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Treatment and Prevention of Plantar Ulcers: A Practical Approach

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SECTION I

The term 'plantar ulcer' was introduced by PRICE (5) in 1959 and was defined as 'a chronic ulceration of the anaesthetic sole of the foot, situated in well defined areas overlying bony prominences, resistant to local or systemic therapy, and characterised by a marked tendency to recurrence'. This definition is the result of careful empiric studies. Properly interpreted, treatment and prevention may be deduced from it by the application of simple biological facts.

The great advances in our understanding of the aetidogy and natural history of plantar ulcers in leprosy which we have seen during the last, relatively few years, have been brought about by an application of the knowledge gained in other diseases with neural damage, and from careful studies of the static and dynamic forces at play in the normal and diseased foot. (1, 5, 6, 7, 8, 13.)

Based on this understanding a therapy has been developed, which shows a close relationship to the simple biological treatment of war casualties, developed by TRUETA (15), and CHIEWITZ (3), which is standard knowledge. (1, 7, 8, 9, 13, 16, 18.)

The same application of basic biological principles has led to the development of methods of prevention, easily applicable everywhere. (1, 9, 12, 14, 17, 18.)

The final achievement, or rather challenge to achievement, was boldly stated by the WHO Scientific Meeting on Rehabilitation in Leprosy at Vellore: 'If our present knowledge is *properly* applied, plantar ulceration should not occur'. (18.) (Italics by the author.)

This paper will attempt a presentation of a practical approach to the problem of plantar ulceration as actually met today.

AETIOLOGY AND NATURAL HISTORY

The aetiology is misuse, or rather misunderstood use, of a foot with plantar anaesthesia. The crucial factor would appear to be the 'roll' of the foot in the normal springy gait. (1, 5, 6, 7, 12, 13.) The large majority of ulcers appear to develop from 'necrosis blisters' (6), which are initially sterile and only later, after break-through become infected. (8.) The further development can be described as an evil cycle of 'scar-ulcer-scar'. (1, 6, 7, 8, 13.) If left unchecked, the deeper structures, bone, joint, and tendon, will become involved. The result is not only a shortened and

deformed foot, but a rigid foot with infinitely greater tendency to ulceration. ([1], [8], [9], [12], [13], [14].) A rigid foot has different mechanics from a pliant foot, with a different distribution of plantar ulceration. ([12].)

TREATMENT

A primary necrosis blister is a sterile, but potentially infected lesion. A developed ulcer is an infected wound. A secondary necrosis blister is a potentially, often actually, infected lesion. The hot, swollen foot with scarring is potentially, and very likely actually, infected. ([1], [6], [8], [13].) A peculiar feature, for which so far no satisfactory explanation has been put forward, is the rarity of violent infection, general sepsis and tetanus. ([1].) Successful treatment is based upon the principles laid down by TRUETA ([15]): Rest, elevation, and free drainage. ([1], [7], [8], [9], [13].) Although there can be little doubt that administration of the correct antibiotic in many cases would hasten healing ([13]), the magnitude of the problem and the rapidly developing resistance to all antibiotics make it imperative to avoid antibiotics and metabolic bacteriostatics to the greatest possible extent. ([1].) Experience has taught us that it is extremely difficult to differentiate between dead and living tissue in these cases, and while securing free drainage, it pays to be extremely conservative in excision of apparently dead tissue. ([1–13].)

POST ULCER CARE AND PREVENTION

They are practically identical. The key points are regular inspection, both by the medical officer respectively, physiotherapist and the patient himself, education in detection of warning signs, issue of proper footwear, and constant, intelligent use of the shoes. ([1], [7], [9], [12], [13], [14], [16], [17], [18].)

SURGERY

When active ulceration is present, surgery should be limited to the minimum, only securing free drainage. In this stage, one should never remove anything other than obviously dead tissue. ([1], [7], [13].) The author is still surprised at the number of times evidently dead tissue when left under a plaster of Paris cast, proves to be very vital indeed. The scarred, but hot and swollen foot is a contraindication to any form of surgery. It should be left alone under protection of a plaster of Paris cast. In the scarred, but quiescent foot a number of indications for corrective surgery may be seen. The aim is to remove severe, additional danger points where thin, adherent scar overlies a bony prominence. Several procedures have been recommended, but the general consensus is that such cases must be left for an experienced surgeon to deal with. The results are not encouraging at all. The indiscriminate excision of offending toes and metatarsal bones cannot be condemned strongly enough. ([1], [2], [8].) A radical approach to the extremely bad forefoot with well preserved hindfoot, a common finding, was recommended a long time ago by GASS ([4]). He scarifies the whole offending area in order to stop once and for all the tendency of the

scar to 'creep' backwards. This is a sound approach, but requires careful and expert surgical evaluation and handling.

