

Diabetics Sepsis — A Review

Satya Nandam, Chandra K Reddy and Margaret Cornelius
Department of Surgery, CWM Hospital
Fiji School of Medicine and the
National Diabetes Centre, Suva.

Sepsis is a frequent and common problem for patients with diabetes mellitus. In Fiji, for various reasons the patient with diabetes mellitus seems especially susceptible to sepsis; the majority having infections of the foot. This stems from an interaction of diabetic complications of neuropathy and vascular disease with generally poor control of blood sugar and a lack of awareness of foot care. An ethnic or a racial susceptibility to infection is suggested as yet another factor.

The foot is especially vulnerable. Trivial trauma may be neglected because it produces minimal symptoms in the diabetic. There is also a tendency for patients to delay seeking treatment till sepsis is well advanced. It must also be added that the initial treatment given may itself be inadequate and inappropriate.

PATHOGENESIS OF DIABETIC SEPSIS

Diabetes mellitus, the basic abnormality, comprises of a diverse spectrum of conditions. The major factors being angiopathy, neuropathy, impaired wound healing and hyperglycaemia. (Figure I).

In Fiji, yet another factor may be responsible for sepsis in the diabetic patient. It is suggested that there may be an ethnic susceptibility to infection. Amongst the Fijians, sepsis is usually severe and the associated angiopathy is generally minimal. Whereas in the Indian diabetic the reverse is generally true.

The exact mechanism producing the angiopathy and the neuropathy is still unknown. Current evidence, however suggests that good blood glucose control significantly affects the development of microangiopathy in the retina and kidney and probably has an effect on the development of neuropathy.¹

Neuropathy

The lower limb, especially the foot, is continually exposed to trauma. To provide adequate protection to a part an intact sensory system is necessary.

Diabetic neuropathy affects the sensory nerves, the nerve and organs, the motor nerves and the autonomic nerve fibers. At one end of the scale there are patients who have touch, pinprick and temperature sensibility impairment and complain of severe burning sensation and pain; while at the other end there are patients who have motor nerve involvement which is associated with muscle wasting and impaired tendon jerks. The involvement of autonomic joints are also signs of peripheral nerve damage.

Angiopathy

The arterial disease in diabetes involves both the small and large vessels. The pathogenesis of vascular disease is complex and as yet not fully understood. The changes in the large vessels are comparable in the diabetic and the non-diabetic but in the former the process is greatly accelerated.² The essential feature of microangiopathy or capillary disease is the thickening of capillary basement membrane.

It has been recognised that there are multiple risk factors in the development of diabetic peripheral vascular disease. These include smoking, hyperglycaemia, hypertension, hypercholesterolemia, high levels of triglycerides; duration of diabetes and the age of the patient.^{3 4}

Venous disease does not appear to be a significant feature in the vascular complications of diabetes mellitus.

Impaired Wound Healing

Experimental studies have shown that there is impaired wound healing in the diabetic patient especially those with poorly controlled blood glucose concentrations (over 250mg percent) and those with infection.⁵ Defects in wound healing in diabetes mellitus that are correctable by the administration of insulin and/or the reduction of hyperglycaemia include

- (1) granulocyte phagocytosis
- (2) granulocyte chemotaxis
- (3) granulocyte killing of bacteria
- (4) granulocyte adherence
- (5) synthesis of protocollagen
- (6) synthesis of collagen
- (7) capillary ingrowth and
- (8) fibroblast proliferation.⁵

Bacteriology

From the bacteriological point of view there are additional risk factors. There is a significantly increased pathogenic carrier rate in diabetes mellitus. The organisms include coagulase positive staphylococcus aureus and B-haemolytic streptococcus.⁶ It has been found that there is a significant diminution in the intracellular bacteriocidal activity of leucocytes with Staphylococcus aureus and Escherichia coli in patients with poorly controlled diabetes in comparison with control groups.⁷

Most studies have shown Staphylococcus aureus to be the most common micro-organism, involved in diabetes sepsis, but anaerobes are equally involved: studies have

