Smallpox and Mpox (Vaccinia) Vaccine Live

AHFS Class: 80:12 — Vaccines (tofc-80)

Smallpox and Mpox (Vaccinia) Vaccine Live *(AHFS DI)*

FDA Boxed Warning:

Suspected cases of myocarditis and/or pericarditis have been observed in healthy adult primary vaccinees at an approximate rate of 5.7 per 1000 receiving smallpox and mpox (vaccinia) vaccine live (ACAM2000®).[1,]

Encephalitis, encephalomyelitis, encephalopathy, progressive vaccinia, generalized vaccinia, severe vaccinial skin infections, erythema multiforme major (including Stevens-Johnson syndrome), eczema vaccinatum resulting in permanent sequelae or death, ocular complications, blindness, and fetal death have occurred following either primary vaccination or revaccination with ACAM2000® or other live vaccinia virus vaccines that were used historically.[1,]

Accidental eye infection (ocular vaccinia) may result in ocular complications including keratitis and corneal scarring that may lead to blindness.[1,]

These risks may result in severe disability, permanent neurological sequelae and/or death and are increased in individuals who:[1,]

- Have cardiac disease or history of cardiac disease
- Have eye disease treated with topical steroids
- Have congenital or acquired immune deficiency disorders including individuals taking immunosuppressive medications
- Have eczema or a history of eczema or other acute or chronic exfoliative skin conditions
- Are younger than 12 months of age
- Are pregnant

ACAM2000® contains live vaccinia virus that can be transmitted to individuals who have close contact with the vaccinee and the risks in contacts are the same as those for the vaccinee.[1,]

The risk for experiencing serious vaccination complications must be weighed against the risk of experiencing a potentially severe or fatal smallpox or mpox infection.[1,]

Brands: ACAM2000®

Introduction

Smallpox and mpox (vaccinia) vaccine live is a live replicating vaccinia virus vaccine containing replication-competent vaccinia virus derived from a plaque-purified clone of the New York City Board of Health vaccinia strain.[1,2,]

Uses

▪ Smallpox

Smallpox and mpox (vaccinia) vaccine live (ACAM2000®) is indicated for active immunization for the prevention of smallpox disease in individuals determined to be at high risk for smallpox infection.[1,]

The US Centers for Disease Control and Prevention (CDC) Advisory Committee on Immunization Practices (ACIP) has issued recommendations and clinical considerations for the use of vaccines in preventing smallpox.[2,] Although routine vaccination against smallpox in the US ended in the 1970s, ACIP recommends that certain populations at high risk of occupational exposure to orthopoxviruses be vaccinated.[2,]

There are currently 2 licensed smallpox vaccines in the US (smallpox and mpox [vaccinia] vaccine live [ACAM2000®] and smallpox and mpox vaccine live, non-replicating [JYNNEOS®]).[2,] In the event of a smallpox emergency, ACIP states that ACAM2000 would be made available to persons exposed to smallpox virus or who are at high risk of smallpox infection, depending on the circumstances of the event; specific use of JYNNEOS in a smallpox emergency will be based on risk of exposure and relative contraindications to ACAM2000.[2,] For additional information, consult the CDC website at https://www.cdc.gov/smallpox/hcp/vaccines/index.html (https://www.cdc.gov/smallpox/hcp/vaccines/index.html)

▪ Mpox

Smallpox and mpox (vaccinia) vaccine live (ACAM2000®) is indicated for active immunization for the prevention of mpox disease in individuals determined to be at high risk for mpox infection.[1,6,]

The CDC ACIP has issued recommendations and clinical considerations for the use of vaccines for mpox prevention in the US.[6,] There are 2 vaccines (JYNNEOS and ACAM2000) currently available.[6,] During the ongoing clade II mpox outbreak that started in the US on May 17, 2022, JYNNEOS has been the main vaccine used in the US.[6,] For additional information on ACIP recommendations, consult the CDC website at https://www.cdc.gov/monkeypox/hcp/vaccine-considerations/vaccination-overview.html (https://www.cdc.gov/monkeypox/hcp/vaccine-considerations/vaccination-overview.html)

Dosage and Administration

▪ General

Smallpox and mpox (vaccinia) vaccine live (ACAM2000®) is available in the following dosage form(s) and strength(s):

