

A Practical Approach To Variola

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Abstract

Variola is a historical infectious disease once used as a weapon of terrorism and known to be a deadly infection for many communities that once had been believed to be eradicated from the world. With current distention among great nations this infection may have the potential to pose harm once again. This presentation has been developed to create an awareness of the diagnosis of variola and an understanding of the specifics of the manifestation and prevention of the disease. The overall goal is to educate and empower providers to deliver consistent practice and patient education on this infectious disease.

INTRODUCTION

Variola, also known as smallpox is a serious, contagious and sometimes fatal infectious disease. There is no specific treatment, only preventative measures aimed to fight this disease (Center for Disease Control and Prevention, 1997). The last case of smallpox in the United States was in 1949, from a world perspective the last naturally occurring case occurred in 1977 in Somalia. The risk for variola decreased greatly before this 1977 case and thus in 1971 the United States had discontinued routine vaccinations for the general public. Due to the overall worldwide success of the international commitment to the vaccination process for variola in 1980 the World Health Assembly certified the world free of naturally occurring smallpox, a feat of unprecedented accomplishment (Center for Disease Control and Prevention).

The concern of this infectious disease is the serious threat it poses to our civilian population in the form of biological warfare. The virus does not occur naturally, but clinically in laboratories. There are known stockpiles of the virus in two World Health Organization reference laboratories: The Institute of Virus Preparations in Moscow, Russia and the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia. There have been allegations concerning the Russian production of more virulent and contagious strains of variola and with the changes in the Russian government, further concern exists that this expertise may have fallen into non-Russian hands and become more of a potential for the threat of terrorism (Henderson, 1999).

The reintroduction of smallpox could create an epidemic disease that would create widespread concern and panic. The outbreak would create a need for extensive emergency control measures. Thus the need for education on this disease is eminent. Many health care providers have never seen this infection, nor have medical schools presented it in seriousness as it was declared over twenty years ago to be irradiated from society.

DEFINING VARIOLA

The historical presence of variola as bioterrorism dates back to the French and Indian Wars in the 1760's. British soldiers gave blankets used by smallpox victims to unfriendly Indian tribes, with the primary intention of creating smallpox outbreaks among the Indians. This proved effective in killing more than 50% of the tribes (Eachempati, Flomenbaum and Barie, 2002).

The etiology of variola is a DNA virus that is unique to humans. The virus is spread via person to person contact and inhalation of air droplets or aerosols. Incubation period of variola is an average of 12-14 days with a range of 7-17. The disease presents as a febrile illness with general myalgias for the initial 2-3 days of infection. Then the rash of smallpox presents on the face, mucous membranes of the mouth and pharynx, spreading to the trunk and extremities. The lesions develop at the same pace as papules, to vesicles then progress to a scab, this process more commonly occurs over a nine day period, they present to the touch as very firm papules and appear with central umbilication (Figure 1).

Figure 1

Figure 1: Lesion of Smallpox



The lesions are more densely concentrated on the face and extremities (Figure 2). The patient remains febrile throughout the evolution of the rash and may experience considerable pain as the rash progresses. The result of the rash once healed leaves a large pocked scar on the skin (Henderson, 1999).

Figure 2

Figure 2: Facial expression of smallpox



The above description presents the ordinary type variation of smallpox, the more common presentation of variola. There are three other presentations of the virus:

1. Modified,
2. flat-type or malignant, and
3. hemorrhagic smallpox.

The modified type presentation occurs in those patients who have been immunized and may present with a disease course that is less severe and progresses rapidly with little complication.

Less common is the malignant or flat-type of smallpox that is more common in children presenting with a flat confluent lesion that appears “velvety” to the touch. This type is often associated with fatality, of those that may survive scarring is less likely from the lesions. The last variation is known as hemorrhagic smallpox is found in those who are highly immunocompromised. In this presentation the virus multiplies in the spleen and bone creating a toxemia that is systemic. The progression of disease is marked by petechia and hemorrhages and is usually fatal by the 5th to 6th day of presentation (CDC Smallpox, 2002).

The infectious properties of variola range from the onset of the rash until the scabs have separated; this may take up to 3-4 weeks. The patient is most infectious for 7-10 days which occurs at the onset of the rash through the formation of scabs (Henderson, 1999). The presence of scabs presumably presents a lesser risk of virus transmission as it is estimated that the virion is tightly bound to the scabs fibrin matrix. Nevertheless it is highly suggestive to promote caution in light of global concerns and wait until the scabs have separated to discontinue isolation from the general public (Plotkin and Orenstein, 1999).

