

THE RISK OF GENITAL EDEMA AFTER EXTERNAL PUMP COMPRESSION FOR LOWER LIMB LYMPHEDEMA

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In a single lymphedema treatment facility, 128 consecutive patients with lower limb lymphedema were retrospectively analyzed for the development of genital edema. The patients were separated for analysis on the basis of who used or did not use compressive pump therapy. Of the 128 patients with lower limb lymphedema, 75 received no pump therapy, and 53 used pumps. Of the 75 who did not use pump compression, only 2 had genital edema. Of the 53 patients who used pump compression, 23 patients developed genital edema after pump therapy ($p < .0001$). The incidence of genital edema was unaffected by age, sex, grade or duration of lymphedema, whether lymphedema was primary or secondary, whether a single or sequential pump was used, the pressure level applied, or duration or hours per day of pump therapy.

Compressive pump therapy for lower limb lymphedema produces an unacceptably high incidence of genital edema.

Lymphedema is a chronic, debilitating disorder. Untreated, primary and secondary lymphedema tends to worsen with time (1), with a multitude of clinical and psychological complications. These include limb immobility, loss of function, pain, paresthesias, recurrent infections, skin ulcerations, lympho-cutaneous fistulae, genital edema, and rarely angiosarcoma (2,3). Other disabilities include impaired performance of common household and work tasks, inability to wear normal

clothing, and difficulty with sexual relations. Accordingly, adequate treatment of lymphedema is recommended.

The gradation of lymphedema has been defined by the International Society of Lymphology (4). Grade 1 has minimal fibrosis, edema pits on pressure, and reduces on limb elevation; Grade 2 has overt fibrosis, non-pitting edema and fails to reduce with limb elevation; Grade 3 has marked trophic changes characterized by the expression "elephantiasis." Current treatment for lymphedema includes: Complex Lymphedema Therapy (CLT) (5-13), benzopyrone drugs (2,13), surgery (6,14), and pneumatic compression pumps (15-24). Early phase (Grade 1) lymphedema responds to elevation and use of compression garments. Operative procedures include debulking, lymphatic or lympho-nodal anastomosis to veins, omental transplantation and lymphatic transplants (6) but morbidity is high and long-term effectiveness is questionable. Moreover, some operations (e.g., micro-surgical shunts) are available only in a few specialized centers (6,14).

External pneumatic compression devices or "pumps" are commonly used to treat peripheral lymphedema. Several clinical reports show that pumps reduce lymphedema; however, the clinical outcomes vary widely (15-24). Maintenance of edema reduction depends on the continued use of pumps and/or compression garments (19).

The amount of improvement in swelling after therapy appears related to degree of fibrosis with the lower grades of lymphedema responding more favorably (23). Complications of pump treatment include cellulitis and arterial insufficiency with occasional tissue necrosis and even limb amputation (24,25). Onset of edema in previously normal regions and increased fibrosis proximal to the cuff of the pump has been described (3,6,7). However, there is no demographic data available as to what proportion of patients are treated by pumps in the general lymphedema population, nor of the results or complications. This report examines the incidence of genital edema in 128 consecutive patients with lower limb lymphedema who were evaluated and treated at one facility.

CLINICAL EXPERIENCE

Subjects

The presence of genital edema was studied retrospectively in 128 consecutive patients with lower extremity lymphedema in a single treatment facility. The demographics of the study groups are illustrated in *Table 1*,

and are similar to previous series (7-13,18-21) thereby demonstrating the study patients did not manifest unusual clinical features. Each patient was interviewed and examined by at least two of the authors. Before evaluation, each patient completed an information form. Moreover, a complete medical history was obtained without emphasizing any relationship between genital edema and pump usage.

Statistical Analysis

Chi square tests were mainly used with Yale's correction or Fisher's exact tests. For age and duration, student T and Mann-Whitney tests were utilized.

Each set of data was analyzed for a) whether the outcome in a patient treated with a pump was affected by age, sex, duration of lymphedema, grade, unilateral/bilateral leg lymphedema, single or sequential pump, pump pressures, hours per day of usage, length of time of pump therapy, or whether lymphedema was primary or secondary; b) whether pump therapy was related to the incidence of genital edema; c) whether pump therapy correlated to any factors in a) or correlated with the incidence of genital edema.

