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Maggots in End Stage Squamous Cell Carcinoma and Management of the Dipterous Larvae - A Narrative Review

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ABSTRACT
BACKGROUND: The causative agent for myiasis remains undefined. This article provides a multimodal management for the myiasis in addition to the causative & preventive methods.
INTRODUCTION: "Myiasis" describes a chronic non healing necrotic wound infested with fly larvae. It is very common in immunocompromised individuals with poor hygiene & sanitation. Myiasis is associated with end stage Oral Squamous Cell Carcinoma.
OBJECTIVE: To identify the causative organism and the appropriate treatment for myiasis.
METHODS: A systematic electronic literature search was conducted on major databases like Research gate, MEDLINE, BIOSIS, Cochrane library, google scholar and PubMed using keywords in combination with terms such as "maggots in oral carcinoma, oral myiasis, palliative care and end stage squamous cell carcinoma" and the articles published from 2004 to 2021 with a total of 27 full text articles were collected. Manuscripts discussing cases of oral myiasis in paediatric as well adult patients were included in the review.
RESULTS: The literature search of full text articles were collected, and they were further used to formulate this review. In this case report and review article, sites involving oral cavity, nasal, cheek and orbital region were discussed. Despite their constraints, various modes of treatment for maggots have been collected. Literature shows ivermectin, nitrofurazone, turpentine oil and other asphyxiation methods can be effectively used as a treatment for myiasis.
DISCUSSION: In addition to medical treatment, surgical removal of the larvae is necessary for complete recovery. Patients must be kept on chemotherapeutic drugs to avoid progression of the larvae and infestation of the wound with maggots. The social component like basic health care plays a crucial role in prevention. Surgical debridement is considered a definitive treatment in maggots infested carcinoma.
KEYWORDS: *Maggots, Carcinoma, ivermectin, nitrofurazone, surgical debridement.*

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I. INTRODUCTION:

Oral myiasis was first described by Laurence in 1909. [1, 2] It is a parasitic infection caused by dipterous larvae. [3, 4] The word 'myiasis' was first coined by The Reverend Frederick William Hope. Keyt described ocular myiasis in 1900, while Elliot documented it in 1910 in India. In India, sheep nose botfly larvae (Oestrus ovis) are typically the source of infestations. [5, 6, 7] The word "myiasis" is derived from a Latin word "muia" which means

fly and "iasis" means disease.[8] In Greek 'Myi' means 'mosca' that describe infestation of the larvae in humans and vertebrate animals. Any tissue that is accessible to the fly to deposit its eggs can be invaded. The oral cavity may be invaded by maggots through the periodontium or the oral mucosa, separating the periosteum from the bone.[9] Few other sites of involvement include orbit, oral cavity, nasopharynx, skin and intestine. [10] This manuscript aims to describe various treatment modalities for maggots infested cases of oral carcinoma.

II. MATERIALS & METHODS:

A retrospective literature review was done in search engines such as PubMed, MEDLINE, BIOSIS,Cochrane library, google scholar and research gate databases and the articles published from 2004 to 2021 with terms such as "maggots in oral carcinoma, oral myiasis, ivermectin, palliative chemotherapy and end stage squamous cell carcinoma" were collected and reviewed. Furthermore, the option of similar articles was used. In addition to a search of review article, case reports and the most relevant papers, a hand search of journals relevant to the field of oral cancer, oral surgery and infection that includes 'Journal of dermatology', Journal of oral pathology', 'Journal of Oral and Maxillofacial Surgery', 'British Journal of Oral and Maxillofacial Surgery' 'International journal of surgery case reports', 'Journal of Dental Lasers' and 'Journal of Craniofacial Surgery' was reviewed. The relevant manuscripts published only in the English language were given full consideration. A total of 27 articles were scrutinized from the database, and they were further used to formulate this review. Despite their constraints, various modes of treatment for oral myiasis, cause of death in maggots infested carcinoma, most affected population and preventive methods have been collected. Literature shows ivermectin, nitrofurazone, turpentine oil and other asphyxiation methods can be effectively used as a treatment for myiasis in addition to surgical removal of the larvae as a definitive treatment.

INCLUSION & EXCLUSION: The studies on oral myiasis in patients diagnosed with OSCC and articles about myiasis were included in the review. The manuscripts in any language apart from English and abstract only format were excluded.

DATA EXTRACTION AND QUALITY ASSESSMENT: After evaluating the titles, keywords, abstracts, full articles and their references and applying inclusion as well as exclusion criteria, a total of twenty-seven manuscripts were selected for inclusion in our review.

RATIONALE OF THE RESEARCH: To help researchers understand and formulate a cohesive summary of existing knowledge about maggot infestation in squamous cell carcinoma and various medical and surgical management of the dipterous larvae.

RESULTS: After conducting the search with the previously mentioned keywords, a total of 30 articles were identified, out of which 3 were excluded due to inadequate content retrieved from the site. In these 27 articles, cases involving the skin, cheek, buccal mucosa, oral cavity, nasal cavity, and ocular region were discussed. Literature shows ivermectin, nitrofurazone, turpentine oil and other asphyxiation methods can be effectively used as a treatment for myiasis.

A collective review in terms of the site of involvement and treatment provided were given in the following tabular column.

