

# The Geriatric Amputee

ROBERT MAZET, JR., M.D.<sup>1</sup>

The geriatric amputee not infrequently suffers from debilitating diseases other than the one which caused his amputation. These affect his prognosis for life, for retention of his other leg, his ability to use a prosthesis, the performance of activities of daily living, his participation in social affairs, his ability to work, and often his finances.

Does the elderly amputee live as long as a nonamputee of similar age? Do diabetic amputees die sooner, do they lose the opposite extremity more often, than nondiabetics? Which amputees will use a prosthesis? To answer these and other related questions the Amputee Clinic Teams of the Los Angeles County General Hospital and the Veterans Administration Hospital reviewed 1,770 geriatric patients who, during a ten-year period, became lower-extremity amputees at or above the ankle. We have more recently studied 110 patients who were initially ambulated on preparatory prostheses at the Veterans Administration Hospital. From these studies criteria for probable successful performance on an artificial leg have been derived. Also evolving from these criteria are the procedure employed in the selection of amputees for prosthetic prescription, the training program followed by the Los Angeles Veterans Administration Hospital Amputee Clinic Team, and the development of a special type of prosthesis for a small but worrisome group of patient?.

The combined County and Veterans Hospital study disclosed that the geriatric amputee is more likely to die during the year immediately following his amputation than his nonamputee counterpart (Fig. 1). At the end of a year 94 per cent of the otherwise-comparable general population were living, while only 67 per cent

of the VA patients and 55 per cent of the County patients had survived. However, if the amputee does not succumb during the initial critical year, he has essentially the same probability of survival as the nonamputee.

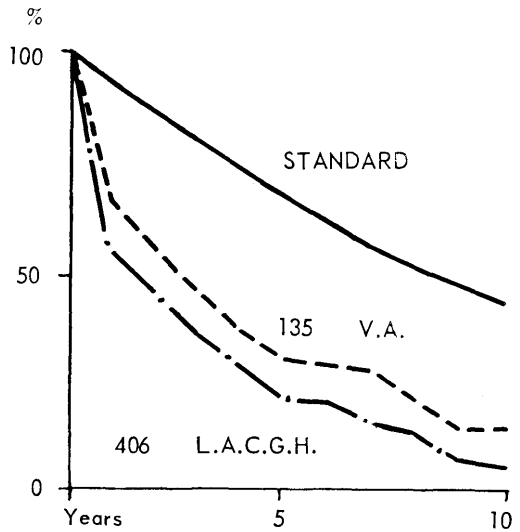


Fig. 1. Survival of geriatric amputees as compared with that of the general geriatric population. The survival rate of the general population over 55 years of age is shown by the solid curve, that of the VA amputees by the broken curve, and that of the Los Angeles County General Hospital amputees by the dot-dash curve. The curve marked "standard" represents a population comparable on the basis of race, sex, and age to the County patients. It is based upon mortality tables for the United States for the years 1949-1951 as given in *Vital Statistics of the United States*, U.S. Department of Health, Education, and Welfare.

The same study shows that the gloomy outlook propounded for the diabetic amputee is not justified. It will be noted that the survival rates for diabetic and nondiabetic amputees are equally good (Fig. 2).

The one area in which the diabetic is at a disadvantage is in the probability of loss of the

<sup>1</sup> Chief, Orthopaedic Service, Veterans Administration Center, Wilshire and Sawtelle Blvds., Los Angeles, Calif. 90073.

