VARICOSE ULCERS

A study of their underlying causes and etiology with special emphasis on the Physical treatments employed.

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HISTORY OF TREATMENTS.

AS early as the 14th Century, varicose ulceration was diagnosed. Guide Chauliac noted the influence of fat on its causation. Ointments and lotions were the earliest forms of treatment and included those used by Indian healers, miracle men and professional quacks, as well as those employed to-day by the medical profession.

Ulcers have been treated for decades by physical means. Brodie in 1846 used a medicated elastic bandage; Noble in 1924 suggested rubber sponges and Dickson Wright used a large adhesive felt pad with a thin bandage to flatten out the edges of the ulcer. Galvanism and Zinc iontophoresis were then introduced. Until 1930, however, most treatments were unsatisfactory. They involved prolonged bed rest with loss of income and blockage of hospital beds.

Hot dressings and various plasters were the next development and of these, Unna's Paste was thought to be the most efficient form of treatment until a few years ago. Viscopaste and Ichthopaste bandages were then introduced and served to lessen the risk of dermatitis.

Treatment was then completely revolutionized, based fundamentally on tight bandaging from toes to knees, covering the septic discharging ulcer and causing the patients to be ambulatory. These new ideas were known only to a few including an old herbalist woman in Lancashire, with an enormous practice.

These methods have been developed and are commonly employed to-day with the addition of Ultra-Violet Light treatments.

Although ultrasonic therapy has only recently been considered as useful in the treatment of varicose ulcers, the biological effect of ultrasonic waves was first discovered in 1917 by Langevin. He found, by chance, that fish exposed to a powerful irradiation field from an under-water ultrasonic emitter were paralysed. However, the first successful attempts to employ ultrasonics therapeutically were made by Pohlman, Richter and Parow in 1939.

Intense propaganda in favour led to undue hope and finally disappointment, but recently research has laid down the principles of the therapy and better apparatus has made cure more possible.

PART I.

ULCERS OF THE LEG.

1. CLASSIFICATION.

(a) **Non-Infective Ulcers:**
Interference with the vitality of the part by injury, lack of circulation or deficient innervation.

(b) **Inefective Ulcers:**
Direct action of specific infection.

(c) **Ulcerated or malignant tumours:**
Originating in or invading the skin.

Varicose ulcers are classified under non-inefective ulcers although secondary infection is usually present.

2. DIFFERENTIAL DIAGNOSIS.

An ulcer is an indolent raw area which tends to persist and is more often than not infected.

To differentiate varicose ulcers from other ulcers of the leg, it is important that careful histories be obtained. Previous ulcers and sites, miscarriages, time of existence of ulcers, whether multiple or single, whether painful or not, are all facts which should be recorded.

The types of ulcer commonly occurring in the leg which should be distinguished from varicose ulcers are:—

(a) **Syphillitic Ulcers:**

These ulcers are generally multiple and occur chiefly in the outer, upper part of the leg. They have a characteristic "punched out" appearance with raised hard edges. Old and new ulcers are always present and they are practically painless. A Wassermann blood test is done.

(b) **T.B. Ulcers:**

These occur in the legs mostly near the joints and are multiple or single. Often seen in children with evidence of the disease elsewhere. The ulcers have a soft base with undermined edges, grey slough and a thin watery discharge. They are most painful.

(c) **Mycotic Ulcers:**

There is a "ringworm" arrangement in this type of ulcer and they are multiple. They start as blisters which burst, become infected and finally tend to heal in the centre. The skin of patients with varicose veins is susceptible to this infection.

(d) **Factitious Ulcers:**

Occur chiefly in hysterical women. A "Glove and Stocking" anaesthesia is present. They are rare and usually in a position easily accessible to the patient.

(e) **Traumatic Ulcers:**

These are not usually mistaken for varicose ulcers. They commonly occur over the shin bone and show other signs of trauma.

Other conditions simulating ulcers but which rarely are, include:

Raynaud's diseases, Diabetes, Tropic disease and Cancer.

3. DESCRIPTION OF VARICOSE ULCERS.

It is claimed that the term varicose ulcer is a misnomer, since there are many causative factors other than damage to the deep venous system. The term has arisen due to the close association of this condition with varicose veins. Strictly speaking, however, these ulcers due to venous stasis and thrombosis should be termed gravitational ulcers. In fact any ulcer due to a faulty flow of venous blood may be termed a gravitational ulcer. However, for the purpose of this discussion, all are included under the general heading of Varicose Ulcers, as popularly accepted.

