Vaccination of Laboratory Staff Working with Vaccinia

*For the purposes of this document the term ‘staff’ refers to both staff and student laboratory workers*

The issue of vaccination of staff working with vaccinia virus has recently arisen due to a laboratory worker claiming to potentially have suffered an adverse reaction to the vaccination.

**Background**

Staff at ANU who come into contact with vaccinia virus through their work are advised to be vaccinated against the virus, as per current Australian recommendations and legislative requirements[7,8,13]. Recently an incident report has been lodged with the Occupational Health and Safety Unit regarding an individual who claims to be suffering from an ongoing heart condition potentially as a result of this vaccination.

The current procedure at the ANU is to send staff to Sydney, to Associate Professor William Rawlinson, who provides counselling and then administers the vaccinia (smallpox) vaccination where appropriate. Post vaccination follow-up is provided 10 days after the vaccination, either by A/Prof Rawlinson, or by Professor Peter Collignon who is an infectious diseases expert located at The Canberra Hospital.

Staff are currently advised to receive revaccination every 10 years.

**Vaccinia Vaccine and Side Effects**

The current vaccinia vaccine used in Australia is a live virus that is capable of replicating in human cells and causing a usually mild illness. The vaccine confers immunity to other viruses in the genus Orthopoxvirus (eg monkeypox, cowpox, smallpox) [1]. Side effects and adverse reactions to the vaccine are wide ranging in type and severity.

Some of the more common and less severe reactions may be [1]:

- Most frequently, inadvertent inoculation at other sites of the body can occur. This happens when the person touches the vaccination site and then touches, for example, their eye.
- A fever – this is less common among adults than children.

Some of the moderate and severe adverse reactions may be:

- Eczema vaccinatum – a localised or systemic dissemination of vaccinia, occurring most commonly in people with a history of eczema or some other skin conditions.
- Generalised vaccinia – a generalised rash that can vary in extent and is generally self-limiting except in those who may have underlying immunodeficiency.
- Progressive vaccinia – progressive necrosis in the vaccination area, which may spread to other areas of the body. Very serious, however occurs almost exclusively among those with an underlying immunodeficiency.
- Postvaccinial encephalitis – mainly affects primary vaccinees.

These complications are rare, and their occurrence is more frequent among those receiving their first vaccination, and younger children [1]. Fatal complications are very rare, and occur at a rate of approximately 1 death/million primary vaccinations, and 0.25 deaths/million revaccinations [1].

**Strains of Vaccinia**

Various strains of vaccinia virus are used in the laboratory for experimental purposes.  

**Standard and recombinant** vaccinia strains are capable of replicating in human cells, and thus can cause illness in humans. Examples of these strains include: Copenhagen, Lister, NYCBOH, Wyeth and WR [1]. Laboratory-acquired infections with standard and recombinant vaccinia strains have been reported in the literature [2-6].

Some strains of poxviruses have been developed that are **highly attenuated**, host restricted and replicate either not at all or poorly in human cells. Examples of these strains include: MVA, NYVAC, ALVAC and TROVAC [1]. These highly attenuated strains of poxvirus do not result in productive infection in humans.

Australian information and recommendations on vaccinia virus vaccination can be found in the Australian Immunisation Handbook [7], and AS/NZS 2243.3 [8]. The Immunisation Handbook recommends that the only current indication for vaccination with vaccinia/smallpox vaccine in Australia is for laboratory workers using live vaccinia virus. AS/NZS 2243.3 reinforces this by also recommending vaccination in these circumstances. The Australian recommendations do not differentiate between the more virulent and the highly attenuated strains of vaccinia.

In America, the Advisory Committee on Immunisation Practices (ACIP) has written a document [1] on the use of vaccinia vaccine. This document includes information on use of the vaccine to protect laboratory workers who handle vaccinia virus. It is much more comprehensive than any Australian information available on the subject.

The ACIP recommends vaccinia vaccine for ‘laboratory workers who directly handle a) cultures or b) animals contaminated or infected with, non highly attenuated vaccinia virus….or other Orthopoxviruses that infect humans’ [1]. Laboratory workers who handle only highly attenuated strains of vaccinia virus, or who handle the Avipoxvirus strains ALVAC and TROVAC do not require routine vaccination.

International opinion is divided as to the necessity and usefulness of vaccination of laboratory workers using vaccinia. There has been speculation that even in a vaccinated worker an exposure through, for example, a splash to the eye or a needlestick injury, may still result in a local infection [2,9]. In the documented cases of laboratory acquired vaccinia infection [2-6] no deaths have been recorded.

