

Burning feet syndrome

A clinical review

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BACKGROUND Burning pain in the feet has been known to occur as a distinct clinical symptom for almost two centuries. Despite being a common and fascinating clinical entity, this syndrome has received scant attention in the medical literature and has been described only in anecdotal reports.

OBJECTIVE This article describes and discusses the various aspects of this intriguing syndrome.

DISCUSSION Burning feet syndrome (BFS) is a common disorder especially among the elderly and is frequently encountered in general practice. There is no specific aetiology and it can occur as an isolated symptom or as part of a symptom complex in a variety of clinical settings. In contrast to the presence of distressing subjective symptoms, the physical examination is marked by a paucity of objective signs. The pathophysiology of BFS is not very clear and treatment varies depending on the aetiology.

Burning feet syndrome (BFS), which is characterised by a sensation of burning and heaviness in the feet and lower extremities, is a common disorder frequently encountered by general practitioners. In the past, this syndrome has been described only in anecdotal reports and has received scant attention in the medical literature. Grierson¹ was, in 1826, the earliest to document such a symptom, but a detailed description was given by Gopalan² in 1946, hence, BFS is also known as Grierson-Gopalan syndrome.

What causes 'burning feet'?

There is no specific aetiology for BFS. It can occur as an isolated symptom or as part of a symptom complex in association with a variety of unrelated clinical settings. Based on the underlying mechanism, the various causes of BFS can

be divided into the following categories (Table 1).

Nutritional causes

Since its initial descriptions,¹⁻³ BFS has been postulated to be caused by vitamin deficiency. The specific vitamin, however, remains obscure, the deficient factor being variously attributed as riboflavin^{2,3} nicotinic acid,⁴ thiamine,⁵ and pyridoxine.⁶ Most patients with burning feet show evidence of riboflavin deficiency.⁷

It is suggested that vitamin B deficiency leads to disturbance in cellular metabolism in the tissues causing accumulation of intermediate metabolites which may cause abnormal and excessive stimulation, or lower the pain and temperature threshold of peripheral sensory nerve endings.² It is also thought that BFS is an early clinical phase of vitamin B12 defi-

ciency related neuropathy before frank neurological signs appear.⁸ No other vitamins apart from the B-group have been implicated in the cause of BFS.

Other conditions associated with vitamin deficiencies such as chronic alcoholism, or patients on chronic hemodialysis, can develop BFS possibly due to associated nutritional deficiencies.⁸

Metabolic or endocrinal causes

Burning feet is commonly seen with diabetes. Patients with signs and symptoms of burning feet may be part of diabetes related small fiber or autonomic neuropathies.⁹ The development of this symptom in diabetics is related to some extent to the severity and duration of the disease. Functional or organic abnormalities may be present in small unmyelinated-C fibers.¹³ The dysfunc-

tional phase can precede organic structural damage and symptoms may develop without signs of overt neuropathy. Burning feet can also occur in other endocrine disorders such as hypothyroidism, though the mechanism is not completely understood.

Hereditary

Familial disorder with an autosomal dominant inheritance may cause BFS.¹¹ The clinical picture is that of bilateral symmetrical pain with no muscle weakness, atrophy or foot deformity. Initially, it was thought that BFS may be the sole manifestation of an hereditary sensory neuropathy (HSN), but subsequently, molecular genetic studies excluded linkage to HSN locus on chromosome 9q22 and 3q13–q22.¹² Therefore, it is concluded that autosomal dominant burning feet represents a distinct clinical entity in itself.

Mechanical causes

Burning feet syndrome may occur as a result of mechanical compression of the peripheral nerves (as seen in tarsal tunnel syndrome) and in diseases such as hypothyroidism, diabetes and rheumatoid arthritis. Nerve entrapment can occur at the level of the tarsal tunnel adjacent to the medial malleolus. Nerve entrapment due to sciatic mononeuropathy and spinal arteriovenous malformation can also cause burning feet.^{13,14}

Psychosomatic causes

Burning sensations and paraesthesia are among the commonest psychosomatic symptoms encountered in the general population. In a study by Keshavan et al,¹⁵ although many patients with burning feet had evidence of peripheral neuropathy, few also had psychological disorders.