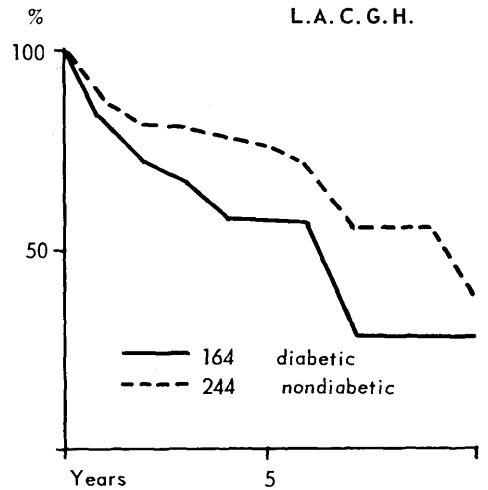
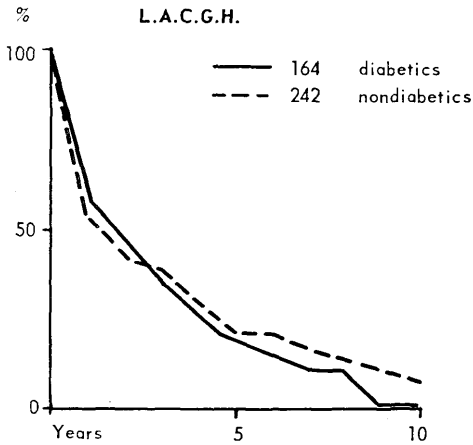
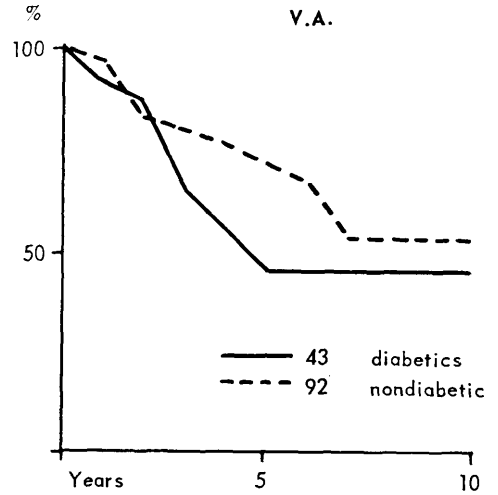
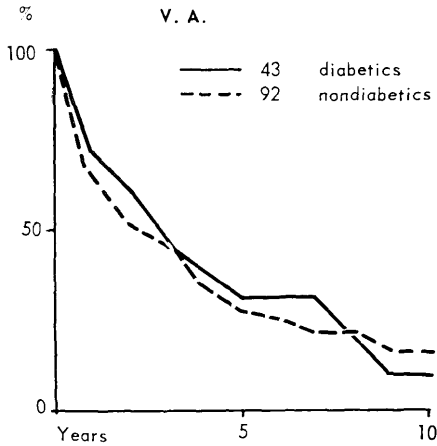


Fig. 2. Survival curves for diabetics and nondiabetics. *Top*, the VA patients. *Bottom*, the Los Angeles County General Hospital group.

Fig. 3. Survival of opposite extremity in diabetics as compared with nondiabetics. *Top*, the VA patients. *Bottom*, the Los Angeles County General Hospital group.

opposite leg. The diabetic is more likely to lose the second leg. Among the VA patients two years after amputation 18 per cent of both groups had become bilateral amputees, but five years later 28 per cent of the nondiabetics and 66 per cent of the diabetics had lost the opposite leg. Among the County patients 20 per cent of the nondiabetics and 28 per cent of the diabetics had lost both legs at the end of two years, and at the end of five years 28 per cent of the nondiabetics and 46 per cent of the diabetics were bilateral amputees (Fig. 3).

Many patients in the combined study who received prostheses did not use them for long. Sixty per cent discarded their artificial legs within six months. McKenzie (5) reported that

50 per cent of the geriatric amputees fitted at the British Ministry of Health's Limb Fitting Centre in Roehampton, England, discarded their prostheses within six months after leaving the hospital environment.

In our clinic it has been found that use of a temporary or preparatory artificial leg, for both above-knee and below-knee cases, is helpful in prognosticating the likelihood of prosthetic use by the amputee. These devices have never been popular in the United States. Kirk (2),

who used fiber sockets on jointless pylons, was for many years the only strong proponent of preparatory prostheses. Their helpfulness in hastening stump shrinkage was not generally appreciated. The vaulting or circumduction caused by a jointless above-knee pylon as long as the normal leg, or the gimp, with shift of center of gravity over the device in the stance phase if the pylon is made shorter, fostered poor gait patterns which were difficult to overcome after the patient received an articulated leg. There is some objection to such pylons on aesthetic grounds. They are not pretty. Furthermore, pylons for above-knee cases stick out in the aisle of a bus or theater, creating a certain amount of confusion and embarrassment to the wearer.

