

Human Myiasis: A Retrospective Case Series Study

Rajkumar Bhati¹, Bhupendra Saini², Mahima Singh³, Jaideep Singh Chouhan⁴

¹Medical Officer, Department of ENT, Government District Hospital, Kekri, Ajmer, Rajasthan

²Medical Officer, Department of ENT, Government District Hospital, Kekri, Ajmer, Rajasthan

³PG Resident, Department of ENT, RNT Medical College, Udaipur, Rajasthan

⁴Assistant Professor, Department of ENT, Dr S. N. Medical College, Jodhpur, Rajasthan

Received: 28-12-2021 / Revised: 15-01-2022 / Accepted: 08-02-2022

Corresponding author: Dr. Jaideep Singh Chouhan

Conflict of interest: Nil

Abstract

Introduction: Human Myiasis is found among elderly and neglected patients. Myiasis caused by larvae belonging to the insects of order Diptera. Myiasis is found in patients with condition like prolong systemic disease, open chronic wound, otitis media, atrophic rhinitis, malignancy and other immunocompromised patients.

Methodology: the study was done in the Department of Otorhinolaryngology, MBGH, RNT Medical College, Udaipur from January 2018 to December 2018. 61 cases of myiasis have been enrolled for the study. Proper history-taking and general physical examination has been done. All maggots were removed using turpentine oil-soaked gauze piece. Regular dressing was done.

Results and Discussion: In this study it was found that males are more prone to myiasis, and middle age group is mostly affected. People from rural areas were mainly affected and mostly they were from lower socioeconomic background.

Conclusion: Most of the cases found in open chronic wound and Limbs were the most common infestation site. Anaemic and immunocompromised individuals were mainly affected. Therefore, this study provides clues to identify etiological risk factors and help us in the management of condition under observation.

Keywords: Myiasis, Diptera, Maggots, Open wound.

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Infestation of live human or other vertebrate host with fly larvae belonging to the insects of order Diptera is called as Myiasis. Infection happens to be by accidental ingestion of eggs or larvae of flies contaminated in food. Myiasis was either found to be asymptomatic or show

gastrointestinal symptoms when ingested through food [1]. Human myiasis can present as cutaneous myiasis, anal myiasis, genitor-urinary myiasis, nasopharyngeal myiasis, ocular myiasis, body cavity myiasis, wound myiasis, aural myiasis and intestinal myiasis [2]. Myiasis caused by fly larvae has been classified in to three types

including obligatory myiasis, facultative myiasis and accidental myiasis. Fly larvae that require living tissue to survive are responsible for obligatory myiasis, those that infest on wounded or necrosing tissue cause facultative myiasis and those fly larvae that are accidentally ingested or deposited on tissues of human or animals may be responsible for accidental myiasis. Fly larvae belonging to the families Calliphoridae (blowflies), Rhinoestrus spp. (botflies), Gasterophilus spp., Hypoderma spp., Chrysoma spp. and Sarcophagidae (flesh flies) are frequently responsible for myiasis in both pet and domestic animals and humans. Other fly larvae belonging to Anisopodidae, piophilidae, Stratiomyidae and syrphidae occasionally cause myiasis. Depending on the relationship between the host and the infesting fly larvae species, myiasis can be of specific, semi specific or accidental. Flies that need a host for larval development cause specific myiasis *Dermatobia hominis* (human botfly), *Cordylobia anthropophagi* (tumbu fly), *Oestrus ovis* (sheep botfly), *Hypodermabovis* (cattle botflies or ox warbles), *Gasterophilus* spp. (horse botfly), *Cochliomyia hominivorax* (new world screwworm fly), *Chrysomya bezziana* (old world screwworm fly), *Auchmeromyia senegalensis* (Congo floor maggot) and *Cuterebra* spp. (rodent and rabbit botfly) [3]. Non-specific myiasis is caused by flies that lay eggs in decaying animal or vegetable matter which also develop larvae in open wounds or sores include *Lucilia* spp. (green botfly), *Cochliomyia* spp. (blue botfly), *Phormia* spp. (black botfly), *Calliphora* spp. (blowfly) and *Sarcophaga* spp. (flesh fly or sarcophagids) [4]. Flies that do not need any host to develop, deposit eggs accidentally leading to pseudomyiasis which is caused by *Muscadomestica* (housefly), *Fannia* spp. (latrine flies), *Eriatalistenax* (rat-tailed maggots) and *Muscina* spp. [5]. More than fifty flies have been reportedly responsible for different

