Slide 1

Screwworm Myiasis

Gusanos, Mosca Verde, Gusano barrendor, Gusaneras

Slide 2

Overview

- Organism
- Economic Impact
- Epidemiology
- Transmission
- Clinical Signs
- Diagnosis and Treatment
- Prevention and Control
- Actions to take

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In today's presentation we will cover information regarding the organism that causes screwworm myiasis and its epidemiology. We will also talk about the economic impact the disease has had in the past and could have in the future. Additionally, we will talk about how it is transmitted, the species it affects (including humans, if applicable), clinical and necropsy signs seen, and diagnosis and treatment of the disease. Finally, we will address prevention and control measures for the disease as well as actions to take if Screwworm Myiasis is suspected. The picture above depicts a female screwworm. Picture courtesy of the USAHA FAD Gray Book.

Slide 3

The Organism

Slide 4

Screwworm Myiasis

- Larvae of the family Calliphoridae
  - *Chrysoma bezziana* (Old World)
  - *Cochliomyia hominivorax* (New World)
- All warm-blooded animals
  - Rarely infects birds
- Can occur in any open wound

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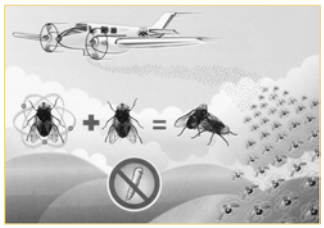
Screwworm myiasis is caused by larvae of the family Calliphoridae: *Chrysomya bezziana* (Old World Screwworm) and *Cochliomyia hominivorax* (New World Screwworm). The New World Screwworm is found only in the Western Hemishpere, particularly in the tropical regions, while the Old World Screwworm is only in the Eastern hemisphere. Any warm-blooded animal, including humans, is susceptible to infestation; however, screwworm myiasis is rarely seen in birds. Any open wound can become infected and is often characterized by a foul-smelling exudate and the presence of larvae within the tissue. Photo depicts the head of the larva (USDA's Illustrated Manual for the Recognition and Diagnosis of Certain Animal Diseases).

Slide 5

Importance

Slide 6	**History** • 1852: First reports of New World Screwworm • 1958: Development of sterile male technique • 1966: U.S. free of Screwworm • 1991: Mexico declared free • 2003: Sterile fly facility established in Panama Center for Food Security and Public Health Iowa State University - 2004	Reports of New World Screwworm date back to 1852. Eradication efforts became successful with the development of the sterile male technique, sterile males are released to prevent females flies from depositing fertile eggs. The US was declared free of screwworm in 1966, however infection was still an issue due to recurrent cases from Mexico. The US formed an agreement with Mexico in 1972 to eradicate screwworm from that country, a necessary step to completely prevent screwworm infestation in the US. Mexico was declared free of screwworm in 1991. The eradication program was extended through Central America to create a permanent barrier to reinfestation. Current eradication efforts are focused on Panama and include the establishment of a sterile fly-rearing facility. Screwworm is still present in Caribbean islands and portions of South America, necessitating strict control measures.
Slide 7	 **Screwworm flies mate once in a lifetime, and if one of the insect pair has been sterilized with gamma rays, neither will reproduce.** Center for Food Security and Public Health Iowa State University - 2004	The sterile fly technique has been used extensively throughout North America to aid in screwworm eradication. The technique takes advantage of the fly's breeding habits; the females only breed once in a lifetime, therefore, the use of sterilized males will result in unsuccessful mating. www.thepanamanews.com/pn/v_07/ issue_07/science_01_04.html
Slide 8	**Economic Impact** • Reintroduction- $540 million/year – Producer loss – Lost meat supply for export • Eradication - $1.27 billion – Control costs – Economic impact Center for Food Security and Public Health Iowa State University - 2004	If screwworm was not controlled in the US, livestock producers and consumers would be seriously affected. Reintroduction of screwworm would generate estimated losses of $540 million annually for production and lost meat supply. If screwworm had to be eradicated again, the cost would depend on the severity and extent of the reintroduction as well as the time of year. It is estimated that eradication could cost $1.27 billion, including the control costs and economic impacts.
Slide 9	Epidemiology The Center for Food Security & Public Health Iowa State University	
Slide 10	**Geographic Distribution** • Western Hemisphere – Only the New World screwworm – Central and South America – Caribbean Islands • Eastern Hemisphere – Only the Old World Screwworm – Found in remaining tropical and sub-tropical areas – Never established in Europe, North Africa, the Middle East or Australia Center for Food Security and Public Health Iowa State University - 2004	New World screwworms are found in the Western Hemisphere, usually in tropical and sub-tropical areas. They were discovered once in the Eastern hemisphere in Libya, but were quickly eradicated in 1991. It is believed that introduction was due to importation of infected animals from South America. Screwworms have been eradicated from the US and much of northern Central America, however they are still present in portions of Central and South America and in the Caribbean Islands. Old World screwworms have never been found in the Western Hemisphere, Europe, North Africa, the Middle East or Australia. They are found in most of the remaining tropical and sub-tropical areas of the Eastern Hemisphere.