Our Canadian and English contemporaries were much more enthusiastic. LeMesurier in 1926 (3), Verrall in 1940 (6), and Key and Pennell (1) in 1958, strongly advocated pylons. Since the advent of various types of articulated temporary, or preparatory legs, they have enjoyed much wider use in our country. Today many clinics espouse them, particularly for above-knee amputees. Elephant boots, or stubbies, for bilateral above-knee amputees have been more generally accepted because their efficacy was usually unquestioned.

which will render the body incomplete. An artificial leg obviates the necessity of making such admission. Sometimes grandpa just wants something to fill the trouser leg as he sits in his wheelchair. Among some amputees the desire for a prosthesis is fear that without one they will appear at a disadvantage, be handicapped socially, or that they will be less able to carry on with their business, thus suffering financial loss.

We know that many amputees 55 years of age or older cannot use such a device. In the combined Veterans Administration-Los Angeles County General Hospital study the number of VA patients who received prostheses was small, as shown herein:

Ages 55-64	50
65-74	23
75-84	11
85+	0
Total	84 (of 450)

Of 267 patients who became amputees at the Veterans Administration Hospital during the period 1961 through 1964, 152 were not considered for prostheses, 38 were considered but not prescribed for (Table 1). Only 69 received permanent prostheses.

TABLE 1. 267 PATIENTS WHO BECAME AMPUTEES AT THE VA HOSPITAL DURING 1961-1964

	Amp. Level	Age at Amp.		Not Seen Amp. Clinic	Seen but No Prescription	Permanent Leg Given
		55+	54-			
Above-knee	177	153	24	118	25	34
Bilateral above-knee	30	27	3	12	9	3
Below-knee	41	26	15	14	0	27
Bilateral below-knee	8	5	3	3	2	3
Above-knee/below-knee	7	3	4	3	1	2
Hip-disarticulation	2	1	1	1	1	0
Knee-disarticulation/above-knee	2	1	1	1	0	0
Totals	267	216	51	152	38	69

Almost all recent amputees, regardless of age or condition of decrepitude, want prostheses. They are sure that if they just had an artificial leg they could walk. The reasons are several. Some patients are unable to alter the body image they have had for so long. They cannot acknowledge to themselves the loss of a part

#### REVIEW OF 110 CASES

We have recently reviewed 110 unselected cases in which the patient had been ambulated initially on a preparatory leg. Most of them were fitted in recent years, but two originally wore our 1948 model. All were followed and

examined a year or more after amputation. All amputations were at or proximal to the ankle.

#### SINGLE BELOW-KNEE AMPUTEES

There were ten single below-knee amputees who were 55 or older. Of the ten:

Four had conventional preparatory legs.

Six had PTB-type preparatory legs.

Nine were diabetics. (We feel very strongly that below-knee amputation in diabetics is often feasible.)

Four had some medical problem which made us doubtful that they could use prostheses. They showed us they could, and were given permanent legs that each wore for three years or more.

Three definitely benefited from the stump shrinkage and improved alignment afforded by provisional legs.

One, the only woman, wore her permanent PTB leg for two years, then died of a coronary thrombosis.

Two men did not want to walk. No permanent legs were furnished them.

#### BILATERAL BELOW-KNEE AMPUTEES

None of the bilateral below-knee amputees was over 54.

#### SINGLE ABOVE-KNEE AMPUTEES

Forty-three of the single above-knee amputees were 55 or over.

Causes of amputation were:

Arteriosclerosis	25
Diabetes	17
Trauma	1
Total	43

Two were given temporary suction-socket legs, while the remaining 41 had pelvic suspension. They wore the pylons for three to 17 months.

Six of the single above-knee amputees died within a year: two from malignancy, one from a coronary, and three just faded away.

Three patients did not do well. One man who had had an iliofemoral endarterectomy could not tolerate any pressure over the femoral triangle, and so had to abandon prostheses. Another had a coronary six months after obtaining

his permanent leg and has been confined to a wheelchair ever since. The third was not motivated and did not walk, and so no permanent leg was given to him.