In the case of the ANU it is felt that the decision to be vaccinated should be made by the individual involved, after detailed advice and counselling.

The advice to revaccinate workers every 10 years has also been closely questioned, and there is much international discussion on the usefulness of revaccination. Recent papers [10,11] have questioned the necessity of revaccination, citing older examples that indicate that smallpox immunity after a single vaccination is long lasting, possibly for decades. The 10-year revaccination recommendation appears to be somewhat arbitrary and does not seem to be based on any concrete epidemiological or immunological data (personal communication, A/Prof Mark Slifka, 5/8/04). There are some indications that repeated vaccination has very little additional effect on top of the initial vaccination [10], and even several vaccinations did not achieve much higher levels of antibodies in the
long term compared to just one or two vaccinations. A booster vaccination may be of some assistance however if the initial vaccination is suboptimal. Most adverse effects from vaccination occur during the primary vaccination; booster vaccinations have a much lower rate of side effects.

Another recent paper presents evidence that smallpox vaccination does not increase risk of heart related complications. However it recommends continuing to exclude anyone with pre-existing heart problems from vaccination unless there are compelling reasons for vaccination.

**ANU Vaccinia Vaccination Recommendations**

1. Considerations involving staff who will work with vaccinia virus should begin before employment with the pre-employment questionnaire and medical screening.
   - Jobs and student positions requiring dealing with vaccinia virus and potential vaccination should be advertised as such, and;
   - Discussion about vaccinia and the vaccination should form part of pre-employment medical screening.
   - Consideration should be given to not employing a person who is medically contraindicated for vaccination, or does not wish to receive the vaccination, in a position that handles standard or recombinant live vaccinia virus, or animals infected with the virus.

2. For those current staff who are medically advised against being vaccinated;
   - Strong consideration should be given to restricting those staff from duties involving handling of standard and recombinant live vaccinia virus, or animals infected with the virus.

   The implications of a laboratory-acquired infection with vaccinia virus, in a person who is medically contraindicated from vaccination could be severe. This group of people could be at risk for the most serious complications of infection.

3. Staff working directly with standard and recombinant strains of vaccinia virus cultures and vaccinia virus infected animals;
   - Must receive mandatory counselling by a doctor approved by the local budget unit, and;
   - then if appropriate must be offered the vaccinia vaccine.

4. Staff who work with highly attenuated strains of vaccinia virus are not required to receive vaccination with vaccinia vaccine, however they should still receive counselling and information if requested.

5. Prior to staff being sent for counselling and potentially vaccination, they should be provided with the following documents from the CDC for their information:
   - ‘Smallpox Vaccine – What you need to know’ 
   - ‘Smallpox Vaccine and Heart Problems’
   - The staff member should read these documents before their appointment for counselling so that they are prepared to raise any questions or concerns.

6. It is desirable for the local ANU budget unit to record;
   - which of those staff who handle vaccinia have received counselling for the vaccination and;
• whether or not they were subsequently vaccinated.

Feedback in writing should be requested from the treating doctor as to which staff were or were not vaccinated. No reasons for staff not being vaccinated should be requested, as this would breach patient confidentiality.

7. A formalised agreement between the ANU and the doctor who administers the vaccination needs to be implemented. This agreement should set out the details of the procedure for counselling and vaccination, along with follow-up procedures.

8. Booster vaccination should still be offered to staff after 10 years given the lack of current knowledge on this subject. This recommendation should be reviewed at regular intervals and kept in line with current knowledge.

9. Regardless of vaccination status, all staff who handle vaccinia virus must wear protective eyewear with side shields whenever handling viable virus or animals infected with the virus.

   One of the most serious potential incidents involving laboratory staff and vaccinia virus is contamination of the eye leading to an eye infection and potentially blindness. As mentioned above it is possible that even vaccinated individuals may still become infected in this situation, so eye protection is mandatory for all staff handling the live virus, or handling animals infected with the virus.

10. Regardless of vaccination status, all staff who handle vaccinia virus must cover any breaks in skin integrity with a waterproof dressing in addition to wearing gloves.

11. If an incident involving a laboratory worker being exposed to vaccinia were to occur, the first point of contact for treatment should be Prof Collignon at The Canberra Hospital, or alternately A/Prof Rawlinson.

References:

11. Slifak. Immunological memory to viral infection. Commentary. Current Opinion in Immunology,

13.
