DOI:10.21276/sjodr.2017.2.1.8

Saudi Journal of Oral and Dental Research
Scholars Middle East Publishers
Dubai, United Arab Emirates
Website: http://scholarsmepub.com/

ISSN 2518-1300 (Print)
ISSN 2518-1297 (Online)

Review Article

An Update on Cutaneous Myiasis: A Review

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Abstract: Myiasis is derived from Greek word mias and was coined by hope in 1840. It refers to invasion or infestation of tissues and organs of human beings by dipterous larva which feed on the host's living or dead tissue, liquid body substance, or ingested food for certain period of time. Cutaneous Myiasis is the most common type of Myiasis. It is subdivided into 3 types: furuncle, migratory and wound Myiasis. This article reviews current literature, various types and the agents causing it. It also discuses life cycle of each species and various treatment techniques.
Keywords: Myiasis, Furunculous Myiasis, Maggot infestations, larva migrans, leishmaniasis, Flea

INTRODUCTION

The term Myiasis was derived from a greek word Mias refers to invasion or infestation of tissues and organs of human beings by dipterous larva which feed on the host's living or dead tissue, liquid body substance, or ingested food for certain period of time [1-3]. Myiasis has been defined by Austen as follows: "There remains yet a third category of flies, chiefly belonging to the great Family Muscidae, the larval stage of which is sometimes actually passed in the living human body, the presence of the larvae in the various organs and tissues, and the disorders or destruction of tissue caused thereby, being comprehensively known as Myiasis [4]." Myiasis was first coined by Hope in 1840 and Oral Myiasis was first described by Laurance in 1909 [5, 6]. The distribution of human myiasis is worldwide, with greater abundance in poor socioeconomic regions of tropical and subtropical countries. It generally occurs in elderly people who are ill or debilitated [7]. Larvae may infect dead, necrotic (prematurely dying) or living tissue in various sites: the skin, eyes, ears, stomach and intestinal tract, or in genitourinary sites [8, 9].

Classification

Myiasis is classified based on 2 main systems: anatomical and ecological system. The anatomical system of classification was first proposed by Bishopp [43] and later modified by James [10]. However, it was found to be unsatisfactory when considering evolutionary and biological relationships, because individual species could be assigned to more than one group and different groups contained species with different levels of dependence on the host. So, a classification system based on the degree of parasitism shown by the fly is also used [4, 10, and 1].

Anatomical Classification:

The anatomical classification system is based on the one proposed by Bishopp [43], later modified by James [10] and by Zumpt [1].

Ecological Classification

Patton [4] classified myiasis based on the degree of parasitism shown by the fly. There are two main groups of myiasis-causing species: the specific parasites, which must develop on live hosts; and the semi-specific parasites, which usually develop on decaying organic matter, such as carrion, faeces and rotting vegetation, but may also deposit their eggs or larvae on live hosts. Zumpt [1] termed the specific parasites obligatory and the semi-specific parasites facultative. The facultative species may be further differentiated depending on whether they are able to initiate myiasis (primary species) or only invade after other species have initiated it (secondary and tertiary species) [4, 1].

In addition, Patton [4] defined a third group of myiasis-causing species, those that cause accidental myiases when their eggs or larvae are ingested by the host. Zumpt [1] termed these pseudomyiases.

Table-1: Anatomical Classification of myiasis

Zumpt	Bishopp	James
Sanguinivorous	Bloodsucking	Bloodsucking
Dermal/subdermal	Tissue-destroying	Furuncular
	Subdermal migratory	Creeping
		Traumatic/wound
		Anal/vaginal
Nasopharyngeal	Infestations of the head passages	Nose, mouth and sinuses
		Aural
		Ocular
Intestinal	Intestinal/urogenital	Enteric
		Anal/vaginal
Urogenital	Intestinal/urogenital	Bladder and urinary passages
		Anal/vaginal

Table-2: Ecological classification of myiasis

Group	Subgroup	Remarks
Specific/obligatory		Parasite dependent on host for part of its life cycle
Semi-specific/facultative	Primary	Normally free-living but may initiate Myiasis
	Secondary	Normally free-living and unable to initiate myiasis but may be involved once animal is infested by other species
	Tertiary	Normally free-living, but may be involved in myiasis when host is near death
Accidental/pseudomyiasis		Normally free-living larvae that may be accidentally ingested and cause pathological reactions

CUTANEOUS MYIASIS

Cutaneous myiasis is myiasis affecting the skin. Cutaneous myiasis include furuncular and migratory along with wound myiasis, depending on the type of infesting larvae[11].