types of myiasis in humans. Previous studies have showed that *M. Stabulans*, the common housefly is responsible for majority of cases of myiasis as the female fly oviposits around 150 eggs on the food or other decaying matter which later undergo developmental changes involving three larval stages (Figure 1) before transforming in to pupa [6,7]. In most of the cases, the appearance of fly larvae just indicates the consumption of food contaminated with larvae and not considered as infection. This is true because 90% of fly larvae infestation is accidental and fly larvae cannot survive and rarely produce complications [8]. Few parasitic dipterous flies only have the ability to grow on dead, necrosing or living tissues [9]. Though gastrointestinal myiasis is common, other sites from which fly larvae are reported include skin, nasopharynx, eye, ear, wounds and genitourinary tract [10-18]. Incidence of myiasis was found to be related to seasonal variations where majority of the reports have been during the end of the summer through rainy season when flies breed and are found in large numbers [19]. Myiasis is a cause of concern not only in the community but also a threat in hospitals of developing and low socioeconomic countries [20]. Reports of myiasis in intensive care units of hospitals are available [21]. A probable transfer of fly larvae from mother to child was also reported in literature. Basically myiasis is the infestation of maggots the immature developmental stage of dipterous flies. Studies have observed myiasis both in animals and human [6]. Poor hygiene and low socioeconomic conditions which are normally found in rural population can be predisposed to this condition [19]. Previous reports have suggested that children may be prone to myiasis more frequently considering their playing habitats and hygiene [22].

Epidemiology:

Human myiasis is most common in tropical regions, though reports of fly larval infestation are available throughout the world [4,19,23]. Travelling to larval endemic areas may be a predisposing factor. Fly larvae show parasitism during their 1st to 3rd instar stages which later leave the host to continue their life cycle as pupa and then into adult flies (Figure 2). Climate conditions including humidity and warm environment help larval developmental stages. Studies have showed that myiasis may be due to fly larvae that are endemically present in a particular region or can be imported from other regions mainly by travelling [23,24]. Most of the fly larvae are transmitted to humans through pet or domestic animals that are infested by larvae. Veterinarians therefore should be vigilant and take necessary precautions to disinfest animals that are transported through continents. Emphasis has been shifted to molecular methods for studies on biology, epidemiology, phylogenetic and taxonomy (identification) of fly larvae that can produce significant economic losses [25,26]. Fly larvae comprise both medical and veterinary importance as a legal evidence in forensic entomology and is responsible as a vector for transmission of livestock parasites/pathogens. Human myiasis is rare in developed countries and may be frequently seen in tropical and sub tropical regions. Geriatric age group, poor hygiene, low socioeconomic conditions, underlying metabolic disorders such as diabetes, vascular disease reducing blood circulation and cancerous conditions can predispose to human myiasis [27,28]. Studies have shown that larvae adapt themselves to a particular environment and undergo hypobiosis either inside or outside the host, according to climatic environmental condition and season. Reports of infestation of a certain type of fly larvae among domestic animals in southern Europe and use of specific antiparasitic treatment could well explain the degree of parasitic

biodiversity and the level of species selection in fly larvae [7]. Heavy rain falls may predispose livestock to be infested with fly larvae that may in turn lead to infestation in other inhabitants including humans. Forest dwelling either due to professional cause or otherwise can predispose to fly larval infestation. Human myiasis is directly related to the endemicity of the fly larval species prevalent in that area [23].