S. No	Year	Country	Case and site of involvement	Review	Management
1	2017	Brazil	Oral myiasis	-	Under general anaesthesia - surgical debridement
2	2008	India	Ocular myiasis	-	Topical anaesthesia - forceps removal Topical moxifloxacin
3	2014	India	Myiasis of cheek and buccal mucosa carcinoma T4N2aM0	-	hemiglossectomy, unilateral neck dissection Turpentine oil & chloroform mixture
4	2017	Brazil	Frontal skin, cheek skin, wound of maxillectomy, neck, scalp skin, periauricular wound, tracheostoma, Oral cavity, skull base and auricular wound.	-	Oral ivermectin and larvae removal
5	2010	New York	-	Review of all	1. Dermatobia hominis - DEET,

				species & management	Mosquito net 2. Cordylobia anthropophaga - ironing clothes, drying garments in the bright sunshine, Direct removal of the larvae by surgery 3. Cuterebra myiasis - Extraction of the larva with forceps, Surgical incision and drainage 4. Wohlfahrtia vigil - forceps removal 5. Gasterophilus - removed with a needle 6. Hypoderma - incision and removal 7. C. hominivorax with Ivermectin 8. W. magnifica - surgical exploration
6	2013	India	Ocular myiasis	-	exenteration and debridement - lesion was irradiated with low dose radiation. topical 5-fluorouracil (5-FU) ointment, laser treatment and systemic chemotherapy
7	2020	Brazil	Myiasis of Cheek & Oral cavity carcinoma T4N2M0	-	Oral ivermectin, palliative chemotherapy 2500 mg of Fauldfluor +50 mg of Cisplatin
8	2000	US	-	671 reviewed	Antibiotics
9	2015	Brazil	Oral and nasal cavity myiasis	-	Ivermectin and ceftriaxone, cephalothin antibiotics
10	2011	Brazil	T2N2M0 mandible carcinoma with myiasis	-	Morphine, Manual removal, chlorhexidine rinse
11	2014	India	Upper eyelid myiasis	-	Manual removal
12	2017	Brazil	-	707 cases reviewed	Surgical removal, oral ivermectin, topical nitrofurazone, topical asphyxiating agent
13	2012	India	Trigeminal neuralgia	-	Neurectomy with diode laser
14	2015	India	Cheek myiasis	-	Turpentine oil and surgical debridement
15	2015	India	Palatal myiasis	-	Manual removal
16	2008	Brazil	Right midface myiasis	-	Ivermectin
17	2010	India	Nasal myiasis	-	Ivermectin with turpentine oil Surgical exploration
18	2004	Brazil	Maxillary labial gingival sulcus myiasis	-	Cephalothin, ivermectin
19	2010	Hong Kong	Orbital myiasis	-	Orbital exenteration
20	2009	Brazil	Upper alveolus and palatal myiasis	-	Cefazolin, metronidazole, Cephalothin, ivermectin
21	2008	Canada	Myiasis below left eye	Review from BIOSIS & MEDLINE	Surgical exploration. Beeswax, digital pressure with wooden spatula & tweezer, venom extractor, irrigation with hydrogen peroxide and chlorhexidine

22	2010	Brazil	Upper lip and lingual gingival myiasis	-	Cephalosporin, Nitrofurazone
23	2009	Germany	Back of neck	-	Surgical excision and doxycycline
24	2008	India	Myiasis of orifice of 21 avulsed site	-	Turpentine oil, manual removal
25	2006	Brazil	Myiasis of upper lip	-	Ivermectin, surgical exploration
26	2012	Brazil	-	Review on cutaneous, wound, cavitary, and intestinal myiasis.	Ivermectin
27	2021	India	-	32 cases of myiasis reviewed	Turpentine oil, ivermectin, asphyxiation agent, mechanical removal, clindamycin and albendazole.

MAGGOT DEBRIDEMENT THERAPY:

Maggots have been used to treat wounds for generations, and historical records date back to antiquity. Modern maggot therapy, on the other hand, rose to prominence in the twentieth century after being reintroduced as a medical therapeutic treatment. These maggots are chosen for their capacity to eat dead tissue while leaving healthy tissue substantially intact. They emit digestive enzymes that degrade necrotic tissue, effectively cleansing the wound and encouraging the formation of new tissue.

Maggots, or larvae, are used medically to clean out necrotic wounds in cases like diabetic ulcer, end stage squamous cell carcinoma and mucoepidermoid carcinoma with devitalized tissue. Maggot therapy, is a type of biotherapy which is also known as maggot debridement therapy (MDT) or the larval therapy, is the intentional introduction of live, disinfected green bottle fly maggots larvae also known as Lucilia sericata by an experienced health care practitioner into a non-healing skin and soft tissue wound of a human or animal with the goal of selectively cleaning out only the necrotic tissue in the wound to promote wound healing. Maggot therapy has been shown to be especially helpful in situations when traditional wound care methods have failed, such as diabetic ulcers, pressure ulcers and certain forms of infections. It is regarded as a cost-effective and perhaps life-saving therapy option in some cases.