One man became a bilateral amputee after walking for two years on a single conventional leg and did not walk thereafter.

Four were given hydraulic mechanisms, but none was benefited thereby.

Eleven men received the Chupurdia leg,<sup>2</sup> which will be described later.

Thirty-four walked on their permanent legs with varying degrees of vigor, depending on their motivation and general physical condition.

The average time this group of geriatric people used their permanent prostheses was one year.

#### BILATERAL ABOVE-KNEE AMPUTEES

We were conspicuously unsuccessful in making our six geriatric bilateral above-knee amputees ambulatory. Five were diabetic. One just did not want to walk, and three died before obtaining full-length legs. The fifth, age 72, lost both extremities within a month. He walked well in boots. Nine months after the amputations, the boot sockets were placed on Berkeley adjustable legs. One year after the amputations, he was given conventional prostheses. He walked outside to some extent, went to church and lodge meetings, and wore the prostheses all day for several months. He then lost interest and stopped walking a year after he was given prostheses.

A 66-year-old retired admiral had an above-knee amputation for arteriosclerosis five and a half years before being seen by us. He walked on a suction socket for three and a half years and then became a bilateral above-knee amputee. He was furnished elephant boots and, later, articulated suction-socket legs, but he had no real gait training. The boots were cumbersome, and the prostheses were malaligned. None fit very well. Twenty-three months after his second amputation he was given new boots and

<sup>2</sup> Named for Roddy Chupurdia, C.P.O., Chief, Prosthetic-Orthotic Service, Veterans Administration Center, Wilshire and Sawtelle Blvds., Los Angeles, Calif. 90073.

gait training. He was a determined, well-motivated gentleman who wanted to walk. He used total-contact sockets with pelvic belt and Hydracadece for about a year. It then became too much trouble to put on the prostheses. He reverted to the wheelchair and stubbies. These people invariably develop a pronounced lordosis which makes walking more difficult.

#### ABOVE-KNEE/BELOW-KNEE AMPUTEES

Two of the 110 patients whose cases were reviewed were above-knee/below-knee amputees and over 55 years of age. Both were diabetics.

One, a 65-year-old unemployed man, walked on a conventional below-knee device for two years prior to his opposite above-knee amputation. He walked on his old prosthesis and crutches to show us his ability to move about. He then walked on a temporary above-knee device for two months before receiving a permanent leg. He walked a maximum of one block with a four-point gait on two canes and died four years later.

The other, a 62-year-old bartender, walked on a suction-socket leg five years before he lost the opposite extremity below the knee. He demonstrated his ability to use a temporary conventional device, and walked on the permanent prostheses for two years. He then deteriorated, stopped walking, and died three years after the second amputation.

#### LOS ANGELES VETERANS ADMINISTRATION HOSPITAL AMPUTEE CLINIC PROCEDURE

In the Los Angeles VA amputee clinic the postoperative regime is as follows: Stump conditioning and shrinkage commence the first postoperative day on the orthopaedic service. General muscle strengthening is encouraged, and prevention of flexion contractures is stressed. The patients are ambulated between parallel bars and on crutches as quickly as feasible.

The tendency to use wheelchairs is a problem. The nurses like these patients to get into their chairs to go to the bath, toilet, mess hall, and the recreation area. It is easier to put them in a chair than fuss with crutches, and patients find it requires less effort. At home the family feels sorry for the aged amputee, and so they wait on him in his wheelchair, instead of encouraging him to get up and do for himself.

When the patient demonstrates his ability to walk 100 yards on crutches he comes to the amputee conference. (This program is modified for those amputees who are fitted with plaster sockets before leaving the operating table.) One of the duties of the clinic team is to determine whether or not a particular patient will or will not be able to use an artificial leg.

From the review of previous cases, criteria have evolved which are helpful in making a decision for or against the prescription of an artificial leg.

The general criteria follow:

1. The physiological age of the patient. He must be strong enough to activate and control the device. He must be mentally alert and capable of learning to walk.

2. He must have good neuromuscular coordination and balance if he is to learn to shift his weight rhythmically to each leg and develop a smooth gait.

