

## THE PNEUMATIC POST-AMPUTATION MOBILITY AID IN GERIATRIC REHABILITATION

R. Dickstein, T. Pillar and M. Mannheim

*From Flieman's Geriatric Rehabilitation Hospital, Haifa, Israel*

**ABSTRACT.** Several disadvantages of rigid temporary dressings for geriatric amputees led to the trial of a relatively new kind of pylon—the Pneumatic Post-Amputation Mobility Aid (PPAM). Thirty-five geriatric amputees who were referred to a geriatric rehabilitation hospital participated in the study. Thirty-three of these patients learned to walk with the device easily and safely. The below-knee amputees achieved independent gait with a walker as early as their second treatment. The above-knee and the double below-knee amputees required closer supervision. The inexpensive price of the PPAM, its handiness, the possibility of treating several patients with the same device, and the lack of negative side effects, point to the advantages of this kind of pylon for geriatric patients.

*Key words:* Geriatrics, rehabilitation, amputees, artificial limbs

The significance of early temporary limb fitting after a lower extremity amputation has been recognized by many authors (1, 2). The fitting of such a pylon enables the patient to ambulate on his two legs as early as 1-3 weeks following surgery. Early ambulation is of special importance for geriatric patients: it serves as a tool for hindering physical as well as mental deterioration which may result from prolonged wheelchair dependence. This patient population usually suffers from a variety of medical problems, especially problems of the cardiovascular and the locomotor systems, which prevent them from "functional" hopping on the non-amputated leg, even with the aid of crutches or a walker. Hopping on the remaining leg may also be undesirable, since its circulation is usually impaired (3).

Rigid dressings made of plaster attached to a metal rod and a foot-ankle assembly are widely used for ambulation of amputee patients. One or more dressings of that kind may precede the fitting of a permanent prosthesis. Our experience with rehabilitation of geriatric amputees points to several disadvantages of this type of dressing. Firstly, the hard contour is often uncomfortable and even pain-

ful. Secondly the device might be too heavy, especially the A. K. dressings. Thirdly the pylon has to be fitted for each patient individually, a procedure which requires skill and takes up the physiotherapist's (PT) or prosthetist's time.

Recently, a different kind of a temporary prosthesis, the Pneumatic Post-Amputation Mobility Aid (PPAM) has been advocated (4, 5). This device is composed of an air bag which is inflated around the stump to a pressure of about 40 mmHg, and is supported by a simple metal frame. The units and structure of the PPAM have been described elsewhere (5).

The purpose of this paper is to present our experience with the PPAM as a pylon routinely used in rehabilitation of geriatric amputees.

### METHODS

The study population consisted of all amputee patients ( $N=35$ ) who were referred to a geriatric rehabilitation hospital following an average stay of 14 postoperative days in a general hospital. Sex distribution was equal; the average age was 73 years. In all but one patient the etiology of the amputation was Peripheral Vascular Disease (PVD); in two-thirds, secondary to Diabetes Mellitus. In addition 55% of the patients suffered from cardiovascular problems.

Thirty-three patients (93%) became ambulatory with the PPAM as early as the first week of their admission to PT. This population consisted of 26 B. K. amputees, 4 A. K. amputees and 3 double B. K. amputees who had precisely been ambulatory on one prosthesis.

The PPAM was generally donned on the stump bandage; an operative wound which was still open did not hinder the application of the device, unless it was contaminated. All patients began their first week between the parallel bars and then proceeded to ambulate with a walker. Most of the B. K. amputees were able to walk by themselves with the walker following the first or second trial. The A. K. amputees and the double B. K. amputees required a longer period of training between the parallel bars, generally, 2-3 weeks; ambulation with a walker followed, usually requiring supervision in this patient group.

The PPAM was applied routinely, almost every day, to each patient. The amount of time and the distance of ambulation varied and were determined both by the patient's physical condition and by the availability of the devices. In general, the B. K. amputees walked intermittently about an hour each day, whereas the A. K. and the double B. K. amputees walked for 20 min. In addition to ambulation the patients participated in the general course of PT treatments as determined by their diagnosis. Yet, the duration of these treatments was usually reduced, since specific exercises for muscle strengthening were found unnecessary.

The application of the PPAM to a B. K. amputee patient was performed by a PT, PT aide or, in some cases, by a family member. The procedure lasted no more than 7 minutes. Its application to the A. K. amputee was more troublesome and took longer, due to the tendency of the air bag to slip down, especially from very short stumps.

## RESULTS

No skin irritations, pain, or reopening of wounds were noticed. The only unpleasant phenomenon we observed was excessive perspiration by some of the patients. This discomfort was accentuated by the wearing of a cotton stockinet on the stump.

Weight bearing on the PPAM was checked by standing on two bathroom scales. It ranged from 25 to 50% of the body weight. The bathroom scales were also used to teach the patient equal weight sharing on both legs, as suggested by Burgess (1).

Twenty-nine patients used the PPAM till their permanent prosthesis was supplied. This included 21 B. K. amputees (90% of the B. K. amputees), 2 A. K. amputees (50% of the A. K. amputees) and all 3 double B. K. amputees. The prosthesis was ordered as soon as the stump circumference remained unchanged for 2 weeks. This occurred on average 58 days from admission to rehabilitation. The equivalent period prior to our introducing the PPAM was 73 days. The 5 patients (3 B. K. amputees and 2 A. K. amputees) who were found to be unsuitable for a permanent prosthesis, used the device till their discharge from the hospital.

## DISCUSSION

Our experience with the PPAM closely resembles that of Redhead and associates (5). The advantages we found in the PPAM stemmed equally from medical and economic disciplines: The benefits for the patients seem obvious. The device enabled them to stand erect and walk easily and safely. Two-leg

walking relieved extra pressure from the remaining leg and in addition prevented unnecessary loading of the cardiovascular system. The device may have contributed to stump shrinkage, thereby shortening the whole rehabilitation process. Prior to our acquisition of the PPAM, the procedure of temporary limb fitting posed a heavy burden on the PT department. Due to shortage of personnel a considerable number of patients were not fitted with a temporary prosthesis, and therefore had to hop on one leg till they received their permanent prosthesis. The immediate availability of the PPAM has completely solved this problem. The data also indicate that 10% of the patients who were unable to handle a permanent prosthesis, were nevertheless able to walk with the PPAM. For this patient group, home supply of this device might be a desirable solution. Its relative cheap price (about one-fourth of a permanent prosthesis) and the possibility of transferring it to another patient at a later occasion, also makes it economically reasonable.

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## REFERENCES

1. Burgess, E. M., Romano, K. L. & Zettl, J. H.: The management of lower extremity amputations. Prosthetic and Sensory Aid Services, Department of Medicine and Surgery, Veterans Administration, Washington, D.C.
2. Fleurant, F. W. & Alexander, J.: Below knee amputation and rehabilitation of amputees. *Surg Gynec Obstet* 151: 41-44, 1980.
3. Hamilton, E. A. & Nichols, P. J. R.: Rehabilitation of the elderly lower limb amputee. *Br Med J* ii: 95-99, 1972.
4. Little, J. M.: A pneumatic weight bearing temporary prosthesis for below knee amputees: *Lancet* ii: 271-278, 1971.
5. Redhead, R. G., Davis, B. C., Robinson, K. P. & Vital, M.: Post amputation pneumatic walking aid. *Br J Surg* 65: 611-612, 1978.

*Address for offprints:*

Ruth Dickstein  
Flieman's Hospital  
P.O.B. 2263  
Ramat Remez  
Haifa  
Israel