Furuncular Myiasis

It presents as an erythematous furuncle like nodules with one or more maggots. The most common agents to cause furuncular myiasis are Dermatobia hominis and Cordylobia anthropophagi [12].

Dermatobia hominis

It is the most common cause of furuncular myiasis in Americans. Dermatobia hominis is a member of the Oestridae family, is approximately 1.5 cm in length, yellow-brownish in color, and has a plumose arista [13].

Life cycle

The unique and complex life cycle of fly begins with adult fly laying eggs on foliage or depositing eggs on blood sucking intermediary mosquitoes and this method of egg delivery is known as 'phoresis'[14-16]. Heat induces larva to hatch [17], penetrates painlessly into the host skin and gains access to the dermis, forming a typical furunculoid lesion. When the larva is mature, it will emerge from the skin, drop to the soil, and pupate [18].

Cutaneous swellings of the larva are found most commonly on the head as well as other exposed areas of the body [19]. At the apex of the larva, small black spiracles may be seen exuding a seropurulent fluid containing dark feces [20]. Patients experience sudden paroxysmal episodes of lancinating pain as well as pruiritis. Secondary bacterial infection is a possible complication [21].

Cordylobia anthropophaga

Cordylobia anthropophaga is a blowfly that belongs to the family of Calliphoridae [13], is approximately 7-12 mm in length, yellowish brown in color [19, 20].

Life cycle

These flies often lay their eggs in shady areas preferably on objects contaminated with urine or faeces [13, 19]. Upon hatching, the larvae will remain buried in the soil and may survive without food for approximately 9 days while waiting to come into contact with a host. The larva then painlessly penetrates the host skin and develops over 8 – 12 days to form furuncular type of myasis. Following this they emerge from the skin, fall to the ground, and pupate [12, 13, 19, and 22].

Symptoms develop within the first 2 days of infestation and can range from a 'prickly heat' sensation to severe pain. Agitation and insomnia can also occur. Furuncular lesions with surrounding inflammation rapidly develop over a period of 6 days after symptoms begin. Some lesions may develop a central pustule, similar to that of pyoderma [23].

Diagnosis

The diagnosis of furuncular myiasis can be done based on clinical grounds, patient history and travel history. The confirmed diagnosis of furuncular myiasis is done by ultrasound and also helps in complete removal of larva [24, 25]. High-frequency probes and Color Doppler sonography can be used when ultrasound is not able to detect the parasite [26, 27].

Pathology

Biopsies and Fine-needle aspiration cytology is not indicated for myiasis, although it can be diagnostic. Histopathological findings show an ulcerated epithelium with or without hyperkeratosis. Connective tissue shows a polymorphous inflammatory cell infiltrate predominantly neutrophils and lymphocytes. The dipteran larva is located in the dermis, within a fibrous cystic sinus tract [28].

Treatment

Therapy consists of three general techniques: (i) the application of a toxic substance to the larva and egg, (ii) the production of localized hypoxia to force the emergence of the larva, and (iii) the mechanical or surgical removal of the maggots [29].

Liquid paraffin can be applied over the punctum which forces the maggots to wriggle a little further and lubricates the pocket, helping subsequent extraction. If no response, inject Lidocaine beneath lesion or Surgical Excision [30].

Fig-1: Mature Larva of Dermatobia Hominis

Fig-2: showing erythematous furuncle caused by tumba fly larva

Migratory Myiasis

Migratory myiasis is caused by the larvae of horse and cattle bot flies [19]. When dipterian maggots migrate through the burrow in skin, produces migratory myiasis. Gasterophilus (horse bot fly) and Hypoderma (cattle bot fly) are the common agents to cause migratory myiasis [31].

Gasterophillus

Gasterophillus spp. is the most common agent to cause migratory myiasis and belongs to the family Oestridae. Human infections usually occur in rural areas where cattle and horses are raised [1].

Life Cycle

Eggs are frequently laid on hairs of horses. Upon contact with skin the larva penetrates forming a tunnel in the subcutaneous tissue where they wander for long time and produce an intensely pruritic reaction [19]. The larvae may emerge spontaneously from the furuncles or die within the tissues. Death of the larvae terminates the infection in 1-2 weeks without sequelae. The raised, erythematous linear lesions will form and advance at one end where the maggots are present while gradually fades at the other end as the larva wanders about in search of a proper place to molt, leaving a path of migration [32].

Hypoderma

Hypoderma spp. are cattle blot flies belongs to the family Oestridae. Occurs commonly in cattle and yaks and infest those individuals who handle cattle [19].