Varicose Ulcers are by far the most common ulcers of the lower extremities. They occur in the lower one third of the leg, are generally single, sometimes multiple and may be large or small. Such ulcers are generally associated with varicose veins and there is usually a well marked area of inflammatory reaction which at times will spread for several inches beyond the open ulcer. There is localised oedema together with brown pigmentation of the skin and sometimes a history of phlebitis.

The area of the ulcer is deficient in muscular support and collateral circulation. The edges are usually sloping in appearance and the base is covered with large, coarse granulations and a profuse, grayish discharge.

They may be one of the most severe, disabling and painful conditions occurring in late middle life and most commonly in obese persons.

The "indurated leg" which is a term referring to the swollen limb, seat of brawny oedema, is a precursor of ulceration, eczema and chronic invalidism.

PART II.

FACTORS UNDERLYING THE FORMATION OF VARICOSE ULCERS.

4. ANATOMY OF THE VENOUS SYSTEM.

(a) **Anatomy.**

The Venous System of the lower leg consists of superficial and deep portions. The deep veins are those situated deeply among the muscles and bones and which collect the blood from the deeper tissues about the foot and ankle, carrying it upward. It then beccomes the popliteal vein at the lower edge of the popliteal space. This vein continues as the popliteal until it enters Hunter's canal, where it is called the femoral vein. When it passes under Poupart's ligament, it becomes the external iliac and later, at the brim of the true pelvis, unites with the internal iliac to form the common iliac vein.

The superficial venous system of the lower leg, consists of the long and short saphenous veins. The long saphenous forms over the inner side of the foot and ankle, passes upwards medial to the edge of the tibia, past the medial condyle of the femur, along the inner side of the lower thigh and then joins the femoral vein of the deep system, through the foramen ovale two inches below Poupart's ligament.

The short saphenous collects blood from the back and external border of the foot and back of calf. It joins the popliteal vein in the upper edge of the popliteal space.

These systems are connected by collateral anastomosing veins, an extensive network resting in the superficial fat. The superficial veins are connected with the deep veins in the lower leg and thigh by communicating veins.

All these veins, superficial, deep and communicating are supplied with valves with their cusps facing upward and inward. This tends to prevent the reflux of blood and maintains the blood column above them. These valves are usually of the bicuspid type.

(b) **Embryology:**

Valves first develop in the embryo at 3½ months and by 5 months are completely developed. They are usually located at the entrance of the saphenous into the femoral and popliteal veins and are found distal to the opening of a tributary. There is no definite regularity in their location.

(c) **Histology:**

The wall of a vein is made up of three layers:—

(i) *Intima:* layers of cuboidal epithelium lining the inner walls with elastic interna beneath.

(ii) *Media:* large amounts of muscle tissue interspersed with fibrous tissue and scattered elastic tissue.

(iii) *Adventitia:* consists almost entirely of fibrous elements with small amounts of muscle tissue.

Throughout the media and adventitia are scattered the vasa vasorum of the vein wall.

With abnormalities in the venous system, degenerative changes occur in the lining coats of the vein.

5. PHYSIOLOGY OF THE VENOUS SYSTEM.

The normal circulation in the venous system is from the extremities towards the heart in a proximal direction; both in the superficial and deep veins.

This is aided by:—

(i) The contraction of the left ventricle which is a force from behind driving the blood along the veins.

(ii) The negative intrathoracic pressure which exerts a suction effect or pull upon the column of blood in the large veins of the abdomen. The blood is also forced upward during inspiration for when the diaphragm descends it increases the intra-abdominal pressure. This increase in pressure is transmitted to the blood in the veins and since the valves prevent the blood from passing downwards it is propelled upwards.

(iii) **Abdominal and Limb Muscles:**

In standing, the abdominal muscles contract and offer a firm support for the large veins of the abdomen. If this was not so blood would collect in these veins and the flow to the heart would be reduced.

The muscles of the limbs perform a similar function. Furthermore, the contraction of muscles when walking forces the blood upward towards the heart with a pumplike action. The valves prevent any back flow.

The vascular system of the leg has been described as being similar to a U-shaped glass tube.

The aorta and large arteries being one limb, the capillaries, the bottom and the large vein trunks and vena cava the other limb. When filled with fluid, the system is in equilibrium. If the blood is introduced into one side, an equal amount must flow out of the other, i.e. when the heart pours blood into the aorta, an equal amount must flow from the vena cava, into the right side of the heart. Thus venous return is accomplished irrespective of the body's position. However, in the erect position there are gravitational influences and a large quantity of blood accumulates in the lower parts of the leg. The human "U-tube", unlike those of glass does not have rigid and impermeable walls. The vessels have elastic coats which are apt to give way under high pressure, the lumen widens and blood accumulates with resultant venous stasis.

