

## Myiasis

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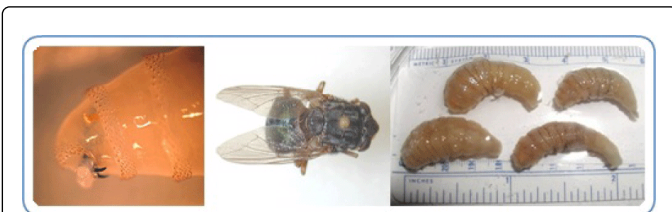
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### Abstract

Flies are well known bothersome biting nuisances of humans and animals. They can as well transmit infectious diseases and deeply invade living tissues, causing amputation, disfigurement, and, rarely, death. Flies can serve as mechanical vectors for organisms causing infectious diseases like shigellosis and leishmaniasis. They can also lay their eggs on human flesh, and their developing larvae, or maggots, can invade subcutaneous tissues and penetrate external body cavities, such as the orbits, ears, and nares. Myiasis is one of the diseases that can be caused by dipterous fly's larvae invasion of viable or necrotic tissues. The most common clinical presentation is furuncular myiasis (superficial cutaneous); other manifestations include cavitory (atrial or invasive), intestinal, urinary, and vaginal myiasis. The major curative treatment modality for myiasis is the removal of the intact larva. A range of approaches have been successful including occluding the opening, eg, with occlusive coatings of petroleum jelly (Vaseline) or others, and gentle extraction of the intact larva when it protrudes its abdomen to reach air. Surgical intervention may sometimes be necessary. Along with larval removal, myiasis wounds should be cleansed and conservatively debrided; tetanus prophylaxis administered, and bacterial secondary infections treated with antibiotics. Prevention of myiasis includes minimizing flies' preferred breeding environment, and following different modalities to prevent flies or larvae bites.

### Myiasis

Skin lesions are a common reason for returned travelers to seek medical evaluation, Among 269 patients in France with travel-associated skin problems, Myiasis was found to be the cause of around 9% of such lesions [1].



**Figure 1:** L to R: Close-up of the anterior end of a larva, showing the mandibles and one of the anterior spiracles. Adult of *Dermatobia hominis*, the human bot fly. Four larvae of *Dermatobia hominis*, removed from a human host. DPDx, Georgia Museum of Natural History.

Myiasis is an ectoparasitic infestation of viable or necrotic tissues by the dipterous larvae of higher flies. Although there are many families of dipterous flies (order Diptera), flies from three families cause most human and animal myiasis:

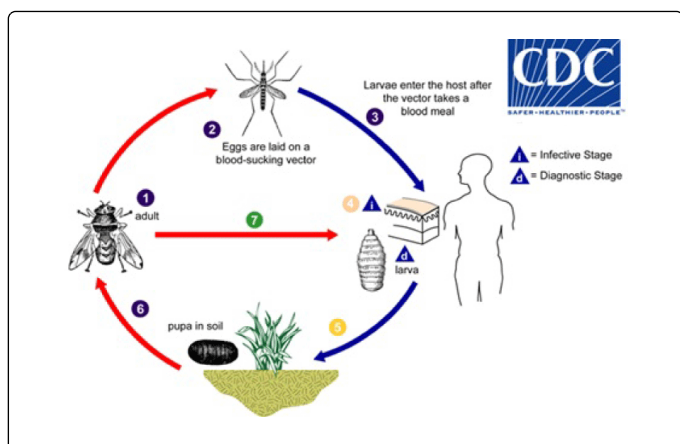
1. Oestridae eg. *Dermatobia hominis* or botflies (Figure 1).
2. Calliphoridae eg. *Cochliomyia hominivorax* or screwworms and blowflies and *Chrysomya bezziana* or the Old World screwworm, *Cordylobia anthropophaga* or the tumbu fly.

3. Sarcophagidae, carrion-feeding flies. Flies in the genera *Cuterebra*, *Oestrus* and *Wohlfahrtia* are animal parasites that also occasionally infect humans.

