Amputations in Peripheral Vascular Disease*

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(Editor's Note: The major part of this article is reprinted by permission from the Journal of the Medical Society of New Jersey. For this reprinting, Dr. Schmukler has expanded the section on "Prosthesis").

Until the cause of organic occlusive vascular diseases is definitely established, and prophylactic measures taken to prevent them; until lipid metabolism can be controlled to prevent atherosclerotic plaques from adhering to the intima of arteries; until thrombosis and embolism can be prevented and it will be routine to excise arterial segments and replace them with homografts or plastic tubular substitutes; until all this happens, peripheral vascular specialists will be continually confronted with the problem of rescuing "medical" therapeutic failures. These failures result in slow progressive ischemia and eventual death of tissues, with or without secondary infection intervening. Instances of sudden onset of gangrene of an extremity result from an acute occlusion, either thrombotic or embolic, in which embolectomy may sometimes, but not always, prevent mortification of the tissues.[1]

Whatever the cause, the development of gangrene in an extremity necessitates its removal, early or late, in part or in whole. Proper procedure in amputation surgery will spell the difference between success or failure in the treatment of these medical therapeutic inefficacies, and is the subject of this paper.

DIAGNOSIS

The various occlusive diseases associated with the occurrence of gangrene are:

1. Arteriosclerosis and atherosclerosis, with or without diabetes
2. Thrombo-angiitis obliterans
3. Embolism or thrombosis
4. Polycythemia vera

The gangrene which results from any of these causes may be slow or rapid, localized or extensive, with or without infection. The extent of gangrene encountered will influence the type of operative procedure.

Gangrene is most frequently associated with the metabolic diseases of arterio and atherosclerosis.[2] Both diabetics and non-diabetics survive to an age when they may develop occlusive vascular disease in which gangrene can occur, necessitating surgical intervention. Ischemia is the common denominator for all of these conditions. No single method of effective treatment for the occlusive vascular diseases has, as yet, been discovered and spontaneous complications are not controllable.[3] Two-thirds of all amputations are due to the progress of the disease itself. The other one-third can be ascribed to the neglect of the patient and the treating physician in equal measure.

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The patient is culpable when he disregards the importance of diabetic control, neglects the care of his feet, uses local escharotics, fails to wear properly fitted shoes, is derelict in the treatment of burns or minor accidents and ignores the warning symptoms of impending gangrene.[4] The physician errs when he fails to establish a diagnosis, tenders improper treatment and employs poor technic in doing minor amputations.

Arteriosclerosis is predominantly a disease of males. When, however, diabetes is associated with the arteriosclerosis, a higher proportion of patients will be found among females.

Patients who rarely develop gangrene will complain of symptoms for a longer period than those who are destined to develop gangrene with subsequent amputation. In these prospective amputees, gangrene occurs shortly after the onset of disease. This may be due to the fact that they suffer a more progressive form of the disease with a hastening and telescoping of the symptoms.[5]

Calcification of arteries does not necessarily bear any relation to the presence or location of an arterial occlusion. Seventy-five to ninety per cent of the blood supply to an extremity may be lost without impairment to normal activity because of the presence of adequate collateral circulation. It is only when there is greater need for an increased amount of blood that the diseased state of the extremity becomes evident.

Buerger's Disease is now more frequently found, both in males and females, due to the increased use of tobacco.[6] The gangrene of Buerger's Disease may involve the upper as well as the lower extremities. Major amputations of the upper extremities are rarely found necessary, though individual finger amputations frequently are. Because Buerger's Disease is essentially a disease of the comparatively young, conservative therapy is advisable, unless the physician encounters a fulminating gangrene with extremely severe pain.

Spontaneous acute thrombosis of a major artery is most commonly found as a complication of arteriosclerosis obliterans. This complication may be due to the rupture of an atheromatous abscess or a spontaneous subintimal hemorrhage. Onset is acute and may produce complete obstruction of a major arterial pathway. The extent of the resultant gangrene will depend on the presence of collateral circulation. Acute thrombosis of an artery may also be encountered in polycythemia vera due to the alteration in viscosity of the blood with increase of the cellular elements.