To dispel this surplus, the body relies on the contraction pf the muscles of the calf. When these muscles contract as in walking, they act as a peripheral heart, squeezing blood from the lower leg into the popliteal and the femoral veins.

The valves prevent the back flow.

6. PATHOLOGY OF VEINS AND ULCERS.

Loss of valve function, followed by dilation of the vein walls, is the first step in the formation of varicose veins.

When the valves do not function properly, the blood sqeezed out of the lower leg, will return as soon as the muscles relax. No amount of walking or muscle movements will prevent the blood from stagnating.

Pierre Delbet gives the mechanical explanation that it is back pressure from the iliac veins, causing the valves at the sapheno-femoral junction to give way and permit reverse flow. Apparently the valves degenerate throughout adult life and there is evidence of a general connective tissue weakness in the body which is progressive with age.

As a result of this loss of valve function, venous stasis occurs and oedema develops. If prolonged for weeks or years changes such as induration and ulceration occur and aching and pain result from anoxaemia.

These changes constitute the picture observed in lower leg ulcers. They are rarely found alone and are nearly always accompanied by chronic pitting oedema and brawny, indurated skin. The patient complains of dull aching or bursting pain whenever the lefg is vertical. These symptoms constitute the components of a "lower-leg-stasis syndrome". Grave circulatory disturbances underly this syndrome.

In an investigation carried out by Gunnar Bauer, the femoral and popliteal veins were found to be in a pathological condition. The salient feature was an almost complete absence of normal functioning valves.

The presence of varices in the superficial system predisposes towards the development of thrombophlebitis of the deep system. This inflammatory condition is associated with hard clot or thrombus formation which is tender and painful. The tissues become indurated with an intense cellulitis.

With the stagnation of blood in the varicose veins the blood is poorly oxygenated and more susceptible to infection. If there is a continued congestion of the skin, a dermatitis and later eczema may develop with possible ulcer formation.

Ulcers occur largely in the skin. There is an inflammatory reaction of the tissue beneath and gangrene and separation of superficial layers of skin. At times the area resembles a carbuncle. No one bacterial organism can be held as the specific cause of ulceration.

7. ETIOLOGY AND CAUSATION.

In the case of Varicose Ulcers, persistent oedema or induration is usually present in the dependent parts and the tendency to ulceration is aggravated by:—

(i) Some obscure reflex mechanism as a result of trauma.
(ii) The presence of infection.
(iii) Muscular inactivity.
(iv) Varicose Veins.

Venous stasis, with resulting stagnation of fluid in the tissues, is the basic factor producing the lowering of tissue resistance and secondary ulceration.

The potential difference between blood in the veins and the fluid in the tissues is equalised. Stasis results, tissues become waterlogged and their resistance to infection or trauma becomes lowered because of impaired nutrition. Secondary infection by pyogenic organisms is always present. The surrounding skin becomes indurated and purplish brown.

The immediate cause of tissue breakdown, is often trivial. It may be embolic and due to infected teeth, tonsils, haemorrhoids, etc. If not cared for, infected veins may increase, an ulcer results and may penetrate deeper. The ulcer cycle always causes much damage to circulation and nutrition of the tissues and leaves them more susceptible to future ulceration. Often after years of ulceration and healing, a continuous potential state of gangrene exists. Ulcers developing in this case are truly trophic.

Occupations involving a lot of standing, particularly those of barbers, laundresses, dentists and blacksmiths, reduce the pumping effect of muscular contractions, with resultant stagnation.

(a) Causation of Ulcers:

Ulcers are the end result of the predisposing pathological conditions which have been operating for many years—obesity, stasis, lack of muscle tone in leg muscles, lack of exercise, standing and non-function of vein valves. Medical diseases may be aggravating factors and trauma the exciting cause, with supervening infection.

(i) *Varicose Veins:*

Varicose Veins are common antecedents and may be due to trauma, phlebitis, burns or fractures with resultant retrograde venous flow. Varicosity diminishes free return of blood and leads to congestion, lack of nutrition and ulceration. The back pressure in the reversed venous circulation is considerable. When the patient is standing the venous pressure can be between 90 mm. and 170 mm. Hg. This stagnant column of blood causes oedema and the surrounding tissues are affected. Even a mild degree of trauma in such an area, initiates the formation of an infected varicose ulcer.

(ii) *Previous Thrombosis:*

A main causative factor in ulceration is a previous thrombosis of deep veins of the leg, which may affect the iliac, femoral and popliteal veins. There may be phlebosclerotic and similar idiopathic changes.

In 1949 a series of cases studied by Annings showed:

88·6%—due to deep varicose thrombosis.

11·4%—due to varicose veins.