Multiple-dose vial containing Lyophilized Antigen Component, Live to be reconstituted with the supplied Diluent Component.[1,] After reconstitution, a single dose of ACAM2000 is approximately 0.0025 mL.[1,]

▪ Administration

Administer smallpox and mpox (vaccinia) vaccine live (ACAM2000®) only after being trained on the safe and effective administration of the vaccine by the percutaneous route (scarification).[1,]

Do not administer by injection.[1,]

Provide the FDA-approved patient labeling (Medication Guide) to the vaccine recipient and provide instructions on vaccination site care.[1,]

See Full Prescribing Information for complete instructions for vaccine preparation and administration (including handling precautions and disposal instructions) and instructions for interpreting the response to vaccination (including vaccination failures).[1,]

▪ Dosage

It is *essential* that the manufacturer's labeling be consulted for more detailed information on dosage and administration of this drug. Dosage summary:

Pediatric Patients

Prevention of Smallpox or Mpox Disease.

One droplet of reconstituted smallpox and mpox (vaccinia) vaccine live is administered by the percutaneous route (scarification) using 15 jabs of a bifurcated needle.[1,]

The droplet (approximately 0.0025 mL) of reconstituted vaccine is picked up with a bifurcated needle by dipping the needle into the vial of reconstituted vaccine.[1,]

CDC provides recommendations for revaccination of laboratory and healthcare personnel at risk of occupational exposure to variola and mpox viruses.[1,]

Adults

Prevention of Smallpox or Mpox Disease.

One droplet of reconstituted smallpox and mpox (vaccinia) vaccine live is administered by the percutaneous route (scarification) using 15 jabs of a bifurcated needle.[1,]

The droplet (approximately 0.0025 mL) of reconstituted vaccine is picked up with a bifurcated needle by dipping the needle into the vial of reconstituted vaccine.[1,]

CDC provides recommendations for revaccination of laboratory and healthcare personnel at risk of occupational exposure to variola and mpox viruses.[1,]

Cautions

▪ Contraindications

Do not administer ACAM2000 to individuals with severe immunodeficiency.[1,] These individuals may include individuals who are undergoing bone marrow transplantation or individuals with primary or acquired immunodeficiency who require isolation.[1,]

▪ Warnings/Precautions

Serious Vaccination Complications and Death

Smallpox and mpox (vaccinia) vaccine live (ACAM2000®) contains live, replication-competent, vaccinia virus.[2,4,] Individuals at greatest risk of experiencing serious complications following receipt of a replication-competent smallpox vaccine are often those at greatest risk for death from smallpox, and the risk for serious vaccination complications must be weighed against the risk for a potentially fatal smallpox infection.[1,]

Serious complications that may occur following primary vaccination or revaccination with replication-competent smallpox and mpox (vaccinia) vaccine live include myocarditis and/or pericarditis, encephalitis, encephalomyelitis, encephalopathy, progressive vaccinia (vaccinia necrosum), generalized vaccinia, severe vaccinial skin infections, erythema multiforme major (including Stevens-Johnson syndrome), eczema vaccinatum, accidental eye infection (ocular vaccinia) which can cause ocular complications including keratitis and corneal scarring that may lead to blindness, and fetal death in pregnant women.[1,] These complications may rarely lead to severe disability, permanent neurological sequelae, and death.[1,] Fetal death can occur if replication-competent smallpox vaccine live is administered to pregnant women.[1,]

Based on clinical trials of ACAM2000®, symptoms of suspected myocarditis or pericarditis (such as chest pain, raised troponin/cardiac enzymes, or ECG abnormalities) occur in 5.7 per 1000 primary vaccinations (95% CI: 1.9-13.3).[1,] This finding includes cases of acute symptomatic or asymptomatic myocarditis or pericarditits or both.[1,]

Historically, death following vaccination with live vaccinia virus is a rare event; approximately 1 death per million primary vaccinations and 1 death per 4 million revaccinations have occurred after vaccination with live vaccinia virus.[1,] Death is most often the result of sudden cardiac death, postvaccinial encephalitis, progressive vaccinia, or eczema vaccinatum.[1,] Death has also been reported in unvaccinated contacts accidentally infected by individuals who have been vaccinated.[1,]