An acute arterial embolus produces the same clinical result, that is, gangrene. The source of the embolus is centrally located as in arteriosclerotic heart disease or mitral stenosis associated with auricular fibrillation. Emboli are always lodged at an arterial bifurcation, whereas thrombosis may occur in any portion of an artery. Correct diagnosis here is of primary importance because embolectomy is a surgical emergency in this type of occlusion.

PRE-OPERATIVE CARE

The greatest progress in the management of peripheral vascular problems can best be achieved by a group of physicians and surgeons who are essentially interested in this specialty.[7] They should work as a team and be willing to devote the required time and care to the treatment of their patient. Standardization of therapy would be advantageous both to the physician and to the patient. Though painstaking, without glamor and often frustrating, these problems must be an essential consideration of the medical profession because of the ever greater needs of an ageing population.

The prognosis of a patient suffering from gangrene associated with

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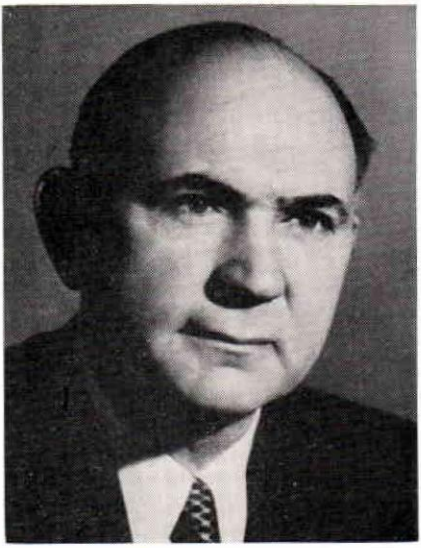

other debilitating diseases is, as a rule, not good. Associated diseases encountered in these patients of middle or old age are diabetes, heart disease, hypertension, cerebrovascular disease, cancer, polycythemia, malnutrition and anemia.

An attempt should be made by the internist of the team to correct, if possible, some of the associated maladies pre-operatively. With the use of antibiotics and anticoagulants, one can be more courageous in the surgical handling of these cases with a substantial reduction in the incidence of major amputations. Delay in possible and conservatism is indicated while the patient is being rehabilitated by transfusion and other necessary medications. Such a conservative course of action could not be advocated before the advent of antibiotics. Since these drugs have become available, the site of amputation and the mortality rate have both been lowered.

OPTIMUM TIME FOR OPERATION

The optimal amputation time varies in each individual and no hard and fast rules can be laid down. Factors, such as infection, vascular supply, age of patient and his response to therapy, are involved. The mortality rate is often lowered by a wise decision. Where infection is minimal and controllable, in Buerger's Disease, arteriosclerosis and in diabetes, ultra-conservatism is advocated. A necrotic toe should be permitted to demarcate. If infection spreads, then immediate amputation of an extremity may be a life-saving measure. In the embolic and thrombotic types of gangrene, amputation should be delayed from one to three weeks to allow time for demarcation and development of collateral circulation. Such a course of procedure is more feasible in cases of "dry gangrene". Amputation for pain can be performed at a time suitable to all concerned. Certainly no amputation should be performed due to the surgeon's impatience or the shortage of hospital beds. A patient's leg, on the scale of human values, will far outweigh a few extra days, weeks, or even months of conservative therapy.

Sympathectomy cannot affect the pathologic changes in the blood vessels nor the course of the underlying disease.[8] The increased blood flow in an extremity following the extirpation of the sympathetics is in the skin alone, and not in the muscles.[9] Sympathectomy is frequently done in the

hope that the results will have warranted the operation. I do not believe that sympathectomy, whether chemical or surgical, will ever hold an important place in the treatment of these conditions in view of the type of pathology present. However, if time should prove this operation effective, then it should be universally adopted. Its validity has not as yet been established.

