REFRESHER COURSE FOR GENERAL PRACTITIONERS

WARTS OF THE FEET

BY

L. FORMAN, M.D., F.R.C.P.

Physician, Skin Department, Guy's Hospital

Warts of the feet are a common minor ailment. They may lead to considerable discomfort, and, as they often occur on pressure points, may give rise to incorrect positioning of the foot. They are seen in patients of all ages and both sexes, the maximum incidence being between the ages of 10 and 25. In children minor epidemics occur in schools, the infection being acquired by inoculation of the bare feet in swimming-pools and changing-rooms and when dancing. That warts are contagious is a matter of common clinical experience. One may appear on the physician's finger after contact with the instrument used for curettage, and there is experimental evidence that the causative agent is a virus. The incubation period of the plantar wart is variable, from six weeks to five months, and occasionally as long as a year.

Histopathology

The wart consists of a localized hyperplasia (acanthosis) of the epithelial cells (see Fig. 1). There is an increased rate of division of the basal layers, excited by the overlying infected cells. The latter contain intranuclear inclusion bodies and exhibit "ballooning" of the protoplasm. M. J. Strauss and his colleagues have reported the finding of crystalline particles (Fig. 2) in the inclusion bodies under the electron microscope; these they take to be the infecting virus. The rete pegs become thickened and project downwards, with a corresponding elongation of the papillae carrying the fragile capillaries. The latter are easily ruptured by pressure on the wart, and small haemorrhages are carried through the epidermis to show on the surface as discrete black dots. There is an associated increase in the horny layer.

Strauss and his colleagues noted that the warts which showed the "virus" histopathology differed in clinical appearance from those which did not contain inclusion bodies. The "virus" warts were single or multiple, but not confluent, and surrounded and almost hidden by a collar of horn. When exposed by the removal of horn the wart had a soft consistence and with the curette shelled out cleanly. Warts which did not show the characteristic histopathology were of the superficial dry hyperkeratotic type.

Clinical Appearance

The individual plantar wart is skin-coloured or brown, often speckled with brown or black points of haemorrhage. The surface is rough and irregular, tending to show lobulation in the larger warts. The main mass of the wart may be pressed down into the skin by the body weight and barely show above the surface. In addition a thick collar of horn is formed by the surrounding compressed normal skin. If this collar is trimmed away it will be seen that the skin ridges lead up to the edge of the epithelial mass of the wart and then stop short (Fig. 3). Further paring of the wart will cause pain as the nerve endings between the cells are reached, and soon points of bleeding will indicate the severance of the tops of the elongated papillae. Further dissection causes acute discomfort and free bleeding.

Warts may be single or multiple and occur anywhere on the foot or toes. The pressure areas are commonly involved, as they are particularly likely to pick up infected fragments of horn. Warts may reach 1 cm. in diameter, and often they are grouped with a large wart in the centre and smaller warts as a constellation around, suggesting that the latter

have arisen by inoculation from the "mother" wart. Another arrangement, seen usually in adults, is the so-called "mozaic wart," where a number of small warts, equal in size, compress each other to a polygonal shape. Mozaic warts have a uniform covering of thick horn. The ball of the foot or the heel are the sites commonly affected. This kind of wart indicates multiple invasion and probably low immunity, for it is the type most resistant to treatment.

Differential Diagnosis

Among the common conditions which may be mistaken for plantar warts are corns and callosities. (For a detailed description see the Refresher Course article by Mr. N. C. Lake on "Minor Ailments of the Feet," published on May 5, 1951.) Horny scars left after caustic, surgical, or x-ray treatment of a wart may also be confusing. Because of the thin epidermis and dilated vessels in the atrophied cutis, haemorrhages readily occur which may speckle the horn as in a true wart. Further, the scarred epidermis may be irregular in thickness, the horny cap following the contour to give a rough surface. However, careful dissection will expose the thinned and irregular epithelial base without bleeding, and inspection with a lens after stretching the skin will demonstrate the normal ridge markings. Other localized keratomata rarely cause difficulty, for they are usually multiple. They are either congenital and present on the hands and feet (keratoma punctata) or form part of a general cutaneous disorder—for example, Darier's disease or arsenical keratosis. A pigmented naevus or melanoma appears as a brown or black area with the epithelium stretched and smooth over the surface. If it becomes malignant the increase in size will be noted by the patient, and the epithelium may become necrotic. The malignant melanoma presents as a dark