Data on the incidence of adverse events among US military personnel and civilian first responders vaccinated with a previously available smallpox vaccine live containing replication-competent vaccinia virus (i.e., New York City Board of Health strain; Dryvax®) during vaccination programs initiated in December 2002 are shown in Table 1.[1,] The incidence of preventable adverse events (eczema vaccinatum, contact transmission, and autoinoculation) reported in these programs was notably lower compared with data collected in the 1960s when smallpox vaccination was routinely recommended in the US population; this difference presumably is because of better vaccination screening procedures and routine use of protective bandages over the inoculation site.[1,] Myocarditis and pericarditis were not commonly reported following smallpox vaccination in the 1960s, but emerged as a more frequent event based on more active surveillance in the military and civilian programs.[1,]

Table 1. Incidence of Serious Adverse Events Reported with Smallpox Vaccine Live (Dryvax®) in 2002–2005

Adverse event	N [a]	Incidence per million	N [b]	Incidence per million
Myocarditis/pericarditis	86	117.71	21	519.52
Post-vaccinal encephalitis	1	1.37	1	24.74
Eczema vaccinatum	0	0.00	0	0.00
Generalized vaccinia	43	58.86	3	74.22
Progressive vaccinia	0	0.00	0	0.00
Fetal vaccinia	0	0.00	0	0.00
Contact transmission	52	71.18	0	0.00
Auto-inoculation (non-ocular)	62	84.86	20	494.78
Ocular vaccinia	16	21.90	3	74.22

[a] Department of Defense program as of January 2005 (n = 730,580): 71% primary vaccinations; 89% male; median age 28.5 years.[1,]

[b] Department of Health and Human Services program as of January 2004 (n = 40,422): 36% primary vaccinations; 36% male; median age 47.1 years.[1,]

Cardiovascular Events

In clinical trials involving 2983 individuals who received ACAM2000® and 868 individuals who received a previously available smallpox vaccine live (Dryvax®), 10 cases of suspected myocarditis (7 out of 2983 ACAM2000® recipients [0.2%] and 3 out of 868 Dryvax® recipients [0.3%]) were identified.[1,] The mean time to onset of suspected myocarditis and/or pericarditis after vaccination was 11 days (range: 9–20 days).[1,] All individuals who experienced these cardiac events were naïve to vaccinia.[1,] Of these 10 cases, 2 were hospitalized; none of the remaining 8 required hospitalization or treatment with medication.[1,] Of the 10 cases, 8 were subclinical and detected only by ECG abnormalities with or without associated elevations of cardiac troponin I.[1,] These cases resolved by 9 months, with the exception of one female in the Dryvax® group who had persistent borderline abnormal left ventricular ejection fraction on ECG.[1,]

The best estimate of risk for myocarditis and pericarditis in recipients of replication-competent smallpox vaccine live is derived from the phase 3 clinical trials comparing ACAM2000® and Dryvax® where there was active monitoring for potential myocarditis and pericarditis.[1,] Among vaccinees naïve to vaccinia, 8 cases of suspected myocarditis and pericarditis were identified across both vaccine groups, for a total incidence rate of 6.9 per 1000 vaccinees (8 out of 1162).[1,] The rate for the ACAM2000® group was 5.7 (95% CI: 1.9-13.3) per 1000 vaccinees (5 out of 873 vaccinees) and the rate for the Dryvax® group was 10.4 (95% CI: 2.1-30.0) per 1000 vaccinees (3 out of 289 vaccinees).[1,] No cases of myocarditis and/or pericarditis were identified in 1819 vaccinia-experienced subjects.[1,] The long-term outcome of myocarditis and pericarditis following smallpox vaccine live vaccination is currently unknown.[1,]

Ischemic cardiac events, including fatal events, and non-ischemic, dilated cardiomyopathy have been reported following ACAM2000 and other live vaccinia virus vaccines that were used historically. The relationship of these events to vaccination is unknown.[1,]

There may be increased risk of adverse events following vaccination with smallpox vaccine live in individuals with known cardiac disease, including those diagnosed with previous myocardial infarction, angina, congestive heart failure, cardiomyopathy, chest pain or shortness of breath with activity, stroke or transient ischemic attack, or other heart conditions.[1,] In addition, risk of adverse events may be increased in individuals who have been diagnosed with 3 or more of the following risk factors for ischemic coronary disease: high blood pressure, elevated blood cholesterol, diabetes mellitus or high blood sugar, first degree relative (e.g., mother, father, brother, sister) who had a heart condition before 50 years of age, or history of smoking cigarettes.[1,]