Clinical features:

Human myiasis clinical features vary according to the site of infestation and the type and number of fly larvae. Asymptomatic infestation cannot be ruled out. Obligate myiasis causing flies create nasopharyngeal cavities (nasal bots), digestive tract bots and even involve any internal organs of animals and human [29]. Larvae can be deposited in the eye causing painful ophthalmomyiasis resembling a foreign body in the eye sensation. Inflammatory reaction at the site of larviposition due to mast cell activation and IgE production may limit larval development [30]. Larvae accidentally ingested in mouth can be present in oral cavity in the damaged gums and teeth spaces. Larval infestation of skin, cutaneous myiasis can present in different forms like furuncularmyiasis, creeping myiasis, wound myiasis and subcutaneous myiasis. Cutaneous myiasis or larva migrans (normally observed in *Ancylostomaduodenalea* nematode) can be seen on feet, buttocks and trunk and presents as a boil, pruritic or erythematous, pain full masses or lines formed due to movement of larvae in skin and sub cutaneous tissues [31]. Larval presence in the ear (aural myiasis), can lead to perforation of tympanic membrane, hearing loss and hemorrhage and rarely the larvae may migrate in to meninges. Gastrointestinal myiasis, caused due to accidental ingestion of fly larvae may be presenting as nausea, vomiting, abdominal

pain, abdominal distention, loss of appetite, weight loss and episodic diarrhea similar to intestinal parasites. Larvae from gastrointestinal tract may move in to skin and other organs. Gastrointestinal myiasis is most often ignored as pseudo myiasis as most fly larvae die before reaching small intestines due to acidity. Myiasis cases involving various other organs, with different underlying conditions are reported in literature. Reports of infection in neonates reveal no predilection to age. Nosocomial myiasis though rare has been reported [32, 33]. So this study was planned to investigate the clinic-etiological pattern and management of myiasis.

Material and Methods:

The study was conducted in the Department of Otorhinolaryngology, MBGH, RNT Medical College, Udaipur. It is a retrospective observational study conducted for a period of 12 months (January 2018–December 2018). 61 cases of myiasis taken for the study. All the patients with maggots were included in the study after taking proper informed and written consent. Patients who did not give consent for the study, were excluded. The patients in this study were categorized under following Heads: age, gender, address, SEC and systemic comorbidities, site of myiasis, local comorbidities, mental status, hospital stay, and complications.

Data collection procedure:

Examination:

Each patient thoroughly examined for myiasis site, otorhinolaryngological and general condition. Any history regarding ear/nasal discharge, aural/nasal pain, aural/nasal bleeding, and passing of maggots from the ear/nasal cavity/oral cavity and surrounding the head and the neck region, malignancy, ruptured or surgically created wound, history of chemotherapy or radiotherapy, prolonged steroid therapy, HIV, diabetes mellitus, and anemia were taken. Detailed inquiry about

social status, condition of surrounding, and sanitation was taken

Observation:

A brief general examination was conducted to assess the nutritional status and built of the patient, degree of dehydration, anemia or any central nervous system examination done with complicated cases. A detailed Systemic and ENT examination was carried out and any abnormality was noted down. Complete hemogram, blood sugar level, liver and kidney function test and urine routine microscopy, and X-ray mastoid Schuller's view & PNS water's view were carried out. Turpentine oil soaked gauze piece was kept over wound/ myiasis site and maggots were removed with forceps. After removal of maggots, cleaning of wound/ myiasis site was done and wound/myiasis site was covered with betadine soaked guaze. In aural myiasis, turpentine oil soaked wick was kept in external auditory canal and maggots were removed with Tilley's forceps. After removal of maggots, antibiotic drops were instilled and regular aural toileting was done[34]. All patients were treated with systemic antibiotic and intravenous fluids. After removing the maggots, they were disposed off after putting them in KMnO₄ solution /boiling water.[35]

Results & Discussion:

Human myiasis is most common in tropical regions, though reports of fly larval infestation are available throughout the world. Climate conditions including humidity and warm environment help larval developmental stages. Studies have showed that myiasis may be due to fly larvae that are endemically present in a particular region or can be imported from other regions mainly by travelling. In our study, out of 61 patients, 50 (81.97%) were male patients and 11 (18.03%) were female patients (**Table 1**). A study conducted by Singh *et al.* in 1993 on myiasis found that