3. He must have sufficient vision to see where he is going, to climb steps and curbs, and to ambulate on even ground.

4. His general health must be good. If he could not walk before amputation, he will not afterward. Any chronic debilitating cardiac condition, hemiplegia, Parkinson's disease, ataxia, etc., precludes use of prosthesis. If amputation was done for malignancy it is wise to wait six months for signs of recurrence or metastases before prescribing.

5. Circulation of the opposite extremity must permit walking on it for at least 100 yards.

6. Motivation is the most important prerequisite. The patient who lives at home with his family, is self-supporting and self-respecting, who has vocational and avocational interests, such as church or fraternal groups, and who was an active person before amputation, will probably use an artificial leg.

7. The patient must not expect too much of the leg. Sometimes patients expect the leg to "walk" them. They have to accept the fact that *they* must learn to "walk" the leg and put out the energy necessary to do so.

Another decision relative to prosthetic prescription for the elderly amputee is the degree of rehabilitation the team can hope to attain in each individual. Geriatric patients can generally be placed in one of four groups:

1. Those whose condition precludes walking, and who desire a prosthesis for cosmesis only. They want something to look natural in the wheelchair. We do not prescribe purely cosmetic legs.

2. Those who want something they can rely on to permit getting about the house and out to the car. These are the debilitated people who lack the strength to walk more than a short distance, but who retain some pride and want to be independent of the wheelchair.

For this rather small group of people, we have a special device, the Chupurdia leg, which will be described later in this article.

3. Those who want to attend social functions, to go to the grocery store and post office, to do a little putting about the house and in the garden, and to take care of their own daily needs. Most of the geriatric amputees fall into this category. For these we usually supply a conventional-type prosthesis.

4. Those who will return to full activity and to work. These are rare among geriatrics.

In our modern society, much ambition has been stifled, much self-respect lost, and much dependence fostered. Veterans' benefits, Social Security, Medicare, and a multitude of other welfare measures have unfortunately resulted in making it more profitable for many patients, particularly geriatrics, to sit at home or out in the sun and let the world pay them, rather than to be productive.

We put *all* amputees, 55 or over, on preparatory legs initially. Any other patients whose motivation and ability are doubtful also receive preparatory devices.

To obviate the undesirable features of jointless pylons, we commenced in 1947 to use a temporary device with an open-end, leather, lace-up, thigh corset, inserted into a double-bar long leg brace, with knee and ankle joints (Fig. 4). Later we discarded the leather socket for one made of plastic. These temporary legs were helpful aids, but they were awkward, and the unsteady patient was fearful of their instability. He developed rather poor gait patterns. It became evident that the preparatory device should, as nearly as possible, approximate the

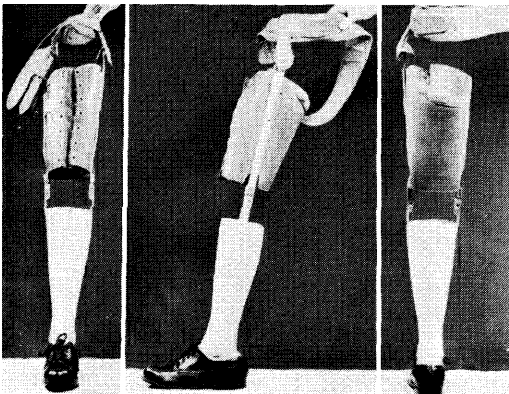


Fig. 4. Early model of the temporary leg.