Ocular Complications and Blindness

Accidental infection of the eye (ocular vaccinia) following vaccination with replication-competent smallpox vaccine live may result in ocular complications including keratitis and corneal scarring that may lead to blindness.[1,] Patients who are using corticosteroid eye drops may be at increased risk of ocular complications.[1,]

Congenital or Acquired Immune Deficiency Disorders

Severe localized or systemic infection with vaccinia (progressive vaccinia) may occur following vaccination with replication-competent smallpox vaccine live in individuals with weakened immune systems, including those with leukemia, lymphoma, organ transplantation, generalized malignancy, HIV/AIDS, or cellular or humoral immune deficiency, and those receiving radiation therapy or treatment with antimetabolites, alkylating agents, high-dose corticosteroids (more than 10 mg of prednisone daily or equivalent for 2 weeks or longer), or other immunomodulatory drugs.[1,] Smallpox and mpox (vaccinia) vaccine live is contraindicated in individuals with severe immunodeficiency.[1,] Vaccinees with close contacts (including sexual contacts) who have these conditions may be at increased risk because live vaccinia virus can be shed and then transmitted from the vaccinee to these close contacts.[1,]

History or Presence of Eczema and Other Skin Conditions

Individuals with eczema of any description, such as atopic dermatitis, neurodermatitis, and other eczematous conditions, regardless of severity of the condition, and individuals who have a history of these conditions at any time in the past, are at higher risk of developing eczema vaccinatum following vaccination with replication-competent smallpox vaccine live.[1,] Close contacts who have eczematous conditions may be at increased risk because the live vaccinia virus can be shed and then transmitted from the vaccinee to these close contacts.[1,]

Vaccinees with other active acute, chronic, or exfoliative skin disorders (e.g., burns, impetigo, varicella zoster, acne vulgaris with open lesions, Darier's disease, psoriasis, seborrheic dermatitis, erythroderma, pustular dermatitis) or household contacts having such skin disorders might also be at higher risk for eczema vaccinatum.[1,]

Infants Younger than 12 Months of Age

Based on data from historical use of other live vaccinia virus vaccines, the risk of serious adverse reactions following vaccination with ACAM2000 is higher in infants (< 12 months of age).[1,] Vaccinated persons who have close contact with infants must take precautions to avoid inadvertent transmission of ACAM2000 live vaccinia virus to infants.[1,]

Pregnancy

ACAM2000 has not been studied in pregnant women.[1,] Based on data from historical use of other live vaccinia virus vaccines, ACAM2000 can cause fetal vaccinia and fetal death.[1,] If ACAM2000 is administered during pregnancy or within 6 weeks before becoming pregnant, the vaccinee should be apprised of the potential hazard to the fetus.[1,] Vaccinees should be counseled to avoid becoming pregnant (or getting their partner pregnant) for 6 weeks after vaccination and until the vaccination site has healed.[1,]

Pregnant women who are close contacts of vaccinees may be at risk of adverse fetal outcomes because ACAM2000 live vaccinia virus can be transmitted from vaccinees.[1,]

Severe Allergic Reactions

Appropriate medical treatment must be immediately available to manage potential anaphylactic reactions following administration of ACAM2000.[1,] Persons who experienced a severe allergic reaction following a previous dose of ACAM2000 or following exposure to any ingredient of ACAM2000, including neomycin or polymyxin B, may be at increased risk for severe allergic reactions.[1,]

Management of ACAM2000 Complications

The CDC can assist physicians in the diagnosis and management of patients with suspected complications of ACAM2000 vaccination.[1,] Vaccinia immune globulin intravenous (human) (CNJ-016) is indicated for the treatment of certain complications due to vaccinia vaccination.[1,] If CNJ-016 and/or other antivirals are needed or additional information is required, physicians should contact the CDC Emergency Operations Center (EOC) at 1-800-232-4636 (CDC-INFO).[1,] V

Prevention of Transmission of Live Vaccinia Virus

The most important measure to prevent inadvertent autoinoculation and contact transmission from ACAM2000 vaccination is thorough hand washing after changing the bandage or after any other contact with the vaccination site.[1,]

