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MANAGEMENT OF PERIPHERAL EDEMA, INCLUDING LYMPHEDEMA OF THE ARM AFTER RADICAL MASTECTOMY

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INCAPACITATING, intractable edema of the extremities has long been a difficult problem to manage. Surgical attempts to create new lymphatic channels by means of subcutaneous tubes, strings, or pedicled skin grafts have not been consistently successful. In recent years, encouraging results have been achieved with technically improved methods of correcting, when possible, the underlying causes of vascular obstruction or insufficiency, reducing the weight of the obese patient, and selectively using diuretics and various forms of elastic or other compressive supports.

The purpose of this report is to describe a program of management that has been successful in 26 consecutive patients with edema of the arm, and in 83 consecutive patients with edema of the leg. Treatment is based upon the principle of squeezing edema fluid from the extremity by gentle, controlled pneumatic massage, then measuring and precisely fitting the extremity with a prestressed, elastic sheath.* The function of the sheath is to maintain interstitial pressure that favors continuous capillary absorption of the edema fluid. The special advantage of the elastic sleeves and stockings used in this study, over the commercial products in standard sizes, is in the precise individual fitting of the extremity.

Considerations in Treatment—The Upper Extremity

The incidence (up to 30 per cent) of edema of the arm following radical mastectomy attests to the fact that this is a common and serious complication.

**Treatment was performed by Miss Gertrude B. Rose and Mrs. Robert D. Kruse of the Department of Physical Medicine and Rehabilitation.*

The extensive removal of axillary lymphatic channels and the stripping of the adventitia of the axillary vein leave only a few lymphatic channels[1] to function, and these are exceedingly vulnerable to obstruction by infection. Probably infection is the most common cause of the ensuing lymphedema; less common causes are occult recurrent neoplasm, occlusion of the axillary vein, and radiation fibrosis. Excessive lymphedema of the arm has been controlled effectively with various types of massage and elastic support.[2] However, there has been little success in preventing recurrent cellulitis, induration, and acute swelling of the arm, using exercises, ultrasound, numerous operative approaches to establish new lymphatic channels, and radiotherapy to the arm itself.

Halsted[3] termed the lymphedema, "elephantiasis chirurgica," and observed it less often after he modified the technic of wound closure so as to reduce necrosis of the edge of the wound, and fluid collection beneath flaps. He believed that infection was largely responsible for postoperative lymphedema of the arm, and cited the conclusions of Matas: "The one etiologic factor which seems to be inseparable and essential to its pathogeny is infection—frequently repeated—which brings about permanent alterations in the vasculolymphatic apparatus of the skin and its underlying connective tissue."

The onset of lymphedema months or years after operation, particularly in patients whose wounds healed primarily without necrosis, infection, or fluid collection, has been poorly understood and continues under investigation. In the present study, a careful record was made of all postoperative infection, even when it was trivial. Physical evidence of infection ranged from overt cellulitis with fever, pain, and hard, brawny edema, to the faintest suggestion of induration and warmth in the posterior upper arm. Because in one patient without clinical evidence of infection a severe cellulitis developed after treatment with pneumatic massage, all patients with lymphedema of the arm were treated prophylactically with an antibiotic prior to massage.

Materials and Methods

The types of clinical edema encountered in this study are summarized in *Tables 1* and *2*. The duration of edema of the arm before treatment was as follows: two months (one patient), nine months (two patients), one year (one patient), one and one-half years (four patients), two years (six patients), three years (three patients), 3½, 5, 6, 7, 7½, 9, 10, 17, 19 years (one patient each). In three patients with active infection, cultures of tissue fluid aspirated from the posterior upper arm yielded coagulase-positive and pencillin-resistant *Staphyloccus aureus.*

Management of lymphedema of the arm consisted of the following five phases. *Phase 1.—Careful instruction in care of the hand and arm to prevent even trivial superinfection.* Essential features included protection of the hand and arm from needle and pin puncture wounds, detergents, hangnails, burns, and neglected minor infections. *Phase 2.—Administration of an antibiotic to control possible infection whether*

Table 1.—*Analysis of factors in patients with edema of the arm after radical mastectomy*

Number of patients							
Total	Wound drained	Fluid under flaps postop.	Postop. roentgen therapy	Clinical evidence of infection before therapy	Onset of lymphedema: Early	Onset of lymphedema: After 3 months	Obvious response to antibiotic*
26	11	16	20	17	10	16	17