The three main advantages of maggot therapy for a wound are debridement, disinfection and improved healing. Debridement is the process of clearing the wound bed of nonviable necrotic tissue and cellular debris. Necrotic tissue serves as a microbial substrate, therefore removing it may help lower the chance of infection. Wounds are rapidly and efficiently debrided by maggots without causing harm to living tissue. Because they are photophobic, maggots will naturally seek down dark nooks and crannies that may be inaccessible to a surgeon's knife. Mechanisms for disinfection include simple mechanical irrigation of the wound by increased secretions/ excretions which are produced by the larvae by the action of the midgut commensal Proteus mirabilis on digested bacteria and the elimination of antibacterial substances from living maggots. The proteolytic digestion of necrotic tissue aided by the maggots initiates enhanced healing. [11]

CLASSIFICATION OF MYIASIS: According to the ecological classification myiasis is categorized into three types. Obligatory Myiasis when infestation is necessary for the survival of fly larvae, which arises when the larvae need a live host to finish their life cycle. Facultative/ semi specific Myiasis is when a Fly larvae can develop in carrion or decomposing organic materials, but they can also opportunistically infest living tissue. It is further divided into three groups: Primary, secondary and tertiary. Primary myiasis is described when myiasis can be initiated. Secondary is when it is unable to initiate myiasis whereas tertiary myiasis usually infests a corpse or in a near death host who are in a dry stage of decomposition. Accidental myiasis if an infestation happens when fly eggs or larvae are inadvertently consumed or introduced into the body by cuts, insect bites, tainted food or polluted water.[11] The Bishopp system, which was subsequently altered by James and Zumpt, serves as the foundation for the anatomical classification scheme. Those writers employed various terms that had the same meaning. Bishopp's classification includes 1. Sanguinivorous or sucking blood, 2. Cavitary myiasis, when the infestation is given the name of the diseased organ, such as cerebral, auditory, nasal, and ophthalmomyiasis, 3. Cutaneous myiasis, furuncular and migratory and 4. Wound myiasis. [11] According to Zumpt, the larvae feed on the host's dead or living tissue, neoplastic and ulcerated necrotic sores, liquid bodily components and swallowed food. Thus, depending on the host tissue, myiasis can be divided into primary and secondary cases. Secondary myiasis occurs

if it feeds on decaying and dead tissue (scavengers), while primary myiasis occurs if it feeds on living tissue (biophagous). Based on its aetiology, myiasis can be divided into three groups: pseudo myiasis, particular or required myiasis, and semi-specific or optional myiasis. When food or liquid is inadvertently eaten along with larval flies or eggs, pseudo myiasis develops. On the other hand, larvae that thrive in necrotic tissue (necro biophagous), mostly in improperly treated wounds, and smell fetid are the source of semi-specific myiasis, commonly referred to as secondary myiasis. Patients with oral squamous cell carcinoma develop secondary myiasis as the larvae feed on the dead and decayed tissue of the host.[12]

MAGGOTS MORPHOLOGY & LIFE CYCLE: Maggots range in size from 2 to 3 mm in diameter and 5 to 20 mm in length. The maggots have a vivid brown colour that leans pink. The thick, non-sclerotic integument covering the maggot's body is striated with dark bands featuring strong, thorn-like spines. The front portion displayed projections that resembled five fingers. There is a fissure in the posterior section of it, and the anal segment bears three straight slit-like openings with lateral swellings. Observing the larvae as they surface in the lesion's central punctum allows for the diagnosis of myiasis. The larvae's caudal ends are still visible at the surface while they are feeding. Because their hooks allow them to stick to the tissue, the larvae can live at depths within the tissue. The patient feels uncomfortable because of larval movements and their exudation. The larvae leave the wound once they have reached maturity to finish the developmental cycle and become new flies. 100–500 eggs can be laid by a single female fly. In lesions that are pus-filled, haemorrhagic, and necrotic, flies lay their eggs. Within twenty-four hours, the eggs hatch into larvae, which pierce the tissue and devour it. Larvae cause haemorrhage into the tissue because they are voracious eaters. [13]
In due course, the hosts react to the infestation by forming capsules in the tissue that the larvae attach themselves to. When the mucoperiosteum and epithelium separate, neighbouring tissue becomes available to the larvae for nourishment, causing the tissue to tunnel. [14] It is parasitic on humans for eight days during the larvae phase. The maggot flies lay eggs that hatch into larvae that enter the tissue and grow there. The larvae have a three-day feeding cycle before migrating deeply into the wound. Larvae use segmental hooks that are angled backward to cling to surrounding tissue. Being photophobic, they lurk below the tissue surface. [15] Multiple tunnels that the maggots create into the soft tissue are referred to as "pockets" or "cavitation." [16]

CLINICAL FEATURES: Sites of involvement, in contrast to the eyes, ears, nose and sinuses less frequently involved sites include the mouth, throat, urogenital, and gastrointestinal tracts in addition to the skin. The symptoms of myiasis include an ulcer infected with maggots, bad breath, tight and oedematous tissue, and deterioration of soft tissue. Sensation of the larval movement and pain or swelling in the mouth, teeth, lips or palates are some of the symptoms associated with oral myiasis that have been documented. The symptoms include stridor, laryngospasm, coughing, nasal signs such nasal discharge, sneezing, dyspnoea as well as throat itching. [17] Clinically patients present with tense intraoral oedema, fetid odour, tissue necrosis, gingival bleed, indurated swelling of the lip, inflamed erythematous tissue with bony involvement and ulcerated lesions may or may not present. Tenderness will be present over the nose, maxillary sinus region and in the infra-orbital margin. Infestation of the nose has a high chance of intracranial penetration. Orbital involvement includes weakness over the lamina papyracea. Thrombophlebitis of the vein occur due to infection from the diploic vein of frontal and sphenoid sinus as it is a valveless communication between orbit and cranium. [18, 19]