Individuals susceptible to adverse effects of vaccinia virus (i.e., those with cardiac disease, eye disease, immunodeficiency states [including HIV infection], eczema, pregnant women, infants) should be identified and measures should be taken to avoid contact between such individuals and those who have received replication-competent smallpox vaccine live and have active vaccination lesions.[1,]

Recently vaccinated healthcare personnel should avoid contact with patients, particularly those with immunodeficiencies, until the scab at the vaccination site has separated from the skin.[1,] However, if continued contact with patients is unavoidable, vaccinated healthcare workers should ensure that the vaccination site is well covered and follow good hand-washing technique.[1,] In this setting, the loose gauze held in place with first aid tape may be covered with a semipermeable (semi-occlusive) dressing as an additional barrier. Semipermeable polyurethane dressings are effective barriers to shedding of vaccinia.[1,] Semipermeable polyurethane dressings are effective barriers to shedding of vaccinia.[1,] However, exudate may accumulate beneath the dressing, and care must be taken to prevent viral spread when the dressing is changed.[1,] In addition, accumulation of fluid beneath the dressing may increase skin maceration at the vaccination site.[1,] Accumulation of exudate may be decreased by first covering the vaccination site with dry gauze, then applying the dressing over the gauze.[1,] The dressing should be changed every 1–3 days.[1,]

Blood and Organ Donation

Blood and organ donation should be avoided for 6 weeks following vaccination with ACAM2000.[1,]

Limitations of Vaccine Effectiveness

Vaccination with ACAM2000 may not protect all recipients.[1,]

Specific Populations

Pregnancy.

There is a pregnancy exposure registry that monitors pregnancy outcomes in women exposed to ACAM2000 during pregnancy. Healthcare providers, state health departments, and other public health staff should report to the National Smallpox Vaccine in Pregnancy Registry (NSVIPR) all pregnant women who, from 42 days prior to conception onward, received ACAM2000 or had close contact with a person who received ACAM2000 within the previous 28 days. Civilian women should contact their healthcare provider or state health department for help enrolling in the registry. All civilian and military cases should be reported to the DoD, telephone 619-553-9255, Defense Switched Network (DSN) 553-9255, fax 619-767-4806 or e-mail usn.nhrc-VaccineRegistry@health.mil.

All pregnancies have a risk of birth defect, loss, or other adverse outcomes. In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2% to 4% and 15% to 20%, respectively.

ACAM2000 has not been studied in pregnant women. Based on data from historical use of other live vaccinia virus vaccines, ACAM2000 can cause fetal harm when administered to a pregnant woman

ACAM2000 is not recommended for administration to pregnant women in non-emergency situations. If ACAM2000 is used during pregnancy or within 6 weeks before becoming pregnant, or if the vaccinee lives in the same household with or has close contact with a pregnant woman, the pregnant individual should be apprised of the potential hazard to the fetus

Disease caused by smallpox (variola virus) can cause severe illness during pregnancy. Adverse pregnancy outcomes including spontaneous abortion and stillbirth have occurred after smallpox and mpox maternal infections

Congenital infection, principally occurring during the first trimester, was observed after vaccination with live vaccinia smallpox vaccines during the era of routine smallpox vaccination. Generalized vaccinia of the fetus, early delivery of a stillborn infant, and perinatal death have been reported from the historical experience with other live vaccinia smallpox vaccines.

Lactation.

ACAM2000 has not been studied in lactating women. It is not known whether ACAM2000 is excreted in human milk. No human or animal data are available to assess the effects of ACAM2000 on the breastfed infant or on milk production/excretion. The developmental and health benefits of breastfeeding should be considered along with the mother's clinical need for ACAM2000 and any potential adverse effects on the breastfed child from ACAM2000 or from the underlying maternal condition. For preventive vaccines, the underlying condition is susceptibility to disease prevented by the vaccine

Persons vaccinated with ACAM2000 and who have close contact with infants (e.g., breastfeeding) must take precautions to avoid inadvertent transmission of live vaccinia virus to infants, which may result in serious complications

Females and Males of Reproductive Potential.

An individual vaccinated with ACAM2000 should be counseled to avoid becoming pregnant (or getting their partner pregnant) for 6 weeks after vaccination.

Pediatric Use.