(iii) *Congenital weakness:*

Congenital weakness of the vessels may be an important cause and there is apparently a heriditary factor not to be overlooked. The vein walls are sufficiently strong enough during the early years, but under the stress and strain of later life, with back pressure from the iliac veins and straining from heavy work, the walls dilate with loss of valve function.

(iv) *Trauma:*

Usually injury to a vein heals rapidly, but such conditions as phlegmasia alba dolis following pregnancy or exposure to cold, where there is deficient circulation or pyogenic infection, without free drainage, an ulcer may result.

Any slight trauma may cause an abrasion when the skin is weak and varicose.

The ultimate formation of an ulcer is a question of mechanics. The foot and lower leg become engorged and waterlogged, the dependant parts are acted upon by gravity, the nutrition is impaired and the skin breaks down.

The persistence of an ulcer is still a question of mechanics together with added low-grade bacterial infection. Thus only by elevating the foot or by tight bandaging can the waterlogging fluid be driven from the foot and the ulcer given a chance to heal. Recently it has been suggested that the causation may be associated with a calcium imbalance of the body.

(b) Symptoms:

The most important symptoms associated with varicose veins and ulcers are the infiltrations of abnormal effusions of fluid into the tissues, often resulting in the formation of connective tissue and other changes. It may be muscular infiltration, causing pain and stiffness of joints, but the common area is the calcaneo-malleolar region, spreading to the back of the small of the leg. Pereosteal infiltrations of the tibial surface and sub-cutaneous or cutaneous infiltrations on the inside of the knee are extremely painful.

There may be oedema of the whole leg, which is tense and shiny with pitting on pressure. The leg feels heavy.

Causes of these infiltrations may be partly central, partly peripheral and sometimes intermediary.

(i) *Causes of Central Origin:*

These are due basically to weak heart, after operations, nephritis, asthma and emphysema. Fevers such as typhoid, pneumonia and rheumatic fever necessitate long bed rest with reduced muscular movement. Hence the original cause of infiltration in distal parts of the leg is hastened.

(ii) *Intermediate Causes:*

Badly fitting elastic stockings and tight garters, are contributory factors. Fear of draught and cold has an influence on the state and function of the lower limbs.

(iii) *Peripheral Causes:*

Fractures may cause severance of important vessels or their involvement in callus formation. Plaster bandages and prolonged immobilisation may inhibit the circulation. Sometimes the treatment of a fracture is compromised or essentially delayed by infiltrations in the ankle region. These limit the mobility of the foot, with resultant atrophy of the calf muscles and discomfort.

Trauma plays a definite part, causing distortion of the area and accompanying infiltration.

Obvious nutritional disturbances of the skin, such as pigmentation, atrophy and induration, are early indications of tissue breakdown. Phlebitis and peri-phlebitis of small veins may be present.

Ulcers are limited in depth by the superficial and deep fascia and always appear deeper, because of the swollen margins.

Pain is a prominent symptom of varicose ulcer, and sometimes it can become so severe, that the patient is forced to bed. Necrosis of the skin and discharge from the ulcer, affords relief.

The terminal nerve filaments which supply the ulcer area, are not broken down, but are held under pressure in the area of cellulitis and congestion. They are acutely eroded and inflamed, and are thus hypersensitive.

When a patient is on his feet, there is increased congestion of the tissues and fluid stagnation with consequent increased pressure on the terminal endings. Severe pain results.

(c) **Varicose Veins:**

There is a close association of varicose veins with ulcer development, thus it is necessary to consider in some detail, the basic etiology of varicose veins.

Some authorities maintain that the etiology of ulcers is a trophoneurotic distrubance, a condition resulting secondarily to the development of varicose veins.

Definition:

A varicose vein is defined as one which has undergone dilation, elongation and tortuous changes in shape, with thickening of the wall. Furthermore, there is no power in the vein to carry blood to the heart, as the valves are incompetent.

Etiology:

It was found by Lake, Pratt & Wright in 1942, that 67% of women had varicose veins who had not been pregnant, although there was a higher incidence in women who had. This was possibly due to the fact that women have softer and less supportive surrounding tissues to the walls of veins, and that at times of pelvic congestion, back pressure is more marked in venous circulation.

Recent evidence has shown that the absence of Vitamin C may have a direct bearing on the development of varicose veins.

Causative Factors:

(i) Age—rare under 18 years.

(ii) Sex—commoner in women than men, but not to any great extent. Probably less noticeable in men, because they hide their legs.

(iii) Pregnancy—responsible for many cases arising in 3 ways:

(a) Obstruction to return of blood from legs, due to gravid uterus.

(b) Toxaemia sometimes damages veins.

