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Original Contribution

Association of Spirochetes and Lyme Disease with Morgellons Disease

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Morgellons Disease (MD) is a multisystem disorder with a primary symptom characterized by emerging of small fibres from the skin. For years, many doctors thought MD is a psychiatric disorder and treated the patients with antipsychotic drugs, behavioural therapy and counselling. However, recent studies suggest that MD is a completely different entity from psychiatric disorders. Morgellons pathophysiology remains a mystery even up to now. It was previously considered to be a delusional disorder due to its similarity to delusions of parasitosis or delusional infestation described many years ago. This constellation of symptoms has not been well studied in different populations, however, a study in North California found a prevalence of 3.65 per 100,000 for MD, with Caucasian and female predominance.

INTRODUCTION

Morgellons disease (MD) is a rare disease with a previously mysterious etiology and pathogenesis. It is characterized by the presence of multi-coloured filaments that lie under, are embedded in, or project from skin. The filaments can be white, black, or brightly coloured [1]. Its main symptom was stated to be development of fibres or materials from the skin, with or without cutaneous lesions, and it was found to significantly affect the health-related quality of life of the patients[2,3]

While the cause of Morgellons disease has not been fully established, there have been recent serological and clinical evidence linking it to Lyme borreliosis, hence it is thought to be a true somatic disease [4,5,6]. Morgellons disease parallels bovine digital dermatitis (BDD), an infectious disease of cattle, characterized by dermatitis and papillomatous lesions of the skin around the coronary band in the hooves of livestock. Livestock with BDD have been reported to be serologically reactive to the antigens of *Borrelia burgdoferi* [7]. This is the organism mainly responsible for Lyme disease, a spirochetal tick-borne infection. This prompted the investigation into the possible link between spirochete and MD. Furthermore, some symptoms present in patients with Morgellons disease often resemble those of Lyme disease, such as fatigue, arthralgia, and neuropathy [7,8].

Some symptoms that have been reported in Morgellons disease include crawling sensations under the skin; slow-healing lesions appearing suddenly; hyperpigmented scars when lesions heal; severe itching; seed-like objects or specks in lesions or on intact skin; fine, thread-like fibres of with different colours in lesions and intact skin; and a sensation of something trying to penetrate the skin from the inside out [8]. Filaments in Morgellons disease have been said to originate from epithelial cells, from the Stratum Basale, and from the root sheath of hair follicles, similar to BDD [7].

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HISTORY OF MORGELLONS

The two-year old son of Mary Leitao, a former laboratory technician suffered from dermatological lesions that contained multi-coloured fibres upon magnification with a microscope. After dismissal from numerous doctors, she named the disease her son was suffering from Morgellons, due to its resemblance to a dermatological malady described in the 1600s [9]. The name came from a letter written in 1674 by Sir Thomas Browne, an English physician. The letter contained a brief description of a skin disease characterized by "outbreaks of harsh hairs" on the backs of French children [10]. However, the accounts by Browne and other physicians who described similar diseases were likely referring to a heterogeneous group of skin conditions different from the one referred to as Morgellons today. The diseases described previously occurred primarily in childhood and were often associated with cough and convulsions [10].

Mary Leitao founded the Morgellons Research Foundation in 2004 to raise awareness and funding for research into what she considered a disfiguring and disabling condition. The foundation believes that it is a new infectious disease that will be confirmed by future research [11]. Since then, the disease has been publicly debated and has enjoyed wide media coverage. This has been blamed for the increase in number of self-diagnosed Morgellons disease sufferers [9]. A majority of health professionals, including most dermatologists, still regard Morgellons as a manifestation of other known medical conditions such as delusional parasitosis and believe any fibres found are exogenous, from items such as clothing [4,8,12].

