INTRODUCTION

Myiasis is the development of fly larvae that infest the skin, necrotic tissues, and natural cavities in living persons.1–3 The fly larvae belong to the order Diptera, class Insecta,1 and the species vary depending on the geographic area. Myiasis cases are classified into three categories, depending on the causative agent: obligatory myiasis, caused by Dermatobia hominis, Cochliomyia hominivorax, Cordylobia, Oestrus ovis, Wohlfahrtia magnifica, or Hypoderma bovis1–4; facultative myiasis, by Calliphora vicina, Phaenicia sericata, Lucilia ilustris, or Sarcophaga haemorrhoidalis; and accidental myiasis, by Musca domestica, Drosophila sp., Chrysomya albiceps, Eristalis tenax, Piophila casei, among others.4–8

Factors contributing to the development of human myiasis include low socioeconomic status, unhealthy environment, alcoholism, neurological disease, lack of personal hygiene, presence of varicose ulcers, advanced stages of cancer, malnutrition, immunosuppression, sexually transmitted diseases, diabetes, oral cavity lesions, advanced age, and animal husbandry.5–7

Human myiasis has been reported on a few occasions in Peru. Beltran9 reported three cases of ophthalmo-myiasis by Q. ovis, whereas Miranda10 described cutaneous myiasis by C. hominivorax (five cases) and Stomoxys calcitrans (one case); on the other hand, Espinoza3 reported an oral myiasis by C. hominivorax. However, this infestation has been poorly studied in this country. It can occur in various ways, with different levels of severity and a difficult therapeutic approach. In this regard, the aim of our study was to describe the clinical and epidemiological aspects and the risk factors associated with obligatory myiasis (one of the most frequently reported in Peru), as well as its therapeutic approach.

METHODS

A retrospective study was performed on all patients admitted with a confirmed diagnosis of myiasis (CIE-10: B87) at Hospital Regional Lambayeque and Hospital Nacional Almanzor Aguina Asenjo (both category III hospitals) from January 2012 to December 2015. The diagnosis was made on clinical presentation, removal of larvae, and evidence of larval development and morphology.

Clinical (disease duration, type of presentation, signs, and symptoms), epidemiological (place of origin), therapeutic (drugs used), and follow-up data were collected from patients’ medical histories (age, gender, and comorbidities), and identification of each type of myiasis was based on the larval morphology (tracheal trunks, dorsum, etc.), as described in literature8; briefly, different larval specimens were collected into saline and sent to the Laboratory of Parasitology of the Hospital Regional Lambayeque for entomologic identification by taxonomic keys that emphasize certain morphological features8 (Figure 1). The study protocol was approved by the ethics committee of Hospital Regional Lambayeque. The authors claim to respect the confidentiality of the data and the protection of anonymity of patients.

RESULTS

As shown in Table 1, in this retrospective study we reported nine clinical cases compatible with the diagnosis of myiasis, which were categorized into age groups: pediatric (two cases; mean age of 3 years), middle-aged adults (one 52-year-old case), and elderly patients (six cases; mean age of 73.5 years). Four of these cases were male, and patients’ interviews revealed that only four of nine cases were contracted in the tropical rain forest, whereas the others were from the coastal area of Peru.

We reported five cases of myiasis caused by C. hominivorax, and four cases caused by D. hominis. Of the five cases caused by C. hominivorax, four were related to comorbidities such as cancer (invasive squamous cell carcinoma, laryngeal cancer, squamous cell carcinoma, and breast cancer), whereas the remaining case had a clinical history of tuberculosis. On the other hand, two of the infestations caused by D. hominis were pediatric cases without established comorbidities.

In one case (nasal myiasis), the larva was asphyxiated with Ocimum basilicum “basil,” manually removed, and then the
patient received antibiotic treatment. The therapeutic approach to myiasis varied among the cases; however, antibacterial (beta lactams and quinolones), antiparasitic (ivermectin), and anti-inflammatory therapy were common. In some cases by C. hominivorax, surgical cleansing was used. See additional details in Table 1.