57.8% cases were females and 41.8% cases were males. [37]

Table 1: Total Cases of Human Myiasis

Sex	Total cases	Percentage
Male	50	81.97%
Female	11	18.03%
Total	61	100%

Table 2: Correlation with age and sex

Age group	Male (%)	Female (%)	Total (%)
1-10 yrs	3 (6%)	1 (9.09)	4 (6.56%)
11-20 yrs	2 (4%)	2 (18.18%)	4 (6.56%)
21-30 yrs	4 (8%)	1 (9.09%)	5 (8.20%)
31-40 yrs	10 (20%)	0 (0%)	10 (16.39%)
41-50 yrs	15 (30%)	3 (27.27%)	18 (29.51%)
51-60 Yrs	10 (20%)	1 (9.09%)	11 (18.03%)
>61 yrs	6 (12%)	3 (27.27%)	9 (14.75%)
Total	50 (81.97%%)	11 (18.03%)	61 (100%)
Mean Age±SD	44.3±15.8	41.3±22.3	P value=0.109

Age varies between 2 and 75 years with slightly higher distribution in middle (41-50 yrs) age groups. The overall mean age is 43.72 years. The mean age in female was **41.3±22.3** years and in male was **44.3±15.8** years. There was slightly higher

predilection in male but the mean age difference between male and female were statistically insignificant (**P value 0.109**) (**Table 2**). According to a study done by Singh *et al.*, there was no sex predilection.[37]

Table 3: Cases in Rural vs Urban area

District	Rural (%)	Urban (%)	Total (%)
Udaipur	15 (37.50%)	17 (80.96%)	32 (52.45%)
Dungarpur	4 (10%)	0 (0%)	4 (6.56%)
Pali	1 (2.50%)	0 (0%)	1 (1.64%)
Chittorgarh	5 (12.50%)	2 (9.52%)	7 (11.48%)
Bhilwara	4 (10%)	0 (0%)	4 (6.56%)
Pratapgarh	1 (2.50%)	0 (0%)	1 (1.64%)
Sirohi	1 (2.50%)	2 (9.52%)	3 (4.92%)
Banswara	2 (5%)	0 (0%)	2 (3.28%)
Rajsamand	3 (7.50%)	0 (0%)	3 (4.91%)
Out of rajasthan(from m.p.)	4 (10%)	0 (0%)	4 (6.56%)
Total	40 (65.57%)	21 (34.43%)	61 (100%)

Myiasis is an uncommon disease in humans and common in rural areas compared to urban areas. All patients' social details were collected and analyzed thoroughly.

There were 21 (34.43%) cases residing in urban area, 40 (65.57%) cases were from rural area (**Table 3**). 59 (96.72%) cases were from lower SEC, whereas only 2 (3.28%) belonged to upper SEC. 1 (1.64%)

patient was mentally retarded. 7 (11.48%) patients were destitute. A study by Gabriel *et al.* in 2008 on oral myiasis [38] and a case report by Al Jabr in 2015 on aural myiasis also support that poor SEC, illiteracy, and poor hygiene were significant predisposing factors for myiasis.[39]

We have observed that myiasis cases admitted in our institute were from Southern Rajasthan and frontline areas of Madhya Pradesh. 4 (6.56%) cases from transitional plain of luni basin, 47 (77.04%) cases from sub-humid southern plains, 6 (9.84%) cases from humid southern plains (agro-climatic zones) of rajasthan. Rest 4

(6.56%) cases were frontline areas of Madhya Pradesh.

