>
<td>No significant effect on other outcomes such as cardiovascular death (HR 1.06, 95% CI 0.15–7.56; (P = 0.95)) or major adverse cardiac events (HR 0.54, 95% CI 0.24–1.21; (P = 0.13))</td>
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The 2006 ACC/AHA = 0.14, 0.0001). Of note, benefit was seen in 0.0001) and overall mortality was re-

G Cardiovascular death, with P = 0.05 = 0.009) 1y 9 0.01); the = 0.002 with

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15

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In ACIP’s 2010 recom-

*P

Death caused by CVD

P = 0.005 with

vaccine vs control

The table below provides a summary of the results from the FLUVACS and FLUCAD trials. The incidence of stroke was lower in the vaccine group compared to the control group. Multivariate analyses, influenza vaccination was still associated with a reduced risk of stroke/TIA (odds ratio 0.46; 95% CI 0.28–0.77). Significance was apparent only in the ischemic stroke subtype, with no benefit in those with hemorrhagic stroke. Furthermore, other vaccines, including pneumococcal, given within the past year were not associated with a decreased incidence of stroke.

A prospective cohort study evaluated the mortality data of 102,698 people older than 65 years at the initiation of a voluntary, free-of-charge influenza vaccination program. Only 35,637 (34.7%) received a vaccination during the program, which ran from October 1 through December 31, 2000. During the next 10 months, mortality caused by stroke was reduced by 65% (P < 0.0001) and overall mortality was reduced by 44% (P < 0.0001). Of note, benefit was seen in individuals at high risk (ie, recently hospitalized, diagnosis of chronic or severe disease, or being a resident of a nursing facility or chronic care facility) and in those considered to be at lower risk. After adjusting for age, sex, and risk status, vaccination was significantly associated with lower mortality risk for all-cause (HR 0.56, 95% CI 0.52–0.60) and stroke (HR 0.35, 95% CI 0.27–0.45).

### Current Recommendations

Influenza vaccination in patients with CVD is not a new recommendation. As early as 1960, the US Public Health Service issued a statement that patients with CVD should be immunized routinely against the influenza virus. This recommendation is still upheld by the Advisory Committee on Immunization Practices (ACIP). In ACIP’s 2010 recommendations on influenza vaccination, patients with chronic cardiovascular disorders other than isolated hypertension are listed as a priority group for receiving the vaccine. This recommendation is based not only on the higher risk of severe respiratory illness but also on noninfluenza complications associated with contracting the influenza virus. Evidence of improved CVD outcomes in the ACIP report is based on results from the FLUVACS and FLUCAD trials.

This report also describes two observational studies that have demonstrated decreased hospitalizations and deaths in patients with established CVD or known risk factors.

The American Heart Association (AHA) and the American College of Cardiology (ACC) recommend that patients with CVD receive the influenza vaccine. The 2006 ACC/AHA Science Advisory recommends (class I) that patients with coronary and other atherosclerotic vascular diseases receive the influenza vaccination annually as a part of a comprehensive secondary prevention strategy. The advisory recommends early seasonal administration for optimal protection, although patients should receive the vaccine as long as it is available throughout the entire influenza season.

Last updated in 2002, the AHA guidelines for primary prevention of CVD and stroke do not mention influenza
vaccination as a preventive strategy. In contrast, the 2011 guidelines for primary prevention of stroke released by the American Stroke Association do recommend (class IIa) annual vaccination for patients at risk for stroke. This indicates that the American Stroke Association recommends in favor of vaccination as a useful and effective preventive strategy but that some conflicting evidence exists.

Overcoming Barriers to Vaccination

Patients fail to receive annual influenza vaccination for many reasons. Some patients may have misconceptions about the adverse effects; however, serious adverse effects from influenza vaccine are extremely rare. Most are limited to mild injection-site reactions, pain, fever, myalgia, or headache, and usually last fewer than 2 days. Others may fear that they are at risk for contracting influenza virus from the vaccine. Patients should be assured that intramuscular influenza vaccine contains virus that is killed during production and is therefore noninfectious. Other barriers to vaccination may include cost, fear of pain associated with the injection, or other religious, racial, ethnicity, and cultural beliefs.

Many patients with CVD do not consider themselves at high risk for influenza. One study indicated that fewer than two-thirds of patients with CVD believed that they were at increased risk of complications associated with contracting the influenza virus.

Educating patients about the other benefits of influenza vaccination may subdue negative connotations about the vaccine and subsequently increase vaccination rates. Healthcare professionals should educate and vaccinate patients at any and all opportunities. If vaccine is not available, then patients should be referred to another provider. Many healthcare providers do not stock influenza vaccine. A survey of board-certified cardiologists, endocrinologists, and pulmonologists found that cardiologists were the least likely clinicians to stock influenza vaccine.

Among practitioners who did not stock the vaccine, the most common reason cited was the assumption that patients would receive the vaccine elsewhere. Influenza vaccination in patients with or at risk for CVD is a standard of care, and all providers should assume the responsibility of inquiring about vaccination status, providing education, and ensuring that patients have the opportunity to be vaccinated.

Conclusions

Data have become available that suggest a benefit in both cerebrovascular and cardiovascular protection with influenza vaccination. Although most of the evidence has been observed from large cohort studies and smaller randomized controlled trials, few have shown nonsignificant results and none have demonstrated that influenza vaccination worsens CVD outcomes. It may be evident that the benefits from vaccination outweigh the risks in patients with CVD or known risk factors; however, vaccination rates fall consistently below national objectives. Several national guidelines recommend annual influenza vaccination in people with a history of CVD. An annual influenza vaccination is a simple intervention aimed at decreasing cardiovascular morbidity and mortality, and practitioners should be mindful of ensuring that patients are protected. Although it may take months or years to titrate antihypertensive medications, control blood glucose, or reduce cholesterol levels, it only takes minutes to administer an annual influenza vaccination.

References

Rogers et al • Annual Influenza Vaccination