Slide 11	**Morbidity/ Mortality** • Mobidity variable – Varies with conditions – Near 100% of newborns in favorable environment • Mortality varies with treatment – If treated rarely leads to death – Untreated almost always results in death Center for Food Security and Public Health Iowa State University - 2004	Morbidity varies between regions, but can near 100% in favorable environments. In some areas the navel of almost every newborn animal can be infested. Mortality is dependent on number of egg depositions and the treatment of such infestations. If only one egg deposition occurs, or if the infection is rapidly treated, mortality is usually very low. However, if wounds are left untreated and multiple fly oviposits occur, affected animals often die within 7-10 days as a result of secondary infection or toxicity.
Slide 12	Transmission	
Slide 13	**Animal Transmission** • Female fly deposits eggs into wound • Larvae feed on living tissue • Multiple infestations in one wound are common • Non-contagious • Importation of infected animals Center for Food Security and Public Health Iowa State University - 2004	Transmission occurs when a female fly deposits eggs in a superficial wound. One female can lay up to 400 eggs at a time. After hatching, the larvae burrow into the flesh. The larvae feed on living tissue (they do not feed on dead tissue) for several days before dropping to the ground to pupate. The adult screwworms emerge and are ready to mate within 3-5 days, beginning the cycle again. Infected wounds attract other female flies and multiple infestations often occur. It is not contagious between animals. Flies are transmitted to nonendemic countries often through importation of infected animals.
Slide 14	**Human Transmission** • Infected in same manner as animals • Can transmit adult screwworms to nonendemic areas Center for Food Security and Public Health Iowa State University - 2004	Humans are infected in the manner as animals. Any superficial wound is susceptible to infestation. Humans are capable of transmitting screwworms over long distances when screwworm adults are carried in transport vehicles.
Slide 15	Animals and Screwworm Myiasis	

Slide 16

Clinical Signs

- Larvae visible in wound by 3 days
  - May be hundreds present
- Bloody discharge
- Foul-smelling odor
- Depression
- Off feed
- Separation
- Attempt to control discomfort

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Any wound can become infested by screwworms. Larvae emerge from eggs within 8-12 hours and begin feeding. The initial infection is difficult to observe, as there is little movement of the larvae. As the larvae feed, the wound enlarges and becomes deeper. There may be hundreds of larvae within the wound. Within 3 days the larvae are usually visibly embedded in the wound and a bloody discharge develops. There is often a distinct, foul odor associated with the wound. Occasionally the wound may not be obvious, but there will be a small opening in the skin with pockets of larvae beneath. The affected animal usually exhibits signs of depression, goes off feed, and separates itself from the herd. Animals often rub against trees, lick the wounds, and stand in water in an attempt to relieve the discomfort. The image depicts and infested calf navel. The navel of a newborn animal is a common site of screwworm infestation. Photo of screwworm myiasis in a calf navel from the USAHA FAD Gray Book.