The presentation of smallpox is most commonly confused with varicella (chicken pox). The main differentiation in these two infectious disease processes is that the lesions of smallpox present more commonly in concentration on the face and extremities at the same rate and the same stage of development. To contrast varicella presents in crops body wide with lesions at varying stages of development such as vesicles, pustules and scabs (Plotkin and Orenstein, 1999).

Laboratory evaluation of a patient suspected of having variola consists of ruling out varicella first. The method of choice is to obtain a sample of the lesion, to evaluate for varicella zoster virus. This procedure can be completed by a local health official. If varicella is ruled out, further evaluation for variola must be completed by the CDC. The method of obtaining the sample is outlined specifically by the CDC and led by the local or state health department (CDC Smallpox, 2002).

Treatment of smallpox is primarily supportive therapy. There is no proven antiviral treatment for smallpox, but research to evaluate new antiviral agents continues to provide promise. Recent studies with cidofovir are proving potentially useful if initiated within the first one to two days of exposure. However, this drug presents with limited research on utility as well as its known complications of

renal toxicity. Further research in the use of antivirals with variola is paramount (Henderson, 1998).

Patients with smallpox can benefit from supportive therapy such as intravenous fluids, medicine to control fever or pain, and antibiotics for any secondary bacterial infections that may occur (CDC Smallpox 2002).

The primary focus of this disease is prevention through vaccination procedures to help the body develop immunity. In a post exposure scenario vaccine given within four days has been shown to improve the clinical course of smallpox, after four days, the fatality rates approach 30%. It is also estimated that those who have previously been vaccinated will exhibit an accelerated immune response; investigations have shown that antibody levels are substantially lower ten years post-vaccination leaving concern as to what level of immunity is present (Eachempati, Flomenbaum and Barie, 2002). The CDC estimates that smallpox vaccination provides high level of immunity for three to five years and decreasing immunity thereafter (CDC Smallpox, 2002). A very small recent study by the University of North Carolina revealed the potential that there may be a more robust immunity for some individual (Frelinger and Garba, 2002). Obviously more research is needed to investigate the presence of immunity in those vaccinated prior to 1971, with little knowledge of the continuation of immunity the process of revaccination is being encouraged (CDC Smallpox, 2002)

Smallpox vaccine is currently approved by the US Food and Drug Administration (FDA) for use in persons in special risk categories, including laboratory workers directly involved in smallpox research (Henderson, 1999). Current variola vaccine supply is at 15.4 million doses, with the current events of terrorism the CDC has accelerated agreements to produce smallpox vaccine and implement a vaccination plan. Per Dr. William Atkinson, epidemiologist for the CDC the plan for vaccination will commence with those at high risk being the first. The plan is not in force as yet and still in development, but will most likely begin with the following groups being vaccinated in stages to include health care workers and enforcement agencies being among the first, then public workers (ie: sanitation workers, public transportation workers and teachers) followed by the general public (Atkinson, 2002)

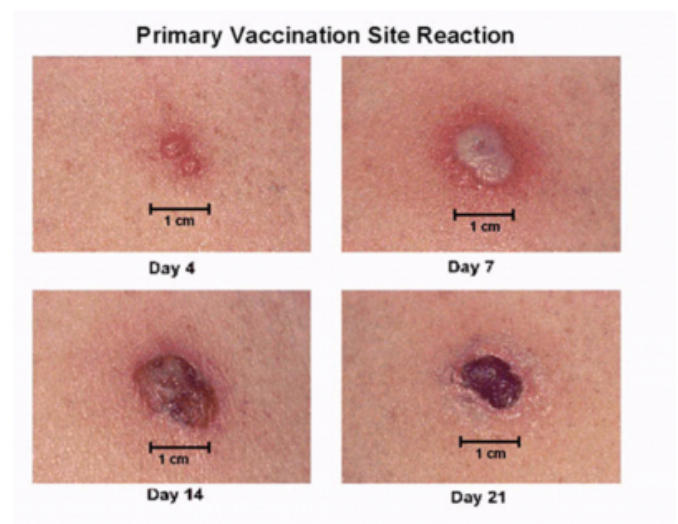
The vaccine for variola is made from *Vaccinia*, a related orthopoxvirus that when utilized as a vaccine provides protection from all orthopoxviruses (Zarbock, 2002). Vaccine administration is not via a hypodermic needle, it is

not an injection as most routine immunizations are given. The vaccine is given by using a bifurcated (two pronged) needle that is dipped into the vaccine solution then used to prick the skin a number of times in a few seconds. The pricking is not deep, but should cause enough disruption to create few droplets of blood to form. The vaccine is routinely given in the upper arm (Center for Disease Control and Prevention, Smallpox overview).