All the patients were admitted in Isolation ward, MBGH, RNT Medical College, Udaipur, and managed with frequent manual removal of maggots, regular dressing with antibiotics cover which covers Gram positive and Gram negative bacteria, and mosquito netting during sleep to prevent the further laying of eggs.[39] The number of maggots significantly reduced on 3rd day of admission. The average hospital stay encountered was 3.9 days. A study by Pradip Mallik *et al.* in 2019 on myiasis also shows similar average hospital stay.[40]

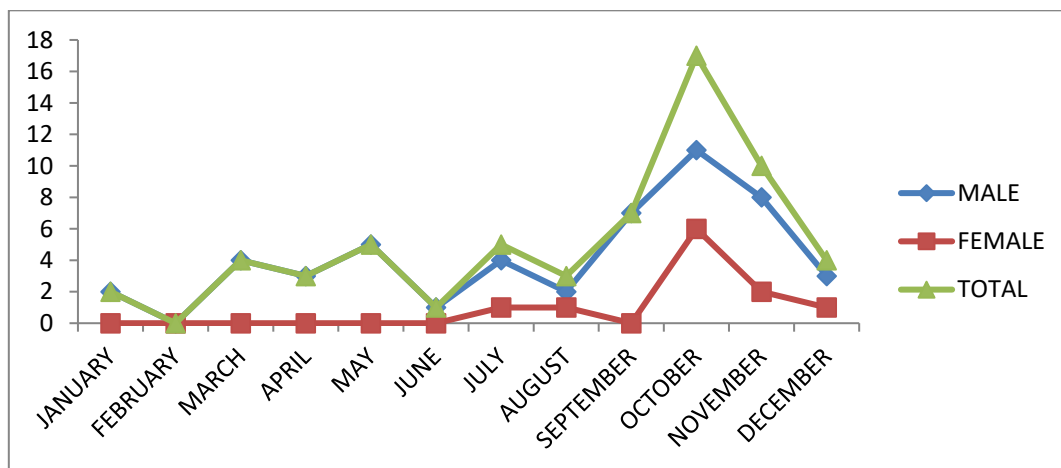


Figure 1: Graph showing Incidence of occurrence according to months

We have observed that myiasis commonly encountered during the period of September to November. (Figure 1). A study conducted by Singh *et al.* in 1993 on

aural myiasis [37]and study by Pradip Mallik *et al.* in 2019 have shown that myiasis commonly encountered during the period of October to December.[40]

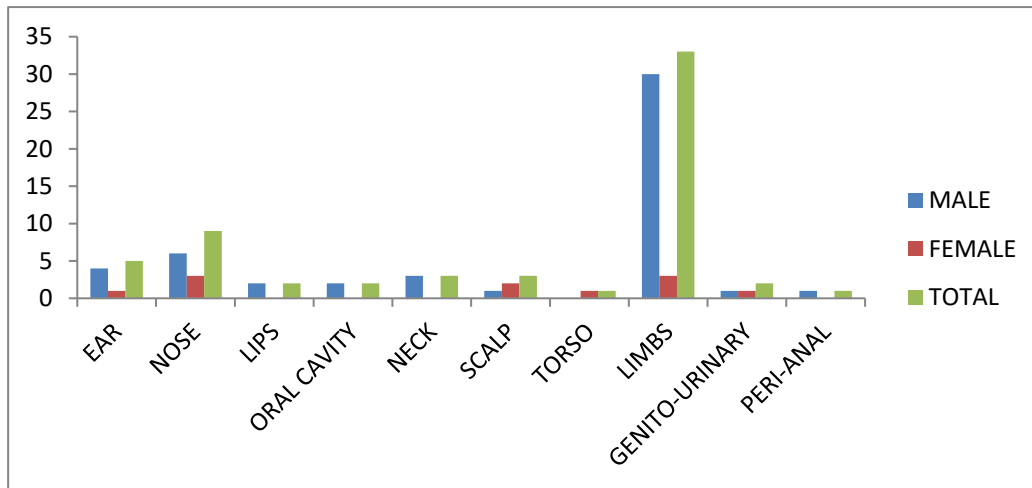


Figure 2: Graph Showing Infestation Sites Recorded

In our study, most common sites of infestation were limbs (33 out of 61 cases) followed by nose (9 out of 61 cases) and least common sites were torso (1 out of 61 cases) and perianal region (1 out of 61

cases) (Figure 2). A study conducted by Xianyi Zhou *et al.* in 2019 shown that 60 and 59 out of 199 cases of human myiasis most commonly occurred respectively in the mouth and limbs, especially the lower limbs.[41]