(c) Sometimes a phlebitis which in turn causes superficial veins to become varicose.

(iv) Infective diseases—general lowering of tone of muscular system.

(v) Occupation—constant standing in bad atmospheres and light with undermining of general health.

(vi) Tight garters and similar restrictions.

(vii) Endocrine deficiency.

Sicard considers a deficiency of ovarian stimulation in the female and hypophyseal secretion in the male a factor. The whole venous system is hypotonic, due to lack of hormones. He also considers a lack of sympathetic stimulation to the vein wall, which leads to dilation.

(viii) Absence of Vitamin C.

(ix) Hereditary factor and a congenital weakness of vein walls.

The symptoms associated with varices, include a heavy feeling in the leg; paraesthesia of the skin of lower extremities, and oedema of legs and ankles.

Varicose veins do not always cause indolence or sepsis. The deep and superficial induration accompanying varicose veins, is probably due to interstitial fibrosis, from organisation of oedema. Chronic phlebitis and periphlebitis of venules, may be the possible cause.

PART III.

THE TREATMENT OF VARICOSE ULCERS.

INTRODUCTION.

8. The treatment of varicose ulcers has been classified under three headings:

SURGICAL, MEDICAL and PHYSICAL.

As after care and the patient's co-operation are so important in effecting a permanent cure, they have been included under a separate heading.

In the treatment of any case of varicose ulcer, two conditions must be recognised.

(i) The primary condition or etiological factor present, is the stagnation of blood in the parts. This lowers the resistance of the tissues to infection.

(ii) With venous stasis, slight trauma may be the immediate cause of ulcer development. Treatment is therefore aimed at correcting the reflux blood flow, promoting a better circulation and protecting the area from future trauma. Supportive measures are therefore indicated, to aid the venous and lymphatic circulation in the lower leg, directly about the site of ulceration.

Early treatment and continued after-care, are essential to heal ulcers and keep them healed. It is important to realise, however, that to treat the ulcer without treating the veins or other underlying cause, is a waste of time. In fact, untreated diabetes, syphilis, kidney disease and septic foci, will often prevent healing.

There are certain prophylactic measures which help to minimise the risk of ulceration. These include:—

(i) Avoidance of sepsis.
(ii) Early passive and active movements post-operatively.
(iii) Early diagnosis of deep vein thrombosis, and the use of anti-coagulant drugs.
(iv) Weight reduction.

A. EXAMINATION OF PATIENT.

As in all other cases when a patient with an ulcer presents himself for treatment, a careful examination is made.

The history is investigated, to find out the etiology of the condition. Previous thrombophlebitis, pregnancies, date of first ulceration, recurrence, disability caused and persistence are noted. The amount of oedema and swelling of feet are determined. Complicating factors, such as diabetes, nephritis, etc. are looked for.

Each ulcer case is considered separately, and a different diagnosis should be made. This is important to verify that the ulcer is varicose, and to avoid incorrect treatment.

B. CHOICE OF TREATMENT.

Surgery is indicated where there is an obvious offending vein, when a resection or ligation may be performed, or injections administered. In the case of large, sluggish ulcers, an excision of the whole area may be made, and/or skin grafts implanted in the ulcer area, to hasten healing.

As a general routine, conservative measures should always be practised, before resorting to more drastic means.

The direct application of any particular solution or ointment, has no value in itself in bringing about recovery. Unnas' Casts have for years been considered the most effective form of treatment, but are now slowly being replaced by less cumbersome physical methods.

The modern ambulatory treatments, are gradually taking precedence over all methods, as with the patients' full co-operation, ulcers should heal in two or three weeks, as against the months of incapacity with other forms of treatment. There is a more marked improvement in the circulation and in the general health of body and mind.

9. SURGICAL TREATMENT.

Surgical treatment can be divided into two parts:—

(1) Surgery affecting the veins, which has an indirect effect on the healing of the ulcer, and
(2) The direct application of surgery to the ulcer area.

A. **Aims of Treatment:**

(a) To attempt to correct the defective circulation present.
(b) To hasten healing.
(c) To try and prevent any possible back flow of blood.

B. **Methods of Treating the Veins:**

(a) "*Bloodless stripping* operation on the internal saphenous vein.

(b) *The removal of varicose veins*, which in many instances, prevents the onset of ulceration and induration.

(c) *Ligation* of sections of the great saphenous vein along its course, usually below the saphenofemoral opening.

A short setion of vein between the ligatures is resected. In addition, multiple incisions may be made at a distance of 1-in. or so from the ulcer, thus ligating all varices feeding the area. Areas of good tissue are left, however, between the incisions to supply nourishment to the part. This ligation of the great saphenous vein at the foramen ovale, can be followed immediately, or at a later date, by injection of offending veins. This is the more modern form of treatment employed.