Intraoral intumescence present with pulsations due to the movement of the larva. Multiple carious teeth and lack of poor oral hygiene with halitosis. A natural bodily cavity infestation is referred to as cavitary myiasis. Typically, the name of the affected anatomic region is assigned to the infestation. Ocular myiasis is one type where patients experience 'looking through the branches in a tree'. Larvae survive in lacrimal secretion, erode the conjunctiva and destroy the cornea. Orbital damage with permanent blindness may result. Globe and intracranial invasion are also reported. Severe orbital myiasis may require exenteration. The three types of ophthalmomyiasis are orbital, internal, and external, depending on where the larval infestation occurs. A restricted infestation of the superficial peri-ocular tissues is referred to as external ophthalmomyiasis, which is further divided into palpebral and conjunctival infections. Examination findings include photophobia, superficial punctate keratopathy, lid oedema, red eye, punctate conjunctival haemorrhages, fibrovascular proliferation, exudative detachment of the retina and even fibrovascular scarring, pseudo membrane development, and conjunctival hyperaemia. When parasitic dipterous larvae enter the subretinal space through the conjunctiva and sclera, internal ophthalmomyiasis results with red eye, tenderness over eye and vision loss. When a high number of dipterous larvae infiltrate and demolish the orbital contents, it results in orbital myiasis. Slit-lamp examination facilitates the process, but viable larvae have the tendency to avoid bright light. In case of lacrimal myiasis the larva travel down through the lacrimal canal to reach the nasal cavity. [20]

Nasal and palatal involvement involve the paranasal sinus that show opacification of the right maxillary sinus. Axial and coronal CT sections reveal soft tissue thickening in soft palate region, nasal cavity and nasal septum, thinning of the cartilaginous part of the nasal septum and erosion of the bony nasal septum, hard palate

and intercellular septae of ethmoid air cells. The posterior nasopharyngeal space was partially obliterated due to marked soft palate swelling. Leprosy patients are more susceptible to nasal myiasis due to atrophic rhinitis, ulcers of the nasal mucosa, suppurative wounds of the nasal cavity, and loss of sensory stimuli perception like sneezing reflex. Nasal myiasis presents with pain over the face, anosmia, epistaxis, mucopurulent or blood-stained nasal discharge, nasal pain and bad odour. In addition to helping with the removal of the maggots with a forceps, a rhinoscopy examination may be utilized to treat the patient. Examining the area may reveal mucosal oedema, congestion and ulcers. More occurrences are reported in tropical countries like India and in subtropical countries because of the warm and humid environment. Myiasis is common in sub-developed countries and in rural zones populated with animals such as cattle, goats and pigs.

Ambroise Pare, the chief surgeon of King Charles IX and King Henry III, observed that maggots infested in open wounds. A plethora of visible previous suppurative lesions is another significant feature that draws in and encourages the female insect to deposit eggs. The incidence is uncommon in healthy individuals but increase of the disease is associated with abandoned elderly population, advanced periodontal disease, tooth extraction sites, incompetent lips, thumb sucking habit, pre-existing open mouth sleeping habit individuals, hostile habitats, neglected cases of advanced oral squamous cell carcinoma (OSCC), basal cell carcinoma (BCC), mucoepidermoid carcinoma, chronic alcoholics and smoker, suppurative lesions or skin ulceration like diabetic, neurotrophic and malignant ulcers, hemiplegic individuals, epileptic, facial trauma, sick, debilitated and intellectual disability people who are unable to defend themselves, poor socioeconomic status, inadequate personal and oral hygiene with low immunity.[21]

Middle age and elderly are common risk groups observed with both gender involvement. Cochliomyia hominivorax, Wohlfahrtia magnifica and Chrysomya bezziana are the most common species found worldwide known to cause human wound myiasis. C hominivorax and C bezziana myiasis usually manifests with severe pain.

Cutaneous myiasis is a common clinical form under which furuncular and migratory forms are included. Dermatobia hominis and Cordylobia anthropophaga are the most common causative agents of furuncular myiasis. Dermatobia hominis, the human botfly also known as torsalo. It is indigenous to Central and South America and is well-known for its unusual life cycle, which entails using humans as intermediate hosts for parasitizing mammals. Symptoms of Dermatobia hominis larvae (sometimes referred to as "bots") in the skin might include pain, swelling, redness, and itching at the infestation site. Additionally, some people might develop allergic reactions or subsequent bacterial infections. Clinical symptoms and a travel history to endemic countries are usually used to diagnose Dermatobia hominis infestation. In rare circumstances, visual inspection or the detection of movement beneath the skin may be used to confirm the larvae's presence. Dermatobia hominis-induced cutaneous furuncular myiasis is indicative of the "egg" penetration location. The eggs are developed on a mosquito vector while the mosquito feeds, and they are subsequently injected into the human host. The larvae grow and burrow into the skin after 50–60 days, eventually descending to pupates. Irritation and inflammation surround the lesions. Ultrasound investigation has demonstrated that, in endemic locations, a single cooked lesion may occasionally contain many larvae. Neutrophils are the predominant inflammatory cells while eosinophils are rare in primary infected hosts, where the inflammatory response develops slowly at first. Over time, the reaction intensifies, encircling the larvae in a necrotic halo of inflammatory cells encircled by fibroblasts, and causing the inflammation to spread into the surrounding tissue. The enzymatic demise of the larvae results in the observation of collagen breakdown. It's possible that the cavity surrounding the larva is epithelialized, and that a foreign body reaction caused its rupture. [22]