AMPUTATION SITE

With antibiotics and with experience in treating peripheral vascular diseases, greater conservatism is exercised in choosing the site for amputation. In the lower extremity, the five suitable levels for amputation are: the individual toes, transmetatarsal area, supramalleolar area, below the knee and mid-thigh. The criteria for the choice will be the extent of gangrene or ulceration, the degree of infection, the condition of the adjacent areas, the measure of arterial impairment, the severity of the pain, and the general condition of the patient.[10]

1. *Single toe amputation* may be done for dry gangrene or an ulcer of the distal end with good demarcation. This is most suitable for 2nd, 3rd and 4th toes.

2. *Transmetatarsal amputation* with primary closure is indicated in gangrene limited to the toes. When infection is present, an open guillotine amputation at this level, may be attempted. If the gangrene spreads to the foot, a transmetatarsal operation is no longer feasible. This type of surgery should be performed whenever possible. The benefit to the patient, which should take precedence over all others is that the transmetatarsal amputee can walk comfortably without a prosthesis. This procedure is especially valuable in pathology affecting *both* lower extremities. It is the surgeon's responsibility to inform the patient before surgery that, should this operation fail because of insufficient blood supply, a below the knee amputation will be necessary.

3. *Supra-malleolar amputation* is done only as a life-saving measure in the presence of fulminating infection or severe associated diseases such as carcinoma. There is no shock. The operation time is short. A more definitive type of amputation can be performed later.

4. *Mid-leg amputation* should be done whenever possible if there seems a reasonable chance for healing. Age is no contra-indication. Mortality is considerably less than in mid-thigh amputation. A knee joint is a valuable possession. This operation should be attempted even with an absent popliteal pulse if there is good collateral circulation. Among older patients, many more can, and do, wear a "below-the-knee" prosthesis rather than an "above-the-knee" false leg. Mastery of such a prosthesis is easier and it weighs less. This is an important consideration with cardiac and hypertensive patients and in those with bilateral amputations, because it avoids total invalidism.

5. The three major indications for *thigh amputation* are (1) extensive gangrene plus infection of the leg with absent femoral pulse; (2) gangrene of the foot associated with the flexion contracture of the knee joint; and (3) recent thrombosis or embolism of the femoral or iliac artery with a high level of gangrene. Although primary closure with healing is better at this site, it carries a high mortality rate and should be avoided whenever possible.

PSYCHOLOGIC PRE-CONDITIONING

The average patient is apprehensive about surgical procedures in general. He faces the loss of limb with considerably more fear, grief, and anxiety. A common reaction is: "I would rather die than lose a leg." A patient chronically ill with this disease has already spent years trying to save his leg. By the time such surgery becomes necessary, his

morale has tail-spinned, his physical stamina is low, and his financial means and feeling of security have been considerably diminished. Such a patient fears to face the future socially and economically. He is in dread of becoming a burden to himself and his family. Reassurance is not enough. The patient must be given a clear picture of his disability and future adjustment. If presented properly, and if the occasion is provided to meet amputees who are not only ambulatory but useful, the surgeon is able to convince the patient and gain his cooperation. This is an unglamorous task, but it is a necessary one. Amputation should never be performed without the patient's knowledge, unless as an emergency life-saving measure. The emotional shock is of lesser magnitude when the patient has been properly prepared before, rather than after an amputation.

ANESTHESIA

Anesthesia plays a great role in the care of the emotionally shocked and physically degenerated patient with occlusive vascular disease. General anesthesia is not recommended in these patients because of its pulmonary and embolic complications. Local anesthesia constricts the small vessels when the tissues are infiltrated by the injection material. Refrigeration anesthesia is now used only in debilitated patients with severe sepsis, disorientation and lack of diabetic control, as an emergency measure. The perfected, one-leg, low spinal anesthesia is best for amputation.

TECHNIC

The classical amputations are not done in peripheral vascular disease because of the patient's age and physical condition and because of the underlying vascular deficiency of the extremities.