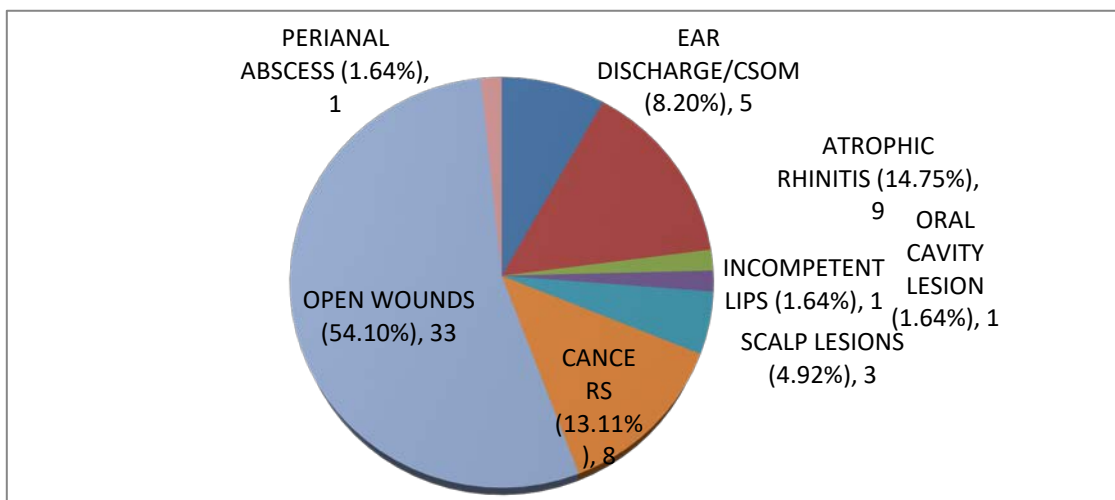


Figure 3: Pie Chart Showing Underlying Diseases & Conditions

In our study, most common underlying disease/condition recorded was open wounds with infection (54.10%) followed by atrophic rhinitis (14.75%) while least common was perianal abscess (1.64%) (Figure 3). In a study conducted by Xianyi Zhou *et al.* in 2019, open wounds with infections and bedridden/wheelchair bound/ debility were most commonly

recorded as underlying disease/condition.[41]

In ENT myiasis, Intracranial extension, at least theoretically, is a possible dangerous complication of aural/nasal myiasis but in our study no intracranial extension seen in aural/nasal myiasis. A study of the 18 cases of aural myiasis by Pradip Mallik did not show any intracranial involvement secondary to an infested ear.[40] In our

study, one patient of myiasis expired due to MODS.

Conclusion:

Myiasis is commonly affecting middle age group (41-50 yrs) patients. Slightly higher predilection was found in male but the mean age difference between male and female were statistically insignificant (**P value 0.109**). In general, people residing in rural area have higher chances of getting infested due to poor personal hygiene, overcrowding, illiteracy, animal contact, and poor sanitation. Flies were attracted by foul smelling discharge and laid eggs. As per the observation, the most common local risk factor in general cases of myiasis is chronic infected open wound. The most common local risk factor in aural myiasis is chronic otitis media and in nasal myiasis is atrophic rhinitis. As such, death due to myiasis is very rare. Treatment part consists of frequent manual removal of maggots, with topical and systemic antibiotic cover and mosquito netting during sleeping.

Financial support and sponsorship:

The study was not funded/ sponsored by any government or commercial agencies.