ACAM2000 has not been studied in the pediatric population. The safety and effectiveness of ACAM2000 in all pediatric age groups is based on the safety and effectiveness of ACAM2000 in adults, historical data on safety and effectiveness of live vaccinia virus smallpox vaccines in pediatric populations, and efficacy of ACAM2000 in protecting non-human primates from lethal challenge with mpox virus. Before the eradication of smallpox disease, live vaccinia virus smallpox vaccines were administered routinely in all pediatric age groups, including neonates and infants, and were effective in preventing smallpox disease. During that time, live vaccinia virus was occasionally associated with serious complications in children, the highest risk being in infants younger than 12 months of age.

Geriatric Use.

Clinical studies of smallpox vaccine live (ACAM2000®) did not include sufficient numbers of individuals 65 years of age or older to determine whether they respond differently than younger individuals.[1,] There are no published data to support use of the vaccine in geriatric individuals older than 65 years of age.[1,]

▪ Common Adverse Effects

Information regarding the safety of smallpox vaccine live (ACAM2000®) has been derived from clinical trials evaluating the vaccine, data compiled during the era when routine smallpox vaccination was recommended using previously available replication-competent vaccinia vaccines (e.g., Dryvax®), and adverse event data obtained from military and civilian smallpox vaccination programs during 2002–2005 that used Dryvax®.[1,]

Common adverse events following vaccination with replication-competent smallpox vaccine live include inoculation site signs and symptoms, lymphadenitis, and constitutional symptoms (e.g., malaise, fatigue, fever, myalgia, headache).[1,] These adverse events are less frequent in revaccinated individuals than in those receiving the vaccine for the first time.[1,]

Inadvertent inoculation at other sites is the most frequent complication of replication-competent vaccinia vaccination.[1,] The most common sites involved are the face, nose, mouth, lips, anus, and genitalia.[1,]

Self-limited skin rash (e.g., urticaria and folliculitis) not associated with vaccinia replication in skin may occur following vaccination.[1,]

Drug Interactions

▪ Specific Drugs

It is *essential* that the manufacturer's labeling be consulted for more detailed information on interactions with this drug, including possible dosage adjustments. Interaction highlights:

There are no data evaluating the simultaneous administration of smallpox vaccine live with other vaccines.[1]

Actions

▪ Mechanism of Action

Smallpox and mpox (vaccinia) vaccine live is a live virus vaccine containing replication-competent vaccinia virus derived from a plaque-purified clone of the New York City Board of Health vaccinia strain.[1] Vaccinia virus and variola virus (causative agent of smallpox) are both orthopoxviruses, and immunity induced by vaccinia virus cross-protects against variola virus.[1]

Smallpox vaccine live does not contain smallpox (variola) virus and cannot spread or cause smallpox.[1]

Following percutaneous administration using a bifurcated needle, vaccinia virus contained in the vaccine causes a localized virus infection in the epidermis at the site of inoculation, surrounding dermal and subcutaneous tissues, and draining lymph nodes.[1] The vaccine virus may be transiently present in blood and infects reticuloendothelial and other tissues.[1] Langerhans cells in the epidermis are specific targets for the early stage of vaccine virus replication.[1]

The formation of a pustule ('pock' or 'take') at the site of inoculation provides evidence of protective immunity.[1] The vaccinia virus replicates within cells and viral antigens are presented to the immune system.[1] Neutralizing antibodies and B and T cells provide long-term memory.[1] Although the level of neutralizing antibody to vaccinia that protects against smallpox is unknown, more than 95% of individuals who receive primary immunization develop neutralizing or hemagglutination inhibiting antibodies to vaccinia.[1]

Advice to Patients

The following information contains important points for the clinician to discuss with patients during counseling. For more comprehensive monographs suitable for distribution to the patient, please refer to the *AHFS Patient Medication Information* monographs available from MedlinePlus (https://vsearch.nlm.nih.gov/vivisimo/cgi-bin/query-meta?v:project=medlineplus) (in English and Spanish; written at a 6th- to 8th-grade reading level).