### Life Cycle

There are two life cycles depending on flies families and the need of a vector. Adults of bot fly *Dermatobia hominis*, resembles a bumblebee are free-living flies [1]. They capture blood-sucking arthropods (such as mosquitoes) and lay their eggs on the vectors' bodies, using a glue-like substance for adherence [2]. Bot fly larvae develop within the eggs, but remain on the vector until it takes a blood meal from a mammalian or avian host. Newly-emerged bot fly larvae then penetrate the host's tissue [3], and feed in a subdermal cavity [4] for 5-10 weeks, breathing through a hole in the host's skin. Mature larvae (15-20 mm in length) drop to the ground [5] and pupate in the environment. Larvae tend to leave their host during the night and early morning, probably to avoid desiccation. After approximately one month, the adults emerge to mate and repeat the cycle [6].

Other myiasis-causing flies (including *Cochliomyia*, *Cuterebra*, and *Wohlfahrtia*) have a more direct life cycle, where the adult flies, the size of a housefly, lay their eggs directly in, or in the vicinity of, wounds on the host [7]. In *Cochliomyia* and *Wohlfahrtia* infestations, larvae feed in the host for about a week, and may migrate from the subdermis to other tissues in the body, often causing extreme damage in the process.



### Geographic Distribution of Myiasis Causing Flies

*Dermatobia hominis* and *C. hominivorax* are Neotropical species, ranging from Mexico into South America. The Congo floor maggot (*Auchmeromyia luteola*) and *Cordylobia anthropophaga* are distributed in Africa south of the Sahara. *Wohlfahrtia magnifica* occurs in the Mediterranean basin, Near East, and Central and Eastern Europe; *W. vigil* occurs in northern United States and Canada. Cuterebra species are found in the New World. *Oestrus ovis* is found throughout the world in areas where sheep are tended.

### Clinical Presentation

Furuncular myiasis is the most common clinical manifestation and occurs when one or more *Cordylobia anthropophaga* (tumbu fly) larvae penetrate the skin, causing pustular lesions that resemble boils or furuncles (Figure 2).



**Figure 2:** Boil-like lesions on a patient with botfly myiasis; the central punctum is apparent. Image courtesy of Kenneth E Greer.

The gravid female Tumbu fly deposits its eggs on moist sandy soil or on wet clothing (e.g., cloth diapers) hung outside to dry. When the human victim dons egg-infested clothing, larvae emerge and rapidly burrow into the skin with sharp mandibles for further development. In this case, myiasis lesions are usually located on body regions covered by clothing, such as the buttocks and trunk. On the other hand, the female *D. hominis* (botfly) captures blood-feeding insects, usually mosquitoes, and attaches her eggs to the undersurface of the insect which then delivers the botfly eggs to its blood meal victims. Infestations with *D. hominis* are often characterized by cutaneous swellings on the body exposed areas such as the scalp, face, and

extremities. These cutaneous swellings may produce discharges and be painful [2]. Patients may have a sensation of irritation, crawling or episodic lancinating pain.

Infestations with *C. hominivorax*, which causes wound myiasis, can be more serious, as this species may travel through living tissue in the body and not stay subdermal like most of the other species of flies that cause myiasis. Death has occurred with severe infestations of *C. hominivorax*. Secondary bacterial infections may also occur. Flies in the genera *Phormia* and *Phaenicia* cause facultative myiasis, where adult flies lay their eggs in pre-existing, festering wounds and do not invade healthy, living tissue.

Cavitary myiasis is usually caused by zoonotic screwworm larval deposition in open wounds or external orifices, such as the nares, ears, and orbits, and may be characterized by deep tissue larval invasion, with secondary infection and extensive tissue necrosis. In nasal myiasis, patients present with epistaxis, foul smell, passage of worms, facial pain, nasal obstruction, nasal discharge, headache, dysphagia, and sensation of foreign body in the nose.