Healing depends on adequate circulation, so that whatever pre-operative diagnostic technics have been used to determine the adequacy of the circulation, the ultimate decision as to the site of operation, will be the presence of bleeding at the point of incision.[11] Bleeding is the best direct measure of collateral circulation. The normal pink appearance of the muscle is another indication of tissue viability. A greyish "cooked" appearance alerts the surgeon to the realization that there will be further spread of gangrene. Therefore, if a "below-the-knee" incision is made and there is insufficient evidence of bleeding, the surgeon must then go to a higher level below the knee or to the middle or upper third of the thigh. *Flaps should never be made.* The skin must not be separated from the underlying fascia. A circular guillotine incision has proved to be the best. Even "dog ears" should not be excised, for gangrene, of the skin may result at these points. The femur, tibia and fibula should be cut short enough to allow for subsequent soft tissue retraction. The sharp anterior surface of the tibia at its lower edge, being subcutaneous, must be roundly bevelled to avoid subsequent prosthesis pressure.[13] Large nerves, like the sciatic should be injected with 1 per cent procaine before high sharp sectioning to avoid shock to the patient. The retraction of the nerve end above the wound will help to prevent neuroma and phantom pain. This serious post-operative complication occurs more frequently in "above-the-knee" than in "below-the-knee" amputations. To close the wound edges, sew only the skin and fascia with thin black silk or stainless steel wire, gently approximating the edges without instruments and without tension. If in doubt as to healing by primary closure, the wound is best left open to heal by secondary granulation. A posterior splint is always necessary in "below-the-knee" amputations to prevent flexion contractures of the knee joint. For "below-the-knee" amputations, the best operation position is with the patient on his abdomen. Always expose and examine both legs before

beginning the operation, to avoid any tragic consequences.

"POSTOPERATIVE CARE"

The same teamwork which characterized the pre-operative care on the part of the internist and the surgeon, is necessary for the successful postoperative care of the patient. Immediate medical attention is necessary to avoid complications which may ensue as a result of the associated pathologic findings. Supportive therapy is essential for proper postoperative treatment.

Surgically, the wound is not disturbed for 7 to 10 days unless there is a systemic reaction. If Parresine® mesh is used directly on the wound, there will be no adherence of the dressing to the skin or the exposed muscles in an open guillotine operation. Sutures are removed a few at a time, and if no wound tension is present, may be permitted to stay in longer. The patient should be put in a wheel chair one day after the operation, and if there are no contra-indications, he should be exercised in a walker shortly afterwards. It is not wise to hasten stump revision in the presence of skin necrosis along the suture line. Given time it will heal.

Instructions should be given to the patient for active contraction of the quadriceps muscle in a "below-the-knee" amputation, and the side to side movement of an "above-the-knee" stump. The posterior splint in a "below-the-knee" amputation should be removed only when there is no longer any tendency for flexion contracture of the knee. When the stump is healed, shrinking and conditioning for fitting a prosthesis is to be begun by the proper use of ace bandages.

In the meticulous attention paid to the operation site, the other leg is frequently forgotten. The increased pressure exerted on the bed by the heel of the remaining foot can cause pressure necrosis which can spread rapidly, necessitating a second amputation. A foam rubber sheet placed under that heel will prevent such pressure necrosis. *A cut down on the remaining foot for transfusion or intravenous therapy should not be permitted.* Such procedures have often caused spreading gangrene at the site of the cut down incision, with dire consequences.

REHABILITATION

The surgeon's task is not completed with the healing of the stump. Rehabilitation is important and should not be overlooked.[13] The aid of the family and all persons who come in close contact with the patient should be enlisted. Rehabilitation will lighten the postoperative care of the amputee. The patient should be assured that he is not going to be helpless. He should be encouraged to use crutches and make his own toilet. The younger patient should be urged to return to his job, and hobbies offered to the man or woman who is too old to work. This will help neutralize the shame and depression which these patients feel because of their helplessness.

If family circumstances do not permit this type of rehabilitation at home, the amputee should then be sent to a rehabilitation center, where he will be cared for by professional personnel and will have the opportunity for group training.

