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ABSTRACT

Background: **Lymphedema is characterized by accumulation of lymphatic fluid in a given body part. Lympho vascular transplant surgery has now become one of the main modalities in the treatment. There is however no consensus on the ultimate donor sites. We share our experience with vascularized lymph node transplant surgery with nodes gotten from two different anatomical locations in the neck.**

Objective: **To determine the outcome of patients managed by vascularized lymph node transplant surgery with lymphovascular tissues from sub-mandibular and supraclavicular donor sites.**

Methodology: **This was a comparative study of patients managed by lymphovascular tissue transplant in Kenyatta National Hospital, a tertiary hospital in Kenya between January 2013 and December 2023. All patients had lymphoscintigraphy done to confirm the diagnosis of lymphoedema .Patients were divided based on lymph node donor sites ; one group (SMN) and the supraclavicular group (SCN) The limb girths were taken prior to surgery and then followed up at regular interval for at least one year. Variables considered in the study were the length of surgery, number of nodes harvested, reduction in the limb girth and complications.**

Results: **A total of 44 patients were seen with 24 patients in SMN and 20 in SCN. The age range for the patients were 13 to 67 years with a mean age of 36 .6 years. The mean time for harvesting the nodes in the SCN was 3 hours 19 minutes while the SMN was 2 hours 14 minutes. There were more nodes harvested from the SMN compared to the SCN group though the difference was not statistically significant.**

Conclusion: **Both donor sites are effective in the management of lymphedema. However there is significant reduction in the operative time with the submandibular group of nodes due to a more consistent anatomical location of the blood vessels.**

INTRODUCTION

Vascularized lymph node transplant surgery (VLNT) though first described in rodents in 1979 followed by clinical application in 1982 , has gained momentum in the last few years with more centers adopting this technique alongside lymphaticovenous anastomosis (1) The technic involves harvesting lymph nodes with the surrounding adipofascial tissues and blood vessels and anastomosing them to the recipient site in an area where there is marked lymphedema. The optimal donor sites for the nodes should be one that provides more nodes , easy to harvest and has minimal morbidity to the patients. Traditional donor sites include the groin, axilla, omentum and the neck region. The groin and axilla though commonly used in some centers have been shown to have undesired complications such as secondary lymphedema that could be catastrophic to the patient (6,7).Though the omentum as a donor has been perfected in some

centers it is a more invasive procedure leading to either open or laparoscopic laparotomy. The neck nodes have been reported in literature by many authors. Commonly used nodes have been the submandibular nodes (SMN) harvested with the facial artery and the supraclavicular node (SCN) harvested with the transverse cervical artery. No studies to our knowledge have been done to compare nodes from these two distinct anatomical locations in the neck. We undertook this study to compare patients managed by either modality of treatment.

MATERIALS AND METHODS

Study Design: This was a comparative study of patients managed at Kenyatta National Hospital a tertiary hospital in Kenya of lymphoscintigraphy confirmed lymphedema between January 2013 and December 2023.

Study Subject: Patients were consecutively sampled into two groups with one group managed by SCN and the other with SMN. Consent / assent to participate in the study were taken from all patients. Ethical approval was gotten from the local ethics board.

Figure 1: *Harvested lymphnodes form the submandibular region*

Prior to surgery a thorough clinical examination was done to determine the extent of lymphoedema. The affected limb girth was measured using a tape from a fixed position; for the lower limb 12 cm proximal to the tip of the medial malleolus and for the upper limb 12 cm proximal to the radial styloid process. Variables determined were the average length of time taken to harvest the nodes, the number of nodes harvested, complications encountered at the donor site and the reduction in lymphedema at one year of follow up. The recipient site for both groups was determined by the extent of lymphedema with lymphedema involving the entire lower limbs nodes placed in the proximal thigh, involvement up to the distal thigh in the popliteal region, involvement of the leg placement around the ankle region. For the upper limb the nodes were placed in the forearm. (Figures 2-4).

