THE SCOURGE OF DIABETES MELLITUS FOOT SYNDROME (DIABETIC FOOT GANGRENE)

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Introduction
Diabetes mellitus which manifests as chronic hyperglycaemia following derangement of carbohydrate, protein and lipid metabolism is caused by an absolute or relative lack of insulin. It leads to great morbidity and mortality many of which are attributable to chronic complications like DM foot ulcers or gangrene which are collectively called the diabetes mellitus foot syndrome (DMFS).

Epidemiology
Diabetes mellitus (DM) is the commonest endocrine condition that is seen in medical out-patient’s clinics in Nigeria and many countries worldwide. Approximately 280 million people live with the disease worldwide of which 5 million are found in Nigeria, the highest number in the African continent. DM is increasingly being seen in Nigeria and some communities record prevalence as high as 5-10%. Diabetes is the commonest cause of amputation in Nigeria and most of the world and it is estimated that 15% of patients will develop DMFS at least once.

Types of DM Foot Syndrome
DMFS is said to occur when ulcers, gangrene or foot deformities occur in the foot or feet of a known person with DM. DMFS is a potentially fatal condition. There are several types but the definitions are not very clear cut. When the foot is predominantly dry and shriveled it is said to be dry gangrene, when soggy putrefying with plenty exudates it is called wet gangrene or simply a DM foot ulcer when the lesion is just a shallow ulcer.

Aetiopathogenesis
DMFS is a complex condition that arises as a result of the interplay of several factors. These are

(i) Neuropathy: this is a major factor in the development of foot ulcers. Neuropathy makes the nerves either hypersensitive or hyposensitive leading to a foot which has impaired ability to recognize pain, pressure, temperature differences and position. The overall effect is a leg or foot prone to trauma or high external pressure.

(ii) Peripheral Arterial disease: this occurs as a result of thickening of the vessel walls, loss of elasticity and eventually impairment of arterial blood flow to the extremities, especially the toes and feet. This leads to
ischaemia, reduced oxygen supply to the feet and therefore poor recovery or healing from otherwise trivial trauma

(iii) Foot deformities: people with DM have subtle foot deformities arising from the above two factors, scarring, stiffening of the joints, arthritis, loss of subcutaneous fat, drying of the skin all of which are common in DM

(iv) Infections: in DM both the innate and the acquired immune response are impaired leading to an increased susceptibility to infections. The common initiating infection may be a fungal infection which thereafter becomes secondarily infected with bacteria. Such infections often progress spreading along the tissue planes till overwhelming limb and life threatening cellulitis and sepsis ensue.

(v) Trauma: inadvertent trauma commonly occurs in DM due to neuropathy and this is often complicated by infections. Poor sight might also be a major contributory factor in sustaining injury.

CLINICAL FEATURES OF DMFS

The presentation of DMFS varies, ranging from an innocent looking sore on the foot or toe which fails to heal to a swollen discolored leg with a large foul smelling sore.

The severity is often quite related to the degree of glycaemic control preceding the development of the ulcer. Those with poor control often have rapidly deteriorating ulcers and fast ascending gangrene. The underlying aetiological factors also contribute to the appearance of the foot lesion. In the patients with severe peripheral arterial disease the leg appears dusky and the whole foot may be black and mummified connoting dry gangrene, while the foot is often swollen and foul smelling in those with infection and mild peripheral arterial disease with or without neuropathy.

In the purely neuropathic foot ulcer the edges of the wound are distinct, sharp, the sore being over a pressure point of the metatarsals, the heel or the big toe. The wound is often clean with minimal slough and the tendon reflexes are reduced or absent. Sensation is also reduced in these patient's feet.

CLINICAL GRADING OF DMFS

In order to objectively categorize the severity of DMFS Wagner designed a grading system based on the appearance and extent of the foot lesion. This has enabled both physicians and surgeons appropriately assess the patient and determine the line of management. The simplified grading, grades 1-5 is as listed

(i) Superficial ulcer
(ii) Deep ulcer
(iii) Ulcer extending to bone, tendons, etc
(iv) Gangrene of a toe, or part of the foot
(v) Gangrene of the whole foot

Another useful grading system is the Fontaine grading for peripheral arterial disease. This is graded I, II, III. Grade I is when there is pain of claudication (in the calf) after walking 200m, II is pain occurring before 200m and grade III is when there is rest pain.

INVESTIGATIONS

Glycaemic control: This is paramount in the care of DM. The simplest of these is the fasting and or random plasma glucose which gives an idea of the current control while a HBA1c test will reveal the control in the preceding 2-3 months.

Bacteriological: This comprises wound swab for microscopy, culture and sensitivity to determine the offending or secondarily infecting microbe. For DMFS most ulcers are infected with mixed bacteria, though pseudomonas staph aureus or E-coli is frequently found.

Radiological: X rays of the feet help identify vascular calcification which is often seen in PAD. Also gas formation, osteomyelitis or foreign bodies in the wound can be readily demonstrated on plain radiographs, while arteriography can be used to determine severity and location of arterial diseases.

Neurophysiological: Tests such as nerve conduction velocity, temperature sensitivity can all be done to determine type and severity of neuropathy. The highly technical ones are done by computer assisted sensory evaluation (CASE). CASE is not available locally at present.
Vibrametry: qualitative, semi quantitative and quantitative vibrametry can be done with various devices to assess vibration sense. The basic qualitative one can be done in any centre, using a turning fork.

Ankle Brachial Pressure Index: this can be done with a minidoppler to measure the degree of arterial pressure or thickening. Normal ABI is 0.9-1.1. In medial sclerosis the finger may be very high, as much as 2-3 while in peripheral arterial occlusive disease the index may be as low as 0.5

Pedography: The simplest of these can be done with foot impressions on a Harris mat while the more sophisticated can be done with high tech equipment like the EMED pressure mat systems. These enable composite pressure pattern pictures to be formed and guide in the choice of footwear and in the treatment of the feet.

**TREATMENT**

Treatment of DMFS is multidisciplinary with the physician and the podiatrist/surgeon at the forefront of management. The patient’s glycaemic control has to be improved, hydration must be made optimal, hemoglobin levels need to be shored up and appropriate antibiotic coverage instituted. Almost invariably the patients require admission for in-patient management, commencement of insulin and the use of parenteral antibiotics for several days to weeks.

**OUTCOME**

DMFS remains a major cause of death in the person with diabetes and is by far the condition that leads to the longest hospitalization in DM patients. Those who survive often do so at the expense of the limb requiring life saving lower extremity amputation. Duration of treatment runs into several months and the cost is phenomenal. Life expectancy after DMFS is shortened with about 80% of them dying of disease reasons in 5 years.

**PREVENTION**

The toll of DMFS on the individual and on healthcare facilities is very great, with patients spending as much as N200,000.00 in Nigeria and staying in hospital for up to 3-6 months. Thus prevention remains the best option for the avoidance of this dreadful condition. This usually is in the form of patient education.

**REHABILITATION**

Recovering from DMFS may require major life adjustments depending on the outcome, the duration of hospital stay and the presence of other co-morbidities. The loss of a lower extremity may require the fitting of prosthesis, learning how to walk again and learning to cope and maintain good self esteem. A driver may require to be transferred to a desk job in the transport section of his company or change his car from manual to automatic if he has lost a limb. Physiotherapy may be required to build up muscle tone and bulk for patients bedridden for several months.

**CONCLUSION**

DMFS is a disease with far reaching effects. Its presence portends a great loss of time, money and functional ability and is associated with multiple comorbidities all of which lead to a shortening of life expectancy and quality of life.

**REFERENCES**

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