TABLE 1
Demographics of Patient Population With Lymphedema (LE)
Treated With and Without a Pump

Variable	Pump	No Pump	p-values
Males	14 (11%)	18 (14%)	0.76
Females	39 (30%)	57 (45%)	
Lymphedema (LE)			
Age (years)	49.1 (18.8)*	46.2 (21.2)*	0.82
Duration (years)	12.6 (11.4)*	13.2 (10.6)*	0.85
Grade 1	6 (5%)	20 (16%)	0.06
Grade 2/3	47 (37%)	55 (16%)	
Primary	45 (35%)	28 (22%)	0.28
Secondary	30 (23%)	25 (20%)	
Unilateral	34 (27%)	33 (26%)	0.025
Bilateral	19 (15%)	42 (33%)	
*Mean±SD			

GE	No Pump	Pump
(-)	73 (97%)	30 (57%)
(+)	2 (3%)*	23 (43%)**

* $p < 0.0001$;
**No genital edema before pumping

GE	Single	Sequential
(-)	12** (43%)	16** (57%)
(+)	14† (37%)	24† (63%)

*Not statistically significant; **5 patients used both types of pumps; †8 patients used both types of pumps

RESULTS

The initial 128 consecutive patients presenting with lower extremity lymphedema were examined by the authors for evidence of genital edema. Of the 75 patients who did not use pumps, there were only 2 (3%) with genital lymphedema (Table 2), one of whom (a 2-month old female) had vulvar edema since birth. Of the 53 patients who used pumps, genital edema developed in 23 (43%). The difference was highly significant ($p < 0.0001$). Each patient reported that genital edema was absent before compressive pump utilization, that it developed subsequently, and persisted after discontinuance of compression pumping. The incidence of genital edema was not influenced by sex, age, duration of lymphedema, if primary or secondary or the grade of lymphedema. The occurrence of bilateral lower limb lymphedema in the pump treated patients (15%) compared with the non-pump treated patients (33%) was significantly different ($p = 0.025$). However, when this difference was analyzed as a factor in production of genital edema, it was not significant ($p = 0.31$).

The development of genital edema after use of an external pump was not affected by the type of compression pump utilized, whether single or sequential, the pressure

gradient (mmHg) used for treatment, the duration (months) of pump therapy, or the hours per day of pump treatment (Tables 3-6).

DISCUSSION

Patients with peripheral lymphedema often display multiple disabilities both organic and psychologic and those with genital edema have major psycho/sexual symptoms including severe depression. Scrotal, penile and vulvar edema are often irreversible, respond poorly to treatment, and often are the site of external lymphocutaneous fistulae, and, accordingly, represent a potentially serious complication of lower extremity lymphedema.

Consideration of the basic anatomy of the lymphatic system illustrates the non-physiologic mechanism of pump treatment. Kubik demonstrated that the lymphatic system is made up of many regional "lymphotomes," which have minimal collateral communications (26). Lymph fluid from these lymphotomes drains through increasingly larger lymphatic vessels to enter regional lymph nodes. If these lymph nodes are blocked, excised or fibrosed, the only lymphatic pathways remaining are marginally effective lymphatic collaterals. These collaterals can theoretically be opened

TABLE 4
Duration of Pump Therapy (Months) in Lower Limb Lymphedema Correlated with Occurrence of Genital Edema (GE)*

GE	<1	1-3	4-12	12+
(-)	8 (27%)	6 (13%)	5 (17%)	11 (33%)
(+)	6 (26%)	6 (26%)	3 (13%)	8 (35%)

*Not statistically significant

TABLE 5
Lack of Correlation of Pump Pressure Gradient (mmHg) With Occurrence of Genital Edema (GE)*

GE	<40	40-80	>80	Unknown
(-)	2 (9%)	7 (30%)	5 (22%)	9 (39%)
(+)	4 (13%)	8 (27%)	7 (23%)	11 (37%)

*Not statistically significant

by Complex Lymphedema Therapy (CLT) (5-13) as suggested by lymphoscintigraphic imaging (3,7).