Figure 2a: *Patient with left arm grade 3 lymphoedema*

Figure 2b: *Patient 2A, with resolved lymphoedema after transplant surgery, Note donor site in the distal arm*

Figure 3A: *Patient with both left and right leg grade 3 lymphoedema*

Figure 3B: Same patient in figure 3A, with resolved left leg lymphoedema after transplant in the distal leg

Figure 4:

Post operatively follow up was at a regular interval for at least one year to determine on the outcome of the procedure. Complications were noted in both groups of patients.

RESULTS

A total of 44 patients with lymphoedema involving the upper and lower limbs were followed up during the study period of ten years between January 2013 and Dec 2022. The mean age for the patients in the SMN was 36.4 years with an age range from 15 to 65 years while for the SCN group was 36.7 years with a range from 13 to 69 years. The average circumference of the thigh for the SCN group was 40.2 cm and 39.4 cm for the SMN group with percentage reduction at one year of follow up of 21.9 and 22.6 % respectively. For the patients whose recipient site was in the popliteal fossa the circumference reduction was 23.2 and 23.4 % for the SCN and SMN groups respectively. Patients whose recipient site was in the distal leg the reduction was 23.3 % for the SCN and 23.4 % for SMN group and 25.8 and 27.3 percent for the SCN and SMN group in patients who had upper limb surgeries. Table 2 and 3 summarizes the above findings. The average surgical time for harvesting submandibular lymph node was 2 hours 14 min and for supraclavicular nodes was 3 hours 19 minutes. The average number of nodes harvested in the submandibular group was 4.5 nodes while for the supraclavicular was 3 .9 nodes .Two patients in the supraclavicular group had to be converted to the submandibular group due to unavailable vascular pedicle. Two patients in the SMN group had marginal mandibular nerve neurapraxia with one patient in the SMN being unhappy with her scar (figure 4). Table 2 summarizes the above findings.)

Table 1: *Patient characteristics and surgical related observations between the two groups*

	Submandibular group (n=24)	Supraclavicular group(n=20)	P value
Mean age	36.4 (15-65)	36.7(13-69)	0.932
Mean duration for harvesting nodes	134 min	199 min	<0.001
Average No of nodes	4.5 nodes	3.9 nodes	0.650
Conversion to alternative sites	0	2 patients	0.571
Nerve related complications	1 patient	0	0.776
Unsightly/hypertrophic scars	1 patient	0	0.776

Table 2: *Outcomes at the two anatomical sites*

Recipient Anatomical location	N	Limb size prior to surgery	Limb size after 6 month cm	Limb size at 1 year(cm)	Total reduction in size (cm)%	P values
Upper thigh	16	40.2	31.9	31.2	9 (22.4)	0.018
SCN group	7	40.2	31.9	31.4	8.8 (21.9)	0.021
SMN group	9	39.4	31.6	31.2	9.2 (22.6)	0.030
Popliteal fossa	10	38 .6	36.8	36.1	12.5	0.480
SCN group	5	36.6	29.4	28.1	8.5 (23.2)	0.025
SMN group	5	36.8	29.8	28.4	8.4 (22.8)	0.026
Distal leg	6	37 5	28,7	28.0	9.5	0.014
SCN group	3	35.6	28.3	27.2	8.3(23.3)	0.026
SMN group	3	35.8	28. 2	27.1	8.6 (23.4)	0.022
Upper limb recipient	12	26.3	20.4	20.2	6.1	0.096
SCN group	6	26.3	19.7	19.5	6.8 (25.8)	0.066
SMN group	6	26.7	19.5	19.4	7.3 (27.3)	0.050

Table 3: *Comparison between the two groups of patients at one year of follow up*

Anatomical location of the transplanted Nodes	SCN group % reduction N =20	Submandibular group % reduction N = 24	P value
Upper thigh	21.9	22.6	0.842
Popliteal region	23.2	22.8	0.909
Distal leg	22.3	23.4	0.755
Upper limb	25.8	27.3	0.670

DISCUSSIONS

Management of early lymphedema has largely been by conservative means such as prolonged compression therapy and skin care to prevent ulcerations and infection. Established lymphedema on the other hand has traditionally been managed by debulking procedures such as modified Charlies procedure, buried dermal skin flaps and or liposuction .(2) These management strategies have however resulted in suboptimal results leading to a need to refine the treatments further. Modified Charles procedure for example has been associated with inferior aesthetic outcomes. Further the grafted wounds after excisions are generally unstable and could keep on breaking leading to prolonged hospital stay or outpatient visits. .