TECHNIQUES FOR OBTAINING REST

Given free drainage and absence of general sepsis, which must of course be treated with appropriate drugs, any wound will heal if the affected foot is kept permanently elevated and at rest, while cross infection is being prevented. ([1–13].) The magnitude of the problem, and the scarcity of hospital beds has made it imperative to find other methods of securing the necessary rest of the affected leg. While an ulcer is freely draining, and while there is oedema and swelling, bed rest with elevated foot is the only sensible treatment. ([1, 9, 13].) As soon as the ulcer is dry and local oedema has subsided, the patient may be made ambulant in a well fitted plaster of Paris cast with a rocking device preferably a Bohlar iron. The majority of ulcers will heal within six weeks. If indicated, the leg may be kept in plaster cast for any length of time. ([1, 7, 9, 13].) This strongly emphasises the contention that the interruption of the walking roll is the most important part of the treatment. ([7, 13].) The need for a water resistant device for use where it is necessary or desirable to send the patient to his home, while under treatment, led to the development of ' the Karigiri boot' ([13]) where the foot rests on a platform with some shuffling movement on an intervening layer of absorbent felt, the whole device contained by a boot of gauze bandages impregnated with prevulcanised rubber latex. While not quite so effective as a well preserved plaster cast, it is cheaper, and it is waterproof. We have at present difficulties in India about obtaining the correct grade of rubber latex, and experiments are going on to find a suitable preparation. A number of cases, notably necrosis blisters, very small, early ulcers, and cracks of the sole heal remarkably well while the patient is made ambulant on a simple shuffleboard with interposed felt, kept in place round the ankle with lengths of elastoplast. ([13].)

PROTECTIVE FOOTWEAR

The long and winding road of experimentation that has led to our present understanding of this problem was started in 1956 by ROBERTSON (quoted by WARD, [17]). The following principles are recognized: (1) a correct fitting of the shoe ([1, 17]), (2) rigidity of the shoe ([1, 5, 7, 9, 12, 13, 14]), (3) an impervious undersole ([1, 17]), (4) moulding of the inner sole ([1, 12, 14, 17]), (5) a resilient inner sole ([1, 14, 17]).

(1) It is self-evident that careful fitting to avoid 'shoe bites' is absolutely essential in an anaesthetic foot. It is worth remembering that the shoe should be longer than the foot to allow for expansion when weight is placed on the foot.

(2) In the rigid foot with previous bone involvement, this is a *sine qua non*, but even in the pliant foot, the concept of the roll as the causative factor in occurrence of ulcers makes it desirable. This can be achieved either by using a plane or slightly moulded rigid sole with a rocker

incorporated. This is the standard method so far in India. ([1], [17].) This is a cumbersome shoe with poor inherent balance and little attraction for the patient. The wooden clog ([12]) appears to fulfil the demands for a solid, nice looking, acceptable shoe. A number of reasons have so far prevented us from introducing this pattern in India.

(3) When a flexible shoe is prescribed, it becomes important to prevent nails and thorns from perforating and causing damage to the foot. This is usually done by applying an undersole of split tyre rubber. ([1], [17].)

(4) The original idea was to mould the inner sole accurately to the sole of the foot, thus making sure of an even distribution of weight. This is true in the static phase, but cannot be obtained during the dynamic phases of gait. Also if the moulding is less than absolutely perfect, it militates against its very purpose and creates new and dangerous pressure areas. A slight moulding of the instep may be desirable, but this will usually be taken care of by the resilient insole. The metatarsal bar ([1], [17]) is a device that aims at removing pressure from the metatarsal heads and transferring it to a wider area further back. This is a logical concept when the stance is contemplated, but since the roll is the important factor and also because a large number of the feet with fairly extensive scarring of the forefoot and good mid- and hindfoot, which constitute the traditional indication for a metatarsal bar, will also exhibit a certain degree of rigidity, the metatarsal bar loses most, if not all, of its importance.

(5) The rationale of the resilient inner sole is primarily to supply an artificial resiliency where the original resiliency of the sole is lost due to scarring ([1], [13], [17]). By derivation this has been applied as a preventive in anaesthetic, but unscarred feet. Experience has supported this. All workers seem to agree that microcellular rubber of hardness shore 15 degrees is the most universally adoptable material ([1], [13], [17]).