The painful boil-like lesions that result from larvae piercing healthy skin and causing itching sores that gradually grow into larger lesions are known as furuncular myiasis. Creeping myiasis is a type of cutaneous myiasis in which fly larvae migrate under the skin. The diagnosis of creeping myiasis is more challenging than that of furuncular myiasis because the fly larvae may not be seen if an escape or breathing hole has not yet formed. One or more boil-like lesions that do not heal, visible on the skin, with erythema ranging from a few mm to more than two centimetres; some serous, serosanguineous, or seropurulent discharge from a central pore linked to pruritus. The migratory pattern of the lesions is caused by a dipteran maggot that begins to wander through burrows in the skin. This condition is known as migratory myiasis, or creeping myiasis. Nearly majority instances of creeping myiasis in humans are caused by the larvae of the genera Gasterophilus (horse bot fly) and Hypoderma (cattle bot fly). The myiasis associated with Gasterophilus species is superficial and features transparent, serpentine, black tubes (creeping eruption). Hypoderma spp. generate a deeper (subcutaneous) creeping myiasis that is more painful and occasionally results in skin swellings. After stopping its movement, the larva creates a hole in its skin to complete its development. It then emerges from the "furuncle" to pupate in the ground. Furuncular myiasis is the common diagnosis made for hypodermal myiasis as a result. Ultrasound investigation can be very useful to confirm a case of furuncular myiasis and for the complete removal of the larvae. To reach the trachea, Cuterebra larvae most likely enter the human mouth or nose. They then burrow into the mucous membrane and travel all the way up to the epidermis, where they eventually mature into warbles with breathing

holes. In some cases, the larva was coughed out, perhaps due to its persistence in the tissues of the trachea. Sometimes the symptoms of a Cuterebra infestation resemble those of creeping myiasis. This is since larvae in their first instar can enter human skin directly, usually in the region of a cut, and then proceed into the tissue. Spiracles, or breathing holes arranged in two clusters at the projecting end of the larva, are a useful tool for identifying fly larvae. (commonly observed as two dark patches). It is possible for air bubbles to come out of the central punctum if the lesion is submerged in water or saliva. The larva's penetration of the skin can occasionally be felt as a strong sting at the lesion site a few days or weeks before symptoms manifest. Usually only one larva is discovered in a warble, but in a patient with W. vigil caused myiasis, upto five larvae have been found in a single warble. It's crucial to remember that a failed attempt at skin penetration by a larva can lead to its movement and invasion of cutaneous tissue in other areas. These unsuccessful intrusions typically result in a red pimple and can be confused with a real warble that contains a maggot. Furuncular myiasis in humans is usually benign and heals quickly with nearly no problems when treated properly. In the case of a creeping eruption, the small, immature Gasterophilus spp. larvae have been extracted using a needle.

PRESERVATION OF LARVAE: Once removed, the maggot should be destroyed by immersing it in extremely hot (enough to produce vapor) but not boiling water for 30 seconds. This will stop the maggot from decomposing and preserve its original colour. The larvae will shrink and putrefy if they are killed off directly. Maggots should then be stored in a 70%–95% ethanol solution. The technique outlined above maintains larval length and morphology the best. If a 70% ethanol solution is unavailable, 70% isopropyl alcohol might be utilized in its place. Formalin solutions should not be utilized since they cause the larval tissues to become excessively rigid, which makes processing them challenging. Facultative parasites can be grown on raw meat or a sterile liver agar combination, however certain obligatory parasites might be able to endure on raw meat. Specimens, adult or larval, should be sent to an entomology or parasitology centre for accurate identification. Accurate parasite identification along with thorough patient history documentation will be used to document myiasis cases, hence providing data on the distribution, behaviour and epidemiology of these parasites. This will help with myiasis diagnosis, treatment, and prevention. Blood ammonia level should be checked to rule out maggot induced ammonia toxicity.[23]

DIFFERENTIAL DIAGNOSIS:

Differential diagnosis of the lesions includes infected sebaceous cyst, lymphadenopathy, allergic rhinitis, cellulitis, insect bites, subcutaneous cysts and malignancy.

COMPLICATION: Maggots scrape away the tissue and lacerate the fine blood vessel. Hence, haemorrhage within the lesion can be encountered. Bleeding can be controlled by application of direct pressure over the site with sterile gauze. Once the larvae begin its feed from the necrotic wound, severe destruction of the surrounding tissue will result in spaces called ‘pockets’. Further ulceration over the destructed region results in bacterial infection. Larvae release toxins to destroy host tissue. Proteolytic enzymes released by surrounding bacteria decompose the tissue and larvae that feed on this rotten tissue. [24]

REPORT OF A CASE:

This report aimed to present a case of a 57-year-old male who presented pale, malnourished and cachectic. Carcinoma of the right-side buccal mucosa with tissue destruction was present. Lesion extended from the level of the ala of the nose on the right side, 1 cm from the corner of the lip, extended to involve posterior to the posterior border of the mandible antero-posteriorly and involved the right submandibular and submental region that crossed the midline [Fig 1]. Patient had periorbital swelling, itching, destruction of the nasal cartilage and nasal mucosa. Patient had difficulty in food intake with loss of appetite. Exposed wound was infested with maggots. Patient was a chronic smoker and alcoholic for the past 30 years. Patient had end stage squamous cell carcinoma with clinical TNM stage of T4N1M0.