(d) *The injection treatment of varicose veins:*

The principle of injection into a vein, is to inflame and damage the inside wall, so that the vein becomes a solid cord which has no inside passage. This cord becomes more and more fibrous, and is finally absorbed.

The injection used is sclerosing, not clotting, so no danger of embolism exists. Various drugs and techniques are used.

The treatment is indicated in the case of:

(i) Varices which have developed the complications of ulcer, eczema, etc.

(ii) Tortuous veins of the calf and leg, so large and painful as to be disabling to the patient.

Injections are absolutely contra-indicated in the case of distended, superficial varicose calf veins, which are secondary to the obliteration of deeper veins, by attacks of phlebitis.

Injection cures only the offending veins, and does not affect the patient's tendency to have, and to develop varicose veins. Even after healing, the area readily breaks down due to inattention to veins, and no instructions as to the wearing of elastic stockings or bandages.

The surgeon always injects into an aseptic state. Usually a few days in bed with the limb elevated, and hot saline packs, relieve the inflammation and oedema, prior to injecting.

(e) *Division of the Popliteal Vein:*

Blocking of the large avalvular vein trunk, at its lower end in the popliteal region, prevents any possible back flow. Contractions of the calf muscle, drives the blood through numerous fine-calibred channels into the veins in the muscle of the thigh, and no back flow occurs. This operation is preferred as a routine now by Gunnar Bauer, at Mariestad Hospital, Sweden. Out of 245 cases treated, 180 had open ulceration and 33 had a history of repeated ulceration. All cases responded and healed in a time shorter than with conservative treatment. At the same time as dividing the popliteal vein, those veins with a retrograde blood flow were dealt with, either by dividing, injecting or stripping. It was found that the use of anti-spasmodic drugs and repeated sympathetic blocking, was of little or no value, but lumbar sympathectomy caused rapid healing.

C. **Surgery Applied to Ulcer Area:**

(a) *Skin Grafting:*

In time, most ulcers heal, but when the ulcer has begun to heal and is clean, the burying of skin grafts in the granulations in the ulcer hastens a cure.

The graft is not undertaken until all coarse, watery granulations have disappeared, infection cleared up and the ulcer bed covered with fine epithelial granulations. Preliminary bed rest is often advocated, to reduce the oedema and clear up sepsis.

The skin from which the graft is to be taken, must be thoroughly cleaned. This area is usually the thigh, and the graft is taken under local anaesthetic.

For ambulatory treatments, small pinch grafts are implanted in the ulcer area and hasten epithelialisation.

When a large Thiersch graft is used, the ulcerated scar is sometimes excised because with oedema, scarring and induration, fibrous tissue forms causing a dimished blood supply, which lessens the chance of a graft taking.

Firm pressure is maintained over the graft for some time post-operatively.

(b) *Autohaemic Treatment:*

This method of treating ulcers was described by Nade. Blood was drawn from the patient's antecubital vein. This was applied by dropping or blowing it into the ulcer surface, and spreading it into a film which is allowed to clot. Of 15 cases treated, 9 were cured, 2 improved and 4 were unchanged. Further investigation is being carried out on ulcers by irradiating them, with strong doses of ultra violet light, before applying the blood.

(c) *Excision of Area.*

Some surgeons excise the whole ulcer area, and let the wound heal by granulations.

Any form of surgery is definitely contra-indicated where any infection is present. Badly infected and necrosing ulcerations, must be cleared up and preferably healed, before any operation performed.

Operative treatment may cause an ulcer to heal, but the patient still has much oedema and swelling of the lower legs, and still requires support for the extremity. Future trauma to the area, may and probably will cause re-ulceration. The patient has little chance of permanent healing.

After operative treatments too, patients generally remain in bed from 2—3 weeks and there is a distinct possibility of post-operative embolus and death, especially in obese patients.

10. MEDICAL METHODS.

In addition to giving support to the dependant extremity, and of correcting the pathological circulation present, the local application of soothing, healing preparations has been accepted.

A. **Unnas' Cast and Adhesive Strips:**

Unnas' cast and adhesive strips have been the most popular and accepted as the most efficient form of treatment, until the past few years. It used to be the best hope of the surgeon ,in treating this condition.

Many doctors to-day advise that the cast be applied directly over the large, open, weeping, badly infected ulcer area, and changed every two or three days.