PROSTHESIS

It behooves the surgeon to familiarize himself with the problems of prosthesis. The best way is to visit a limb manufacturing establishment and observe how the limbs are made and fitted. Limb makers should be cautioned about undue pressure during stump conditioning and subsequent weight bearing. Limbs are made of willow wood or light metal. In peripheral vascular disease, fit and the avoidance of pressure are the important things. In a "below-the-knee" prosthesis, fifty per cent of the weight is borne by the thigh lacer or corset. The other fifty percent of the weight

bearing is on the internal condyle of the tibia, the tibial tubercle and the head of the fibula. The skin over these bony prominences is not biologically fit for weight bearing and may break down. In all "above-the-knee" prosthesis, 75 per cent of the weight is borne by the ischium and 25 per cent on the circumferential skin and soft parts of the stump. Stump socks cushion the pressure also, as well as the shock of walking. In spite of these precautions, increased pressure and impaired circulation of the stump in these cases cause a breaking down of the tissues with a spread of gangrene, sometimes necessitating stump revisions.

The Middle-Aged or Aged Amputee

The importance of proper communication between surgeon and limb maker cannot be over estimated, especially since the number of amputations among the geriatric segment of the population has augmented itself and is on the increase with each passing year.

One rarely hears or reads a discussion of the needs of the middle-aged or aged amputee. This paper affords the opportunity of presenting the problems and suggesting treatment for this oft neglected part of our amputee population. The following observations have been gleaned from the experience of handling such patients over a period of many years.

The amputee population of the aged carries with it formidable social, medical, economic and rehabilitative difficulties for the family, the vascular surgeon and the limb maker which may be considerably eased if the attending surgeon and the limb maker understand each other's problems.

The limb maker must realize that he is dealing with a human being and not merely an amputation stump. Every individual reacts differently to a catastrophe and amputation of an extremity comes within this category. The type of patient reaction is influenced by hereditary and environmental factors as well as by the idiosyncracies of advancing age.

THE CERTIFICATION BOARD

The great number of military amputees resulting from the holocaust of World War II has done much to establish better rapport between the physician and the prosthesis agent, as did the establishment, in 1946, of a central body which represented the ethical artificial limb shops in the United States (the American Board for Certification). Before this time, the industry had no uniform standard of ethics and no training program. Its relation with medicine and the public was therefore haphazard. This chaotic condition was remedied by the formation of a recognized organization whose members are adequately trained and certified.

Such training and certification promises the amputee greater and more efficient service. The individual limb maker recognizes that his responsibility does not end with the fabrication and sale of the limb. His service must be coordinated with that of the surgeon before and after the operation. The task continues until the satisfied client is properly fitted, trained in the use of the limb, adjusted mentally through intelligent handling and advised about the new problems which face him.

In fairness to the conscientious limb maker of the past, all the faults were not his own. General surgeons were interested primarily in the operation and the physical recovery of the patient. Amputations were rarely performed with the prosthesis in mind, nor was any interest shown in the prosthesis which followed. Surgeons knew little or nothing of the method of fitting, the types of material used or the many other problems which faced the limb maker. Because of lack of cooperation between surgeon and limb maker and no "follow-up" to insure a successful physical and mental acceptance of the

problem, the patient was bound to be the sufferer.

With the development of Peripheral Vascular Disease as a specialty, the situation has been greatly improved. The vascular surgeon is now aware of the underlying pathology and the vascular status of the extremities. The stump is now fashioned with the prosthesis in mind in which length is considered and the resulting incisional scar is properly placed. The bones are not left too long and the sharp anterior edges of the tibia are roundly bevelled in a "below the knee" amputation. The surgeon's knowledge extends beyond the bounds of surgery and he interests himself in the after care of the stump, weight bearing, muscle exercises and the prevention of joint contractures. He is also concerned with the types of materials used in the manufacture of artificial limbs, the construction, component parts, various socket types, weight distribution, proper fit and principles of ambulation. This knowledge mediates toward mutual understanding and respect between surgeon and limb maker which results in the proper evaluation of problems of a particular patient while under treatment.

It should be noted that former principles and attitudes held by limb makers in the fitting of young amputees must be discarded in the handling of, and providing for geriatric peripheral vascular disease stumps. This large group of older patients is neither physically nor psychologically the same as the younger age group.

