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SUCTION ASSISTED PROTEIN LIPECTOMY (SAPL) EVEN FOR THE TREATMENT OF CHRONIC FIBROTIC AND SCARIFIED LOWER EXTREMITY LYMPHEDEMA

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ABSTRACT

Chronic lymphedema results from the accumulation of adipose tissue and fibrotic solids and poses a significant challenge for the treating clinician. Despite its many challenges, chronic lymphedema can be safely and effectively treated using a minimally invasive technique known as suction assisted protein lipectomy (SAPL). We present the use of SAPL in a 65-year-old female with a history of chronic, congenital, non-compressible, solid predominant lymphedema for over 40 years. Her lymphedema was complicated by multiple episodes of severe cellulitis that often required hospitalization and treatment with intravenous antibiotics. The patient also had an excisional procedure designed to debulk the lymphedema swelling performed over 35 years prior by an outside provider. The procedure resulted in substantial scarring and fibrosis between the skin and underlying fascia over a significant area of the leg with only minimal improvement in symptoms. Following SAPL, a stable excess volume reduction of 86% was achieved along with a significant improvement in range of motion of the knee. Furthermore, the patient had no further episodes of recurrent cellulitis. We have found SAPL to be effective even in patients with complex, chronic lymphedema presentations with extensive preexisting scarring from prior surgery..

Keywords: liposuction, lymphedema treatment, suction assisted protein lipectomy, SAPL, scarred leg

Lymphedema is a debilitating condition that results from reduced lymphatic circulation and can arise from both acquired and congenital causes. The initial fluid phase is characterized by pitting edema and accumulation of excess lymphatic fluid. If left untreated, this accumulation of inflammatory lymphatic fluids elicits adipose tissue hypertrophy and deposition of fibrotic solids, resulting in a chronic, solid-predominant phase that is characterized by non-pitting edema (1,2). In the solid phase, solids may characterize over 90% of the excess volume and will be refractory to treatments that only address the fluid phase such as conservative therapy, vascularized lymph node transfer (VLNT), and lymphaticovenous anastomoses (LVA) (3-5). The earliest described surgical approaches in the treatment of chronic lymphedema often involved open, aggressive local excision of the solid tissues (6,7). Nevertheless, modern innovation has led to advanced surgical techniques that effectively target both the fluid and solid phases of lymphedema. These approaches have been described extensively in the medical literature (3,7-17).

Figure 1. Patient suffered from longstanding congenital lymphedema of the left leg prior to the SAPL procedure. The scar from her previous excisional operation is visible on the medial aspect of her left leg.

Suction assisted protein lipectomy (SAPL) has been demonstrated to be an effective tool for the removal of the solid components that characterize the chronic, solid predominant form of lymphedema (7,18,19). SAPL can successfully and consistently reduce excess volume, with one-year reductions of over 100% in both arm and legs (4,17,18). Long-term prospective studies have reported even further volume reductions in the years following the procedure (20-22). SAPL has also been demonstrated to be safe and does not result in further lymphatic damage when performed properly (23). Here, we report the successful use of SAPL to treat even a leg with chronic, congenital, solid predominant lymphedema that had large amounts of scarring and fibrosis present after a previous unsuccessful lymphedema excisional procedure performed thirty-five years prior to SAPL.

CASE REPORT

The patient is a 65-year-old female with a history of congenital lymphedema who presented with significant chronic lymphedema of the left lower extremity (*Fig. 1*). Approximately thirty-five years ago, the patient had undergone surgery to excise significant amounts of soft tissue at the medial and lateral aspects of the affected leg by an outside physician. This initial surgery resulted in substantial scarring and fibrosis and the patient experienced minimal improvement over time. Conservative treatment modalities including multiple courses of complete decongestive therapy, manual lymphatic drainage and compression garment failed to further improve her condition. She suffered numerous episodes of cellulitis, many of which required hospitalization and treatment with intravenous antibiotics. Physical examination was consistent with chronic, solid predominant lymphedema. Minimal pitting was found in the soft tissues throughout the leg. Extensive scarring and fibrosis were seen and felt in the tissues especially over the entire medial aspect of the leg. The excess size and weight of the leg significantly decreased her range of motion, ability to walk and exercise, and made finding properly fitting clothing very difficult.

