

Case Report / Olgu Sunumu

## Surgical treatment of lower extremity lymphedema with subcutaneous implantation of silicone tubing

*Alt ekstremite lenfödeminin subkütan silikon tüp implantasyonu ile cerrahi tedavisi*

Deniz Çevirme<sup>1</sup>, Ahmet Zengin<sup>1</sup>, Evrim Abamor<sup>2</sup>, Hasan Sunar<sup>1</sup>, Mehmet Kaan Kırallı<sup>1</sup>

*Institution where the research was done:*

Kartal Koşuyolu Yüksek İhtisas Training and Research Hospital, İstanbul, Türkiye

*Author Affiliations:*

<sup>1</sup>Department of Cardiovascular Surgery, Kartal Koşuyolu High Specialization Training and Research Hospital, İstanbul, Türkiye

<sup>2</sup>Department of Nuclear Medicine, Kartal Dr. Lütfi Kırdar City Hospital, İstanbul, Türkiye

### ABSTRACT

A 65-year-old male patient was admitted to our clinic with swollen, painful, and wound discharge of lower extremity. There was widespread edema, skin infection, and lymphangitis secondary Stage 3 lymphedema below the knee. In addition to conventional treatment methods, lymphatic artificial pathway creation was used with subcutaneous implantation of silicone tubing. In conclusion, subcutaneous implantation of silicone tubing is a new technique that can be applied in advanced stage lymphedema patients, which increases the effectiveness of compression therapy.

**Keywords:** Lymphatic vessels, lymphedema, silicone tube.

Lower extremity lymphedema (LEL) is caused by total or partial obstruction of lymphatic collectors as a consequence of skin and deep tissue infections. Some lymphatic fragments maintain patency, but their transport capacity is not adequate for excretion of excess edema fluid. Afterward, limb weight increases, adversely affecting its function, and hyperkeratosis and fibrosis of subcutaneous tissue develop.<sup>[1]</sup> If some part of peripheral collecting lymphatics remain patent and partially drain tissue edema as lymphovenous, nodovenous anastomosis, and free lymphatic flap transplantation can perform. Advanced stage of lymphedema, in whole lymphatic collators develop

### ÖZ

Altmış beş yaşında erkek hasta alt ekstremitede şişlik, ağrı ve akıntılı yara ile kliniğimize başvurdu. Diz altında yaygın ödem, cilt enfeksiyonu ve lenfanjite sekonder Evre 3 lenfödem vardı. Konvansiyonel tedavi yöntemlerinin yanı sıra, subkütan silikon tüp implantasyonu ile lenfatik yapay yol oluşturuldu. Sonuç olarak, subkütan silikon tüp implantasyonu ileri evre lenfödem hastalarında uygulanabilecek, kompresyon tedavisinin etkinliğini artıran yeni bir yöntemdir.

**Anahtar sözcükler:** Lenfatik damarlar, lenfödem, silikon tüp.

total occlusion and sclerosis and, in such cases, microsurgical operation may not work out. As a result, creating an artificial pathway with silicon tubes for edema fluid away to the non-obstructed region can be an option to treatment of appropriate patients.<sup>[2]</sup>

In this article, we report a successful surgical treatment of advanced stage LEL with subcutaneous implantation of silicone tubing (SIST).

### CASE REPORT

A 65-year-old male patient was admitted to our clinic with swollen, painful, and wound discharge of lower

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**Correspondence:** Deniz Çevirme, MD. Kartal Koşuyolu Yüksek İhtisas Eğitim ve Araştırma Hastanesi, Kalp ve Damar Cerrahisi Kliniği, 34865 Kartal, İstanbul, Türkiye. Tel: +90 216 - 500 15 00/1631 e-mail: dnczvr@hotmail.com

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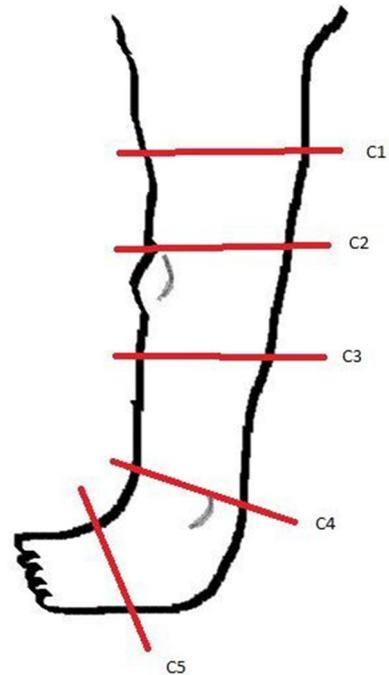
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**Figure 1.** (a) Before the operation. Stage 3 lower extremity lymphedema according to LEL index. (b) Two weeks after operation (Stage 1 right lower extremity and Stage 2 left lower extremity as LEL index, chronic atrophic changes in the skin without infection and severely reduced edema are seen).