Formula for Unnas' Paste:

Zn. Oxide	30	parts.
Phenol	2	,,
Gelatin	30	,,
Glycerine	50	,,
Water	90	,,

The gelatin is soothing to the skin, and acts as a medium to carry any medicant with which it is mixed. The glycerine is sedative and soothing and helps to take care of excessive perspiration, due to its affinity for water. The Zinc Oxide is mildly antiseptic. Ichthyol and other drugs are often incorporated. The solution is made up, mixed thoroughly and set aside to cool, to form a semi-solid mass. The container is placed in hot water to soften and warm the paste. It is applied from the knees to the toes. The leg is wrapped in a cotton gauze bandage, applied evenly with no ridges over the tibia. The heel is left uncovered. Over the layers of bandage, another layer of Unnas' paste is applied, and rubbed into the bandage. This repeated and allowed to cool. Several layers of gauze may be used.

To-day bandages are prepared which have the Unnas' paste rolled in. Ichthyopaste and viscopaste bandages are the most common, and are easier to apply.

Support is thus given to the extremity, and if maintained, the patient can be assured that the ulcer will heal.

These pastes are only applied when the ulcer is practically healed, according to McPheeters and Anderson.

The first cast is removed at the end of one week. The area is inspected and unless other conditions have developed, a new cast is applied. This is left on for two weeks, then removed and a new one applied. This is left on for two, three or four weeks.

The Unnas Cast is clumsy and unsightly.

The method of strapping with adhesive strips, applied directly to the ulcer area for support, has given good results.

The limb is strapped with strips of adhesive, one after the other, beginning at the toes and working upward. Each succeeding strip of adhesive, overlaps the one below, until the foot, ankle and lower leg are strapped well above the ulcerating area.

The strips are applied snugly. This is similar to the application of the Unna paste, and the basic principle of both these methods is practically the same.

The adhesive strapping is left on, and allows the wound to become bathed with its own pus secretion, until it finally oozes through between the strips of plaster and saturates the dressing. The strapping is then removed, wound cleansed and restrapped.

Adhesive bandages may give rise to dermatitis, and it is then advisable to apply Ichthyopaste, viscopaste or an Unna bandage. A Crebon bandage, made up of lead plaster, colophony and soap, under the elastoplast, minimises the risk of dermatitis. All bandages must be carefully removed to avoid destruction of granulation tissue.

B. **Ointments and Lotions:**

If the ulcer and tissues are badly inflamed and painful, the patient is put to bed with the application of hot packs. These quieten down the inflammation, and the additional use of a supportive bandage hastens healing.

Mildly stimulating ointments and lotions are used, but these mainly prevent dressings from sticking to the granulating surface. Any mild ointment, preferably a Zn. Oxide base with a mild stimulating, healing medicament is good. Iodine seems to be of definite, positive value in the treatment of chronic ulcers, but does not help all cases. It has been found that the use of hyaluronidase, in the treatment of chronic ulcers, has been successful. The ulcers over the malleoli, were painful and disabling and of long duration. They were resistant to all the usual therapeutic measures.

Hyaluronidase is an enzyme, prepared from bovine testes, snake venom, bacteria and other sources, and is applied by iontophoresis and subcutaneous injections around the ulcer. Tissue metabolism is improved, and the passage of necessary agents into the ulcerated area facilitated.

The ulcer base, healed with red granulating tissue and healing was characterised by the near absence of visible scar tissue formation. Inflammation disappeared, but oedema was still present, and this persistent oedema contributed to the difficulty in final epithelialisation. Pain was relieved. It is to-day applied in powder form.

It is, however, not so much the ointment applied to the ulcer surface, as the tight compression bandage, together with walking, that promotes healing.

C. VACCINE TREATMENT.

Some authors, Pondorff being the most prominent, believe in the vaccine treatment, and in the development from the bacteria present in the ulcer, of an autogenous vaccine with which the patient innoculates himself against his own infection. He thinks the secretion from the ulcer area, which is retained by the Unnas cast or bandages, softens the indurated skin. A secondary absorption occurs through this softened skin. surface, and the patient becomes innoculated with his own vaccine. Few to-day agree with this theory.

More recent treatment, is the introduction of vaso-dilating drugs through the skin, by means of iontophoresis. These should, however, only be used as adjuncts to the supportive therapy, which is more corrective of the pathology present, and is the basic principle of treatment.

11. PHYSICAL METHODS.

Physical treatment aims at bringing about a return to normal activity, and is based upon recent findings concerning the direction of venous flow, when the patient begins to walk. When the patient is standing still, the veins are filled with blood, and the upward flow is almost neglible. Walking is thus encouraged because of the effect of muscular contraction on the deep veins.

Previously, patients were treated with prolonged bed rest, but this is contra-indicated as the muscles atrophy from inactivity, and the circulation becomes more sluggish.