* *All patients were treated with erythromycin. Three patients were also treated with Albamycin (novobiocin sodium), The Upjohn Co. One patient was also treated with Albamycin (novobiocin sodium), Upjohn; and Kantrex (desoxystreptomycin), Bristol Laboratories, Inc.*

Table 2.—*Analysis of factors in patients with edema of the leg*

Etiology of edema	Number of patients	Duration of edema, yr.	No. of patients with: Ulcers of the leg	No. of patients with: Recurrent infection
Venous insufficiency; stasis syndrome, varicose veins	46	1 to 21	21	7
Postphlebitic	20	1/12 to 20	8	7
Obstructive edema				
Pelvic cancer	11	1/12 to 2	0	0
Vena cava occlusion	2	2 to 14	0	0
Lymphedema praecox	4	10 to 23	0	4

or not it was clinically evident. In 17 of 26 of the patients, infection was clinically evident, in most in the form of erythema, heat, and hard, brawny induration of the arm and forearm; in others, infection was subtle and appeared only as a strip of warmth and induration of the posterior upper arm. The initial course of antibiotic consisted of 250 mg. of erythromycin, four times daily, for a period of one

week, or until all clinical signs of infection disappeared. More recently, the problem of drug-resistant staphylococci has required the judicious use of the new anti-staphylococcal drugs. *Phase 3.—Application of intermittent pneumatic massage of the extremity (Fig. 1).* This treatment was deferred until all evidence of infection had

Fig. 1. The technic of pneumatic massage of the arm; the patient may be treated either in the sitting or in the supine position.

disappeared. Massage was continued for multiple three-hour periods until no pitting edema of the arm remained. *Phase 4.—Measurement for a precisely fitted elasticized nylon sleeve (Figs. 2-4).* When edema extended to the dorsum of the hand, the sleeve length included a gauntlet extension. *Phase 5.—Postural rehabilitation by means of trapezius exercises.* Exercises were taught to correct the slumped posture assumed by many women because of the great weight of the swollen arm. Several of the patients also had an "outlet syndrome" on the involved side, which responded well to improved posture and exercises.

The Lower Extremity

Patients with edema secondary to incompetent varicose veins, postphlebitic syndrome, occlusion of the inferior vena cava, or obstructing pelvic neoplasm were treated with pneumatic massage until all edema had disappeared from the

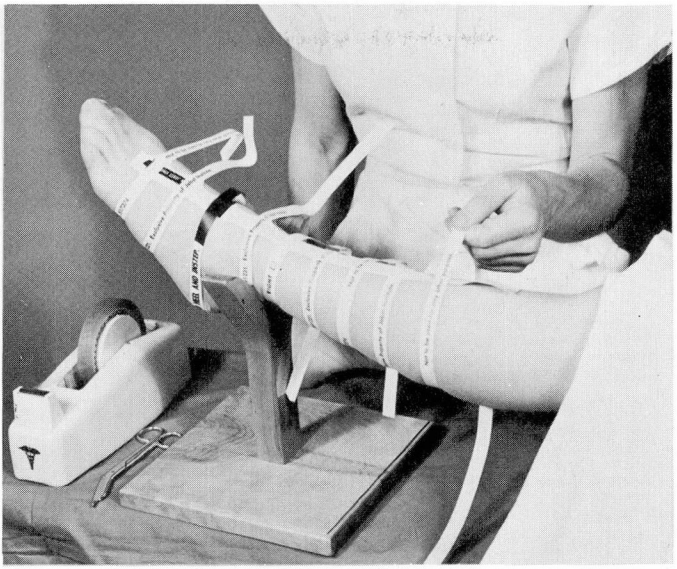

Fig. 2. Method of measuring the extremity with paper tapes for precise fitting of a prestressed elasticized nylon or dacron sheath.

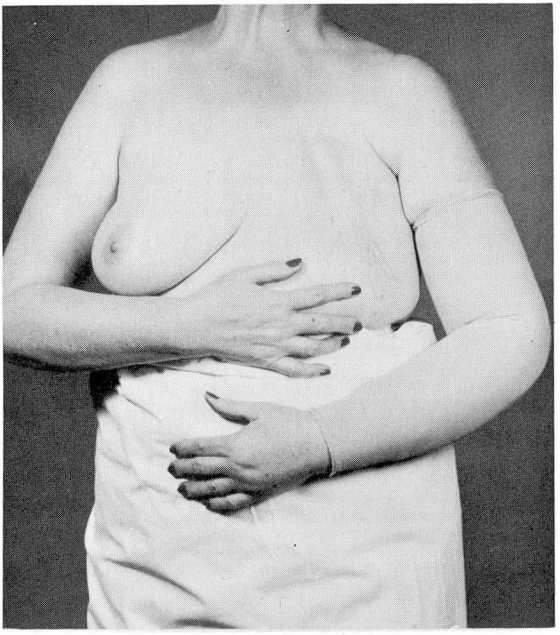

Fig. 3. Standard arm sheath that extends from the wrist to just below the deltoid insertion.