extremity. In his medical history, he had hypertension, but no diabetes mellitus, and had exposed intermittent subcutaneous tissue infection six years ago. On his physical examination, there was widespread edema, skin infection, and Stage 3 lymphedema below the knee, but was Stage 2 lymphedema above the knee in the bilateral lower extremities (Figure 1a). No arterial or venous pathology was detected on Doppler ultrasonography. Due to the skin and subcutaneous infection, ciprofloxacin 500 mg and wound care treatment (mixed wound care products which include burrows solution 30 g, zinc oxide 60 g, and lanolin 90 g) was administered in advance the surgical treatment for one month. Multilayer tight compression bandaging was applied in addition to wound care treatment until the operation. The LEL indices were used for the volumetric assessment of the affected extremity with severe edema. The LEL index and calculation of the formula are calculated by taking the sum of the squares of the circumference in five areas of a lower extremity and dividing it by body mass index (Figure 2).<sup>[3]</sup> The LEL index was of the right lower extremity was 303.5 and of the left one was 335.3. According to this measurement, bilateral LEL indices were Stage 3.

The operation was performed under spinal anesthesia. Starting at the level of the medial malleolus



**Figure 2.** C1: Circumference at 10 cm above the superior border of the patella, C2: Circumference at the superior border of the patella, C3: Circumference at 10 cm below the superior border of the patella, C4: Circumference at the lateral malleolus, C5: Circumference at the dorsum of the foot. LEL index:  $(C1^2+C2^2+C3^2+C4^2+C5^2)/\text{body mass index}$ ; <250 Stage 1; 250 to 300 Stage 2; 300 to 350 Stage 3, >350 Stage 4.



**Figure 3.** Skin incisions and created tunnel in the subcutaneous tissue.

of the ankle, a 1-cm incision was made on the medial side of the leg at approximately 15-cm spaces, and a tunnel was created in the subcutaneous tissue to the femoral triangle (Figure 3). A second tunnel was established with the same technique in a posteromedial line parallel to the previous tunnel and two tunnels were connected in the femoral triangle in the region of inguinal lymph nodes. Subsequently, two pieces of antibiotic-impregnated peritoneal distal catheters-closed type (Desu Medical, Ankara, Türkiye) (Figure 4) of 1.3-mm outer diameter and 1.1-mm inner diameter were washed with 2,500 IU heparin and inserted into the tunnels for both lower extremities (Figure 5).

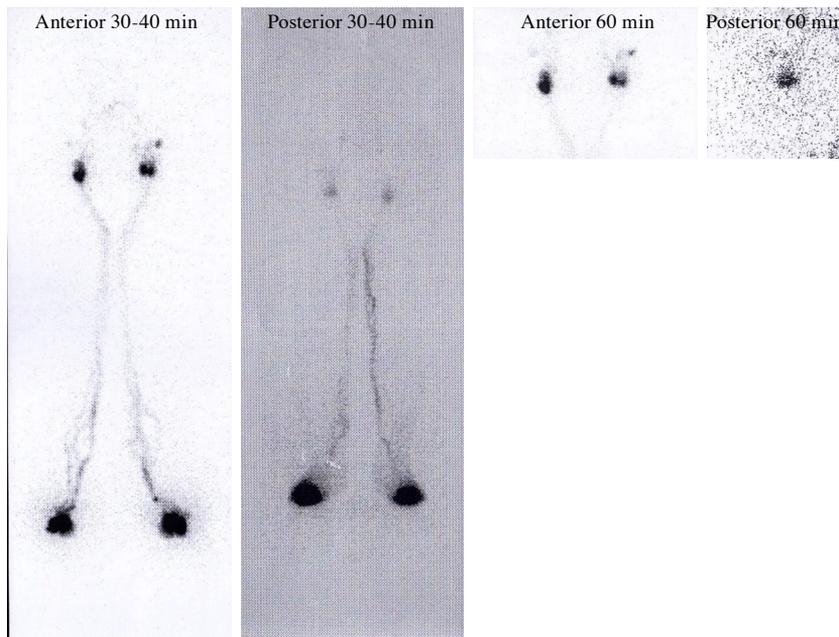


**Figure 4.** Antibiotic-impregnated peritoneal distal catheter-closed type.

The silicone tube replaces the sclerosed lymphatic vessels and provides the flow from the high-pressure compartment in the distal extremity to the low-pressure compartment in the proximal extremity by artificial pathways. Even as the tip of the tube in the distal of the extremity has a length of 3 to 4 cm with many holes, the tip in the femoral region (proximal tip) has a single hole structure that provides only drainage. The same