FIG. 1.—Histopathological features of a plantar wart. Great increase in horn (H); hypertrophy of epithelium and rete pegs (E); elongated papillae containing capillaries (P); cells in the Malpighian layer containing eosinophilic granules and masses in the protoplasm (I); dense deeply staining nuclei containing inclusion bodies, the cell bodies being degenerated and ballooned (N). These cells can be traced through the horn. (Drawn by Miss A. Gretener, of the Institute of Dermatology, University of London.)

FIG. 2.—Crystalline particles from inclusion bodies. ($\times 40,000$). (M. J. Strauss, H. Bunting, and J. L. Melnick, *J. invest. Derm.*, 1950, 15, 433. Reproduced by kind permission.)

brown or black crusted mass, bleeding easily and raised from the surface. (See also Refresher Course article by Dr. H. Gordon on "Cancer of the Skin," published on August 11, 1951.)

Indications for Treatment

Plantar warts in children often subside spontaneously. It is difficult to give an accurate figure for this, but at least 25% will disappear over a period of observation of one year. Even in adults this may occur after two or three years. One could therefore delay treatment in certain cases.

What then are the indications for active therapy? Children may not be allowed to take part in some school activities because of the risk of infecting others. The wart may be painful and lead to disability in walking or playing games. When the wart increases in size and new warts appear, spontaneous healing may be too long delayed.

The aim of any treatment of warts on the feet is that it should be speedy, giving the minimum of pain and disablement. Further, no treatment should be advised that is apt to damage the underlying fibro-fatty tissue to any significant extent and lead to scarring or ulceration.

Single or multiple warts in children, with the features of virus warts, will respond to treatment on any of the lines to be discussed, but the dry, multiple, or mozaio wart of the adult or elderly patient can be resistant and calls for the exercise of the utmost therapeutic ingenuity. The method of treatment chosen will depend on the age of the patient, the type and number of the warts, and the time available.

In a child, when the wart reacts with a considerable inflammatory response it is well to wait four weeks before repeating

FIG. 3.—Plantar wart ($\times 6$) in a child of 9 years, showing the sharp border and interruption of the normal pattern of skin ridges. (From the Photographic Department, Guy's Hospital, London.)

treatment. If successful, the wart will have separated away or be easily lifted off. The epidermis beneath is thin and pink but will soon regain a normal colour and thickness. If no relapse occurs within a month, cure may be assumed. In adults it is wise to wait at least two months before the patient is discharged.

Suggestion

Treatment by suggestion includes buying the wart and burying the coin; applying plants, weeds, and meat, the suggestion being that the living content of the wart is thus transferred. The wide range of agents used has led to the view that suggestion alone will be adequate. The visit to the doctor itself and the act of inspection also suggest strongly to the patient that relief of the warts will be obtained. A plantar wart in a child may involute in the interval between the first inspection and a subsequent visit for treatment. Warts have also been successfully treated while the patient is in the hypnotic state.

Occlusive Strapping

Simple occlusion of plantar warts by strapping carried around the foot and pressing on the wart may be successful. The strapping should be changed every two weeks and the macerated horn and wart substance pared down. D. A. Duthie and D. I. McCallum have recently reported that in 60% of a series of 90 warts so treated the substance of the wart could be removed within one to three months, with cure. They also combined this method with the application of podophyllin in oil.