Miscellaneous causes

Burning feet symptoms have also been reported in various unrelated clinical conditions. Erythromelalgia, also known as erythermalgia, is an uncommon disorder

characterised by burning pain and redness of the extremities and may be primary or secondary to systemic disorders such as diabetes, collagen vascular disorders, or myeloproliferative disorders such as polycythemia vera or essential thrombocytosis.¹⁶ The symptoms of this disorder are probably related to intravascular platelet aggregation and may involve a hyperactive axon reflex in C-nociceptive fibers or a mutation of the capsaicin receptors.¹⁷

Other unrelated and less common conditions with symptoms of burning feet are chronic mountain sickness,¹⁸ leishmaniasis,¹⁹ Gitelman syndrome²⁰ (a rare renal tubular disorder), and carnitine deficiency state.²¹ Patients who do not reveal any abnormalities even after exhaustive laboratory investigations are usually labelled idiopathic.

Clinical features

Although no geographical or seasonal variation is known, BFS has been mainly reported in Asian and Far East countries during a hot summer.^{3–5} It is most common in those over 50 years, although it can occur in any age group. Usually discarded by physicians as vague and unimportant, the symptoms characterised by a burning sensation, heaviness, numbness, or a dull ache in the feet, can be extremely distressing to the patient. Burning is usually limited to the soles of the feet but may ascend to involve the dorsum, ankles or lower legs. The arms and palms of the hands are spared. A few patients occasionally complain of 'pins and needles' or tingling in the lower extremities.

Symptoms show worsening at night with day time improvement. Patients with underlying psychiatric disorders may present with a myriad of psychosomatic signs and symptoms in association with burning feet. On examination, there is a paucity of objective signs. The overlying skin and blood vessels are normal in most, while in some patients there may be accompanying erythema of the feet with

Table 1. Causes of BFS

Nutritional

- Vitamin B deficiency
- Malabsorption syndrome
- Chronic alcoholism

Metabolic/endocrinal

- Diabetes mellitus
- Renal failure (dialysis patients)
- Hypothyroidism

Hereditary

- Autosomal dominant BFS

Mechanical (entrapment neuropathies)

- Tarsal tunnel syndrome
- Traumatic nerve compression

Psychosomatic

Miscellaneous

- Erythromelalgia
- Chronic mountain sickness
- Gitelman syndrome
- Leishmaniasis
- Multiple sclerosis

Idiopathic

warm overlying skin as in erythromelalgia.¹⁶ There is no local tenderness over the affected parts. Neurological examination is essentially normal in most patients but some may show a varying degree of hypo- or hyper-aesthesia.⁹ Knee and ankle jerks show normal to brisk reaction, but are never absent or diminished.^{2–4} There are no signs of upper motor neuron involvement such as extensor plantars or increased tone. Motor power is maintained and there is no atrophy or wasting of the overlying muscles.

Most nutritionally deficient patients develop signs and symptoms of burning feet after approximately 4–5 months of deficient diet. Skin manifestations of vitamin deficiency such as scrotal dermatitis or pellagra-like rash can precede the onset of burning sensation in the feet. Some patients develop retrobulbar neuritis as a part of vitamin deficiency syndrome.³ Physical examination may be entirely normal, as in familial BFS.¹²

Approach to the patient with burning feet

As burning feet can occur in a wide spectrum of disorders, the approach to such a patient is not simple. A thorough clinical history and examination regarding nutritional status, vitamin deficiencies, and metabolic disorders such as diabetes and hypothyroidism, and a detailed family history are required in determining further investigations. Diagnostic tests are shown in Table 2. Although patients with burning feet should be evaluated for a secondary cause, an underlying psychosomatic illness as the cause of the symptoms should be ruled out by psychiatric assessment.