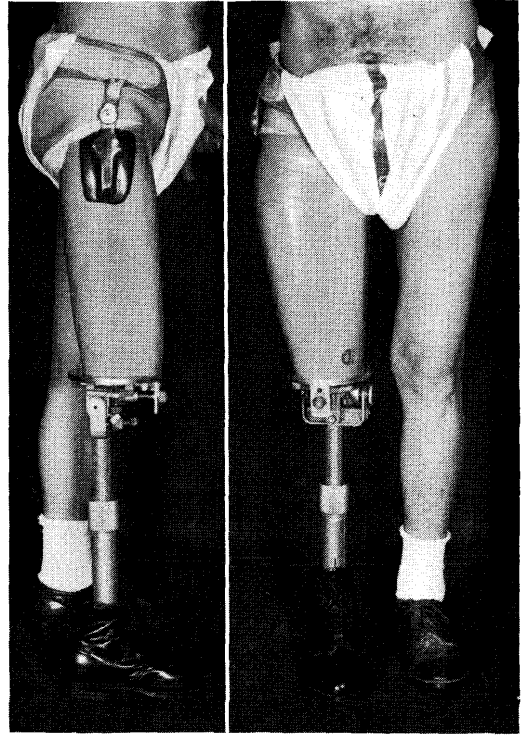


Fig. 5. The Berkeley adjustable leg. The knee can be rotated, displaced in any direction, and adjusted for desired varus, valgus, flexion, or extension. The foot can be adjusted in all planes, and the height of the shin can be changed as indicated.

anticipated permanent one. Not until the advent of the Berkeley adjustable leg did we have the needed tool (Fig. 5). For a number of years we have been making a socket of the type we think the patient will wear permanently, and putting this on the Berkeley leg. We follow the same procedure for both above- and below-knee amputees (Fig. 6). The patients wear this device for varying lengths of time, as indicated for the individual case.

Most learn to use the temporary device and are provided a permanent leg. Some convince us and themselves that they cannot use a permanent leg.

A preparatory leg not only aids stump shrinkage, but is also of infinite help in attaining the most efficacious alignment, especially for below-knee amputees.

Gait training commences as soon as the patient ambulates on a preparatory prosthesis.

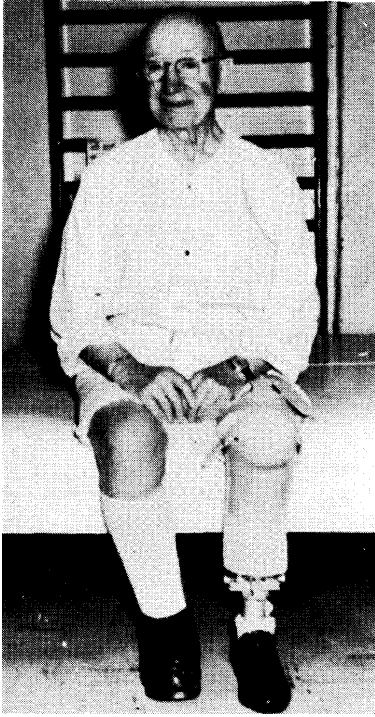


Fig. 6. Below-knee model of the Berkeley adjustable leg.

Adjustments in alignment are made as indicated.

While the geriatric patients are wearing the provisional leg, deficiencies not previously detected may become evident. Latent weakness of the opposite extremity, because of circulatory deficiency or a neuromuscular condition, can adversely affect balance, coordination, or sustained walking. Cerebral arteriosclerosis may so impair the memory that these patients simply cannot learn to use the artificial leg. Muscle weakness prevents locking the knee in a few. Where this occurs we replace the Berkeley mechanism on the provisional leg with the Hosmer knee-locking type, and put a French lock in the permanent prosthesis.

The conventional-type socket rather than the suction socket is prescribed for the elderly amputee for the following reasons:

1. Old people have neither the strength nor the patience to pull themselves into a suction socket.
2. The fit in a suction socket is more critical. These people are more comfortable wearing a sock. They like its cushioning effect.

3. The sock absorbs perspiration, and the socket stays cleaner.
4. They feel more secure with the pelvic belt.
5. Amputees who have worn a conventional socket for many years are not happy with suction sockets.

We do not use hydraulic knees because:

1. Geriatric amputees do not like the inherent friction of this knee.
2. They walk slowly and the swing-control feature is not needed.
3. They have a shuffling gait. They do not quickly flex the knee 20 deg. at push-off to activate the toe pick-up. The hydraulic mechanism does not help them.

For much the same reasons, PTB prostheses are not used routinely.

1. The fit is more critical in a PTB, and many patients like the cushioning effect of two socks.
2. Instability of the knee occurs more often in the oldsters, and so they need outside knee joints.
3. Those who have short stumps also need the external knee stability.
4. People who are accustomed to conventional sockets do not readily adapt to the PTB-type gait or socket.