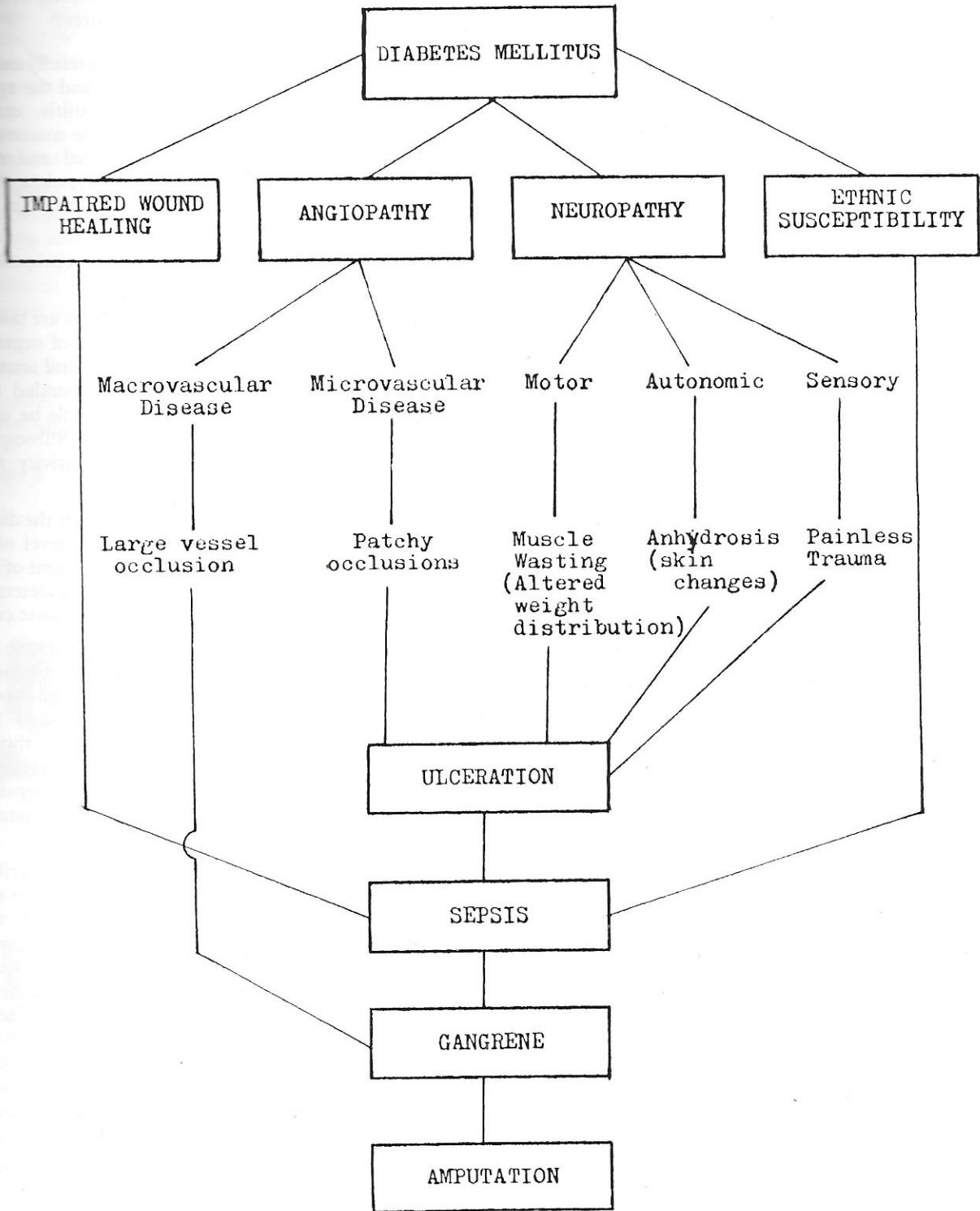


Figure 1 Pathogenesis of Diabetic Sepsis (Modified from Levin¹)

shown these to be *Proteus*, *Escherichia coli*, *Klebsiella* and *Pseudomonas*.

Synergism between aerobes and anaerobes is thought to be the cause of fulminating sepsis associated with foul odour characteristic of sepsis of diabetic foot.⁸

There may also be an impaired immune response in the diabetic patient.⁹

Thus in a neuropathic foot with a compromised blood flow and exposed to trauma, sepsis is the eventual outcome. The frequency of lesions of the foot is even greater when the foot of the diabetic is unprotected and neglected (as is the case in the majority of diabetics in Fiji).¹⁰

MANAGEMENT OF DIABETIC SEPSIS

There is at present no specific treatment for established diabetic neuropathy and vascular disease. Therefore the major therapeutic approach towards diabetic infections is through education of the diabetic patient and the population at risk, in the care of the foot.

In the education of the patient certain points must be repeatedly emphasised.