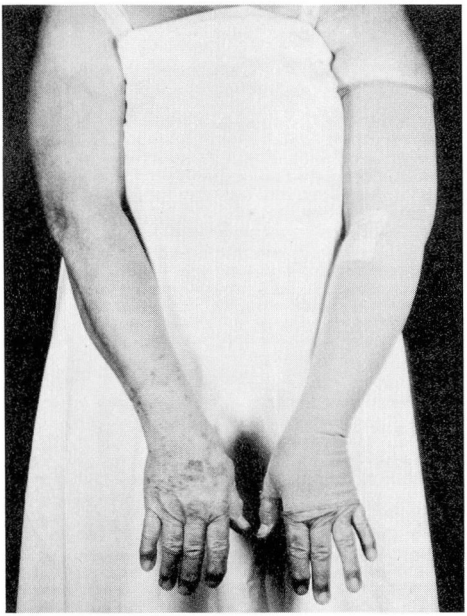

Fig. 4. Arm sheath with gauntlet extension to the base of the fingers, for patients with edema of the dorsum of the hand. Moleskin is inserted at the antecubital fossa to prevent chafing.

leg, and then were fitted with long or short, or long and short stockings *(Figs. 5 and 6)*. Ulcers of the leg were first encouraged to heal by means of continuous elastic support. Patients with chronic refractory ulcers were admitted to the hospital for excision and skin graft of the ulcer area in conjunction with appropriate venous surgery prior to being fitted for stockings. Patients who had edema of the legs and acute infection were hospitalized and treated with elevation of the legs, and systemic antibiotics prior to being fitted for stockings.

The four patients with lymphedema praecox were treated as outlined above. One patient received additional therapy: the entire lower leg was infiltrated with procaine hydrochloride and hyaluronidase prior to pneumatic massage. The injections were not greatly beneficial, presumably because of the nature of the lymphedema and its long duration.

Materials and Technic

Several varieties of pneumatic pumps and sheaths were tried, the goal being an automatic cycling pump with controllable degree and duration of pressure cycles, comfortable to the patient, and practical for inpatient or for outpatient use. It was learned that a milking type of massage with pressure gradients beginning peripherally and progressing proximally, is not essential. Elevation of the

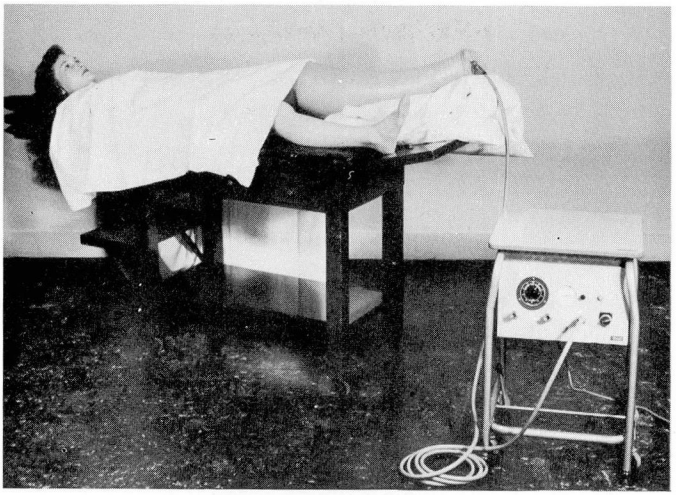

Fig. 5. The technic of pneumatic massage of the leg; both legs may be treated simultaneously.

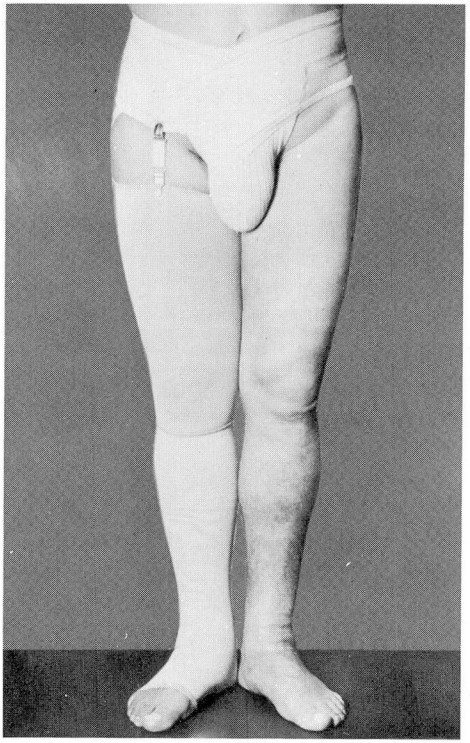

Fig. 6. Long and short stockings showing support suitable for male patients.