Slide 17

Post Mortem Lesions

- Death often occurs when untreated
  - Allows for multiple infestations
- Result of secondary infection
  - Smaller animals more susceptible

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Death can occur in untreated infestations. Lack of treatment attracts other females and results in multiple infestations. Lesions may extend into body cavities and lead to associated pleuritis, sinusitis or peritonits. Death is usually the result of secondary infections and toxicity. Smaller animals are more susceptible to the effects of infestation. The photograph of a dead cow illustrates the severity of wounds caused by screwworm infestations. (USDA's Illustrated Manual for the Recognition and Diagnosis of Certain Animal Diseases).

Slide 18

Sampling

- Before collecting or sending any samples, the proper authorities should be contacted
- Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease

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Before collecting or sending any samples from animals with a suspected foreign animal disease, the proper authorities should be contacted. Samples should only be sent under secure conditions and to authorized laboratories to prevent the spread of the disease.

Slide 19

Clinical Diagnosis

- Suspect in any animal with signs
- Differentials include any fly larvae that infest wounds
  - Several types may be present
- Samples to collect
  - Larvae from the deepest portion of wound

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Screwworm myiasis should be suspected when clinical signs are observed. Differential diagnosis includes any flies that are capable of infesting wounds. Several types of larvae may be present due to likelihood of multiple infestations. Larvae should be collected from the deepest part of the wound, as facultative larvae may be present at the edges of the wound.

Slide 20

Laboratory Diagnosis

- Microscopic examination
  - Identification of larvae
- Careful sample collection and handling
  - 70% alcohol
- ELISA tests in development

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Laboratory diagnosis consists of microscopic examination of the larvae and eggs present in the wound. Larvae are pointed at one end and blunt at the other with dark brown spines circling the body. Field diagnosis is difficult and should always be considered presumptive. Before collecting any samples, the appropriate authorities should be notified. Samples must be sent under secure conditions to the authorized laboratory. Screwworms are a potential human hazard, therefore appropriate precautions should be taken when handling samples. Larvae (pictured above) should be collected from the deepest part of the wound, as facultative larvae may be present at the edges, and placed in 70% alcohol for transport. There are new ELISA tests in development to make screwworm identification much easier and faster. Picture courtesy of the USAHA FAD Gray Book.

Slide 21

Treatment

- Obtain samples first
- Topical application of larvicide
  - 2-3 successive days
- Spray or dip with organophosphate
  - Prevents reinfestation

Samples of larvae should be obtained before treatment is begun. Treatment consists of topical application of larvicide directly into the wound for 2-3 successive days. Doramectin can be used to prevent further development of larvae present in the wound, as well as those that may be subsequently deposited. Spraying or dipping animals with an organophosphate insecticide, such as coumaphos, will also provide protection against reinfestation once the wound is cleared of the infestation.

Slide 22

Screwworm Myiasis in Humans

Slide 23

Clinical Signs in Humans

- Larvae visible within wound
- Bloody discharge
- Foul-smelling odor
- General discomfort

Clinical signs in humans will be identical to those seen in animals. Larvae will be visible in the wound within 3 days of egg laying. The wound will enlarge as the larvae feed and a foul-smelling, bloody discharge will develop. The patient may experience general discomfort. The photo depicts a larvae that was removed from the abdomen of a patient. www.epmonthly.com/SecondOpinion/SecOp1101B.gif

Slide 24

Post Mortem Lesions

- Untreated wounds will enlarge
  - Can extend into body cavities
- Death unlikely unless untreated
  - Result of secondary infection

Death is unlikely to develop, as most people will seek treatment when lesion is discovered. However, in cases where treatment is not initiated, the wounds will continue to enlarge and extend into body cavities. If death results it will usually be a result of secondary infections or toxicity.