In these patients, the underlying diseases, such as arteriosclerotic peripheral vascular disease, diabetes, heart disease, etc., must be adequately controlled by the attending physician in order for the amputee to be able to use the prosthesis. One of the most important considerations should be the preservation of the remaining limb, which is usually involved in the arteriosclerotic process. This necessitates suggestions for intelligent foot hygiene as well as a properly fitted shoe made of soft leather.

Gentleness in handling tissues is of paramount consequence. Rough handling of a stump by massage should be avoided. Ace bandages must be gently applied to avoid embarrassing the local circulation. Exercising of the stump with weight lifting is almost always contra-indicated. The stump must not be exposed to extremes of heat or cold, and strong chemicals or medicaments.

Proper fit of a prosthesis is the major consideration. Height, weight, age and occupation of the patient must all be evaluated. Prosthesis should be cosmetically appealing to the female amputee. Knee lock is essential for "above the knee" prosthesis. An ischial bearing thigh corset is advised for short "below the knee" stumps. A rubber liner is best for sockets to avoid pressure over the unphysiologic weight bearing areas with resultant ulceration and necrosis. Pain in a stump may not always be due to socket fitting, but to vascular insufficiency.

The materials used in the construction of the prosthesis are of relatively small importance. The lightest material available is recommended. Because of age, general debility and altered physical activity, the strength and durability of the material are also of minor consequence.

The patient is more cooperative when the limb maker evinces an attitude of sympathetic understanding. It is the limb maker's responsibility to explain the simple mechanics of use and the ease of making simple repairs. Progressive stump shrinkage and the proper and hygienic use of stump socks should be described. The need for new sockets when chafing of tissues and instability occurs, should be advised. Servicing and repair of limbs is necessary and remunerative, and patients should be encouraged to seek the advice of the original limb

maker. Frequently, patients have been mistreated and are forced to seek services elsewhere. On occasion a second limb maker, by innuendo, infers that the limb needing adjustment has not been properly made and suggests a new one, when only a few minor repairs are necessary on the limb already owned by the patient. This does not lead to better understanding or respect for limb makers by patients or physicians.

Visual aid and demonstrations by limb makers themselves, if they are amputees, or by other clients is a good emotional support for a new amputee. The patient requires reassurance, encouragement and understanding. It should not be expected of a new amputee to learn the use of a limb without training. This is especially important in the aged, whose amputations are frequently associated with other medical and surgical ailments. The leg amputee must acquire reasonably good balance in both limbs before taking a step on the prosthesis. The final step is the training and use of the limb in the routine pursuits of life, which in the geriatric group is circumscribed, since even before amputation, there was a decrease and slowing down of life's activities.

Vascular surgeons have the responsibility of showing their ageing amputees the way to be useful members of society. The best way to achieve this goal is by cooperation between surgeon and limb maker.

PREVENTING AMPUTATION

The specialty is no longer limited to amputation but includes the following procedures:

1. Aortography and arteriography for diagnosis
2. Embolectomy in acute occlusions
3. Arteriectomy and thrombo-endarterectomy
4. Substitution surgery with homografts, veins and tubes made of plastic materials.

It may be within the realm of possibility substantially to reduce the number of major amputations because of the progress of both research and surgery in the peripheral vascular field.

100 AMPUTATIONS

Personal experience with one hundred amputations reveals the following statistics, which follow the pattern of those reported in the current literature. The age range was 36 to 84. Average age was 66. Of the 100 patients, 41 were female.

CAUSES

48 Arteriosclerosis
33 Arteriosclerosis with diabetes
3 Buerger's disease
8 Embolus
7 Thrombosis
1 Polycythemia

SURGERY

21 Mid-thigh
54 Mid-leg
11 Transmetatarsal
14 Individual toes
28 Open
72 Closed
10 Bilateral
6 Revisions

CONCLUSION

Amputation surgery in peripheral vascular disease is on the increase because the metabolic diseases have become more prevalent in an ageing population.[14] The very presence of gangrene and the necessity for amputation is an admission of defeat by the angiologist. Advances in vascular surgery, the use of antibiotics and anticoagulants have decreased the mortality and morbidity and have enabled the surgeon to be more conservative in his choice of incision site and the optimal time for operation.