Success of the vaccination is found in the development of an erythematous raised papule at the vaccine site in three to four days. This papule then forms a vesicle which will rupture and lastly will form a scab which will separate in three weeks, leaving a small scar (Figure 3). The vaccination site must be cared for properly to avoid spread to other parts of the body or to other people (Center for Disease Control and Prevention, Smallpox overview).

Figure 3

Figure 3: Smallpox vaccine response



The following risk factors must be taken into consideration when vaccinating individuals, avoidance of vaccine with these conditions is advised to avoid serious complications:

1. Eczema,
2. other skin conditions such as atopic dermatitis, burns, impetigo or varicella zoster,
3. life threatening allergic reactions to neomycin, streptomycin and tetracycline,
4. diseases that are associated with immunodeficiency, and
5. pregnant women, and

6. children under the age of one year (CDC Smallpox, 2002).

Smallpox vaccination is associated with some risk for adverse reactions.

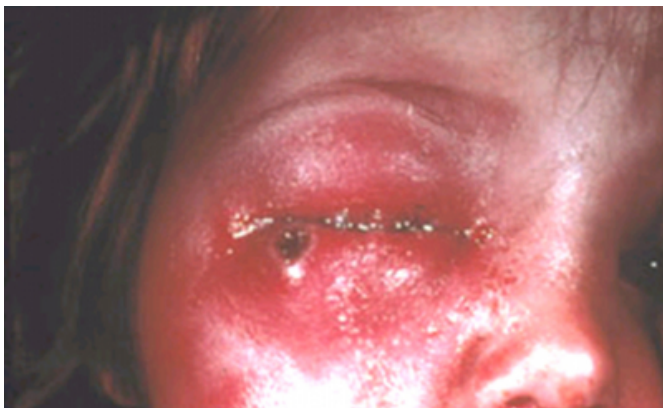
The more common side effects include fever, headache and myalgias. The major complications of smallpox vaccination are noted below with the incidence associated in primary vaccination:

1. Inadvertent autoinoculation 1:1,700,
2. Generalized vaccinia 1:5,00,
3. Eczema vaccinatum 1:26,000,
4. Progressive vaccinia 1:667,000, and
5. Postvaccinial encephalitis 1:80,000, and
6. Death 1: million (Center for Disease Control Vaccine, 2001).

Inadvertent autoinoculation occurs from self infliction of virus from the vaccination site. This is more commonly seen in children age one to four. Lesions may occur more commonly on muco-cutaneous areas such as the eye (Figure 4), mouth and rectum. These lesions will heal spontaneously with no specific treatment except for ocular involvement which should be followed with ophthalmological evaluation due to the potential of corneal involvement (Center for Disease Control Vaccine, 2001).

Figure 4

Figure 4: Autoinoculation of the eye



Generalized vaccinia is characterized by vesicles or pustules on normal skin distant from the vaccination site. The patient may also have fever and systemic signs to a varying degree.

Supportive care is most generally the recommendation in this patient (Center for Disease Control Vaccine, 2001).

Eczema vaccinatum is a generalized spread of the vaccinal lesions. This superinfection is usually limited to the eczematous areas and thought to be caused from direct inoculation through breached skin integrity. Thus the risk of vaccination in the presence of patients with eczema or other skin conditions as previously stated. The treatment of choice follows the therapy for burns and the use of vaccine immune globulin (VIG) to boost immune response (Center for Disease Control Vaccine, 2001).

Progressive vaccinia is characterized by painless, progressive enlargement of the vaccination site with minimal or absent local inflammation. The patient is not toxic and there are no systemic signs. Over time the concern is for metastatic lesions to progress in the later stages. Treatment consists of VIG and antivirals, such as cidofovir (Center for Disease Control Vaccine, 2001).

Postvaccinial encephalitis presents with meningeal signs of ataxia, muscular weakness, confusion, paralysis, lethargy, coma and or seizures. The onset of symptoms occurs nine to fourteen days following primary vaccination and is believed to be due to an autoimmune or allergic mechanism rather than direct infection of the central nervous system. There are no treatment regimens for postvaccinial encephalitis other than supportive care. VIG is not indicated in this presentation and outcome may be poor (Center for Disease Control Vaccine, 2001).

The following adverse effects are not seen as contraindications in the setting of and out break of smallpox or verified exposure. In this case the weight of the effects of the disease is far greater than the risks associated with the vaccine (Center for Disease Control Vaccine, 2001).

CONCLUSION

Variola presents a potential threat to our society that creates urgency in the education of health care providers with the disease process and treatment. This one time irradiated and somewhat forgotten infectious disease continues to potentially sit in the destructive hands of terrorists. Education can ensure awareness of the disease and lead to safety for our communities by creating an appropriate response to the disease presentation and treatment.

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