If the strapping gives rise to irritation of the skin it should be removed and not reapplied, for a strapping dermatitis may extend very widely beyond the original areas of contact.

Freezing

Most plantar warts are treated by physical or chemical agents which damage or destroy the epithelial mass and provoke inflammatory reaction in the skin around.

Freezing with carbon-dioxide snow is a popular, safe, and convenient method. For a small wart or group of warts the stick prepared in the "sparklet" apparatus is adequate; if the wart is larger it can be frozen in segments by the small stick, or a larger stick can easily be prepared. For this the snow is collected from the escaping nozzle of the carbon-dioxide cylinder in a chamois-leather bag and hammered down firmly into a boxwood or plastic mould selected to the size of the wart to be treated. After the horn over and around the wart has been pared down the carbon-dioxide stick is firmly applied, and the wart and the surrounding skin become white and hard. The time of application depends on the size and depth of the wart: from one to three minutes is adequate. With the longer exposure a blister may form within 24 hours. If this is large and uncomfortable it can be snipped in four days, and in many instances the wart riding in the roof of the blister can be detached and the wound dressed. Healing is rapid, with a minimal amount of scar. If blistering has not occurred and after three weeks the wart has not shown any sign of early separation, the snow can be reapplied. There is no contraindication to four or more applications if there is a minimal response in adults. This treatment can be used with confidence for children, in whom the cure rate is 90%; in adults it is 50%.

Liquid oxygen is another convenient agent for freezing plantar warts in the clinic. The temperature of liquid oxygen is -182°C ., 125°C . lower than that of carbon-dioxide snow. It is supplied in a vacuum bottle and applied on a wool-tipped applicator for periods of 20 to 40 seconds, depending on the size of the wart, until the latter has been well frozen.

Escharotics

The chemical necrotizing agents in common use are salicylic acid, monochloroacetic acid, nitric acid, saturated silver nitrate solution, and the silver nitrate stick. The more

penetrating substances such as monochloroacetic or nitric acid should be used with great caution.

Salicylic acid is used in the form of a 40% plaster cut to the shape of the wart, applied for seven days and then removed. After the macerated horn has been scraped away the irregular and papilliferous mass of the wart will be exposed. The applications are repeated at weekly intervals, and the necrotic epithelium is removed until the granulating cutis is eventually exposed.

Other caustics are used in a similar manner, the period between treatments being determined by the depth of the necrosis. If pain is severe the caustic application should be removed and the area bathed with a mild antiseptic lotion, such as 1% cetrimide or potassium permanganate 1:2,000. Any fluid or pus under the wart should be released and a bland boric ointment applied. There is a definite risk of scarring if caustic applications are allowed to damage the cutis to any degree.

Formalin

A much safer method than the use of escharotics is to fix the cells of the wart with formalin. The wart-bearing area of the foot is soaked in 3 to 5% formalin in a shallow dish for 10–15 minutes once or twice a day for three to six weeks. The only discomfort is dryness and irritation of the skin, but treatment must be stopped if there is any evidence of formalin sensitivity. Soaking in formalin is also to be recommended for multiple or mosaic warts.

Podophyllin

Podophyllin resin is also an effective and safe remedy for plantar warts. It has a selective action on the nuclei of the cells and in a 10–25% solution or suspension in oil produces necrosis of the epithelium. The horn is pared off the wart and the podophyllin suspension in oil applied; it is prevented from spreading laterally beyond the wart by a ring of strapping, and, finally, a covering of strapping is placed on top. Contact with the oil is allowed for 24 to 48 hours, depending on the rapidity of the epithelial necrosis and the discomfort. The soft white epithelium is then scraped away and the treatment repeated every one or two weeks. After 8 to 10 weeks the bulk of the wart will have been removed, leaving a granulating base of cutis. If excessive, the inflammatory reaction should be treated as indicated above.