The control of blood glucose at all times assumes prime importance. Together with good diabetic control good foot care is essential if the individual is to avoid serious limb-threatening problems. The following foot-care advice is suggested (Table I).

Table I
FOOT CARE IN DIABETES

1. Do not walk bare-footed.
2. Wear comfortable shoes.
3. Wash feet daily with mild soap and warm water. Dry carefully, especially between toes.
4. Inspect toes, between toes, pressure points, daily for cuts, scratches, blisters etc. (Use a mirror to inspect or seek help, if eyesight poor).
5. Use oil for dry skin.
6. Cut nails across.
7. Do not cut corns or callosities.
8. Avoid chemicals or other topical applications viz balms, ointments, corrosive potions. Avoid adhesive or occlusive dressings.
9. Avoid extremes of temperature. Avoid hot-water bottles etc.
10. Do not smoke.
11. Exercise limbs regularly.
12. Seek medical advice early for any foot problem.
13. Do not listen to friends, neighbours and others not qualified (about diabetes and foot care).

When the diabetic presents with infection it is not uncommon for the lesion to be advanced in the majority of patients. Hospitalization becomes necessary.

A complete history, a detailed physical examination with full laboratory and radiological investigations whenever possible, must be done.

The control of hyperglycaemia and associated problems of dehydration, acidosis etc., if present, should be urgent and

active. Invariably the patient will require Insulin to stabilise the diabetes. Associated medical conditions of hypertension, ischaemic heart disease etc have to be fully assessed and controlled as the patient is likely to require general anaesthesia for surgical procedures.

The sepsis (of the foot or limb) has to be carefully assessed. The anatomical extent of the infection and the types of lesion viz gangrene, ulceration, cellulitis etc. are determined. The state of the micro and the macro vessels and the arterial circulation need detailed and careful assessment. Palpation of the peripheral pulses will, in most cases, help determine the extent of large vessel disease.

The distribution and severity of diabetic neuropathy can easily be established.

In all cases of diabetic sepsis wound swabs are taken for the identification, isolation and sensitivity of organisms. Where facilities permit anaerobic culture and sensitivity tests must be carried out. It is recommended that a combination of cloxacillin and metronidazole be used in the early management of diabetic sepsis. Subsequently with the availability of the culture/sensitivity results appropriate antibiotics may be introduced.

Surgical procedures are carried out only after the diabetes is stabilised (an acceptable blood glucose level of 150-250mg percent achieved); the anatomical extent of sepsis mapped out; the state of arterial circulation determined and the patient put under appropriate antibiotic cover.

It must be remembered that patients with severe sepsis come to hospital or seek medical advice with the hope of saving the infected limb. The aim of the surgeon should be the same. Hence surgical procedures should be as conservative as possible. Careful and thorough debridement of the lesion is carried out. This is confined to the already defined anatomical extent of sepsis and based on a thorough knowledge of the anatomical compartments and fascial planes.

Diabetic infections of the foot have been aptly described as "iceberg" lesions. The external or the skin lesion is nearly always deceptive. Pus and necrotic debris lurk within tissue planes and along tendon sheaths. Decompression and drainage of all the extensions of sepsis are essential. All devitalised tissue is excised and the wound washed and irrigated gently. If an amputation is necessary then the flaps are based at a level of adequate arterial blood supply and fashioned to achieve early and aseptic healing. The availability and the types of limb prosthesis should also guide the surgeon in determining the level of amputation.

In the presence of large vessel occlusion(s) (demonstrated clinically and confirmed radiologically by arteriograms) consideration must be given to reconstructive surgery. The benefits of arterial reconstructive procedures provide not only an early and complete wound healing but long term improvement in the arterial blood flow to the limb.

The complete care and management of patients with diabetic sepsis includes rehabilitation. In Fiji, it is not uncommon for diabetics to have frequent admissions for sepsis.¹⁰

The control of diabetes generally lasts while the diabetic is an inpatient. Upon discharge from hospital, apart from a hurried review in the Outpatient Clinics, there is no organised aftercare or follow-up or rehabilitation available. For most patients with amputation stumps, there is no suitable prosthesis available. Artificial limbs are expensive and beyond the financial means of the vast majority of patients. Inadequately fitted and crude prosthesis cause tissue damage at weight-bearing sites and increases the risk of sepsis.


In summary the aim of this review is to increase the awareness of the problems of diabetic sepsis in the ever increasing number of diabetics in the population. A brief account of the pathogenesis of infection; an outline of prophylactic measures and the management of patients with sepsis are presented.

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