*Cochliomyia hominivorax*, the New World screwworm, is a common cause of cavitary myiasis in the Americas; and *Chrysomya bezziana*, the Old World screwworm, is a common cause of cavitary myiasis in Africa, Asia, and Indonesia [3]. Cavitary myiasis must be managed aggressively with surgical debridement and antibiotic therapy for secondary infections to limit tissue damage and disfigurement.

*Oestrus ovis* has been known to cause a condition called ophthalmomyiasis, which is infection of the eye with fly larvae. Patients complain of severe eye irritation, redness, foreign body sensation, pain, lacrimation, and swelling of the eyelids.

Intestinal myiasis is uncommon, usually caused by the accidental ingestion of maggot-contaminated food, and characterized by self-limited nausea, vomiting and diarrhea. Genitourinary myiasis is also uncommon and may present as dysuria, hematuria and pyuria, following larval invasion of the urethra (urinary myiasis) or vagina (vaginal myiasis) [4].

### Laboratory studies

Diagnosis is typically made by identification of fly larvae or maggots. The exact type of species can be difficult to determine from examination [5]. However, CBC count may show leukocytosis and eosinophilia.

### Differential diagnosis

- Cutaneous leishmaniasis
- Delusions of parasitosis
- Abscess
- Cellulitis
- Dermatologic Manifestations of Onchocerciasis (River Blindness)
- Exaggerated arthropod reaction
- Foreign body reaction
- Furunculosis
- Lymphadenopathy
- Ruptured epidermoid cyst
- Tungiasis
- Cutaneous larva migrans

## Imaging studies

MRI has been used in a number of cases of cerebral myiasis; breast myiasis; and facial, orbital and furuncular myiasis. Doppler ultrasonography can also be very useful in establishing the diagnosis and in determining the size of the larvae. CT scan has also been used.

## Procedures

Biopsies are not necessary, but if performed, histopathologic findings include an ulcerated epidermis with an inflammatory infiltrate of neutrophils, lymphocytes, giant cells, mast cells, plasma cells, and eosinophils that occur in stages. The larvae can be seen in cross-section.

## Treatment

Removal of the intact larva is curative, although secondary bacterial infection can complicate the infestation. A range of approaches have been successful including occluding the opening (eg, with occlusive coatings of petroleum jelly (Vaseline), clear fingernail polish, tobacco tar, pork fat, raw beefsteak, or bacon strips and gentle extraction of the intact larva when it protrudes its abdomen to reach air [5].

Unsuccessful occlusive therapy may asphyxiate larvae and necessitate their surgical or vacuum extraction [6]. Along with larval removal, myiasis wounds should be cleansed and conservatively debrided, tetanus prophylaxis administered, and bacterial secondary infections treated with antibiotics, like amoxicillin/clavulanic acid Igram every 12 hours for five days (Figure 3).



**Figure 3:** Cellulites developed after a patient self-squeezed the maggot out of his infected skin (Image by Hiba M Radwan, MD).

## Systemic/topical ivermectin

An alternative treatment for all types of myiasis is oral ivermectin (200µg/kg once a day for 1-2 days) or topical ivermectin (1% solution), proven especially helpful with oral and orbital myiasis [7].

## Prevention and Control

Prevention and control of myiasis includes:

- (1) Controlling of domestic and livestock animal larval infestations;
- (2) Minimizing flies preferred breeding grounds by appropriate disposal of animal carcasses and offal and cementing floors to eliminate maggot flies egg-laying surfaces;
- (3) Proper management of any open human wounds or cutaneous infections;
- (4) Sleeping on raised beds or cots in screened huts or tents;
- (5) Wearing long-sleeved shirts and pants, which can be pyrethrin or pyrethroid impregnated and spraying exposed skin with diethyl toluamide (N,N-diethyl-metatoluamide [DEET])–containing repellents and
- (6) Ironing both sides of all clothes and diapers left outside to dry in Tumbu fly habitats [2].

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