**Figure 5.** Insertion of silicone tubes in the subcutaneous tunnels.



**Figure 6.** Evaluation of patency of silicone tubes with lymphoscintigraphy picture.

closure technique was performed for all incisions. Finally, bilateral lower extremities were covered with a tight elastic bandage to increase the silicon tubes drainage subsequent to the operation. A total of 1,200,000 U of long-term penicillin was administered postoperative Day 0 and then oral amoxicillin 1 g daily was given for one week. The patient was discharged two days later.

At two weeks of follow-up, thought that SIST is a new technique that can be applied in advanced stage lymphedema patients. The patency of silicon tubes was evaluated on lymphoscintigraphic pictures. Technetium Tc 99m colloidal albumin (Nanocoll; GE Healthcare, Munich, Germany) 0.5-0.7 mCi was injected into the bilateral subcutaneous first and second interdigital region, and static regional follow up imaging was done 30 and 60 min. Both right and left silicone tubes were confirmed to be open (Figure 6). The LEL index of the right lower extremity was 241.1 and of the left one was 287.4. The LEL index decreased from Stage 3 to Stage 1 in the right lower extremity and from Stage 3 to Stage 2 in the left one (Figure 1b).

## DISCUSSION

Skin and deep tissue infections are a cause of secondary lymphedema due to developing lymphangitis and occlusion of lymphatic collators.<sup>[4]</sup> In the early stage lymphedema patients, microsurgical lymphovenous anastomosis techniques are performed successfully,

while in advanced stage patients, alternate procedures come to mind one of them is SIST.<sup>[2]</sup>

The first SIST was attempted in a patient who had lymphedema after treatment of breast cancer, but this technique was discarded due to infection.<sup>[5]</sup> In the literature, the first successful report was published by Olszewski and Zaleska<sup>[2]</sup> in 2015. The study group included 20 patients with obstructive lymphedema of the lower limbs that developed after lymphadenectomy and irradiation of the pelvis due to uterine cancer with unsuccessful conservative therapy. Success of SIST occurred in the treatment of advanced stage lymphedema with this report. This report declared the circumference decreased in all patients within the first two weeks, differently at various levels of the limb, by -3.2 to -3.9% with a range from +3 to -17% as the success of the surgery. The presented report by Olszewski and Zaleska<sup>[2]</sup> selected the patient who had secondary lymphedema due to lymphadenectomy and irradiation. However, in our presented case, selected lymphedema was secondary to lymphangitis and, differently, an antibiotic-impregnated tube was inserted into the subcutaneous tissue.

Lymph node dissections are of two types, flap and free. The flap removal technique has ceased to be a desirable method in clinical practice due to possible flap rejection, as well as complications such as edematous deformed tissue formation that may occur in the recipient and/or donor area. Free lymph dissection

is very laborious and requires to be expert of super microsurgery, and its success rates are controversial in the literature.<sup>[6]</sup> Therefore, silicone tube implantation offers a surgical alternative as an easier, faster, and applicable method. More case series are needed to conduct a comparative study for free lymph node transplantation. In this report, we present the first case that we operated in the light of the available literature. Case series and long-term follow-ups to be composed in our future studies would provide more enlightening content for rates and comparisons.

Banding is the cornerstone therapy for lymphedema.<sup>[7]</sup> Although banding is the effective method, concomitant SIST may facilitate draining the lymphatic fluid away to non-obstructed region. A published randomized-controlled trial reported by Singh *et al.*<sup>[8]</sup> reports that a combination of artificial lymphatics in the form of silicone tubes and banding leads to a more significant reduction in the limb volume and limb circumference compared to solely banding. Whereas solely banding reduced by 8%, SIST reduced the extremity volume by 25%. While the increased pressure in the tissues allows the passage of lymph fluid through artificial pathways between the compartments, lifelong bandage therapy would increase the effectiveness of this passage and increase the patient's quality of life.

In conclusion, subcutaneous implantation of silicone tubing is a new technique that can be applied in advanced stage lymphedema patients, which increases the effectiveness of compression therapy.

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**Data Sharing Statement:** The data that support the findings of this study are available from the corresponding author upon reasonable request.

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