METHODS

SAPL was performed based on the method first described by Brorson et al with

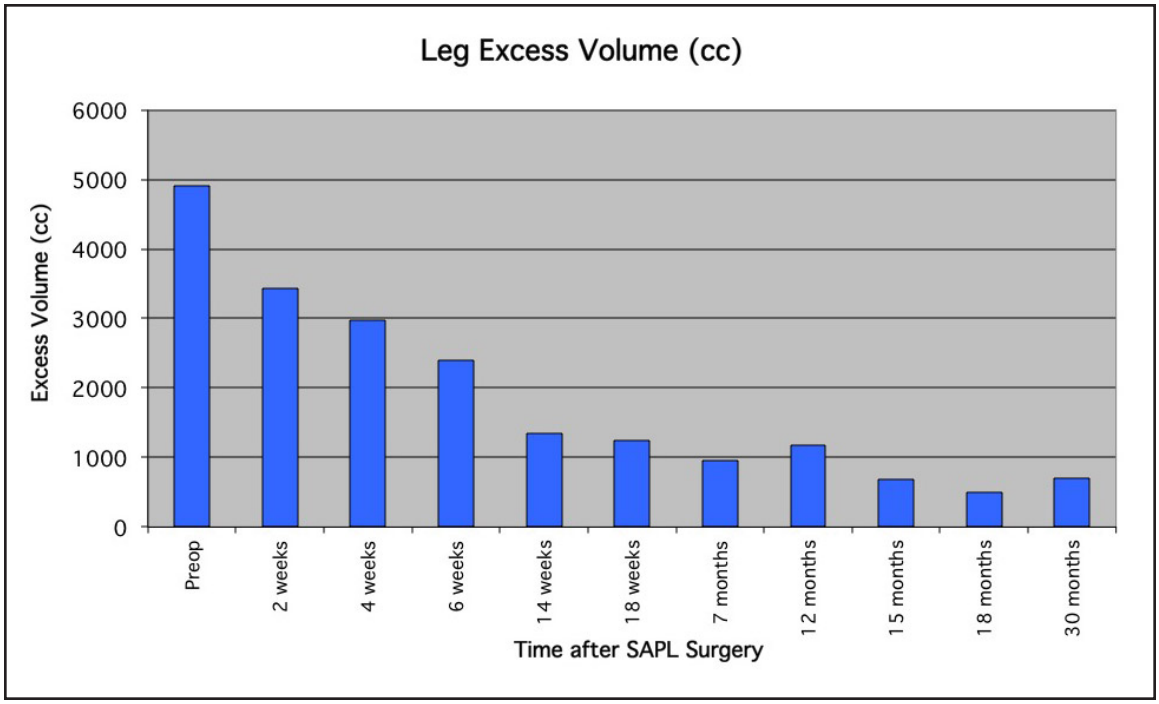

Figure 2. Excess volume calculations (cc) for patient from preop to 30 months post SAPL.

refinements in technique (18). The excess volume of the leg is defined as the difference in the volume of the lymphedema affected leg minus the volume of the opposite, unaffected normal leg. Volumes were calculated with the truncated cones method using circumferential measurements of the leg taken at 4 cm intervals as described previously (24). In this patient, the calculated volume excess was 4914cc, and the total aspirated volume during surgery was 4450 cc. 91% of the aspirated content was solids. Our SAPL protocol does not include further analysis of the fat versus protein content of the solids. There were no complications. The case complexity was significantly enhanced due to the diffuse scarring and fibrosis present over a wide area between the skin and underlying fascia from her prior excisional procedure. This scarring limited the amount of volume reduction. Postoperative continuous compression with custom, flat knit compression garments managed by a specialized lymphedema therapist was implemented pursuant to our SAPL protocol. In this case, ongoing, continuous compression garment use is required for 23 hours per day. This is unchanged from the patient's preoperative compression garment requirement that had been required previously to prevent further progression of her disease.

RESULTS

A stable overall excess volume reduction of 4227 cc (86%) was achieved at 15 months after surgery that remained relatively stable thereafter (*Fig. 2*). The excess loose skin present after surgery contracted completely, as typically occurs with the SAPL procedure. She had significant improvement in mobility of the knee joint after surgery. At three months after surgery, the patient's range of motion of the knee improved from 85 to 120 degrees. By nine months following the procedure, the volume, mobility and appearance of

Figure 3. Patient at nine months following SAPL.