Instruct the vaccine recipient or caregiver to read the FDA-approved Medication Guide for ACAM2000.[1] Provide pregnancy registry information to individuals vaccinated with ACAM2000 who are or may become pregnant.[1]

Vaccine recipients or caregivers must be informed of the major serious adverse reactions associated with vaccination, including myocarditis and/or pericarditis, progressive vaccinia in immunocompromised persons, eczema vaccinatum in persons with skin disorders, auto- and accidental inoculation, generalized vaccinia, urticaria, erythema multiforme major (including Stevens-Johnson syndrome) and fetal vaccinia in pregnant women.[1]

Vaccine recipients or caregivers must be informed that they should avoid contact with individuals at high risk of serious adverse effects of vaccinia virus, for instance, those with past or present eczema, immunodeficiency states including HIV infection, pregnancy, or infants less than 12 months of age.[1]

Vaccine recipients or caregivers must be advised that virus is shed from the cutaneous lesion at the site of inoculation from approximately Day 2 post-vaccination until the scab separates and the lesion is re-epithelialized typically 3 to 6 weeks after primary vaccination.[1] Vaccinia virus may be transmitted by direct physical contact.[1] Accidental infection of skin at sites other than the site of intentional vaccination (self-inoculation) may occur by trauma or scratching.[1] Contact spread may also result in accidental inoculation of household members or other close contacts (including sexual contacts).[1] The result of accidental infection is a pock lesion(s) at an unwanted site(s) in the vaccinee or contact and resembles the vaccination site.[1] Self-inoculation occurs most often on the face, eyelid, nose, anus and mouth, but lesions at any site of traumatic inoculation can occur.[1] Self-inoculation of the eye may result in ocular vaccinia, a potentially serious complication.[1]

Vaccine recipients or caregivers must be given the following instructions:

The vaccination site must be completely covered with gauze secured loosely with first aid adhesive tape.[1] If the vaccine recipient is directly involved in patient care, the gauze may be covered with a semipermeable dressing that allows passage of air but not fluids. Keep the site covered until the scab falls off on its own.[1]

The vaccination site must be kept dry.[1] Normal bathing may continue, but cover the vaccination site with waterproof bandage when bathing.[1] Do not scrub the site.[1] Cover the vaccination site with loose gauze held in place with first aid adhesive tape after bathing.[1] Don't scratch the vaccination site.[1] Don't scratch or pick at the scab.[1]

Do not touch the lesion or soiled gauze, semipermeable dressing, or bandages and then touch other parts of the body such as the eyes, anal and genital areas where the virus can spread.[1]

After changing the gauze, semipermeable dressing, or bandages, or touching the site, wash hands thoroughly with soap and water or >60% alcohol-based hand-rub solutions.[1]

To prevent transmission to contacts, physical contact of objects that have come into contact with the lesion (e.g., soiled bandages, clothing, fingers) must be avoided.[1]

Wash separately clothing, towels, bedding or other items that may have come in direct contact with the vaccination site or drainage from the site, with using hot water with detergent and/or bleach.[1] Wash hands afterwards.[1] Soiled and contaminated gauze, semipermeable dressings, and bandages must be placed in plastic bags for disposal.[1]

The vaccinee must wear a shirt with sleeves that covers the vaccination site as an extra precaution to prevent spread of the vaccinia virus.[1] This is especially important in case of close physical contact with others.[1]

The vaccinee must change the gauze and semipermeable dressing every 1 to 3 days.[1] This will keep skin at the vaccination site intact and minimize softening.[1]

Do not put salves or ointments on the vaccination site.[1,]

When the scab falls off, throw it away in a sealed plastic bag and wash hands afterwards.[1,]

Additional Information

AHFS*first*Release™. For additional information until a more detailed monograph is developed and published, the manufacturer's labeling should be consulted. It is *essential* that the manufacturer's labeling be consulted for more detailed information on usual uses, dosage and administration, cautions, precautions, contraindications, potential drug interactions, laboratory test interferences, and acute toxicity.

Preparations

Smallpox and mpox (vaccinia) vaccine live (ACAM2000®) is stored in the US Strategic National Stockpile (SNS) and is not commercially available in the US.[1, 2,] The SNS ensures that certain drugs and medical supplies are readily available to prevent or treat specific diseases, including during public health emergencies, and is managed by the US Department of Health and Human Services (HHS) Office of the Assistant Secretary for Preparedness and Response (ASPR).[3,]

Excipients in commercially available drug preparations may have clinically important effects in some individuals; consult specific product labeling for details.