SECTION II

In section I, a highly condensed outline of the principles of the aetiology and natural history of plantar ulcers, and of the logical treatment and prevention of these, has been given. The author is very well aware that neither is this complete, nor is it the final word in this field. This section deals with the practical application of this knowledge, as found in a leprosarium, and as seen at roadside clinics and outpatient departments.

THE LEPROSARIUM

In such an institution, where no full scale ulcer programme has been instituted previously, and where the admission and discharge policy is still largely patterned on the old idea of the asylum, *i.e.* admit when the patient cannot manage the social problems outside – and 'once in, never out', one is likely to find a fairly large number of highly crippled patients with no real desire for improvement in their often apalling ulcer condition. One is also likely to find a number of patients who are beginning to realize that joint attempts from the administrative and medical section are being

made to rehabilitate patients outside the leprosarium. Not infrequently these patients will be rather reluctant to accept real chances of obtaining restored feet. An ulcer is often regarded as a ticket for continued stay in the leprosarium. Even though valiant, and fairly successful advances are being made from asylum to hospital, these problems will be with us to some extent.

The first necessity for a medical officer who initiates a full scale ulcer programme is a complete understanding of the principles and practice of the matter. He must also be fully convinced, not only that it can be done, but that it is one of the most important steps towards a successful medical and social rehabilitation. He must then win the wholehearted support of the administrative section. It must be clearly understood and accepted, that such a programme will call for certain good facilities in staff and equipment. A reasonable number of hospital beds must be available. Initially, it will quite likely play havoc with the smooth running of the leprosy centre, since we still largely depend on patients for carrying out a significant amount of the unskilled and semi-skilled tasks. If the programme is carried out sensibly and efficiently, this phase will not last long. Soon the patients who used to go to work with poorly applied and bulky bandages, will start out for a full day's work with no bandages, but with well fitting, well kept shoes. Undoubtedly, a number of activities will have to be given up in return for more suitable ones. The most remarkable change is seen where the ulcer programme is geared to a developing social and economic rehabilitation programme. The leprosy patient as coolie disappears and the skilled, rehabilitable worker emerges.

Methods of record-keeping must be developed, which are simple and quick, so that there is a good chance of the actual records being kept. Ancillary staff, either technicians or patients, must be secured, and must be imbued with the right spirit. It should be possible to train such ancillary staff to recognize the various types of ulcers, cracks, blisters, etc., and to record them properly under proper supervision from the medical officer or a trained physiotherapist. The application of the various types of standard treatment and the technique of the necessary therapeutic measures such as plaster of Paris boots, Karigiri boots, shuffleboards with felt, must be taught properly during the actual work. A shoe workshop must be set up, that can turn out the necessary number of simple shoes in sufficient numbers. This also should be run with supervision from the medical officer and/or a trained physiotherapist.

The very first step, which may very well be undertaken to convince patients, as well as administrative and ancillary staff, that it can be done, and that it is worthwhile doing, should be a careful selection of a few intelligent, co-operative patients with minimal ulcers on otherwise good feet. Only when it is possible to point to known successful cases, can one expect full support on all sides.

Once this stage has been achieved, a full scale regular foot inspection of every patient in the home is necessary irrespective of the state of the

disease, with careful recording of the findings. At this point, the problem is likely to be too big for the existing facilities, so it will be wise to concentrate on children, younger patients, and those with a good chance of return to normal society. Of prime importance is prompt action on the findings from the foot inspection.

If active sepsis is found, the patient is put to bed with a protective dressing, the foot is kept elevated, and appropriate drug therapy is instituted.

If no active sepsis but local swelling and heat is found, and the ulcer is freely discharging, the patient is put to bed, the foot is kept elevated, therapy is instituted with soaks in lukewarm soapy water, followed by protective dressing with 4 per cent mercurochrome. Provided a careful 'no touch' technique is followed, along with a separate soak bowl for each patient, this has been found to be the simplest and quickest way of preventing cross infection, while preserving free drainage. A notable effect of mercurochrome solutions is that dead tissue is left mummified, thus presenting one with a crisp, inoffensive ulcer, ready for the next step.

When the ulcer is crisp and dry with no localized swelling nor signs of sepsis, it is ready for the ambulatory stage either in a well fitting plaster of Paris cast, or if considered more suitable, a Karigiri boot. These should be left intact for six weeks as a routine. If complete healing is not found, they may be re-applied.