Sympathectomy is not now the answer to the problem. Of much greater import is correct early diag-

nosis, proper pre- and post-operative care, psychologic preparation of the patient before operation as well as post-operative rehabilitation. Conservatism in treatment, and type of amputation depending on the condition of the patient, the extent of infection, and the reserve vascular supply, are the paramount considerations.

Vascular surgeons have the responsibility of showing their ageing amputees the way to be useful members of society. With a proper prosthesis, they need not exist as helpless maladjusted human beings. It is the hope of all vascular specialists that the progress in surgery and research in the field of peripheral vascular disease will lead to a reduction in the number of major amputations which are now memorials to "medical" therapeutic failures. It is also our hope that more physicians will devote themselves to the treatment of these diseases because, only if the number of specialists is augmented, can the increased number of patients involved, expect and receive, adequate medical and surgical help.

BIBLIOGRAPHY

1. Pratt, Gerald H.: Cardiovascular Surgery, Philadelphia, Lea and Febiger (1954)

2. Allen, Barker and Hines: Peripheral Vascular Disease, edition 2, Philadelphia, W. B. Saunders (1955)

3. Lefevre, Fay: Management of Occlusive Diseases of the Extremities, J.A.M.A. 147:1401 (Dec. 8, 1951)

4. Edwards, E. A., McAdams, A. J., Crowe, C.: Events Leading to Major Amputations in Patients with Arteriosclerosis, New England Journal of Medicine 249:514 (July-Dec. 1953)

5. DeBaky, M. E., Creech, O., Woodhall, J. P.: Evaluation of Sympathectomy in Arteriosclerotic Peripheral Vascular Disease, J.A.M.A. 144:1227 (Dec. 9, 1950)

6. Collins, W. S., Wilensky, N. D.: Peripheral Vascular Disease, edition 2, Springfield, Illinois, Charles C. Thomas (1953)

7. McLaughlin, C. W., Jr., Weedman, J. W.: Infection and Gangrene in the Diabetic Extremity, Nebraska State Medical Journal 35:316 (Oct. 1950)

8. Julian, O. C.: Surgery of the Sympathetic Nervous System with Special References to Vascular Disorders and Painful States, Surgical Clinics of North America, Philadelphia, W. B. Saunders (1954)

9. Wessler, Stanford: Clinical Progress, Intermittent Claudication, Circulation 9:806 (May 1955)

10. Silbert, S., Haimovici, H.: Criteria for the Selection of the Level of Amputation for Ischemic Gangrene, J.A.M.A. 155:1554 (Aug. 28, 1954)

11. Smith, H. G.: Amputations Above or Below Knee for Primary Peripheral Vascular Disease, The Journal of Bone and Joint Surgery 32B:392, British Edition (1950)

12. Fletcher, J., Ruben, H. B.: Conservative Amputation in Arteriosclerotic Obliterans, California Medicine 76:389 (January 1952)

13. Kessler, H. H.: The Principles and Practices of Rehabilitation, Philadelphia, Lea and Febiger (1950)

14. Menendez, C. V., Linton, R. R.: Peripheral Vascular Disease, New England Journal of Medicine 251:382 (Sept. 2, 1954)

WHAT'S NEW(S)

An Electric Cast Cutter, developed in England, has been introduced in this country by the *Orthopedic Equipment Company of Bourbon, Ind.* Paul Leimkuehler, who has used it, passes on the word that this cast cutter works very well in cutting fibreglass plastic such as used in artificial arms, and in some cases sockets and shins on artificial legs. Paul reports that in the past he has used saws of various types and none of them were nearly as fast or as easy as cutting the plastic with this cast cutter.

• JOSEPH E. TRAUB, C. P., has resigned as Chief of the Prosthetic and Orthopedic Service of the University of Buffalo's Chronic Disease Institute. He has accepted a position with the Lanham Limb and Brace Company of San Bernardino, Calif.