External pump compression may be effective in "low protein" venous edema where tissue fluid is forced directly back into the bloodstream. However, in lymphedema, the excess fluid is simply displaced into adjacent lymphotomes. If this region is drained by obstructed or extirpated nodes, it seldom can accommodate the excess lymphatic fluid and surplus interstitial protein is left behind (27) as suggested by radioimaging tracers (27,28). Whereas the flow of fluid may be enhanced, the residual protein in the tissues remains and increased colloidal osmotic pressure exerted by the proteins in the tissues causes the edema to recur. Continual utilization of a pump and/or high compression garments are needed to restrict the recurrence of edema fluid. Often this approach is impractical and does not circumvent the problem caused by the more proximal lymphatic blockade. Moreover, sustained high external pump pressures may damage remaining intact lymphatic vessels. Thus, pump pressures over 45 mmHg may damage the initial lymphatics (29,30). Increased interstitial protein is associated with progressive fibrosis and "chronic inflammation" so characteristic of lymphedema (2,31).

Zelikovski, developer of the sequential pump, Lymphapress, claims that a pump is most useful in Grade 1 lymphedema and that Grades 2 or 3 are less ideally suited for compressive pump therapy (23). In this investigation, 102 of 128 or 80% of the patients had Grade 2 or 3 lymphedema.

Nowadays, a non-operative, safe, non-invasive treatment known as Complex Lymphedema Therapy (CLT) is commonly used effectively to reduce peripheral lymphedema (5-13,32,33). CLT consists of manual compression, external compressive bandaging, and specific physical therapy exercises. The pattern of both the lymphatic drainage and the follow-up physical therapy exercises is based on specific collateral pathways determined for each individual at the time of consultation. Factors to be considered to determine the collateral pathways include surgical scars (which may block lymph flow), areas of lymph nodal dissection, areas of skin and subcutaneous tissue fibrosis and risk for edema in the contralateral limb. The regional lymphatic anatomy and collateral pathways between lymph drainage areas have been described by Kubik (3). The successful reduction of lymphedema through CLT is based on the hypothesis of increasing lymphatic drainage through opening of collateral circulation from

TABLE 6
Lack of Correlation of
Hours per Day Compression With
Occurrence of Genital Edema (GE)*

GE	<1	1-4	5-12
(-)	6 (20%)	16 (53%)	8 (27%)
(+)	5 (22%)	11 (48%)	7 (30%)

*Not statistically significant

the obstructed lymphotomes into normally functioning lymphotomes. Unlike pump therapy which has to be utilized on a continual basis, after a single course of CLT (averaging 5 days per week for 4 weeks), edema reduction is not only maintained, but further improves in compliant patients. Compliance consists of wearing compressive garments and performing special physical therapy exercises 15-20 minutes, twice daily.

Lymphedema of the genital area is more difficult to control because of the problem of achieving adequate external compression to this anatomical area. These sites are thus difficult to bandage-wrap without causing untenable functional problems with activities of daily living. At our facility, in conjunction with CLT, limited success has been achieved in reducing genital lymphedema. Patients are fitted with compression bike shorts over their leg compression bandages. A good athletic supporter for scrotal or penile edema in the males and a sanitary pad for edema of the vulva provides increased compression to these areas. Special breathing exercises with manual pressure in the abdominal and pelvic areas during forceful exhalation, may increase lymphatic flow and help reduce suprapubic and genital lymphedema. Patients are taught how to perform these exercises in the supine position with their legs elevated on

a wedge and the buttock and genital areas elevated on pillows and rolls. Whereas patients and therapists report a noticeable decrease in the suprapubic and genital lymphedema utilizing these techniques, objective confirmation of edema reduction by measurement is problematic. Subjectively, patient complaints of pelvic "throbbing," "bursting," "congestion," and tolerance for sitting, standing and walking are improved by compression treatment.

In patients with lower limb lymphedema, utilization of pneumatic compressive pumps are significantly associated with the likely development of genital edema. If pump treatment is to be administered for lower limb lymphedema, one must give major consideration to the development of genital edema especially when an alternative, effective, safe, non-invasive option is available, namely, CLT.

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