Publication Brief

Transit-time Ultrasound Technology-assisted Lymphatic Supermicrosurgery

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BACKGROUND
The efficacy and minimal invasiveness of lymphatic supermicrosurgery with construction of a lymphaticovenular anastomosis (LVA) make it increasingly used to treat lymphedema. However, the procedure depends on the use of healthy, functioning lymphatic vessels because its success relies on establishing a favorable lymph-to-vein pressure gradient. Here-to-fore, surgeons had relied on intraoperative visual inspection both to select the lymphatic vessels to be used and then, to assess anastomotic patency by observing for blood “wash-out” in the vein to which the lymph vessel is anastomosed.

OBJECTIVE
To examine and report whether transit-time ultrasound technology, with sensitivity reaching 0.01 mL/ min, could be of value in measuring minuscule flows in microscopic lymphatic vessels.

METHOD
• Lymphatic supermicrosurgery was performed in two patients: one with Campisi stage IV upper and one with Campisi stage III lower extremity lymphedema;
• A Transonic 0.7 mm Microsurgical Flowprobe was used in conjunction with a Transonic AureFlo system to measure lymphatic flows before and after construction of the LVA;
• A total of 28 lymphatic vessels were assessed/measured and 15 LVAs were constructed;
• Mean flow values, based on three consecutive measurements, were recorded;
• Transit-time ultrasound flow measurements were compared with the surgeon’s visual assessments.

RESULTS
• Lymphatic flows ranged from 0 to 1.2 mL/min; LVA flows ranged from 0.22 to 1.4 mL/min;
• In all 28 lymphatic vessels, flow measurements consistently correlated with the surgeon’s observation;
• Healthy-looking lymphatics had flow values higher than those from unhealthy-looking vessels;
• All LVAs with positive “wash-out” had flow ≥0.47 mL/min.
• In 5 LVAs with no visual “wash-out”, there were reproducible flows, all < 0.47 mL/min;
• In 3 LVAs, lymphatic flows were higher after the anastomoses was constructed;
• Both patients experienced prompt relief of lymphedema symptoms during the first postoperative week and continued to do well at six months following the surgery.

CONCLUSION
• Based on the findings, the clinicians concluded that the transit-time ultrasound holds promise in:
  1) guiding lymphatic vessel selection;
  2) confirming anastomotic patency;
  3) ascertaining if the absence of “wash-out” unequivocally indicates anastomotic occlusion.
• Further studies with higher sample sizes are needed to confirm the accuracy and reliability of the measurements and their correlation with varying qualities of the lymphatic vessels.

TAKE HOME
• Landmark, first-ever publication of direct flow measurements in lymphatic vessels in humans including a picture of a Flowprobe measuring human lymphatic flow and flow traces.

REFERENCE