#### BILATERAL ABOVE-KNEE AMPUTEES

All the bilateral amputee patients at the Los Angeles VA Center are given stubbies, or elephant boots, initially. On these, the patients learn balance and enjoy a certain degree of independence and mobility. The boots get the patients out of the wheelchair, thus helping to prevent flexion contractures, and they aid in muscle development and stump shrinkage. Boots are also useful in permitting the patient to get about his home at night (Fig. 7).

Rocker-bottom stubbies are no longer used at the Los Angeles VA Center. Plastic, total-contact, rectangular sockets, with pelvic band and belt, are placed on a modified-type SACH foot.

A cushion heel is used instead of a rocker bottom. It is lighter. It acts as a shock absorber on heel strike. It assists the patient in maintaining balance. The fear of falling backward is eliminated.

The trochanter-knee-ankle (TKA) line, which is the center of gravity, hits the posterior end of the solid part of the foot, for stability. (In a rocker foot the center of gravity is in the center of the flat space on the rocker bottom.)

If the stump is flexed, the socket must be, too. Then the foot is placed to the rear in rela-

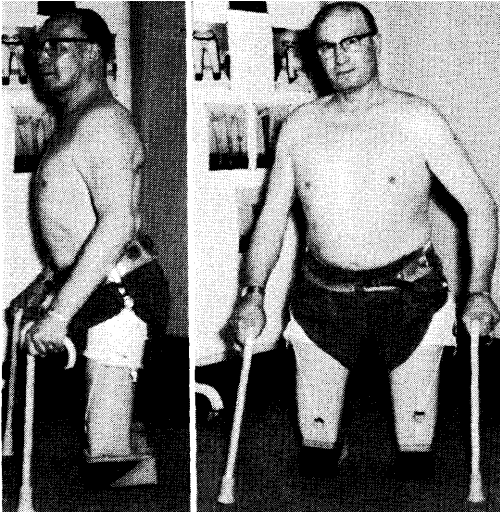


Fig. 7. Elephant boots, utilizing the principle of the SACH heel.

tion to the socket in order to keep the TKA line in its proper relationship for balance.

#### THE CHUPURDIA LEG

Many single, above-knee, geriatric amputees want to walk, but, because of a chronic debilitating condition, are not able to use a conventional (or suction-type) above-knee device. These are persons whose sense of balance is impaired, whose muscular control is uncertain, whose reaction time is slowed, and whose eyesight is poor. They need a stable knee. They do not want to be confined to a wheelchair, they want something to fill the empty trouser leg, and they want something on which they can walk for short distances.

The Chupurdia leg (Fig. 8) fulfills these criteria. A French-type knee lock provides stability. Backing into a chair releases the lock, and the patient may sit. On rising, the knee locks when fully extended.

The original Chupurdia leg was lighter than a conventional prosthesis because the blade-like shin was lighter than the conventional shin (Fig. 8). However, the bearing surface of this shin proved to be too small. It did not stand up under the hard use some of the wearers gave it, and we had to sacrifice the saving in weight. Now we use a conventional leg with total-contact socket, pelvic band and belt, single-

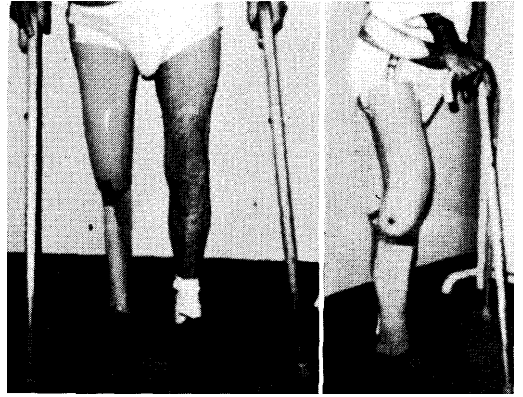


Fig. 8. The Chupurdia leg with French-type knee lock and rudder-type shin.



Fig. 9. The new Chupurdia leg with single-bolt knee and French-type knee lock.

axis knee with French-type knee lock (posterior lock) and a SACH foot (Fig. 9).