References:

1. John, David and Petri, William. Markell and Voge's Medical Parasitology: 9th Edition. Missouri: Saunders Elsevier 2006:P: 328-334.
2. Palmer ED. Entomology of the gastrointestinal tract: a brief review. Mil Med 1970;135: 165-176.
3. Angulo-Valadez CE, Scholl PJ, Cepeda-Palacios R, Jacquet P, Dorchie P. Nasal bots a fascinating world! Vet Parasitol 2010;174: 19-25.
4. Fernandes LF, Pimenta FC, Fernandes FF. First report of human myiasis in Goiás state, Brazil: frequency of different types of myiasis, their various etiological agents, and associated factors. J Parasitol 2009;95: 32-38.
5. Dogra SS, Mahajan VK. Oral myiasis caused by *Muscadomestica* larvae in a child. Int J Pediatr Otorhinolaryngol 2009;73: 1604-1605.
6. Hall M, Wall R. Myiasis of humans and domestic animals. Adv Parasitol 1995;35: 257-334.
7. Otranto D, Colwell DD. Biodiversity and extinction versus control of oestrid causing myiasis in Mediterranean area. Parasite 2008;15: 257-260.
8. Touré SM. Myiasis of economic importance. Rev Sci Tech 1994;13: 1053-1073.
9. Whitehorn JS, Whitehorn C, Thakrar NA, Hall MJ, Godfrey-Faussett P, et al. The dangers of an adventurous partner: *Cordylobia anthropophaga* infestation in London. Trans R Soc Trop Med Hyg 2010;104: 374-375.
10. Avula JK, Avula H, Arora N, Manchukonda UK, Vivekavardhan Reddy N. Orofacial myiasis of the gingiva and nasal cavity: a report of two cases and general review. J Periodontol 2011;82: 1383-1388.
11. Perez-Eid C, Mouffok N. Human urinary myiasis caused by *Fannia canicularis* (Diptera, Muscidae) larvae in Algeria. Presse Med 1999;28: 580-581.
12. Shaunik A. Pelvic organ myiasis. Obstet Gynecol 2006;107: 501-503.
13. Komori K, Hara K, Smith KG, Oda T, Karamine D. A case of lung myiasis caused by larvae of *Megaselia spiracularis* Schmitz (Diptera: Phoridae). Trans R Soc Trop Med Hyg 1978;72: 467-470.
14. Yuichi C, Satoshi S, Masatomo H, et al. Vaginal myiasis due to *Sarcophaga peregrina* (Diptera: Sarcophagidae) on a patient with atrial fibrillation, cerebral infarction and leg amputation [abstract]. Med Entomol Zool 2005;56: 247-49.

