Scenario D
Foot and Mouth Disease (FMD)

Summary of Experiment

This is a FMD vaccine challenge study using goats. Both control and challenge animals are housed in separate environments. A new live attenuated virus vaccine has been imported from another country. Prior to viral challenge, animals will be vaccinated through subcutaneous injection. Test animals will be exposed to FMD via intranasal contact.

Lyophilized FMD virus is stored in crimp sealed glass vials. It is reconstituted by injecting 0.5 mL of sterile phosphate buffered solution (PBS) into vial. The vial is then gently agitated to mix. The entire contents are then drawn back into the same syringe. The needle is first capped and then removed from the syringe by twisting off. The capped needle is thrown in the trash. Approximately 0.1 mL of the contents of the syringe are then introduced intranasally into each animal using the same syringe.

Animals are observed for signs of disease for several weeks. Blood samples will be collected at regular intervals to perform serological assays and viral titers.

Vaccines being tested have been imported from another country. Animals are exposed to FMD via intranasal exposure. Periodically, FMD isolates are grown and lyophilized – this work is done in a laboratory area located at another building. Untreated solid waste is sent to public trash disposal.

There have been no known cases of human FMD infections. Because FMD does not infect humans, but spreads rapidly among animals, it is a much greater threat to the agriculture industry than to human health.

Equipment

- Laminate bench top (old, cracked, some holes and peeling up in some places)
- Basic centrifuge (no sealed rotor or safety cups)
- Vortexer
- Small glass crimp sealed vials
- Glass vacutainers with rubber septum are used to collect and store blood samples
- Sink for disposing of liquid waste and hand washing
- Plastic bag for collecting solid waste (no trash can)
- High pressure washers for animal pens
- Feed and water system

Lab Environment

- Open window ventilation (screens fitted to window but some screens have unrepaired holes)
- Animal pens are in separate buildings from the clinical laboratory
- Ceramic tiled floor

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- Humid environment
- Rural setting
- Separate animal pens, infected animals housed separately
- Compost pile for animal bedding, and dung
- FMD is endemic in the country where the lab is housed

PPE

- Lab coats are worn in the lab and occasionally taken home for laundry
- Gloves are available but generally not worn
- Persons are required to don coveralls and rubber boots prior to entering animal pens, upon leaving animal pens, the coveralls and rubber boots are rinsed with water and flushed down the drain before reuse.

Personnel Practices

- No vaccination or occupational health services available
- Hand washing done occasionally
- Lab waste is untreated and collected by municipal (local government) waste services
- Occasional (~weekly) cleaning done by a building custodian.
- Needles are capped and thrown in the regular trash
- Food and drink are stored in the same refrigerator with lab supplies and reagents

Security Practices

- Interior doors are unlocked and propped open during the day
- Exterior doors are only locked at night
- Cultures not secured or inventoried
- No personnel verification program
- Animal pens are kept locked
- Lyophilized FMD isolates are stored together with test vaccine in a freezer located in the common area of the animal holding facility

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Agent Facts

Infectious Dose: By inhalation: 10,000 virus particles (swine); 400,000 virus particles (calf)

Stability:

SUSCEPTIBILITY TO DISINFECTANTS: FMD virus is highly sensitive to changes in pH and can be deactivated by solutions with pH's below 7 or above 8.5. Thus, any acidic or alkali solution, mixed with a detergent to facilitate penetration into different surfaces, is effective. Examples include 0.2% citric acid, 10% formalin solution, 4% sodium carbonate, 2% sodium hydroxide, others.

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PHYSICAL INACTIVATION: Heat-labile (temperatures above 50°C), sensitive to UV irradiation.

SURVIVAL OUTSIDE HOST: Can survive over a year in fat-contaminated wood, between 26-200 days in soil, sacking or straw; 35 days on cardboard, wood, or metal contaminated with blood; up to two weeks on wool; 4 weeks on cow hair; 14 days on dry manure; 34-42 days on liquid manure, 21 days in wash water from pens, indefinitely in freezing temperatures.

Incubation Period: 2-14 days, depending on species

Mortality Rate: 5%, up to 90% in young animals

Morbidity Rate: Close to 100%

Duration of Illness: 7-14 days

Severity of Illness: Mild to Severe

Duration of Infection: 28 days maximum for normal infection; a carrier state is possible.

Long term effects after infection: Poor health, reduced yields

Allergen (yes/no): No

Carcinogenic/mutagenic (yes/no): No

Abortogenic (yes/no): Yes

Toxin Production (yes/no): No

Immune Suppression (yes/no): No

Ability to Mutate in Host or Environment (yes/no): Yes

Infection Mitigation Measures:

For animal pathogens

Detection Possible: Yes (ELISA, PCR, cell culture, virus isolation, others)

Culling: Yes

Prophylaxis: No

Immunization: Yes

Post Infection Treatment: No

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Routes of Infection:

Inhalation: Yes

Ingestion: Yes

Percutaneous: Possible

Contact: Yes

Vector-Borne: No (except as carried on animate and inanimate surfaces, like human clothing or vehicles)

Sexual Transmission: Yes

Vertical Transmission: No

Communicability:

Human to Human: No Evidence

Human to Animal: No Evidence

Animal to Animal: Yes

Animal to Human: No Evidence

Multiple Species: Yes (swine, sheep, goats, deer, water buffalo, other cloven-hoofed ruminants)

Where it is present: The FMD situation has improved markedly in recent years particularly in Europe and some countries in Southeast Asia and South America. However, the disease remains endemic and at a high prevalence in many countries in Africa, the Middle East, Asia and South America. Europe, North and Central America, Pacific nations and the Caribbean are free of the disease. Most countries free of the disease restrict the storage and study of it to a small number of facilities within their borders, to reduce the likelihood of accidental release.

Perception of malicious use: MEDIUM

Culture: Culture of FMD for diagnostics purposes can be performed by inoculation of primary bovine thyroid cells, primary pig, calf, and lamb kidney cells, or BHK-21 and IB-RS-2 cell lines. Cell cultures are observed for CPE (cytopathic effect, evidence of viral infection). Vaccine production involves large-scale culturing and killing of FMD virus.

FMD virus can replicate and be excreted from the respiratory tract of animals. Airborne excretion of virus occurs during the acute phase of infection. FMD viruses may occur in all the secretions and excretions of acutely infected animals including expired air.

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