An extremely important part of the regime, unfortunately too often neglected, is measurement for shoes and actual making of the proper shoe so that it is ready the moment the ambulatory device is removed. The idea is to imbue the patient and the staff alike with the understanding that an anaesthetic foot must never touch the ground unprotected by proper footwear. As emphasised, not least by PRICE and ROSS, the ideal footwear is a rigid shoe of the wooden clog variety with resilient insole. Several reasons have made it very difficult to introduce this in India. Quite often we may have to accept that our cobblers cannot make them, and that our patients refuse to wear them. If one can gain the confidence of the patients to the point where they will follow advice about careful walking, it may be perfectly permissible to issue a simple, socially more acceptable chappal (sandal of Indian type).

The whole programme will, in the final assessment, rest on the amount of confidence the medical officer can gain from the staff and patients. Measures of disciplinary action, fines, depriving of privileges, etc., and granting of extra privileges to especially careful patients may all have to be brought into play, but they can never supplant the growth of confidence.

As the programme aimed at the children and younger easily rehabilitable patients gains momentum, and the strain on hospital space and time eases a little, it will become possible to start working with the more recalcitrant ulcers and also the more reluctant patients. It must be understood clearly that while the aim, the possible goal, in the first series, is

eventually to arrive at the point where no ulcers are diagnosed, as a result of the early, preulcerative danger signs being recognized and treated as the potential ulcers they are, the really badly damaged foot can never aim so high. Certainly the incidence of ulcers and particularly the incidence of really bad ulcers can be reduced drastically. But undue optimism is as dangerous and disappointing as undue pessimism.

At this point, the problems of 'cold' surgery will present themselves with increasing frequency and urgency. It is not the intention here to give indications and contraindications which can be found in several readily available papers ([1], [2], [4]). However, it seems timely to underline that 'cold' surgery in the scarred, anaesthetic foot, no less than 'hot' ulcer surgery, is a job for a highly qualified surgeon with wide experience in the field, and with full surgical facilities at his disposal.

An ulcer programme as outlined here is time-consuming, but extremely rewarding, although it is remarkable how soon the strain starts to ease. The gravest danger is to become complacent and think that the problem is over. Unless a constant pressure is kept up *with strict enforcement of regular foot inspection*, prompt action, and steady supervision and encouragement, the situation will deteriorate in a remarkably short time.

THE OUT-PATIENT CLINIC

Since the initial reaction of most patients, certainly in India, usually is extreme reluctance to accept the suggested foot therapy, and since it may not be feasible to introduce it in the early stages anyway for lack of personnel and space, the first and most important problem in the out-patient department is to continue a careful, *regular supervision of the feet and the footwear of the discharged patients*. Every facility should be extended to these patients, including the shoe workshop, for prompt repair of damaged or worn shoes, expecially since the village cobbler invariably will repair with a liberal use of nails. Herein lies one of the real dangers to anaesthetic feet, even if he will accept the shoes of leprosy patients at all for repair.

With the increasing number of discharged patients attending clinics with proper shoes on the feet, and no ulcers, other patients will begin to realize the possibility and later on the benefit of ulcer treatment and prevention. It is very important that facilities are available and are offered promptly when such desire is found.

Usually, the regime will be a short term admission for the specific purpose of ulcer treatment. Certainly a large number of ulcers and pre-ulcerative stages will be seen where it is perfectly possible to apply immediately a plaster of Paris boot, a Karigiri boot or a shuffleboard with felt. There is, however, so great a reluctance to return to the village with these obvious outward stigmata, that until a high degree of confidence has been built up in a large group of patients, advance may be practically impossible.

THE ROADSIDE CLINIC AND THE HOUSE-TO-HOUSE VISITATION

Both offer almost ideal conditions for quick discovery of early damage to anaesthetic feet. One difficulty is that while the patients may be willing to accept unpalatable advice from a senior worker, these are those whom such patients see comparatively rarely. When this understandable reluctance has been overcome, these roadside and domiciliary patients will provide the best possible pabulum of an intensive ulcer programme.

Since a number of ulcers will be found, both in the outpatient department, the roadside clinic, and while visiting the homes of the patients, where it is impractical or simply impossible to give proper treatment without admitting to a well equipped hospital, it is imperative for these branches to have the backing of the hospital section of the leprosarium. Nobody doubts that this could equally well be done in a general hospital, but so far that seems to be an unrealized dream.

SUMMARY

The accepted concepts of the pathogenesis of plantar ulceration in leprosy are presented as the basis for a logical scheme of treatment and prevention. The practical application of this knowledge is described in an ulcer programme in inpatient leprosaria, and under ambulatory conditions.

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