15. Mumcuoglu I, Akarsu GA, Balaban N, Keles I. Eristalistenax as a cause of urinary myiasis. *Scand J Infect Dis* 2005;37: 942-943.
16. Ogbalu OK, Achufusi TG, Adibe C. Incidence of multiple myiasis in breasts of rural women and oral infection in infants from the human warble fly larvae in the humid Tropic-Niger Delta. *Int J Dermatol* 2006;45: 1069-1070.
17. Caumes E, Carrière J, Guermonprez G, Bricaire F, Danis M, et al. Dermatoses associated with travel to tropical countries: a prospective study of the diagnosis and management of 269 patients presenting to a tropical disease unit. *Clin Infect Dis* 1995;20: 542-548.
18. Rossi MA, Zucoloto S. Fatal cerebral myiasis caused by the tropical warble fly, *Dermatobia hominis*. *Am J Trop Med Hyg* 1973;22: 267-269.
19. Delenasaw Y, Worku L, Solomon GS, Helmut K (2007) Human myiasis in an endemic area of Southwestern Ethiopia: Prevalence, knowledge, perceptions and practices. *Ethiop J Health Dev* 2007;21: 166-172.
20. Ghosh T, Nayek K, Ghosh N, Ghosh MK. Umbilical myiasis in newborn. *Indian Pediatr* 2011;48: 321-323.
21. Mielke U. Nosocomial myiasis. *J Hosp Infect* 1997;37: 1-5.
22. Dehecq E, NzunguPN, CailliezJC, Guevart E, Delhaes L, et al. *Cordylobia anthropophaga* (Diptera: Calliphoridae) outside Africa: a case of furuncular myiasis in a child returning from Congo. *J Med Entomol* 2005;42: 187-192.
23. Derraik JG, Heath AC, Rademaker M (2010) Human myiasis in New Zealand: imported and indigenously-acquired cases: the species of concern and clinical aspects. *N Z Med J* 2010;123: 21-38.
24. Dalton SC, Chambers ST. Cutaneous myiasis due to *Dermatobia hominis* (the human botfly) in a New Zealand traveller returned from South America. *N Z Med J* 2009;122: 95-99.
25. Otranto D, Stevens JR (2002) Molecular approaches to the study of myiasis causing larvae. *Int J Parasitol* 2002;32: 1345-1360.
26. John Smart, Karl Jordan, RJ Whittick, British Museum (Natural History) - 1943- 269 pages A handbook for the identification of insects of medical importance 2007, the university of Michigan, Printed by order of the Trustees of the British Museum, 1943.
27. Sesterhenn AM, Pfützner W, Bräulke DM, Wiegand S, Werner JA, et al. Cutaneous manifestation of myiasis in malignant wounds of the head and neck. *Eur J Dermatol* 2009;19: 64-68.
28. Ogugua KO, Achufusi TG, EmeEO, Dorcas SB, Chika HA (2011) Human Myiasis in Neonates and Children of the Niger Delta Wetlands and South-East Nigeria. *Journal of Cosmetics, Dermatological Sciences and Applications* 2011;1:171-176.
29. Ito E, Honda A, Honjo M, et al. Migratory myiasis due to *Hypodermabovis* [abstract, original in Japanese]. *Rinsho Derma* 2003;45: 129-131.
30. Batista-da-Silva JA, Moya-Borja GE, Queiroz MM. Factors of susceptibility of human myiasis caused by the New World screw-worm, *Cochliomyia hominivorax* in São Gonçalo, Rio de Janeiro, Brazil. *J Insect Sci* 2011;11: 14.
31. Clyti E, Deligny C, Nacher M, Del Giudice P, Sainte-Marie D, et al. (2008) An urban epidemic of human myiasis caused by *Dermatobia hominis* in French Guiana. *Am J Trop Med Hyg* 2008;79: 797-798.
32. Cepeda-Palacios R, Scholl PJ. Factors affecting the larvipositional activity of *Oestrus ovis* gravid females (Diptera: oestridae). *Vet Parasitol* 2000;91:93-105.

33. Freedman DO, Weld LH, Kozarsky PE, Fisk T, Robins R, et al. Spectrum of disease and relation to place of exposure among ill returned travelers. *N Engl J Med* 2006;354: 119-130.
34. Jervis Bardy J, Fitzpatrick N, Masood A, Crossland G, Patel H. Myiasis of the ear: A review with entomological aspects for the otolaryngologist. *Ann OtolRhinolLaryngol* 2015; 124:345-50.
35. Sinha V, Shah S, Ninama M, Gupta D, Prajapati B, More Y, et al. Nasal myiasis. *J Rhinol* 2006; 13:120-3.
36. Spradbery J. *A Manual for the Diagnosis of Screw-Worm Fly*. Canberra: Department of Agriculture Fisheries and Forestry; 2002.
37. Singh I, Gathwala G, Yadav SP, Wig U, Jakhar KK. Myiasis in children: The Indian perspective. *Int J Pediatr Otorhinolaryngol* 1993; 25:127-31.
38. Gabriel JG, Marinho SA, Verli FD, Krause RG, YurgelLS, Cherubini K, et al. Extensive myiasis infestation over a squamous cell carcinoma in the face. Case report. *Med Oral Patol Oral Cir Bucal* 2008;13:E9-11.
39. Al Jabr I. Aural myiasis, a rare cause of earache. *Case Rep Otolaryngol* 2015; 2015:219529.
40. Mallik P, Sinha V, Jha S, Swani J, Maniya N, Yadav S. A clinico-etiological study of aural myiasis. *Indian J Otol* 2019; 25:180-3.
41. Zhou X, KambalameDM, Zhou S, Guo X, Xia D, Yang Y, et al. (2019) Human *Chrysomyabezzi* myiasis: A systematic review. *PLoS Negl Trop Dis* 13(10): e0007391.