Surgical Removal

Surgical removal of a wart is rapid, but the injection of a local analgesic into the foot is painful. Excision of a wart should not be done if a pressure area is involved, because the scar will have to bear weight and may be painful. Should there be a recurrence *in situ*—and this may happen particularly in adults—further treatment will be apt to increase the extent of the scar. Scarring is minimal when plantar warts are removed with a curette, and in an adult with numerous warts this is often the method of choice. It can be carried out under a local analgesic, but a short general anaesthetic may be required. The wart is outlined by an incision in the collar of horn and is readily removed with a sharp spoon from the depression in which it lies. The overhanging horny collar may then be trimmed with scissors. Healing is rapid, within a few days, under a simple antiseptic dressing. The results are good, and treatment can safely be repeated if relapse occurs, as it may do even after several months. This is also a safe method for the dry and mosaic wart, which is outlined by the knife-point and carefully and thoroughly scraped away.

Cauterization.—The galvano-cautery can be used to coagulate a wart, and the charred tissue scraped away with a curette. It is doubtful whether this method is any more effective than simple curettage.

Radiotherapy

The use of x rays or radium is the treatment preferred by many dermatologists because it is painless and the patient

is able to continue his normal activities. About 50% are cured with an x-ray dosage of 400 to 600 r, and this is a safe dose to give. Some dermatologists and radiotherapists give up to 1,500 r, but there are warts which are resistant even to this dosage, particularly the dry and hyperkeratotic type in adults. Attempts to cure them with x rays may lead to persistent radio-atrophy or even ulceration. In my view x rays or radium are never indicated in the treatment of children or young adults. Their skins are vulnerable to x rays and they have longer to live, so that there is more opportunity for late permanent atrophy to occur.

Thorium X, which emits most of its energy as alpha particles, is much less likely to cause damage to the deeper tissues. The dosage used has been 2,000 electrostatic units per ml. of collodion, applied at intervals of three weeks for a maximum of four applications. The preliminary removal of horn before each application is important, as the horn has a screening effect. Thorium X has been found to be most useful in the treatment of adults or the elderly when the warts have not responded to caustics, freezing, or to surgical measures, and should be limited to these cases.

There remains the recalcitrant adult case in which treatment by caustics, surgery, and radiation has failed. These patients have been unable to develop any immunity to the wart virus, and it may be worth trying to stimulate antibody production by the use of a wart virus vaccine.

Conclusion

It must be emphasized that the successful management of warts of the feet depends on the ability to make an accurate diagnosis based on careful dissection of a suspected area. If the wart does not respond to therapy which is safe and non-mutilating, it is best to forbear. Discomfort can be relieved by paring the horn and the application of felt or padding.

Next Refresher Course Article.—"Clinical Assessment of Backache," by Mr. J. G. Bonnin.

LOYAL ADDRESS FROM THE B.M.A.

The Secretary of the British Medical Association has sent the following Loyal Address to the Home Secretary for transmission to the Queen:

TO THE QUEEN'S MOST EXCELLENT MAJESTY

*The Humble Address of the President and Members
of the British Medical Association*

MAY IT PLEASE YOUR MAJESTY,

We, Your Majesty's dutiful and loyal subjects, the members of the British Medical Association distributed throughout Your Majesty's Commonwealth and Empire, beg leave to express our deep sorrow at the heavy affliction that has fallen upon Your Majesty, Her Majesty The Queen Mother, and the other Members of the Royal Family by the death of our beloved Sovereign, King George, Patron of the Association.

We beg Your Majesty to be pleased to accept our loyal congratulations on Your Majesty's Accession to the Throne. We pray that Your Majesty's Reign may be long, illustrious, and blest with peace, and we humbly offer to Your Majesty an assurance of our high regard and affection and our unfailing fidelity to Your Majesty's Throne and Person.

Signed on behalf of the British Medical Association,

A. W. S. SICHEL,
President.

E. A. GREGG,
Chairman of Council.

S. WAND,
Chairman of Representative Body.

A. M. A. MOORE,
Treasurer.