Clinical examination of the site revealed a tense and oedematous, inflamed tissue with suppuration. Patient had poor oral hygiene with a fetid odour. Severe pain, constant vomiting and dysphagia were also present. Right submandibular and bilateral submental nodes were fixed. Patient was not cooperative for medical or surgical treatment of oral cancer. Due to lack of patient education and oral hygiene maintenance, destructive lesions were infested with maggots, clinically seen as cavitation/pocket [Fig 2]. Patient experienced crawling of the maggots over the face and mouth. With concern about the quality-of-life morphine was given for pain management. Chlorhexidine 0.12% was used to debride the necrotic tissue. As a palliative care, fibre optic diode laser, solid, semiconductor 800 to 980 nm continuous and gated pulses are used to remove maggots [Fig 3]. Photocoagulation and photo ablation effect of laser was used to bring the maggots out to the surface. Maggots were grasped with clinical pincer and removed alive under LA [Fig 4]. Each larva measured about 7–10 mm in length, creamy white in colour, cylindrical and tapered towards the head. Thorough debridement was done, and wound hygiene maintained. Nasogastric tube was inserted as the patient had difficulty in food intake. Daily dressing was done

for 3 days to remove the residual larvae. Despite the surgical treatment, the patient died 2 months post- treatment. Cause of death could be acute haemorrhage due to extension of the carcinoma.

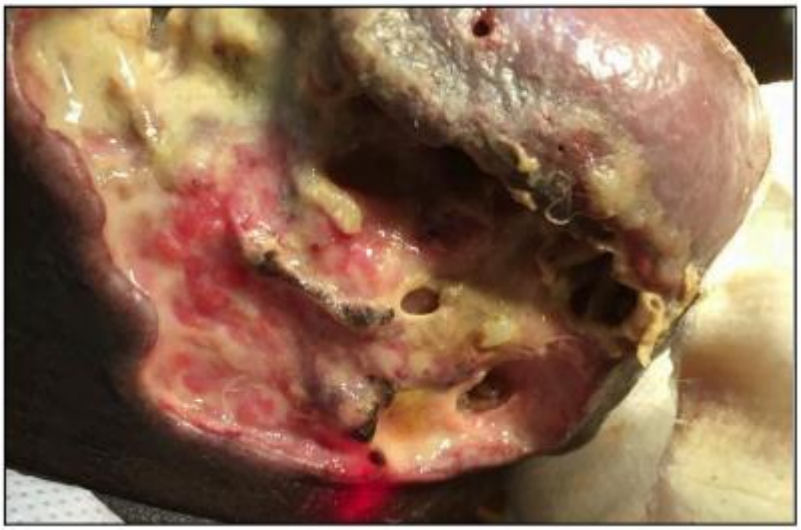

Fig 1: Necrotic site involving the lower right submandibular and submental region of end stage squamous cell carcinoma infested with maggots. Skin appears tense, oedematous, glossy with soft tissue destruction. Maggots have eroded the skin and subcutaneous fat.

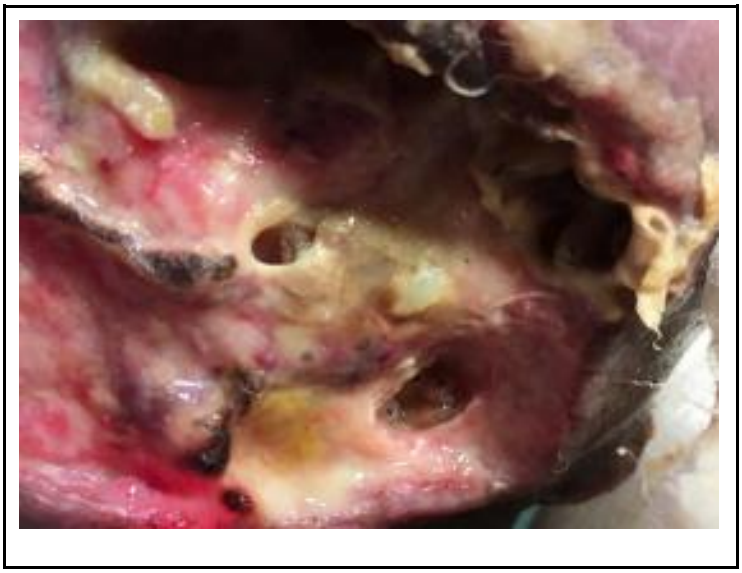

Fig 2: Maggots with its caudal end faced towards the exterior surface. Cavitation or pocket present in the involved region where the maggots get buried deep under the surface.