Eleven patients have been provided with the original model. It permits patients who would not otherwise be mobile to get about the house unaided, to go out, to enter a car, and to walk with confidence. They use two canes outside and walk haltingly, but they walk.

Those patients were between 59 and 74, averaging 66 years of age. Nine were diabetics' and two were arteriosclerotics. One of them died of malignant melanoma, but he used the



Chupurdia leg for nine months. Another walked on his leg for one year before the opposite leg was amputated. He did not walk thereafter. One man discarded the Chupurdia leg after using it for 20 months, because it was too heavy.

One patient failed quite rapidly after the Chupurdia leg was ordered, and is not strong enough to use it.

One man lives with an indulgent sister and enjoys his invalidism. He can walk but prefers not to.

The other six have used this device for periods of one to four years.

The newer Chupurdia leg (Fig. 9) has been used on four patients with equally satisfactory results. This device fills a definite need in a small group of enervated people who would not walk in a prosthesis without a knee lock.

#### DISCUSSION

A combined study of 1,770 lower-extremity geriatric amputees by the amputee clinic teams of the Los Angeles County General Hospital and the Veterans Administration conducted several years ago revealed several illuminating facts:

1. The mortality rate among these people is appreciably higher than that of the general population of similar age during the first postamputation year. If the amputee survives this year, his probability of survival is virtually the same as that of nonamputees.
2. The outlook for longevity of diabetic amputees and nondiabetic amputees is similar.
3. The diabetic is more likely to become a bilateral amputee.
4. More than half the amputees who received artificial legs discarded them within six months.

This study and a more recent review of 267 amputees disclosed that not quite one-third of the amputees received prostheses.

From these studies and the experience in our amputee clinic, criteria have evolved which are believed to be helpful in assaying the probability of prosthesis use by a particular amputee.

The desirability of employing preparatory legs was demonstrated by a review of 110 pa-

tients, sixty-one of whom were 55 or older. Temporary devices are useful to promote stump shrinkage, obviate or decrease joint contractures, ascertain optimum alignment of prosthesis, permit earlier gait training, and demonstrate whether or not the patient can handle an artificial device. All bilateral above-knee amputees should initially ambulate on elephant boots. All geriatric amputees who are being considered for prosthetic prescription should be ambulated on a provisional leg first.

Nine of the ten geriatric below-knee amputees of the 110 reviewed were diabetic. It is believed that amputation in this area in diabetics is feasible and highly desirable.

A small group of decrepit above-knee amputees are best served by a lightweight, articulated leg with a French-type knee lock. Geriatric patients, with few exceptions, prefer a pelvic belt to suction socket, and many prefer a conventional leg to the PTB below-knee leg. The hydraulic mechanism is not helpful to the geriatric amputee.

In our experience bilateral above-knee amputees rarely use their artificial legs, and unless single above-knee amputees are carefully chosen and skillfully trained, many will discard their legs within six months. However, of the well-chosen and trained, most do use their prostheses effectively for longer than a year.

#### LITERATURE CITED

1. Key, G. D., and G. E. Pennell, *Rehabilitation of the elderly amputee*, Can. J. Surg., 2:44, 1958.
2. Kirk, N. T., *Amputations*, W. F. Pryor Co., Hagerstown, Md., 1943.
3. LeMesurier, A. B., *Artificial limbs*, J. Bone & Joint Surg. (Brit.), 8:292, 1926.
4. Mazet, R., F. J. Schiller, O. J. Dunn, and A. J. Neufeld, *The influence of prosthetic wearing on the health of the geriatric patient*, Project 421, Office of Vocational Rehabilitation, Department of Health, Education, and Welfare, Washington, D.C., 1963.
5. McKenzie, D. S., *Prosthetic rehabilitation of the aged in Great Britain*, pp. 32-42 in *The geriatric amputee*, Publication 919, National Academy of Sciences-National Research Council, Washington, D.C., 1961.
6. Verral, P. J., *Surgical procedures in general practice, Amputation stumps and artificial limbs*, Brit. Med. J., 1:62, 1940.