**DISCUSSION**

This report discloses a series of myiasis cases by two obligate parasites, C. hominivorax and D. hominis, from two referral hospitals in the northern macro region of Peru in recent years (2012–2015).

Human myiasis remains a neglected disease, i.e., poorly studied and not adequately treated by health authorities; however, a number of cases with difficult approaches have been reported, from oral,² cutaneous,³ ophthalmomyiasis,⁹ tracheostomal,¹¹ to nosocomial² myiasis. Frequent complications are bacterial superinfection that causes septicemia, tetanus,⁷ and cerebral myiasis causing death.¹³

In this study, we report cases of cutaneous, scalp, nasal, and tracheostomal myiasis, all of positive clinical course but with high symptoms. Patients with myiasis caused by D. hominis had severe pain, phlogosis in skin lesions, active bleeding, and cutaneous abscesses, whereas in the cases caused by C. hominivorax, patients had a history of tuberculosis, squamous cell carcinoma, or laryngeal or breast cancer.

All the cases of cutaneous myiasis caused by D. hominis were contracted in areas with tropical climates, all with a history of insect bite, which subsequently showed phlogosis signs in the wound; this is compatible with the clinical and life cycle of this type of Diptera.¹ ² ⁴ ⁷ On the other hand, the myiasis caused by C. hominivorax affected patients with old, necrotic, and exposed skin lesions, such as squamous cell carcinomas or tracheostomy patients; i.e., unlike the life cycle of D. hominis (Figure 2), it did not require a vector for the development of myiasis, merely an exposed wound.

Because D. hominis is transmitted by mosquitoes or other hematophagous arthropods, it causes problems for people living in tropical areas, where these vectors, which carry the larval eggs on their bodies to the host, abound. By contrast, C. hominivorax, whose transmission is direct, could present a wider geographical distribution in the northern regions of Peru.² ³ ⁵ ¹³

As shown by our data, this parasitic infestation mostly affected either elderly or very young patients. Interestingly, children were most commonly infested by D. hominis,⁴ whereas adults (with comorbidities of necrosis such as cancer and tuberculosis) were most affected by C. hominivorax.³ ⁵ ⁶ ¹¹