Smallpox and mpox (Vaccinia) Vaccine, Live (https://www.accessdata.fda.gov/scripts/cder/ndc/default.cfm?sugg=NonProprietaryName&ApptName=Smallpox+and+mpox+%28Vaccinia%29+Vaccine%2C+Live&collapse=1)

Parenteral cutaneous multiple puncture

For solution, for percutaneous inoculation

1–5 × 10^8 PFU per mL (nominal dose of approximately 0.0025 mL)

ACAM2000® *(supplied as multiple-dose vial of Lyophilized Antigen Component, Live to be reconstituted with the Diluent component)*, Emergent BioSolutions (https://www.accessdata.fda.gov/scripts/cder/ndc/default.cfm?sugg=LabelerName&ApptName=Emergent+BioSolutions&collapse=1)

Related Resources

AHFS Patient Medication Information (https://vsearch.nlm.nih.gov/vivisimo/cgi-bin/query-meta?v:project=medlineplus&query=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live) and other related patient health topics (MedlinePlus)
ASHP Drug Shortages Resource Center (https://www.ashp.org/Drug-Shortages)
CCRIS (https://toxnet.nlm.nih.gov/cgi-bin/sis/search2/r?dbs+ccris:%%22Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live%%22) (Chemical Carcinogenesis Research Information System)
ChemID*plus* (https://chem.nlm.nih.gov/chemidplus/name/Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live)
Biochemical Data Summary (http://www.drugbank.ca/unearth/q?utf8=%%E2%%9C%%93&query=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live&searcher=drugs&approved=1&vet_approved=1&nutraceutical= (US and Canada)
Clinical Trials (https://www.clinicaltrials.gov/ct/search?submit=Search&term=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live)
DailyMed (https://dailymed.nlm.nih.gov/dailymed/search.cfm?query=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live) (drug labels)
DART (https://toxnet.nlm.nih.gov/cgi-bin/sis/search2/r?dbs+dart:%%22Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live%%22) (Developmental and Reproductive Toxicology Database)
Drugs@FDA (https://www.accessdata.fda.gov/scripts/cder/drugsatfda/index.cfm?fuseaction=Search.SearchAction&SearchType=BasicSearch&SearchTerm=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live) (approval information)
European Medicines Agency (https://www.ema.europa.eu/en/search/search?search_api_views_fulltext=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live)
FDA National Drug Code Directory (https://www.accessdata.fda.gov/scripts/cder/ndc/default.cfm?sugg=NonProprietaryName&ApptName=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live&collapse=1)
FDA Recalls, Market Withdrawals, and Safety Alerts (https://www.fda.gov/Safety/Recalls/default.htm)
HSDB (https://toxnet.nlm.nih.gov/cgi-bin/sis/search2/r?dbs+hsdb:%%22Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live%%22) (Hazardous Substances Data Bank)
Inxight Drugs (https://drugs.ncats.io/substances?q=%%22Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live%%22) (National Center for Advancing Translational Sciences)
LactMed (drug effects on breastfeeding) (https://toxnet.nlm.nih.gov/cgi-bin/sis/search2/r?dbs+lactmed:@or+%%28@na+%%22Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live%%22+%%29)
New Drug Approvals (https://ahfs.ashp.org/drug-assignments.aspx)
Orange Book (https://www.accessdata.fda.gov/scripts/cder/ob/default.cfm?panel=0&drugname=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live) (therapeutic equivalence)
PharmGKB (https://www.pharmgkb.org/search?connections&gaSearch=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live&query=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live&ty (Pharmacogenomic data from PharmGKB)
Pillbox (*beta*) (https://pillbox.nlm.nih.gov/pillimage/search_results.php?

submit=Search&splid=&getingredient=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live) (drug identification and images)
PubMed (https://www.ncbi.nlm.nih.gov/pubmed?DB=pubmed&term=Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live%%5BAll+Fields%%5D) (scientific journals)
Safety-related Labeling Changes (https://www.accessdata.fda.gov/scripts/cder/safetylabelingchanges) (FDA/CDER)
ToxLine (https://toxnet.nlm.nih.gov/cgi-bin/sis/search2/r?dbs+toxline:%%22Smallpox%20and%20Mpox%20(Vaccinia)%20Vaccine%20Live%%22) (Toxicology Literature Online)

† Use is not currently included in the labeling approved by the US Food and Drug Administration.

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