The types of patient treated are those with healing or recently healed ulcers, or dry, scaling unhealthy skin, caused by disturbed venous return.

The success of treatment depends upon the patients' co-operation and they must be made to understand all instructions concerning the care of the leg. Written instructions on home care should be given as well.

Patients should be made to report for re-examination at lengthening intervals, and must report any slight relapse.

The length of time spent on treatments, a minimum of ¾ hour, places heavy demands on hospital staff, but the results justify it.

A .**Aims of Treatment:**

(i) To prevent stagnation of blood and tissue fluid under and around the ulcer, and hence improve the circulation.
(ii) To reduce oedema present.
(iii) To give support to dilated varices, mechanically holding their walls compressed.
(iv) To counteract the effects of gravity.
(v) To soften areas of induration in the lower leg.
(vi) To control infection and promote healing.
(vii) To improve the nutrition of the skin.
(viii) To approach the patient psychologically, and encourage him to get well.
(ix) To rehabilitate the patient.
(x) To prevent recurrence of the condition.

B. Means of Treatment:

Numerous methods are employed to-day. The Bisgaard method, however, seems to have taken precedence over most other forms of treatment, and is used by many, even if in a somewhat modified form. Before proceeding to a detailed description of this method, some of the electrical means employed will be considered.

(a) **Short-Wave Diathermy:**

This method aims primarily at improving the circulation, clearing up infection and reducing oedema.

If a faulty sensation and excessive congestion in the parts is present, an indirect heating in the form of lumbar diathermy should be applied. A mild thermal, progressing to a thermal treatment is given, until the toes become warm.

If sensation is normal and the part not congested, a coplanar treatment to the lower leg is given. The heating should be athermal, and applied for 5 minutes progressing to 10 minutes.

(b) **Ultra-Violet Light:**

This method of treatment is used in cases of infection and extreme indolence. It aims at sterilising the floor of the ulcer bed, improving circulation, promoting healing, and freeing the area from a foul odour. It can be given alone or combined with Short Wave Diathermy.

A first degree erythemal dose is given to the whole of the surrounding area, and progressed by 25% each day.

A double fourth degree erythemal dose is given to the ulcer area, with surrounding protection. This dose destroys bacteria and produces a vasodilation at the base of the ulcer, with resultant increase of discharge from the wound. The treatment is given twice a week, or on alternative days, when Short-Wave Diathermy is used.

Infra-Red may be applied over the wound, but is a superficial heating and of not much use.

(c) **Faradism Under Pressure:**

This method is used for gross oedema, and assists the mobility of the joints. A dressing is applied over the ulcer. Two large pads, one under the sole of the foot, and one under the calf, are applied and secured in position by a Bisgaard bandage.

The treatment is given for 5 minutes, a rest and then another 5 minutes, progressing to 15–20 minutes, with frequent rest periods. This treatment can be given daily.

(d) **Zinc Ionisation:**

This method is used for its drying effect on a weeping wound. It prevents infection, is slightly antiseptic, and aids the circulation.

The ulcer is packed with ribbon gauze, soaked in a 1% Zinc Sulphate solution. The active pad is then placed over and ½-in. round the ulcer. The amount of current used is 4 m.a. per sq. ins. of wound, and the treatment given until the needle drops. The poles are reversed at the end of treatment, to facilitate an easy removal of the pad. Treatment should only be given twice a week. A dry dressing is used to cover the wound in between treatments.

(e) **Ultrasonic Therapy:**

The first successful attempts to employ ultrasonics therapeutically were made in 1939. Only recently, however, has research laid down the principles of the therapy.

Irradiation by ultrasonic waves, sets tissue particles in very rapid but small vibrations. The ultrasonic energy is absorbed in the tissues and converted into heat.

Two effects are produced, viz.: thermal and mechanical.

(i) *Thermal effects:*

There is a rise in temperature of several degrees. The organism responds to the stimuli by hyperaemia, limited only by increased heat dissipation at high temperatures. Biochemical reactions may be started or accelerated.

The nature of these waves is similar to those of short wave Diathermy, but is confined more to the periphery, and hence more localised.

(ii) *Mechanical effects:*

There is a vibration in the tissues, but the nature of these effects is not fully elucidated. There is possibly a rise in the permeability of cell membrances, which begin or accelerate osmotic processes. It is thought to aid the thermal effect, in increasing metabolism and is said to have an analgesic and spasmolytic effect.

These effects are beneficial in cases which need hyperaemia, stimulation of metabolism, and analgesia or relief of spasm. They are employed in inflammatory processes, because of the production of hyperaemia in deep tissues. They often cause more rapid regeneration in indolent wounds, like varicose ulcers.

(*To be continued.*)

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