Treatment

Treatment of BFS depends on the cause. Management can be divided into general and disease specific measures.

General measures

General treatment for all cases of BFS includes reassurance about the benign nature of the disorder. Wearing open and comfortable shoes, especially those with arch supports, and wearing cotton socks is helpful. Soaking the feet in cold water (not ice cold) for around 15 minutes can bring symptomatic temporary relief. Avoidance of feet exposure to heat should be advised. Tricyclic antidepressants or membrane stabilising agents such as carbamazepine or gabapentin may be used for symptomatic relief.

Disease specific measures

As most cases of BFS occur as a consequence of malnutrition or vitamin deficiency, it is important to elucidate which particular vitamin is responsible for the condition. A suggested vitamin B treatment regimen is shown in Table 3 if a deficiency is detected. In patients with diabetes, small doses of insulin in addition to oral hypoglycaemic agents, adequate calories and vitamin supplements are helpful. Local application of capsaicin ointment and percutaneous

Table 2. Useful diagnostic studies in BFS

Suspected clinical condition	Test
In all patients	Complete blood count and red blood cell indices, routine biochemistry
Vitamin B deficiency or malnutrition	Serum levels of B group of vitamins like thiamine, riboflavin, and cyanocobalamin Tests for malabsorption
Malabsorption syndrome (chronic diarrhea, postgastric surgery)	Oral glucose tolerance test
Diabetes (if signs/symptoms or risk factors for diabetes are present)	Thyroid function tests (T3, T4, TSH)
Hypothyroidism	Platelet count, bone marrow aspiration (to rule out myeloproliferative diseases such as essential thrombocytosis or polycythemia vera)
Erythromelalgia	Serum and urine electrolytes (magnesium, sodium, potassium and chloride)
Gitelman syndrome (young patients with fatigue, muscle weakness, cramps and fasciculations or simply asymptomatic hypokalaemia)	Electrophysiological studies (nerve conduction velocities, electromyography or nerve biopsy)
Neuropathy , if present or strongly suspected	Molecular genetic studies
Familial inheritance	Imaging studies such as MRI or CT
Mechanical cause (entrapment neuropathy)	

Table 3. Suggested treatment regimen for BFS with injectable vitamin B preparations

Vitamin	Dose and duration
Riboflavin	6–10 mg intramuscularly for 2–3 weeks
Thiamine	50–100 mg intramuscularly for 2–3 weeks
Pantothenate	20–40 mg intramuscularly for 2–3 weeks
Nicotinic acid	100 mg intramuscularly for 2–3 weeks
Cyanocobalamin	1000 µg 3–4 times a week for one week followed by twice a week for another week

nitroglycerine therapy may alleviate pain and burning.²² In erythromelalgia, treatment with aspirin typically produces rapid but short lived relief of symptoms. Elevation, cooling of limbs and systemic analgesia may be helpful. In mechanical cases such as tarsal tunnel syndrome, conservative treatment with arch supports and wider shoes may successfully relieve discomfort. If BFS is due to flat

feet, orthotics may help restore the foot's arch. If inflammation of the nerve is causing the compression, nonsteroidal anti-inflammatory drugs (NSAIDs) may be prescribed. In patients where pain is not relieved by NSAIDs, local injectable steroids may be beneficial. Surgical decompression to relieve nerve entrapment may be needed if conservative measures fail.

Conclusion

Burning feet is a common complaint especially in the elderly and can occur in a variety of unrelated clinical settings. Common causes include diabetes mellitus, psychosomatic disorders and various vitamin deficiency states, rarely erythromelalgia or familial disorder. Mechanism involves vasomotor disturbances or altered pain and temperature threshold of peripheral sensory nerve endings. Treatment depends on the specific aetiology and includes injectable vitamin B preparations, membrane stabilising agents and cooling measures.

Conflict of interest: none declared.

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