With the advent of physiological procedures to manage lymphoedema in the last few decades better functional and aesthetic outcomes have been reported (15,16). These procedures have mainly been lympho lymphatic, lymphactico venous and vascularized lymphnode transfer. The procedures could be in isolation or in combination. There indications are however not uniform and one therefore needs to select the appropriate procedure for the patient.

Vascularized lymph node transplant entails free transfer of lymphnode tissues with surrounding adipofascial tissues that is rich with lymphatic vessels .These tissues have the ability to integrate into the recipient tissue and provide the much needed avenue for lymphatic fluid absorption . Though not clear on how the transplanted nodes work two school of thoughts have emerged with one suggesting that the harvested nodes leads to lymphagiogenesis of new lymphatic vessels while the other suggests that lymph nodes creates physiological lymphatic venous shunts that aids in sapping lymphatic fluid into the venous system. This is aided by a pump mechanism created by the arterial venous pressure differences (17-22)

In our study we have demonstrated that there was no difference in the outcome of patients treated by nodes either from supraclavicular or submandibular groups. Further the anatomical recipient of the nodes whether proximal or distal didn't appear to interfere

with the outcomes. The only significant difference was that harvesting sub-mandibular nodes were faster than supraclavicular group of nodes. In addition sub-mandibular vasculature was more consistent compared to the supraclavicular groups. Similar findings were demonstrated by Ciudad *et al* who showed that anatomical location of the nodes didn't affect the final results in the management of patients with lymphoedema (15).

In conclusion vascularized lymph node transplant has a positive role in the management of patients with lymphoedema irrespective of the donor site and the recipient site. Both submandibular and supraclavicular sites could be used. It is however easier and faster to harvest nodes from the submandibular donor site compared to the supraclavicular site.