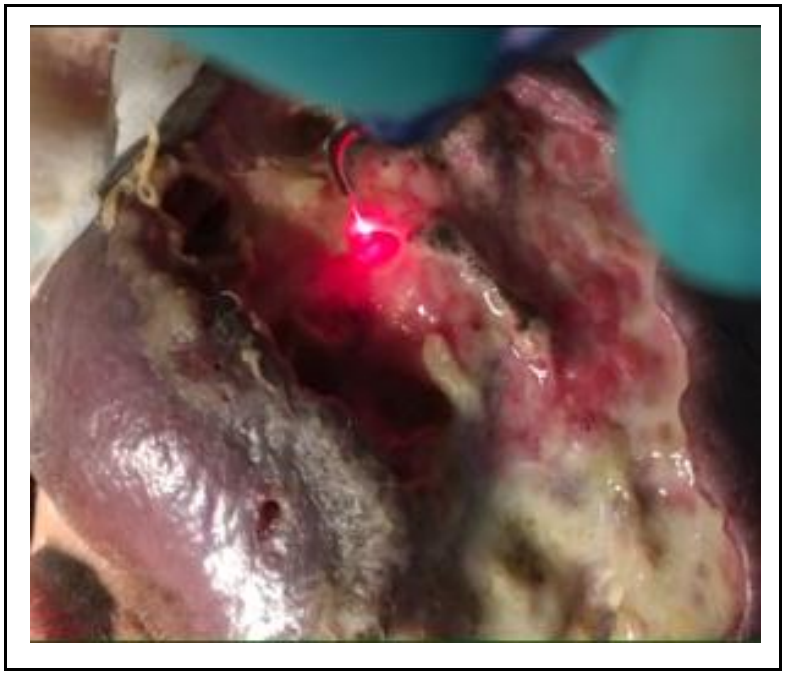

Fig 3: Diode laser used for removal of maggots with its thermal ablative effect. Maggots will protrude from the deeper tissue with the heat produced by the laser.

Fig 4: Maggots removed with clinical pincer from the necrotic wound. Nearly 100 maggots were collected and killed with the help of hot water immersion method.

MULTIMODAL MANAGEMENT: In addition to the biological aspects of the condition, multimodal management takes a holistic approach to patient care, considering psychological, social and environmental factors that may have an impact on health and well-being. Enhancing the patient's overall quality of life and meeting all their requirements are the main objectives. Treatment for cases of oral cancer infected with maggots requires multidisciplinary professional coordination. It takes a team effort from the surgeon to surgically debride the wound, as well as from the social worker, psychological team, chemotherapy, radiotherapy and palliative care.

1. DIGITAL PRESSURE: In most cases of furuncular myiasis, digital pressure applied to both sides of the lesion with the use of two wooden spatulas is sufficient to drive the larvae out. The pressure point can be gently tractioned with tweezers or forearms.
2. BACON FAT: Furthermore, lesions have been treated with bacon fat to entice larvae to migrate into it. The larva may not emerge for up to a day, and when it does, it might need to be plucked out or picked up with tweezers.
3. LIDOCAINE: 2 mL of lidocaine is injected into the nodule (beneath the larva), as this pressure may drive the larva out. Surgical excision might be required if the larva is dead or does not emerge after all other

attempts have failed; lidocaine gel can be used to numb the larva to facilitate removal.

4. HYDROGEN PEROXIDE: Conventional methods with chemical agents cause asphyxiation and expel the maggot out of the wound. The infected necrotic area can be irrigated with saline or a diluted antibiotic, such as hydrogen peroxide or 5% to 15% chloroform in light vegetable oil, to treat wound myiasis or body orifices infested with maggot larvae. High amounts of hydrogen peroxide may damage healthy tissue and obstruct cellular repair mechanisms, which could impede the healing process even though it has antibacterial qualities and can help clean wounds.

5. TOPICAL ASPHYXIATION AGENTS: A few more methods for debridement include beeswax, olive oil, calomel, iodoform, phenol (10% creolin) and calomel. They are given topically with the goal of suffocating the larvae and compelling them to emerge from the wound cavity in pursuit of surface air. For the elimination of maggots, pure petroleum jelly (like Vaseline) is a suggested or useful method. Petroleum jelly will be successful in eliminating or killing maggots from cuts or other afflicted regions, even if it can produce a barrier on the skin and suffocate some insects. Furthermore, using petroleum jelly on cuts or regions infested with maggots might not deal with the root of the problem and might even result in consequences like infection.

6. ETHER: The larvae can get paralyzed by ether or other volatile substances. An older technique for getting rid of maggots is ether, which has been recorded in old medical journals. Ether was occasionally administered to wounds or affected regions to kill maggots and aid in their removal. Ether is a volatile liquid with anaesthetic qualities. Ether vapor inhalation can cause respiratory irritation as well as other health issues. 70% alcohol can also be used in place of ether.

7. VENOM EXTRACTOR: Compared to the previously discussed asphyxiation methods, a method that uses a commercial venom extractor has shown some promise and may be more effective and successful. By creating suction around the wound site, venom extractors may be able to remove venom before it spreads throughout the body. Rather than employing a venom extractor in conjunction with maggot therapy, regular wound care methods and medical treatment would be used if there are concerns regarding the presence of venom in a wound, such as from a previous insect bite.

8. SALINE / CHLORHEXIDINE: 0.9% saline or aqueous Chlorhexidine 0.12% irrigation can be done. Because saline solution is gentler and has a decreased chance of adverse reactions, it might be selected. However, chlorhexidine irrigation may be taken into consideration, considering the patient's tolerance and any potential dangers, if there is a considerable risk of infection or if the wound requires further antimicrobial action. Chlorhexidine antiseptic has broad spectrum activity. For efficient wound debridement, maggots require both a clean wound bed and a wet environment to thrive. Particularly at high doses, chlorhexidine may alter the wound's natural ecology and impair the maggot's capacity to perform at their best. Thereafter, manual removal of any leftover maggots is possible, although surgery might be required for larvae that are severely embedded deep inside the soft tissue. Nitrofurazone was also recommended as an effective flushing method. When used together for wound irrigation, nitrofurazone and chlorhexidine may have synergistic antimicrobial properties that lower infection risk and facilitate a sterile environment.