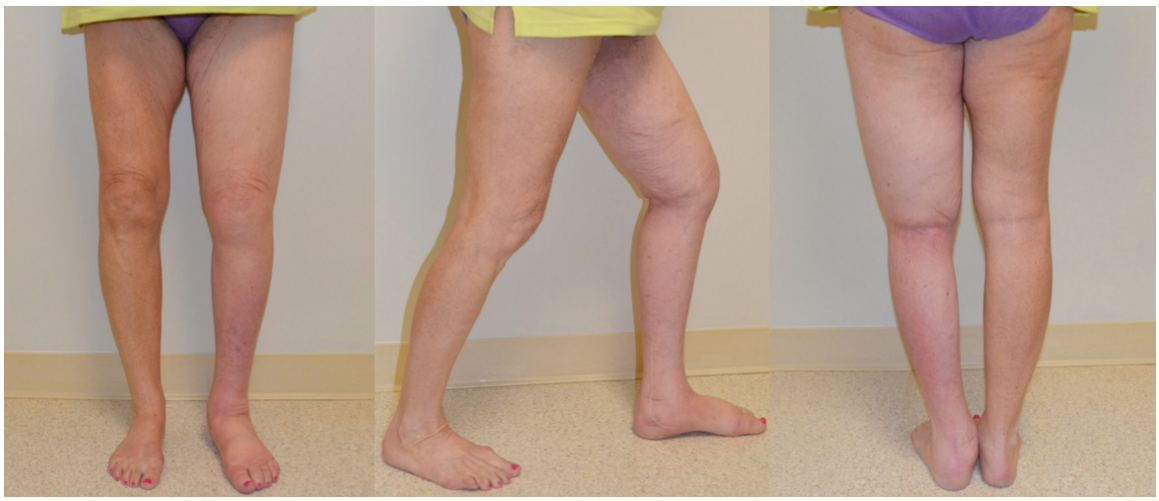

Figure 4. Patient at twenty-one months following SAPL.

the affected leg were comparable to those of the unaffected leg (*Fig. 3*). Additionally, her increased mobility facilitated her ability to exercise, leading to weight loss and further volume reduction in both lower extremities. The patient reports dramatic improvement in her activities of daily living and a significant positive impact on her quality of life. Since the procedure, she has had no further episodes of cellulitis. The volume reduction and improvement in mobility facilitated her ability to exercise, which resulted in further volume reduction. At 15 months after surgery, the patient's excess volume reduction was 86% and she continued to improve (*Fig. 4*).

DISCUSSION

SAPL is extremely effective, targeting the solid components of chronic lymphedema. Although SAPL is a minimally invasive technique, we have found it to be effective

even in cases where a long history of disease and extensive scarring were present. We feel strongly that best results are achieved when SAPL is performed as part of an integrated lymphedema treatment system that includes lymphedema therapy, SAPL and microsurgery such as VLNT and LVA. Therapy is required for all patients, and proper patient and procedure selection in each case are essential for best outcomes.

The SAPL surgery has been shown not to damage lymphatics, and we know of no cases in which a patient's lymphatics or lymphedema has worsened after the procedure. We routinely perform indocyanine green imaging and lymphatic mapping at the beginning of the surgery. This guides our surgery in the cases where intact lymphatics are still present. We have found that indocyanine green imaging performed after the procedure confirms that the superficial lymphatic structures remain unchanged after SAPL (25).

Lifelong postoperative compression therapy is required after surgery to prevent fluid reaccumulation (4,17). As in this case, essentially all patients who are candidates for SAPL surgery already require the same, continuous compression garment use prior to consideration for this procedure. The compression requirement may be reduced significantly in selected patients where we perform vascularized lymph node transfer (VLNT) and/or lymphaticovenous anastomosis (LVA) as a second stage procedure after healing from SAPL is complete (17). A lymphedema therapist trained and experienced in SAPL protocols must be involved in patient care both before and after surgery to ensure success (17). It should be emphasized that SAPL technique and necessary post-surgery care makes SAPL significantly different from cosmetic liposuction. Consequently, to ensure safety and success of the surgery, SAPL should only be performed by experienced lymphedema surgeons who are trained and experienced in this specific technique.

CONCLUSION

SAPL provides effective, minimally invasive volume reduction in cases of chronic, solid predominant lymphedema. SAPL is effective even in an extremity with a long history of significant scarring and fibrosis secondary to a prior debulking procedure.

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