Slide 25

Diagnosis

- Laboratory Tests
  - Microscopic examination of
    - Larvae identification
  - Differentials include any fly larvae that infest wounds
  - ELISA

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Screwworm should be suspected in any wound exhibiting the appropriate clinical signs. Differential diagnosis includes larvae of all flies capable of infesting wounds. Laboratory tests consist of microscopic examination of larvae for identification. ELISAs are currently being developed to make diagnosis of screwworm faster and easier to perform.

Slide 26

Treatment

- Removal of larvae
- Debridement, if necessary
- Good hygiene

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Treatment consists of careful removal of larvae from an infested wound. Once the larvae are removed, there is usually no other treatment necessary if no complications exist. Occasionally debridement of the wound may be necessary if there is extensive tissue damage. It is important that good hygiene be practiced to prevent further infestations.

Slide 27

Public Health Significance

- Humans are susceptible
  - 138 cases in Nicaragua
  - 530 cases in El Salvador
- Use proper precautions if screwworm is suspected

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Screwworms will infest wounds of any warm-blooded animals, therefore, humans are at risk. In countries where screwworm has recently been eradicated, the human risk is evident. In Nicaragua 138 cases of screwworm were reported, while in El Salvador, 530 human cases were documented between 1990 and 1992. If screwworm is suspected in animals, the proper precautions should be taken to avoid human infection. The photo depicts the proper method for larvae removal (USDA's Illustrated Manual for the Recognition and Diagnosis of Certain Animal Diseases).

Slide 28

Prevention and Control

Screwworms will infest wounds of any warm-blooded animals, therefore, humans are at risk. In countries where screwworm has recently been eradicated, the human risk is evident. In Nicaragua 138 cases of screwworm were reported, while in El Salvador, 530 human cases were documented between 1990 and 1992. If screwworm is suspected in animals, the proper precautions should be taken to avoid human infection. The photo depicts the proper method for larvae removal (USDA's Illustrated Manual for the Recognition and Diagnosis of Certain Animal Diseases).

Slide 29

Recommended Actions

- Notification of Authorities
  - Federal:
    Area Veterinarian in Charge (AVIC)
    www.aphis.usda.gov/vs/area_offices.htm
  - State veterinarian
    www.aphis.usda.gov/vs/sregs/official.htm
- Treat infested wounds with larvicide
- Suspend animal movement

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State and federal veterinarians should be immediately informed of any suspected case of Screwworms. Infested wounds should be treated with a larvicide and animal movement suspended to prevent further spread of the larvae.

Slide 30

Disinfection/Vaccination

- Destruction of larvae
- Larvicide in infested wounds
- Organophosphates
- No vaccine available

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Any larvae that are removed from wounds should be destroyed immediately. Infested wounds should be cleaned with an approved larvicide to destroy any larvae that were not removed. Organophosphate insecticides are effective against newly hatched larvae, immature larvae and adult flies. These can be applied by dipping or spraying methods. No vaccine is available.

Slide 31

Prevention

- Surveillance in nonendemic areas
  - Prevent importation
- Frequent animal inspections in endemic areas
  - Organophosphate treatment
- Seasonal avoidance

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In non-endemic areas surveillance of all imported animals is necessary to prevent entrance of screwworm. If screwworm is endemic, animals should be checked frequently to discover and treat cases. Spraying or dipping animals with an organophosphate insecticide will protect against infestation for 7-10 days if wounds are present. Animal breeding and management practices (branding, castrating, dehorning) can be performed during the season when screwworm activity is lowest.

Slide 32

Additional Resources

Slide 33

Internet Resources

- World Organization for Animal Health (OIE) website
  - www.oie.int
- USAHA Foreign Animal Diseases – "The Gray Book"
  - www.vet.uga.edu/vpp/gray_book/index
- USDA-APHIS Veterinary Services
  - www.aphis.usda.gov/vs

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Slide 34

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Slide 35

Acknowledgments

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