9. NITROFURAZONE: Nitrofurazone flushing creates an aseptic environment. The antibacterial spectrum of nitrofurazone is broad, and its derivatives exhibit antibacterial, antiprotozoal, and antiparasitic properties. Nitrofurazone is a synthetic nitrofuran that is used as a topical anti-infective medication with a broad antibacterial spectrum. It functions by blocking the use of enzymes by bacteria that are involved in the metabolism of RNA, DNA, and carbohydrates. Additionally, it is bactericidal against most bacteria that cause infections on the skin. Because there is no evidence of carcinogenicity and it is not absorbed by the skin, mucous membranes, surrounding tissues, or the systemic circulation after local delivery, its topical treatment is safe for human usage. The topical solution has a faint, distinctive smell and is a clear, slightly thick, light-yellow liquid that dissolves in water. With 0.2% nitrofurazone in a water-soluble polyethylene glycol base that is stable in solutions with a pH range of 4 to 9.10, the soluble dressing serves as a topical antiseptic. Nitrofurazone is mostly used as a topical antibacterial treatment in patients with burns and skin grafts. It was licensed for the prevention of urinary tract infections linked to catheter use.

10. IVERMECTIN: Oral administration of 6 mg of ivermectin, a semi-synthetic macrolide antibiotic and antiparasitic that was derived from Streptomyces avermitilis, once day for three days is an effective treatment for patients of advanced oral squamous cell carcinoma that are infested with maggots. The release of gamma amino butyric acid triggers the action of ivermectin, causing the larvae to die, become trapped in the wound, and eventually eliminate themselves without the need for mechanical removal. Ivermectin side effects include skin eruptions, fever, headaches, lightheadedness, muscle aches, and joint and lymphatic pain.

11. TURPENTINE OIL: Turpentine oil-impregnated cotton buds can be applied to the socket orifice for about ten minutes. They suffocate the larvae to death. Although it does not destroy the larvae, turpentine oil was used to aid maggots in emerging from deeply seated wounds.

12. LASER: The maggots can be effectively removed by laser photocoagulation and laser ablative effects. If administered topically or consumed in large quantities, turpentine oil can be harmful. If it becomes absorbed

through the skin or mucous membranes, it might irritate the skin, trigger allergic reactions, or even be hazardous to the system. Consequently, care should be used when applying turpentine oil, particularly to vulnerable or ill people.[25]

13. MANUAL DEBRIDEMENT: The standard treatment of myiasis is removal of the larvae and irrigation with antiseptic solution as described by Shinohara et al. Under LA, the maggots can be mechanically removed which is the final treatment. The physical extraction of maggots from a wound or other afflicted region is referred to as "mechanical removal of maggots." Manual removal requires the use of tweezers or forceps. It is imperative to exercise caution to eradicate all maggots in order to avert more infestation or possible consequences. Maggots can be manually removed by flushing the wound with saline solution or another suitable irrigating solution. This helps to loosen the maggots from the wound bed. Additionally, irrigation can aid in debridement and wound cleaning. In case of extensive lesions removal of cellulite and devitalised tissue is recommended.

14. PAIN & INFECTION CONTROL: Enough pain control should be given because the patient may experience discomfort during the mechanical removal of maggots. Before removal, the region may be made numb using local anaesthetic. Caution must be exercised to avoid infection both during and after the mechanical removal of maggots. To lower the risk of infection, the wound can be cleaned with antiseptic solutions following removal. Following the mechanical extermination of the maggots, the wound needs to be closely watched for any indications of infection or additional infestation. It is important to adhere to proper wound care procedures to accelerate healing and avoid problems. Under all circumstances, care should be taken to prevent rupturing the maggots, as this may lead to further infections or even life-threatening allergic responses. The wound must be well cleaned and tetanus prophylaxis maintained as needed. Antibiotic prescriptions ought to be written in response to signs of bacterial infections.

Preventive approaches include,

1. adequate personal hygiene
2. access to primary health service
3. basic healthcare
4. control of the fly population
5. cleaning and covering of the wounds
6. educating the susceptible population
7. reducing fly breeding habitats
8. appropriate handling of food scraps and trash cans to prevent the spread of necrotic lesions.
9. The application of insect repellents containing diethyltoluamide (DEET) may help prevent the infestation of D. hominis.
10. It is possible to effectively remove clandestine eggs deposited in clothing, particularly by C. anthropophaga species, by ironing and drying textiles in direct sunshine.
11. Fly management in the field is crucial. Aerial spraying, destroying animal corpses, following basic sanitary and hygiene procedures and cleaning the debris and trash from the vicinity of homes are only a few of the strategies that should be employed.
12. It has proven to be quite effective to inactivate female flies by releasing more males who had previously been sterilized by ionizing radiation.
13. As a humid environment favours the growth of myiasis, moist ulcerated necrotic wounds are prone to be affected. Being a tropical country, Myiasis infestation is very common in India. And it accounts for poor sanitation too.
14. Use of habit breaking appliances and treatment for incompetent lips. [26,27]

III. CONCLUSION

Myiasis is a creeping, furuncular (boil-like) traumatic lesion that can form in the end stage of oral squamous cell carcinoma if medical and surgical treatment is not provided promptly. Ideal management is surgical debridement of the maggot's larvae. Surgical debridement should be performed with caution not to leave any larvae in the necrotic wound for the successful treatment.

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