In this context, myiasis must be managed by the authorities as a sanitary problem in this region. Furthermore, public policies in animal health are also necessary for the management of myiasis in the agricultural field as domestic and wild animals are reservoirs of this disease³ ¹³ and tourism to endemic areas has become increasingly common.¹⁵ Finally, the diagnosis of myiasis is clinical and epidemiological, and should be duly recognized in health care centers for suitable treatment and control.
<table>
<thead>
<tr>
<th>Case</th>
<th>Age (gender)</th>
<th>Patient comorbidities</th>
<th>Description</th>
<th>Injury features</th>
<th>Received treatment</th>
<th>Isolated species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>74 (M)</td>
<td>Uncontrolled hypertension</td>
<td>Presented a snake bite on the right foot 5 days before symptoms</td>
<td>Two phlogotic and furunculoid nodules with small pores on the right foot, where movement of larvae was observed by ultrasound</td>
<td>Ciprofloxacin 200 mg, IV every 12 hour; Oxacillin 2 g, IV every 4 hour; Chlorphenamine 4 mg, 1 tab. PO</td>
<td>Dermatobia hominis</td>
</tr>
<tr>
<td>2</td>
<td>52 (F)</td>
<td>None</td>
<td>Presented an insect bite on the buttock and, a month later, a local abscess was observed</td>
<td>Painful bleeding boil-like lesion on buttock; The diagnosis was made by ultrasound; lesions (3 mm) with surrounding edema (8–10 mm) and larvae were observed</td>
<td>Cefazolin 500 mg, IV every 8 hour; Glucose 5 × 1,000 mL; Mupirocin ointment in ampule applied twice a day</td>
<td>Dermatobia hominis</td>
</tr>
<tr>
<td>3</td>
<td>2 (F)</td>
<td>Prematurity, low psychomotor development</td>
<td>Presented an insect bite on the buttock a month before hospitalization</td>
<td>Painful abscess (2 by 2 cm) on the buttock with excoriation and larvae emerging from the lesion</td>
<td>Cefazolin 300 mg, IV every 8 hour for 11 days; Ivermectin 9 drops (single dose)</td>
<td>Dermatobia hominis</td>
</tr>
<tr>
<td>4</td>
<td>71 (M)</td>
<td>Invasive squamous cell carcinoma of the distal phalanx</td>
<td>Treated for an increase of the skin eruption on the left foot</td>
<td>Phlogotic and erythematous skin eruption on the fifth toe of the left foot</td>
<td>Drainage by surgery; Exeresis of the toe of the infiltrated foot; Cefazolin 1 g Gentamicin 80 g, IV every 8 hour</td>
<td>Cochliomyia hominivorax</td>
</tr>
<tr>
<td>5</td>
<td>4 (M)</td>
<td>None</td>
<td>Presented an erythematous and pruritic scalp lesion a month before</td>
<td>Scabby lesion (3 by 2 cm) with purulent discharge on the frontal region</td>
<td>Hydroxyzine 15 days; Ivermectin single dose</td>
<td>Dermatobia hominis</td>
</tr>
<tr>
<td>6</td>
<td>71 (F)</td>
<td>History of tuberculosis</td>
<td>Facial cellulite; anterior epistaxis and referred nasal pain.</td>
<td>Nasal pain; respiratory distress and epistaxis.</td>
<td>Cefazolin 200 mg, IV every 8 hour; Clindamycin 600 mg, IV every 12 hour</td>
<td>Cochliomyia hominivorax</td>
</tr>
<tr>
<td>7</td>
<td>67 (F)</td>
<td>Laryngeal cancer (III)</td>
<td>Tracheostomy due to respiratory distress</td>
<td>Presence of larvae in the place of tracheostomy; cervical abscess surrounded by necrotic tissue, brown discharge, and traces of blood</td>
<td>Ivermectin 14 mg (60 drops) PO, ceftriaxone 2 g/day PO and metronidazole 500 mg, IV every 8 hour</td>
<td>Cochliomyia hominivorax</td>
</tr>
<tr>
<td>8</td>
<td>85 (M)</td>
<td>Arterial hypertension; squamous cell carcinoma; nasal inverted papilloma and history of nasal myiasis</td>
<td>History of nasal polyps (surgically intervened three times); necrotic lesion on the upper third of the nose</td>
<td>Presence of larvae in the necrotic area on the upper third of the nose; intense pain</td>
<td>Ivermectin 3 mg, two tablets in 2 days; surgical cleansing</td>
<td>Cochliomyia hominivorax</td>
</tr>
<tr>
<td>9</td>
<td>73 (F)</td>
<td>Invasive left breast cancer (III) Diabetes mellitus II</td>
<td>Ulcerated lesion with necrosis, irregular borders and phlogosis on nipple; serosanguineous discharge and larvae emerging from the lesion</td>
<td>Presence of larvae in the lesion and necrotic area on the left breast; itching and pain</td>
<td>Ivermectin 14 mg (60 drops) PO for 2 days; Ciprofloxacin 200 mg, IV every 12 hour; Clindamycin 600 mg, IV every 8 hour</td>
<td>Cochliomyia hominivorax</td>
</tr>
</tbody>
</table>

M = male; F = female. All cases progressed favorably during hospitalization.
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REFERENCES


Figure 2. Cycle according to the type of myiasis: Cochliomyia hominivorax and Dermatobia hominis. This figure appears in color at www.ajtmh.org.