extremity, and an evenly distributed increase in interstitial pressure is sufficient, together with rhythmic release of the pressure for the comfort of the patient. This was accomplished by a tubular plastic bag* into which the stockinette-clad extremity was placed for from two to 12 hours. The most efficient pump used had three channels for simultaneous treatment of three patients, with pressure and exhaust phases adjustable reciprocally as fractions of a three-minute cycle. The pump generated pressures as high as 150 mm. of Hg; maximal pressures of 75 mm. of Hg were used on the arms, and from 125 to 150 mm. of Hg on the legs.

The primary purpose of pneumatic massage was to permit the fitting of an elastic sheath over an infection-free limb rid of excessive fluid. The limbs were measured by means of individual paper tapes. The material of the sleeves or stockings was of sufficient weight to provide good support with maximal comfort, but, because of its relative thinness, sleeves had to be replaced about every four months and stockings about every three months. Patients with massive edema of the legs sometimes required both long and short stockings; some type of suspension support was necessary to keep the long stockings drawn smoothly without wrinkles. The cost of the appliances was considered to be reasonable by the majority of patients.

Results

The upper extremity. The results of treatment of lymphedema of the arm after radical mastectomy were gratifying. Reductions in the size of the arms ranged from return to normal, to disappearance of only pitting subcutaneous edema. A long history of recurrent cellulitis was more prejudicial to an excellent response than was a long duration of edema. This might be expected because of fibrotic changes in the skin and subcutaneous tissues after chronic or recurrent infection. Patients have been enthusiastic about the results, apparently because physically the arm became much lighter and more comfortable, and the range of motion at elbow, wrists, and fingers increased; and psychologically, a positive, aggressive program of treatment was welcome after months or years of their being told that nothing could be done to help the disability. Failure of treatment was largely due to the psychologic reluctance of certain patients to accept any disability, or the knowledge that their arms could never be rendered completely normal. Those patients refused to wear the elastic sleeves, expressed disappointment in the entire program, and were the only patients who have had recurrent bouts of infection.

The lower extremity. Continuous control of edema without recurrent ulcers or recurrent cellulitis occurred in 79 of the 83 patients treated. The four failures were due to physical inability to put on the snug stockings, in two instances, and refusal by two obese patients to adhere to reducing diets and to wear foundations to support their long stockings. The four patients with lymphedema praecox were of special interest: in only one of them dramatic reduction in the size of the

**Pneumatic sleeves and pumps were supplied by the Jobst Institute, Toledo, Ohio.*

leg was obtained, but all have continued to use the elastic supports and none has had recurrence of infection.

Comments

The results in most patients have been encouragingly good. Pneumatic massage has been repeated periodically at the request of some patients who have allowed edema to recur because they failed to replace worn-out appliances early enough. Enthusiasm of patients regarding control of excessive edema and recurrent infection has been proportional to the original amount of edema and disability. The most dramatic response to treatment was obtained in a woman referred for amputation of both legs because of intolerable pain associated with a severe postphlebitic syndrome: after treatment and the wearing of both long and short stockings on each leg, she has been free of edema, pain, and progressive stasis changes, and has had normal use of the legs for the past six months.

Adjunctive use of weight-reducing diets, diuretics, and local foot care has been individualized. Diuretics have proved useful and safe when taken every other day during the week before menses in younger women.

Summary

A program for individualized therapy of edema of the extremities and its complications is described. The importance of infection in etiology and treatment of lymphedema of the arm following radical mastectomy is stressed.

References

1. Ju, D. M. C.; Blakemore, A. H., and Stevenson, T. W.: Lymphatic function test. S. Forum (1954) 5: 607-612, 1955.

2. Brush, B. E., and associates: Treatment of postmastectomy lymphedema. A.M.A. Arch. Surg. 77: 561-566; discussion, 566-567, 1958.

3. Halsted, W. S.: Swelling of arm after operations for cancer of breast—*elephantiasis chirurgica*—its cause and prevention. Bull. Johns Hopkins Hosp. 32: 309-313, 1921.