Life Cycle

The eggs are deposited on to the hair of cattle and less commonly in humans [33]. Within a week eggs are hatched and the larvae penetrates deeply into the subcutaneous tissue, travel slowly for considerable distances, invading the skin, connective tissue, musculature, and even the nervous system along the way [19]. They may produce a tender, slightly raised and erythematous linear lesion [19, 32, and 34]. The erythema usually persists for several hours or days and then resolves, leaving behind a yellow-pigmented patch as the larva moves on to infest another area [32].

Diagnosis

The definite diagnosis in these cases is revealed by applying 2 or more drops of mineral oil in the visible line of inflammation. An ultrasound is useful to reveal larva in hypoderma furuncle lesion [35]. Molecular identification of parasite can be done using PCR-restriction fragment length polymorphism (PCR-RFLP) analysis [35, 36, and 37].

Treatment

Migratory myiasis is generally treated by Surgical Excision. Previously, oral albendazole or ivermectin was used o mobilize the parasites and surgical removal of maggots [35].

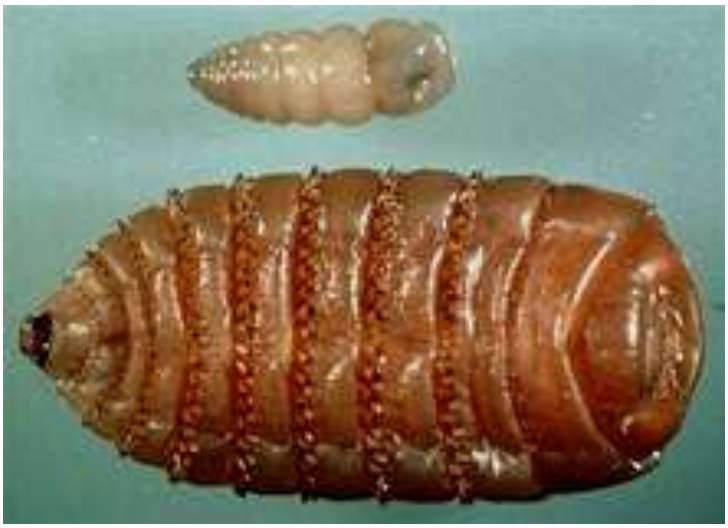

Fig-3: Gastrophillus spp., early larva (top) and mature larva (bottom). Fully developed Larva have hooked mouth parts that help them attaching to host tissues

Wound Myiasis

Wound myiasis occurs when fly larvae infest open wounds in a living host. Cochliomyia hominivorax and Chrysomya bezziana are two important species of screwworm flies that cause obligatory wound myiasis in humans, domestic mammals, and wild mammals [13]. The most important predisposing factors that can cause wound myiasis are poor economic status, psychiatric illness, alcoholism, diabetes, peripheral vascular disease, poor dental hygiene, and physical disabilities [38].

C. hominivorax and C. bezziana myiases

Screw worm infestations are rare in humans and typically painful. Eggs are laid in the batches of 150-500 eggs which results in multiple infestations within host. Females of both the species are attracted towards the wounds and lay eggs at the edge of the lesion. Upon hatching the larva causes extensive tissue destruction leads to local pain and secondary bacterial infection. Other clinical manifestations include fever, chills, bleeding, and fistula formation [39].

Wohlfahrtia magnifica

Wohlfahrtia magnifica is an obligatory parasite that deposit living larvae in traumatic skin lesions as well as mucosal surfaces of the host [13, 40]. The larvae feed for 5–7 days within the host causing tissue destruction and may even lead to death. After approximately 7 days, the larvae will emerge, fall to the ground, and pupate [13].

Diagnosis

Wound myiasis can be diagnosed by clinical inspection of wounds. Biopsy or imaging techniques are rarely indicated or even necessary.

Treatment

Removal of larva followed by debridment is the treatment of choice. 15% chloroform in olive oil or ether mobilizes the larva and facilitates easy removal of maggots [41]. Topical treatment with 1% ivermectin in a propylene glycol solution can also be used [42].

Fig-4: Myiasis due to *C.* hominivorax in a B lymphoma patient.

CONCLUSION

Cutaneous Myiasis can cause mild to severe symptoms depending on the species and site of infestation. It occurs commonly in elderly individual who are ill or debilitated. It also occurs in people who have poor hygiene and low economic status. Treatment may include irrigation, debridment, surgical exploration and use of tropical or systemic steroids in case of secondary infections but it can be prevented by use of mosquito repellents containing DEET, protective clothing and sleeping curtains.

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