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Reconstructive

Transitioning from Microsurgery to Supermicrosurgery: The Recurrent Ulnar Artery Model

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Supermicrosurgery refers to a technique of dissection and anastomosis of vessels smaller than 0.8 mm.[1] The technique is widely regarded as the natural evolution of microsurgery, as our preoperative planning and imaging improve, instruments become more precise, and microscopes more advanced.[1]

To date, supermicrosurgery technique has been employed to treat distal finger amputations and lymphoedema, and allows for perforator-to-perforator reconstructive solutions.[2] However, its true potential and uptake may only be reached through more extensive and innovative training solutions, developing the surgeon's fine motor skills and precision in anastomosis.[3]

Simulated training models have been shown to be effective in developing both microsurgical and supermicrosurgical skills.[4] The authors aimed to develop a cheap and novel training model to enable a smooth transition from microsurgery to supermicrosurgery technique by facilitating both skill transfer and acquisition, without the need of supermicrosurgery instruments.

The recurrent ulnar artery model provides an excellent opportunity to develop both microsurgery and supermicrosurgery skill (**See Video [online],** which shows a demonstration of the recurrent ulnar artery chicken wing microsurgical model in practice). This is an ex-vivo model using a chicken wing, which is based on the ulnar artery and its side-branch, the recurrent ulnar artery. The lead author (R.Y.K.) of this video article dissected 20 chicken wing models over a 2-month period, and performed 20 microsurgical and 40 supermicrosurgical anastomoses. Standard microsurgery instruments (compromising a needle-holder, curved micro-scissors, jeweler's forceps, and a vessel dilator), a table-top operating microscope, and 10-0 S&T Nylon sutures were utilized.

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Received for publication May 19, 2022; accepted August 17, 2022.

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Plast Reconstr Surg Glob Open 2022;10:e4589; DOI: 10.1097/GOX.0000000000004589; Published online 17 October 2022.)

The recurrent ulnar artery was found at the first knuckle of the chicken wing in all 20 specimens. Twenty anastomoses were performed end-to-end at the ulnar artery, with a mean vessel diameter of 1 mm. Twenty anastomoses were performed end-to-side between the recurrent ulnar artery and ulnar artery, with a mean vessel diameter of 0.7 mm. Finally, 20 anastomoses of the recurrent ulnar artery were performed end-to-end, with a mean vessel diameter of 0.4 mm. The mean diameter of the ulnar artery was found to be 1 mm, and the recurrent ulnar artery to be 0.4 mm across all 20 dissections. The total cost of the training model was 22 pence GBP (or 27 cents USD).

The recurrent ulnar artery chicken wing model provides a consistent, easily dissected and cheap solution to develop microsurgery and supermicrosurgery skills. It allows for an effective transition from anastomoses of greater than 0.8 mm, to those between 0.4–0.7mm in a graduated approach and within the same training setting and session, differentiating it from other training models.[4,5] It is, however, limited by its inherent ex-vivo nature and inability to assess real-time flow. Although it does not require specific supermicrosurgery instrumentation, it does need higher magnifications of up to 45× through a tabletop microscope. Future research is needed to validate the model, assess flow through anastomotic repairs, and focus on the learning curve assessment.

REFERENCES

1. Badash I, Gould DJ, Patel KM. Supermicrosurgery: history, applications, training and the future. *Front Surg.* 2018;5:23.
2. Hong JPJ, Song S, Suh HSP. Supermicrosurgery: principles and applications. *J Surg Oncol.* 2018;118:832–839.
3. Kannan RY, Koshima I. A case-control analysis of the knight's move technique in a chicken wing microsurgery model: video article. *Plast Reconstr Surg Glob Open.* 2021;9:e3476.
4. Pafitanis G, Narushima M, Yamamoto T, et al. Evolution of an evidence-based supermicrosurgery simulation training curriculum: A systematic review. *J Plast Reconstr Aesthet Surg.* 2018;71:976–988.
5. Wu XQ, Liu HR, Yu ZY, et al. A super-microsurgery training model: the mouse caudal artery anastomosis model. *Front Surg.* 2022;9:841302.

Disclosure: *The authors have no financial interest to declare in relation to the content of this article. This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.*

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