REFERENCE

1. Shesol B F, Nakashima R, Alavi A, Hamilton R W. Successful lymph node transplantation in rats, with restoration of lymphatic function. *Plast Reconstr Surg*. 1979;**63(06):**817–823. [PubMed] [Google Scholar]
2. Chang D W, Masia J, Garza R, III, Skoracki R, Neligan P C.Lymphedema: Surgical and Medical Therapy *Plast Reconstr Surg* 2016138(3, Suppl):209S–218S. [PubMed] [Google Scholar]
3. Gratzon A, Schultz J, Secrest K, Lee K, Feiner J, Klein R D. Clinical and psychosocial outcomes of vascularized lymph node transfer for the treatment of upper extremity lymphedema after breast cancer therapy. *Ann Surg Oncol*. 2017;**24(06):**1475–1481. [PubMed] [Google Scholar]
4. Dionyssiou D, Demiri E, Tsimponis A et al. A randomized control study of treating secondary stage II breast cancer-related lymphoedema with free lymph node transfer. *Breast Cancer Res Treat*. 2016;**156(01):**73–79. [PubMed] [Google Scholar]
5. Schaverien MV, Badash I, Patel KM, Selber JC, Cheng MH. Vascularized Lymph Node Transfer for Lymphedema. Semin Plast Surg. 2018 Feb;32(1):28-35. doi: 10.1055/s-0038-1632401. Epub 2018 Apr 9. PMID: 29636651; PMCID: PMC5891655.
6 Vignes S, Blanchard M, Yannoutsos A, Arrault M. Complications of autologous lymph-node transplantation for limb lymphoedema. *Eur J Vasc Endovasc Surg*. 2013;**45(05):**516–520. [PubMed] [Google Scholar.
7. Ciudad P, Manrique O J, Date S et al. Double gastroepiploic vascularized lymph node tranfers to middle and distal limb for the treatment of lymphedema. *Microsurgery*. 2017;37(07):771–779. [PubMed] [Google Scholar]
8. Ciudad P, Date S, Lee M H et al. Robotic harvest of a right gastroepiploic lymph node flap. *Arch Plast Surg*. 2016;**43(02):**210–212. [PMC free article] [PubMed] [Google Scholar]
9. Coriddi M, Skoracki R, Eiferman D. Vascularized jejunal mesenteric lymph node transfer for treatment of extremity lymphedema. *Microsurgery*. 2017;**37(02):**177–178. [PubMed] [Google Scholar]
10. Scaglioni M F, Arvanitakis M, Chen Y-C, Giovanoli P, Chia-Shen Yang J, Chang E I.Comprehensive review of vascularized lymph node transfers for lymphedema: outcomes and complicationsMicrosurgery 2016 [PubMed
11. Ciudad P, Maruccia M, Socas J et al. The laparoscopic right gastroepiploic lymph node flap transfer for upper and lower limb lymphedema: technique and outcomes. *Microsurgery*. 2017;37(03):197–205. [PubMed] [Google Scholar
12. Bank J, Chang D W. Philadelphia, PA: Elsevier; 2016. Microsurgical procedures: vascularized lymph node transfer from the supraclavicular region. Principles and Practice of Lymphedema Surgery; pp. 148–154. [Google Scholar]
13. Mardonado A A, Chen R, Chang D W. The use of supraclavicular free flap with vascularized lymph node transfer for treatment of lymphedema: A prospective study of 100 consecutive cases. *J Surg Oncol*. 2017;115(01):68–71.
14. Sapountzis S, Singhal D, Rashid A, Ciudad P, Meo D, Chen H C. Lymph node flap based on the right transverse cervical artery as a donor site for lymph node transfer. *Ann Plast Surg*. 2014;**73(04):**398–401. [PubMed] [Google Scholar]
15. Ciudad P, Agko M, Perez Coca JJ, Manrique OJ, Chang WL, Nicoli F, Chen SH, Chen HC. Comparison of long-term clinical outcomes among different vascularized lymph node transfers: 6-year experience of a single center's approach to the treatment of lymphedema. *J Surg Oncol*. 2017 Nov;**116(6):**671-682. doi: 10.1002/jso.24730. Epub 2017 Jul 10. PMID: 28695707
16. Raju A, Chang D W. Vascularized lymph node transfer for treatment of lymphedema: a comprehensive literature review. *Ann Surg*. 2015;**261(05):**1013–1023. [PubMed] [Google Scholar
17. Patel K M, Lin C Y, Cheng M H. From theory to evidence: long-term evaluation of the mechanism of action and flap integration of distal vascularized lymph node transfers. *J Reconstr Microsurg*. 2015;**31(01):**26–30. [PubMed] [Google Scholar]
18. Suami H, Scaglioni M F, Dixon K A, Tailor R C. Interaction between vascularized lymph node transfer and recipient lymphatics after lymph node dissection-a pilot study in a canine model. *J Surg Res*. 2016;**204(02):**418–427. [PMC free article] [PubMed] [Google Scholar]
19. Ito R, Zelken J, Yang C Y, Lin C Y, Cheng M H. Proposed pathway and mechanism of vascularized lymph node flaps. *Gynecol Oncol*. 2016;**141(01):**182–188. [PubMed] [Google Scholar]
20. Cheng M H, Huang J J, Wu C W et al. The mechanism of vascularized lymph node transfer for lymphedema: natural lymphaticovenous drainage. *Plast Reconstr Surg*. 2014;**133(02):**192e–198e. [PubMed] [Google Scholar]
21. Yan A, Avraham T, Zampell J C, Aschen S Z, Mehrara B J. Mechanisms of lymphatic regeneration after tissue transfer. *PLoS One*. 2011;**6(02):**e17201. [PMC free article] [PubMed] [Google Scholar]
22. Aschen S Z, Farias-Eisner G, Cuzzone D A et al. Lymph node transplantation results in spontaneous lymphatic reconnection and restoration of lymphatic flow. *Plast Reconstr Surg*. 2014;**133(02):**301–310. [PMC free article] [PubMed] [Google Scholar]