DISTRIBUTION

Not many studies have been carried out on the epidemiology of Morgellons disease. In a cohort of 1000 North Americans with Lyme disease, 6% were diagnosed of Morgellons [13]. It is commoner in Caucasians, females, and those aged 45-60 years [4,8,13]. In 2017, the first case of Morgellons disease in Korea was reported in a 30-year-old woman. She presented with a 2-month history of pruritic erythematous patches and erosions on the arms, hands, and chin [14]. Most patients have also been found to have tickborne co-infections and to present with disseminated Morgellons disease [4,13]. Female predominance in Morgellons has been thought to be a result of the fact that females are meticulous when it comes to dermatological care, and are therefore more aware of any skin changes. Secondly, an exaggerated response to infections typically seen in women may explain the female predominance [13]. While no case of death directly linked to the disease has been reported, it has been found to cause significant physical and psychological distress to sufferers [8,15].

CLINICAL ASPECTS OF MORGELLONS DISEASE

Symptoms reported by patients with Morgellons disease include: emergence of materials from the skin; crawling sensations under the skin; lesions appearing suddenly and healing poorly; hyperpigmented scars when lesions heal; severe itching; and a sensation of something trying to penetrate the skin from the inside out [4,8]. Also, musculoskeletal symptoms, crippling fatigue, insomnia, cognitive impairment, depression, hypothyroidism, vision change, unexplained weight gain and anxiety have been reported among patients with MD [4,13].

A standardized guideline has not yet been established for the diagnosis of MD, however, Middelveen *et al* [16] proposed a diagnostic criteria as follows:

1. Primary features (Must include the following):
   A. Multicoloured filaments embedded in the skin or protruding from the skin

2. Secondary features (May include one or more of the following):
   A. Calluses
   B. Ulcerative lesions
   C. Papular lesions
   D. Burning, itching, and biting sensations
   E. Hair loss
   F. Atypical hair/nail production
   G. Dry appearance with or without flaking skin
   H. Oedema
   I. Hyper- or hypo-pigmentated lesions
   J. Hypertrophic scars
   K. Excoriation marks
   L. Slowly healing lesions
   M. Aging skin

MD has been classified into early localized, early disseminated, late localized and late disseminated stages based on based on the duration and location of the MD lesions. Early localized MD are those with lesions/fibers present for less than three months and localized to one area of the body such as the head, trunk or extremities. Early disseminated MD are those with lesions/fibers present for less than three months and involving more than one area of the body. Late localized lesions were those present for over six months and localized to one area of the body, while late disseminated MD are those

with lesions/fibers present for more than six (6) months and involving more than one area of the body [6].

MD has also been classified as Mild (Stage A), moderate (Stage B) and severe (Stage C) MD based on unique histopathological patterns seen. Stage A lesions demonstrated minimal immune infiltrates and disorganization of cells; macrophages were not present, and haemorrhage was negligible. Extracellular isolated spirochetes and intracellular staining of keratinocytes in the lower epidermis was occasionally seen. Stage C lesions demonstrated positive staining of keratinocytes in the stratum basale and stratum spinosum and positive intracellular staining of macrophages for *Borrelia*. Aggregate *Borrelia* colonies were frequently seen, haemorrhage was frequent, and intracellularly stained fibroblasts were occasionally seen. Stage B lesions demonstrated a pattern intermediate between Stages A and C [16].

Most patients with MD are usually diagnosed with a psychosomatic illness. Typically, patients have been to over 10 doctors and report that their symptoms are usually not taken seriously or dismissed. Patients report that physicians make a quick diagnosis of delusional parasitosis with little to no physical examination done. They often attribute the ulcers and excoriation marks on the skin to attempts at self-mutilation, and fail to provide patients with the care they require [17].

ETIOLOGY

Previous studies have shown the linkage between MD and spirochaetal infection, specifically *Borrelia burgdorferi (Bb)*. Spirochetes was previously detected on light microscopy, however, the detection of borrelial species by culture, immunofluorescent staining, electron microscopy or PCR is currently valid proof in the presence of MD symptoms [18]. Savely and Striker (2010) in their study explored the link between Morgellons disease and Lyme disease, reported that 96.8% of their subjects with MD either tested positive for Lyme disease on Western blot or were clinically diagnosed, also, many had positive tests for coinfecting tick-borne illnesses. In addition, the distribution of the Lyme disease patients and Morgellons patients were quite similar [8].

Fesler *et al* in their study on 60 North Americans with MD found that all of them were positive for Bb infection. Similarly, tickborne coinfections such as *Babesia spp* (62%), *Bartonella* and *Rickettsia* (25% each), *Ehrlichia* (15%) and *Anaplasma* (10%) were found in patients with MD [13]. In another study, the presence of spirochetes was confirmed by multiple testing modalities, including culture, histology, anti-Bb immunostaining, electron microscopy, PCR and *in situ* Bb DNA hybridization, using dermatological tissue, blood and vaginal secretions [6]. Furthermore, the fibers in Morgellons lesions have been hypothesized to be spirochetes in their vegetative form, long and fibrous; and characterized by a crest spiraling along the surface. These fibres often require magnification of 50× or more to be seen, and at that magnification they can be mistaken for textile fibres [15].

Recently, Agrobacterium was added to the organisms that could be responsible for the Morgellons disease. These are phytopathogens usually in present soil, that causes cancerous growths on the host plant species [19]. This association was made in 2007 when five Morgellons patients' skin fibres were seen to contain cellulose produced by Agrobacterium at the site of infections, which also possessed Agrobacterium genetic material [20]. However, the role of Agrobacterium in the causation of MD is yet to be confirmed.

TREATMENT MODALITIES

There is yet to be a standardized treatment modality for MD, however, several therapies have been tried. Some authors have reported success in treating MD patients with antibiotics. Antibiotics used in treating Lyme disease such as doxycycline and amoxicillin have been used and have shown to be effective in many cases [17,21]. It should be noted that spirochetes have the ability to persist even in hostile environment and can adopt different sizes and shapes. They can form round bodies, L-form bacteria, microcolonies or biofilms-like aggregates, which remarkably change the response of *Borrelia* to hostile conditions, thereby making it antibiotic resistant [22]. Antibiotics effective against Agrobacterium such as cefepime, carbapenems, tetracyclines, and ciprofloxacin [19] can also be tested in MD patients.

Reid (2010) reported success with using Pimozide after trials of Azithromycin and prednisolone failed, however, only one patient was treated in this paper [23]. Pimozide is an antipsychotic drug with antipruritic properties which has been effective in the treatment of delusions of infestation [24]. However, individuals with MD are often resistant to treatment with antipsychotics, hence, the antipruritic effect of pimozide can be presented in order to destigmatize the medication [23]. This medication may be effective in the treatment of MD due to the psychologic symptoms that are associated with the disease, which often occurs after onset of skin lesions and may be as a result of neuroborreliosis [25]. Apart from MD, many dermatological conditions often have a psychological

component, hence, Lee et al (2010) advocated for the use of psychotropic agents in dermatology [26].

A better approach would be multidisciplinary management team consisting of at least a dermatologist and a psychiatrist. A study which reported the experiences of an integrated multidisciplinary team in the management of MD found that treatment with very low-dose antipsychotics and dermatological medications was effective. Risperidone and TL01 light treatment were most beneficial in improving or stabilising symptoms. They also included oral antibiotics and topical antiseptic emollients in their treatments [27].

In general, prompt diagnosis and early treatment contributes to a better prognosis. Treatment aimed at the underlying tick-borne disease is essential to resolve MD dermopathy, and it could entail the prolonged use of combination-antibiotic therapy and the identification and treatment of any coinfecting tick-borne diseases or other exacerbating factors. Antiparasitic therapy may be useful in some patients with MD although parasites have not been found to cause the disease. Antipsychotic therapy alone often fails, and should be combined with therapy against the underlying tick-borne infection [25].

CONCLUSION

To conclude, MD is an emerging dermopathy which patients often self-diagnose before presenting to the physician. It is associated with *Borrelia* infection and other tick-borne infections. The disease has a chronic and debilitating course, which makes the fact that some medical practitioners erroneously consider it to be a delusional disorder distressing to the patients. Studies have shown that MD is a somatic illness. The optimal treatment for MD remains to be determined, however, the best approach is integrating psychological care with dermatological care.

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